Curramore Wildlife Sanctuary
Ecohealth Report 2020

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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 Curramore Wildlife Sanctuary (Curramore). Metrics from the program are reported in annual Ecohealth Reports and Scorecards. This is the Ecohealth Report for 2020.

Values of metrics set out in this report were based on data collected during the most recent Ecohealth survey conducted on Curramore, in 2019. The complete set of metrics and their values are summarised in the accompanying Ecohealth Scorecard.

In 2019, a Standard Trapping Survey and Standard Camera Survey were undertaken at seven monitoring sites located in the four major vegetation types on Curramore (rainforest, wet sclerophyll forest, dry sclerophyll forest and regrowth). Sites were surveyed for small-medium mammals and reptiles using standard trapping methods (pitfall traps, funnel traps and box traps). Camera traps were used to target small-medium mammals and large terrestrial mammals and reptiles.

A total of 52 native vertebrate species were recorded in the 2019 surveys, comprising 12 mammals, 32 birds, seven reptiles and one frog. The abundance and average species richness of small-medium mammals and reptiles was generally low. This likely reflects drought conditions between 2017-2020, as well as the adverse weather conditions encountered during 2019 surveys (unseasonal cold and wet weather), which greatly reduced reptile captures.

A new species was confirmed for the sanctuary in 2019: the Three-toed Snake-tooth Skink (*Coeranoscincus reticulatus*), which is listed as 'Vulnerable' under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*.

No feral herbivores were detected in the 2019 Standard Camera Survey.

Foxes were detected at 57% of survey sites in 2019, and a dog (likely a domestic dog) was detected at one site. No feral cats were detected in 2019.

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Cover photograph: Sub-tropical rainforest at Curramore Sanctuary. Andrew Howe/AWC

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 (Kanowski et al. 2018), Ecohealth Monitoring Plans are developed, each describing the conservation values or assets of each property, and threats to these assets; and setting 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 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 Curramore Ecohealth Report 2020, draws on surveys conducted during 2019 (the most recent Ecohealth surveys conducted on the sanctuary) to calculate values for metrics that track the status and trend of the Ecohealth indicators. The companion Curramore Ecohealth Scorecard 2020 presents these metrics in a summary format.

Curramore Wildlife Sanctuary

Curramore Wildlife Sanctuary ('Curramore') is located in south-east Queensland, Australia, within the traditional lands of the Gubbi Gubbi people. It is located on the western escarpment of the Maleny plateau (Figure 1). While the plateau has been extensively cleared, the steep escarpment on which Curramore is situated remains mostly forested. The sanctuary is 175 hectares in extent, with elevation ranging from 200 m at the Mary River Valley near Conondale to 660 m near the summit of Donavan's Knob. The geology is predominantly acid volcanics (rhyolite and microgranite), with smaller areas of basalt (Figure 2). The sanctuary encompasses most of the headwaters of Little Cedar Creek, a tributary of the Mary River.

