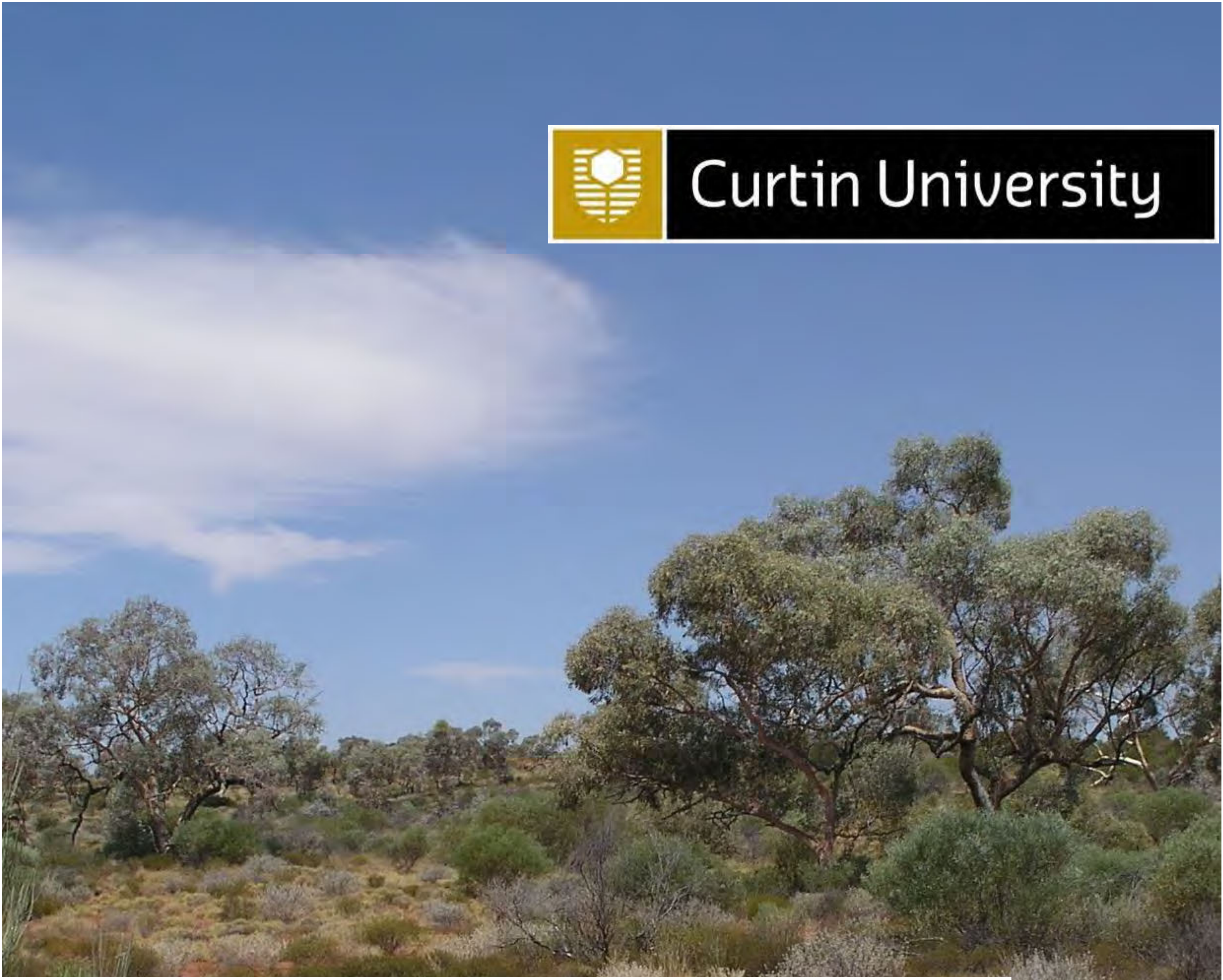

# Camera trap image collation and species analysis within Great Victoria Desert Landscape Conservation Initiative areas (GVDBT research areas)

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Curtin would like to pay respect to the Aboriginal and Torres Strait Islander members of our community by acknowledging the Traditional Owners of the land on which the Perth campus is located, the Whadjuk people of the Noongar Nation; and the Wongutha people of the North-Eastern Goldfields on which our Kalgoorlie campus is located. We acknowledge the Traditional Owners, their ancestors, Elders, and emerging for their stewardship of Country.



*Image credit: Jalouise.com.au.investment*

## REPORT INFORMATION

- Project Name: Camera trap image collation and species analysis within the Great Victoria Desert landscape conservation initiative area. Report No. 3.
- Date of report completion: July 2026
- Report Author(s): Mark Cowan, Curtin University
- Project Proponent(s): Great Victoria Desert Biodiversity Trust Management Panel

## KEY FINDINGS

• **Influence of Seasonal Conditions:** Detection rates increased substantially for most mammal species during the latter part of the sampling period, particularly for predators such as feral cats, dingoes and foxes. This pattern is likely to reflect the favourable conditions following widespread rainfall, which may have increased both animal activity and local abundance through improved prey availability and reproductive success.

• **Independent Animal Detections:** A total of 8572 independent animal detections (defined as one detection per species, per camera, per 24-hour period) were recorded across the functioning cameras, averaging 91.3 independent detections per camera (SD = 57.1). Despite this overall total, detection rates for individual species remained low across much of the survey area, particularly for less common species, highlighting the value of a large camera network and extended survey duration for detecting rare fauna.

• **Species Dominance:** Camels were by far the most frequently detected species, accounting for more than 50% of all independent detections (4,436 detections). Dingoes (729 detections) and feral cats (568 detections) were the next most frequently recorded species. These values represent independent detection events rather than counts of individual animals. For social or gregarious species, including camels, dingoes and some bird species, a single independent detection often contained multiple individuals. For almost all other species, however, an independent detection invariably represented a single individual.

• **Malleefowl Detections:** Malleefowl detections increased substantially during the current survey, with 24 independent detections from 11 cameras recorded compared with only three detections during the previous sampling period. Most detections occurred at on-track cameras (15 detections from six cameras), with the remaining nine detections were recorded at five off-track cameras.

• **Sandhill Dunnart Detections:** A total of 43 independent detections from eight cameras were recorded during the current sampling period, compared with 26 and 32 detections during the previous two sampling periods. Almost all detections occurred during the first of the two sampling periods assessed here, with 42 of the 43 detections recorded during this period and only a single detection during the second. Given the relatively low number of detections and their uneven distribution between sampling periods, it is difficult to determine whether this pattern reflects genuine changes in abundance or activity, variation in detectability, or differences in sampling conditions.

- **Feral Cat Detections:** Cat detections increased substantially compared with the previous survey, from 48 independent detections to 568 detections recorded from 80 cameras (42 on-track and 38 off-track). During the first sampling period, detections were similar between off-track (50 detections) and on-track (60 detections) cameras. During the second sampling period, detections increased considerably at on-track cameras (288 detections) compared with off-track cameras (170 detections). However, the proportion of cameras detecting cats remained broadly similar between deployment types. This suggests that the higher number of on-track detections is more likely to reflect increased detection probability rather than greater abundance. Visual examination of the detection records indicates that the same individuals were repeatedly detected at on-track cameras, consistent with cats using vehicle tracks as movement corridors. These findings demonstrate that higher detection frequencies should not necessarily be interpreted as indicating higher abundance without considering how camera placement influences detection probability.

- **High Spatial and Temporal Overlap Between Cats and Dingoes:** Feral cats and dingoes were frequently detected at the same camera locations, particularly on-track where both species were recorded at 42 of the 50 cameras (84%). On off-track cameras they coincided at 11 (24%) of cameras. Activity patterns were also remarkably similar with no obvious evidence of temporal avoidance by cats. While these observations do not allow conclusions regarding predator interactions, they suggest that the elevated detections of cats during this survey were more likely associated with favourable seasonal conditions than strong predator-mediated interactions.

- **Off-Track Cameras Capture Greater Species Diversity:** Off-track camera deployments continued to record higher species diversity than on-track cameras, with a mean Margalef's species diversity (d) of 1.2063 (SD = 0.4986) compared with 0.870 (SD = 0.2830) for on-track cameras, indicating that off-track deployments provide a more representative assessment of mammal assemblages.

- **Low Detection Rates and High Variability:** Detection rates remained low for most species, particularly those of conservation significance. Considerable variability between survey periods, together with inconsistent camera performance, continues to limit the ability of the monitoring program to reliably detect changes in biodiversity or assess management outcomes for all but the most common and widespread species.

- **High Rate of False Detections:** Of the 1,058,443 images captured during the survey, 987,339 (93%) were classified as false detections, with only 71,104 images (6.8%) containing animals. This very high proportion of false detections indicates that camera placement and field-of-view selection could be substantially improved. Although vegetation growth during the extended deployment period contributed to false triggering, many false detections could be avoided with better camera placement. Improving camera positioning would reduce false detections, improve battery life and memory card utilisation, and substantially reduce the effort required for image processing and analysis.

- **Camera Failures:** During the first survey period, 39 cameras recorded imagery for less than 75% of the deployment period (i.e. fewer than 282 days of the 377-day deployment). During the second survey period, at least 10 cameras recorded imagery for less than 75% of the deployment period (i.e. fewer than 133 days of the 179-day deployment). Across the combined

555-day monitoring period, 37 cameras recorded imagery for less than 75% of the total deployment duration (i.e. fewer than 416 days). The reasons for these reductions in camera operation cannot be determined from the available information but are likely to include full memory cards, depleted batteries, equipment malfunction and other camera failures. As the 75% threshold is conservative, the actual number of cameras that ceased operating before the end of the deployment periods was likely higher.

- **Off-Track Cameras Were Slightly More Reliable:** Off-track cameras remained marginally more reliable than on-track cameras, with 16 off-track cameras recording imagery for less than 75% of the total deployment duration compared with 21 on-track cameras.

## CONTEXT

This report represents the third assessment of the Great Victoria Desert Biodiversity Trust's (GVDBT) camera trap program in the Great Victoria Desert (GVD). It summarises the third and fourth rounds of data collection and provides an evaluation of these data.

Since May 2022, ninety-six remote camera traps have been deployed in two distinct areas of the GVD, each covering approximately 30 km × 30 km. These areas are designated as the Reference Area (RA) and the Management Area (MA). The RA is located adjacent to the south-western boundary of the Plumridge Lakes Nature Reserve, while the MA is approximately 23 km east of the Queen Victoria Spring Nature Reserve. The north-eastern corner of the MA lies approximately 20 km from the south-western corner of the RA.

The purpose of these two areas is to enable a before-after-control-impact (BACI) experimental design at a landscape scale. Planned manipulations in the MA may include fire regime modifications and introduced predator management. In contrast, the RA will serve as a control area with no planned interventions. The camera network aims to establish a baseline understanding of biodiversity in both areas, focusing on conservation-significant species such as malleefowl, sandhill dunnarts and mulgara, as well as introduced predators and herbivores.

In each area, 25 infrared flash cameras are positioned along track edges at intervals of more than 3 km, while 23 white flash cameras are deployed off-track in long-unburnt vegetation at intervals of more than 1.5 km. The initial assessment covered the period between camera installation in May 2022 and the first servicing in August 2023, approximately 16 months after deployment.

This report presents the most recent camera trap data and, together with data from the previous survey periods, provides individual site assessments and collective analyses of on-track and off-track camera deployments within both the RA and MA. Emphasis is placed on conservation-significant species and introduced species.

As in the previous analysis, the data have been integrated into the CPW PhotoWarehouse database (hereafter, CPW), enabling the viewing of collated camera trap imagery, generation of reports and export of data. As CPW is no longer maintained by its developers, a new database system, Camera Trap SQLite, developed by the author and based on the open-source SQLite database engine, has also been provided. This system provides a simplified and faster interface for viewing, filtering and updating images while maintaining all data in an accessible SQLite database. Additionally, a link to a web-based application (Cowan 2017) that facilitates spatial and temporal analysis of the data is provided for further exploration.

## DATA COLLATION

Camera trap data were provided on a hard drive, with images organised into separate folders for each survey visit. Within each visit, images were further organised into four folders representing the sampling strata (RA - On Track, RA - Off Track, MA - On Track and MA - Off Track). Within these folders, images were stored in separate folders for each camera.

A total of 96 cameras remained deployed across the study. The first sampling period extended for approximately 377 days (24 April 2024 to 6 May 2025), while the second sampling period extended for approximately 178 days (6 May 2025 to 31 October 2025), giving a total intended deployment period of approximately 555 days. One camera (54B) had not been serviced since before the commencement of this survey and contained images dating back to 23 August 2023.

Image data were provided for 93 cameras during the first visit and for all 96 cameras during the second visit. Although the intended deployment period was 555 days, the effective sampling period varied considerably among cameras because many appeared to have ceased recording images before the next servicing visit. During the first sampling period, 66 cameras recorded images for less than the total deployment period, with image capture spanning an average of 237 days (range 1–361 days). During the second sampling period, approximately 20 cameras recorded images for less than the full deployment period, with image capture spanning an average of 101 days (range 1–162 days). Four cameras recorded images for only a single day following the second visit.

The reasons for the apparent cessation of image collection could not be determined from the supplied data because battery status and other camera diagnostic information were not available. Consequently, it is unknown whether these cameras ceased recording because of battery depletion, camera malfunction, memory card issues or simply because no further detections occurred to trigger image capture, although the latter is considered unlikely for most cameras. As a result, although the deployment spanned 555 days, the effective sampling effort varied substantially among cameras.

Subsequent analyses are based on the combined dataset from both sampling periods rather than treating the visits separately. In total, 1,058,443 images were available for analysis.

Image processing and data collation followed the same workflow used in the previous survey assessments to ensure consistency between survey periods.

Images were initially processed using MegaDetector AI software (Beery et al., 2019). A detection probability threshold of 10% was applied to separate images likely to contain animals from those containing no animals. To minimise false negatives, all images classified as non-detections were manually reviewed using FastStone Image Viewer (FastStone, 2023), and any images containing animals were returned to the positive image dataset. False positives were not removed at this stage, as they were identified and excluded during subsequent species identification.

Camera traps frequently capture multiple images of the same individual or group within a short period (e.g. a kangaroo grazing in front of a camera or a dingo investigating the camera). To minimise repeated manual identification, image sequences were grouped using the image capture times recorded in the EXIF metadata. Using R (R Core Team, 2024), images captured within 10 seconds of one another at the same camera were assigned to a single sequence, and the image with the highest MegaDetector confidence score was selected as the representative image for species identification.

The representative images were imported into the CPW PhotoWarehouse database (hereafter, CPW) (Newkirk, 2016), where species identity and associated metadata (camera, date and time) were recorded.

As CPW is no longer maintained by its developers, the complete dataset can also be managed using Camera Trap SQLite, an open-source SQLite-based database developed by the author. Although CPW was used for this assessment to maintain compatibility with previous survey periods, Camera Trap SQLite provides a simpler and faster interface for viewing, filtering and updating camera trap data.

Diversity analyses were undertaken using PRIMER v7 (Clarke & Gorley 2015). Calculations and interpretation followed the methods described by Clarke et al. (2014).

## RESULTS- OVERVIEW

While the original number of images from all camera traps was 1,058,443, 93% (987,339) of these were identified as false detections. False detections for each camera are illustrated in Figure 1. A total of 71,104 positive detections were recorded from the 96 cameras assessed, resulting in an average of 748 images per camera (SD = 618.5), as shown in Figure 2.

The number of independent animal detections (defined as a single detection of any species on any camera within a 24-hour period) is shown in Figure 3. A total of 8572 independent animal detections were recorded, with an average of 91.3 detections per camera (SD = 57.1).

At least 37 cameras (38.5%) yielded incomplete datasets, likely because of battery depletion, full SD cards or other equipment malfunctions during the sampling period (Figure 4). These issues were slightly more prevalent among the infrared on-track cameras, with at least 21 cameras providing incomplete datasets. For the off-track cameras, 16 had incomplete datasets. Overall, of the 96 cameras deployed, only 59 were operational for more than 75% of the intended sampling duration.

When assessing species detections, it is important to define the time interval used to establish independence. Extensive analysis of camera trap datasets by the author has shown that, for most species, particularly those that are rare or infrequently encountered, using a single detection per camera per 24-hour period produces results that differ little from those obtained using shorter intervals, such as one hour or less. For many species, there is no difference at all. This is because most animals do not repeatedly traverse the same area within short timeframes, and when multiple detections occur in quick succession, they typically involve the same individual(s). Therefore, throughout this report, a 24-hour interval is used to define independent detections unless otherwise stated.

An assessment of the influence of different independence intervals for all identified mammal species across the entire dataset (April 2024 to October 2025) is presented in Figure 5.

