Quinkan Country Queensland

6–17 March 2017

Bush Blitz Species Discovery Program

Australian Government
Department of the Environment and Energy

bhpbilliton
Sustainable Communities

EARTHWATCH INSTITUTE

Australian Biological Resources Study

What is Bush Blitz?

Bush Blitz is a multi-million dollar partnership between the Australian Government, BHP Billiton Sustainable Communities and Earthwatch Australia to document plants and animals in selected properties across Australia.

This innovative partnership harnesses the expertise of many of Australia's top scientists from museums, herbaria, universities, and other institutions and organisations across the country.

Abbreviations

ABRS
Australian Biological Resources Study

ALA
Atlas of Living Australia

ANIC
Australian National Insect Collection

ATH
Australian Tropical Herbarium

CSIRO
Commonwealth Scientific and Industrial Research Organisation

EPBC Act
Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)

NC Act
Nature Conservation Act 1992 (Queensland)

QM
Queensland Museum

SAM
South Australian Museum

UNSW
University of New South Wales

Summary

In March 2017, a Bush Blitz expedition was conducted in West Quinkan country in northern Queensland, along with several other reserves and properties in the area.

The West Quinkan country is characterised by broad sandstone plateaus into which the Mossman River and its tributaries have cut deep gorges. The vegetation is dominated by forest and woodland, with unmapped patches of vine-thicket/rainforest in sheltered sites and around springs. The sandstones of the West and East Quinkan Reserves have not been affected by grazing and contain important sources of permanent water.

Quinkan is well known as an area of high cultural value but its environmental value is less well understood. The complex landscape of Quinkan, consisting of tropical savanna woodland on eroded sandstone escarpments with some grassland and small patches of rainforest, and its relatively unaltered state, suggests its likelihood as an area of high biodiversity.

Most surveys in the tropical north have been undertaken in the dry season. Logistically, this is much the best option as mobility is generally easier and conditions are more comfortable and safer. However, some taxa are more active, and show increased abundance and diversity, in the wet. A Bush Blitz survey of this area in the wet season was therefore an important opportunity, there being possibilities of extending the range of little-known species or uncovering other endemics in this survey.

During the Bush Blitz approximately 1279 species were recorded. At least 1015 of these species are thought to be new records for the study area and, among these, 128 may be new to science (7 bees, 25 flies, 11 ground beetles, 10 true bugs, 2 cicadas, 1 damselfly, 57 spiders, 5 pseudoscorpions, 1 tailless whip scorpion, 1 micro whip scorpion, 1 harvestman, 2 land snails and 5 stygofauna). Two threatened animal species were recorded: Large Horseshoe Bat (*Rhinolophus robertsi*) is listed as Vulnerable under the EPBC Act and Endangered under the NC Act, and Squatter Pigeon (*Geophaps scripta scripta*) is listed as Vulnerable under the EPBC Act and the NC Act. Two of the vascular plant species recorded are listed as Vulnerable under the NC Act—*Dendrobium bigibbum* and *Hardenbergia* sp. (Mt Mulligan J.R. Clarkson 5775)—with *D. bigibbum* also listed as Vulnerable under the EPBC Act. Three other plant species are listed as Near Threatened under the NC Act.

Some highlights of this Bush Blitz included:

- an undescribed species of skink (genus *Lerista*), collected at Alwal National Park
- the discovery of a new species of damselfly, the first in over ten years
- significant range extensions for a number of target taxa, including a butterfly that was a significant easterly and northerly extension of the range of the species
- the discovery of 57 putative new spider species
- the discovery of two new species of land snail and an additional two species representing first records for Quinkan Country (with one having its range significantly extended westward)
- a noticeably high diversity of native bees of subfamily Nomioidinae
- the discovery of number of new bee species including two new ‘Teddy Bear Bees’
- discovery of a rich stygofauna

Six vertebrate pest species, six exotic or pest invertebrate species and 20 exotic plant species were recorded.

Prior to undertaking the survey, it was expected that the study area would comprise mainly large cattle stations supporting a fairly uniform savannah woodland with evidence of moderate grazing pressure. However, the properties surveyed were generally found to be in remarkably good condition, with minimal evidence of grazing. Most properties also had low weed cover, the only exception being parts of Springvale, which were found to be highly disturbed, with ample weed cover in the understorey.

This survey has confirmed that the Quinkan area is of high biodiversity value as well as high cultural value. The area is currently relatively undeveloped but careful management is required to maintain its high value into the future. Even relatively low-impact activities such as eco-tourism can be detrimental if not conducted with care. Like most of northern Australia, fire has a crucial role to play in this environment and needs to be managed carefully to maintain the diversity of habitats.

Contents

Introduction

This is a report for the Bush Blitz program, which aims to improve our knowledge of Australia's biodiversity. Bush Blitz is an initiative of the Australian Government, through the Australian Biological Resources Study (ABRS), in partnership with BHP Billiton Sustainable Communities and Earthwatch Australia. Bush Blitz aims to:

- promote, publicise and demonstrate the importance of taxonomy through species discovery
- undertake a national species discovery program
- support the science of taxonomy in Australia through training of students and early career researchers, and by providing grants for species description and resolution of taxonomically problematic, nationally important groups
- promote partnerships between scientific institutions, government, industry and non-government organisations
- inform reserve managers and other stakeholders of the results of Bush Blitz projects.

The Quinkan Country Bush Blitz

This Bush Blitz took place during March 2017. Most surveys in the tropical north have been undertaken in the dry season. Logistically, this is much the best option as mobility is generally easier and conditions are more comfortable and safer. However, some taxa are more active, and show increased abundance and diversity, in the wet and undertaking of a Bush Blitz survey of this area in the wet season was therefore an important opportunity.

The area covered by this Bush Blitz was an amalgamation of several properties in the broader study area. Some of these are (formally or in effect) managed as reserves, such as Jowalbinna, two blocks of Unallocated State Land west of Jowalbinna, the East Quinkan Reserve (Agayrra Timara), the Deighton block, and Kings Plains, South Endeavour and Springvale Stations. Others (Bonnyglen, Bellevue, Palmerville, Welcome, Crocodile and Normanby Stations) are working cattle stations. Alwal National Park, which is some way north-west of the other survey properties, was visited by the vertebrate team only, with the aim of collecting additional specimens of an undescribed skink that was discovered during the Olkola Bush Blitz in 2015.

Bush Blitz provided the logistical coordination and overall leadership for the survey. The Queensland Museum (QM) was the host institution, providing the core group of fauna personnel and accessioning the specimens into their collection. Experts from the following organisations also conducted the field and laboratory work:

- Australian Tropical Herbarium (ATH)
- QLD Herbarium
- South Australian Museum (SAM)
- University of NSW (UNSW)
- Macquarie University

Acknowledgements

The ABRS acknowledges the traditional owners of country throughout Australia and their continuing connection to land, sea and community. We pay our respects to them and their cultures and to their elders both past and present.

The Bush Blitz team consisted of Brian Hawkins, Haylee Weaver and Simon Nally. They would like to thank the Laura Rangers, the Western Yalanji Aboriginal Corporation, the Olkola Corporation, Steve Trezise, the South Endeavour Trust, the Rosendale family, Ang Gnarra Aboriginal corporation, Agayrra Timara, the Indigenous Land Council, the QLD Department of the Environment and Heritage Protection, the students and staff of Laura Public School, and the broader Laura community.

The Laura Rangers and the Western Yalanji Aboriginal Corporation shared their knowledge and provided valuable assistance with fieldwork. Sue Marsh and Brad Grogan in particular made major contributions to the success of the trip.

Central (Queensland) Aviation and helicopter pilots Bret Little (Magoo) and Mitch Ballantyne went above and beyond to get teams out into (and back from) the field in sometimes rough conditions.

Natalie Laver and Magoo at the Laura Roadhouse provided comfortable accommodation in a beautiful setting, and John Dessmann's cooking was outstanding. Thanks also to Bradley Smith for his enthusiastic interest in all living things.

This report is dedicated to the memory of Natalie Laver.

Reserve overview

Reserve names: Alwal National Park, West Quinkan Reserve (Wulburjubur), Jowalbinna Reserve, two blocks of Unallocated State Land west of Jowalbinna, East Quinkan Reserve (Agayrra Timara), Deighton block, Kings Plains Reserve, South Endeavour Reserve and Springvale Station Reserve. Bonnyglen, Bellevue, Welcome, Crocodile and Normanby Stations.

Area: approximately 5,300 km^2.

Description

This Bush Blitz takes its name from the unique rock art found among the sandstone escarpments around the town of Laura.

The following is an excerpt from Morgan 1984[1], an unpublished report prepared for The Quinkan Trust.

> 'The Quinkan Area extends over the southern edge of the Laura Basin, a sedimentary structure formed during the Carboniferous period.
>
> Extensive sedimentation occurred within this Basin during the Mesozoic period. During this time, terrestrial and marine sediments unconformably blanketed the basement of deformed Palaeozoic sediments. The former sediments, predominantly sandstones and conglomerates, dominate the two Reserves. Subsequent erosion has removed this mantle from the "Crocodile" area, and exposed the phyllite basement.
>
> Within the Quinkan Area, vegetation types are largely related to geological differences, and to the local climatic variation that occurs due to the effects of orographic rainfall.
>
> Forest and woodlands are the dominant structural forms of vegetation, with the denser vegetation more common in the higher rainfall areas of the east, and on the sandstone plateaus. Locally denser vegetation occurs depending on soil types, springs and microclimates (due largely to aspect). Tree heights rarely exceed 20 metres.
>
> The major faunal habitats are defined by the major geologies. These are: the sandstone plateaus and deep gorges; the northern outwash sand plains; the extensive phyllite areas of the Kennedy Creek catchment; and the alluvial fans and plains of the Laura River valley. These habitats appear to carry faunal communities normally found in monsoonal woodlands.
>
> In addition there are more specific habitats such as cliffs, jointfields, springs and perennial minor tributaries. These support a specialized local fauna and lead to local concentrations of other species. Permanent water also allows the stable existence of core populations of particular species.
>
> The sandstone areas of the Reserves are particularly significant for fauna, since they have not been affected by grazing and they contain the major sources of permanent water in the Quinkan Area.

