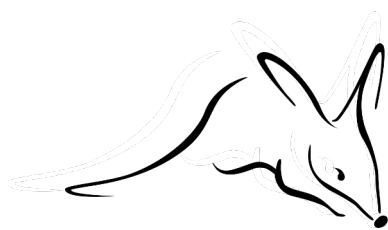


# Mount Zero-Taravale Wildlife Sanctuary

## Ecohealth Report 2020



australian  
wildlife  
conservancy

## Summary

Australian Wildlife Conservancy (AWC) has implemented an Ecological Health Monitoring Program to measure changes in the status and trend of conservation assets, and threats to those assets across Mount Zero-Taravale Wildlife Sanctuary. Metrics from the program are reported in annual Ecohealth Reports and Scorecards. This is the Ecohealth Report for 2020. Values of metrics derived in this report were based on data collected during a targeted survey for Sharman's Rock-wallaby (*Petrogale sharmani*) and fire scar analysis.

In October 2020, AWC deployed camera traps to determine presence of Sharman's Rock-wallabies at 11 sites, including five previously occupied locations. Sharman's Rock-wallabies were detected at three of the 11 sites (27% occupancy). An additional incidental record was detected at a new location during unrelated survey effort. Sharman's Rock-wallaby has now been detected at 36 locations across the sanctuary, representing more than 70% of the identified colonies for the species across its known distribution.

The Common Wallaroo (*Macropus robustus*) was detected at 55% of the rocky sites designed to survey Sharman's Rock-wallaby.

The 2020 fire metrics indicate improvements from baseline levels during AWC fire management on Mount Zero-Taravale, which will likely benefit native species and ecosystems. The average extent of early dry season fire has increased above baseline levels, while the average extent of late dry season fire has decreased (to zero in 2020), and the distance to unburnt vegetation has substantially decreased.

Due to the COVID-19 pandemic and concurrent survey effort associated with the establishment of a feral predator-free enclosure at Mount Zero-Taravale, Ecohealth survey effort was lower than in other years. A significant "inside/ outside fence" fauna monitoring project was conducted at 24 sites in 2020 in a section of the sanctuary (approximately 950 ha) where the feral predator exclusion fence is planned to be built in 2021. After Northern Bettongs (*Bettongia tropica*) are established within the exclusion fence, these data will become part of the Ecological Health Monitoring Program.

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*Document citation:* L'Hotellier F, Hayes C, Watson A, Joseph L, Kanowski J (2021) *Mount Zero-Taravale Wildlife Sanctuary Ecohealth Report 2020*. Australian Wildlife Conservancy, Perth, WA.

*Cover photographs (clockwise from top):* Mount Zero-Taravale landscape (AWC/Jessica Koleck), Sharman's Rock-wallaby (*Petrogale sharmani*) recorded during 2020 survey effort (AWC field camera), Wedge-tailed Eagle investigates camera trap (AWC field camera).



## Introduction

Australian Wildlife Conservancy (AWC) owns, manages, or works in partnerships across 30 properties in Australia, covering almost 6.5 million hectares, to implement our mission: *the effective conservation of Australian wildlife and their habitats*. AWC relies on information provided by an integrated program of monitoring and research to measure progress in meeting its mission and to improve conservation management.

AWC's Ecohealth Monitoring Program has been designed to measure and report on the status and trends of species, ecological processes and threats on each of these properties (Kanowski et al. 2018). The program focuses on selected 'indicator' species, guilds, processes and threats, using metrics derived from data collected through a series of purpose-designed surveys. The structure of the Ecohealth Program on each AWC property is as follows: based on the guidance provided by AWC's over-arching program framework, above, Ecohealth Monitoring Plans are developed, describing the conservation values or assets of each property, and threats to these assets. In addition, the Ecohealth Plans set out the monitoring program that will be used to track the status and trend of selected indicators of these conservation assets and threats. Annual survey plans and schedules are developed to implement these plans. The outcomes of these surveys are presented in annual Ecohealth Reports and summary Ecohealth Scorecards.

This document, the Mount Zero-Taravale Ecohealth Report 2020, draws on surveys conducted during 2020 to calculate values for metrics that track the status and trend of the Ecohealth indicators. The companion Mount Zero-Taravale Wildlife Sanctuary Ecohealth Scorecard 2020 presents the metrics in a summary format. Where data were available, some metrics reported in the Ecohealth Scorecard were calculated based on surveys prior to 2020.

## Mount Zero-Taravale Wildlife Sanctuary

Mount Zero-Taravale Wildlife Sanctuary ('Mount Zero-Taravale') is located on the western slopes of the Coane Range near Townsville, north Queensland, Australia (Figure 1).