The vegetation communities on Curramore can be grouped into four broad vegetation types: rainforest, wet sclerophyll forest, dry sclerophyll forest and regrowth (Figure 2; Stanton 2004). Rainforest includes simple to complex microphyll (small-leaved) to notophyll (large-leaved) closed forests with or without prominent Bangalow Palms (*Archontophoenix cunninghamiana*). Wet sclerophyll forest encompasses various types of tall eucalypt open forest, often dominated by Flooded Gums (*Eucalyptus grandis*), Brush Box (*Lophostemon confertus*) and Tallowwood (*Eucalyptus microcorys*), and with an understorey ranging from sedges and shrubs, the introduced scrambling weed, lantana (*Lantana camara*), to rainforest palms. Dry sclerophyll forest consists of grassy eucalypt woodlands with Grey Gum (*Eucalyptus propinqua*), White Mahogany (*Eucalyptus acmenoides*), Grey Ironbark (*E. paniculata*), Tallowwood, Brush Box and Pink Bloodwood (*Corymbia intermedia*). Regrowth vegetation includes lantana, and regrowth following the treatment of lantana, which is mostly various species of Acacia, Eucalypts and dense stands of rainforest pioneer plants such as Pencil Cedar (*Polyscias murrayi*) and Native Ginger (*Alpinia caerulea*).
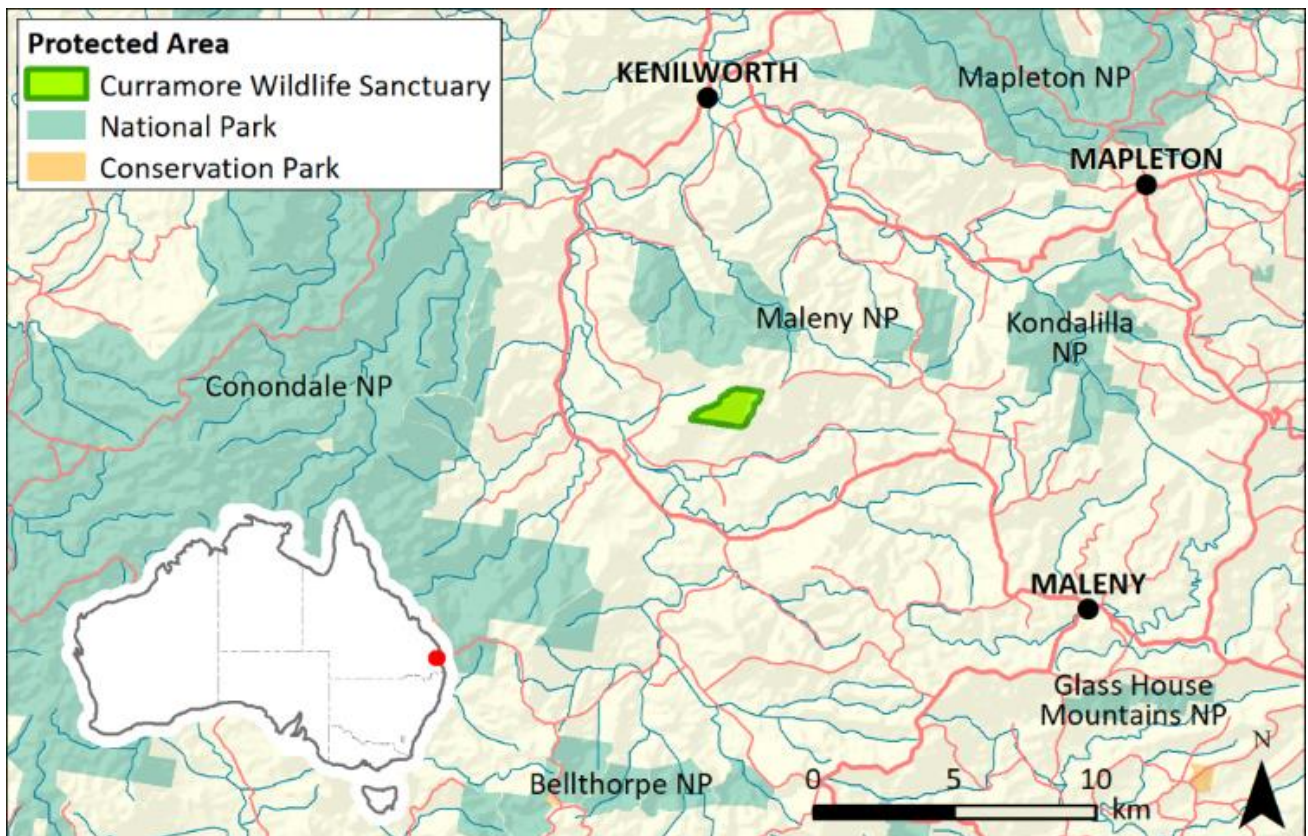
Figure 1. Location of Curramore Wildlife Sanctuary on the Sunshine Coast in southeast Queensland
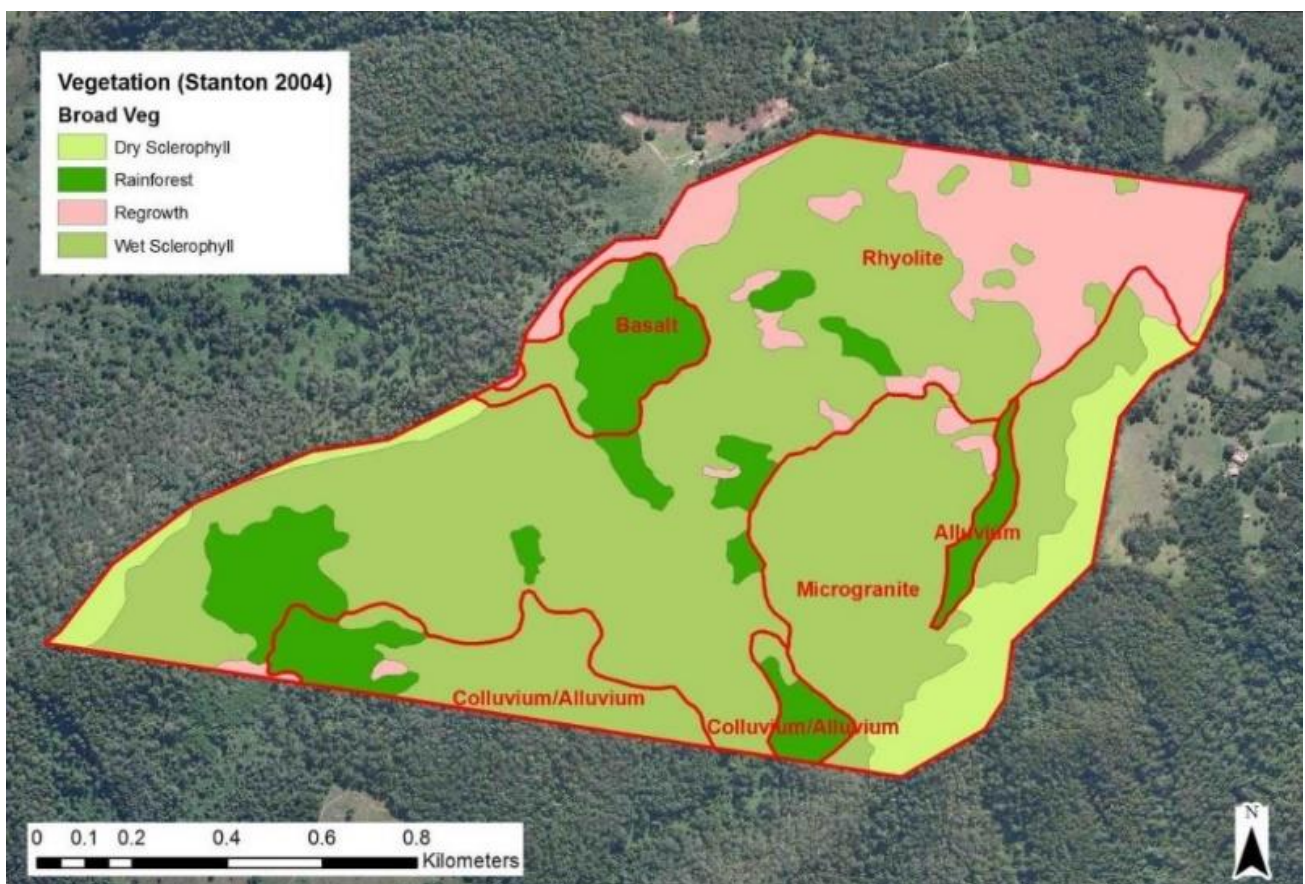

Figure 2. The vegetation and geology of Curramore. Geology boundaries are represented by the red lines and text; coloured areas represent broad vegetation types (Stanton 2004)

Eight vertebrate species listed as threatened under Commonwealth and/ or Queensland legislation are known to occur on Curramore (three birds, three mammals, one reptile and one frog). An additional six threatened vertebrate species are considered 'very likely', 'likely' or 'possible' to occur on the sanctuary.

In addition to AWC's Ecohealth survey program on Curramore, external researchers have undertaken studies on lantana (Virikki et al. 2012) and of freshwater crayfish (*Euastacus urospinosus*) (Hurry et al. 2015).

Climate summary

Climate in the Curramore region varies considerably between locations due to significant changes in topography. The sanctuary typically experiences warm summers and cool winters with rainfall events occurring throughout the year. Rainfall peaks usually occur from December to March although heavy rainfall events may occur at any time of the year. In Maleny, mean maximum temperatures range between 27.1 °C in summer and 18.7 °C in winter (BOM 2020a).

The main weather station in Maleny (Tamarind Rd station, number 040121) ceased collecting data in 2017. The following 2019 data are taken from the nearest applicable stations 'Maleny Denning Rd' (station number 40396) for rainfall, and 'Nambour Daff-Hillside' (station number 40988) for temperature.

