Monitoring bilby (*Macrotis lagotis*) and other animal activity at Lorna Glen using observers on horseback

Neil Burrows, Chris Foster, John Foster, Tiffany Fowler, Christina Gilbert, Kim Hanley and Jason Sinclair

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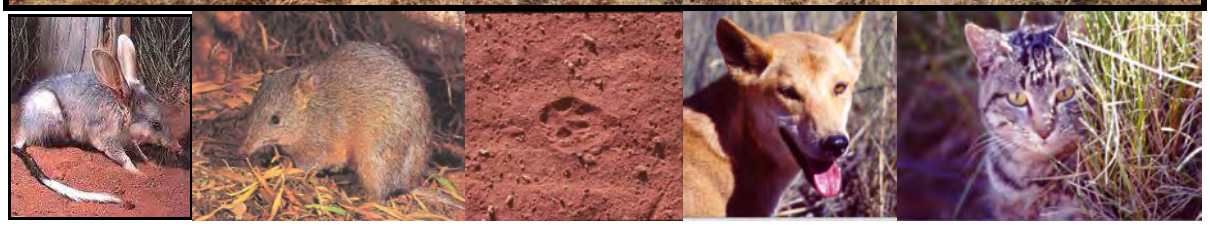

Summary
Following a successful trial in March 2011, a large scale survey (36,000 ha) by 6 observers (4 volunteers) on horseback was completed at Lorna Glen over the period 25th- 28th May 2012. A total of 545 horse km was ridden in four surveys cells, each ~9,000 ha. Over four days, observers visually inspected 1,576 ha of ground, and recorded a total of 247 observations of burrows, tracks and diggings, including 74 bilby burrows. Cells with the greatest diversity of nutrient rich landsystems, supported the highest level of bilby activity.

Based on a number of assumptions, we estimate the bilby population on Lorna Glen is between 128 and 339 animals. Further research is needed to link activity, especially number of burrows, with population to provide a more accurate and precise population estimate. It is encouraging that since reintroductions in 2007-09, the free ranging population appears to be stable or increasing, depending on assumptions used to estimate population size. Consideration should be given to further bilby reintroductions in diverse, high quality habitats to sure up and extend the range of the Lorna Glen bilby population.

The horseback survey was also effective at providing an estimate of the feral cat population. We estimate that there are 18 individual cats in the survey area, or one cat per 2,000 ha, which equates to a feral cat population on Lorna Glen of about 124 animals. The cat track density index from the bush transects was calculated to be 7.8, which is about 25% of what could be expected in the absence of baiting and other control measures. Based on their track pattern, cats showed no bias towards landsystems and occurred uniformly across the landscape. We recommend increasing effort on cat control to reduce predation pressure by carrying out opportunistic ground baiting over the winter months and by intensive targeted trapping programs in spring and autumn.

Releasing a bilby at Lorna Glen (Photo: Judy Dunlop)

Background

Rangelands Restoration is a long term program to restore biodiversity and ecosystem health and function to former pastoral leases in the northern Goldfields. The program is currently focused on the ex-pastoral lease Lorna Glen (Matuwa), which is jointly managed by DEC and the Wiluna Aboriginal Community. The re-introduction of bilbies to Lorna Glen is part of a long term program to re-establish 11 locally extinct native mammals. Over the period 2007-2009, some 128 captive-bred bilbies were re-introduced to various locations on Lorna Glen (see Pertuisel 2010). According to the Translocation Proposal (TP), criteria for successful reintroduction of bilbies are as follows:

- Better than 60% survival by 30 November 2007.
- Body weight of survivors has been maintained or increased by 30 November 2007.
- The appearance of pouch young known to have been conceived at Lorna Glen by March 2008.
- The appearance of new, unmarked Bilbies in the population.
- The successful expansion of Bilbies into large areas of suitable habitat after 18 months.
- An estimated population > 200 by August 2010.

In order to determine whether these criteria are satisfied, it has been, and continues to be, necessary to carry out systematic surveys. Initially, monitoring by radio-tagging and some associated trapping provided some information against some of the success criteria. However, animals are no longer being radio-tagged and they are very difficult to trap.

In order to comply with the TP and to know whether or not success criteria are met, it is essential that bilbies continue to be monitored. Basically, it is necessary to know whether their numbers are trending up, down, or are stable, and where they are. Because of their mostly solitary nature, low density and high mobility (so-called 'nomadic' habit), monitoring their numbers and distribution is problematic. Trapping will be time consuming and ineffective unless we know exactly where the animals are and which burrow they are in, so monitoring will depend on indirect measures, such as recording tracks, burrows, scats and diggings.

A small trial using observers on horseback was carried out in March 2011 (Burrows 2011) when some 25 km of transect was assessed in the immediate vicinity of the Possum Lake bilby release site. This trial demonstrated that using horses as a means of transport to survey for bilbies offered many advantages over other techniques. These included:

- Horses are much softer and quieter on country than ATVs (quad bikes) or 4WDs – machines, to varying degrees, damage / crush the vegetation and the soil, damaging the important cryptogamic crusts. On fragile arid zone soils, just one pass by a machine leaves tracks / impressions that are visible for decades. Repeated surveys along the same transects by quads will result in significant environmental damage as well as visual scarring. Horse tracks virtually obliterate after a downpour of rain.
- Horses can go where quads and other machines can't – for example, through thick scrub and spinifex, dense mulga groves, areas of dead and downed timber, steep creek crossings, steep and scrubby sand dunes and across recently burnt spinifex. It is perilous (and damaging) taking quads (and other vehicles) across recently burnt spinifex for fear of puncturing tyres.
- Horses are faster and more durable than people on foot – if urged, they can walk almost twice the speed of a person and can walk considerably longer distances and for a longer time.
- Horses provide an excellent observation platform; an observer on horseback is considerably higher than one on foot or on a quad bike. For example, the eye-level of a person on an average sized horse (15hh) is ~2.4m above ground, compared with ~1.2m

for a person on a quad bike or ~1.6 for a person on foot. Above ground observation height is particularly important in thick scrub and spinifex with tall, dense seed heads. Also, a horseback observer can pay much greater attention to observing, rather than driving to avoid obstacles.

Method

Six horses were floated to Lorna Glen specifically for the survey and were stabled in the old cattle yards near the homestead. Of the accompanying riders, four were registered DEC volunteers and two were DEC staff. Prior to the commencement of the survey, observers were given a briefing on the project and the purpose of the survey, a safety briefing and a brief in-field training session on how to use the navigation equipment and how to recognise bilby burrows, cat, dog and echidna footprints. Each team of two observers carried a first aid kit, GPS, spare batteries, compass, maps, food and water and a VHF radio. A SAR watch was established and observers radioed back to a mobile base station once they had reached predetermined points along the transects.

Four large cells, each about 9,000 ha (10 km x 9 km) were identified for the survey, being the general locations of bilby reintroductions carried out in 2007-09 (Figure 1). A series of six line transects in each cell were surveyed by observers on horseback over the period 25-28 May 2012. Each transect was about 9 km long and about 1.43 km apart (Figures 3-6). For each cell, three teams of two observers traversed two transects by riding 9 km off a base line track into the bush along the first transect, then turning 90^{o} and riding for ~1.43 km, which was also surveyed, before turning 90^{o} and riding out 9 km along the second transect and back to the baseline track (Figures 3-6). The start and finish points of the transects were pre-loaded as weigh points into a wrist-mounted Garmin ForeTrex GPS, which was used to navigate along the transects and record the actual travel route, distance, speed and travel time. While the straight-line distance of each transect was ~9 km, observers rode up to 11% further due to the need to avoid obstacles and to ride off heading to inspect a burrow or a track. It was also noted by observers that occasionally the electronic compass was not particularly stable, resulting in deviations and corrections *en route.* An example of this is shown in Figure 2 below.