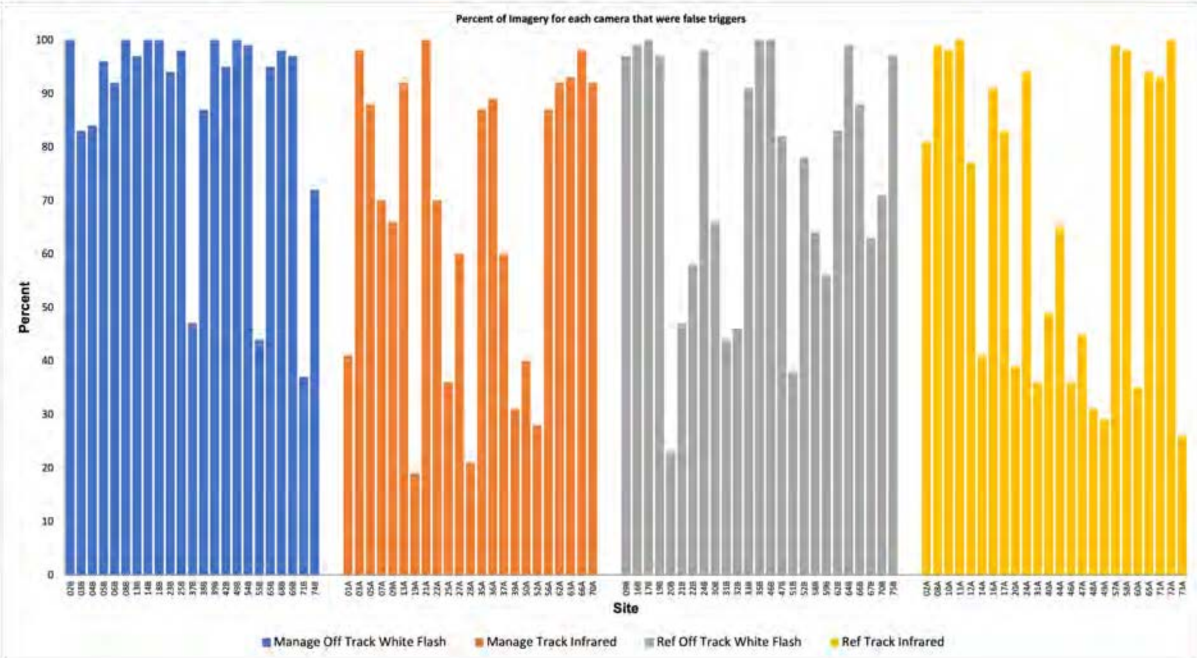


Figure 1 False detections as a percent of the overall imagery taken for each camera during this survey period.

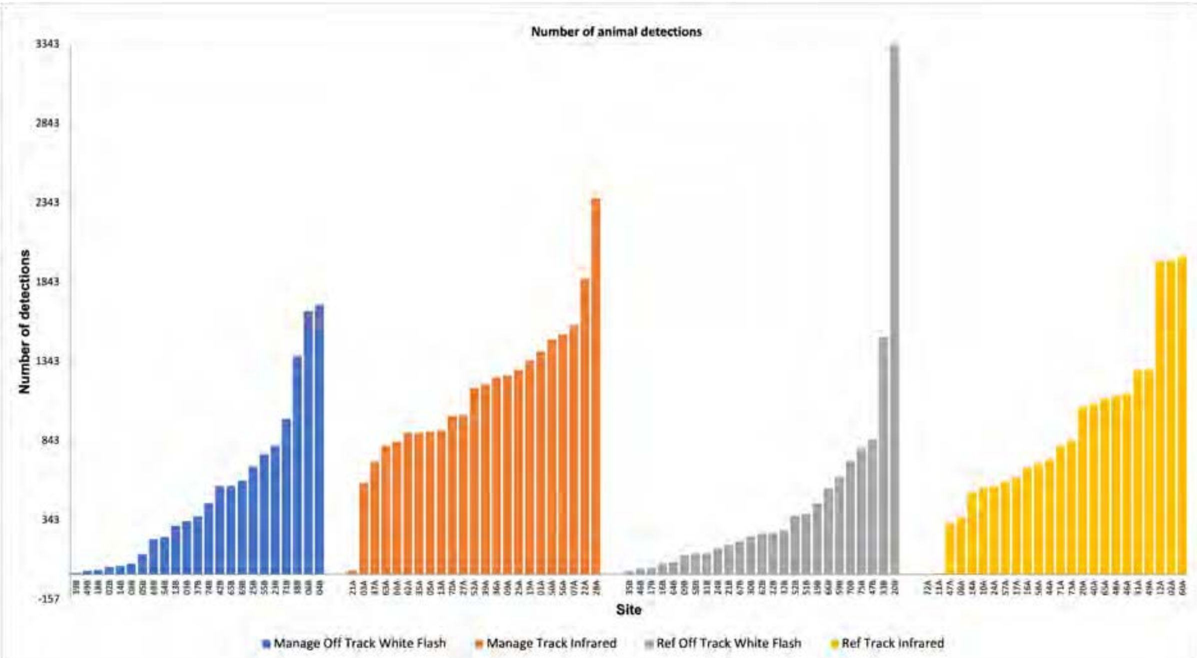


Figure 2 Number of positive detections for each camera during this survey period.

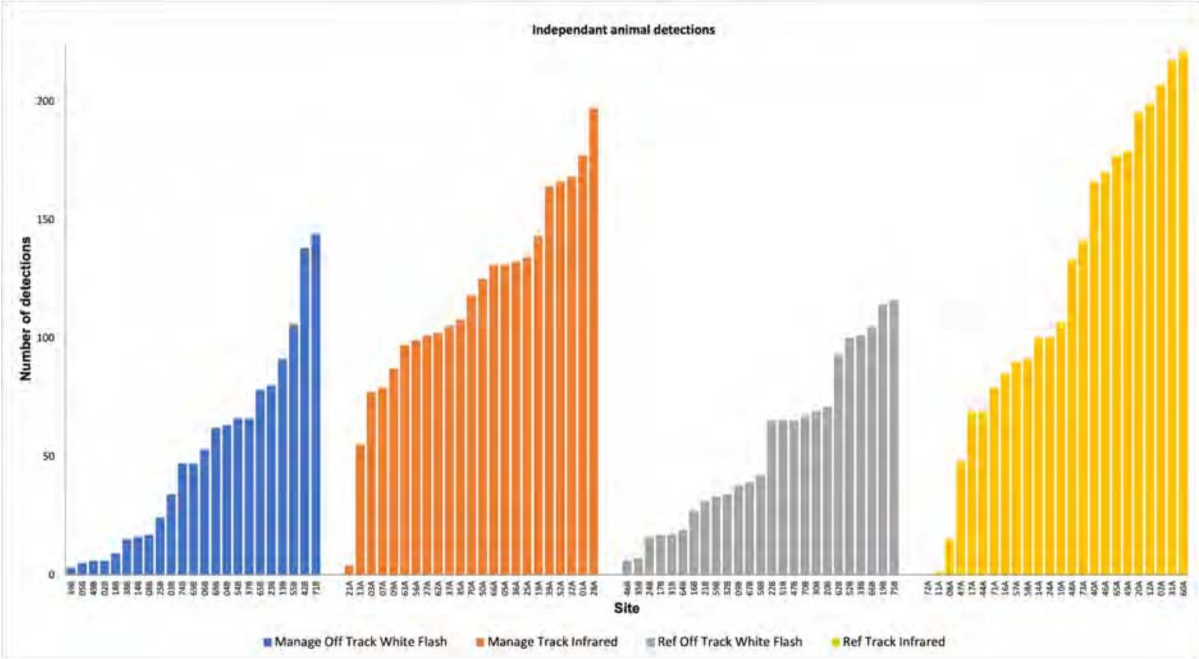


Figure 3 Number of animal detections for each camera.

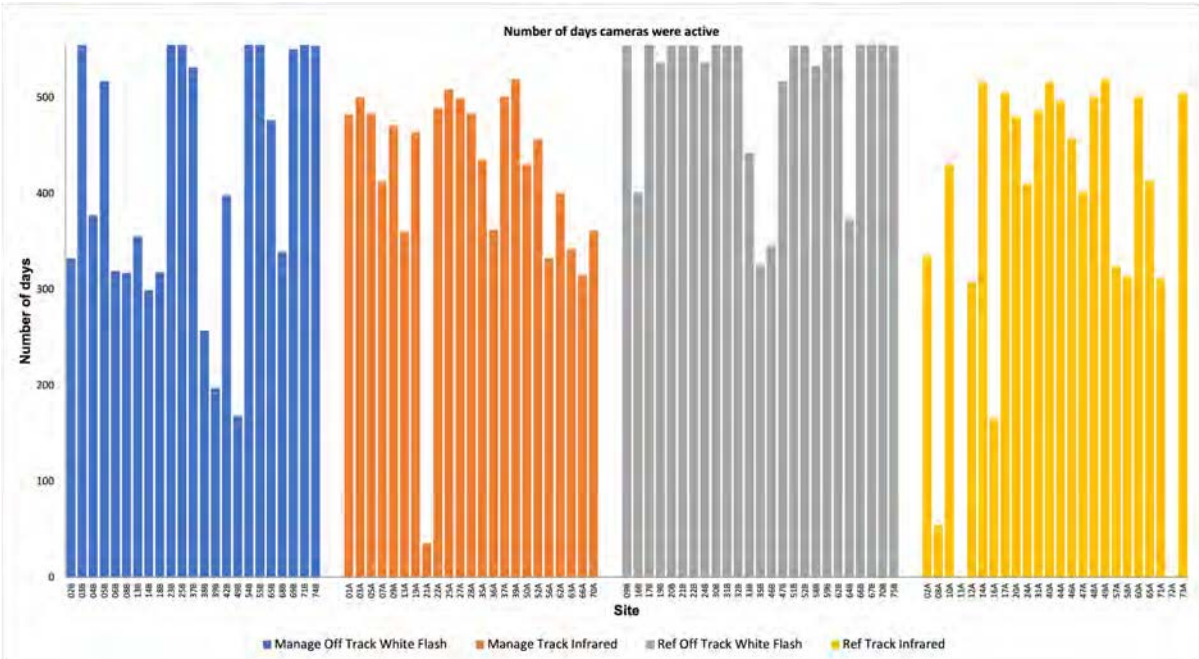


Figure 4 Number of days each camera was active during the survey period.

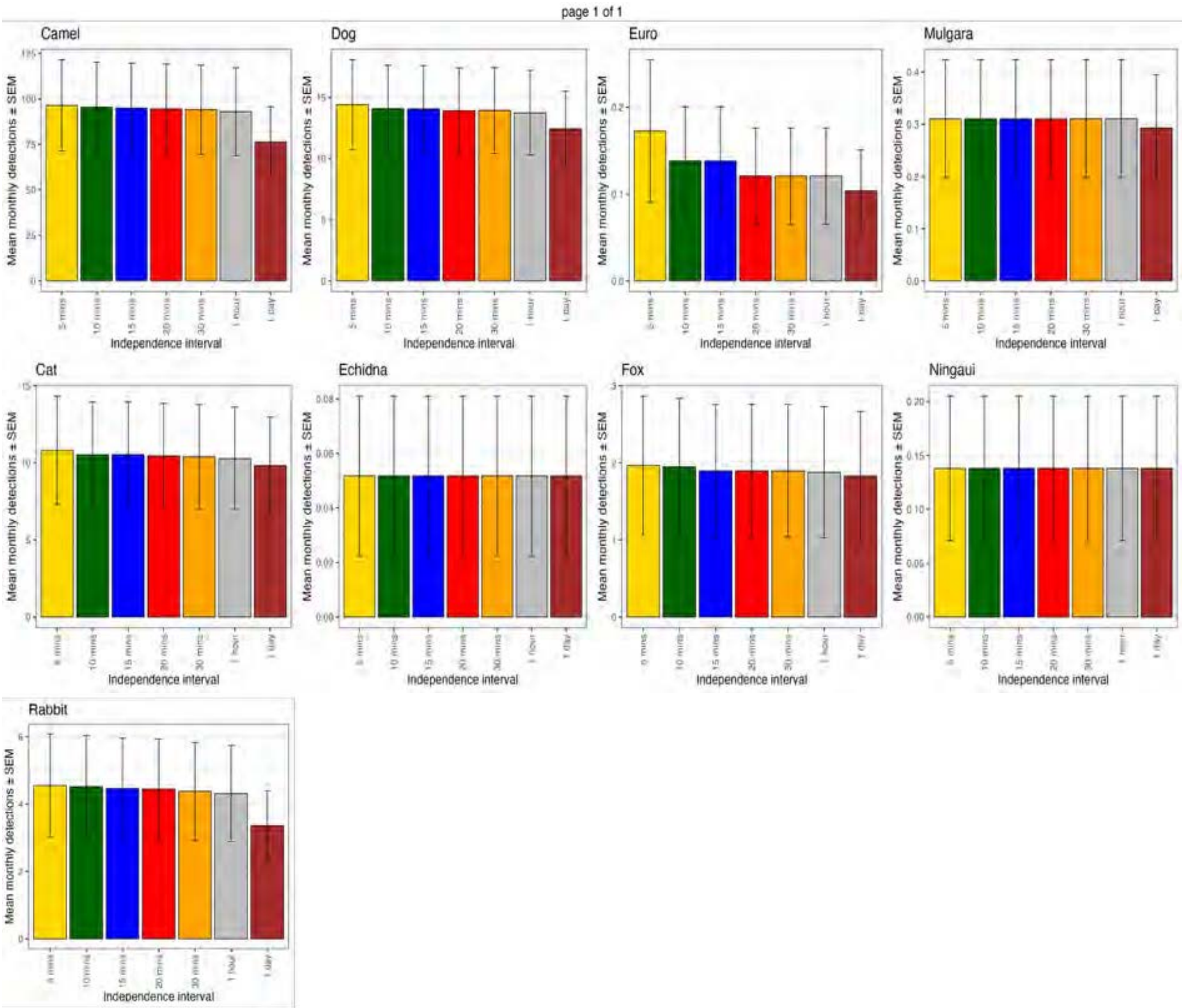


**Figure 5 Difference in detection rates ranging from five minutes to 24 hours for all mammal species identified.**

## RESULTS-ANIMALS

During the current survey period, a total of 53 species were identified, comprising 36 bird species, 13 mammal species and 4 reptile species. The previous survey period recorded 29 species, including 12 bird species, 12 mammal species and 5 reptile species. This contrasts with the first survey, during which 46 species were identified, comprising 25 bird species, 15 mammal species and 6 reptile species. Notably, the fox and echidna were detected during the first survey, were absent from the second survey, but were recorded again during the current survey.

A total of 878 images could not be confidently classified to species because animals were only partially captured, were too small or poorly positioned within the image, or image quality was otherwise insufficient for reliable identification. The number of individual animals represented by these images is substantially lower than 878, as each detection typically comprises a burst of three images and, in some cases, image sequences continued for the same detection event.

Summary detection data for mammals, birds and reptiles are presented in Tables 1 and 2. It should be noted however that the thermal signatures, body size and behaviour of birds and reptiles make them less reliably detected by camera traps than mammals. Consequently, except for conservation-significant species such as the malleefowl, the remainder of this report focuses on the mammal fauna.

During this survey, four introduced species were detected: camel, feral cat, fox and rabbit. Three conservation-significant native species were also recorded: malleefowl, brush-tailed mulgara and sandhill dunnart. Table 1 provides an overview of all independent detections recorded during the survey, detailing each species and its distribution across the respective study areas.

Like previous survey periods, overall mammal species richness was markedly higher off-track (13 species) in both the RA and MA than on-track (8 species), where large mammals dominated the detections. Camels and dingoes had substantially higher detection rates on-track (4,436 and 729 detections, respectively) than off-track (98 and 33 detections, respectively). Camel detections were similar between the RA (2,138) and the MA (2,298), while dingoes, consistent with previous survey periods, were detected more frequently in the RA (426) than the MA (303). Feral cats were recorded 568 times, with 348 detections on-track and 220 off-track. Foxes, which were not detected during the previous survey period, were recorded 104 times, comprising 86 on-track and 18 off-track detections. Only four fox detections occurred in the MA, with the remaining 100 detections recorded in the RA. Rabbits were detected predominantly off-track (178 detections) compared with on-track (28 detections), with 36 detections in the RA and 170 in the MA.

For conservation-significant species, 24 malleefowl detections were recorded during the current survey period. By comparison, only three detections were recorded during the first survey (two on-track and one off-track), all within the same general area of the MA, while no malleefowl were detected during the previous survey period. A total of 16 brush-tailed mulgara detections were recorded, with 15 occurring off-track in the MA and one on-track in the RA. Sandhill dunnarts were recorded 43 times, all from off-track cameras, comprising 32 detections in the MA and 11 in the RA. A degree of caution is warranted when interpreting sandhill dunnart detections, as identification of small mammals, including both rodents and marsupials, can be challenging from camera trap imagery alone. Newly identified sites where sandhill dunnarts have been detected should therefore be confirmed through targeted on-ground surveys.