[1] Morgan, G. 1984 Environmental Study of the Quinkan Area Northeast Queensland and Basis for Management

> The most conspicuous feral animals are pigs and cattle, largely due to their impact on the specific habitats of alluvials and areas of permanent and semi-permanent water. The direct effect of cats and cane toads on fauna is also likely to be significant.'

Conservation values

Quinkan is well known as an area of high cultural value but its environmental value is less well understood. Modelling conducted by CSIRO for Bush Blitz in 2014 identified the West Quinkan country as the continent-wide number one priority for vascular plant survey. Enquiries among QLD taxonomists confirmed that the area is of great interest and poorly known.

The following is an excerpt from the draft values statement by the Australian Heritage Council on the heritage values of Quinkan Country[2].

> 'Quinkan Country is a distinctive rock art region located on a belt of sandstone within south-east Cape York Peninsula. It is distinguished from adjacent rock art regions by the numerous shelters, overhangs and rock surfaces that provide surfaces for painting.
>
> The rock shelters and layers of cultural deposits provide insights into Aboriginal cultural history over the last 34,000 years. Up to 100 sites are being discovered annually through continuing surveys by the Laura Rangers, researchers and others. This is likely to yield additional insights into the prehistory of the area, with the prospect of advancing the understanding of Australian prehistory generally, particularly over the last 2,000 years.'

[2] http://www.environment.gov.au/heritage/organisations/australian-heritage-council/national-heritage-assessments/quinkan-country-proposed-national-heritage-listing

Methods

Taxonomic groups studied and personnel

A number of taxonomic groups were selected as targets for study. Table 1 lists the groups surveyed and the specialists who undertook the fieldwork.

Table 1 Taxonomic groups surveyed and personnel

Group	Common name	Expert	Affiliation
Mammalia	Mammals	Heather Janetzki	QM
Amphibia and Reptilia	Frogs, toads and reptiles	Andrew Amey Rod Hobson	QM
Hymenoptera	Ants	Chris Burwell	QM
	Bees	Remko Leijs	SAM
Lepidoptera	Butterflies and moths	Susan Wright Chris Burwell	QM
Heteroptera	True bugs	Ryan Shofner	UNSW
Cicadoidea	Cicadas	Lindsay Popple	QM
Odonata	Dragonflies & damselflies	Chris Burwell	QM
Arachnida	Spiders	Barbara Baehr	Independent (QM)
		Robert Whyte	Independent (QM)
		Robert Raven	QM
		Jim McLean	Macquarie University
Gastropoda	Land snails	John Stanisic	Independent (QM)
Stygofauna	Stygofauna	Remko Leijs	SAM
Vascular plants	Vascular plants	Eda Addicott	ATH
		Mark Newton	ATH
		Stuart Worboys	ATH
		Raelee Kerrigan	ATH
		Bruce Wannan	ATH
		Darren Crayn	ATH
		Frank Zich	ATH
		Keith McDonald	QLD Herbarium
		Paul Forster	QLD Herbarium

In addition to these target groups, mammals and birds were recorded opportunistically and insects of miscellaneous groups were collected.

The Bush Blitz team would also like to acknowledge the contributions of the following people:

- Patrick J. Couper from QM for herpetological identifications.
- Christine Lambkin and Greg Daniels from QM for identification of flies and report writing.
- Bjorn Fjellstad from QM and Xuankun Li from ANIC for the identification of moths and flies, respectively.
- Karin Koch from QM for specimen recording, label production, report writing and data entry.
- Narelle Power from QM for sorting of specimens collected in traps and coloured pans.
- Serena Lam, Cynthia Chan and Marina Cheng from UNSW for specimen curation and data management.
- Jeremy Wilson from Griffith University for the identification of a new species of *Eupolos*.
- Mark Harvey, Volker Framenau and Martin Baehr for the identification of pseudoscorpions, Lycosidae and Carabidae respectively.

Site selection

All scientists surveyed two standard survey sites selected by Bush Blitz using modelling prepared by CSIRO. Each standard survey site was centred on a point (permanently marked), but the actual area surveyed varied between taxa. Standard methodologies were used to sample these sites.

The use of standard survey sites provides a unique opportunity to examine broad-spectrum biodiversity. Among other benefits, this will enable Bush Blitz's partners at CSIRO to test assumptions (e.g. about relationships between the diversity of different taxa) that underpin many conservation decisions. It will also allow comparisons between sites, and establish a basis for future monitoring by reserve managers.

Aside from standard survey sites, site selection and collection methods were at the discretion of the individual scientist. Site selection depended on access, suitability for trapping and time restrictions. Other considerations included:

- **Vertebrate (including amphibians, reptiles and mammals)** sites on properties to the east and west of Laura were chosen to cover different vegetation and habitat types, including riverine and rocky escarpment country. This was supplemented by incidental records, either made when travelling between sites or contributed by other members of the Bush Blitz team. Kimba Plateau on Alwal National Park was targeted particularly since a skink specimen collected there in 2015 appears to represent an undescribed species and more samples were needed.
- **General invertebrate** sites were selected with a view to sampling the widest possible range of habitat types and the widest geographic range possible in the short time allocated. Insects were collected from sites located within the majority of properties under consideration including Bonnyglen, Crocodile, Kings Plains, Springvale, Welcome and West Quinkan. As dragonflies and damselflies were one of the main insect groups targeted, some sites were selected to encompass a range of freshwater habitats ranging from flowing rivers and streams to ephemeral lagoons and pools. Butterflies and many groups of flies are known to hilltop, a breeding strategy where males congregate at the tops of hills. Consequently, some of the selected survey sites were prominent high points in the landscape. Insect specimens were also extracted and identified from pitfall traps deployed at spider survey sites.
- **Native bee** sites were selected based on two rationales—to sample as many different vegetation types as possible and to survey sites with concentrations of flowering plants, as this is generally

where native bees are collected. Many native bee species have strict relationships with particular flowering plants.

- **Heteroptera** sites were selected based on vegetation characteristics—heterogeneity, presence of flowers, etc, in order to maximise collecting efforts.
- **Spider** sites were chosen initially using Google Earth, then based upon accessibility, proximity to water and safe night access. Some sites were avoided subsequently because of concerns about Indigenous sacred sites or because rope climbing on cliff faces would be necessary.
- **Land snail** sites were selected to cover major vegetation types with emphasis on vine thicket and rainforest habitats.
- **Stygofauna** spring sites were selected, primarily based on the availability of access to the springs. Alternatively, hyporheic sites were chosen near river crossings along the Peninsula Developmental Road, and hyporheic sites at coarse gravel banks along the Mosman River and Kennedy Creek accessed by helicopter.
- **Botanical** site selection was guided by several factors. Overall, it was recognised that the study area as a whole was poorly sampled, so that collections made at any location would be a valuable addition to knowledge of the area. However, other matters influenced prioritisation of sampling, including that Queensland Herbarium staff based at the ATH identified woodlands and rainforests of the West Quinkan sandstones as priorities for survey, due to a paucity of sites on this geology, as well as a need to sample fully the diversity of flora (therefore a full diversity of geologies—basalt, granite and metamorphosed sediments) occurring in the study area.

Survey techniques

A standard suite of survey techniques was used:

- **Vertebrate** specimens were collected using a range of techniques including observation (e.g. observing roadkill, and recording distinctive bird or frog calls) with no or minimal interference to animal, hand-collecting, spotlighting, harp-trapping to intercept microbats, and the use of Elliott and wire cage traps. Spotlighting was very effective for frogs and reptiles, especially given the activity of animals following rain. Frogs in particular could be targeted by their calls and were abundant in the ephemeral pools on the road verge.

  Captures were limited to three per species per site. All specimens collected were preserved as voucher specimens in the QM collection. Collections were made under Department of Environment and Heritage Protection Permits WIMU09571411 (general) and WITK18253717 (Alwal National Park) and the QM Animal Ethics Committee Permit 12-01.
- **General invertebrates** were collected using a range of methods. Insects were searched for during the day. Flying insects (for example flies, butterflies, dragonflies and damselflies) were collected using insect nets (hand-netting). Foraging worker ants were searched for at night, on the ground and on tree trunks and foliage. Ant nests were searched for under rocks, in and under fallen logs, and in dead branches and twigs on trees. Sharkey (Sante Traps) type Malaise traps (designed to capture flying insects) were erected and operated at some sites for 5–9 days, depending on when the sites could be revisited to retrieve the traps.

  Light-trapping was conducted at the two standard survey sites. Two mercury vapour lamps powered by a portable generator were suspended from an aluminium frame in front of either side of a vertical white sheet. Selected insects attracted to the sheets were collected by hand and transferred to ethanol-filled vials. Insects attracted to the fluorescent lights of the laboratory were also collected over the duration of the survey.

  Pitfall-trapping for insects involved installation of a total of ten 120 ml cylindrical plastic vials, with opening diameter 43 mm, at a site. The ten traps were located along a more or less straight line

transect with traps separated by around five metres. Each trap was supplied with a square, black plastic cover, suspended above the opening by nails. Traps were half-filled with 70% ethanol and operated for five days.