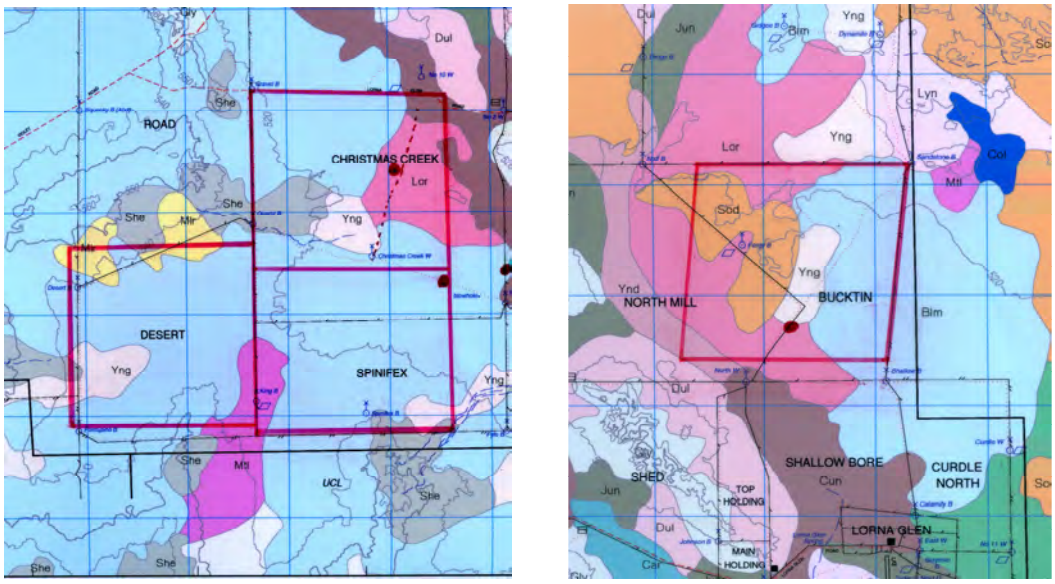

Figure 1: Bilby survey cells (Christmas Creek, Desert, Spinifex and Bucktin) and associated landforms. Each cell is ~9,000 ha (10 km x 9 km).

Two observers making up a team rode about 20 m apart and recorded observations ~20 m either side of each observer, giving a visual sample width of about 60 m per team. One of the horses in one team was reluctant to travel separated from the other horse, so these observers rode closer together, narrowing the sample width for this team to about 40 m. From horseback, clear observation distances through most of the vegetation types encountered (mostly spinifex or mulga country) was about 20-30 m for bilby burrows and about 5 m-7 m for footprints / tracks and digs. As riders were on average ~20 m apart, this gave an average visual sample swathe of ~60,000 m^2 per kilometer of transect. While the main target was signs of bilby activity, signs of activity of other animals, including cat, dog, echidna and rabbit were also recorded.

Bilby burrows were categorized as fresh (very recently used), or old (not recently used). Approximating the time since a burrow was last used requires interpreting and making a judgement on the 'freshness' of signs of tracks in the soil and sometimes scats and diggings (digs) in and around the burrow entrance. Fresh footprints in red sandy loam soil are sharp, crisp and clear and the surface soil colour of a track is often slightly lighter or 'glossier' than the surrounding undisturbed soil. The soil of fresh tracks is usually more friable or looser than that of older tracks. Older tracks loose detail and clarity, or appear blurred, and soil colour and consistency of the track is similar to the surrounding undisturbed soil. The rate of 'weathering' of animal tracks and digs is a function of time and of elements such as wind and rain. Very recent, or fresh tracks and very old, weathered tracks are usually obvious to most observers, but only experienced observers are able to reliably estimate the age of tracks (in days).

F*igure 2: Examples of actual tracks taken along survey transect lines by observers on horseback. The top dotted line is a typical track whereas the bottom line is the result of the electronic compass malfunctioning and requiring calibration. The position of the observer was logged by the GPS every 6 seconds – shown is position every 3.41 minutes. Each transect is 9 km.*

Rainfall on 17th and 18th May, some 7 days prior to the survey, provided a useful event marker for assisting with ageing tracks, digs and burrow activity. Fresh burrows were those

that had signs of being used very recently, most likely in the last 2-3 days and certainly since the last rainfall event. Old, or not recently used burrows were those that were structurally sound with no weathering or other signs of deterioration or decay, but had the appearance of not having been used recently, within the last 2-3 days, and certainly since the last rain. Only animal diggings and tracks that were made since the last rain were recorded.

All tracks and other signs of activity of interest were marked and stored on a GPS and hand written notes were made about the observation. Observers only recorded signs if they were confident about what animal had made them. For example, on occasions, it was difficult to determine the animal responsible for diggings, burrows or other soil disturbance especially if they were 'old' so these were not recorded. The paucity of bilby digs recorded (Table 1) is a reflection of identification uncertainty and potential confusion with animals such as varanids.

Results & Discussion

The total distance travelled on horseback was 272.7 km or 545.4 horse km. Over four days, each horse and rider covered about 95 km including the distance to ride the transects, close the circuit and re-join the horse float. The total area visually checked was 1,576 ha or 4.3% of the entire survey area. Total moving time per observer was 22.7 h, or about 5.67 h per survey cell including 'ferry' time. The average time to complete a survey cell, including stops, was 6.79h and average moving speed (excluding stops) was 4.3 km/h. While the survey transects are mapped as straight lines in the figures below, the actual track taken by observers was not always a straight line, as explained above and demonstrated in Figure 2. A summary of observations made for all survey cells is contained in Table 1.

Table 1: Summary of bilby, cat, dog and echidna activity recorded in each survey cell by observers on horseback. Recent means in the last 2-3 days or since the last rain 7 days prior to the survey.

	Christmas Creek (CC)	Spinifex (SP)	Desert (DT)	Bucktin (BT)	TOTAL ACTIVITY
Bilby burrows recently used	9	2	4	13	28
Bilby burrows not recently used	15	2	11	18	46
Bilby dig recent	3	3	3	10	19
Bilby track recent	15	2	6	8	31
Cat track recent	18	15	17	13	63
Dog track recent	11	6	2	1	20
Echidna track or dig recent	7	12	6	11	36
Rabbit dig or scats recent	2	0	2	0	4
TOTAL ACTIVITY	80	42	51	74	247

Bilby activity

Bilby burrows recently used (BBRU – symbol is a circle with centre dot), bilby burrows not recently used (BBNRU – symbol is a square with centre dot) and fresh bilby tracks (BBT – symbol is concentric circles) detected along survey transect are shown for each survey cell in Figures 3-6 below. Red lines mark the survey cell boundary and the broken lines approximate the survey transects (~9km long x 1.43 km apart). Some observers were more confident with identifying bilby tracks than others, so there is some bias with respect to this activity measure. This highlights the need for further training and standardization of the methodology across observers, which will be done prior to the next survey.