The mean maximum temperature in 2019 was above average at 26.8°C (Figure 3; BOM 2020b). The mean minimum temperature was 16.0°C, close to average (Figure 3; BOM 2020c). The total rainfall during 2019 was 1,305 mm (BOM 2020d). This was over 600 mm below the annual average of 1,922 mm for the region (Figure 4). In 2020 the rainfall slightly increased to a total of 1,632 mm, still almost 300 mm below average annual rainfall (BOM 2020d). The two wettest months of 2019 occurred during the 2019 Standard trapping survey, with 390 mm falling in March and 305 mm in April (BOM 2020d).
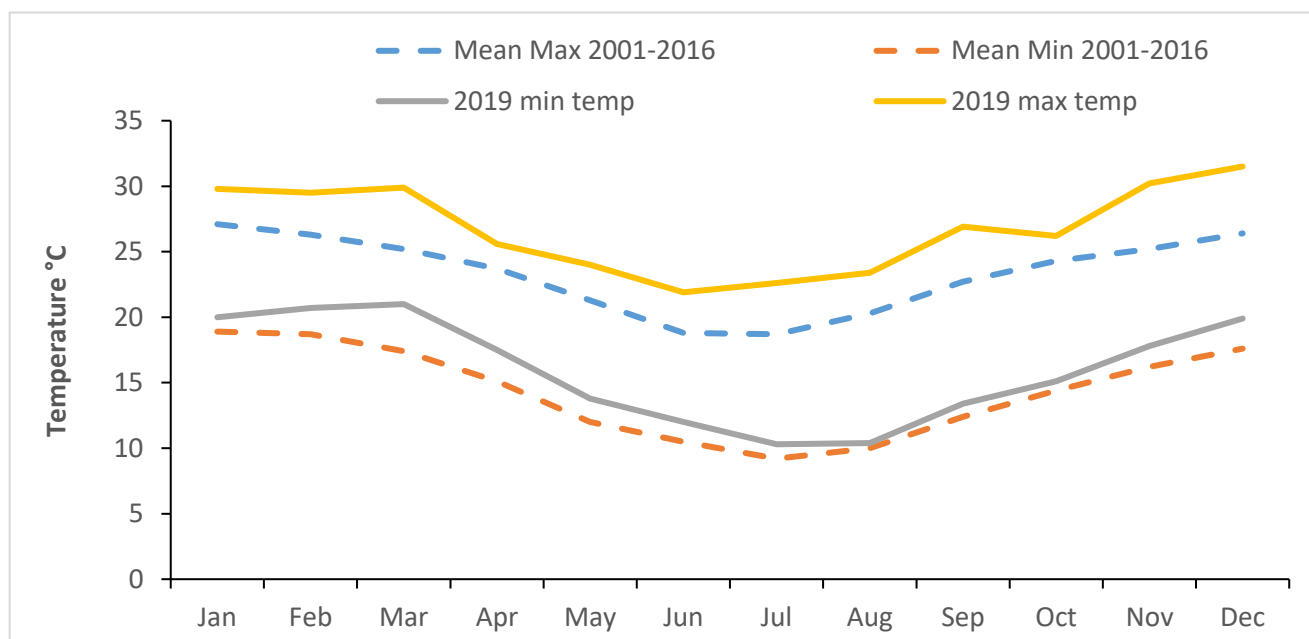

Figure 3. 2019 and long-term (2001-2016) mean maximum and minimum temperatures for Maleny district. Data acquired from Nambour Daff-Hillside (station number 40988) for 2019 (BOM 2020b, 2020c), and from Maleny Tamarind St (station number 040121) for 2001-2016 (BOM 2020a).
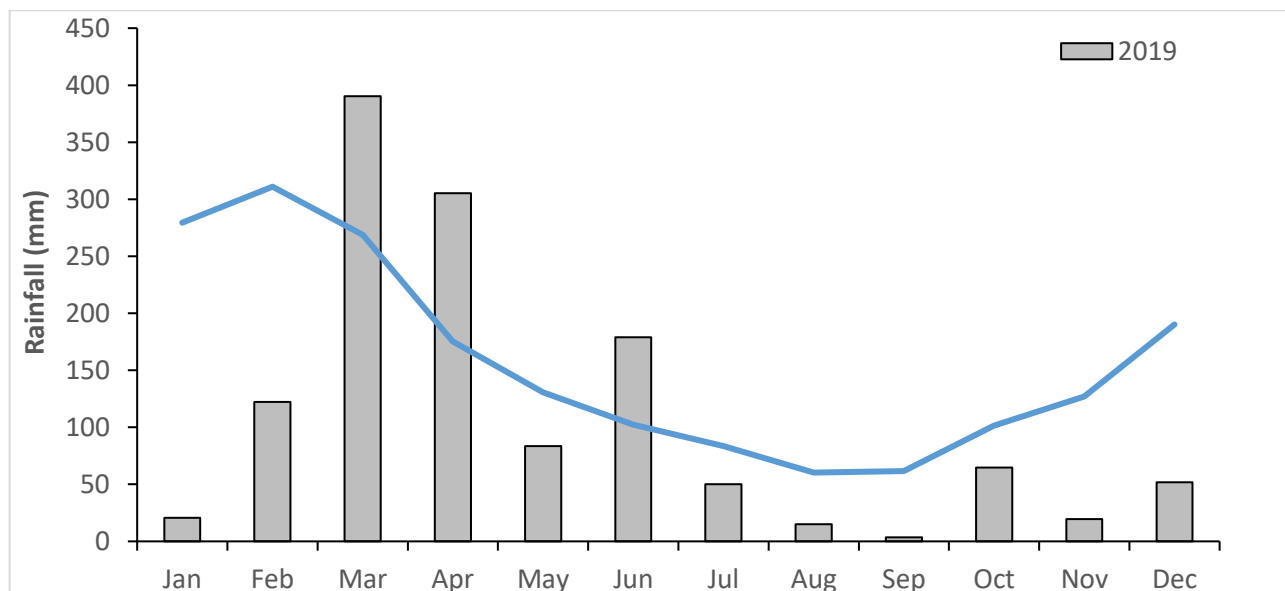
Figure 4. 2019 rainfall in the Curramore region compared with average annual rainfall, 1915-2017. The Standard trapping survey was conducted in April 2019. Data acquired from Maleny Denning Rd (station number 40396) for 2019 and Maleny Tamarind St (station number 040121) for 1915-2017.

Methods

Indicators and metrics

Curramore'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 Curramore, 18 biodiversity (species and guilds) indicators have been selected for monitoring (Table 1). These indicators were reported on in the current reporting period (based on 2019 surveys; the most recent biodiversity surveys undertaken on Curramore). In future years, reporting for other taxa (including frogs and birds) will be added. Threat metrics are selected to ensure monitoring the status and trends of introduced weeds, predators and herbivores and inappropriate fire regimes (where relevant). Eight threat indicators have been selected for monitoring (Table 2). Seven of these were reported on using data collected from 2019 and 2020.