**Table 1. Independent detections of fauna that were identified from camera traps on track and off track in both the management area and the reference area. This covers both survey periods with / delimiting detections from May 25 from October 25.**

| Common Name | reference area off track | management area off track | reference area on track | management area on track | Total |
|---|---|---|---|---|---|
| Australian pipit | 2/0 | | 0/1 | | **3** |
| Bearded dragon | | | | 0/1 | **1** |
| Bird | 37/7 | 12/7 | 8/1 | 0/1 | **73** |
| Black tree monitor | 8/3 | 7/0 | | | **18** |
| Black-faced woodswallow | 1/0 | 2/0 | 1/0 | | |
| Budgerigar | 91/0 | 90/1 | | | **182** |

| Common Name | reference area off track | management area off track | reference area on track | management area on track | Total |
|---|---|---|---|---|---|
| Bustard | 2/1 | 2/5 | 4/4 | 2/11 | **31** |
| Camel | 34/27 | 14/23 | 1175/902 | 1240/1021 | **4436** |
| Cat | 32/80 | 18/90 | 44/155 | 16/133 | **568** |
| Chestnut-backed quail-thrush | 5/1 | 6/4 | 1/5 | | **22** |
| Cockatiel | 1/0 | 1/0 | | | **2** |
| Collared sparrowhawk | 1/0 | | | | **1** |
| Common bronzewing | 12/29 | 8/7 | 3/1 | 3/4 | **67** |
| Crested bellbird | 57/15 | 7/5 | 2/2 | 0/5 | **93** |
| Crested Dragon | | | | | |
| Crimson chat | 21/0 | 8/0 | | | **29** |
| Crow | 5/0 | 2/0 | 0/3 | 3/1 | **14** |
| Currowong | 24/18 | 58/7 | 2/1 | 1/5 | **116** |
| Diamond dove | 4/0 | 2/0 | | | **6** |
| Dingo | 11/15 | 4/3 | 199/201 | 78/218 | **729** |
| Dragon | 6/0 | 3/0 | | | **9** |
| Dunnart | 69/28 | 60/36 | | | **187** |
| Echidna | 0/1 | 1/1 | | | **3** |
| Emu | 0/2 | 2/0 | 1/16 | 13/14 | **48** |
| Euro | 5/1 | | | | **6** |
| Fox | 1/17 | | 15/67 | 0/4 | **104** |
| Gilberts Whistler | | | | | |
| Goulds sand goanna | 9/3 | 15/6 | 1/0 | | **34** |
| Grey butcherbird | 2/4 | 1/3 | 1/0 | | **11** |
| Grey kangaroo | 49/58 | 43/45 | 39/50 | 13/39 | **336** |
| Grey shrike-thrush | 10/1 | 1/5 | | | **17** |
| Grey teal | | 3/0 | | | **3** |
| Hooded Robin | | | | | |
| Jacky winter | | 1/0 | | | **1** |
| Little buttonquail | 47/0 | 45/0 | 1/0 | 1/0 | **94** |
| Magpie | 1/9 | 1/3 | 1/1 | 1/3 | **20** |
| Malleefowl | 0/6 | 0/3 | 0/1 | 3/14 | **24** |
| Mammal | 10/26 | 16/27 | 9/9 | 3/7 | **107** |
| Masked woodswallow | 12/0 | 16/0 | | 0/1 | **29** |
| Mouse | 0/6 | 7/6 | | | **19** |
| Mulgara | | 7/8 | 1/0 | | **16** |
| Ningaui | 2/1 | 4/1 | | | **8** |

| Common Name | reference area off track | management area off track | reference area on track | management area on track | Total |
|---|---|---|---|---|---|
| Owlet nightjar | 1/0 | 6/0 | 2/0 | | **9** |
| Pied butcherbird | 1/1 | | | | **2** |
| Pygmy Desert Monitor | | | | | |
| Rabbit | 12/17 | 28/121 | 2/5 | 3/18 | **206** |
| Red-capped Robin | | | | | |
| Redthroat | 2/0 | | | | **2** |
| Ring-necked parrot | 0/2 | | | | **2** |
| Sandhill dunnart | 10/1 | 32/0 | | | **43** |
| Sandy inland mouse | 10/57 | 22/4 | | | **93** |
| Short-tailed Grasswren | | | | | |
| Scarlet-chested parrot | 8/2 | | | | **10** |
| Skink | | 2/0 | | | **2** |
| Spinifex hopping mouse | 217/146 | 130/111 | | 0/3 | **607** |
| Splendid Fairy-wren | | | | | |
| Spiny-cheeked honeyeater | 1/0 | | | | **1** |
| Spotted nightjar | 2/5 | | 1/0 | | **8** |
| Striated Pardalote | | | | | |
| Tawny frogmouth | 0/1 | | | | **1** |
| Thorny devil | 4/0 | | 9/0 | | **13** |
| Unknown | 10/6 | 4/6 | 3/5 | 0/7 | **39** |
| Wedge-tailed eagle | 1/0 | | | | **1** |
| White-browed babbler | 7/1 | 1/0 | | | **9** |
| White-fronted honeyeater | 1/1 | 3/0 | 1/0 | | **6** |
| White-winged triller | 8/0 | 7/0 | | 1/0 | **16** |
| Willie Wagtail | | | | | |
| Yellow-throated miner | 3/8 | 3/15 | | 6/1 | **30** |
| Zebra finch | 1/0 | | | | **1** |
| **Total** | **873/605** | **720/553** | **1517/1430** | **1378/1510** | **8568** |

The proportion of cameras that detected each species, on-track and off-track, within both the RA and MA, as well as across all cameras combined for the entire survey period (April 2024 to October 2025), is presented in Table 2.

For conservation-significant species, sandhill dunnarts were detected at 8% of all cameras, with all detections off-track at 17% of cameras in the RA and 17% in the MA. Brush-tailed mulgara were detected at 5% of cameras overall, with detections at 17% of the off-track cameras in the MA and 4% on-track in the RA. Malleefowl were detected at 11% of cameras overall, with detection rates of 20% on-track and 13% off-track in the MA, and 4% on-track and 9% off-track in the RA.

Camels, feral cats and grey kangaroos were detected at more than 70% of all cameras, while dingoes were detected at more than 55%, although detection rates varied between the RA and MA and between on-track and off-track cameras. Camels were detected at more than 88% of on-track cameras, and up to 78% of off-track cameras. Dingoes were detected at more than 84% of on-track cameras but at substantially lower rates off-track (13% in the MA and 43% in the RA). Grey kangaroos were detected at 71% of cameras overall, with detection rates ranging from 60% to 76% among the four sampling strata.

Foxes were detected at 21% of all cameras, with detection rates exceeding 26% in the RA but less than 8% in the MA. Feral cats were detected at 85% of cameras overall, with broadly similar detection rates on-track (MA = 92%, RA = 76%) and off-track (MA = 74%, RA = 91%). Rabbits were detected at 26% of cameras overall, with lower detection rates on-track (MA = 20%, RA = 16%) than off-track (MA = 43%, RA = 26%).

**Table 2. Proportion of cameras within the different treatments on which each species was detected. This covers the time cameras were in the field from April 2024 to October 2025 and are expressed as percentages.**

| Common Name | reference area off track | management area off track | reference area on track | management area on track | all camera s |
|---|---|---|---|---|---|
| Australian pipit | 9 | 0 | 4 | 0 | **3** |
| Bearded dragon | 0 | 0 | 0 | 4 | **1** |
| Black tree monitor | 30 | 17 | 0 | 0 | **11** |
| Black-faced woodswallow | 4 | 4 | 4 | 0 | **3** |
| Budgerigar | 74 | 70 | 0 | 0 | **34** |
| Bustard | 13 | 13 | 28 | 28 | **21** |
| Camel | 78 | 70 | 88 | 92 | **85** |
| Cat | 91 | 74 | 76 | 92 | **85** |
| Chestnut-backed quail-thrush | 17 | 9 | 12 | 0 | **9** |
| Cockatiel | 4 | 4 | 0 | 0 | **2** |
| Collared sparrowhawk | 4 | 0 | 0 | 0 | **1** |
| Common bronzewing | 52 | 39 | 16 | 20 | **31** |
| Crested bellbird | 78 | 35 | 8 | 12 | **32** |
| Crimson chat | 43 | 13 | 0 | 0 | **14** |
| Crow | 9 | 4 | 4 | 12 | **7** |
| Currowong | 70 | 30 | 4 | 8 | 27 |
| Diamond dove | 4 | 9 | 0 | 0 | 3 |
| Dingo | 43 | 13 | 88 | 84 | 58 |
| Dragon | 17 | 9 | 0 | 0 | **6** |
| Dunnart | 65 | 70 | 0 | 0 | **32** |
| Echidna | 4 | 9 | 0 | 0 | **3** |

| Common Name | reference area off track | management area off track | reference area on track | management area on track | all cameras |
|---|---|---|---|---|---|
| Emu | 9 | 9 | 28 | 60 | **27** |
| Euro | 9 | 0 | 0 | 0 | **2** |
| Fox | 26 | 0 | 48 | 8 | **21** |
| Goulds sand goanna | 39 | 52 | 4 | 0 | **23** |
| Grey butcherbird | 22 | 13 | 4 | 0 | **9** |
| Grey kangaroo | 74 | 74 | 76 | 60 | 71 |
| Grey shrike-thrush | 39 | 22 | 0 | 0 | **15** |
| Grey teal | 0 | 9 | 0 | 0 | 2 |
| Jacky winter | 0 | 4 | 0 | 0 | **1** |
| Little buttonquail | 43 | 43 | 4 | 4 | **23** |
| Magpie | 17 | 4 | 8 | 12 | **10** |
| Malleefowl | 9 | 13 | 4 | 20 | 11 |
| Masked woodswallow | 30 | 35 | 0 | 4 | **17** |
| Mouse | 17 | 26 | 0 | 0 | **10** |
| Mulgara | 0 | 17 | 4 | 0 | **5** |
| Ningaui | 13 | 17 | 0 | 0 | **7** |
| Owlet nightjar | 4 | 13 | 4 | 0 | **5** |
| Pied butcherbird | 9 | 0 | 0 | 0 | **2** |
| Rabbit | 26 | 43 | 16 | 20 | **26** |
| Redthroat | 9 | 0 | 0 | 0 | **2** |
| Ring-necked parrot | 9 | 0 | 0 | 0 | **2** |
| Sandhill dunnart | 17 | 17 | 0 | 0 | **8** |
| Sandy inland mouse | 39 | 30 | 0 | 0 | **17** |
| Scarlet-chested parrot | 22 | 0 | 0 | 0 | **5** |
| Skink | 0 | 4 | 0 | 0 | **1** |
| Spinifex hopping mouse | 74 | 57 | 0 | 8 | **33** |
| Spiny-cheeked honeyeater | 4 | 0 | 0 | 0 | **1** |
| Spotted nightjar | 26 | 0 | 4 | 0 | **7** |
| Tawny frogmouth | 4 | 0 | 0 | 0 | **1** |
| Thorny devil | 13 | 4 | 0 | 0 | **4** |
| Wedge-tailed eagle | 4 | 0 | 0 | 0 | **1** |
| White-browed babbler | 22 | 4 | 0 | 0 | **6** |
| white-fronted honeyeater | 9 | 13 | 4 | 0 | **6** |
| White-winged triller | 26 | 26 | 0 | 4 | **14** |
| Willie Wagtail | 4 | 0 | 0 | 0 | **1** |
| Yellow-throated miner | 26 | 22 | 0 | 4 | **13** |
| Zebra finch | 4 | 0 | 0 | 0 | **1** |

Geographic detection distributions for the three conservation-significant species, sandhill dunnart, malleefowl and brush-tailed mulgara, are presented in Figures 6 - 8. Detection distributions for introduced mammals across both the RA and MA are presented in Figures 9 - 13, while all other mammal species are presented in Appendix A (Figures 17 - 24). In all figures, green points indicate off-track cameras, and blue points indicate on-track cameras. Numbers represent independent detections.

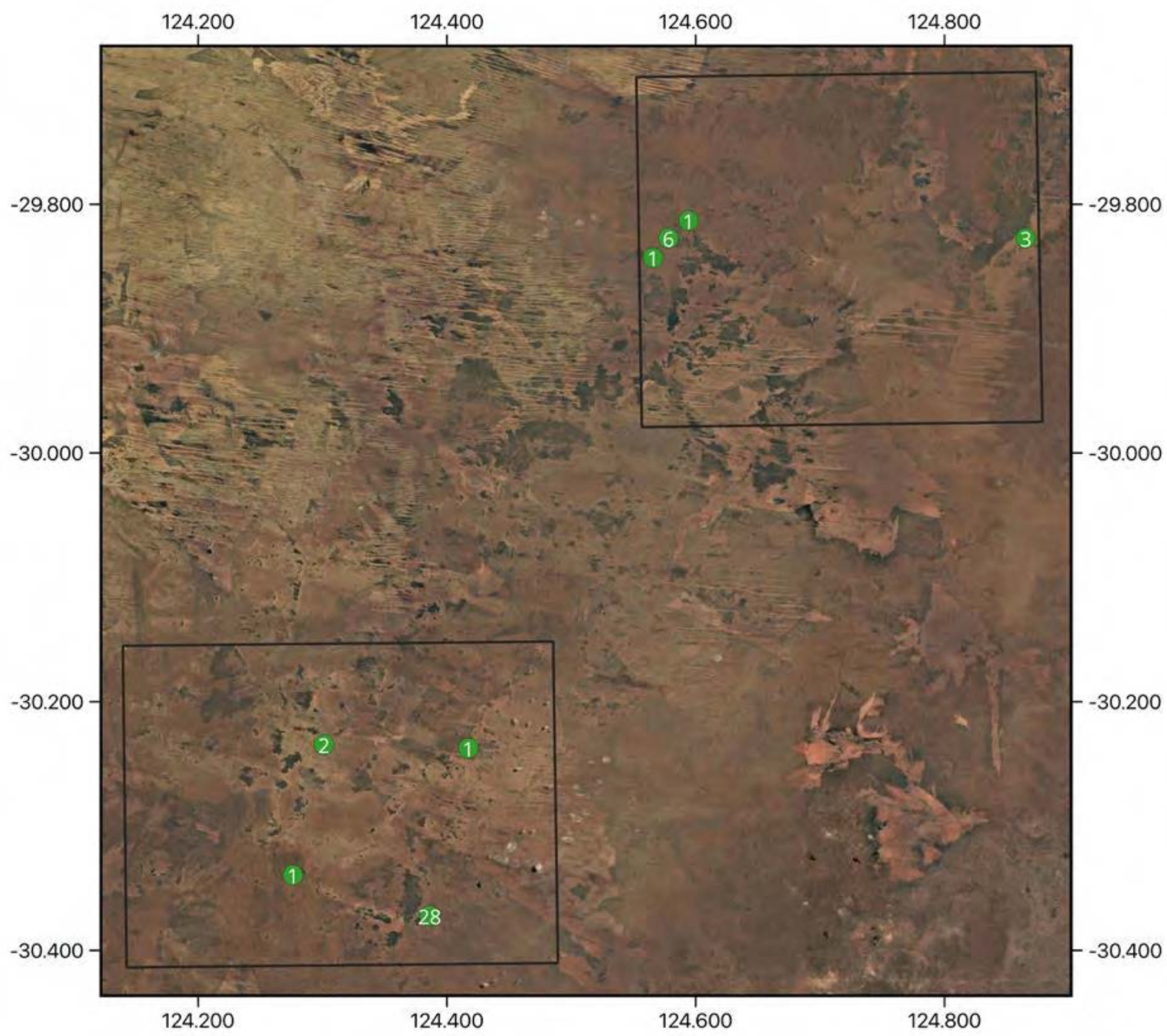


**Figure 6 Sandhill Dunnart detections in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

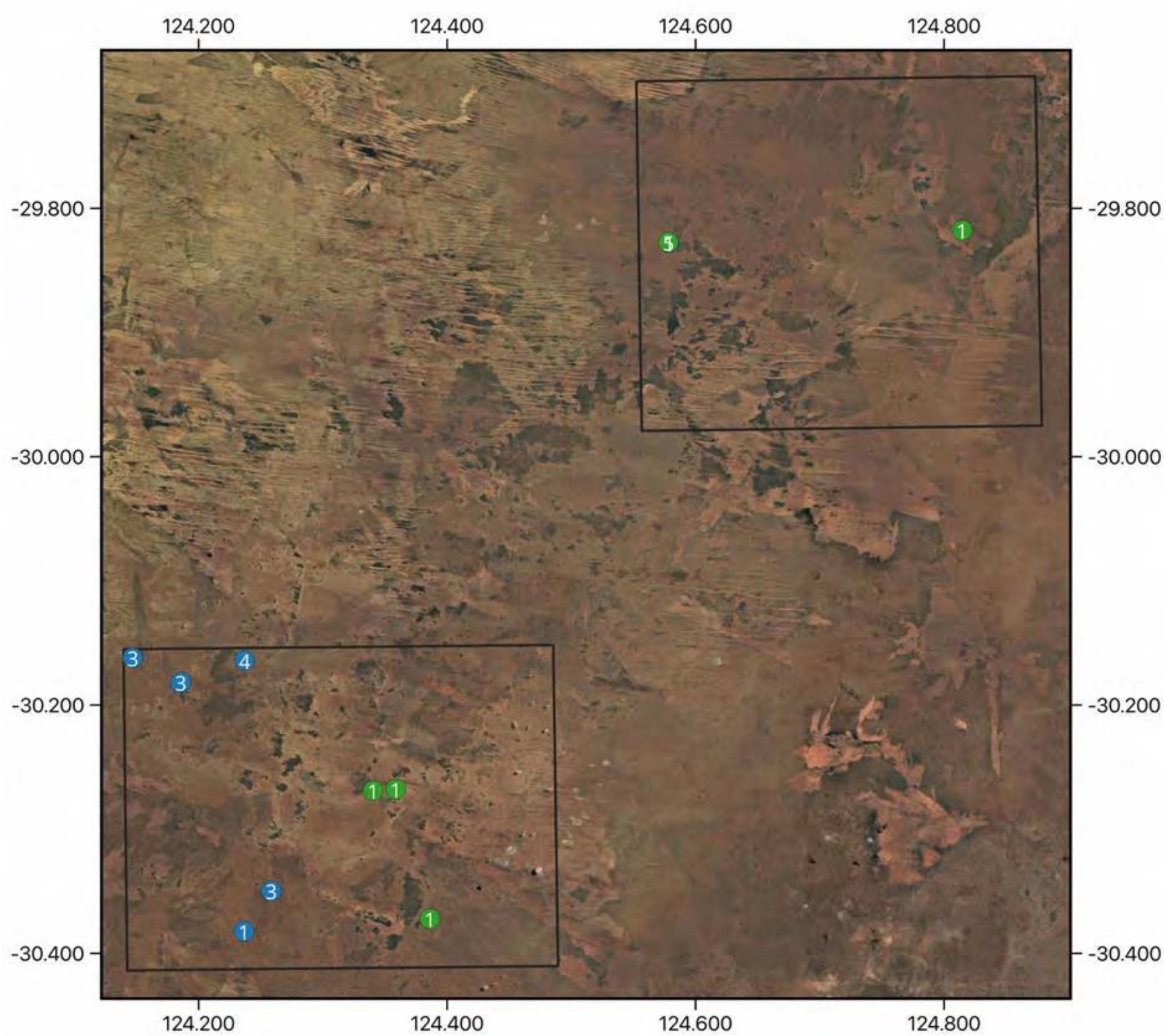


**Figure 7 Malleefowl in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent**

a single detection.