Leaf litter extracts were also conducted at one other site. The leaf litter was gathered by hand and sieved with a litter sifter (mesh of approximately 15 mm). Deeper accumulations of leaf litter in hollows and at the bases of trees were targeted. Litter was collected until approximately two to three litres of the sieved portion were accumulated, the litter then transferred to a cloth bag. The sieved litter was processed in Tullgren funnels within 24 hours of collection. Funnels were operated overnight, each using a single 60 W incandescent bulb.

Bark spray (pyrethrum knockdown) samples were conducted at two additional sites. At each site, the trunks of 10 large living trees (at least 20 cm diameter at breast height) were sprayed using cans of Mortein fast knockdown (synthetic pyrethroid) insecticide, the jet directed from the base to as far as possible up the trunk. Invertebrates falling from the trunks were collected on sheets of ripstop nylon placed at the bases of the trunks. After 15 minutes, the sheets were collected and their catches transferred to an ethanol-filled vial using a suspended fabric funnel.

Coloured pan traps were employed at the two standard survey sites. They were arranged in a more or less straight line transect with traps separated by approximately one metre. Each bowl was with filled with around 250 ml of a weak detergent solution (four litres of water with a couple of drops of detergent). Traps were operated for 24 hours and the catches from the 16 traps at each site were sieved, combined and transferred to 70% ethanol. Pan traps of various colours and in various numbers were also deployed at a number of other sites.

- **Native bees** were mostly surveyed individually using a hand net, by sweep netting of specific plants, using blue vane traps, and using a vehicle net, coloured pan traps and malaise traps. Plant species on which the bees were collected were recorded.
- **Cicada** records were obtained using three methods—specimen collection by hand, net or light trap; audio recordings *in-situ* or in a fabric cage in the field using a Tascam DR-40 digital recorder with a Sennheiser ME66/K6 short shotgun microphone; and aural 'observations'.
- **Spiders** were collected using pitfall traps and by hand-collecting. The traps were filled with propylene glycol.
- **Land snails** were collected by hand from under woody debris and rocks, from leaf litter accumulations around the base of trees and shrubs and by raking the ground in the sandy soil in riparian situations. Both live snails and dead shells were taken. The great majority of land snails can be identified from the shells alone and their presence usually indicates the presence of living individuals. Hence, *post mortem* collection forms an important part of land snail survey, especially in drier areas where snail activity is limited by climatic conditions. Leaf litter collection for subsequent sorting for shells is also generally an important part of snail recovery. A quantity of leaf litter was taken from selected sites for sorting by microscope in the laboratory. Conditions for land snail collecting were ideal with daily rain providing moist ambient conditions for snail activity.
- **Stygofauna** sampling of hyporheic waters near springs used the Karaman–Chapui method of digging a small hole in the creek bed, and scooping subsurface water into a plankton net or the Bou-Rouche method by inserting a perforated steel pipe about 50 cm into a gravel bed and pumping and filtering up to a hundred litres of water. Additionally, springs vents and outflows were sampled using a small hand net.

  Gravel beds along the rivers were also sampled because it is known that such sub-surface habitats can contain groundwater organisms. Especially in the Quinkan area using a helicopter, this proved a much more efficient way to sample groundwater sites than the time-consuming hike from the plateau down into the gorge where most of the spring sites were situated. Gravel beds along the rivers were sampled using the Bou-Rouche method.

- **Botanical** samples were collected in the field, photographed whilst fresh, pressed in the field or stored and transported in thick plastic bags, and processed at the end of each work day. Apart from a few rainforest plants, only fertile (i.e. bearing buds, flowers or fruits) material was collected, as infertile material is both difficult to identify and makes for poor research specimens. Samples were documented, pressed and dried following standard herbarium methodology. Subsamples of some specimens were dried in silica gel for later DNA extraction.

Identification

The specimens taken were identified using available literature and the holdings of museums and herbaria. Most specimens, vouchers and tissues, were lodged at the QM. Botanical specimens were lodged at the ATH and the Queensland Herbarium. Specimens collected by UNSW and SAM will remain with the taxon specialist while further research is carried out.

Results

Locational data for all flora and fauna records are available to reserve managers. At least 1015 species were new records for the study area, including 128 putative new species—these await formal identification (some results are yet to be finalised and the total excludes general insects). Two threatened animal species, two threatened plants, 12 exotic or pest animal species and 20 weed species were also recorded.

Table 2 provides a summary of the flora and fauna records for the study area.

Table 2 Summary of flora and fauna records

Group	Common name	Total species recorded	Species newly recorded for any of the properties in the study area	Putative new species	Threatened species*	Exotic and pest species**
Mammalia	Mammals	13	13	0	1	4
Aves	Birds	97	96	0	1	0
Reptilia	Reptiles	34	29	0	0	1
Amphibia	Frogs and toads	13	6	0	0	1
Hymenoptera	Ants	93	93	0	0	3
	Bees	76	76	7	0	1
Lepidoptera	Butterflies	62	60	0	0	0
	Moths	7	7	0	0	0
Diptera	Flies	76	76	25	0	0
Carabidae	Ground beetles	28	18	11	0	0
Heteroptera	True bugs	76	76	10	0	0
Cicadoidea	Cicadas	19	19	2	0	0
Odonata	Dragonflies and damselflies	41	40	1	0	0
Arachnida	Spiders	145	145	57	0	1
	Scorpions	2	2	0	0	0
	Pseudoscorpions	5	5	5	0	0
	Tailless whip scorpions	1	1	1	0	0
	Micro whip scorpions	1	1	1	0	0
	Harvestmen	1	1	1	0	0

Group	Common name	Total species recorded	Species newly recorded for any of the properties in the study area	Putative new species	Threatened species*	Exotic and pest species**
Gastropoda	Snails	14	12	2	0	1
Stygofauna	Stygofauna	unknown	5+	5+	0	0
Plants	Seed plants	452	219	0	2	20
	Ferns and fern allies	23	15	0	0	0
Total		1279	1015	128	4	32

* Species listed as Threatened under the Commonwealth EPBC Act or an equivalent listing.
** Includes native species that at times are pests or are exotic to this region.

Species lists

Lists of all species recorded during the Bush Blitz are provided in Appendix A. Species lists were compiled using data from participating institutions. Lists of species previously known to occur in the study areas were provided for some taxonomic groups but not others so this should not be considered a complete species list for the park.

Some specimens have been identified only to family or genus level. This is partly because identification of specimens to species level is very time-consuming, with detailed microscopic examination needed in many cases. Also, some groups are 'orphans': currently no experts are working on them, or are available to work on them, and the taxonomic literature is out of date; species-level identification is not possible for these groups. Unidentified Bush Blitz specimens are held in institutional collections where they are available for future study. Collections hold many such specimens, among them species not yet described (i.e. unnamed species) as well as described species that have not been identified. For example, ANIC holds tens of thousands of unidentified specimens. Specimens often wait decades before the resources become available for their study. A key component of Bush Blitz is the funding of studies of specimens collected on Bush Blitz surveys.

Nomenclature and taxonomic concepts used in this report are consistent with the Australian Faunal Directory, Australian Plant Name Index, Australian Plant Census, AusMoss, and the Catalogue of Australian Liverworts and Hornworts.

Discussion

Putative new species

Here we use the term 'putative new species' to mean an unnamed species that, as far as can be ascertained, was collected for the first time during this Bush Blitz. It is confirmed as a new species once it is named and its description published. Specimens collected during the Bush Blitz also include unidentified taxa that are already known from museum and herbarium collections—these are not counted as putative new species.

Fauna

Invertebrates

Bees

Seven unnamed bee species have been confirmed including two *Amegilla* (*Asaropoda*) species, one of which (*A.* n.sp.QKRL033) has a banding pattern similar to species of *Amegilla* (*Zonamegilla*), which so far is unique for *Asaropoda*. The other (*A.* n.sp.cf. *epaphrodita*) resembles *A. epaphrodita* from the Darwin area and *A. housteni* from the Kimberleys, but has an entirely black abdomen. The remaining undescribed species were determined as such since, using available keys to sub genera, they could not be referred to any known species.

Flies

The Laura area has historically been well collected for Diptera by Greg and Alice Daniels and Margaret Schneider, especially around Fairlight and Fairview Homesteads to the south-west of Laura. Thus species not recognised from previous collections are probably new to science.

Eight new robber fly (Asilidae) species were collected during the Bush Blitz and were not recognised from previous collections. The two female specimens of *Colepia* QKBB sp. 1 represent a distinctive new species. The genus occurs in many habitats along eastern Australia and currently contains 13 described species as well as three or four undescribed.

Sixteen new bee fly (Bombyliidae) species from 6 genera (1 undescribed) were collected during the Bush Blitz and were not recognised from previous collections. Three new bee fly species of *Balaana* collected in Springvale were distinctive. Five male specimens were collected, including three specimens of *Balaana* QKBB sp.2. All specimens were hand-netted by Susan Wright or Lindsay Popple from the Springvale property. Also a male and female of a new bee fly species from an undescribed genus ('Quinkan' MS) were noteworthy. The specimens were collected from Crocodile and Welcome. The genus is difficult to place to Tribe within the Anthracinae as it shares characteristics with the Exoprosopini and Villini, but appears to be most closely related to *Atrichochira* which is in the Exoprosopini.

One new stiletto fly (Therevidae) species, not recognised from previous collections, was collected during the Bush Blitz.

Ground beetles

Eleven new species from six different genera of ground beetle (Carabidae) were found in different locations of the Quinkan Country. The species were identified by Dr Martin Baehr: *Abacetus* (1 species),

Carenum (2 species), *Clivina* (4 species), *Hypharpax* (1 species), *Loxandrus* (1 species) and *Notiobia* (2 species) are now recorded from Quinkan Country.