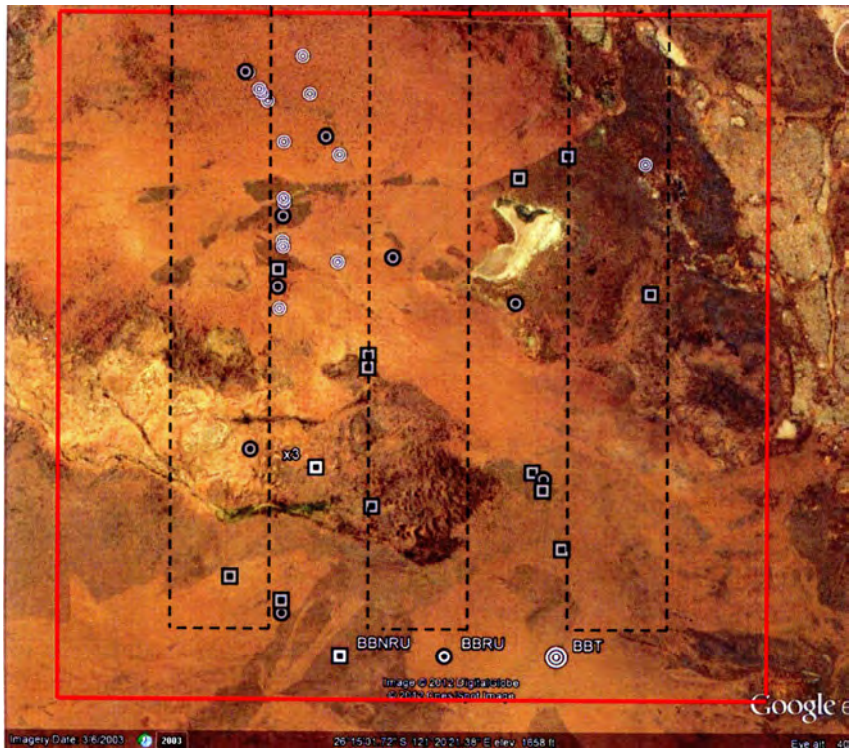

Figure 3: Bilby activity recorded along survey transects in the Christmas Creek cell