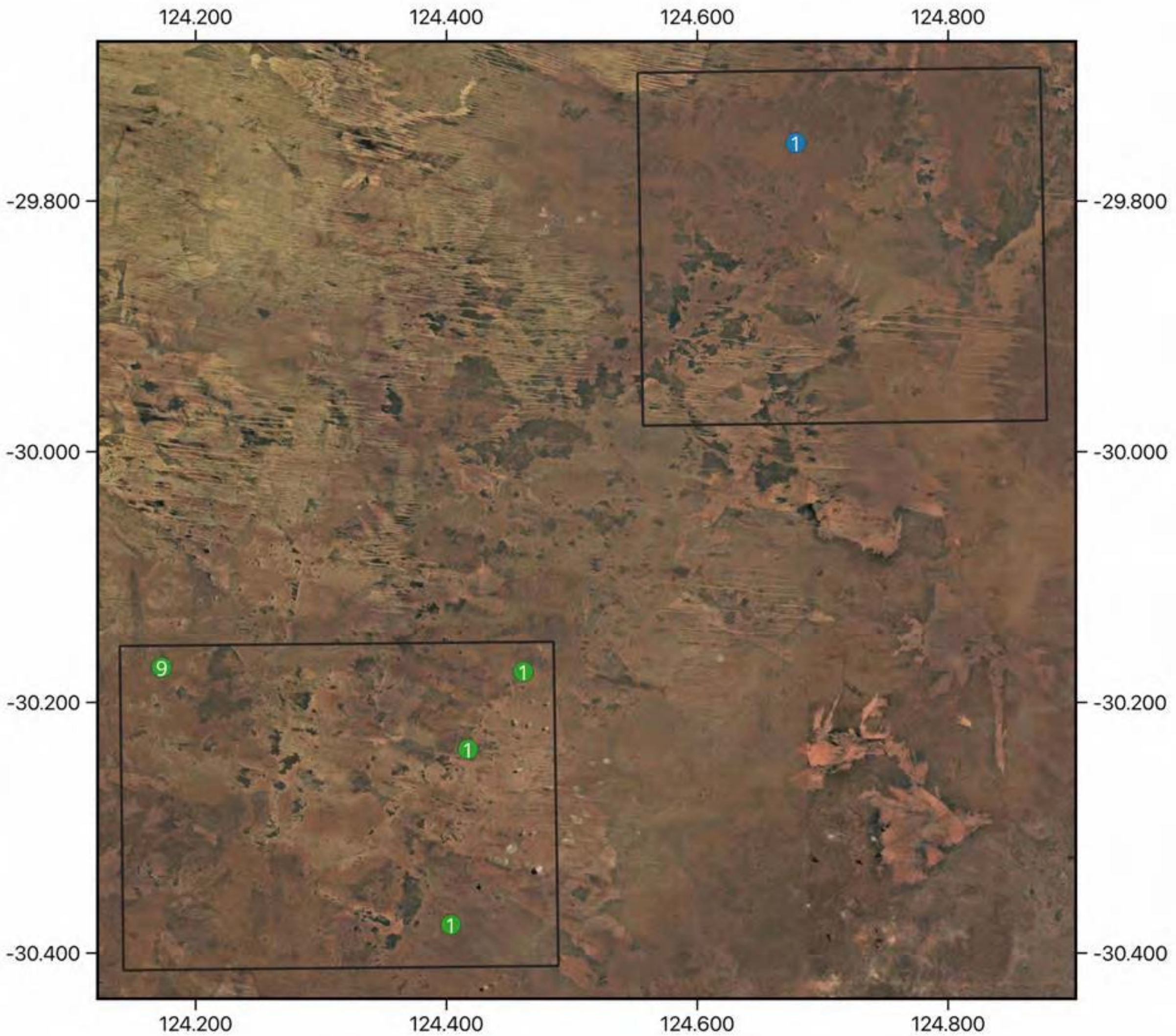


**Figure 8 Mulgara in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

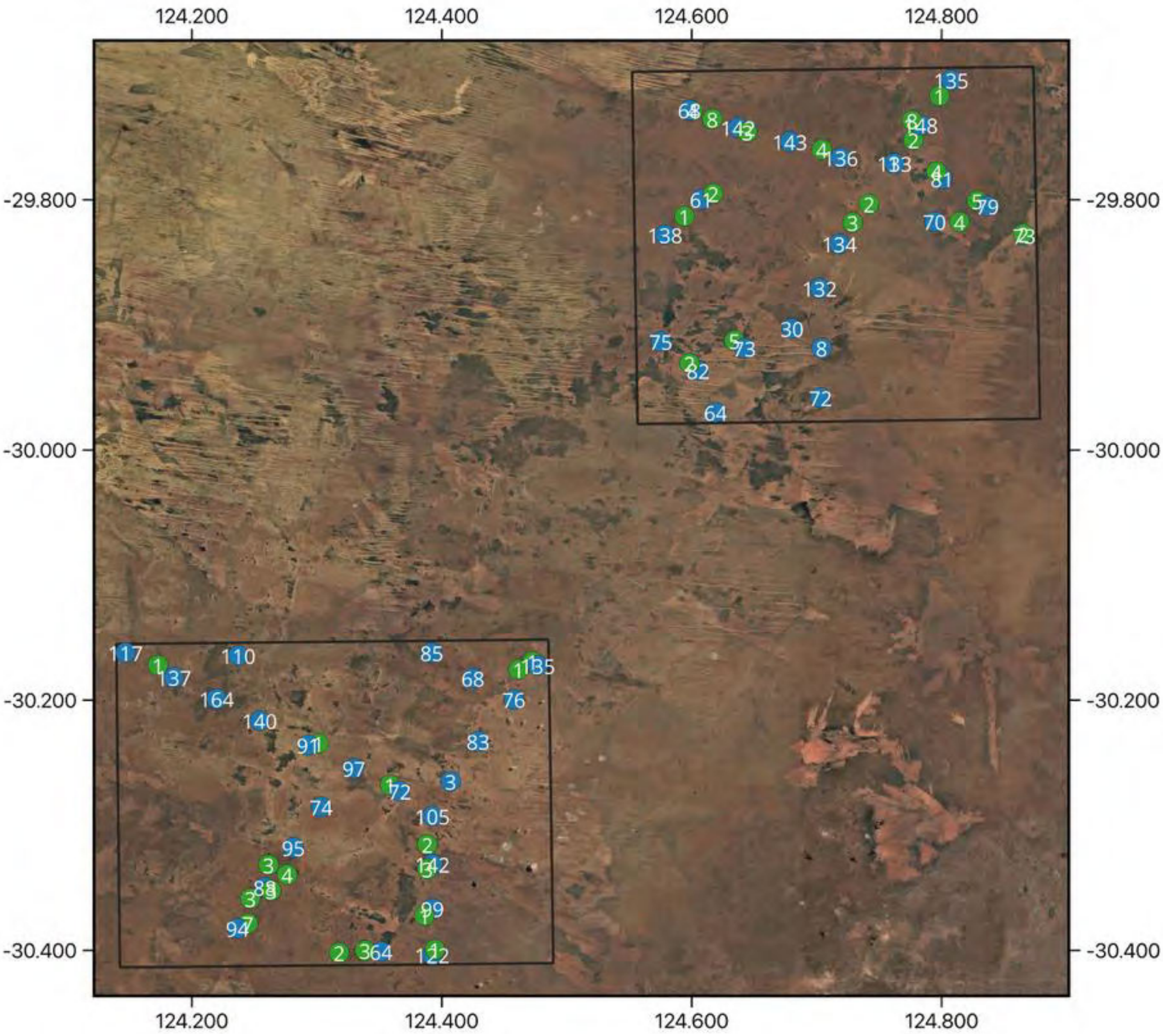


**Figure 9 Camel detections in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

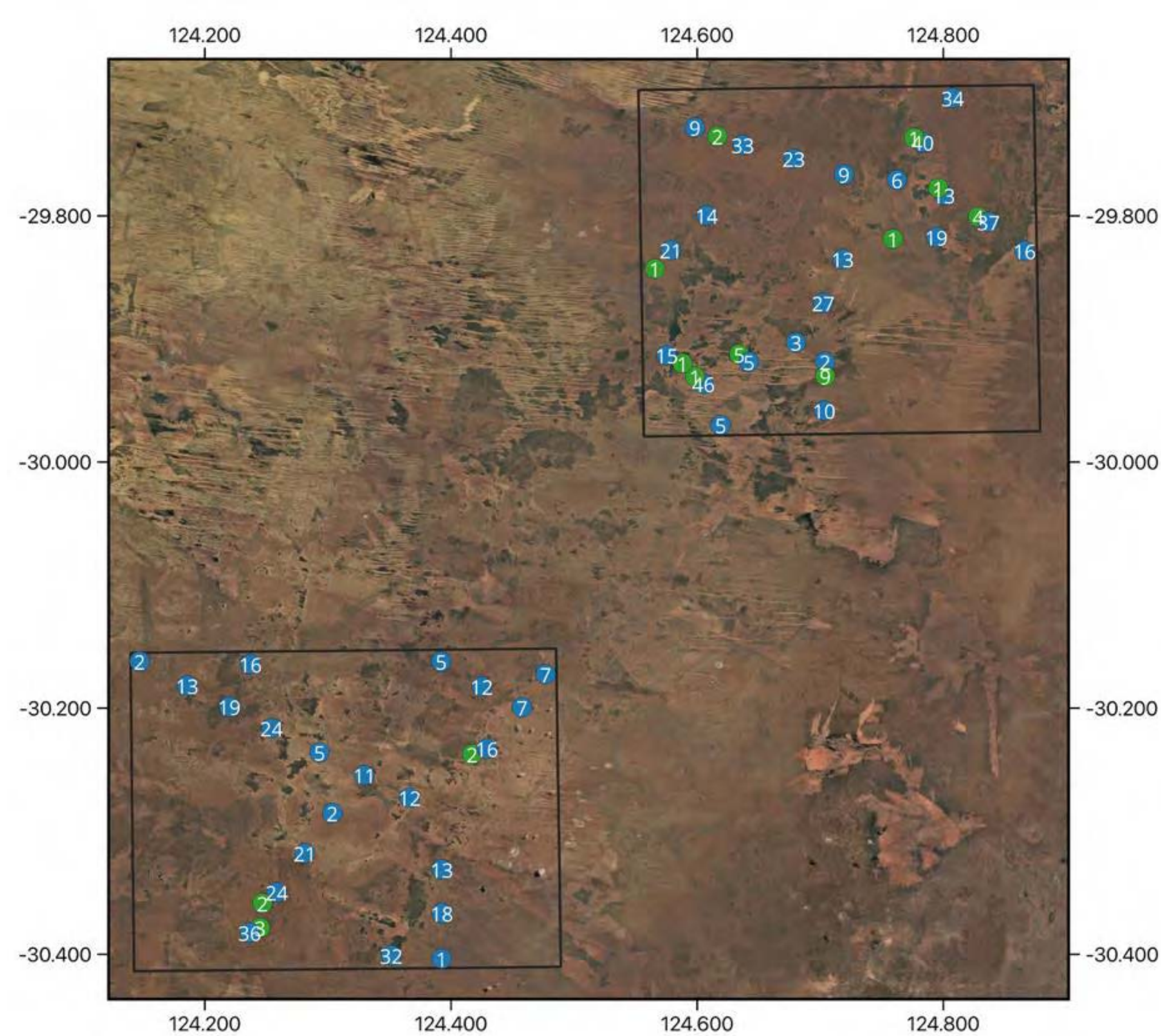


**Figure 10 Dingo detections in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

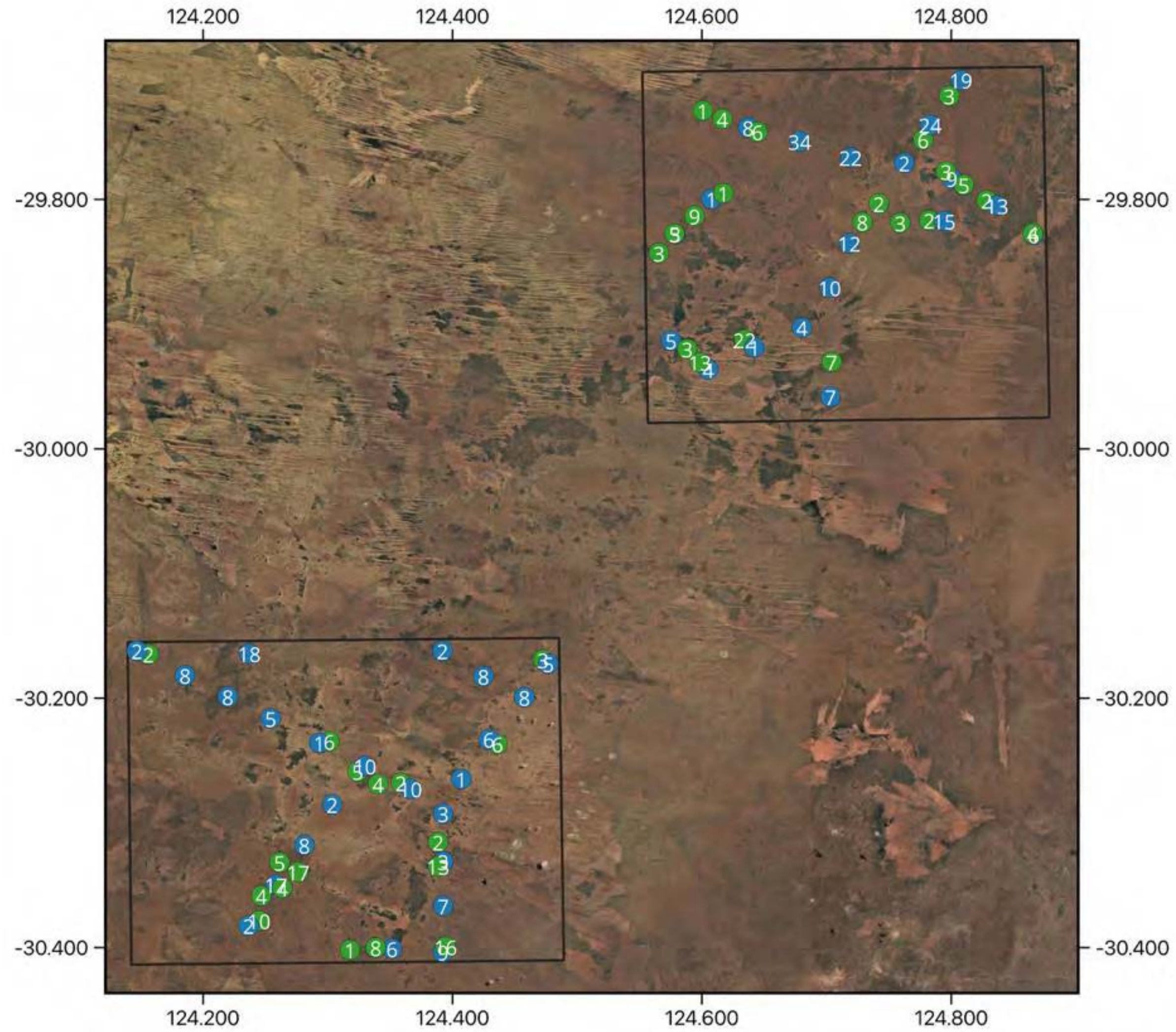


**Figure 11 Cat detections in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

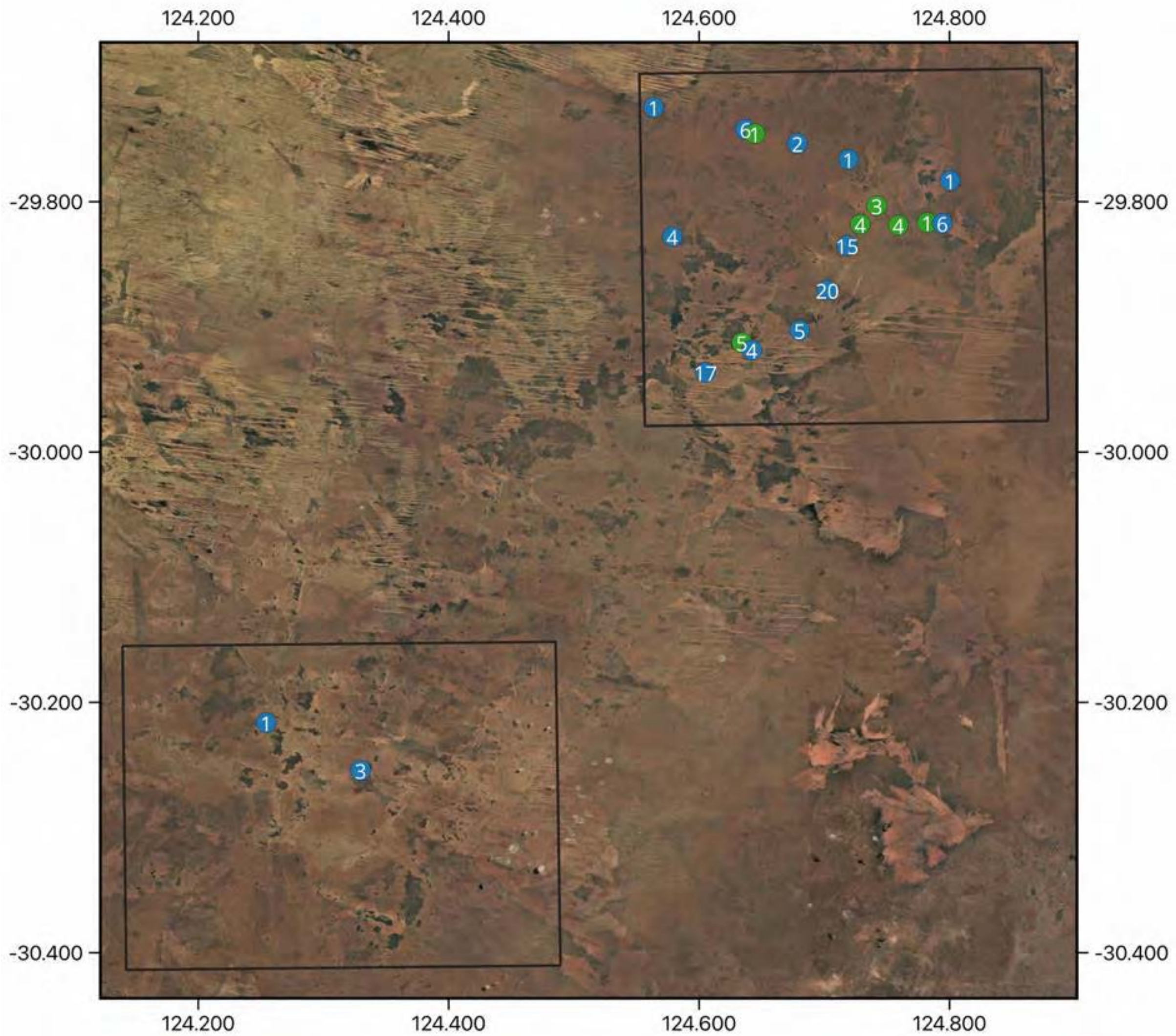


**Figure 12 Fox detections in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

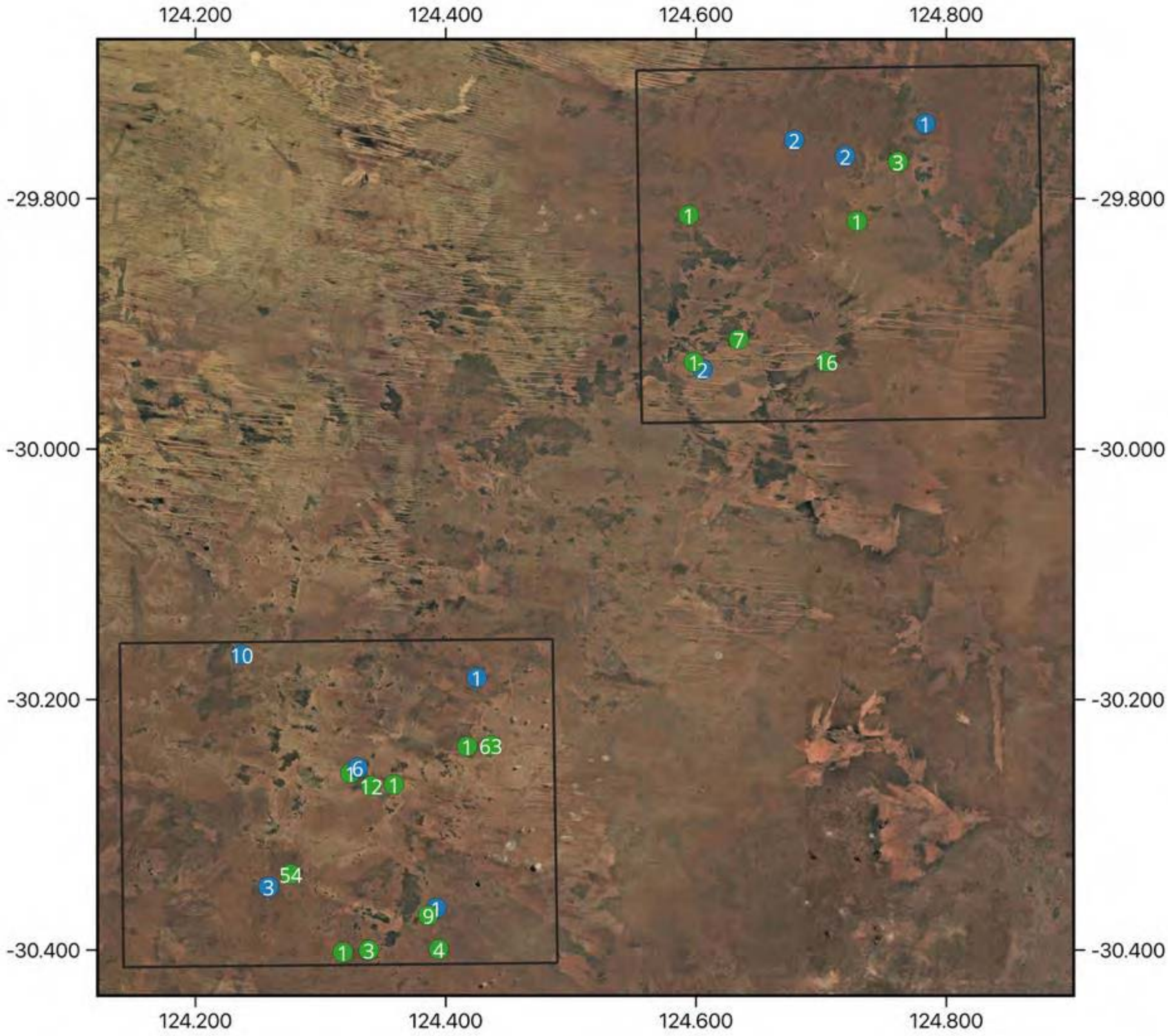


**Figure 13 Rabbit detections in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

As part of the evaluation of biodiversity in the study area, we again calculated two diversity indices: Margalef's Species Richness Index (d) and Pielou's Evenness Index (J'). These indices provide insights into both species' richness, and the evenness of species present in the environment. Data from all available cameras were analysed to calculate these values for both on-track and off-track locations.

For the on-track cameras, the average number of species detected was similar in both the MA (mean = 5.13, SD = 1.46) and the RA (mean = 4.96, SD = 1.82). Margalef's Species Richness Index (d) for the management area was 0.87 (SD = 0.26), while for the reference area it was 0.86 (SD = 0.31). Pielou's Evenness Index (J') values were 0.43 (SD = 0.15) for the management area and 0.52 (SD = 0.15) for the reference area.

For the off-track cameras, the average number of species detected was 4.57 (SD = 2.04) in the management area and 4.84 (SD = 1.70) in the reference area. Margalef's Species Richness Index (d) for the management area was 1.22 (SD = 0.58), while for the reference area it was

1.19 (SD = 0.42). Pielou's Evenness Index (J') values were 0.76 (SD = 0.16) for the management area and 0.69 (SD = 0.21) for the reference area.

Individual camera values are presented in Table 3 for on-track cameras and Table 4 for off-track cameras.

**Table 3 number of species (S), number of individuals (N), the Shannon-Weiner Index (D) and Pielou's Evenness Index (J') for on-track cameras.**

| Study Area | | S | N | d | J' |
|---|---|---|---|---|---|
| Ref Track Infrared | 02A | 5 | 199 | 0.7557 | 0.6678 |
| Ref Track Infrared | 08A | 2 | 10 | 0.4343 | 0.7219 |
| Ref Track Infrared | 10A | 5 | 105 | 0.8595 | 0.4710 |
| Ref Track Infrared | 11A | 1 | 1 | **** | **** |
| Ref Track Infrared | 12A | 7 | 197 | 1.1357 | 0.4822 |
| Ref Track Infrared | 14A | 5 | 97 | 0.8744 | 0.4832 |
| Ref Track Infrared | 16A | 4 | 81 | 0.6827 | 0.5361 |
| Ref Track Infrared | 17A | 2 | 69 | 0.2362 | 0.3751 |
| Ref Track Infrared | 20A | 4 | 195 | 0.5689 | 0.6531 |
| Ref Track Infrared | 24A | 6 | 98 | 1.0905 | 0.4376 |
| Ref Track Infrared | 31A | 6 | 215 | 0.9310 | 0.4965 |
| Ref Track Infrared | 40A | 7 | 154 | 1.1912 | 0.6065 |
| Ref Track Infrared | 44A | 4 | 153 | 0.5964 | 0.8545 |
| Ref Track Infrared | 46A | 6 | 169 | 0.9747 | 0.3726 |
| Ref Track Infrared | 47A | 6 | 44 | 1.3213 | 0.6035 |
| Ref Track Infrared | 48A | 5 | 125 | 0.8284 | 0.7864 |
| Ref Track Infrared | 49A | 6 | 177 | 0.9660 | 0.4878 |
| Ref Track Infrared | 57A | 4 | 90 | 0.6667 | 0.4842 |
| Ref Track Infrared | 58A | 7 | 91 | 1.3301 | 0.4227 |
| Ref Track Infrared | 60A | 8 | 217 | 1.3011 | 0.5336 |
| Ref Track Infrared | 65A | 7 | 174 | 1.1630 | 0.4049 |
| Ref Track Infrared | 71A | 4 | 79 | 0.6866 | 0.3514 |
| Ref Track Infrared | 73A | 3 | 141 | 0.4041 | 0.2274 |
| Manage Track Infrared | 01A | 5 | 171 | 0.7780 | 0.3745 |
| Manage Track Infrared | 03A | 5 | 135 | 0.8154 | 0.6314 |
| Manage Track Infrared | 05A | 5 | 127 | 0.8257 | 0.5285 |
| Manage Track Infrared | 07A | 4 | 151 | 0.5979 | 0.3257 |
| Manage Track Infrared | 09A | 5 | 84 | 0.9028 | 0.3279 |
| Manage Track Infrared | 13A | 2 | 108 | 0.2136 | 0.1831 |
| Manage Track Infrared | 19A | 7 | 142 | 1.2107 | 0.4883 |
| Manage Track Infrared | 21A | 2 | 4 | 0.7213 | 0.8113 |
| Manage Track Infrared | 22A | 5 | 167 | 0.7816 | 0.3696 |
| Manage Track Infrared | 25A | 4 | 133 | 0.6135 | 0.2416 |