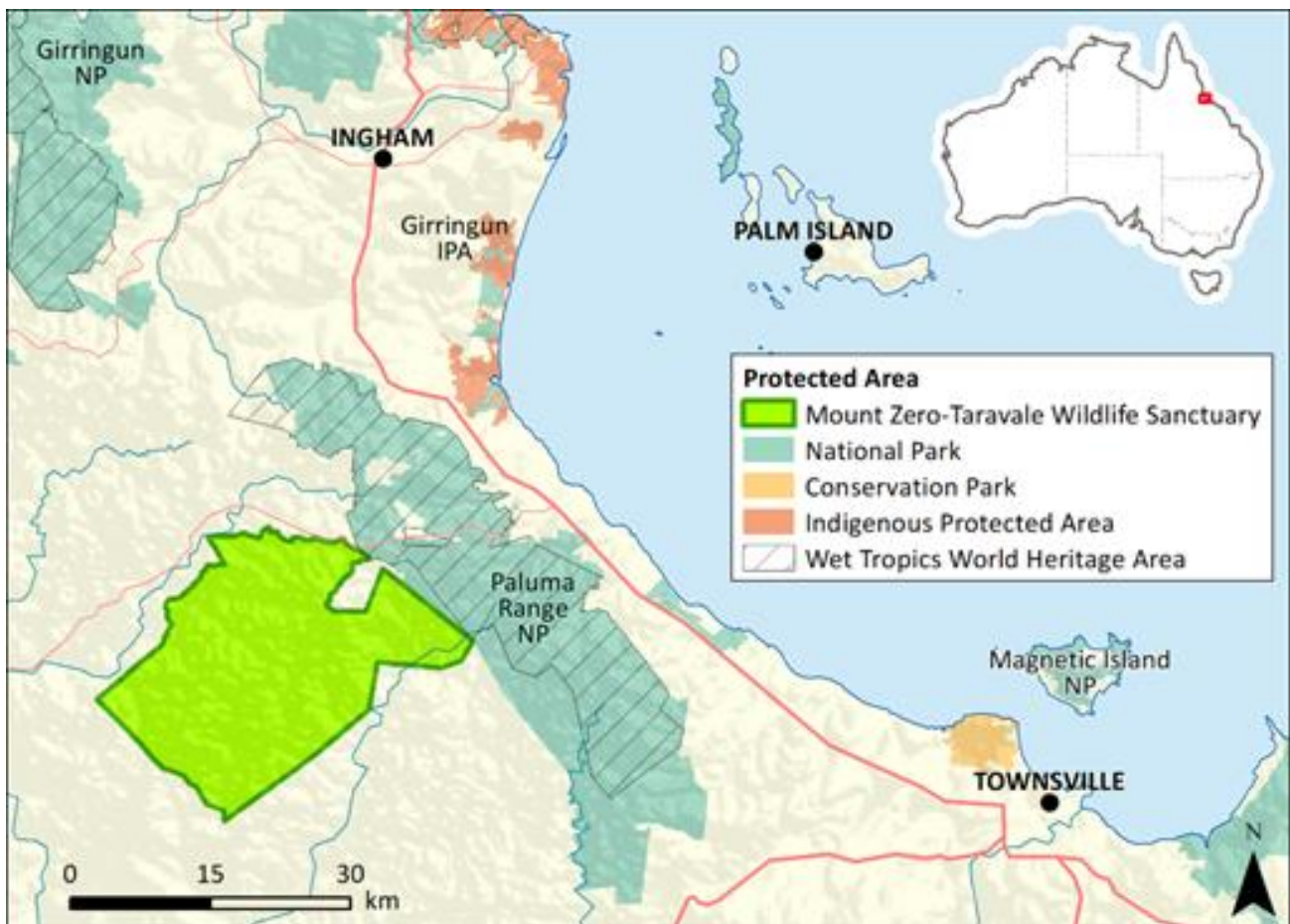
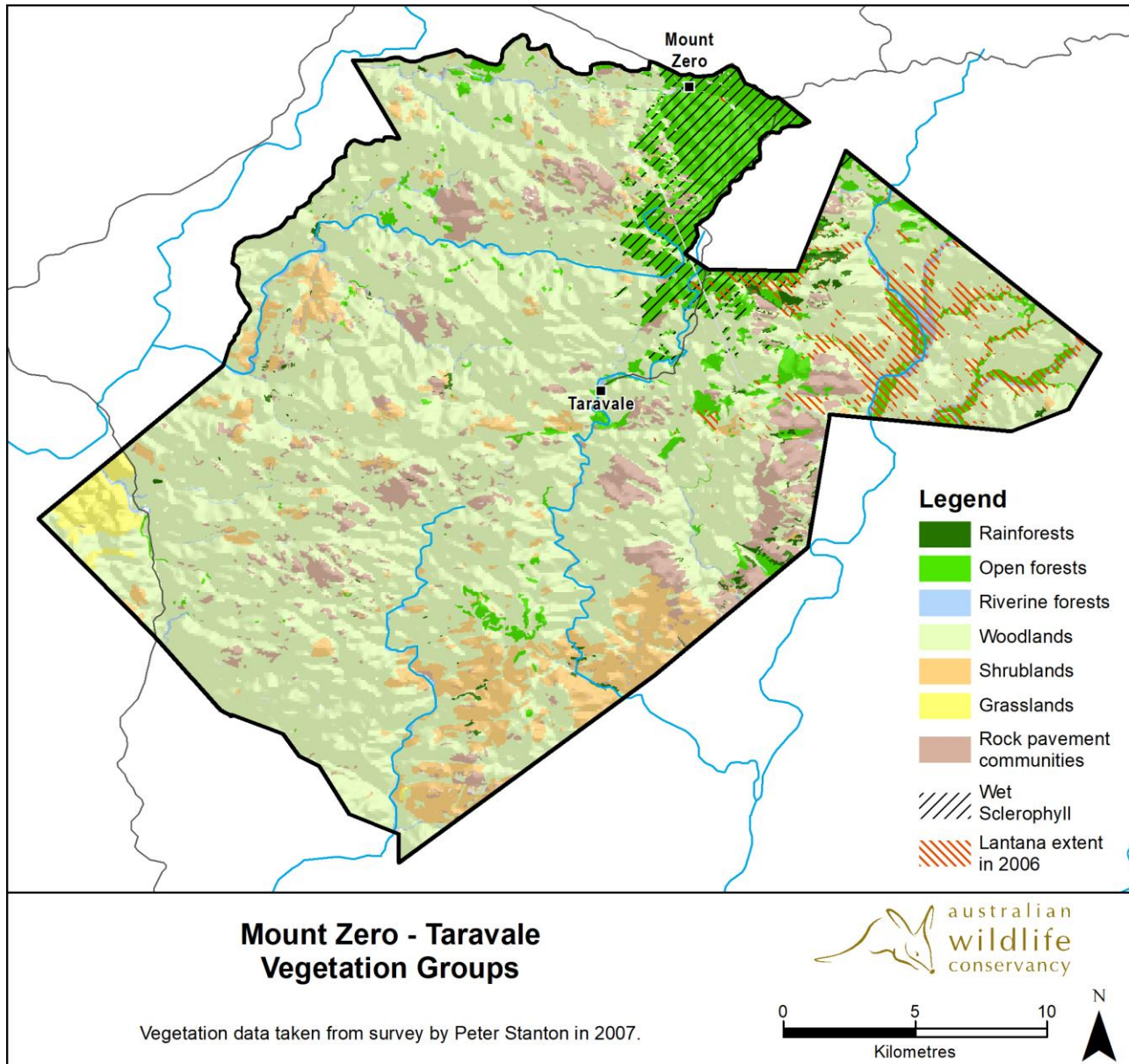


Figure 1. Location and regional context of Mount Zero-Taravale, north-east Queensland

Mount Zero-Taravale is within the traditional lands of the Gugu Badhun people. The sanctuary covers 59,138 ha and supports a diverse range of ecosystems including rainforest, wet sclerophyll forests, woodlands and spinifex grasslands (Stanton 2007). The sanctuary encompasses parts of the Wet Tropics and Einasleigh Uplands bioregions and supports elements of both wet tropical and rangeland biotas. Prior to acquisition by AWC, the Mount Zero and Taravale leases had a history of pastoral activities, timber harvesting and mining.

The habitat types present on Mount Zero-Taravale are diverse, reflecting the range of rainfall (2,000 mm along the eastern edge to 800 mm along the western boundary), altitude (over 1,000 m in the north, down to 300 m in the south) and sheer ruggedness (e.g., gorges and cliffs) which create fine scale habitat variation. There are 68 vegetation types on Mount Zero-Taravale (Figure 2), which can be grouped into 19 broad habitat types (Stanton 2007). The geology of the sanctuary comprises alluvial flats in the Star Valley, quartz arenite, rhyolite metamorphics and granite outcroppings (Stanton 2003).



**Figure 2. Broad vegetation groups of Mount Zero-Taravale, north-east Queensland.** Source: Stanton (2007).

To date, 220 bird species have been detected on the sanctuary, along with 91 reptile, 63 mammal, 21 frog, and seven fish species. Fifteen 'threatened' or 'near threatened' vertebrate species have been confirmed on Mount Zero-Taravale. This includes Sharman's Rock-wallaby (*Petrogale sharmani*), with over 70% of all known colonies existing on the sanctuary, and historic records of the Northern Bettong (*Bettongia tropica*).