Particularly interesting are the specimens of the hygrophilous genus *Clivina* (Scaritini), which probably include seven species. Besides two common species widespread in eastern and northern Australia, the sample includes one new species which currently is being described and so far is very rare in Cape York Peninsula (however more common in the Northern Territory), and four species which belong to a large species group that requires revision.

Two rather small species of the speciose genus *Carenum* (Scaritini) are unknown and most probably new species, according to knowledge of this genus from Lower Cape York Peninsula.

Note: Data for ground beetles are not provided in Appendix A.

Heteroptera

Ten new species of Heteroptera were discovered, highlighting the taxonomic impediment of the hemipteran suborder in Australia. The discovery of five new species of Orthotylinae further cements the hyperdiversity of this subfamily of plant bugs (family Miridae), as well as the inadequacy of the generic framework, particularly for the nominate tribe. The discovery of a new species of the coreid genus *Agriopocoscelis* is also noteworthy because it was previously known from a single species. This new species is highly cryptic, with a greyish brown colour and thin, parallel-sided body.

Cicadas

Two new cicadas were collected during the Bush Blitz. *Graminitigrina* QKBB sp.1 was collected from the lower and middle slopes of a sandstone hill, approx. 18.5 km south-east of Laura on the eastern side of the Peninsula Development Road. This is the first record of *Graminitigrina* from the eastern side of Cape York, although the grassy woodland habitat is fairly typical of sites inhabited by this genus. The adults were found in large numbers on grass and small shrubs and were found to be poor flyers, which is atypical for the genus *Graminitigrina*. This new species bears the characteristic morphological traits of *Graminitigrina*; however it is strikingly darker than any of the previously described members of the genus, which generally look closely similar in outward appearance. The new species also has a distinct calling song.

The second new species, *Mugadina* QKBB sp.1, was encountered in small numbers in a highly localised area on the basalt middle slopes of Mt Earl, Springvale Station. Males were calling from low down on grasses amongst a heavy weed infestation. The new species is distinctive and allied to *Mugadina emma*, but differing in the smaller size, higher-pitched calling song and orange eyes in live specimens.

Dragonflies and damselflies

Five specimens, one male and four females, of a completely new species of isostictid damselfly were collected from two localities—Bonnygen Site 2, Spring Creek and Springvale, near Helipad 14. The new species has been examined by Günther Theischinger and determined to belong to the genus *Oristicta*. *Oristicta* currently contains a single described species, *O. filicicola*, which was also collected during the Bush Blitz. The new species is *Oristicta rosendaleorum* Burwell & Theischinger, published in Theischinger, G. & Burwell, C.J. 2017. A second species of *Oristicta* Tillyard (Odonata: Isostictidae). Zootaxa 4323 (1): 83–95.

Spiders

During the Bush Blitz, 57 new species from 18 spider families were discovered. The spiders were Barychelidae (3 species), Clubionidae (1 species), Corinnidae (3 species), Ctenidae (1 species), Ctenizidae

(1 species), Desidae (1 species), Eutichuridae (1 species), Gnaphosidae (6 species), Idiopidae (1 species), Lamponidae (1 species), Lycosidae (10 species), Mitugidae (1 species), Oonopidae (6 species), Oxyopidae (3 species), Salticidae (6 species), Theraphosidae (1 species), Theredíidae (1 species) and Zodariidae (10 species).

Wolf Spiders (Lycosidae) belong to one of the most diverse spider families in Australia and are only partly revised. These species are difficult to identify. Quinkan Country is home to ten new species assigned to five genera, of which at least one genus is new as well.

Goblin Spiders (Oonopidae) are mostly hard-bodied spiders with strong sclerotised abdominal plates. Not much would be known about these tiny litter- and canopy-dwelling goblins if they had not been the object of an international research effort, a Planetary Biodiversity Inventory (PBI), funded by the National Science Foundation (NSF) in the USA. So far six new species from four genera have been identified among specimens collected on the Bush Blitz.

Only 19 species of Lynx Spiders (Oxyopidae) are known in Australia. Most species are difficult to identify, as no recent modern revision is available in the literature. It is likely that three new species are among the specimens collected during the Bush Blitz.

Ant-eating spiders (Zodariidae) belong to one of the most diverse spider families in Australia. Although some genera have been revised recently, other genera still await revision. Altogether ten new species assigned to three different genera were collected on the Bush Blitz.

Other arachnids

One species of micro whip scorpion has been confirmed as a new species. Five pseudoscorpion species found on the expedition are probably new to science, as is one species of tailless whip scorpion and one harvestman.

Land snails

Two putative new species (Pupinid CY 6, Rhytidid CY 8) were recorded in a rainforest gully on West Quinkan. Pupinid CY 6 closely resembles *Signepupina ventrosa* from the lowlands of the Wet Tropics but differs in size and shell shape. Rhytidid CY 8 is a member of a genus of carnivorous snails whose nearest relative, *Scagacola einasleigh*, lives in the Undara lava fields. The occurrence of these new species in a heavily rainforested gully in drier sandstone country highlights the evolutionary significance of rainforest refugia in West Quinkan. Potential indications are that these species are vicariant derivatives of once more widespread ancestral species at a time when rainforest communities covered much more of the landscape.

Stygofauna

Very little is known about stygofauna in Queensland. The nearest known stygofauna site is near Chillagoe where cave amphipods (Paramelittidae: *Chillagoe thea*) are known to exist in a number of limestone caves.

Stygofauna species have very small distributions that are confined to individual aquifers or catchments and stygofauna species are not known from aquifers or catchments surrounding the Quinkan properties. Therefore any stygofauna found in a so far un-sampled catchment or aquifer should be considered as unnamed species. All groundwater dependent taxa collected during the Bush Blitz are considered new species.

Table 3 Putative new invertebrate species

Family	Species
Bees	
Apidae	*Amegilla (Asaropoda)* n.sp.cf. *epaphrodita*
Apidae	*Amegilla (Asaropoda)* n.sp.QKRL033
Colletidae	*Chrysocolletes* n.sp.QKRL014
Colletidae	*Chrysocolletes* n.sp.QKRL017
Colletidae	*Leioproctus (Protomorpha)* n.sp.QKRL021
Halictidae	*Nomia (Paulynomia)* n.sp.QKRL041
Megachilidae	*Austrothurgus* n.sp.QKRL015
Flies	
Asilidae	*Cerdistus* QKBB sp.1
Asilidae	*Cerdistus* QKBB sp.2
Asilidae	*Cerdistus* QKBB sp.3
Asilidae	*Colepia* QKBB sp.1
Asilidae	*Ommatius* QKBB sp.1
Asilidae	*Ommatius* QKBB sp.2
Asilidae	*Ommatius* QKBB sp.4
Asilidae	*Ommatius* QKBB sp.5
Bombyliidae	*Balaana* QKBB sp.1
Bombyliidae	*Balaana* QKBB sp.2
Bombyliidae	*Balaana* QKBB sp.3
Bombyliidae	*Comptosia* QKBB sp.1 *australensis* sp. grp
Bombyliidae	*Comptosia* QKBB sp.2 *australensis* sp. grp
Bombyliidae	*Comptosia* QKBB sp.3 *australensis* sp. grp
Bombyliidae	*Comptosia* QKBB sp.4 *australensis* sp. grp
Bombyliidae	*Comptosia* QKBB sp.5 *microrhynchus* sp. grp
Bombyliidae	*Comptosia* QKBB sp.6 *prosimplex* sp. grp
Bombyliidae	*Comptosia* QKBB sp.7 *wilkinsi* sp. grp
Bombyliidae	*Exechohypopion* QKBB sp.1 nr *nigricostatum*
Bombyliidae	*Exechohypopion* QKBB sp.2 nr *nigricostatum*

Family	Species
Bombyliidae	*Exechohypopion* QKBB sp.3 nr *velox*
Bombyliidae	'Quinkan' MS QKBB sp.1
Bombyliidae	Staurostichus QKBB sp.1
Bombyliidae	*Villa* QKBB sp.1 nr *zonipennis*
Therevidae	*Patanothrix* QKBB sp.1
Ground beetles	
Carabidae	*Abacetus* "quinkan sp."
Carabidae	*Carenum* "quinkan sp.01"
Carabidae	*Carenum* "quinkan sp. 02"
Carabidae	*Clivina* "quinkan sp. 01"
Carabidae	*Clivina* "quinkan sp. 02"
Carabidae	*Clivina* "quinkan sp. 03"
Carabidae	*Clivina* "quinkan sp. 04"
Carabidae	*Hypharpax* "quinkan sp."
Carabidae	*Loxandrus* "quinkan sp."
Carabidae	*Notiobia* "quinkan sp."
Carabidae	*Notiobia* "quinkan sp. 02"
True bugs	
Coreidae	*Agriopocoscelis* sp_BBQKN17_Msp044
Miridae	Gn_Austromirini_001 sp_BBQKN17_Msp026
Miridae	Gn_Orthotylini_001 sp_BBQKN17_Msp027
Miridae	Gn_Orthotylini_002 sp_BBQKN17_Msp028
Miridae	Gn_Orthotylini_003 sp_BBQKN17_Msp029
Miridae	Gn_Zanchiini_001 sp_BBQKN17_Msp024
Miridae	Gn_Phylini_002 sp_BBQKN17_Msp032
Miridae	*Diomocoris* sp_BBQKN17_Msp043
Miridae	Gn_Mirini_004 sp_BBQKN17_Msp040
Tingidae	Gn_Tingini_001 sp_BBQKN17_Msp078
Cicadas	
Cicadidae	*Graminitigrina* QKBB sp.1