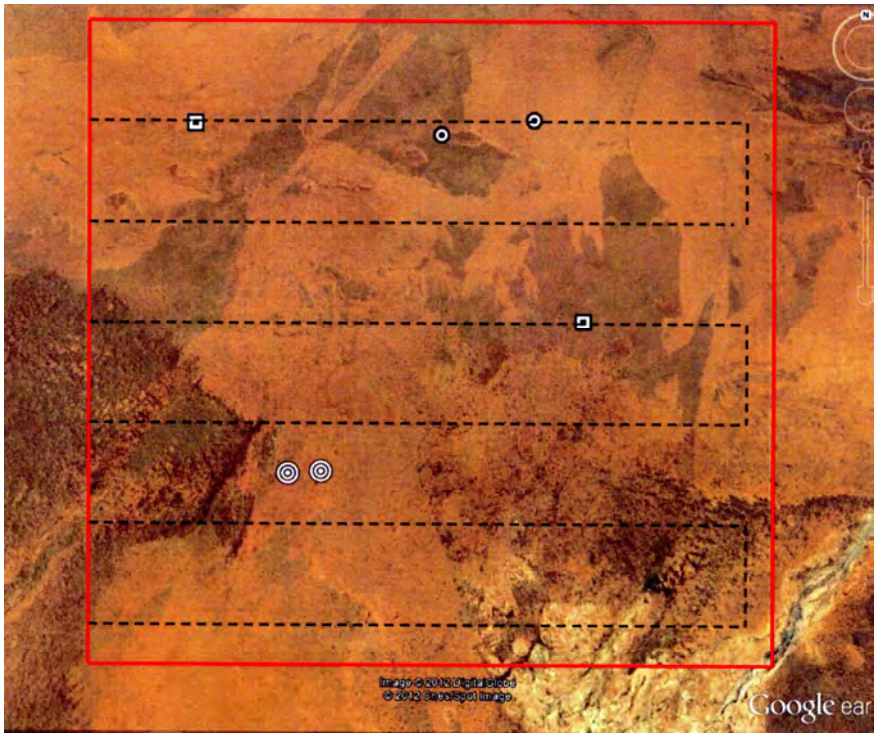

Figure 4: Bilby activity recorded along survey transects in the Spinifex cell

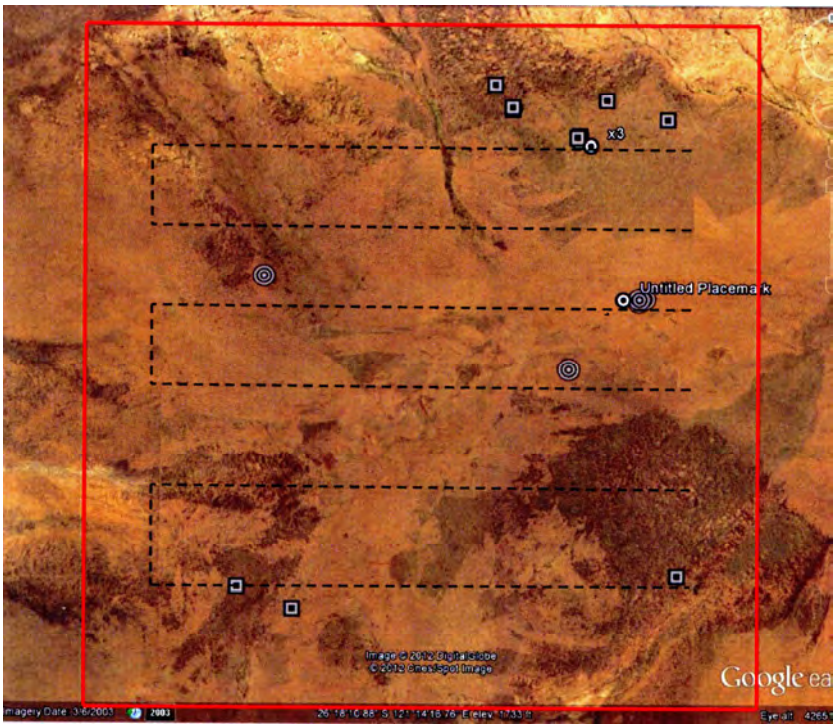

Figure 5: Bilby activity recorded along survey transects in the Desert cell

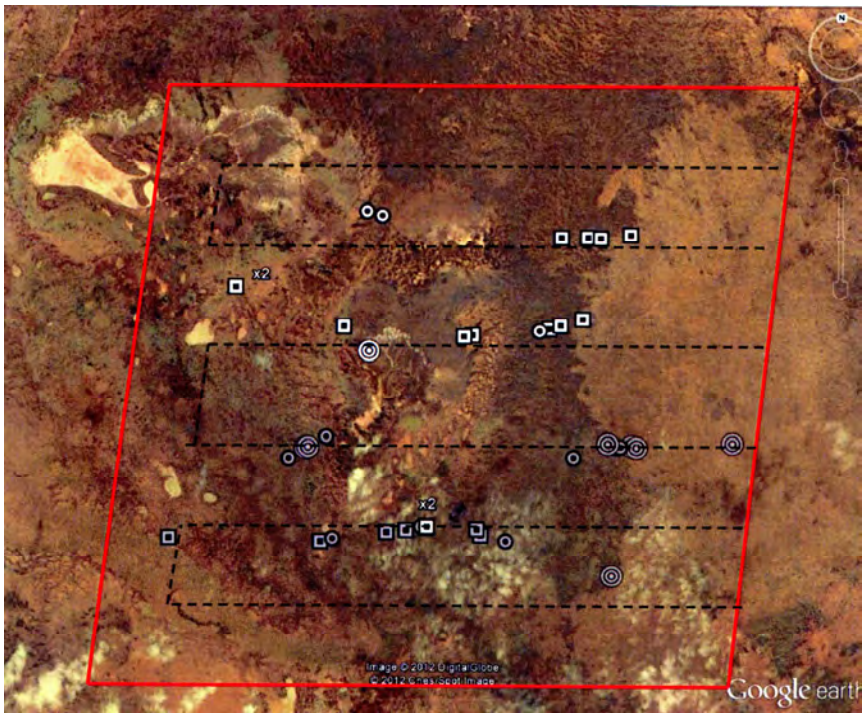

Figure 6: Bilby activity recorded along survey transects in the Bucktin cell

Bucktin survey cell (Figure 6) yielded the highest level of bilby activity, followed by Christmas Creek, Desert and Spinifex cells with the latter showing very low signs of bilby activity (see also Figure 7). Of a total of 74 bilby burrows detected along the transects, about 38% were classified as recently used and 62% as not recently used (at least since last rain). Assuming the transects were representative of the broader landscape within the survey cells, this equates to a bilby burrow approximately every 21.3 ha, or 1,690 burrows in 36,000 ha, being the total area of all four survey cells. Of these, 642 are estimated to have been recently used.

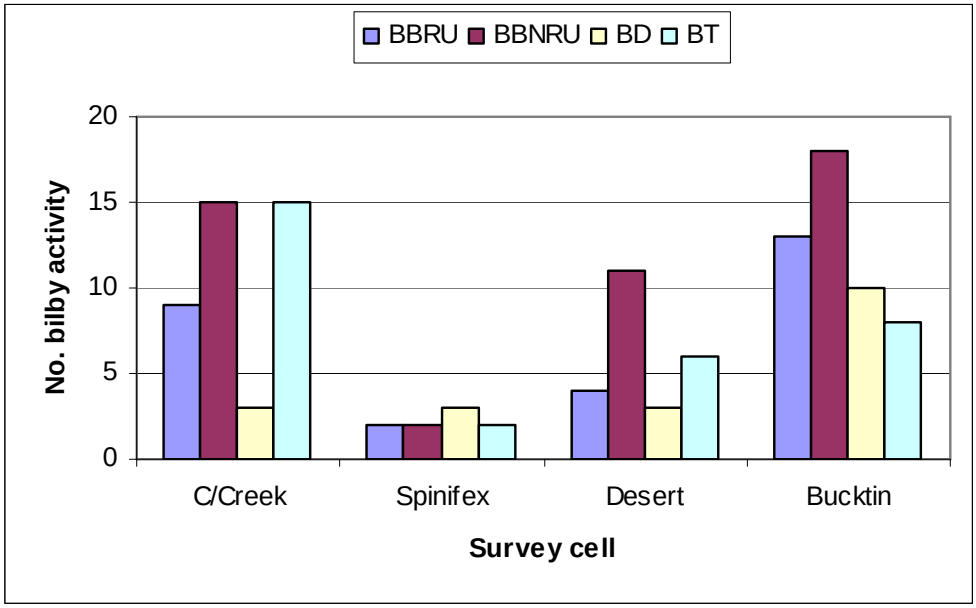

Figure 7: Bilby activity recorded from sample transects in each survey cell. BBRU = bilby burrows recently used (since rain); BBNRU = bilby burrows not recently used (since rain), BD = bilby digging recent, BT = bilby tracks recent.

The proportion of various landsystems, or broad habitat types in each survey cell, together with a summary of bilby burrows within in each landsystem, is contained in Table 2. The Bullimore system (spinifex dominated sand plains and dunefields) made up 65% of the area surveyed, with the Lorna landsystem (commonly mulga or other small trees and shrubs over spinifex on sandy or loamy soils) being next most abundant comprising 12% of the survey area. Bilby burrows were detected on all landsystems in the survey area except Cunyu, which only comprised 1% of the area surveyed. Interestingly, the Lorna landsystem, which comprised 12% of the survey area, contained 20% of burrows. The Bullimore landsystem made up 65% of the survey area but contained only 56% of burrows.

Table 2: Landsystem composition of survey cells and association with bilby burrows

Landsystem	Christmas Creek (CC)	Spinifex (SP)	Desert (DT)	Bucktin (BT)	% of total survey area	% bilby burrows
Bullimore	59%	92%	75%	32%	65%	56%
Lorna	19%	0	0	36%	12%	20%
Sherwood	10%	1%	0		3%	4%
Yanganoo	8%	0	11%	8%	7%	4%
Cunyu	4%	0	0	0	1%	0%
Mithchell	0	7%	7%	0	3%	1%
Millrose	0	0	7%	0	2%	3%
Sodary	0	0	0	24%	6%	12%
Total	100%	100%	100%	100%	100%	100%

Feral cat, wild dog, echidna and rabbit activity

Feral cat, wild dog / dingo, echidna and rabbit tracks / digs recorded by observers in each survey cell is shown in Figure 8. Cat tracks were the most abundant and occurred at a similar density in all cells, suggesting a fairly even, unbiased distribution of cats across the landscape. Dog activity was about one third that of cats, and patchy with a relatively high level of activity in Christmas Creek and to a less extent, Spinifex cells, but very low in Desert and Bucktin cells. Echidna activity was relatively common and uniform across all cells and rabbit activity was very low.

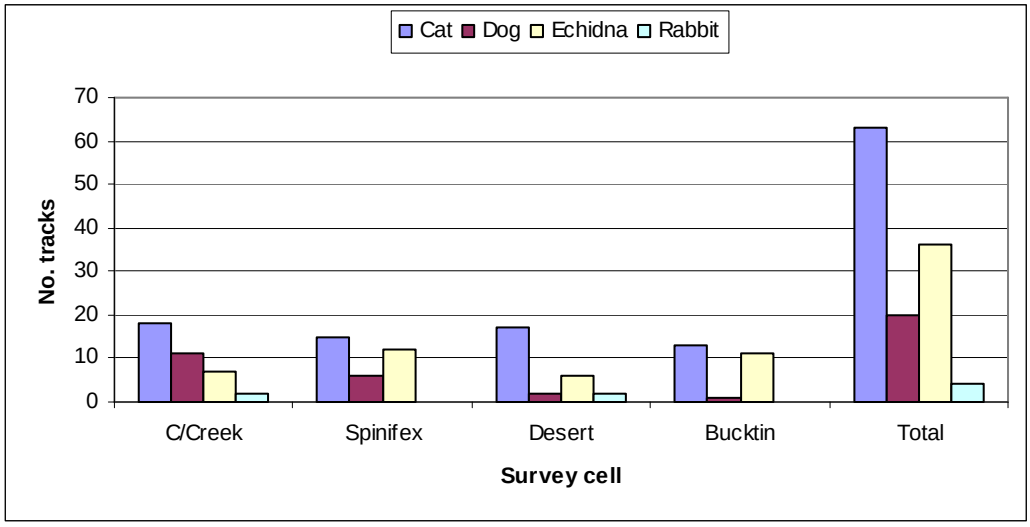

Figure 8: Frequency of occurrence of cat, wild dog / dingo, echidna and rabbit tracks and digs