Since acquisition, AWC has undertaken considerable survey effort at Mount Zero-Taravale across all major habitat types including wet sclerophyll forests, savanna woodlands and spinifex. This includes extensive inventory survey work, intensive live-trap and camera-trap surveys for the endangered Northern Bettong, as



well as a preliminary study of the response of the fauna of wet sclerophyll forest to invasion by rainforest plants (Middleton 2009; Kanowski et al. 2012, 2016). Past survey effort has expanded the list of species found on the sanctuary, including records of species on the edge of their known range (e.g., Black-striped Wallaby (*Macropus dorsalis*) and the Australian Coral Snake (*Brachyurophis australis*)), threatened species such as the Atherton Delma (*Delma mitella*) and new range extensions like that of the Magnificent Broodfrog (*Pseudophryne covacevichae*). Major conservation actions implemented by AWC at Mount Zero-Taravale include: (i) fire management, particularly the restoration of a fine-scale mosaic of early dry season burning across the savanna woodlands; (ii) ongoing weed control programs, particularly for *Lantana camara* infestations; and (iii) a large-scale restoration program for wet sclerophyll forests (Kanowski 2012, 2016).

The overarching aim of fire management on Mount Zero-Taravale is to re-establish ecologically appropriate fire regimes; those which promote the conservation of species, ecological communities and ecosystem processes (Cooper et al. 2019; Webb et al. 2020). Additional objectives include the protection of life and property and control of invasive weeds. The outcomes of fire management are assessed annually through an analysis of satellite imagery (e.g. Cooper et al. 2019; Webb et al. 2020).

### Climate and weather summary

A strong rainfall gradient exists across Mount Zero-Taravale. The north-eastern elevated parts of the sanctuary (around Mount Zero) receive over 2000 mm annually, declining to less than 800 mm in the lower elevation parts of the south-west (Figure 3).

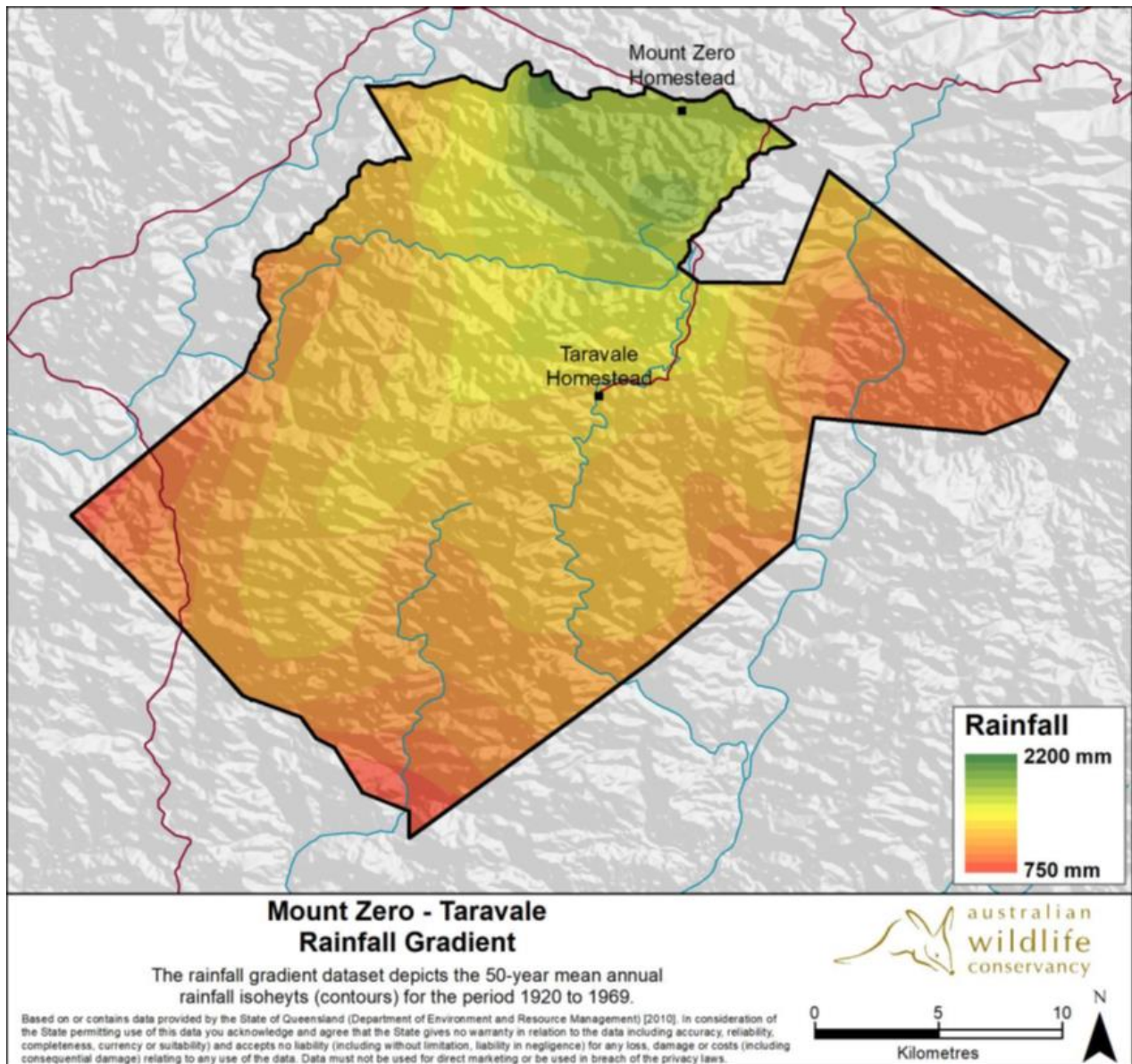
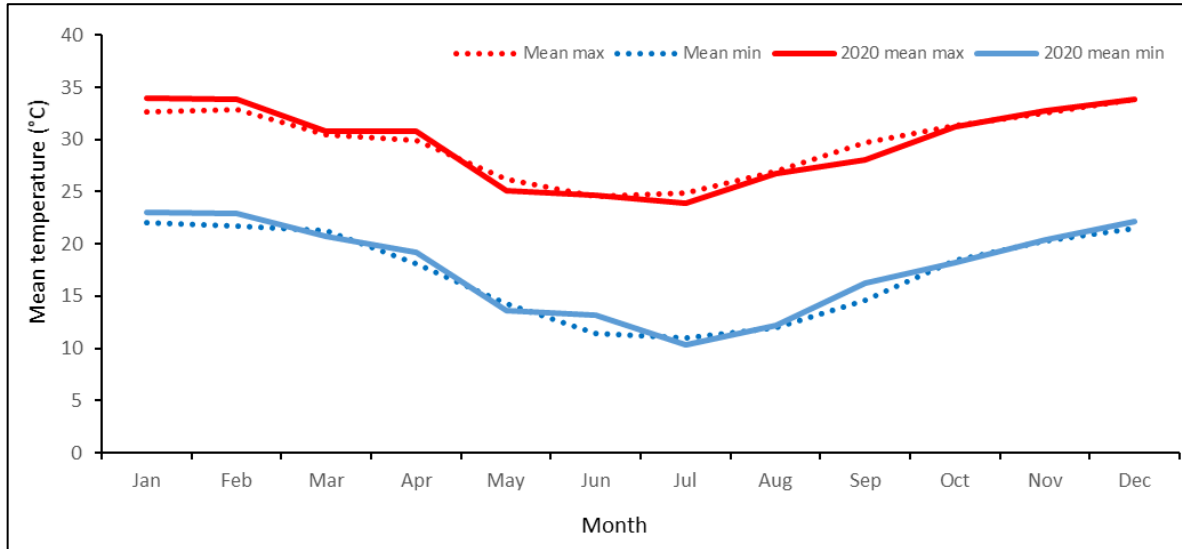


Figure 3. Modelled rainfall across Mount Zero-Taravale. Source: Cooper et al. (2019).