Family	Species
Cicadidae	*Mugadina* QKBB sp.1
Damselflies	
Isostictidae	*Oristicta rosendaleorum*
Spiders	
Barychelidae	*Idiommata* “quinkan sp. nov.41”
Barychelidae	*Mandjelia* sp. nov.
Barychelidae	*Zophorame* "quinkan sp. nov.49"
Clubionidae	*Clubiona* "quinkan sp. nov. 80"
Corinnidae	*Nyssus* "quinkan sp.nov. 01"
Corinnidae	*Poecilipta* "quinkan sp. nov. 02"
Corinnidae	*Poecilipta* "quinkan sp. nov. 26"
Ctenidae	*Anahita* "quinkan nov.14"
Ctenizidae	*Conothele* sp. nov.
Desidae	*Barahna* "quinkan sp.nov. 77"
Eutichuridae	*Cheiracanthium* "quinkan sp. nov. 02”
Gnaphosidae	*Anzacia* sp.
Gnaphosidae	*Ceryerda* "quiinkan sp.nov 69"
Gnaphosidae	*Encoptarthria* "quinkan sp. nov. 74"
Gnaphosidae	*Gnaphosidae* "quinkan sp. nov. 73"
Gnaphosidae	*Gnaphosidae* "quinkan sp. nov. 75"
Gnaphosidae	*Gnaphosidae* "quinkan sp. nov. 76"
Idiopidae	*Euoplos* sp. nov.
Lamponidae	*Lampona "quinkan nov.13"*
Lycosidae	*Artoria* sp.
Lycosidae	*Artoriinae* new genus "quinkan sp. nov.38"
Lycosidae	*Hogna* "quinkan sp. nov.15"
Lycosidae	*Hogna* "quinkan sp. nov.16"
Lycosidae	*Hogna* "quinkan sp. nov.17"
Lycosidae	*Hogna* "quinkan sp. nov.18"
Lycosidae	*Hogna* "quinkan sp. nov.34"

Family	Species
Lycosidae	*Hogna* "quinkan sp. nov.36"
Lycosidae	*Lycosinae* "quinkan sp. nov.37"
Lycosidae	*Venatrix* "quinkan sp. nov.19"
Miturgidae	*Odomasta* "quinkan sp. nov. 44"
Oonopidae	*Ischnothyreus* "quinkan sp. nov. 53"
Oonopidae	*Opopaea* "quinkan sp. nov. 40"
Oonopidae	*Opopaea* "quinkan sp. nov. 56"
Oonopidae	*Opopaea* "quinkan sp. nov. 59"
Oonopidae	*Pelicinus* "quinkan sp. nov. 42"
Oonopidae	*Xestaspis* "quinkan sp. nov. 60"
Oxyopidae	*Oxyopes* "quinkan sp. nov. 50"
Oxyopidae	*Oxyopes* "quinkan sp. nov. 51"
Oxyopidae	*Oxyopes* "quinkan sp. nov. 52"
Salticidae	*Jotus* sp. nov. "quinkan sp. 28"
Salticidae	*Maratus* "quinkan sp. nov. 29"
Salticidae	*Maratus* "quinkan sp. nov. 70"
Salticidae	*Omoedus* "quinkan sp 31"
Salticidae	*Pungalina* sp. "quinkan sp. 32"
Salticidae	*Simaetha* sp. "quinkan sp. 33"
Theraphosidae	*Selenotypus* sp. nov.
Theridiidae	*Steatoda* "quinkan sp.nov. 10"
Zodariidae	*Australutica* "quinkan sp.nov. 04”
Zodariidae	*Habronestes* "quinkan sp.nov. 03"
Zodariidae	*Habronestes* "quinkan sp.nov. 05"
Zodariidae	*Habronestes*"quinkan sp.nov. 06"
Zodariidae	*Habronestes* "quinkan sp.nov. 08"
Zodariidae	*Habronestes* "quinkan sp.nov. 11"
Zodariidae	*Habronestes* "quinkan sp.nov. 12"
Zodariidae	*Neostorena* "quinkan sp.nov. 07"
Zodariidae	*Neostorena* "quinkan sp.nov. 09"

Family	Species
Zodariidae	*Neostorena* "quinkan sp.nov. 39"
Pseudoscorpions	
Geogarypidae	*Geogarypus* "quinkan sp.nov. 65"
Olpiidae	*Euryolpium* "quinkan sp.nov. 55"
Olpiidae	Olpiidae “quinkan sp.nov. 54"
Olpiidae	Olpiidae “quinkan sp.nov. 66”
Olpiidae	Olpiidae “quinkan sp.nov. 67”
Tailless whip scorpions	
Charontidae	*Charon* sp. nov?
Micro whip scorpions	
Hubbardiidae	Hubbardiidae "quinkan sp 35"
Harvestmen	
Phalangiidae	*Opilio* sp.
Land snails	
Pupinidae	Pupinid CY 3
Rhytididae	Rhytidid CY 8
Stygofauna	
Order: Copepoda Superfamily: Harpacticoidea	
Order: Syncarida Family: Bathynellidae	New genus, new species
Order: Oligochaeta	
Order: Turbellaria	
Order: Hydracarina	

Flora

Vascular plants

Several collections remain unidentified at the time of writing. These could include new species.

Threatened species

Australia is home to an estimated 580,000–680,000 species, most of which have not been described. Approximately 92% of Australian plants, 87% of mammals, 93% of reptiles and 45% of birds are endemic. Changes to the landscape resulting from human activity have put many of these unique species at risk. Over the last 200 years, many species have become extinct; many others are considered to be threatened, i.e. at risk of extinction.[3]

Fauna

Vertebrates

Table 4 Threatened vertebrate species

Family	Species	Common name	Status	Comments
Birds and mammals				
Columbidae	*Geophaps scripta*	Squatter Pigeon	EPBC (Vulnerable) State (Vulnerable)	Sightings at two localities only
Rhinolophidae	*Rhinolophus robertsi*	Large-eared Horseshoe Bat	EPBC (Vulnerable) State (Endangered)	Single animal caught. No information on abundance in region.

Flora

Native flora and fauna species that are considered at risk of extinction are protected under Queensland *Nature Conservation Act* 1992 (NC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act). Depending on the assessed level of risk, rare flora species can be listed as Endangered, Vulnerable or Near Threatened, the latter being a NC Act classification only.

Table 5 lists the Threatened and Near Threatened plant species recorded or collected during the Bush Blitz. They were recorded from a variety of habitats—*Cucumis costatus* from a sandstone cliff, *Dendrobium bigibbum* was epiphytic in gorge rainforests, while *Dianella incollata*, *Hardenbergia* sp. (Mt Mulligan J.R. Clarkson 5775) and *Homoranthus tropicus* were species of thin soils on sandstone plateaus. *Homoranthus tropicus* was a prominent shrub stratum species.

[3] Chapman, A. D. 2009, Numbers of Living Species in Australia and the World, 2nd edn. Australian Biological Resources Study, Canberra.

Table 5 Threatened and Near Threatened flora species

Family	Species	Status
Cucurbitaceae	*Cucumis costatus*	Near Threatened (NC Act)
Fabaceae	*Hardenbergia* sp. (Mt Mulligan J.R. Clarkson 5775)	Vulnerable (NC Act)
Hemerocallidaceae	*Dianella incollata*	Near Threatened (NC Act)
Myrtaceae	*Homoranthus tropicus*	Near Threatened (NC Act)
Orchidaceae	*Dendrobium bigibbum*	Vulnerable (NC Act & EPBC Act)

Exotic and pest species

Conservation reserves help to protect Australia's Rare and Threatened Ecosystems and provide refuge for species at risk. Invasive species can have a major impact on already vulnerable species and ecosystems, as well as economic, environmental and social impacts. The inclusion of exotic and pest species records as part of this report is designed to provide land managers with baseline information to assist with further pest management programs.

Fauna

Vertebrates

Table 6 Pest or exotic vertebrate species

Family	Species	Common name	Comments
Mammals			
Canidae	*Canis familiaris*	Domestic Dog/Dingo	If Dingo, may help to reduce/ suppress cats or foxes in the area
Muridae	*Mus musculus*	House Mouse	Widespread species
Muridae	*Rattus rattus*	Black Rat	Widespread species
Suidae	*Sus scrofa*	Pig	Several sites with pig diggings and one animal sighted in West Quinkan; species seems widespread throughout area; difficult to control in this type of landscape

Family	Species	Common name	Comments
Reptiles			
Gekkonidae	*Hemidactylus frenatus*	House gecko	Found at Laura and around the buildings at Welcome Station; a south-east Asian species that has become abundant in buildings throughout coastal and sub-coastal Queensland in the last 30 years; opinion on the ability of this species to invade more natural environments is divided but it has been found living in the bush at latitudes similar to Quinkan
Toads			
Bufonidae	*Rhinella marina*	Cane Toad	Abundant; well established since its spread from the initial release area of Tully in 1935

Invertebrates

Ants

Three exotic ant species were collected on the Bush Blitz—Black Crazy Ant (*Paratrechina longicornis*), *Strumigenys emmae* and *Technomyrmex difficilis*.

The native range of Black Crazy Ant is uncertain. It has often been suggested to be Asian in origin as it is known to inhabit natural forests in that region. However, recent revisionary work on *Paratrechina* indicates the centre of diversity of the genus is in the Afrotropical and Malagasy regions, where four of the five species of *Paratrechina* are native. Therefore an Asian origin of *P. longicornis* is questionable. Regardless, *P. longicornis* is now pantropical and is introduced to Australia where it is widely distributed across the northern tropics and subtropics. It is typically associated with disturbed habitats such as agricultural, peri-urban and urban areas and rarely penetrates native forests. A small number of specimens were collected in spider pitfall traps 18.5 km SE Laura at Site F4. This is the site of a microwave repeater tower and is somewhat disturbed. This species is unlikely to spread into undisturbed habitats in the region.

