1 Site selection and description method

Method summary

Ninety-eight sites were initially selected for the Tanami Regional Biodiversity Monitoring (Tanami RBM) program (for approximate site map see supplementary material: TRBMSurveySitesPublic.bmp). Sites were stratified across (i) land unit, (ii) north-south region, and (iii) proximity to mining areas. Approximately 10 sites were used in previous monitoring in relation to the rehabilitation of mine waste dumps at Dead Bullock Soak, Tanami Mine, Dogbolter and Redback Mines (Low *et al.* 1998, Low *et al.* 2003, Foster & Low 2004). Sample independence was attained by locating sites at least 4 km apart. The total sample size was deemed statistically robust, but the final number of sites (total and for each sampling technique) was also determined by logistical and financial constraints (Foster & Low 2004).

Supplementary material associated with this dataset is identified for each method and available for download. For all combined data see supplementary material: Tanami_RBM_V1_Public.accdb. Observer names have been removed and replaced with a code.

(i) Land units

Land units, used as surrogates of biodiversity, were derived by combining the characteristics of regolith units (Wilford & Butrovski 1999). Regoliths with similar geology, soils and landform were grouped into inferred similar land units, forming ten land units over the study area. Existing biological data showed the greatest species diversity occurred in six of the ten mapped land units. Ranked by greatest species diversity, these were:

1) loamy sandplain,
2) palaeodrainage,
3) lateritic sandplain,
4) lateritic rise,
5) elevated drainage depression, and
6) chert rise.

During the on-ground site establishment phase in December 2004, lateritic and chert rises were found to be a graded ecotone rather than discrete units. Therefore, laterite and chert rises were subsequently combined into a broader 'rocky rise' land unit. Lakes, separate from paleochannels, were also added to the final list of six land units across which the 98 sites were stratified:

1) loamy sandplain,
2) palaeodrainage,
3) lateritic sandplain,
4) rocky rise (lateritic and chert),
5) lake (fresh and salt), and
6) elevated drainage depression

(ii) North-south sub-region

Sites were stratified across a northern group and a southern group, divided at approximately 20° 15' S latitude (8 km south of Rabbit Flat Roadhouse). The purpose of the division was to test theories of declining biodiversity across a north to south gradient of increasing aridity.

(iii) Proximity to mining area

A threshold of 15 km from a mining area was selected as the basis for investigating the impact of mining activities on local biota. As dingoes use mine sites for water and food, smaller fauna near mine sites are at risk from predators drawn to the mine. Sites less than 15 km from a mine were designated as 'impact' sites and those greater than 15 km were designated as 'control' sites.

(iv) Site establishment, description and sampling protocol

Due to logistics and access constraints, eighty-nine sites were used in the final monitoring program. Survey plots of 300 m x 200 m were installed at each of the 89 sites, following the protocol described in Neave *et al.* (2004), and marked permanently with steel droppers on diagonally opposite corners (Figure 1). The dominant features of each site, including substrate, disturbance levels, and dominant plant species, were recorded during the first survey (Late wet season 2005) from a 50 m x 50 m quadrat centred at the survey plot (Tanami_RBM_Survey_Site_Descriptions.csv: supplementary materials). Incidental fauna sightings were also recorded at each site or on route to sites. The land unit and target species defined the appropriate sampling methods that were used at each site (Table 1), a combination of bird surveys, tracking, small vertebrate trapping, tree health, and vegetation transects. Note, tree health data are not available in this dataset. The 89 sites were surveyed, with their respective sampling method, on eight occasions in the late-wet season (LWS, February–April: 2005, 2006) and late-dry season (LDS, November–December 2005, 2006, 2007, 2008, 2009, 2012).