Plotting the location of cat tracks, as in Figure 9, can assist in determining the actual number of cats likely to be in each survey cell by the way in which the tracks form clusters, with each cluster potentially being an individual cat. The horseback surveys are at an appropriate scale (9 km long continuous lines with 1.43 km between lines) to detect the movement of all adult cats in the cell, with the sampling scale being within the known home range and travel distances of cats in this environment. An example of the distribution of cat tracks in the Bucktin survey cell is shown in Figure 9. A similar analysis of patterns of track distributions in other cells suggests that there are 5 cats in Christmas Creek and Desert and 4 cats in Spinifex. From this we estimate a total of 18 cats in all four cells (36,000 ha), which equates to 1 cat every 2,000 ha and a cat track density index (TDI) of 7.8

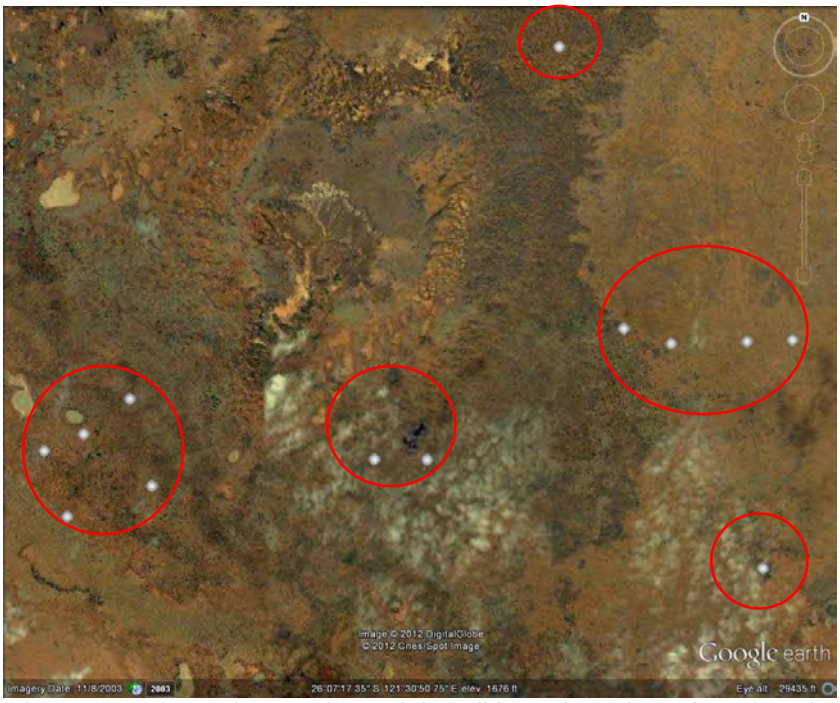

Figure 9: Estimated 5 cats in Bucktin cell based on clustering of tracks

Because of the large distances that dogs travel, it would not be feasible to estimate their population using this technique.

While this technique has proven to be effective at detecting bilby burrows, actually estimating the bilby population from burrow counts is problematic. However, assuming that a) all of the burrows recorded are habitable by bilbies and b) that the ratio of burrows –to-bilbies is 5:1, then we can estimate the bilby population on the 36,000 ha surveyed. The area visually inspected by six observers on horseback over four days was 1,576 ha (4.3% of the total survey area) in which a total of 74 bilby burrows were detected. Making the following assumptions, we can estimate the bilby population on Lorna Glen:

- The sampling transects (Figures 2, 3, 4 & 5) are representative of the broader survey. This assumption is valid.
- There are few or no bilbies outside the cells surveyed. This assumption needs validation, but there have been no casual observation made of bilbies outside the survey cells.
- All recorded burrows are habitable by bilbies i.e., are not 'extinct'. This assumption requires validation.
- That the ratio of burrows-to-bilbies in this environment is 5:1, which is based on a limited amount of observations and radio tracking in the Gibson Desert. This assumption requires validation.

Two calculations are used here to estimate bilby population. The first is based solely on burrows classified as fresh, or recently used, the second on all burrows recorded (recently used and not used recently, but likely to be habitable). The number of recently used burrows recorded was 28 in 1,576 ha visually inspected, which equates to 640 in the 36,000 ha survey area. Therefore, the bilby population estimated from recently used burrows only is;

640/5 = 128 animals.

However, if all 74 burrows recorded by the survey are included in the calculation, then the number of burrows in the survey area is equal to 1,690. Assuming 5 burrows per animal, the estimated population is:

1690/5 = 338 animals.

Figure 10 is an estimate of the number of bilbies in each cell based on the above assumptions and calculations.

Pertuisel (2010) estimated the bilby population had fallen from 126 to 56 animals in 2010, a declining population due to predation by cats, native predators and lack of resources, or an inability of the founder population to find resources in a new environment. Fecundity was not an issue, with 75% of adult females breeding (Pertuisel 2010). Using PVA, Pertuisel also predicted that under most scenarios, and regardless of the size of the founder population, the bilby population at Lorna Glen would most likely be extinct within 20 years, assuming the same level of mortality rates experienced in the early stages post-reintroduction. One of her models suggests a population of just 40 animals by 5 years after reintroduction, but all models predict a declining population.

Based on best estimates from this survey, the bilby population on Lorna Glen is between 128 and 339 animals, considerably more than the predicted 40 by one of the models. Even if the actual population is at the lower end of the estimated range (128 animals), then rather than declining, the population is actually gradually increasing. Pertuisel's modelling clearly demonstrated the sensitivity of bilby population growth to adult mortality rate, so if the population is growing, then it suggests that the adult mortality rate has decreased since the early stages of the initial reintroductions. The primary causes of adult mortality in the early stages were predation and lack of resources. If the population estimates from this survey are realistic, then a decline in adult mortality rate suggests that subsequent generations of bilbies

born on site, unlike the founders which were captive bred, have adapted to the new environment, are more predator aware and are more efficient at locating food resources.

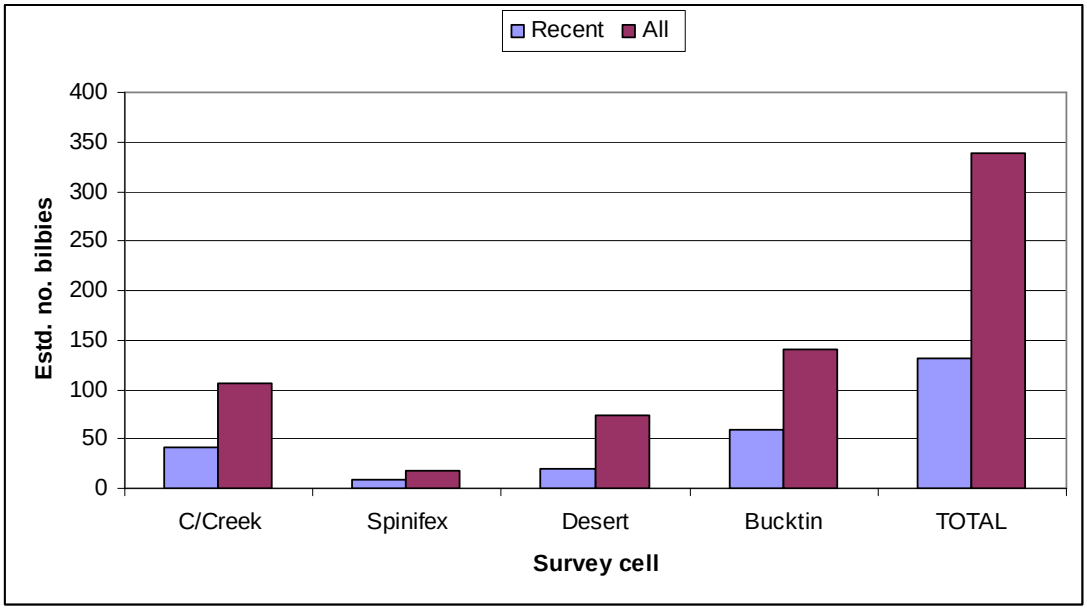

Figure 9: The estimated population of bilbies at Lorna Glen based on the assumptions above and a) recently used burrows only and b) all burrows recorded.