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 3-5 years. These include:

- Standard Trapping Survey
- Standard Camera Survey
- Standard Bird Survey
- Standard Frog Survey, and
- Spotlighting Survey.

In addition to ground-based ecological surveys, on-ground mapping is used to compile the Fire Scar Analysis.

Two of the ecological ground-based surveys were completed at Curramore in 2019: a Standard Trapping Survey in April and Standard Camera Survey in April-May (Table 3). No planned or unplanned fires occurred on Curramore in 2019 or 2020, so no Fire Scar Analysis was undertaken. The methodology is described and results of these surveys and computations are reported on in this document.

Past survey effort on Curramore has included Standard Trapping Surveys, Standard Camera Surveys and a variety of Targeted Surveys. Changes were made to the number and location of survey sites to improve on monitoring power. Thus, the 2019 results effectively represent baseline metrics upon which to compare future Ecohealth monitoring results. No comparisons were made to pre-2020 data due to these changes.

Table 3. Survey effort for Ecohealth surveys on Curramore Wildlife Sanctuary in 2019.

Survey name	Effort	Description/comment	Previous surveys*
Standard Trapping Survey	597 live trap nights (pitfall, funnel, box)	7 of 10 standard monitoring sites surveyed. Each site comprises 20 box, 6 funnel and 4 pitfall traps.	2009, 2010, 2012/2013 new survey design--- 2019
Standard Camera Survey	527 camera trap nights	7 of 10 standard monitoring sites surveyed. Each site comprises 2 camera traps.	2009, 2010, 2012/2013, 2015 new survey design---- 2019

*References for pre-2019 inventory surveys: Duncan and Bright (2009); Kanowski 2013; Kemp et al. 2013.

Table 1. Biodiversity indicators for Ecohealth monitoring on Curramore. Rationale for selection: T = threatened or declining; D = strong driver of ecosystem function; S = surveillance monitoring. Metric definitions: abundance = number of individuals per 100 trap nights; occupancy = percentage of sites recorded; richness = mean number of species per site.

Indicator	Rationale			Survey method	Metric/s
	T	D	S		
Mammals					
Small-medium mammals					
Yellow-footed Antechinus (*Antechinus flavipes*)			*	Standard Trapping Survey	Abundance, Occupancy
Red-necked Pademelon (*Thylogale thetis*)			*	Standard Camera Survey	Abundance, Occupancy
Fawn-footed Melomys (*Melomys cervinipes*)			*	Standard Trapping Survey	Abundance, Occupancy
Bush Rat (*Rattus fuscipes*)			*	Standard Trapping Survey	Abundance, Occupancy
Northern Brown Bandicoot (*Isoodon macrourus*)		*	*	Standard Camera Survey	Abundance, Occupancy
Long-nosed Bandicoot (*Perameles nasuta*)		*	*	Standard Camera Survey	Abundance, Occupancy
Rainforest guild – Live trapping			*	Standard Trapping Survey	Abundance, Occupancy, Richness
Rainforest guild – Camera trapping			*	Standard Camera Survey	Abundance, Occupancy, Richness
Dry sclerophyll guild – Live trapping			*	Standard Trapping Survey	Abundance, Occupancy, Richness
Dry sclerophyll guild – Camera trapping			*	Standard Camera Survey	Abundance, Occupancy, Richness
Large herbivores					
Swamp Wallaby (*Wallabia bicolor*)		*	*	Standard Camera Survey	Abundance, Occupancy
Red-necked Wallaby (*Macropus rufogriseus*)		*	*	Standard Camera Survey	Abundance, Occupancy
Reptiles					
Small-medium-sized reptiles					
Elf Skink (*Eroticoscincus graciloides*)			*	Standard Trapping Survey	Abundance, Occupancy
Dark-flecked Garden Skink (*Lampropholis delicata*)			*	Standard Trapping Survey	Abundance, Occupancy
Rose's Shadeskink (*Saproscincus rosei*)			*	Standard Trapping Survey	Abundance, Occupancy
Rainforest guild			*	Standard Trapping Survey	Abundance, Occupancy, Richness
Dry sclerophyll guild			*	Standard Trapping Survey	Abundance, Occupancy, Richness
Large reptiles					
Lace Monitor (*Varanus varius*)		*	*	Standard Camera Survey	Abundance, Occupancy

Table 2. Threat indicators for Curramore Ecohealth Monitoring Program. Metric definitions: abundance = number of individuals per 100 trap nights; occupancy = proportion of sites recorded.

Indicator	Rationale	Survey method	Metric/s
Feral herbivores			
Deer (*Cervus spp.*)	Threat to wildlife, vegetation	Standard Camera Survey	Abundance
Cattle (*Bos taurus*)	Threat to wildlife, vegetation	Standard Camera Survey	Abundance
Feral predators			
Cat (*Felis catus*)	Major threat to wildlife	Standard Camera Survey. Methods under development for 'population size' metric.	Population size, Abundance, Occupancy
Fox (*Vulpes vulpes*)	Major threat to wildlife	Standard Camera Survey. Methods under development for 'population size' metric.	Population size, Abundance, Occupancy
Weeds			
Lantana (*Lantana camara*)	Weed of National Significance. Weeds are a threat to native vegetation, with associated impacts upon native wildlife	Targeted Weed Survey (lantana)	Extent of infestation (ha), shoot frequency, occupancy. Not surveyed 2020.
Fire			
Fire	Key driver of vegetation dynamics, structure and composition, habitat attributes	Fire Scar Analysis	Area burnt (ha) planned Area burnt (ha) unplanned