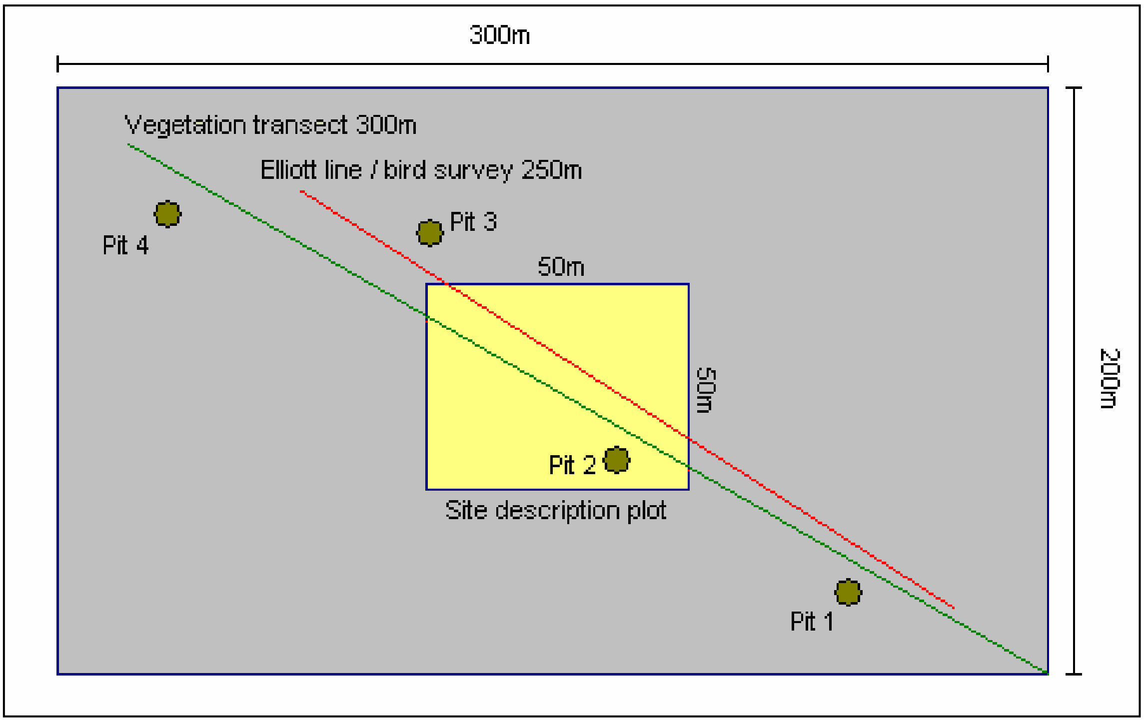

Figure 1. Survey plot configuration for the Tanami RBM. Each 300 m x 200 m survey plot site consisting of a site description 50 m x 50 m quadrat (yellow square), four pit traps (circles), 25 Elliott traps along 250 m (red line), and vegetation transect of 300 m (green line).

Table 1. Site type codes and corresponding sampling methods used in the Tanami Regional Biodiversity Monitoring: BIRD = bird surveys, TRACK = tracking, TRAP = small vertebrate trapping, (TREE) = tree health, VEG= vegetation transects, WETLAND = wetland bird surveys. NB tree health data are not available in this dataset.

Type code	Sampling methods	Number of sites (n=89)
A	3: TRACK, VEG, WETLAND	1
B	2: WETLAND, (TREE)	3
C	4: BIRD, TRACK, TRAP, VEG	28
D	5: BIRD, TRACK, TRAP, (TREE), VEG	2
E	2: TRACK, VEG	49
F	1: WETLAND	1
G	6: BIRD, TRACK, TRAP, (TREE), VEG, WETLAND	1
H	3: TRACK, (TREE), VEG	4

Site locations were rounded to 0.1 decimal degree (approximately 10 km). This denaturing is because some sites contain threatened and/or sensitive species that might be at risk from collection or disturbance. This follows recommendations from the Australian Government's policy on sensitive ecological data (Australian Government Department of the Environment 2016). Central Land Council (CLC) will release the full dataset to clients under a data sharing agreement. This agreement will outline use requirements including protection of sensitive information, acknowledgement and provision of information back to the CLC and traditional owners.

References

Australian Government Department of the Environment (2016) Sensitive Ecological Data – Access and Management Policy V1.0. Environmental Resources Information Network, Landscape Analysis Section, Australian Government, Department of the Environment.

Foster, E. & Low, W.A. (2004). A Framework for Regional Monitoring of Selected Wildlife in the Tanami. Report to Newmont Tanami Pty Ltd., Alice Springs, N.T.

Low, W., Miller, C. and Johnson, C. (1998) Landscape, Flora and Vertebrate Fauna Survey of the Proposed Mineral Leases at Tardis and Molech. Report to Otter Gold NL., Darwin, N.T.

Low, W., Cassanet, M. and Hill, A. (2003) Environmental Impact Assessment of Minotaur ML(A) 23283 and Windy Hill Haul Road, December – January 2002/03. Report to Newmont NFM Tanami Operations, Alice Springs, N.T.

Neave, H., Nano, C., Pavey, C., Moyses, M., Clifford, B., Cole, J., Harris, M. and Albrecht, D. (2004) A Resource Assessment Towards a Conservation Strategy for the Finke Bioregion, NT. Draft unpublished final report to the Commonwealth Department of the Environment and Heritage, NHT Project No. 990006. Conservation and Natural Resources, Department of Infrastructure, Planning and Environment, Alice Springs, N.T.

Wilford, J.R and Butrovski. D (1999). Tanami Granites Regolith-Landforms Map Series; (1:100,000 map scale). Unpublished report to Newmont NFM Tanami Operations, Alice Springs, N.T.