This survey found significantly higher levels of bilby activity in those cells with a diversity of landform systems at relatively fine scales. Heterogeneity of vegetation will result in greater floristic and structural diversity of landscapes and a commensurate increase in the diversity of food resources for bilbies including subterranean plant material, invertebrates and fungi. Soil chemistry, especially levels of organic carbon, and available macro elements (N, P, K), trace elements and the C:N ratio fundamentally and significantly influence site productivity, especially for higher trophic level organisms such as bilbies. From Table 3 below, it can be seen that nutrient levels of soils in the Bullimore system are considerably lower than those in the Lorna and adjacent Sodary landsystems. Data in Table 3 are summarized from data collected by Mark Cowan as part of the biological survey of Lorna Glen. The data set provided to me did not have any data on soil nitrogen (N) levels. Given the importance of N to biological systems, further soil sampling of these landsystems is warranted.

The significantly higher nutrient levels in the Lorna and Sodary landsystems compared with the nutrient depleted Bullimore landsystem could partially explain why there is a higher level of bilby activity in the Christmas Creek and Bucktin cells. These cells have a diversity of Bullimore, Lorna, Sodary and other landsystems, providing a variety of habitats, including relatively nutrient rich habitats. This is consistent with findings of Christensen and Liddelow (pers. comm.) who, working on bilbies in the Gibson Desert Nature Reserve, showed that mulga and other shrub dominated communities with patches of spinifex understorey were preferred to spinifex dominated sand dune-sand plains. They attributed this to a) higher soil nutrient levels, especially nitrogen and b) greater diversity of vegetation floristics and structure, therefore of potential food resources.

Table 3: Mean levels of surface soil macro nutrient and trace element for the Bullimore and Lorna/Sodary Landsystems on Lorna Glen (Sourced from M Cowan). Units are mg/kg.

	pH	N	P	K	OrgC	Cu	Zn	Co	Mg	Mn
Bullimore	5.0	?	1.8	25.8	0.09	0.24	0.14	0.28	27.6	18.2
Lorna/Sodary	5.4	?	6.3	90.0	0.19	0.65	0.40	0.65	86.6	49.049.0

Conclusions and recommendations

The use of volunteer observers on horseback to survey for signs of bilbies and other animals that are difficult to trap has again proven to be effective. Based on a number of assumptions, we estimate that the bilby population is stable or possibly increasing, but more work is needed to link signs of activity such as burrows, with population estimates. Now that a large number of burrows have been identified and geocoded by this project and others (e.g., T. Chapman's project), cameras could be set up near burrows to record bilby activity, leading to a better estimate of the population.

The highest level of bilby activity was associated with cells having greatest diversity of landsystems, being Christmas Creek and Bucktin cells. While a variety of landsystems were used by bilbies, the Lorna landsystem seemed to be a preferred habitat. We attribute this to diversity of vegetation floristics and structure and to higher nutrient status of these sites compared with cells dominated by the Bullimore landsystem, which is nutrient poor.

There are indications that the mortality rate may have decreased since the initial reintroductions, resulting in the bilby population either stabilizing or growing. To further reduce the risk of extinction of the Lorna Glen bilby population, we recommend further reintroductions of at least 100 animals over the next 2 years. These should occur in areas with a diversity of nutrient rich landsystems, which could include some Bullimore as part of the diversity.

The horseback survey technique also enabled data to be collected on the activity of other animals in the bush rather than along roads and tracks. We were able to make estimates of the actual number of cats present in each survey cell, and then by extrapolation, the number of cats on Lorna Glen. It is gratifying that the cat density estimates derived from this technique revealed a relatively low cat population, one that is about 25% of the population that could be expected in the absence of control measures. The survey revealed that under the current seasonal conditions, cats are widespread and have no apparent habitat preference, occurring in similar densities across all landsystems.

To further decrease predator pressure and the risk of local extinction, we suggest increasing effort on cat and dog control by opportunistic ground baiting during the cold winter months, and routine targeted trapping in spring and autumn. Introduced predator monitoring has been scaled back from 4 times per year to twice per year (before and after baiting), freeing up time that should now be spent on targeted trapping.

We recommend that the horseback survey should be repeated annually to establish a bilby population trend. There are some modifications required including:

- At least one full day training where teams work together to standardise identification and interpretation of observations. Having Aboriginal trackers as part of the training and survey teams would be highly desirable.
- A cyber tracker and/or voice recorder for observations as writing legibly on a moving horse, or one that won't stand still is difficult. Re-calibrate the compass on the GPS at the end of each transect.
- A rest day to do some data entry and preliminary analysis, and for volunteers, some sight seeing.

Acknowledgements: We thank Tony and Rowena Woods for providing water for the horses, ensuring we had hot water for a shower after a long day in the saddle, and for willingly helping out in other ways. We also thank the Goldfields Region for supporting this novel approach of bringing work horses back to the rangelands for conservation purposes. The senior author (Neil Burrows) thanks the volunteers who gave up a week of their time to participate in this important project.

Appendix 1: GPS data

Christmas Creek Cell

Lines 1 & 2

Lat	Long	WayPoint	Observation	
-26.225819	121.556721	008	Waypoint	
-26.221384	121.368199	009	Waypoint	Bilby tracks
-26.227518	121.366849	010	Waypoint	Echidna tracks
-26.232008	121.368175	011	Waypoint	Cat tracks
-26.238958	121.36875	012	Waypoint	Bilby burrow old
-26.254233	121.361076	013	Waypoint	Dog tracks
-26.260171	121.357458	014	Waypoint	Cat tracks
-26.273892	121.355725	015	Waypoint	Bilbly burrow old
-26.264825	121.353471	016	Waypoint	Bilby burrow old
-26.263995	121.353053	017	Waypoint	Bilby burrow fresh
-26.263331	121.353039	018	Waypoint	Bilby burrow old
-26.255545	121.351072	019	Waypoint	Cat tracks
-26.247919	121.350122	020	Waypoint	Cat tracks
-26.241631	121.348604	021	Waypoint	Cat tracks
-26.240299	121.348688	022	Waypoint	Bilby burrow fresh
-26.237492	121.348032	023	Waypoint	Cat tracks
-26.229367	121.347838	024	Waypoint	Dog tracks
-26.225359	121.348304	025	Waypoint	Dog tracks
-26.224236	121.348824	026	Waypoint	Cat tracks
-26.223268	121.349095	027	Waypoint	Bilb tracks
-26.223236	121.34912	028	Waypoint	Cat tracks
-26.222652	121.349282	029	Waypoint	Echidna tracks
-26.222107	121.34943	030	Waypoint	Echidna tracks
-26.219871	121.350175	031	Waypoint	Echidna tracks
-26.208879	121.353525	032	Waypoint	Dog tracks
-26.206016	121.355225	033	Waypoint	Dog tracks
-26.204453	121.356358	034	Waypoint	Dog tracks