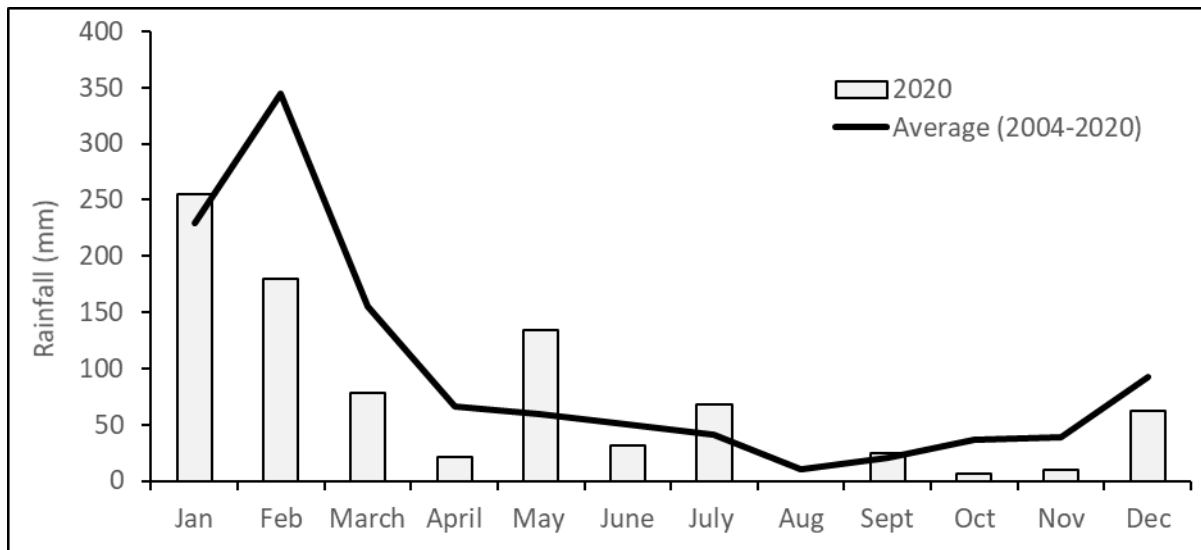
The climate typically consists of warm summers and mild winters. Mean maximum temperatures range between 35 °C in summer and 25 °C in winter (Figure 4). Rainfall is concentrated during the ‘wet season’ (~December to March), with comparatively dry conditions experienced in the latter half of the year (Figure 5).

Climate records are currently sourced from the Taravale homestead (a manual rain-gauge), and Bureau of Meteorology weather station data. The nearest weather station is located at the Townsville Weapons Range, ~26 km south-east of the Taravale Homestead (installed August 2017, BOM weather station number 32196).



**Figure 4. Average maximum and minimum temperatures as recorded at BOM weather station Townsville – Air Weapons Range (Defence), Station number 32196. 2017-2020.**

Average minimum and maximum temperatures recorded in 2020 did not vary markedly from the previous three years (Figure 4). This contrasted to rainfall, with most months receiving below average rainfall apart from a slightly wetter than average May-July period (Figure 5). Although historical datasets are available from nearby coastal locations, they are not readily comparable to Mount Zero-Taravale, due to the strong rainfall gradients in the region (Figure 3).



**Figure 5. Monthly rainfall at Taravale Homestead in 2020, compared with the average across 2004-2020.**  
Note, in 2020, Ecohealth surveys were undertaken in October-November.

## Methods

### Indicators and metrics

Mount Zero-Taravale's Ecohealth Monitoring Program has been designed to measure and report on the status and trends of species, ecological processes and threats on the sanctuary. The program focuses on selected biodiversity and threat indicators, using metrics derived from data collected through a series of purpose-designed surveys. A selection of species or guilds were chosen as biodiversity indicators which fit into one or more of the following categories: (1) declining and/or threatened species or guilds, (2) strong drivers of ecosystem function, or (3) are a member of the full range of taxa (to enable ongoing surveillance monitoring of a range of taxonomic groups to provide early warning of any unexpected declines).

On Mount Zero-Taravale, 69 biodiversity (species and guilds) indicators have been selected for monitoring (Table 1). Two of these indicators, Sharman's Rock-wallaby and the Common Wallaroo (*Macropus robustus*), were reported on in 2020.

Threat metrics are selected to ensure monitoring the status and trends of introduced weeds, predators and herbivores and inappropriate fire regimes (where relevant). Seven threat indicators have been selected for monitoring (Table 2). In 2020, one of these threat metrics (fire) was reported on. In future years, reporting for key weed species will be added.

**Table 1. Biodiversity indicators and metrics for the Ecohealth Monitoring Program.**

Rationale for selection: T = threatened or declining; D = strong driver of ecosystem function; S = surveillance monitoring. Metric definitions for fauna indicators: abundance = number of detections per 100 live trap or camera trap nights ('TN'), or average abundance per site/ transect; occupancy = percentage of sites where species/ guild recorded; richness = average number of species per site; population estimate = estimated number of individuals on sanctuary.