Survey design

Ten permanent monitoring sites were selected for Ecohealth surveys (Figure 5; Appendix 1). These sites are stratified by vegetation type and represent a broad coverage of ecosystems across the property. The sites are used for the Standard Trapping Survey, Standard Camera Survey, Standard Bird Survey, Standard Frog Survey and other targeted surveys. The site names, location and habitat type are in Appendix 1. In 2019, seven sites were surveyed in the Standard Trapping Survey and Standard Camera Survey (one rainforest site, one regrowth site, two dry sclerophyll sites and three wet sclerophyll sites; Appendix 1). The remaining three sites were not surveyed in 2019 due to logistical constraints related to adverse weather conditions. From 2021 onwards, these surveys will be conducted in November. This timing coincides with higher animal activity, when breeding and dispersal of young occurs. This is also a 'happy medium' time to cover all taxa that are monitored at Curramore, including frogs, arboreal mammals and reptiles.
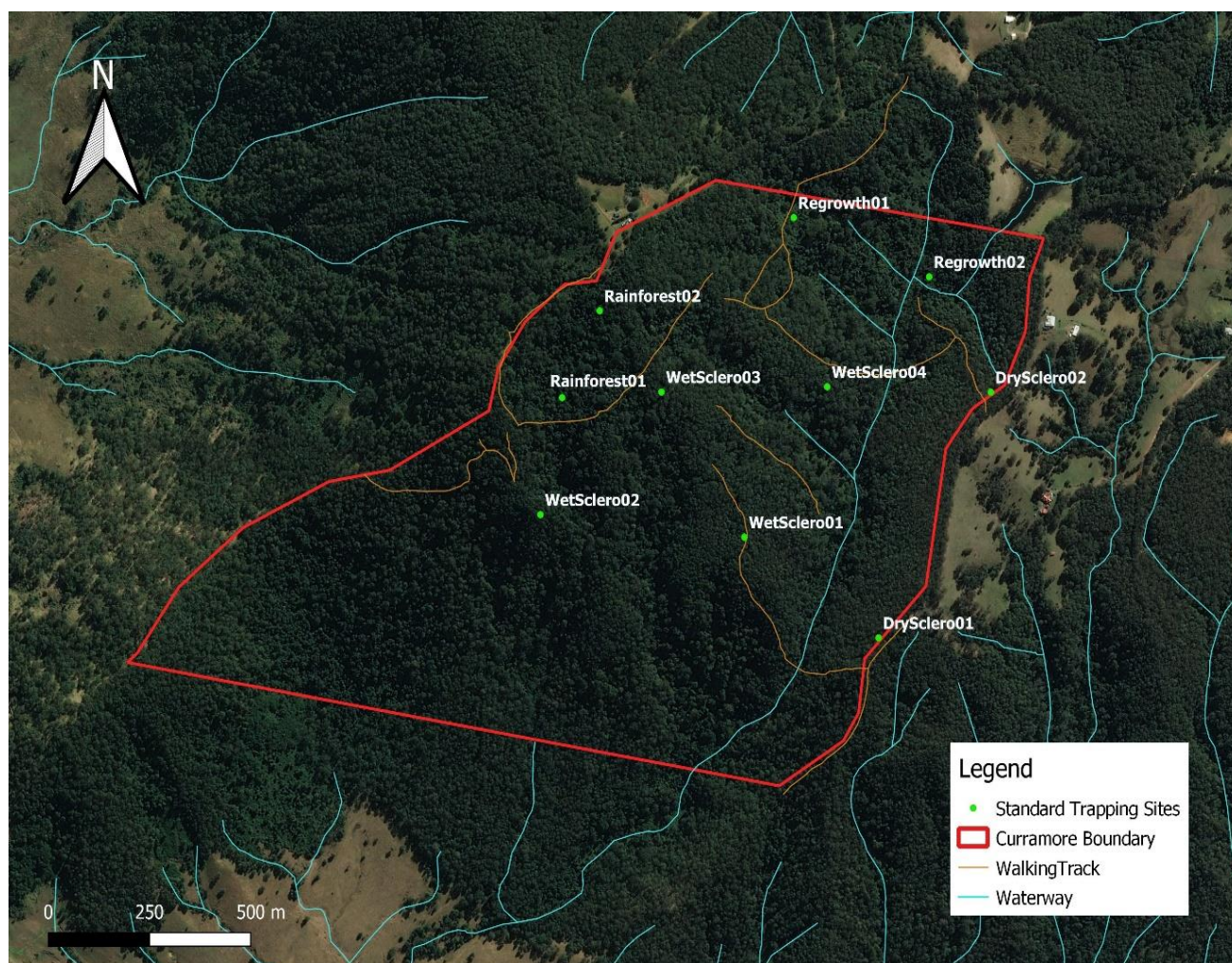

Figure 5. Location of permanent monitoring sites at Curramore

Survey methods

Standard Trapping Survey

A pitfall array was constructed, consisting of four 20 L pitfall traps and six funnel traps, connected by a 30 cm high drift fence (made of dampcourse) erected in a 'T' shape (broken into a 20 m section and 10 m section) (Figure 6). Pitfall traps were set near the ends of each section of fence. Pairs of funnel traps were placed on each side of the fence between pitfalls. Funnel traps were covered in reflective insulation to prevent heat and rain exposure (Figure 7).

At each survey site, 20 Elliot-type box traps were set in two parallel lines, 20 m away from the trapping 'T', with traps spaced 10 m apart (Figure 6). Box traps were baited with rolled balls consisting of oats, peanut butter, vanilla and sardines. Traps were open for three consecutive nights. Box traps were closed during the day and re-opened in the late afternoon. All traps were checked early in the morning and only pitfall and

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funnel traps were checked again late in the afternoon.

Captured animals were identified to species level. Small mammals and reptiles were marked with paint pen to identify recaptures. Some measurements were taken to confirm correct species identification – notably toe pads on *Melomys* species.
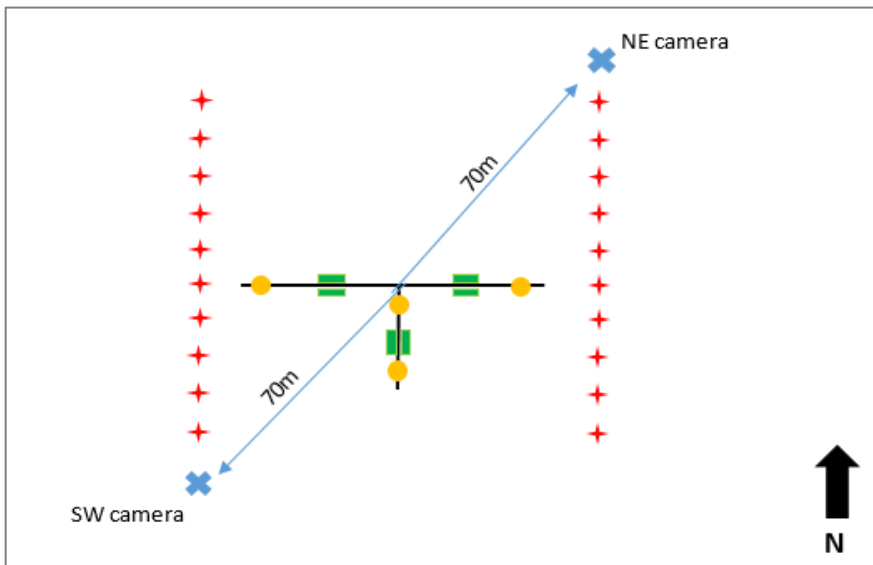

Figure 6. Standard Trapping Survey and Standard Camera Survey site design. Yellow circles = pitfalls; green rectangles = funnel traps; red stars = box traps spaced 10 m apart and 20 m out from the centre of the 'T'; blue cross = camera traps 70 m away from the centre of the 'T' in a NE and SW direction.