Strumigenys emmae is a minute litter-inhabiting ant that has become an almost pantropical tramp (i.e. spread by human activity) species. It is regarded as introduced in Australia and, given its small size and low abundance, is rarely collected in any numbers—its ecological impacts are probably negligible.

Technomyrmex difficilis is a very widespread tramp ant species that is considered to be introduced to Australia. In Australia there are reliable records of the species from northern coastal Queensland and the Top End of the Northern Territory. Its likely ecological impacts in Australia are unknown. Only two specimens were collected in spider pitfall traps at West Quinkan Site F3.

Bees

The introduced honey bee, *Apis mellifera*, is not listed as a pest species however it may act as a pest species in certain circumstances. Feral colonies may take over or occupy nesting hollows that otherwise are used by hollow-breeding small mammals or birds such as parrots, lorikeets and cockatoos. Feral

bees may also compete with native bees, birds and small mammals for nectar and pollen, especially when these resources are scarce. During the Bush Blitz, *A. mellifera* was found, but not abundant. Feral bees can also be a nuisance to visitors of reserves, especially in the dry months when surface water is scarce. They require water for thermoregulation of their colonies and can be very persistent at any water source.

Spiders

Most of the spiders collected are native and not considered to be pest species. However, Daddy Longlegs, *Pholcus phalangioides* is widely distributed and easily carried by humans.

Land snails

One introduced subulinid, *Allopeas gracile*, was recorded from along the Laura–Lakeland Road and near the Laura Roadhouse. This species is a tropical tramp, originally from India but having been spread far and wide through human activity. It has been recorded previously from northern Australia (Torres Strait Islands, Top End, Laura–Lakeland Road, and Olkola National Park, Far North Queensland) and hence its presence in the Laura Basin is not remarkable. On the positive side, this species was not recorded in any native vegetation and is not known to cause any environmental damage.

Table 7 lists the pest and exotic invertebrate species that were collected or observed during the Bush Blitz.

Table 7 Pest or exotic invertebrate species

Family	Species	Common name	Comments
Ants			
Formicidae	*Paratrechina longicornis*	Black Crazy Ant	Two specimens collected
Formicidae	*Strumigenys emmae*		Single specimen collected
Formicidae	*Technomyrmex difficilis*		Two specimens collected
Bees			
Apidae	*Apis mellifera*		Sighted frequently; low abundance
Spiders			
Pholcidae	*Pholcus phalangioides*	Daddy Longlegs	Diverse and easily carried by humans
Snails			
Subulinidae	*Allopeas gracile*	Graceful Awlsnail	Probably widespread in disturbed areas such as roadsides and building sites; a circumtropical introduction

Flora

Of approximately 475 plant taxa collected or observed during the Bush Blitz, only 20 flowering plants were introduced species that have naturalised in Queensland. Weed diversity was highest along major streams such as the Mossman River and Laura River, and around Laura township. A thorough survey around the modified environments of Laura would have uncovered many more naturalised plant species, both cultivated and weedy.

The majority of naturalised species encountered were relatively minor environmental pest species, for example, *Physalis angulata* and Red Natal Grass (*Melinis repens*). Lantana (*Lantana camara*) was not recorded, but is probably present in wetter and more fertile locations. Table 8 lists the exotic plant species that were collected or observed.

Table 8 Weeds

Family	Species	Common name	Comments
Amaranthaceae	*Alternanthera ficoidea*	Joyweed	
Apocynaceae	*Cryptostegia grandiflora*	Rubber Vine	High priority for control[1]. Weed of National Significance[2]. Category 3 restricted plant[3].
Asteraceae	*Bidens bipinnata*	Cobbler's Pegs	
Asteraceae	*Emilia sonchifolia*	Purple Emily	
Asteraceae	*Synedrella nodiflora*	Cinderella Weed	
Asteraceae	*Xanthium occidentale*	Noogoora Burr	Medium priority for control[1]
Cyperaceae	*Cyperus sphacelatus*	Sedge	
Fabaceae	*Senna occidentalis*	Coffee Senna	Low priority for control[1]
Fabaceae	*Stylosanthes humilis*		
Fabaceae	*Stylosanthes scabra*	Shrubby Stylo	
Lamiaceae	*Mesosphaerum suaveolens*	Stinkweed	
Malvaceae	*Sida acuta*	Sida	Low priority for control[1]
Malvaceae	*Triumfetta rhomboidea*	Chinese Burr	
Malvaceae	*Urena lobata*	Urena Burr	
Onagraceae	*Ludwigia hyssopifolia*	Ludwigia	
Poaceae	*Melinis minutiflora*	Molasses Grass	
Poaceae	*Melinis repens*	Red Natal Grass	
Solanaceae	*Physalis angulata*		
Solanaceae	*Solanum seaforthianum*	Climbing Nightshade	
Verbenaceae	*Stachytarpheta jamaicensis*	Snakeweed	Low priority for control[1]

[1] Cook Shire Council (2013) Cook Shire Council Pest Management Plan 2012-2016.
[2] Weeds of National Significance http://environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html
[3] Queensland Biosecurity Act 2014

Range extensions

Fauna

Vertebrates

The Large-eared Horseshoe Bat (*Rhinolophus robertsi*) was found further west than indicated by previous records.

Invertebrates

Ants

Camponotus whitei is a distinctive *Camponotus* species that is confined largely to southern Australia, with a few records from central Australia. The most northerly record of the species is from Queensland, based on records on the ALA, Carborough Range, via Copperbella approximately 115 km south-west of Mackay. The single specimen collected from Bonnyglen, Bush Blitz site B9 represents a north-westerly range extension of approximately 750 km.

Froggattella kirbii is widely distributed through southern Australian, eastern Queensland and the Top End of the Northern Territory and the Kimberley region of northern Western Australia. Records of this species from Cape York Peninsula are very sparse and limited to Hope Vale and Coen. The collection of this species in West Quinkan at site F1 (hilltop) is a third record of the species at the northern limits of its range in Queensland.

Myrmecia gilberti is a widespread bull ant species occurring from southern Victoria to northern Queensland (based on specimen-based records in the ALA). In northern Queensland the majority of records are from the Wet Tropics bioregion with a single collection of the species from far northern Cape York Peninsula (Captain Billy Creek, Heathlands Reserve). A single specimen from a hilltop on Bonnyglen Station and site B9 represents a significant infill distribution record between those in the Wet Tropics and that from Captain Billy Creek.

Butterflies

Tawny Coaster or Orange Glasswing (*Acraea terpsicore*) is native to India and Sri Lanka but has rapidly extended its range eastwards through south-east Asia in recent decades. The first documented record of the species in Australia was from Darwin in April 2012. The species has since expanded its range in Australia at a very rapid rate and is now widespread in the Top End of the Northern Territory and far-northern Western Australia. The first Queensland record of the species was from the Kowanyama area of Queensland's Gulf coast in 2016 where it was said to be 'well established'. More recently the species was recorded further east at Talaroo Station between Mt Surprise and Georgetown, and was detected at six of 13 sites surveyed for butterflies in February 2017 with breeding observed at one site. At the time of the Bush Blitz, the single specimen of *A. terpsicore* collected from Bush Blitz laboratory at Laura was a significant easterly and northerly extension of the range of the species. Immediately following the Bush Blitz survey, however, flights of large numbers of Tawny Coasters were observed further south and east (Niel Bruce pers. comm.) and the species has greatly expanded its range. The species has been observed as far south and east as Townsville and in the south as far west as Hughenden and Winton (Niel Bruce, pers. comm.; Chris Burwell pers. obs.).

Flies

Range extensions and significant distribution records were documented for six species, including two named species and four un-named species. The most scientifically significant range extensions were for the bee flies *Thraxan nodus*, previously known only from the holotype collected from Coen, 200 km

away, and *Thraxan ebenus*, previously known from three specimens, with the nearest collected from Isla Gorge, 1200 km away.

Cicadas

Range extensions and significant distribution records were documented for 11 species, including five named species and all six un-named species. The most significant range extension was for *Nanopsalta* QKBB sp.1, for which the nearest known locality is White Mountains (560 km extension).

Dragonflies and damselflies

Queensland Pin (*Eurysticta reevesi*) was previously known from only three specimens collected by H.B. Hines in 2000 from Torrens Creek Gorge in White Mountains National Park (20°28'50"S 144°55'03"E), about 380 km west of Proserpine, a northerly range extension of 550 km. This species was described by Theischinger (2001) from two males (holotype and paratype). Four specimens of *Eurysticta* (three males and a female) collected from SSS2 have been compared with a third male of *E. reevesi* that was collected together with the types, and all were found to be conspecific. Although the newly collected males show some slight differences in colouration, their terminalia are identical with those of the *E. reevesi* specimen. In addition, this is the first female specimen of *E. reevesi* collected.

Rainforest Vicetail (*Hemigomphus theischingeri*) appears to be restricted to the Wet Tropics bioregion where it inhabits rainforest streams. A single, teneral (i.e. freshly emerged) female specimen of *Hemigomphus* that keys to *H. theischingeri* was collected at Bonnyglen, site P47 (mud spring). The record represents a western extension of approximately 60 km of the northern range of the species and the first record from open eucalypt woodland.

Flora

Vascular plants

Several range extensions and/or unusual records were found among the vascular plant collections. For some of these, the record represents a northernmost or southernmost record, in other cases, it represents significant infill in the known distribution of the species.