Indicator	Rationale			Survey method	Metric/s
	T	D	S		
<b>Mammals</b>					
<b>Small-medium mammals</b>					
Rainforest and wet sclerophyll small-medium mammal guild			*	Standard Trapping Survey	Abundance (per 100TN) Richness
Savanna woodlands small-medium mammal guild			*	Standard Trapping Survey	Abundance (per 100TN) Richness
Spinifex guild small-medium mammal guild			*	Standard Trapping Survey	Abundance (per 100TN) Richness
Yellow-footed Antechinus <i>Antechinus flavipes</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Common Planigale <i>Planigale maculata</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Common Dunnart <i>Sminthopsis murina</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Sharman's Rock-wallaby <i>Petrogale sharmani</i>	*			Sharman's Rock-wallaby Survey	Population estimate (method TBC) Abundance (detection interval TBC) Occupancy
Red-legged Pademelon <i>Thylogale stigmatica</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Rufous Bettong <i>Aepyprymnus rufescens</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Northern Bettong <i>Bettongia tropica</i> Planned reintroduced population	*	*		Standard Trapping Survey Targeted Survey	Population estimate Abundance (per 100TN) Occupancy
Northern Brown Bandicoot <i>Isodon macrourus</i>		*	*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Northern Long-nosed Bandicoot <i>Perameles pallescens</i>		*	*	Standard Camera Survey	Abundance (per 100TN) Occupancy



Indicator	Rationale			Survey method	Metric/s
	T	D	S		
Northern Short-tailed Mouse <i>Leggadina lakedownensis</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Grassland Melomys <i>Melomys burtoni</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Fawn-footed Melomys <i>Melomys cervinipes</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Delicate Mouse <i>Pseudomys delicatulus</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Eastern Chestnut Mouse <i>Pseudomys gracilicaudatus</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Eastern Pebble-mouse <i>Pseudomys patrius</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Bush Rat <i>Rattus fuscipes</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Swamp Rat <i>Rattus lutreolus</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Canefield Rat <i>Rattus sordidus</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Giant White-tailed Rat <i>Uromys caudimaculatus</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Common Rock-rat <i>Zyomys argurus</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
<b>Arboreal mammals</b>					
Common Brushtail Possum <i>Trichosurus vulpecula</i>			*	Spotlighting Survey Standard Trapping Survey	Abundance (per transect/ trap site) Occupancy
Greater Glider <i>Petauroides Volans</i>			*	Spotlighting Survey	Abundance (per transect) Occupancy
Common Ringtail Possum <i>Pseudocheirus peregrinus</i>			*	Spotlighting Survey	Abundance (per transect) Occupancy
<b>Large herbivores</b>					
Agile Wallaby <i>Macropus agilis</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Black-striped Wallaby <i>Macropus dorsalis</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Eastern Grey Kangaroo <i>Macropus giganteus</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Whiptail Wallaby <i>Macropus parryi</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Euro, Common Wallaroo <i>Macropus robustus</i>			*	Sharman's Rock-wallaby Survey	Occupancy
Swamp Wallaby <i>Wallabia bicolor</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
<b>Large predatory mammals</b>					
Dingo <i>Canis dingo</i>		*	*	Standard Camera Survey Targeted Survey	Abundance (per 100TN) Occupancy
<b>Reptiles</b>					
<b>Small-medium reptiles</b>					
Rainforest and wet sclerophyll small-medium reptile guild			*	Standard Trapping Survey	Abundance (per 100TN) Richness (per site)
Savanna woodland small- medium reptile guild			*	Standard Trapping Survey	Abundance (per 100TN) Richness (per site)
Spinifex small-medium reptile guild			*	Standard Trapping Survey	Abundance (per 100TN) Richness (per site)
Arboreal/ nocturnal reptile guild			*	Standard Trapping Survey	Abundance (per 100TN) Richness (per site)

Indicator	Rationale			Survey method	Metric/s
	T	D	S		
Rock specialist reptile guild			*	Standard Trapping Survey	Abundance (per 100TN) Richness (per site)
Tommy Roundhead <i>Diporiphora australis</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Eastern Spiny-tailed Gecko <i>Strophurus williamsi</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Bynoe's Prickly Gecko <i>Heteronotia binoei</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Black-throated Rainbow-skink <i>Carlia rostralis</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Red-throated Rainbow-skink <i>Carlia rubrigularis</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
Straight-browed Ctenotus <i>Ctenotus spaldingi</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
<b>Birds</b>					
Rainforest guild			*	Standard Bird Survey	Abundance (per site) Richness
Wet sclerophyll guild			*	Standard Bird Survey	Abundance (per site) Richness
Savanna woodland guild			*	Standard Bird Survey	Abundance (per site) Richness
Spinifex guild			*	Standard Bird Survey	Abundance (per site) Richness
Nocturnal guild			*	Targeted Survey to be developed	Abundance (per site) Richness
Rocky gorge guild			*	Standard Bird Survey	Abundance (per site) Richness
Peaceful Dove <i>Geopelia placida</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Brown Honeyeater <i>Lichmera indistincta</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Noisy Friarbird <i>Philemon corniculatus</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Golden Whistler <i>Pachycephala pectoralis</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Rufous Whistler <i>Pachycephala rufiventris</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Victoria's Riflebird <i>Ptiloris victoriae</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Striated Pardalote <i>Pardalotus striatus</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Eastern Yellow Robin <i>Eopsaltria australis</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Noisy Pitta <i>Pitta versicolor</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Glossy Black Cockatoo <i>Calyptorhynchus lathami</i>	*			Targeted Survey (external researcher)	Population Estimate Occupancy
Rainbow Lorikeet <i>Trichoglossus moluccanus</i>			*	Standard Bird Survey	Abundance (per site) Occupancy
Masked Owl <i>Tyto novaehollandiae kimberli</i>	*			Targeted Survey to be developed	Abundance (per site) Occupancy
<b>Frogs</b>					
Terrestrial guild			*	Standard Trapping Survey Acoustic Survey TBC	Occupancy Richness
Desert Tree Frog <i>Litoria rubella</i>			*	Standard Trapping Survey Acoustic Survey TBC	Abundance (per 100TN) Occupancy

Indicator	Rationale			Survey method	Metric/s
	T	D	S		
Northern Banjo Frog <i>Limnodynastes terraereginae</i>			*	Standard Trapping Survey Acoustic Survey TBC	Abundance (per 100TN) Occupancy
Ornate Burrowing Frog <i>Platyplectrum ornatum</i>			*	Standard Trapping Survey Acoustic Survey TBC	Abundance (per 100TN) Occupancy
Southern Ornate Nursery-frog <i>Cophixalus australis</i>			*	Standard Trapping Survey Acoustic Survey TBC	Abundance (per 100TN) Occupancy
Magnificent Broodfrog <i>Pseudophryne covacevichae</i>	*			Targeted Survey TBC	Abundance (per 100TN) Occupancy
<b>Freshwater fish</b>					
Running River Rainbowfish <i>Melanotaenia sp.</i>	*			Targeted Survey	Abundance Occupancy

**Table 2. Threat indicators and metrics for the Ecohealth Monitoring Program.**

Metric definitions for fauna indicators: abundance = number of detections per 100 live trap or camera trap nights ('TN') across all sites; occupancy = percentage of sites where species detected; population estimate = estimated number of individuals on sanctuary.