Lines 3 & 4

-26.2342	121.3298	005	Waypoint	Bilby burrow old
-26.248	121.3265	006	Waypoint	Bilby burrow old x 2
-26.2491	121.3266	007	Waypoint	Bilby burrow old
-26.268	121.3276	008	Waypoint	Bilby burrow old
-26.2683	121.3277	009	Waypoint	Rabbit tracks & dung
-26.2364	121.3181	010	Waypoint	cat tracks fresh

Lines 5 & 6

-26.2052	121.315	003	Waypoint	cat track
-26.2071	121.316	004	Waypoint	cat track
-26.2072	121.3162	005	Waypoint	Bilb track
-26.2076	121.3162	006	Waypoint	cat track
-26.2122	121.3174	007	Waypoint	Bilb track
-26.2139	121.3183	008	Waypoint	cat track
-26.2145	121.3188	009	Waypoint	Bilb track
-26.2167	121.3205	010	Waypoint	Bilb burrow fresh

-26.217	121.3207	011	Waypoint	Bilb burrow fresh
-26.2194	121.3217	012	Waypoint	Dog track
-26.2204	121.3221	013	Waypoint	Bilb track
-26.2287	121.3223	014	Waypoint	Dog tracks
-26.235	121.3217	015	Waypoint	Bilby tracks
-26.2371	121.3211	016	Waypoint	Dog tracks
-26.2373	121.3212	017	Waypoint	Echidna tracks
-26.2565	121.3192	018	Waypoint	Echidna tracks
-26.2603	121.3189	019	Waypoint	Dog tracks
-26.2628	121.3186	020	Waypoint	Bilby burrow old x 3
-26.2807	121.3133	021	Waypoint	Bilby burrow old
-26.2825	121.3134	022	Waypoint	Bilby burrow fresh
-26.2843	121.3144	023	Waypoint	blank
-26.282	121.3116	024	Waypoint	Dog tracks
-26.281	121.3103	025	Waypoint	Bilby scats
-26.2775	121.3054	026	Waypoint	Bilby burrow old
-26.2603	121.3086	027	Waypoint	Bilbl burrow fresh
-26.2414	121.3128	028	Waypoint	Bilby tracks
-26.2383	121.3127	029	Waypoint	Bilby burrow fresh
-26.2358	121.3128	030	Waypoint	Bilby burrow old
-26.2329	121.3133	031	Waypoint	Bilby tracks
-26.2322	121.3132	032	Waypoint	Bilby tracks
-26.2308	121.3133	033	Waypoint	cat tracks
-26.2287	121.3134	034	Waypoint	Bilby burrow fresh
-26.2286	121.3134	035	Waypoint	Echidna tracks
-26.2269	121.3135	036	Waypoint	Bilby tracks
-26.2265	121.3134	037	Waypoint	Bilby and cat tracks
-26.2237	121.3133	038	Waypoint	cat tracks
-26.2188	121.3134	039	Waypoint	Bilby tracks
-26.2151	121.3119	040	Waypoint	cat tracks
-26.2132	121.3109	041	Waypoint	Bilby and cat tracks
-26.2122	121.31	042	Waypoint	Bilby tracks
-26.2116	121.3096	043	Waypoint	Bilby tracks
-26.2094	121.308	044	Waypoint	Bilby tracks
-26.2092	121.3077	045	Waypoint	Bilby burrow fresh
-26.2092	121.3077	046	Waypoint	Bilby tracks

Bucktin Cell

Lines 1 & 2

-26.1442	121.5541	077	Waypoint	Cat tracks
-26.1394	121.5379	078	Waypoint	Bilby tracks
-26.1338	121.521	079	Waypoint	Bilby burrow fresh
-26.1335	121.518	080	Waypoint	Echidna tracks
-26.1332	121.5172	081	Waypoint	Bilby burrow old
-26.1331	121.5165	082	Waypoint	Bilby burrow old
-26.1328	121.5148	083	Waypoint	Cat tracks
-26.1323	121.5098	084	Waypoint	Echidna tracks
-26.1322	121.5086	085	Waypoint	Bilby burrow old
-26.1322	121.5085	086	Waypoint	Bilby burrow old
-26.1321	121.5076	087	Waypoint	Bilby burrow fresh
-26.1325	121.5052	088	Waypoint	Bilby burrow old
-26.1329	121.5021	089	Waypoint	Bilby burrow old
-26.1338	121.4934	090	Waypoint	Bilby burrow fresh + scats
-26.1342	121.4914	091	Waypoint	Bilby burrow old
-26.1355	121.4826	092	Waypoint	Cat tracks

-26.1388	121.4727	093	Waypoint	Cat tracks
-26.1338	121.467	094	Waypoint	Bilby burrow old
-26.1332	121.4674	095	Waypoint	Bilby digs fresh
-26.1318	121.47	096	Waypoint	Cat tracks
-26.1301	121.4746	097	Waypoint	Cat tracks
-26.128	121.4773	098	Waypoint	Bilby digs scats fresh
-26.1263	121.48	099	Waypoint	Cat tracks
-26.1223	121.4863	100	Waypoint	Bilby burrow fresh
-26.1208	121.4893	101	Waypoint	Bilby tracks fresh
-26.1209	121.4891	102	Waypoint	Bilby tracks fresh
-26.1191	121.4924	103	Waypoint	Bilby burrow fresh + scats
-26.122	121.532	104	Waypoint	Bilby burrow fresh + scats
-26.1227	121.5363	105	Waypoint	Echidna tracks
-26.1229	121.5372	106	Waypoint	Echidna tracks
-26.1249	121.5436	107	Waypoint	Echidna tracks

Lines 3 & 4

-26.1202	121.5575	038	Waypoint	cat tracks
-26.1202	121.5574	039	Waypoint	Bilby tracks
-26.1202	121.5533	040	Waypoint	Echidna tracks
-26.1203	121.5522	041	Waypoint	cat tracks
-26.1205	121.5494	042	Waypoint	Echidna tracks
-26.1208	121.5441	043	Waypoint	Echidna tracks
-26.1207	121.542	044	Waypoint	Bilby tracks
-26.1205	121.5412	045	Waypoint	Bilby tracks
-26.1205	121.5395	046	Waypoint	Bilby burrow fresh x 2 plus echidna
-26.1205	121.5389	047	Waypoint	Bilby burrow fresh + echidna
-26.1205	121.5387	048	Waypoint	cat tracks
-26.1204	121.5374	049	Waypoint	Bilby tracks
-26.1194	121.5314	050	Waypoint	cat tracks
-26.119	121.5244	051	Waypoint	Bilby dig
-26.107	121.4991	052	Waypoint	Bilby track
-26.1049	121.5023	053	Waypoint	breakaway
-26.1041	121.5562	054	Waypoint	Echidna tracks