Table 9 Range extensions

Family	Species	Comments
Bats		
Rhinolophidae	*Rhinolophus robertsi*	Found on West Quinkan; while this species occurs further north, this record is much further west than known records in the Cooktown region
Ants		
Formicidae	*Camponotus whitei*	750 km north-westerly range extension; typically confined to southern Australia, previously most northerly record from Queensland slightly south of Mackay

Family	Species	Comments
Formicidae	*Froggatella kirbii*	Specimen found at Bonnyglen is 140 km NW of nearest record from Koah in the Wet Tropics and 500 km SSE of single record on Cape York Peninsula from Captain Billy Creek in Heathlands Reserve
Butterflies		
Nymphalidae	*Acraea terpsicore*	At the time of the survey represented a north-north-easterly range extension of around 290 km
Flies		
Asilidae	Asiliinae genus AB sp.B11	Robber fly; genus and species undergoing description; new southern distribution limit
Asilidae	*Leptogaster* QKBB sp.1	robber fly; known previously only from heathlands near the tip of Cape York Peninsula
Asilidae	*Leptogaster* QKBB sp.4	robber fly; known previously only from heathlands near the tip of Cape York Peninsula
Bombyliidae	*Thraxan ebenus*	Bee fly; previously known from three specimens, with the nearest collected from Isla Gorge, 1200 km away
Bombyliidae	*Thraxan nodus*	Bee fly; previously only known from the holotype collected from Coen, 200 km away
Bombyliidae	*Villa* QKBB sp.2 nr *trivincula*	Bee fly; collected in Proserpine area in 2007 as *Villa* nr *trivincula*
Cicadas		
Cicadidae	*Illyria burkei*	Nearest record from Cooktown, though widespread across northern Australia; expected to occur
Cicadidae	*Macrotristria dorsalis*	Known from Georgetown east to Innisfail and north to Bathurst Head, with a potential record from Pennefather River. Nearest locality is Isabella Falls
Cicadidae	*Mugadina* QKBB sp.2	Previously known only from Maryfarms near Mount Carbine
Cicadidae	*Myopsalta* QKBB sp.1	Widespread undescribed species in Queensland, Northern Territory and north Western Australia; nearest other record from Herberton Range

Family	Species	Comments
Cicadidae	*Nanopsalta* QKBB sp.1	Previously known from near Miles north to near Pentland in Queensland in association with sandstone; a significant range extension for this undescribed species
Cicadidae	*Palapsalta* QKBB sp.1	Previously known from the area between Gordonvale and Dimbulah, including the Atherton Tableland; a moderate range extension for this undescribed species.
Cicadidae	*Palapsalta virgulata*	Known from the Wet Tropics south to Blackdown Tableland and possibly Fraser Island; nearest previous record from Mt Carbine
Cicadidae	*Pauropsalta infrasila*	Previously recorded from Bald Hills Station and Isabella Falls near Hope Vale
Cicadidae	*Platypsalta* QKBB sp.1	Also known from Isabella Falls near Cooktown; may be the same undescribed species as from Herberton and Mount Surprise
Cicadidae	*Tamasa burgessi*	No previous records so far inland; possible records from near Shiptons Flat
Cicadidae	*Yoyetta* QKBB sp.1	Previously known from Townsville north to Mount Molloy
Dragonflies and damselflies		
Isostictidae	*Eurysticta reevesi*	550 km northerly extension of the known range and only the second collection of the species
Gomphidae	*Hemigomphus theischingeri*	60 km extension of most northerly range
Vascular plants		
Arecaceae	*Livistona muelleri*	First collection of the species within the study area; first record of any palm on Bonnyglen
Gesneriaceae	*Boea hygroscopica*	First record between the Wet Tropics and Coen
Myrtaceae	*Syncarpia glomulifera*	First record of this genus in the Cape York bioregion
Myrtaceae	*Syzygium pringlei*	Southernmost record of this species
Ophioglossaceae	*Ophioglossum lusitanicum*	First record of this species between Cairns and Heathlands National Park
Poaceae	*Eragrostis jacobsiana*	Southernmost record of this species
Rutaceae	*Zieria aspalathoides* subsp. *aspalathoides*	Northernmost record of this species

Family	Species	Comments
Sapindaceae	*Dodonaea oxyptera*	Northernmost record of this species in Queensland; also in Northern Territory
Scrophulariaceae	*Lindernia alsinoides*	First collections between Cairns and Pormpuraaw
Stemonaceae	*Stemona australiana*	First record between Bakers Blue Mountain and Strathmay (central Cape York); only one previous record in the Einasleigh bioregion
Stylidiaceae	*Stylidium confertum*	Westernmost record of this relatively restricted species; only two previous records in the Einasleigh bioregion
Thymelaeaceae	*Pimelea sericostachya* subsp. *sericostachya*	First record of this species between Windsor Tableland and Coen
Urticaceae	*Pouzolzia zeylanica*	First record of the species between Lakeland Downs and Weipa

Other points of interest

Fauna

Birds

Squatter Pigeons (*Geophaps scripta scripta*) were sighted on Bonnyglen Station. While the northern subspecies (*G. s. peninsulae*) is more abundant, it would be worth monitoring for impacts of habitat loss and degradation, feral species and stock trampling as it is very much a ground-dwelling and ground-nesting species.

In south-eastern Australia and Western Australia, two of the five subspecies of Red-tailed Black Cockatoo (*Calyptorhynchus banksii*) are listed as Endangered. While the northern subspecies occurring at Quinkan is not listed as Endangered it is worth being aware of any impacts of woodland clearing and loss of nesting sites on this species.

Red Goshawks (*Erythrotriorchis radiatus*) are nesting on nearby Lakeland Downs. Little is known of the extent of travel to the north of this Vulnerable (EPBC Act) species.

Reptiles and amphibians

Several reptile species in this area are of interest. The undescribed *Lerista* skink is currently known from only a few square kilometres of the Kimba Plateau. While the plateau is relatively uniform in habitat, and it is reasonable to suppose the skink is widespread throughout, it is important that this be established. Kimba Plateau, and any adjacent suitable habitat, should be strategically surveyed for the extent of occurrence of this species. More widely, the gap between this species and its nearest relative, *L. colliveri*, 500 km to the south near Charters Towers, may well harbour further undescribed species of this genus, which tends to be highly endemic locally and confined to patches of friable soil.

The presence of the Ring-tailed Gecko (*Cyrtodactylus tuberculatus*) as far west as Laura is interesting. When resurrected from synonymy, this species was considered to be confined largely to coastal areas centred on Cooktown. However, recent records at Kings Plains and, during the Bush Blitz, at Laura,

demonstrate that it occurs further inland and in close contact with *C. mcdonaldi* (recorded at Jowalbinna in 2012). A better understanding of the distribution of these two species, while not crucial to successful management, will certainly aid our understanding of the biogeographic history of this area.

The sandstone escarpments of Quinkan are ideal habitat for *Oedura* species (velvet geckos). While the specimens collected on this Bush Blitz key out to the Northern Velvet Gecko (*Oedura castelnaui*), which is widespread on Cape York, their colour pattern was unusual for this species and suggests greater diversity than is currently recognised taxonomically. With a closely related species endemic to nearby Jowalbinna (*Oedura jowalbinna*), further research is warranted. More widespread surveys are needed in the large area of suitable habitat (the sandstone escarpments of Quinkan) with collection of voucher specimens and associated tissue samples.

Invertebrates

Overview

Bonnyglen

Notable finds at Bonnyglen Station included the only specimens of the ant species *Camponotus whitei* and *Myrmecia gilberti*, as well as undescribed cicadas, *Palapsalta* QKBB sp.1 and *Myopsalta* QKBB sp.1; and one of the two specimens of the new species of robber fly, *Colepia* QKBB sp.1. The newly described damselfly *Oristicta rosendaleorum* was collected from wetlands on this property.

Crocodile

Notable finds at Crocodile Station included the new cicada *Graminitigrina* QKBB sp.1, as well as another undescribed cicada, *Nanopsalta* QKBB sp.1, at the F4 site. The only specimen of the undescribed robber fly, *Leptogaster* QKBB sp.4, known previously only from heathlands near the tip of Cape York Peninsula, was also collected at the Crocodile Station hilltop site. The hilltop site also produced one of the two specimens of the new species of bee fly, 'Quinkan' MS QKBB sp.1.

Kings Plains

Notable finds at Kings Plains station included the undescribed cicada *Mugadina* QKBB sp.2, for which a song recording was obtained for the first time during this survey. The only known specimen of *Comptosia* QKBB sp.3 *australiensis* sp. grp was collected here.

Springvale

Notable finds from Springvale included the new damselfly, *Oristicta rosendaleorum*, a new cicada, *Mugadina* QKBB sp.1, and another undescribed cicada *Mugadina* QKBB sp.2. All specimens of the three new species of bee fly *Balaana* were collected at Springvale, as was one of the two specimens of the bee fly *Thraxan nodus*, previously only known from the holotype collected from Coen, 200 km away.

Welcome Station

Notably, the wetland habitats at Welcome Station support a restricted species of dragonfly, *Eurysticta reevesi*, which is otherwise known only from White Mountains near Pentland (west of Charters Towers). Standard Survey Site 2 also produced the only specimen of the undescribed genus and species Asilinae Genus AB sp.B12. SSS1 produced one of the two specimens of the new species of bee fly, 'Quinkan' MS QKBB sp.1, and the only specimen of Asilinae Genus AB sp.B11, a new southern distribution limit.