Figure 7. Standard trapping site in wet sclerophyll forest. AWC field ecologist Emily Rush checking the site set up to make sure it is fully operational. Photo: Andy Howe/AWC

Standard Camera Survey

Two Reconyx Hyperfire PC850 Whiteflash motion sensor camera traps were set at each of the sites, one to detect large herbviores and the other targeting small-medium size fauna (Figure 6). The large herbivore

camera was placed 70 m to the north-east of the central pitfall, tied to a tree at 1.5 metres in height (to the top of the camera). The bait (oats, peanut butter, vanilla and Dairy Krave) was placed inside a PVC bait container and pegged to the ground 3 metres from the base of the tree. The small-medium size fauna camera was placed 70 m to the south-west of the central pitfall, tied to a tree at 1 metre in height (to the top of the camera). The bait (oats, peanut butter, sardines and vanilla) was placed inside a PVC bait container and pegged to the ground 1.5 metres from the base of the tree. Each camera was angled so that the camera's sensor zone was centred on the bait container. Cameras were left in the field for 60 nights. They were set to take three photos (one second apart) per trigger.

Analysis methods

Standard Trapping Survey and Standard Camera Survey

Image processing
Following camera retrieval, images were downloaded and processed through Colorado Parks and Wildlife Photo Warehouse (CPW 2018) for analysis. A 'detection' was defined as one or more photos of a species within a 24 hour period, except when two individuals of a species were in a single photo, in which case that was recorded as two detections.

Mammal metrics
For the small-medium mammal indicator species and guilds, abundance, occupancy, and richness were the metrics used. Abundance was calculated as the total number of individuals detected/ total trap nights x 100. For species detected through live-trapping, the overall number of trap nights was calculated using the total trap nights for all applicable trapping methods (e.g. box, pitfall). Pitfall and funnel traps were checked twice per day but captures in each trap were calculated per 'trap night', that is over a 24 hour period. For species detected through camera-trapping, abundance was calculated as the total number of detections (one detection per species per 24 hr period)/ total camera trap nights x 100. Occupancy was calculated as the percentage of sites surveyed at which a species was detected. For the rainforest and dry sclerophyll guilds, richness was calculated for each guild as the average number of species detected per site.

When calculating abundance and occupancy, only habitat types relevant to the species or guilds in question were used (e.g., 'rainforest' sites were not used for calculating metrics for Northern Brown Bandicoots as this species only occurs in drier habitats). The habitats used to calculate the metrics are provided in Appendix 2.

Abundance and occupancy were calculated for the two large herbivore indicator species; the Swamp Wallaby and the Red-necked Wallaby. Abundance was calculated as the total number of detections (one detection per species per 24 hr period)/ total camera trap nights x 100. Occupancy was calculated as the percentage of sites at which the species was recorded.

Reptile metrics
For the small-medium reptile indicator species and guilds, abundance was calculated as the total number of individuals/ total pitfall and funnel trap nights x 100. For the Lace Monitor, abundance was calculated as the total number of detections (one detection per 24 hr period)/ total camera trap nights x 100. For all reptiles, occupancy was calculated as the percentage of sites at which the species was recorded. For the rainforest and dry sclerophyll guilds, richness was calculated as the average number of species detected per site.

Feral herbivore metrics
For feral herbivore indicator species, abundance was calculated as the total number of detections (one detection per species per 24 hr period)/ total camera trap nights x 100.

Feral predator metrics
For feral predator indicator species, abundance was calculated as the total number of detections (one detection per species per 24 hr period)/ total camera trap nights x 100. Occupancy was calculated as the percentage of sites at which the species was recorded.

Fire Scar Analysis
No fires occurred on Curramore in 2019 or 2020. When fires have occurred previously, all fire scars (from planned and unplanned burns) were mapped on-ground using a handheld GPS. The total burnt area in hectares was calculated using ArcGIS (Environmental System Research Institute Inc., Redlands, CA, USA).

Results

Biodiversity indicators

Small-medium mammals

Seven native small-medium mammal species were detected at Curramore during the 2019 surveys, the majority from both live trapping and camera trapping. Six of these are Ecohealth indicator species (Table 4). Four camera traps that failed during the survey (including 3 in the wet sclerophyll) were excluded from analyses.

Small mammal species were generally at low abundance (Table 4). The Bush Rat had the highest abundance (6.7 per 100 trap nights, with 100% occupancy (5 of 5 sites across 3 habitats)). The Fawn-footed Melomys was detected at all sites except one wet sclerophyll site (an occupancy of 85%). This was the most sites at which any individual indicator species was recorded.

Of the mammals recorded during camera trapping, the Northern Bandicoot had the highest occupancy (100%; recorded at 2 of 2 dry sclerophyll sites), while the Red-necked Pademelon was recorded at only 2 of 7 sites (Table 4). Species richness was generally low across all habitat types. Overall, the total number of species detected ranged between 1 to 4 species/ site for live trapping, and between 0 to 3 species/ site for camera trapping. The average species richness for the dry sclerophyll guild was 2.5 species per site for both live and camera trapping. The single rainforest site had a species richness of 2 for both live and camera trapping (Table 5).

The two small mammal species recorded during live trapping at the rainforest site were the Bush Rat and Fawn-footed Melomys. These two species remain the only small mammals detected during live trapping in the rainforest habitat to date on Curramore. Other mammal species such as the Yellow-footed Antechinus may also occur in the rainforest, but are yet to be detected in this habitat. During camera trapping, the Bush Rat and the Long-nosed Bandicoot were detected at the rainforest site.

Previous inventory surveys in the dry sclerophyll recorded several small mammal species within the dry sclerophyll guild that were not detected in 2019. The Swamp Rat (*Rattus lutreolus*), Pale Field-rat (*Rattus tunneyi*), and Grassland Melomys (*Melomys burtoni*) have not been detected since the 2010 survey, while the Common Dunnart (*Sminthopsis murina*) has not been detected since 2013.

Table 4. Small-medium mammal indicator species recorded during the Standard Trapping Survey in 2019. Habitats: 'RF' = rainforest; 'WS' = wet sclerophyll forest; 'DS' = dry sclerophyll forest; 'RG' = regrowth.