Indicator	Rationale			Survey method	Metric/s
	T	D	S		
Cattle <i>Bos taurus</i>			*	Feral Herbivore Survey TBC	Population estimate
Horse <i>Equus caballus</i>			*	Feral Herbivore Survey TBC	Population estimate
Cat <i>Felis catus</i>			*	Standard Camera Survey	Abundance Occupancy
Red fox <i>Vulpes vulpes</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Pig <i>Sus scrofa</i>			*	Standard Camera Survey	Abundance (per 100TN) Occupancy
Cane toad <i>Rhinella marina</i>			*	Standard Trapping Survey	Abundance (per 100TN) Occupancy
<b>Fire</b>					
Area burnt by early dry season fire		*		Fire Scar Analysis	% of property
Area burnt by late dry season (LDS) fire		*		Fire Scar Analysis	% of property
Cumulative extent of sanctuary burnt by LDS fire in previous 3 years		*		Fire Scar Analysis	% of property
Mean distance to unburnt vegetation		*		Fire Scar Analysis	Mean distance (km)
Mean distance to vegetation unburnt by LDS fire for 3 or more years		*		Fire Scar Analysis	Mean distance (km)

## Survey types and history

To report on the Biodiversity and Threat Indicators, AWC survey teams conduct a variety of surveys repeated on a schedule of 1-5 years. These include:

- Standard Trapping Survey
- Standard Camera Survey
- Standard Bird Survey
- Spotlighting Survey, and
- Targeted surveys (including Sharman's Rock-wallaby and Running River Rainbowfish surveys).

In addition to ground-based ecological surveys, satellite data are analysed to compile the Fire Scar Analysis.



One ecological survey was completed at Mount Zero-Taravale in 2020: a targeted survey for Sharman's Rock-wallaby (Table 3). The Fire Scar Analysis was conducted using satellite data from 1997-2020 (i.e. eight years prior to acquisition to the present). The methodology is described and results of these surveys and computations are reported on in this document.

A total of 308 trap nights were undertaken during the 2020 survey (Table 3).

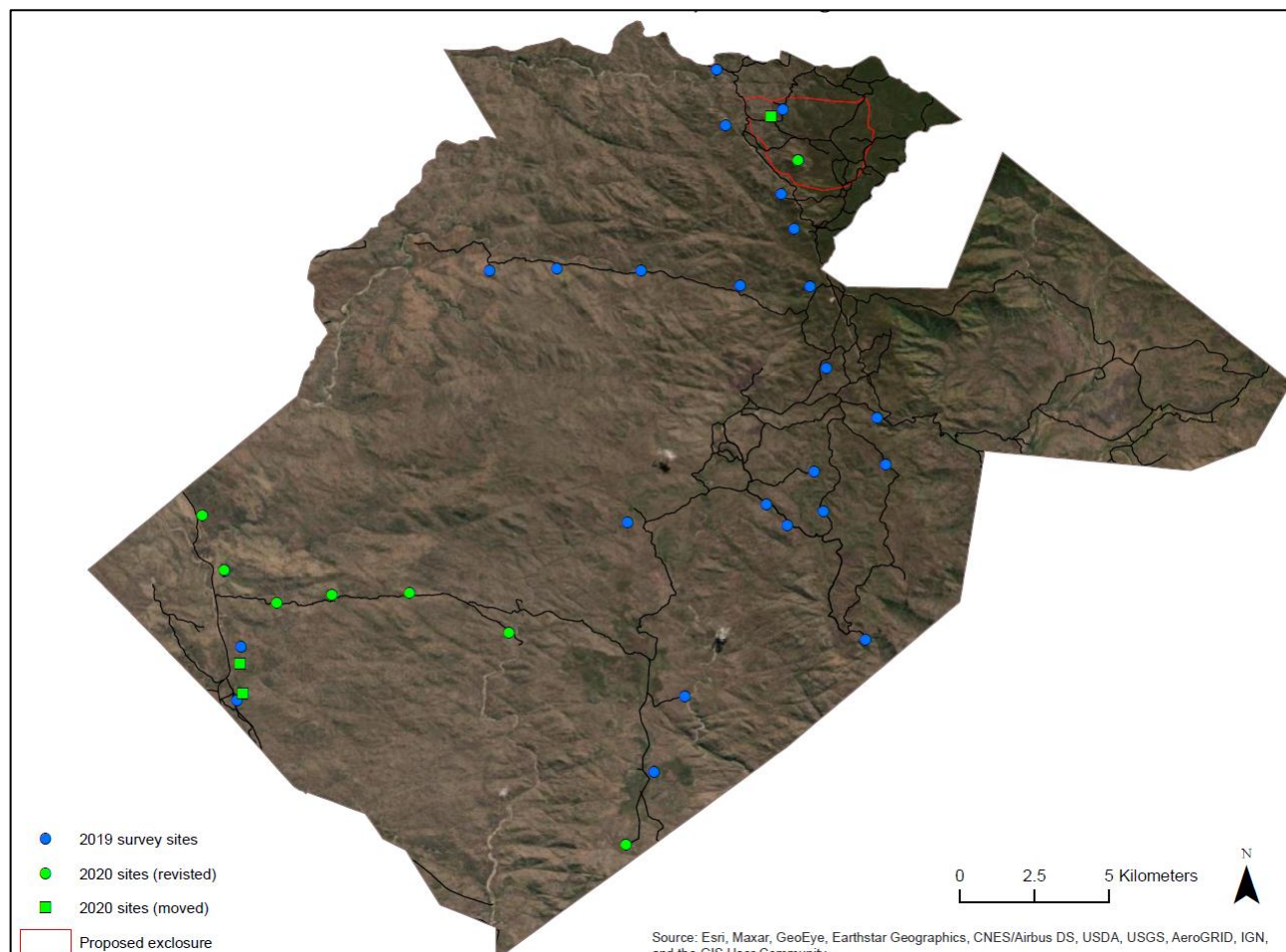
**Table 3. Ecohealth survey effort on Mount Zero-Taravale in 2020**

Survey name	Effort	Description/Comment	Previous Surveys
Targeted survey (Sharman's Rock-wallaby)	308 trap nights	One camera deployed at each of 11 sites. Cameras remained in the field for a minimum of 28 days.	2019 – 31 cameras (855 trap nights)

## Survey design and methods

### Sharman's Rock-wallaby Survey

A targeted survey for Sharman's Rock-wallaby was developed in 2019, with the aim of monitoring the ongoing occupancy of the species across the sanctuary. Survey sites were selected on the basis of: previous records obtained during inventory surveys between 2008 to 2018 (Mulder et al. 2014; Hayes 2019); incidental records; and predictive habitat modelling in coordination with aerial imagery (Hayes 2019). Sites were spaced at least 1 km apart to ensure site independence. A total of 69 potential sites were identified, including 28 locations where Sharman's Rock-wallaby had been known to occur previously (16 road-accessed sites and 12 helicopter access), and an additional 41 sites selected in potential habitat (16 road-accessed and 25 helicopter sites). Thirty-one road-accessed sites were surveyed in 2019 (Figure 6).



**Figure 6. Sharman's Rock-wallaby camera monitoring sites.** Map shows sites sampled in 2019 (blue circles), sites resampled in 2020 (green circles) and sites where location was adjusted in 2020 (green squares).

A subset of the 2019 sites (11 of the 31 sites) were resampled in 2020 (Figure 6). Survey effort in 2020 was limited due to logistical constraints (i.e. Covid-19 travel restrictions), however focussed on (i) those sites

located across the area impacted by summer 2019/ 2020 bushfires, but where Sharman's Rock-wallaby had not been recorded in 2019; and (ii) two previously known locations within the proposed feral-predator free enclosure in the north of the property. Confirming the presence of Sharman's Rock-wallaby within the fence will help to inform future management requirements of those colonies. The location of the camera traps at three of the 2020 survey sites was shifted slightly (up to 500 m) from the 2019 camera trap locations, into more complex rocky habitat considered more likely to support rock-wallabies.