| Manage Track Infrared | 27A | 6 | 98 | 1.0905 | 0.4965 |
| Manage Track Infrared | 28A | 5 | 196 | 0.7578 | 0.3832 |
| Manage Track Infrared | 35A | 6 | 107 | 1.0700 | 0.6178 |

| Study Area | | S | N | d | J' |
|---|---|---|---|---|---|
| Manage Track Infrared | 36A | 7 | 131 | 1.2307 | 0.4759 |
| Manage Track Infrared | 37A | 5 | 104 | 0.8613 | 0.5687 |
| Manage Track Infrared | 39A | 8 | 162 | 1.3759 | 0.5367 |
| Manage Track Infrared | 50A | 4 | 124 | 0.6224 | 0.2005 |
| Manage Track Infrared | 52A | 7 | 166 | 1.1737 | 0.3652 |
| Manage Track Infrared | 56A | 5 | 99 | 0.8705 | 0.2283 |
| Manage Track Infrared | 62A | 6 | 98 | 1.0905 | 0.4663 |
| Manage Track Infrared | 63A | 4 | 94 | 0.6603 | 0.2964 |
| Manage Track Infrared | 66A | 6 | 128 | 1.0305 | 0.4321 |
| Manage Track Infrared | 70A | 5 | 111 | 0.8493 | 0.5278 |

**** data was insufficient to calculate diversity measure

**Table 4 number of species (S), number of individuals (N), the Shannon-Weiner Index (D) and Pielou's Evenness Index (J') for off-track cameras.**

| LCI Location | | S | N | d | J' |
|---|---|---|---|---|---|
| Ref Off Track White Flash | 09B | 3 | 40 | 0.5422 | 0.3471 |
| Ref Off Track White Flash | 16B | 4 | 19 | 1.0189 | 0.8995 |
| Ref Off Track White Flash | 17B | 4 | 22 | 0.9705 | 0.4784 |
| Ref Off Track White Flash | 19B | 7 | 72 | 1.4030 | 0.3757 |
| Ref Off Track White Flash | 20B | 4 | 61 | 0.7298 | 0.4342 |
| Ref Off Track White Flash | 21B | 5 | 17 | 1.4118 | 0.8292 |
| Ref Off Track White Flash | 22B | 4 | 38 | 0.8247 | 0.4298 |
| Ref Off Track White Flash | 24B | 5 | 13 | 1.5595 | 0.8778 |
| Ref Off Track White Flash | 30B | 6 | 45 | 1.3135 | 0.5107 |
| Ref Off Track White Flash | 31B | 6 | 13 | 1.9494 | 0.9329 |
| Ref Off Track White Flash | 32B | 6 | 21 | 1.6423 | 0.8747 |
| Ref Off Track White Flash | 33B | 9 | 55 | 1.9963 | 0.8433 |
| Ref Off Track White Flash | 35B | 3 | 4 | 1.4427 | 0.9464 |
| Ref Off Track White Flash | 46B | 2 | 6 | 0.5581 | 0.6500 |
| Ref Off Track White Flash | 47B | 7 | 39 | 1.6378 | 0.7655 |
| Ref Off Track White Flash | 51B | 6 | 20 | 1.6690 | 0.9248 |
| Ref Off Track White Flash | 52B | 6 | 64 | 1.2022 | 0.6428 |
| Ref Off Track White Flash | 58B | 4 | 15 | 1.1078 | 0.7358 |
| Ref Off Track White Flash | 59B | 3 | 23 | 0.6379 | 0.7335 |
| Ref Off Track White Flash | 62B | 4 | 44 | 0.7928 | 0.3333 |
| Ref Off Track White Flash | 64B | 2 | 4 | 0.7213 | 0.8113 |
| Ref Off Track White Flash | 66B | 5 | 53 | 1.0075 | 0.7080 |
| Ref Off Track White Flash | 67B | 5 | 19 | 1.3585 | 0.7874 |
| Ref Off Track White Flash | 70B | 4 | 35 | 0.8438 | 0.8941 |
| Ref Off Track White Flash | 75B | 7 | 73 | 1.3985 | 0.4161 |
| Manage Off Track White Flash | 02B | 4 | 7 | 1.5417 | 0.9212 |
| Manage Off Track White Flash | 03B | 3 | 11 | 0.8341 | 0.8509 |

| LCI Location | | S | N | d | J' |
|---|---|---|---|---|---|
| Manage Off Track White Flash | 04B | 5 | 24 | 1.2586 | 0.7245 |
| Manage Off Track White Flash | 05B | 4 | 9 | 1.3654 | 0.9875 |
| Manage Off Track White Flash | 06B | 4 | 31 | 0.8736 | 0.9339 |
| Manage Off Track White Flash | 08B | 4 | 9 | 1.3654 | 0.8764 |
| Manage Off Track White Flash | 13B | 4 | 54 | 0.7521 | 0.5681 |
| Manage Off Track White Flash | 14B | 6 | 7 | 2.5695 | 0.9755 |
| Manage Off Track White Flash | 18B | 5 | 7 | 2.0556 | 0.9630 |
| Manage Off Track White Flash | 23B | 6 | 51 | 1.2717 | 0.4828 |
| Manage Off Track White Flash | 25B | 4 | 12 | 1.2073 | 0.6038 |
| Manage Off Track White Flash | 37B | 3 | 41 | 0.5386 | 0.7802 |
| Manage Off Track White Flash | 38B | 2 | 7 | 0.5139 | 0.5917 |
| Manage Off Track White Flash | 39B | 1 | 2 | **** | **** |
| Manage Off Track White Flash | 42B | 9 | 107 | 1.7120 | 0.6674 |
| Manage Off Track White Flash | 49B | 1 | 1 | **** | **** |
| Manage Off Track White Flash | 54B | 7 | 43 | 1.5952 | 0.6810 |
| Manage Off Track White Flash | 55B | 3 | 90 | 0.4445 | 0.7007 |
| Manage Off Track White Flash | 65B | 6 | 28 | 1.5005 | 0.7046 |
| Manage Off Track White Flash | 68B | 8 | 45 | 1.8389 | 0.5870 |
| Manage Off Track White Flash | 69B | 4 | 16 | 1.0820 | 0.8903 |
| Manage Off Track White Flash | 71B | 7 | 100 | 1.3029 | 0.5470 |
| Manage Off Track White Flash | 74B | 5 | 20 | 1.3352 | 0.9596 |