Method drift description

Eighty-three of the 89 site descriptions were completed in February–April 2005. Due to access difficulties or poor weather conditions, surveys of some sites were not completed each year, e.g. wetland sites that were inundated after heavy rainfall (Table 2).

Table 2. Number of surveys of each method completed per survey year. BIRD = bird surveys, TRACK = tracking, TRAP = small vertebrate trapping, VEG= vegetation transects, WETLAND = wetland bird surveys. LWS = Late wet season, LDS = Late dry season.

Method	Required	Survey year							
		01-LWS2005	02-LDS2005	03-LWS2006	04-LDS2006	05-LDS2007	06-LDS2008	07-LDS2009	08-LDS2012
BIRD	31	26	31	29	30	31	22	14	30
TRAP	31	27	31	31	31	31	31	31	29
TRACK	85	71	32	84	81	72	82	85	
VEG	85	74	85	84	84	85	83	85	81
WETLAND	6	3	1	6	4	6	2	2	
Total	**238**	**201**	**180**	**234**	**230**	**225**	**220**	**217**	**140**

2 Vegetation transect method

Method summary

Vegetation was recorded at 85 of the 89 monitoring sites. Plant species and corresponding height classes were recorded at 1 m intervals along a 300 m transect in each survey plot (Figure 1). Transects were completed by one or two teams of two people, using a 50-m measuring tape. Voucher specimens of unknown species were collected for subsequent identification. At each 1-m point along the transect, each plant species and its corresponding height class was recorded (1: 1–10 cm, 2: 10–25 cm, 3: 25-50 cm, 4: 50–100 cm, 5: 100–200 cm, or > 200 cm). If multiple plants occurred at one location, the species and height class was recorded for each stratum ('GroundLayer' and 'Height-g', 'UpperLayer1' and 'Height-u1, 'UpperLayer2' and 'Height-u2, 'UpperLayer3' and 'Height-u3'). See supplementary material for a full plant species list (Tanami_RBM_plant_species_list.csv) and an extract of vegetation transect data (Tanami_RBM_Vegetation_Transects.csv).

Method drift description

While the method for the vegetation transect did not change over the survey years, the observers changed. Some plant species could not be identified. In this dataset, unidentified species are labelled as 'Unknown sp.' with a recorded height class.

3 Bird survey method

Method summary

Bird taxa were recorded at 31 of the 89 monitoring sites. All birds seen or heard from the survey plot were recorded over a 15-minute period each morning and evening by a dedicated observer. Bird species, and the number of individuals seen or heard, were recorded for three mornings and three evenings each survey. During survey years where lakes or paleochannel sites (n=6) were inundated, a wetland bird census was undertaken for 15 minutes. See supplementary material for a full fauna species list (Tanami_RBM_Fauna_Species_List.csv) and an extract of bird survey data (Tanami_RBM_Bird_Observations.csv) and wetland bird survey data (Tanami_RBM_Wetland_Birds.csv).

Method drift description

Because of the usually low number of birds at monitoring sites, the 15-minute survey period was extended to the total time on site (up to one hour) after the first survey (01-LWS2005). Birds were usually recorded by multiple observers while they were checking the traps morning and afternoon. Bird identification and survey skills varied among observers, but skill level was not recorded.

4 Small vertebrate trapping method

Method summary

Trapping for small vertebrates was undertaken at 31 of the 89 monitoring sites. Two trap types were used: (i) pit traps and (ii) Elliott traps. See supplementary material for a full fauna species list (Tanami_RBM_Fauna_Species_List.csv) and an extract of fauna trapping data (Tanami_RBM_Fauna_Trapping.csv). Some 'incidental' species were recorded at the fauna trapping sites. Additional incidental fauna species records were collected near and on-route to survey sites (see supplementary file Tanami_RBM_Fauna_Incidental.csv)

(i) Pit traps:

Four pit traps were permanently established at each survey plot (Figure 1). Each pit trap was a PVC bucket (0.3 m diameter x 0.4 m deep). Each bucket was sunk vertically into the ground so that the top rim was at ground level. A mesh fence (0.3 m high x 10 m long) was erected across the pit, 5 m each side of the bucket, and secured by metal pins and a shallow trench. Pit traps were open for three days and three nights each survey. Pits were checked during the early morning and mid-afternoon to reduce heat stress and ant attack of trapped animals.

(ii) Elliott traps:

Twenty-five Elliott traps were positioned at 10 m intervals along a 250 m transect at each survey plot (Figure 1). Elliott traps were open for three nights during each survey. All 25 Elliott traps were set in the late afternoon, using a 1.5 cm ball of bait in each trap, and checked in the morning before 10:00 hrs. Traps were then closed and left in place until re-opening in the late afternoon.