The Common Wallaroo is frequently detected on targeted Sharman's Rock-wallaby cameras in rocky habitat at Mount Zero-Taravale (Hayes 2019). The targeted survey was therefore also used to provide the 2020 metrics for the Common Wallaroo.

One Reconyx Hyperfire white-flash camera was deployed per site. Camera settings were: rapidfire, high sensitivity, 3 photographs per trigger, no delay, no quiet period. Where possible, cameras were set facing south. Obstructive/ interfering vegetation was cleared to reduce false triggers. Cameras were attached to a tree 50 cm above ground level. A standard PVC bait container was attached to an aluminium picket 30 cm off the ground, secured 3 metres away. Bait balls consisted of peanut butter, oats, vanilla essence, 'Dairy Krave' and sardines. Sardines were added to the bait to incorporate searches for Northern Quolls (*Dasyurus hallucatus*), which could potentially occupy rocky outcrops. Cameras were angled appropriately so that the bait container was located in the centre of the photograph (using either a laser pointer or the 'walk test' function).

Cameras were left in the field for a minimum of 28 days. Data captured beyond the 28-day sampling period were considered 'incidental' only.

## **Analysis methods**

### **Biodiversity indicators**

#### ***Sharman's Rock-wallaby***

Camera data were downloaded and processed using the Microsoft Azure Image Detection API (Application Programming Interface), facilitated by the Microsoft Azure Storage Explorer and Postman platforms. Once the API processing component was completed, data were uploaded into the program 'Timelapse'. Animals were identified to species level if possible (Appendix 1). A spreadsheet containing all captures of species was exported from Timelapse and used to calculate Ecohealth metrics.

The occupancy of Sharman's Rock-wallaby was calculated as the percentage of the 2020 survey sites at which the species was recorded.

The appropriate detection interval to calculate an abundance index for Sharman's Rock-wallaby is currently under review. A method for estimating population size based on camera trap data is currently under development.

The occupancy of the Common Wallaroo was calculated as the percentage of the 2020 survey sites at which the species was recorded. The appropriate detection interval to calculate an abundance index is currently under review.

### **Threat indicators**

#### ***Fire***

Fire scar data were obtained for years from 1997 to 2020 and each scar was attributed by year, month and season. For season, scars detected from January to August (inclusive) were attributed as 'Early', whereas those detected September to December were attributed as 'Late'. The firescar mapping for earlier years was supplied by the Queensland Government, and for later years was undertaken by AWC using 'image change' analysis of Landsat and Sentinel imagery. The maps and statistics for the analyses were created using ArcGIS, and were semi-automated using Python scripting. Further details are provided in the annual Fire Analysis Report (Webb et al. 2020).

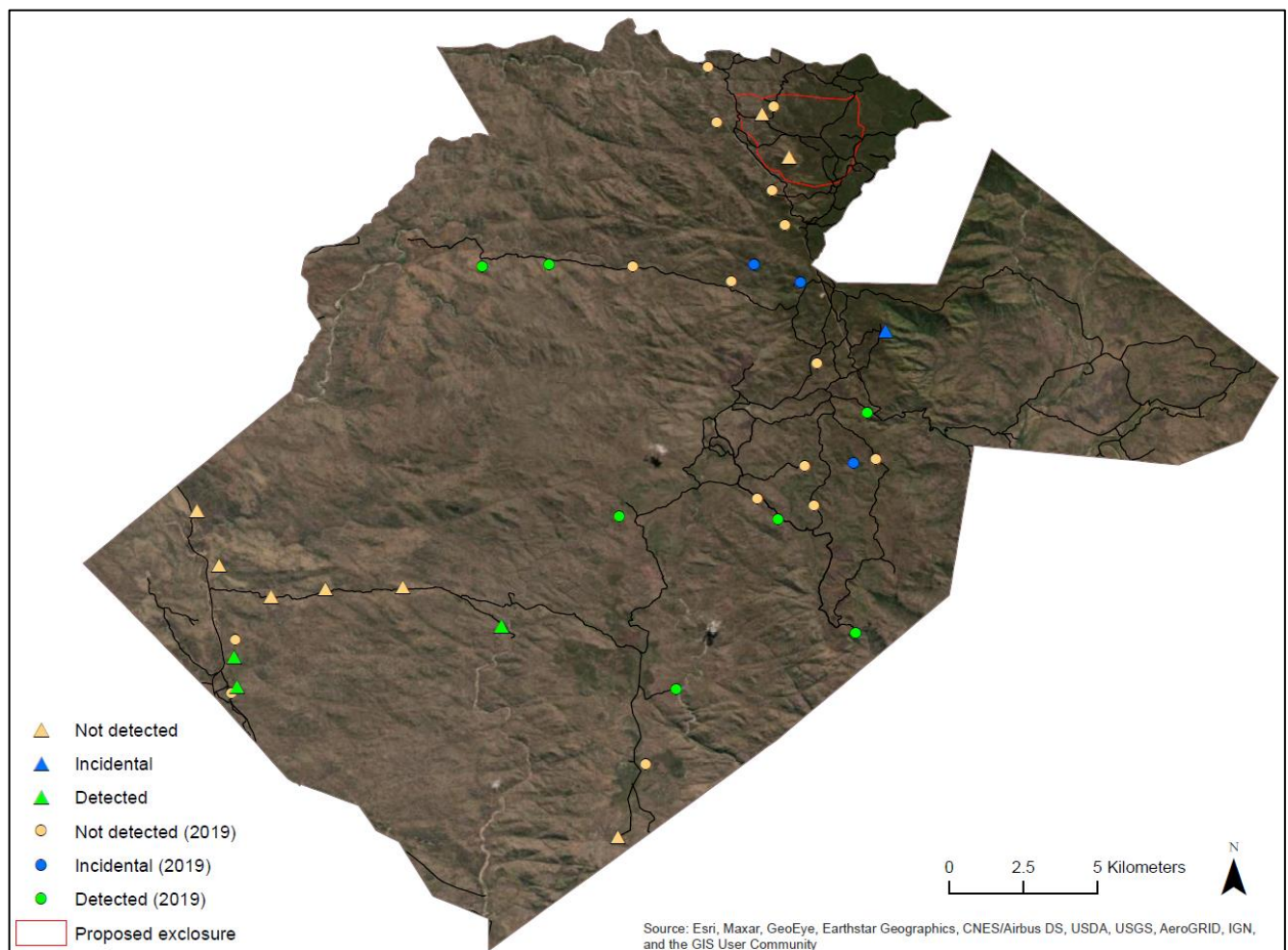
## Results

### Biodiversity indicators

#### Small-medium mammals: Sharman's Rock-wallaby

Sharman's Rock-wallabies were detected at 3 of the 11 sites sampled (27% occupancy). This occupancy rate is similar to that observed in 2019, when 7 of 31 sites (23%) were occupied, although a different set of sites were surveyed each year. The species was also recorded incidentally at a new location in 2020 (Figure 7).