**** data was insufficient to calculate diversity measure

To assess ecological variation in mammal assemblages between on-track and off-track cameras in both the management and reference areas, a square-root transformation was applied to the abundance data to reduce the influence of very common species. The Bray-Curtis similarity index was then used to compare sites based on species composition.

The results indicated that, like the previous sampling period, most clustering among the on-track cameras (Figure 14) occurred at greater than 80% similarity, indicating relatively little variation in species assemblages. In contrast, the off-track cameras (Figure 15), also like the previous sampling period, displayed much lower similarity among sites, with clustering occurring at approximately the 50% similarity level.

When data from all cameras were combined and analysed using the same method, clear assemblage divergence remained between on-track and off-track communities (Figure 16). The greater variability among off-track cameras, both within and between the reference and management areas, indicates that the ecological communities recorded off-track are not only generally richer than those recorded on-track but also exhibit greater variation in species composition among individual camera locations.

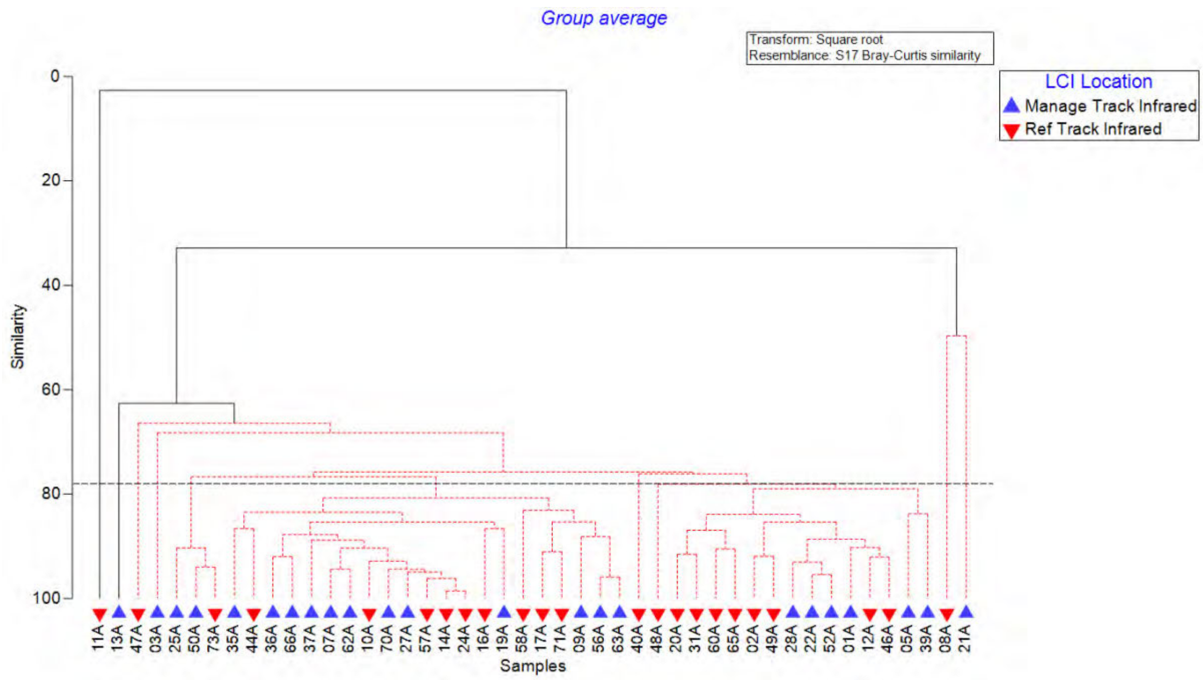


**Figure 14 Similarity (Bray Curtis) of on-track cameras in the reference area (light blue squares) and the management area (red diamonds) based on relative abundance values of mammals.**

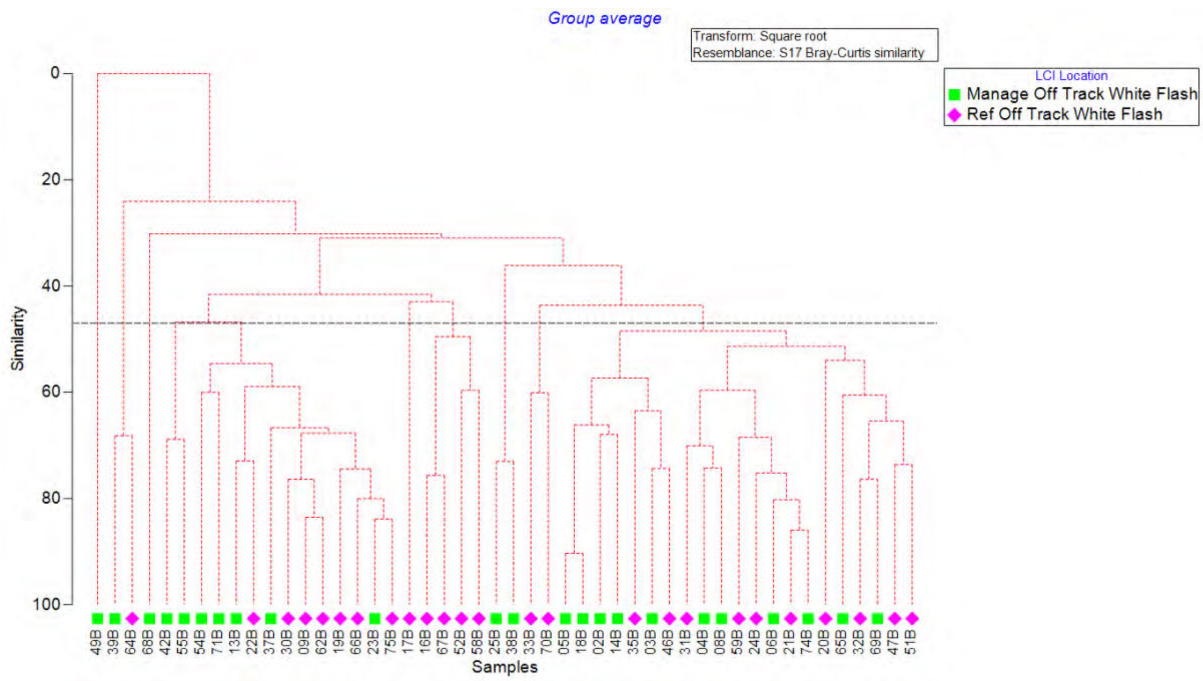


**Figure 15 Similarity (Bray Curtis) of off-track cameras in the reference area (green triangles) and the management area (orange inverted triangles) based on relative abundance values of mammals.**

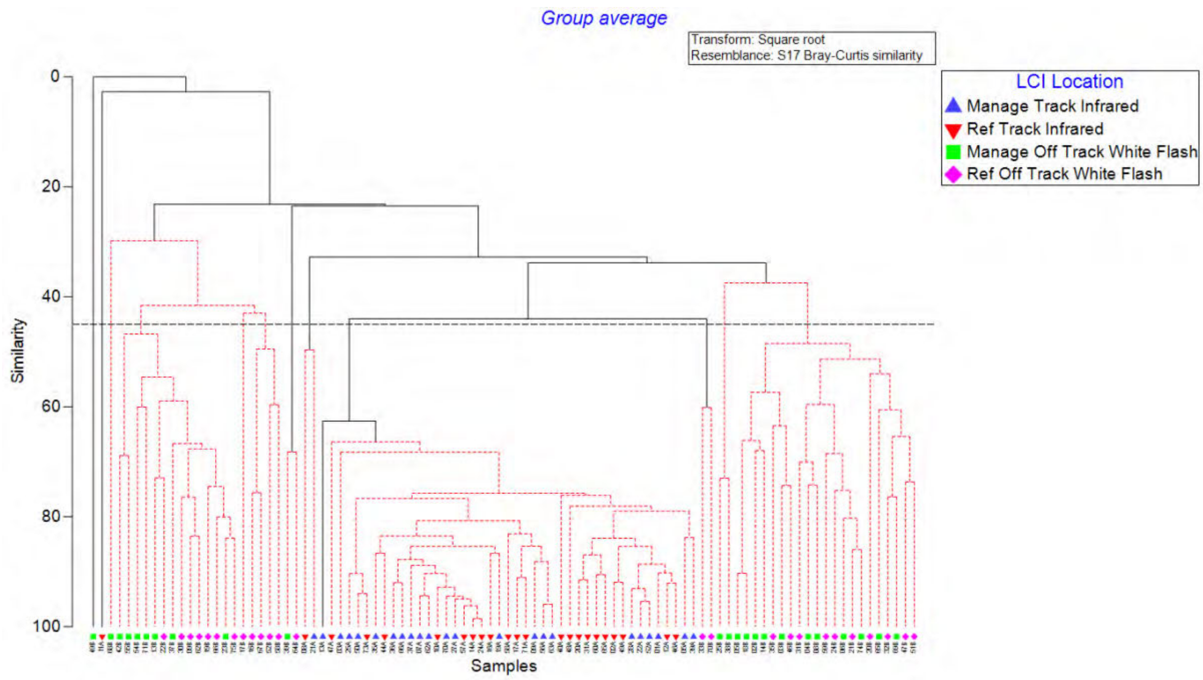


**Figure 16 Similarity (Bray Curtis) of all cameras based on the relative abundance values for mammals. Light blue squares are on-track RA, red diamonds are on-track MA, green triangles are off-track RA and dark blue triangles are off-track MA.**

## DISCUSSION

The results of this survey continue to highlight the challenges associated with using camera traps to monitor biodiversity across the Great Victoria Desert. Although detection rates increased substantially compared with previous sampling periods, particularly for feral cats, absolute detection rates for most species remained low, especially for conservation-significant species. Together with variability between sampling periods and inconsistent camera performance, this continues to limit the ability to draw robust ecological comparisons or confidently assess changes in population abundance for all but the most common and widespread species, such as camels, dingoes and, during this sampling period, feral cats.

One of the most notable findings from this survey was the substantial increase in detection rates across many species, particularly during the latter months of sampling. This pattern coincided with widespread rainfall during the sampling period and is likely to reflect increased primary productivity, prey availability, and the activity and detectability of many mammals, particularly predators. For some species, including feral cats, the increase in detection rates was accompanied by a marked increase in occupancy across the study area. This suggests that the observed changes cannot be attributed solely to increased activity or detectability and are consistent with an actual increase in population abundance, potentially driven by improved survival of offspring following favourable environmental conditions. While this type of camera trap data alone cannot conclusively distinguish changes in abundance from changes in detectability, the combined increase in both occupancy and detection rates provides stronger evidence of real population responses than detection rates alone.

The survey also provided some interesting observations regarding feral cats and dingoes. Although it has been suggested that dingoes may suppress feral cat populations, and there was an image of a dingo with a feral cat in its mouth in this sampling period, there was little overall evidence of this pattern during the present survey. Both species were commonly recorded at the same camera locations, particularly on-track where 42 of the 50 cameras (84%) detected both species. Their activity patterns were also remarkably similar, with both species exhibiting increasing initial activity after dusk, remaining active throughout the night and showing another activity peak before sunrise (Figure 17). There was little indication that cats altered their temporal activity in response to dingoes. While camera trap data cannot determine whether dingoes influence cat populations through other mechanisms, the high degree of spatial and temporal overlap observed during this survey suggests that the elevated detections of both predators were more likely driven by favourable seasonal conditions than by strong predator-mediated interactions.

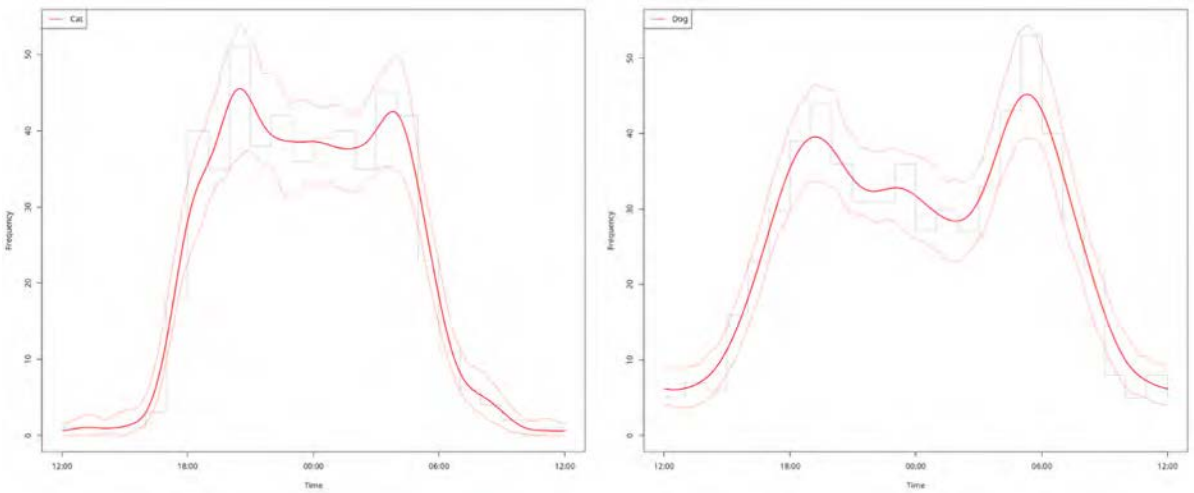


**Figure 17 estimated diel activity patterns of feral cats (left) and dingoes (right) based on independent camera trap detections. Activity curves were estimated using bootstrapped kernel density models fitted to independent detection counts. Grey lines represent the 95% confidence intervals around the estimated activity patterns.**

The considerable variability in species detections, even in the absence of management interventions, continues to highlight limitations in the current monitoring program. Natural population fluctuations, animal behaviour, seasonal environmental conditions and variation in camera performance all contribute to this variability. Consequently, the current survey design remains insufficiently robust to detect meaningful ecological change or evaluate management outcomes for conservation-significant species such as the sandhill dunnart, brush-tailed mulgara and malleefowl. Their consistently low detection rates and high rates of failing to record for full sampling periods severely limit the conclusions that could be drawn regarding population status or responses to environmental or management change.

The species assemblage analysis identified ecological differences between on-track and off-track camera deployments. On-track cameras primarily detected large, wide-ranging species such as camels, dingoes, feral cats and grey kangaroos, with relatively high similarity in species composition among sites. In contrast, off-track cameras recorded more diverse and heterogeneous mammal assemblages, providing a broader representation of the fauna occupying natural habitats and better reflecting the ecological variability present across the landscape.