Data collection:

The snout-vent length (SVL) and total length (TL) of captured vertebrates were recorded in all cases except when the animal escaped or when large numbers of one species was captured (e.g. *Lerista bipes*). The hindfoot length of mice were recorded as an aid to identification and estimating age class, but are not included in this dataset. Records of captured animals were grouped by site. Animals were not marked between trapping sessions, therefore re-captured animals may have been recorded more than once in the same survey year.

Method drift description

In 2012, funnel traps were added into the trapping protocol. Four funnel traps were set in addition to the pit traps and Elliott traps at all trapping sites. Each funnel trap was positioned at the mesh fence of each of the four pit traps.

5 Tracking method

Method summary

Tracking was undertaken at 85 of the 89 monitoring sites.

Overview

Standardised tracking is a highly effective census technique for middle-sized mobile fauna including threatened species such as the greater bilby, mulgara and great desert skink. It is also an efficient tool for capturing data on traditional resource species including macropods, Australian bustard, emu, and echidna, and records for predators such as dingoes and introduced cats and foxes. The use of tracks, scats and burrows are additional indicators of mammalian and reptilian presence and augment standard fauna trapping. In sandy desert country, tracking has been shown to be an effective and efficient method for determining the presence of species which are otherwise not targeted by pitfall or Elliott trapping and which may elude active searches (Masters et al. 1997). Some Indigenous people maintain significant skills in track and sign identification. Central Land Council therefore sees trackplots as an invaluable tool for collecting data on fauna as well as supporting Indigenous people to maintain ecological knowledge and expertise in tracking, be recognised and employed for their skills, and spend time on country.

Trackplot survey method

A 300 X 200 m trackplot was searched for a period of one-person hour, typically four people for 15 minutes. Trackplots were sampled before systematic fauna sampling to avoid disturbing the soil surface. Trackplots were given a trackability score or a comment on the tracking substrate. Animal sign was recorded (tracks, burrows/nests, scats, diggings and remains) and identified to species where possible. The age of the animal sign was estimated and would depend on the clarity of the print, the weather conditions and known behaviour of species present. 'Home' activity was recorded as either active, inactive or abandoned. See supplementary material for a full fauna species list (Tanami_RBM_Fauna_Species_List.csv) and an extract of tracking data (Tanami_RBM_Trackplot_Fauna.csv).

References

Masters, P., Nano, T., Southgate, R., Allan, G. and Reid, J. (1997) The Mulgara: Its Distribution in Relation to Landscape Type, Fire Age, Predators and Geology in the Tanami Desert. Parks and Wildlife Commission of the Northern territory, Alice Springs, N.T.

Method drift description

The standard trackplot method did not change over the period of the project. However different observers and data collection techniques may have affected data quality.

Observer skill

Observer names or skill levels were not recorded; in some cases, the name of the team leader was recorded. Skill levels of both Indigenous and non-Indigenous trackers was variable, with some very experienced trackers with knowledge of many species and capable of tracking an animal over long distances and through poor quality substrate, while some people had limited experience in track and sign identification.

Data collection

Trackplot data was collected on mobile devices (palmtops with connected GPS's and later Trimble Nomad handheld computers) using the CyberTracker™ programme. Digital data collection tools like CyberTracker™ can standardise data collection and expedite data entry. The mobile data collection app is built within the CyberTracker™ studio using elements (data fields) and data controls. Elements can have multiple attributes including name, alias, scientific name, icon and picture. The alternative names and icons made the program very attractive to Indigenous organisations working with people who speak multiple languages, and also because in a harsh fieldwork environment the ability to have large buttons and text is beneficial to many fieldworkers and Indigenous people alike. As with all digital tools the quality of data collected in CyberTracker™ is dependent on appropriate business rules and metadata being defined.

Some issues were apparent in the CLC CyberTracker app. Trackability values were not defined, for example in the same year records included a trackability value of 'Tracking Poor' 'poor' and 'Bad'. The difference between these categories is unknown. In 2005 some tracking data collected on paper recorded the substrate type rather than a trackability value. As the app was redeveloped in later years species' common names changed and they were not linked to appropriate scientific taxonomy.

The trackplot data should only be used to identify presence, not absence or abundance. Despite the skill of some trackers to identify individual animal characteristics the app did not allow observers to differentiate between individuals and it is not possible to know whether two different sign types (eg a track and a scat) were recorded together or in different parts of the trackplot. Some species may be recorded more than once in a trackplot, it is not known whether this was in order to record a different sign type for the individual or because the observer saw the same sign type in another part of the trackplot. However this is not equivalent to the abundance categories used in Moseby et al (2009) as it is likely signs were not recorded consistently by all observers or for all species eg more common signs like camel tracks may not be recorded more than once.

References

Moseby, K., Nano, T., Southgate, R., (2009) Tales in the Sand: a guide to identifying Australian arid zone fauna using spoor and other signs. Ecological Horizons.