West Quinkan

Notable finds from West Quinkan included ant species *Froggattella kirbii*, *Strumigenys flagellata* and *Dolichoderus scrobiculatus*, and the undescribed cicadas *Palapsalta* QKBB sp.1 and *Platypsalta* QKBB sp.1. The hilltop site produced one of the two specimens of the new species of robber fly, *Colepia* QKBB sp.1 and the two specimens of the bee fly, *Thraxan ebenus*, that was previously known from only three specimens, the nearest collected 1200 km away. Also collected were the only specimens of the bee flies *Comptosia* QKBB sp.4 *australensis* sp. grp, *Comptosia* QKBB sp.6 *prosimplex* sp. grp, and *Comptosia* QKBB sp.7 *wilkinsi* sp. grp.

Bees

Seventy-five species of native bees were documented during the Bush Blitz, assigned to four families. Seven species are confirmed to be new to science; 23 species were identified to species level and a further 46 species were identified as morpho-species. These may include further unnamed species. In particular, the subfamily Nomioidinae (Halictidae) was highly diverse and may include additional unnamed species.

Ground beetles

The surveyed ground beetle (Carabidae) fauna of the Quinkan Country is defined by mostly new or un-named species (more than 38% of the carabid species). As yet it is not possible to determine if any of the undescribed species are endemic to the Quinkan Country. None of the described species are endemic to the Quinkan Country—all have wider distributions.

Spiders

The surveyed spider fauna of the Quinkan Country is defined by mostly new or un-named species (more than 73% of the spider species found). As yet it is not possible to determine if any of the undescribed species are endemic to the Quinkan Country. None of the described species are endemic to the Quinkan Country—all have wider distributions.

Spider diversity was higher than for any of the previous Bush Blitz expeditions. It was also the highest arachnid diversity recorded, with all but one arachnid order, Palpigradi, taken. Two of the arachnid orders (Amblypygi and Schizimida) and some of the spiders (e.g. *Hygropoda lineata*) are rainforest endemics, the former two being short range endemics unable to disperse and thus indicators that rainforest was once widespread in the area and has now contracted to gullies.

Snails

The species list of land snails collected during the survey of Quinkan Country is reasonably comprehensive for the area as far as family representation is concerned. The named species include a suite of wide ranging species (*Gastrocopta pediculus, Eremopeas tuckeri, Coneuplecta calculosa*) that are known from many rainforest and dry vine thickets of eastern Queensland. While most species are known from the wider 'base-of-peninsula' area, the two range extensions (*Hadra bipartita, Spurlingia monticola*) and the two new species records (Pupinid CY 3, Rhytidid CY 8) show that there is potential for supplementing the inventory of Quinkan land snails with additional collecting.

The land snails highlight the significance of the rainforest habitats of Quinkan Country. While the riparian rainforest along major drainage lines continue to support more widespread species it is the rainforests in the sandstone gullies of West Quinkan that harbour unique and restricted species of land snail. The Bush Blitz land snail survey was able to sample only two of these habitats and yet discovered two new species. Access is an obvious issue for sampling. These gully rainforests appear to be widespread in West Quinkan and mapping of these should be a priority.

Flora

The ATH visited and surveyed several properties during the Bush Blitz—Bonnyglen, Springvale, Welcome, West Quinkan, unallocated state land south of Jowalbinna (Lot 4 on CP887336), and around Laura township. Although important collections were made at all survey sites, the most significant collections were made on the plateaus and gorges of the Quinkan sandstones.

This Bush Blitz provided an outstanding opportunity for biologists to undertake surveys across one of the most poorly surveyed areas of Australia. We have significantly increased the number of botanical collections from the area, and the number of known species. Several of the collections represent range extensions or infills.

Wet season surveys offered an exciting, albeit climatically challenging, opportunity to explore this landscape and see it at its most productive. These surveys contributed significantly to the knowledge of the area's flora, with 16% of the 547 collections representing new species records for an area three times the size of the ACT. On Springvale Station, the first collections from a rainforest-covered basalt hill were made, with 90% of the collections new records from this property.

Observations of vegetation communities were made at most sites visited, contributing to improved regional ecosystem mapping for the region.

Looking to the future, weeds and conservation of local endemic species are our greatest concerns. The lands visited during the Bush Blitz preserve some of the least weed-impacted landscapes in Queensland, and only careful management, hygiene and quarantine can ensure that this status is maintained in the long term.

Rainforest ecosystems were encountered in deep sandstone gorges. These rich ecological communities support a diversity of species dependent on year-round moisture, among them many species seen nowhere else in the study area. Activities (such as water bores) that impact on the aquifers that feed these communities will negatively impact the often meagre surface flows, and must be avoided.

Glossary

Endemic: native to or limited to a certain region.

Exotic species: a species occurring outside its normal range.

Host plant: a species of plant that is used by larvae of insects as food and a place to develop.

Pest species: a species that has the potential to have a negative environmental, social or economic impact.

Putative new species: An unnamed species that, as far as can be ascertained, was collected for the first time during the Bush Blitz.

Range extension: Increase in the known distribution or area of occurrence of a species.

Species range: The geographical area within which a particular species can be found.

Taxon (plural taxa): A member of any particular taxonomic group (e.g. a species, genus, family).

Taxonomy: The categorisation and naming of species. The science of identifying and naming species, as well as grouping them based on their relatedness.

Threatened: Threatened fauna and flora may be listed under Section 178 of the EPBC Act in any one of the following categories—extinct, extinct in the wild, critically endangered, endangered, vulnerable, conservation dependent.

Type locality: The location where the primary type specimen (holotype or syntype series) was found.

Type specimen(s) (holotype, syntypes): The specimen, or set of specimens, on which the description and name of a new species is based.

Undescribed taxon: A taxon (usually a species) that has not yet been formally described and named.

Vascular plants: A lineage of plants that possess well-developed veins (vascular tissue) in their stems, roots and leaves. Vascular plants include the majority of familiar land plants: flowering plants, ferns, conifers, cycads and fern allies, but not mosses, liverworts or algae.

Vouchers (voucher specimens): any specimen, usually but not always a cadaver, that serves as a basis of study and is retained as a reference.

Notes

All publications are available online at:
www.bushblitz.org.au

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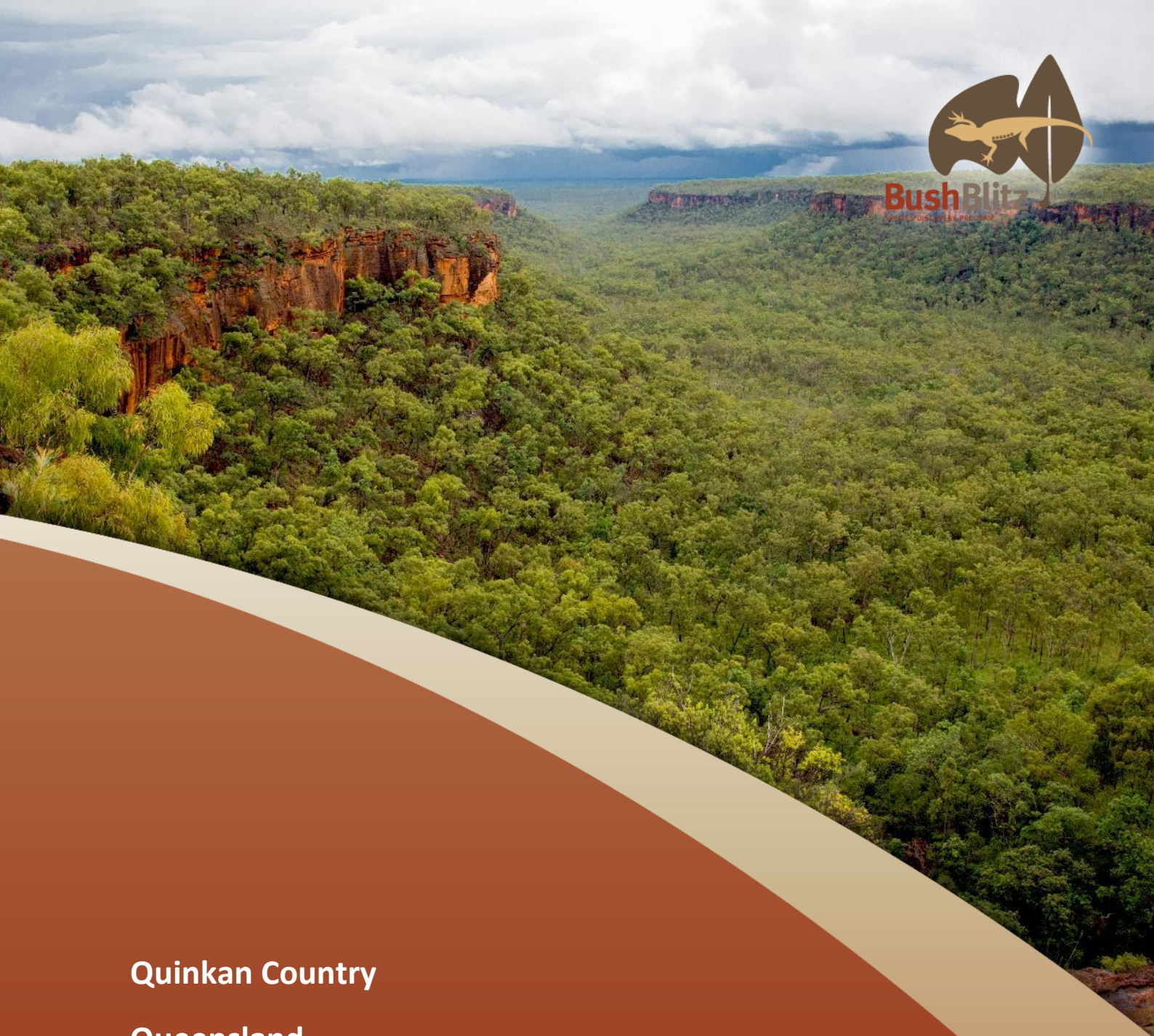

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