Although feral cats were detected more frequently on-track than off-track during this survey, the proportion of cameras detecting cats was broadly similar between the two deployment types. This suggests that the greater number of on-track detections is more likely to reflect increased detectability rather than greater abundance. Linear features such as vehicle tracks are frequently used as travel routes by cats, increasing the likelihood that the same individuals repeatedly pass through the camera detection zone. Consequently, cameras positioned on tracks are likely to record more repeated detections of individual animals than cameras located within the surrounding habitat. Higher detection frequencies on tracks should therefore not be interpreted as evidence of higher cat densities. More broadly, higher numbers of detections should not be assumed to represent greater abundance without considering how camera placement influences detection probability. This distinction between detectability and abundance is fundamental to interpreting camera trap data and provides further support for the transition towards predominantly off-track camera deployments.

The planned relocation of most cameras to off-track locations represents a significant opportunity to address many of the limitations identified during this assessment. A more systematic deployment strategy, focusing on representative habitats rather than linear features, should improve the ecological relevance of the monitoring program while providing a more representative assessment of mammal assemblages across the landscape. It is also likely to improve the capacity of the program to detect conservation-significant species and better evaluate changes in biodiversity through time.

Given the considerable investment required to deploy, maintain and analyse this camera array, it is important that the monitoring program generates data capable of detecting meaningful ecological change over the long term. Continued improvements in survey design, including more standardised camera placement, improved documentation of deployment criteria and the ongoing use of complementary white flash and infrared cameras where appropriate, should substantially improve the reliability and interpretability of future surveys. Collectively, these refinements will strengthen the ability of the program to detect changes in biodiversity, evaluate management outcomes and provide information that is both scientifically robust and directly relevant to conservation management.

In conclusion, while the current survey has limited capacity to detect population change for many individual species, it has identified several important opportunities to strengthen future monitoring. The planned transition towards a predominantly off-track camera network, combined with a more strategic and standardised survey design, should substantially improve the long-term ecological value of the program. Given the significant investment required to operate this monitoring network, these improvements are essential if the program is to provide meaningful long-term information on biodiversity trends and the effectiveness of future management across the Great Victoria Desert.

## RECOMMENDATIONS

- Adopt a standardised camera installation protocol. Cameras should be mounted using a ¼-inch bolt fixed to a stake rather than cable ties, with the passive infrared (PIR) sensor positioned approximately 30–40 cm above ground level. Camera height, bearing, angle and field of view should be standardised as far as practicable to ensure comparable sampling effort among cameras. At the current time, positioning is highly variable and this results in highly variable detection probability.

- Maximise the effective detection zone by minimising vegetation and other obstructions within the camera field of view while retaining representative habitat structure. Attention should be given to reducing vegetation likely to generate false triggers. Examples of problematic deployments are given in Appendix 2.

• Standardise camera settings across the entire camera array using a single master configuration file loaded onto each camera prior to deployment for any camera capable of reading from SD cards. Ensure picture format is the same for all cameras as currently some appear to be set to wide format(1080p) and others are standard (4x3). This affects field of view and detection. Consider assessing whether a night-only operating schedule could reduce false triggers and battery consumption without significantly affecting detections of target species.

• Improve camera servicing procedures by approaching cameras from outside the field of view where possible, switching cameras off before servicing, rearming them only after servicing is complete, and capturing a single test image to confirm correct operation. Personnel should avoid entering the field of view after cameras have been reactivated to minimise unnecessary images of field staff.

• Improve camera reliability by using memory cards of identical capacity, ensuring all rechargeable NiMH batteries are fully charged immediately prior to deployment, recording battery condition during servicing visits and maintaining sufficient charging capacity to prepare batteries for the entire camera array.

• Increase servicing frequency where practical to reduce data loss associated with battery depletion, full memory cards and equipment failures.

• Maintain a contingency pool of replacement cameras. At least five, and preferably up to ten, replacement cameras should be available during servicing trips so failed cameras can be replaced immediately without reducing sampling effort.

• Configure all cameras to embed the camera identification label within every image. This recommendation has been made previously but has not yet been implemented. Embedding the camera ID provides an important quality assurance measure by allowing the source camera to be verified independently of the folder structure and enabling incorrectly allocated images to be readily identified and reassigned.

• Complete standardised field data sheets for every camera during each servicing visit. At a minimum these should record the camera ID, servicing date, battery condition, memory card status, number of images recorded, camera functionality, maintenance undertaken and any other relevant observations. Cameras that were not be serviced or could not be recovered should also be documented.

• Undertake a comprehensive quality assurance review before data are provided for analysis. Camera folders and associated metadata should be checked for completeness and consistency, images verified against camera identifiers, and folder structures reviewed to ensure files are correctly assigned before analysis commences.

• Standardise file naming conventions. Camera folders with single-digit numbers should always include a leading zero (e.g. 09B rather than 9B) to ensure correct sorting and minimise data management errors.

- Ensure personnel responsible for camera deployment, servicing and data management are appropriately trained in equipment operation, survey protocols, data handling and troubleshooting. At least one experienced team member should participate in each field deployment to ensure consistent implementation of monitoring protocols.

- Resolve the identity and locations of cameras 33A and 53B, which could not be included in the present assessment because no previous records or location information could be located. These cameras should be correctly documented before future surveys to ensure all deployed cameras contribute to subsequent analyses.

## LITERATURE CITED


Beery, S., Morris, D., & Yang, S. (2019). Efficient pipeline for camera trap image review. *arXiv preprint arXiv:1907.06772*.

Clarke, K.R. & Gorley, R.N. (2015). *PRIMER v7: User Manual/Tutorial*. PRIMER-E, Plymouth, UK.

Clarke, K.R., Gorley, R.N., Somerfield, P.J. & Warwick, R.M. (2014). *Change in Marine Communities: An Approach to Statistical Analysis and Interpretation* (3rd ed.). PRIMER-E, Plymouth, UK.

Cowan, M.A. (2017). CPW data analysis app- a web-based tool for analysing camera-trap data. Unpublished software.

FastStone (2023). FastStone Image Viewer 7.8. - image browser, converter and editor software. Alberta, Canada. https://www.faststone.org/FSViewerDetail.htm

Newkirk, E. S. 2016. CPW Photo Warehouse. Colorado Parks and Wildlife, Fort Collins, Colorado, USA. https://cpw.state.co.us/mammals-research#230548828-2330132966

R Core Team (2026). _R: A Language and Environment for Statistical Computing_. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.


## ADDITIONAL INFORMATION

Links to online data interrogation application:

https://ningaui.ddns.net/apps/Camera%20Trap%20Data%20Analysis/

username: gvd
password: shd

## APPENDIX 1

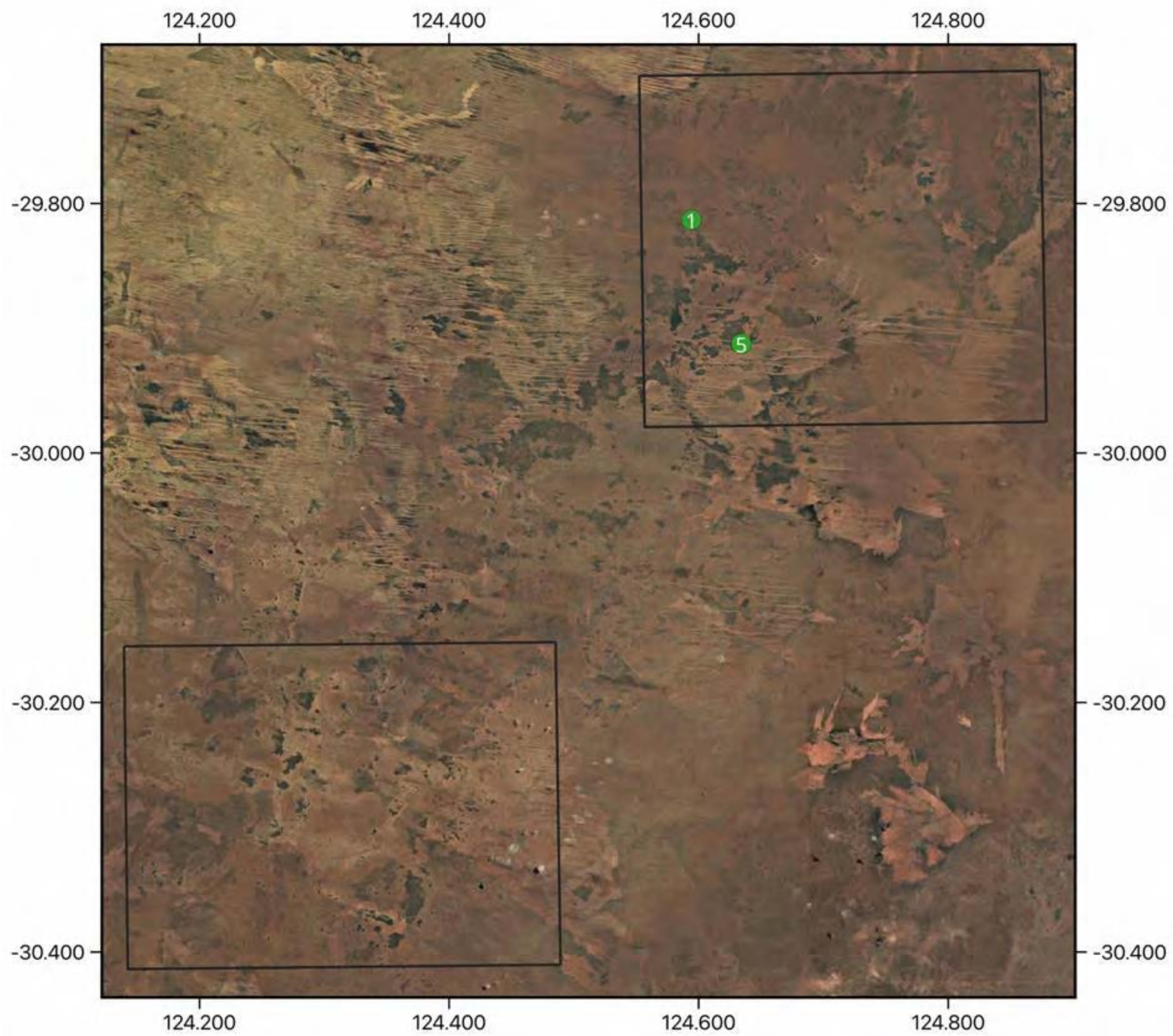


**Figure 18 Euro in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

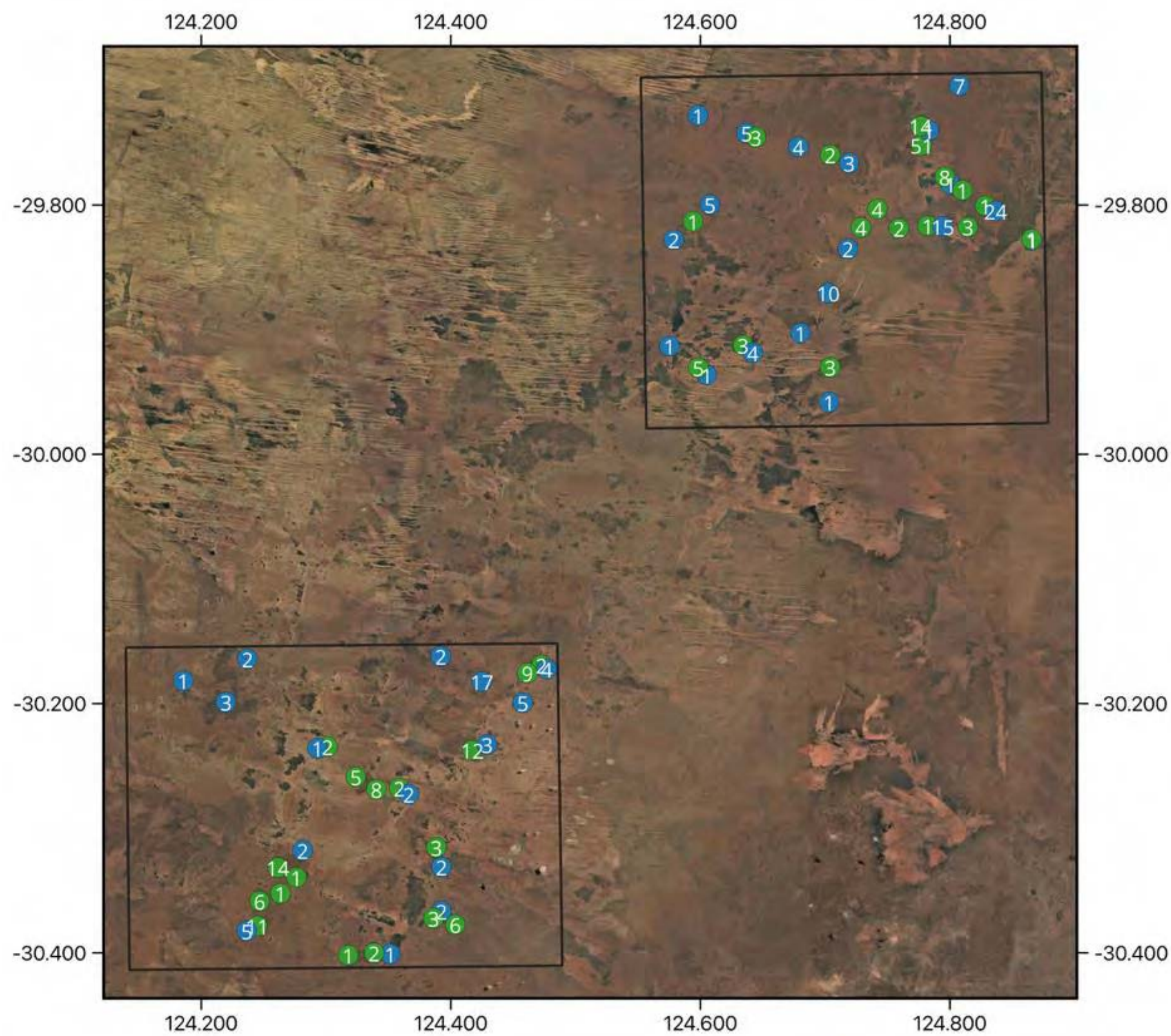


**Figure 19 Western Grey Kangaroo in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

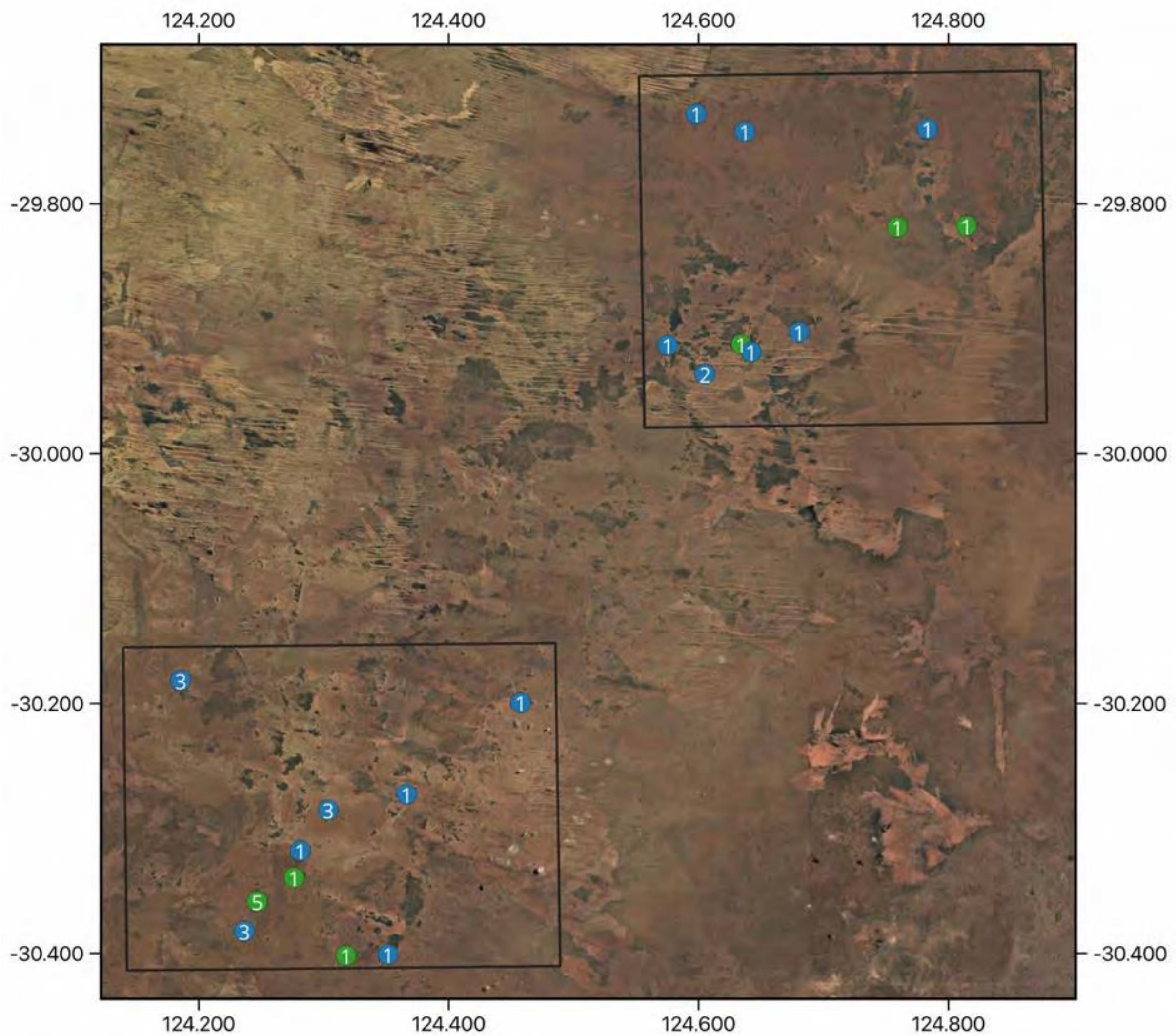


**Figure 20 Bustard in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

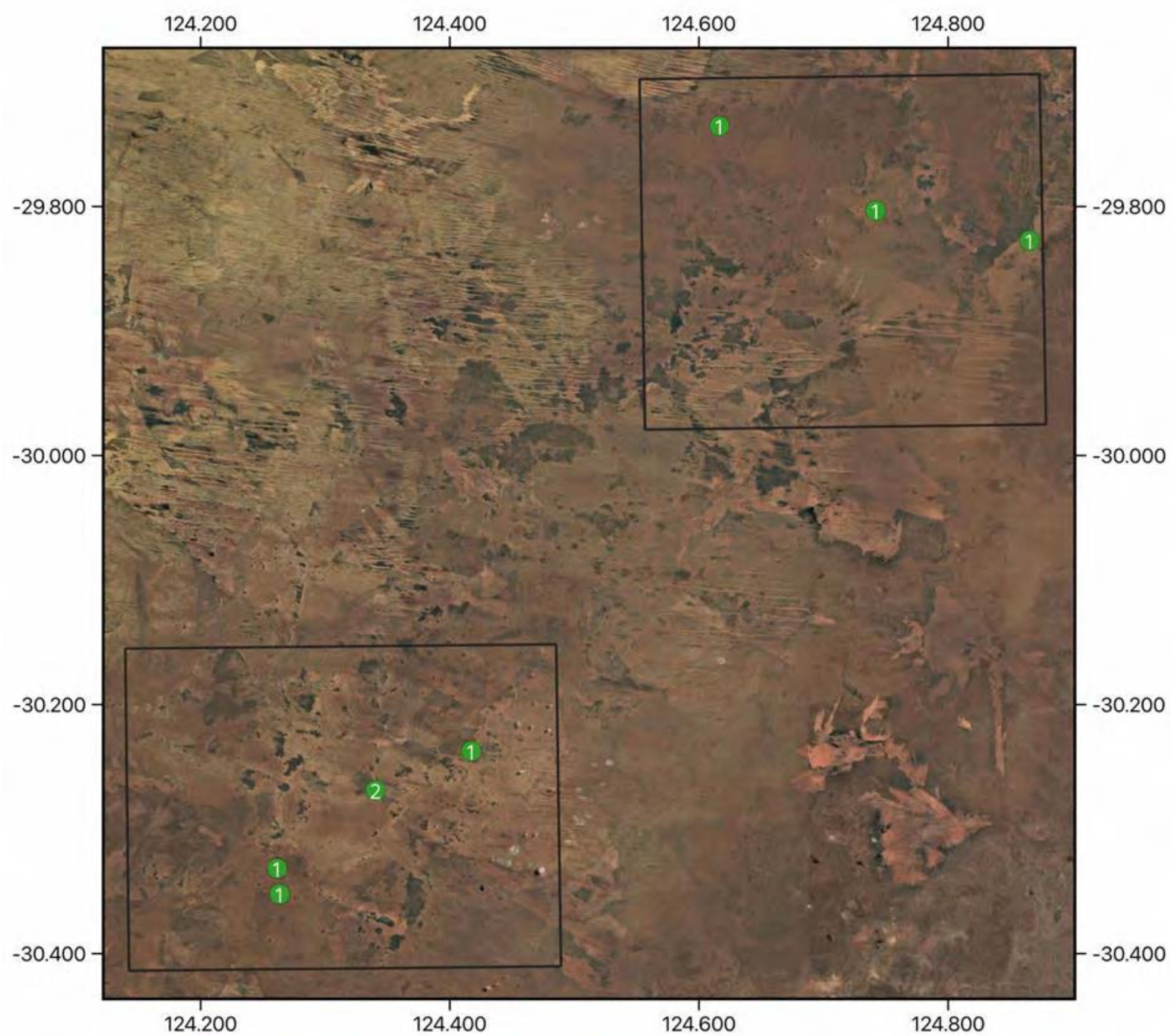


**Figure 21 Ningaui in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

**Figure 21 Rabbit in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

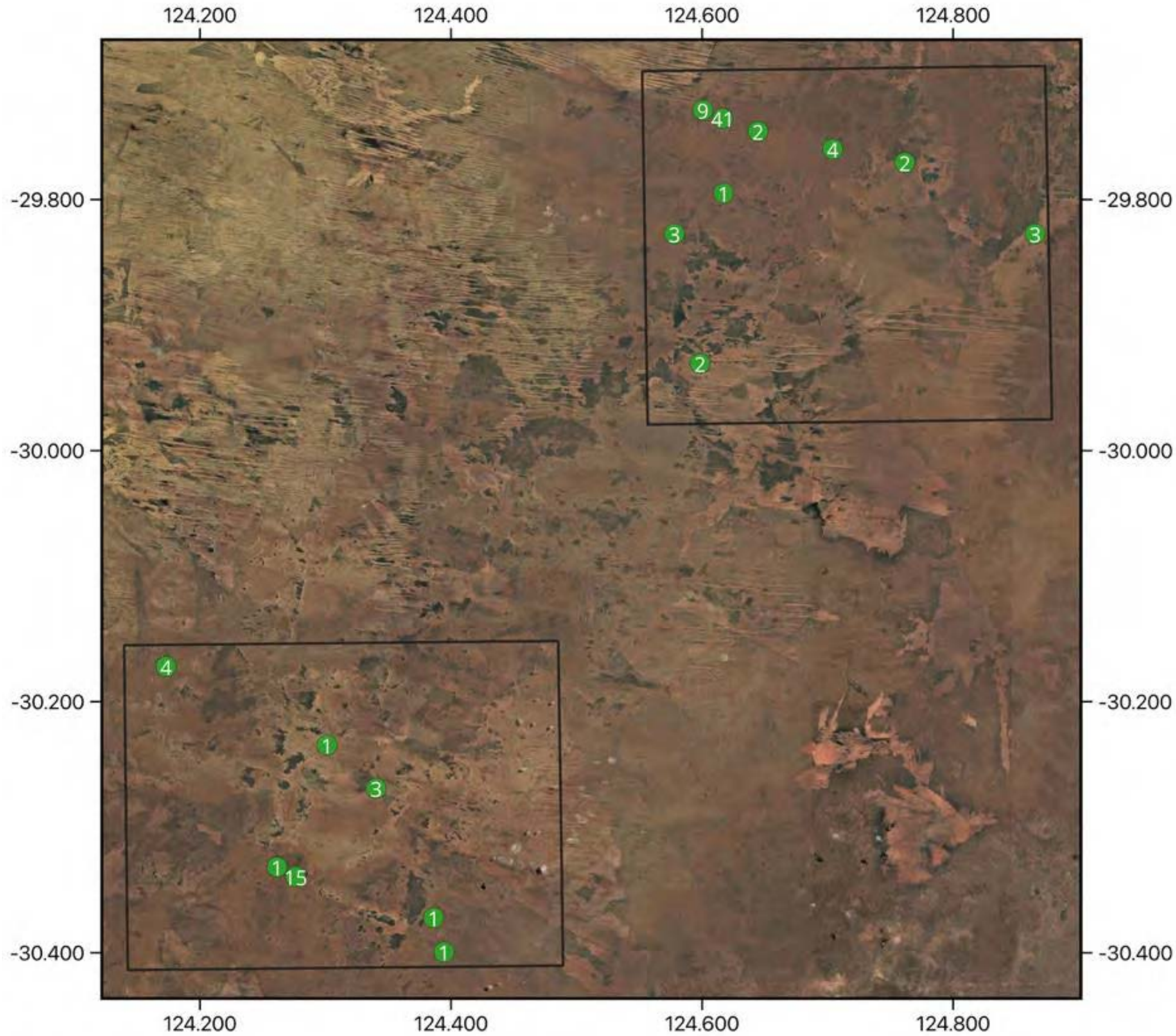


Figure 22 Sandy Inland Mouse in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.

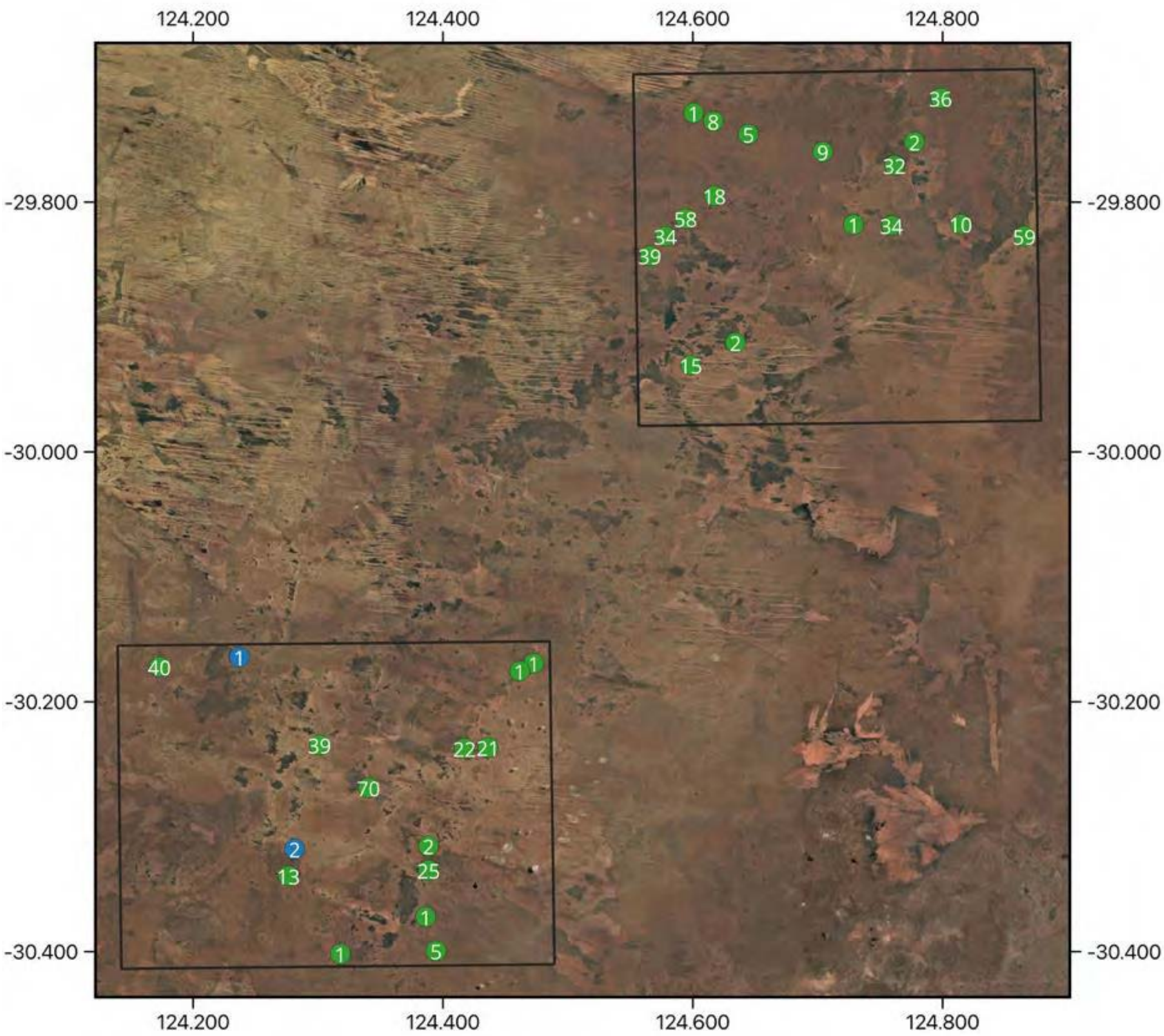


**Figure 23 Spinifex Hopping Mouse in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

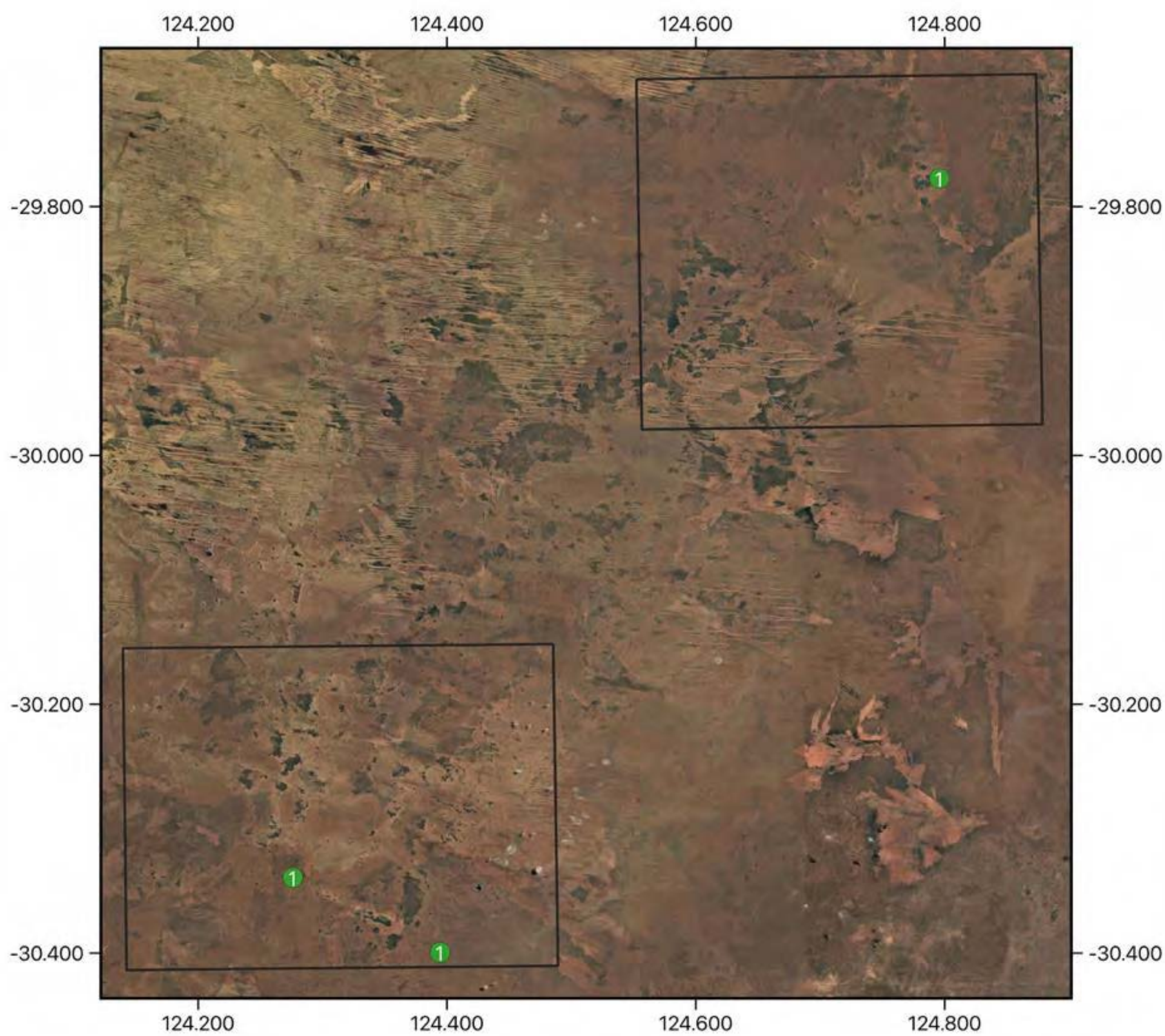


**Figure 24 Echidna in the reference area (upper right box) and the management area (lower left box). Blue points depict cameras on-track and green points, off-track, with the values representing the number of independent detections. Points with no value represent a single detection.**

## APPENDIX 2: EXAMPLE OF ISSUES WITH CAMERA SETUPS.


**Figure 25 left- Camera 49B facing east causing overexposure and false detections early in the morning and right, 49A field of view significantly obstructed.**


**Figure 26 Left camera 18B has limited field of view and unlikely to detect small mammals. Right camera 25B has no clear field of view and is angled much lower than other cameras.**


**Figure 27 Camera 42B, left and 55B, right, have field of views obstructed, especially for small mammals.**


**Figure 7 Camera 24B, right, poorly angled and camera 9A, right, is set too close and angle towards vegetation causing false triggers.**