Species	Independent detections	Abundance	Occupancy	Survey method	No. sites in calcs	Habitat types
Yellow-footed Antechinus	7	1.17	57%	Live trapping	7	RF, WS, DS, RG
Red-necked Pademelon	12	2.28	29%	Camera traps	7	RF, WS, DS, RG
Fawn-footed Melomys	8	1.17	85%	Live trapping	7	RF, WS, DS, RG
Bush Rat	24	6.66	100%	Live trapping	5	RF, WS, RG
Northern Brown Bandicoot	11	4.57	100%	Camera traps	2	DS
Long-nosed Bandicoot	17	3.22	57%	Camera traps	7	RF, WS, DS, RG

Table 5. Small-medium mammal guild metrics from 2019 Standard Trapping Survey.

Guild	Abundance	Occupancy	Richness	No. sites in calculations
Rainforest Guild – Live trapping	6.9	100%	2*	1
Rainforest Guild – Camera trapping	20.8	100%	2*	1
Dry Sclerophyll Guild – Live trapping	1.4	100%	2.5	2
Dry Sclerophyll Guild – Camera trapping	21.0	100%	2.5	2

The richness metric for the rainforest guild in 2019 represents total rather than average species richness, as only one rainforest site was surveyed.

The above metrics should be treated cautiously, given the small number of sites within each habitat type. The generally low abundance and species richness of small-medium mammals at Curramore in 2019 may be related to the below average rainfall experienced since 2017. Future surveys involving repeated visits to these sites will allow for the relationship between rainfall patterns and small-medium mammal abundance and occupancy to be better clarified. In future, some indicator species may need targeted surveys due to low capture rates.

Large herbivores

Two species of large native herbivore were recorded in 2019. The Red-necked Wallaby was found abundantly at the two dry sclerophyll sites (with a total of 17 detections on camera traps), while the Swamp Wallaby was only recorded twice at the same site (Table 6).

Table 6. Large herbivore indicator species recorded during the standard trapping survey in 2019.

Habitats: 'RF' = rainforest; 'WS' = wet sclerophyll forest; 'DS' = dry sclerophyll forest; 'RG' = regrowth.

Species	Independent detections	Abundance	Occupancy	Survey method	No. sites in calculations	Habitat types
Swamp Wallaby	2	0.55	33%	Camera traps	3	DS, RG
Red-necked Wallaby	17	4.72	67%	Camera traps	3	DS, RG

Small-medium reptiles

A total of 7 individual small-medium reptile captures, of 6 species, were recorded in 2019. The threatened Three-toed Snake-tooth Skink (*Coeranoscincus reticulatus*) was recorded for the first time at Curramore in 2019. No reptiles were detected in the rainforest or in the dry sclerophyll; both guilds therefore had zero abundance and occupancy. Two of the 3 small-medium reptile indicator species were recorded in 2019. The Elf Skink was detected twice at 1 wet sclerophyll site (Table 7). The Dark-flecked Garden Skink was detected once at 1 wet sclerophyll site (Table 7). One small-medium reptile indicator species was not recorded: Rose's Shadeskink.

The 2019 small-medium reptile metrics should be treated cautiously given the low number of sites in each habitat type and the conditions during the survey. The very low abundance and occupancy results were likely due to the cool and damp weather experienced during April 2019, as well as the drought conditions experienced since 2017.

As with the small-medium mammals, changes in methods from previous inventory surveys meant trend analyses were not possible. Furthermore, low captures rates of certain species could mean targeted surveys are required to assess their response to management practices and to determine the health of the sanctuary.

Table 7. Small-medium reptile species recorded during the standard trapping survey in 2019.
Habitats: 'RF' = rainforest; 'WS' = wet sclerophyll forest; 'DS' = dry sclerophyll forest; 'RG' = regrowth.

Common name	Individuals	Abundance	Occupancy	Survey method	No. sites in calculations	Habitat types
Elf Skink	1	0.48	20%	Live trapping	5	RF, WS, RG
Dark-flecked Garden Sunskink	1	0.47	14%	Live trapping	7	RF, WS, DS, RG

Other reptiles

The Lace Monitor was found abundantly at 2 sites (1 dry sclerophyll and 1 regrowth site), but was not detected at the remaining 5 sites, giving an overall abundance of 4.6 detections per 100 trap nights, and an occupancy of 28% (i.e., 2 of 7 sites). In previous inventory surveys, the Lace Monitor has been recorded across all habitat types on Curramore.

Threat metrics

Feral herbivores

No introduced feral herbivores were detected in the 2019 survey.

Feral predators

No feral cats were detected in 2019. The red fox (Figure 8) was detected at 4 of the 7 sites (an occupancy of 57%, at an abundance of 2.1 individuals per 100 camera trap nights). Each of these 4 sites were in a different habitat type (dry sclerophyll forest, wet sclerophyll forest, rainforest and regrowth). A domestic dog was detected on one camera trap on the eastern boundary in dry sclerophyll forest.

Figure 8. A red fox detected on camera trap at Curramore in 2019

Fire

No prescribed burning was undertaken in 2019 or in 2020, and no unplanned fire entered Curramore during that timeframe. Very hot and dry conditions over that period across the majority of south-east Queensland led to total fire bans in most areas for the majority of the fire season. The last prescribed burn occurred at Curramore in 2017 and targeted the dry sclerophyll forest on the eastern side of the property. This vegetation type is adapted to being burnt at low intensities and at regular intervals, as this allows regeneration of many tree species and maintains an open grassy understory. Dry sclerophyll forest in the Sunshine Coast hinterland region can be managed with a fire schedule of every 3-7 years as this allows the fuel loads to build to a degree where a fire can be carried however not too much fuel as to cause destructive wildfire (Runde 2020).

On Curramore, a suite of wildlife species prefer dry sclerophyll habitat, while others inhabit the wetter, more enclosed wet sclerophyll and rainforest communities that occur over the vast majority of the property. Dry sclerophyll forest therefore hosts wildlife species that occur nowhere else on the property (e.g. the Northern Brown Bandicoot and the Pale Field Rat).

Discussion

The most recent biodiversity surveys undertaken on Curramore were the Standard Trapping Survey and Standard Camera Survey in 2019. Overall, the abundance and average species richness of both small-medium mammals and reptiles were relatively low, likely due to the ongoing drought and, for reptiles, the cooler temperatures experienced during the April 2019 survey. These baseline results should be treated cautiously given that only seven of the 10 monitoring sites were surveyed, and the unseasonally cold and wet conditions experienced during April 2019. The remaining three sites will be included in future live and camera trapping surveys, providing an additional site in each of the rainforest, wet sclerophyll and regrowth vegetation types. Future repeat surveys will allow greater clarification of the status and trend of the indicator species and guilds, and how these metrics vary with factors such as rainfall and management actions.