Lines 5 & 6

-26.0948	121.5621	070	Waypoint	Dog tracks
-26.0957	121.5588	071	Waypoint	Echidna tracks
-26.1021	121.5334	072	Waypoint	Bilby burrow old
-26.1031	121.5299	073	Waypoint	Bilby burrow old
-26.1036	121.5281	074	Waypoint	Bilby burrow old
-26.1039	121.5264	075	Waypoint	Bilby burrow fresh
-26.1045	121.5157	076	Waypoint	Bilby burrow old + digs
-26.1047	121.5144	077	Waypoint	Bilby burrow old
-26.1033	121.4951	078	Waypoint	Bilby burrow old + digs
-26.1026	121.493	079	Waypoint	Biby digs
-26.0975	121.4777	080	Waypoint	Bilby burrows old + digs
-26.0965	121.4772	081	Waypoint	Bilby dig
-26.0865	121.4988	082	Waypoint	Bilby burrow fresh
-26.0871	121.5013	083	Waypoint	Bilby burrow fresh
-26.0902	121.53	084	Waypoint	Bilby burrow old
-26.09	121.5301	085	Waypoint	cat tracks
-26.0902	121.5342	086	Waypoint	Bilby burrow old + digs
-26.0903	121.5362	087	Waypoint	Bilby burrow old

-26.0897	121.5411	088	Waypoint	Biby burrow old
-26.0877	121.5608	089	Waypoint	Dog tracks

Desert Cell

Lines 1 & 2

-26.2662	121.276797	053	Waypoint	Bilby burrow old
-26.2641	121.270429	054	Waypoint	Cat tracks
-26.2634	121.266765	055	Waypoint	Bilby burrow old
-26.2611	121.248391	056	Waypoint	Bilby burrow old
-26.2621	121.244762	057	Waypoint	rabbit scats
-26.2742	121.193696	058	Waypoint	Cat tracks
-26.2782	121.19365	059	Waypoint	Cat tracks
-26.2799	121.193568	060	Waypoint	Dog tracks
-26.2801	121.193581	061	Waypoint	Cat tracks
-26.2793	121.197744	062	Waypoint	rabbit and cat tracks
-26.2785	121.198969	063	Waypoint	Cat tracks
-26.2728	121.214129	064	Waypoint	Echidna tracks
-26.2726	121.215207	065	Waypoint	Echidna tracks
-26.2677	121.233387	066	Waypoint	Cat tracks
-26.2649	121.251319	067	Waypoint	Bilby burrow old
-26.2646	121.251278	068	Waypoint	Bilby burrow old
-26.2646	121.251349	069	Waypoint	Bilby burrow fresh
-26.2643	121.251175	070	Waypoint	Bilby tracks
-26.2689	121.261635	071	Waypoint	Cat tracks
-26.2689	121.261928	072	Waypoint	Bilby burrow old
-26.2689	121.262259	073	Waypoint	Bilby burrow old
-26.2688	121.262318	074	Waypoint	Bilby burrow fresh
-26.269	121.26228	075	Waypoint	Bilby burrow fresh
-26.2694	121.262521	076	Waypoint	Bilby burrow old

Lines 3 & 4

-26.293344	121.28	026	Waypoint	blank
-26.29335	121.2731	027	Waypoint	Bilby tracks
-26.293547	121.2721	028	Waypoint	Bilby tracks
-26.29355	121.2721	029	Waypoint	Bilby tracks
-26.292283	121.2589	030	Waypoint	cat tracks
-26.287883	121.2341	031	Waypoint	cat tracks
-26.289016	121.2184	032	Waypoint	Echidna tracks
-26.289869	121.2099	033	Waypoint	Bilby tracks
-26.310163	121.225	034	Waypoint	cat tracks
-26.30548	121.2422	035	Waypoint	cat tracks
-26.303923	121.2605	036	Waypoint	Bilby tracks
-26.303874	121.2615	037	Waypoint	blank

Lines 5 & 6

-26.324608	121.259502	055	Waypoint	Echidna tracks
-26.325073	121.255317	056	Waypoint	cat tracks
-26.314801	121.192949	057	Waypoint	Dog tracks
-26.336221	121.205704	058	Waypoint	Bilby burrow old
-26.336221	121.205712	059	Waypoint	Bilby dig
-26.337314	121.208621	060	Waypoint	Bildy dig
-26.339579	121.214765	061	Waypoint	Bilby burrow old
-26.339636	121.221705	062	Waypoint	Echidna tracks
-26.339186	121.226224	063	Waypoint	cat tracks

-26.339386	121.232168	064	Waypoint	cat tracks
-26.340339	121.235977	065	Waypoint	Echidna tracks
-26.341502	121.240049	066	Waypoint	cat tracks
-26.341647	121.242371	067	Waypoint	cat tracks
-26.340964	121.263655	068	Waypoint	Echidna tracks
-26.334686	121.278601	069	Waypoint	Bilby burrow old

Spinifex Cell

Lines 1 & 2

-26.2931	121.2823	035	Waypoint	Echidna tracks
-26.2928	121.2862	036	Waypoint	Cat tracks
-26.2931	121.291	037	Waypoint	Cat tracks
-26.2916	121.2958	038	Waypoint	Bilby burrow old
-26.2932	121.2999	039	Waypoint	Echidna tracks
-26.2938	121.3016	040	Waypoint	Echidna tracks
-26.2941	121.303	041	Waypoint	Cat tracks
-26.2959	121.3175	042	Waypoint	Echidna tracks
-26.2938	121.3247	043	Waypoint	Bilby digs fresh
-26.293	121.3291	044	Waypoint	Echidna tracks
-26.2927	121.3294	045	Waypoint	Bilby burrow fresh
-26.2922	121.3307	046	Waypoint	Cat tracks
-26.2907	121.3422	047	Waypoint	Bilby burrow fresh
-26.2902	121.3701	048	Waypoint	Cat tracks
-26.2993	121.3702	049	Waypoint	Cat tracks
-26.303	121.2888	050	Waypoint	Cat tracks
-26.3026	121.2862	051	Waypoint	Cat tracks
-26.3025	121.2857	052	Waypoint	Echidna tracks

Lines 3 & 4

-26.3182	121.2912	011	Waypoint	Echidna tracks
-26.3178	121.2986	012	Waypoint	cat tracks
-26.3178	121.3028	013	Waypoint	cat tracks
-26.3162	121.3304	014	Waypoint	cat tracks
-26.3162	121.3491	015	Waypoint	Bilby burrow old
-26.3178	121.3592	016	Waypoint	Echidna tracks
-26.3175	121.3633	017	Waypoint	cat tracks
-26.3326	121.3611	018	Waypoint	Echidna tracks
-26.3324	121.3599	019	Waypoint	Echidna tracks
-26.3323	121.3584	020	Waypoint	cat tracks
-26.3341	121.3257	021	Waypoint	Echidna tracks
-26.3342	121.3132	022	Waypoint	Bilby tracks
-26.3343	121.3095	023	Waypoint	cat tracks
-26.3342	121.3085	024	Waypoint	Bilby tracks
-26.3342	121.307	025	Waypoint	blank

Lines 5 & 6

-26.3441	121.2881	047	Waypoint	Dog tracks
-26.3442	121.2897	048	Waypoint	Echidna tracks
-26.3438	121.3029	049	Waypoint	Dog tracks
-26.3482	121.3247	050	Waypoint	Dog tracks
-26.3437	121.3713	051	Waypoint	Dog tracks
-26.3533	121.3692	052	Waypoint	Dog tracks
-26.3533	121.3636	053	Waypoint	Dog tracks
-26.3534	121.3279	054	Waypoint	cat tracks

Appendix 2