Sharman's Rock-wallabies were not re-detected at 2 previously-occupied sites located inside the proposed feral predator-free fence. However, the original records from these locations are relatively old (from 2008 and 2016). In addition, the 2016 record was obtained during a general fauna survey (not targeted at rocky habitat) and likely represented a transient individual; AWC staff could not locate any apparently suitable habitat near the previous camera trap site. These data are too preliminary to make any inferences regarding ongoing occupancy, and targeted survey effort in future years will provide greater clarity.



**Figure 7. Sites monitored for Sharman's Rock-wallaby presence in 2020.** Triangles indicate 2020 survey effort; circles reflect other sites sampled in 2019, blue shows incidental observations.

Thirty-six of the 50 sites known to support Sharman's Rock-wallaby have now been identified on Mount Zero-Taravale, meaning AWC protect more than 70% of known colonies. Future Ecohealth monitoring effort will provide ongoing data relating to the persistence of colonies at these locations. These long-term data will provide insight on the response of this species to extrinsic factors such as rainfall, and how management intervention, particularly fire management, affects this species.

In late 2020, AWC secured funding through the Queensland Government's Community Sustainability Action grant scheme. This will see the targeted Sharman's Rock-wallaby camera survey conducted annually for the following three years in an effort to further understand the impact of fire management on the species. A



revised set of survey sites, targeting those locations where the species has been confirmed through previous effort, will be monitored.

### Large herbivores: Common Wallaroo

Common Wallaroos were detected at 6 of the 11 survey sites in 2020; an occupancy of 55%. This species will continue to be monitored in conjunction with Sharman's Rock-wallaby; future surveys will enable further insights into its occupancy across Mount Zero-Taravale.

## Threat indicators

### Fire

Burning operations in 2020 were guided by the annual Mount Zero-Taravale Burn Plan (McAllister et al. 2020) and comprised an aerial control-burn flight in addition to ground-based ignition. Returning and maintaining the grassy understorey to thickened wet sclerophyll forest continues to be a key focus (Figure 8), in addition to maintaining the fine-scale mosaic of fire age classes established across the broader property.



**Figure 8. Fire management in wet sclerophyll forest (AWC/Josh McAllister).**

The 2020 fire metrics reveal improvements from baseline values that are likely to benefit ecological health. Since AWC commenced fire management, the area burnt by early dry season fire has increased from a baseline of 0% to 11% in 2020, while the area burnt by late dry season fire has reduced substantially (to 0% in 2020; Table 4). The mean distance to unburnt vegetation has halved, and the mean distance to vegetation unburnt by a late dry season fire for 3 or more years is now one-third of the baseline value. More detail on the Mount Zero-Taravale fire program is provided in the annual Fire Report (Webb et al. 2020).

**Table 4. Fire metrics for 2020.**

Metric	Baseline (1997/1999-04)	AWC management (2005/2007-20)	2020 result
Area burnt by early dry season (EDS) fire (%)	0	15	11
Area burnt by late dry season (LDS) fire (%)	12	6	0
Cumulative extent burnt by LDS fire in past 3 years (%)	43	16	30
Mean distance to unburnt vegetation (km)	0.6	0.5	0.3
Mean distance to vegetation unburnt by LDS fire for 3 or more years (km)	1.2	0.6	0.4

Note: baseline values for metrics are the average for the years immediately prior to acquisition of Mount Zero-Taravale by AWC: i.e., 1997-2004 for annual metrics; 1999-2004 for 3 year metrics. AWC management values are averages for years following acquisition of the property by AWC: i.e., 2005 onwards, for annual metrics; 2007-2020, for 3 year metrics.

## Discussion

Across the 11 sites monitored in 2020, Sharman's Rock-wallaby had an occupancy of 27%. This was slightly higher than the 2019 result of 23% occupancy (7 of 31 sites), although a different suite of sites were surveyed in each year. Encouragingly, Sharman's Rock-wallaby was detected at three of five sites where the species was not recorded in 2019. Given the limited survey effort in 2020, no inferences on the population status of Sharman's Rock-wallaby can be drawn at this stage. Future repeated surveys will allow for long-term consideration of occupancy and abundance patterns, as well as the influence of rainfall and AWC's fire management program.

The Standard Trapping Survey and Standard Camera Survey, which are the identified survey methods for many of the sanctuary indicators, are currently scheduled every three years and next planned for 2022. This will provide an update on the status of a majority of indicator species and guilds, and the broader Ecohealth of the sanctuary. In addition, the development of a consistent approach to deriving abundance and population estimate metrics from camera trapping data is currently underway. This includes exploration of the most suitable 'event' periods for different species, including Sharman's Rock-wallaby.

In 2020, no area of Mount Zero-Taravale was affected by late dry season fire, and the fire metrics indicate improvements from baseline values that will benefit the ecological health of the sanctuary.

Although there was limited Ecohealth-related survey effort in 2020, a key focus for the year was collecting baseline data for inside-outside fence comparisons ahead of the construction of a feral predator-free enclosure and Northern Bettong reintroduction. Once Northern Bettongs are established within the enclosure, the surveys associated with the reintroduction will be reported as part of the Ecohealth program.

## Acknowledgments

AWC acknowledges the Gugu Badhun people, the Traditional Custodians, of Gugu Badhun Country on which Mount Zero-Taravale resides. We also acknowledge their continuing connection to land, culture and community. We pay our respects to Gugu Badhun Elders past present and emerging.

AWC's Ecohealth Program is only possible because of the generosity of AWC's supporters. Thanks to the Mount Zero-Taravale Sanctuary operations staff, Josh McAllister (Sanctuary Manager) and Aaron Harper (Land Management Officer) for their support and contributions to the 2020 Ecohealth monitoring program. Special thanks also to volunteer participants on the ecology survey program.

Sharman's Rock-wallaby survey team:

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- Felicity L'Hotellier (Senior Field Ecologist)
- Blanche d'Anastasi (Volunteer)

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## Appendix 1

### Sharman's Rock-wallaby survey 2020

**Table 5. All species recorded during the 2020 survey**

Scientific name	Common name
<i>Aquila audax</i>	Wedge-tailed Eagle
<i>Cracticus tibicen</i>	Australian Magpie
<i>Strepera graculina</i>	Pied Currawong
<i>Trichosurus vulpecula</i>	Common Brushtail Possum
<i>Macropus parryi</i>	Whiptail Wallaby
<i>Macropus robustus</i>	Euro
<i>Petrogale sharmani</i>	Sharman's Rock-wallaby
<i>Wallabia bicolor</i>	Swamp Wallaby
<i>Canis dingo</i>	Dingo
<i>Perameles / Isoodon sp.</i>	Bandicoot (not identified to species)
<i>Felis catus</i>	Feral cat

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