Acknowledgments

AWC acknowledges the Gubbi Gubbi people, the Traditional Custodians, of Gubbi Gubbi Country on which Curramore resides. We also acknowledge their continuing connection to land, culture and community. We pay our respects to Gubbi Gubbi Elders past present and emerging.

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References

Bureau of Meteorology (BOM) (2020a) Summary statistics, Maleny Tamarind St, viewed 4 March 2020, http://www.bom.gov.au/climate/averages/tables/cw_040121.shtml

Bureau of Meteorology (BOM) (2020b) Monthly mean maximum temperature, Nambour Daff – Hillside, viewed 4 March 2020, http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=36&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=040988

Bureau of Meteorology (BOM) (2020c) Monthly mean minimum temperature, Nambour Daff – Hillside, viewed 4 March 2020, http://www.bom.gov.au/

Bureau of Meteorology (BOM) (2020d) Monthly Rainfall, Maleny Denning Rd, viewed 4 March 2020, http://www.bom.gov.au/

CPW (2018) Colorado Parks and Wildlife Photo Warehouse. Colorado Parks and Wildlife. Denver.

Duncan S, Bright T (2009) *Curramore Wildlife Sanctuary Fauna Survey 2008-09*. Australian Wildlife Conservancy. Perth.

Hurry C, Schmidt D, Hughes M (2015) Phylogeography and limited distribution of the endangered crayfish, *Euastacus urospinosus*, Australia. *Australian Journal of Zoology* 63, 236-244.

Kanowski J (2013) *Camera-trap Survey of Curramore Wildlife Sanctuary, December 2012 – January 2013*. Australian Wildlife Conservancy, Perth.

Kanowski J, Joseph L, Kavanagh R, Fleming A (2018) Designing a monitoring framework for Australian Wildlife Conservancy, a national conservation organisation. In: *Monitoring Threatened Species and Ecological Communities* (Eds S Legge, DB Lindenmayer, NM Robinson, BC Scheele, DM Southwell, BA Wintle) pp 241-253. CSIRO, Melbourne.

Kemp J, Jensen R, Kanowski J (2013) *Curramore Wildlife Sanctuary Fauna Survey September 2013*. Australian Wildlife Conservancy. Perth.

Runde K (2020) *Curramore burn plan 2021*. Australian Wildlife Conservancy, Perth.

Stanton P (2004) *The Vegetation of Curramore*. Australian Wildlife Conservancy, Perth.

Virikki D, Tran C, Castley J (2012) Reptile responses to lantana management in a wet sclerophyll forest, Australia. *Journal of Herpetology* 46, 177-185.

Appendix 1. Ecohealth standard trapping sites

Table 1. Location and description of Curramore fauna survey sites. Sites trapped in 2019 are in black text.

Site Name *Previous site name*	Habitat	Longitude	Latitude
CUR-OM-DS01 *DrySclero01 (Kemp et al. 2013)* *CM3 (Duncan and Bright 2009)*	Dry sclerophyll open forest with grey gum, white mahogany and grey ironbark on ridgeline.	152.74113	-26.69875
CUR-OM-DS02 *DrySclero02 (Kemp et al. 2013)*	Dry sclerophyll open forest with grey gum, white mahogany and grey ironbark on ridgeline.	152.74392	-26.69379
CUR-OM-RF01 *Rainforest01 (Kemp et al. 2013)* *CM7 (Duncan and Bright 2009)*	Complex notophyll vine forest with palms, on basalt, in stony gully.	152.73327	-26.69390
CUR-OM-RF02 *Rainforest02 (Kemp et al. 2013)* *CM12 (Duncan and Bright 2009)*	Complex notophyll vine forest on basalt, on mid-slope.	152.73421	-26.69215
CUR-OM-WS01 *WetSclero01 (kemp et al. 2013)* *CM10 (Duncan and Bright 2009)*	Wet sclerophyll forest with brush box and tallowwood on microgranite, on midslope.	152.73780	-26.69672
CUR-OM-WS02 - *Yet to be installed*	Wet sclerophyll forest with brush box and tallowwood on microgranite, on midslope.	-	-
CUR-OM-WS03 – new site established 2019	Wet sclerophyll forest with notophyll vine forest on basalt on midslope.	152.73573	-26.69379
CUR-OM-WS04 – new site established 2019	Wet sclerophyll forest with brush box and flooded gum on microgranite, on midslope.	152.73985	-26.69368
CUR-OM-RG01 *Regrowth01 (Kemp et al. 2013)*	Regrowth forest on mid-slope on rhyolite.	152.73902	-26.69026
CUR-OM-RG02 – new site established 2019	Regrowth forest on mid-slope on rhyolite.	152.74239	-26.69146

Appendix 2. Habitats used in metrics calculations

Table 2. The habitat types at Curramore used for calculating abundance and occupancy metrics for the mammal and reptile indicators detected in 2019. 'RF' is rainforest; 'WS' is wet sclerophyll forest; 'DS' is dry sclerophyll forest; and 'RG' is regrowth habitat.

Indicator	Habitats used in calculating metrics	No. of sites from 2019 included in calculations
Yellow-footed Antechinus	All four habitats are used to determine metrics (RF, WS, DS and RG) as this species occurs across all habitats.	7
Red-necked Pademelon	All four habitats are used to determine metrics (RF, WS, DS and RG) as this species occurs across all habitats.	7
Fawn-footed Melomys	All four habitats are used to determine metrics (RF, WS, DS and RG) as this species occurs across all habitats.	7
Bush Rat	Three habitats are used to determine metrics (RF, WS and RG) because this species occurs in wetter habitats on the property.	5
Northern Brown Bandicoot	One habitat is used to determine metrics (DS) as this species occurs in drier habitats.	2
Long-nosed Bandicoot	All four habitats are used to determine metrics (RF, WS, DS and RG) as this species occurs across all habitats.	7
Swamp Wallaby	Two habitats are used to determine metrics (DS and RG) as this species occurs in drier habitats.	3
Red-necked Wallaby	Two habitats are used to determine metrics (DS and RG) as this species occurs in drier habitats.	3
Elf Skink	RF, WS and RG habitats are used to determine metrics because this species occurs in wetter habitats on the property.	5
Dark-flecked Garden Skink	All habitats are used to determine metrics.	7
Rose's Shadeskink	RF, WS and RG habitat are used to determine metrics because this species occurs in wetter habitats on the property.	5
Lace Monitor	Three habitats are used to determine metrics (WS, DS and RG) as this species occurs in drier habitats.	6