A preliminary study of culturally modified sugarbag trees in the Laura Sandstone Basin, Cape York Peninsula, Queensland

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Abstract

Erythrophleum spp. (Cooktown ironwood) is an endemic north Australian tree that is a key cultural resource. In Cape York Peninsula (CYP), Traditional Owners value, use, care for and manage the trees in culturally appropriate ways. Members of the Agayrr Bamangay Milbi (ABM) Project team have recorded hundreds of culturally modified Cooktown ironwood trees (CMTs) across southeast CYP, stretching from Jowalbinna in the south to Cape Melville in the north. In this paper we specifically discuss CMTs with evidence of sugarbag extraction. These trees provide a chronological sequence of technology (from stone to steel axes) and an important, if vulnerable, material record of natural resource procurement, cultural knowledge and connections to Country. We show how the significance of sugarbag trees is reflected not only in their ubiquity but also in the iconography of rock art, other cultural associations and archaeological values. A dearth of metal-cut sugarbag scars – in stark contrast to elsewhere in CYP and despite an abundance of such axes circulating amongst Aboriginal groups in the region – is posited to be related to the especially violent local contact history associated with mining. We discuss trends in distribution that invite more detailed studies of the environmental distribution of the Cooktown ironwood and of the contemporary distribution of native bees, noting that non-cultural burning and land-clearing practices represent ongoing threats to CMT survival in the region.

Introduction

Cooktown ironwood is an endemic Australian tree that is a key cultural resource for Traditional Owners across northern Australia, who value, care for and manage the trees in culturally appropriate ways passed down from their Old People. Since 2021, members of the Agayrr Bamangay Milbi (meaning 'Country, People, Stories', henceforth ABM) Project have recorded more than 1000 archaeological sites across the Laura Sandstone Basin (LSB) of Cape York Peninsula (CYP), Queensland, a study area stretching from Jowalbinna Station in the south, to Princess Charlotte Bay and Cape Melville in the north (Figure 1). The study area includes the National Heritage-listed Quinkan Country (Cole and Buhrich 2012; Department of Climate Change, Energy, the Environment and Water 2024) which, although best known for its abundant rockshelters painted with vibrant rock art, also contains many other archaeological sites, including CMTs, which are the second most common type after rock art sites (ABM Project unpub. data; DSDSATSIP 2024). Among the CMTs recorded during the ABM Project, those associated with the procurement of sugarbag are the most common.

In this paper we describe efforts to identify and document this increasingly vulnerable but important site type and consider what CMTs reveal about the role of sugarbag in Aboriginal lifeways in southeast CYP. Our discussion includes a consideration of what the spatial distribution of such sites suggests about changing land-use patterns following invasion by non-Indigenous peoples.

Historical background to the study area

Until the latter half of the nineteenth century, the Queensland colonial frontier had not expanded into southeast CYP owing to the latter's remoteness, rugged terrain, tropical (wet-dry) climate with its extreme conditions, and the Aboriginal resistance experienced by the earliest Europeans in the area. This relative isolation changed in 1872 when prospects of gold in the Palmer River area were reported by explorer Willian Hann during a government-sponsored expedition (Denaro and Ewers 1995:28; Hann 1873); payable gold was reported the following year by prospector James Mulligan and colleagues (Mulligan 1875; see Comber 1995 and Kirkman 1980, 1984 for histories of the Palmer River goldfield). From 1873 onwards, many thousands of people ventured to the region, travelling inland by foot or horse on rough tracks across rugged escarpments to the rapidly expanding goldfield positioned about 120 km southwest of Cooktown on the coast (Figures 1–2). The Palmer was by far the densest area of non-Indigenous occupation in all of CYP, although the population was both decentralised and mobile, with a high turnover, and the rush lasted only about two decades.

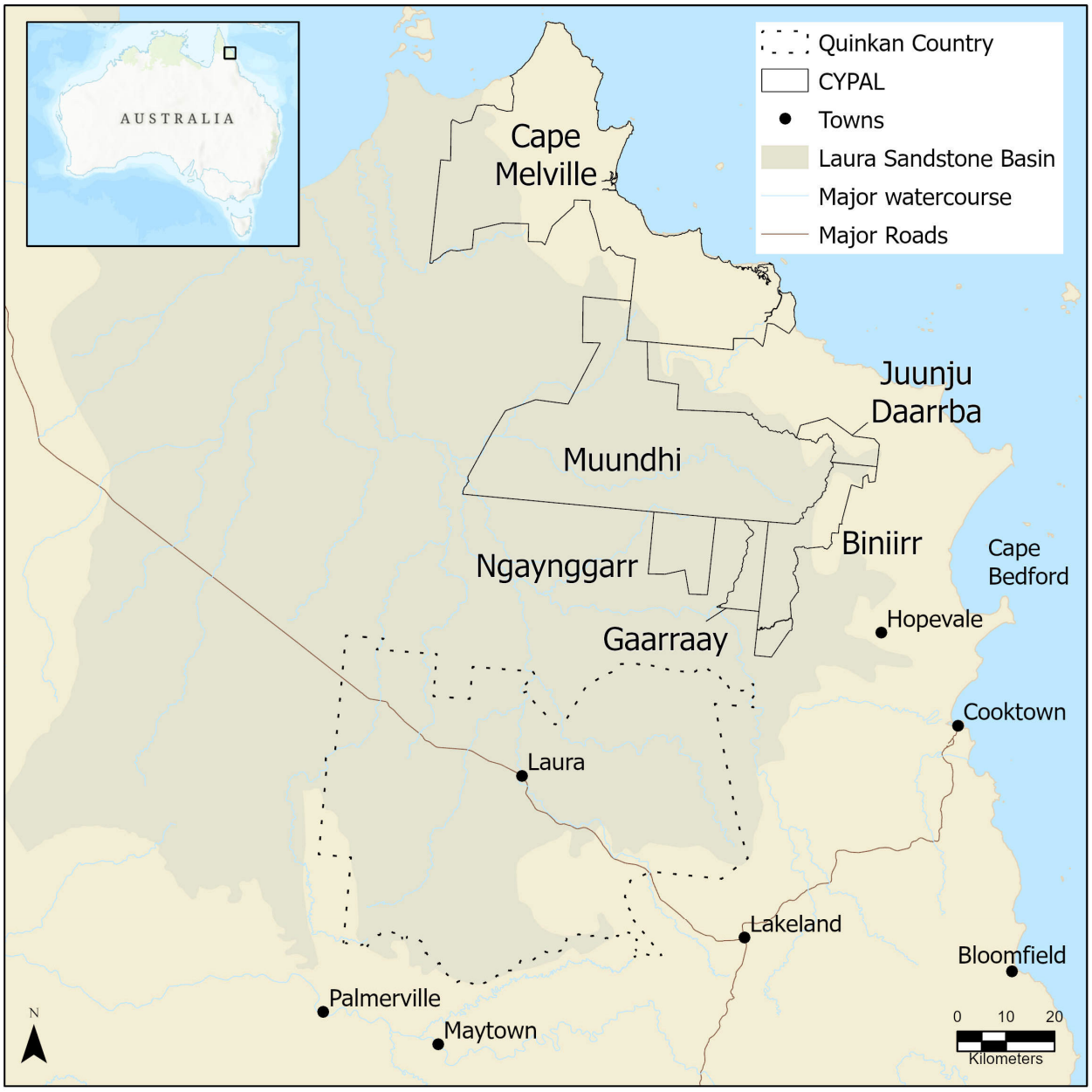

Figure 1. The ABM Project study area.

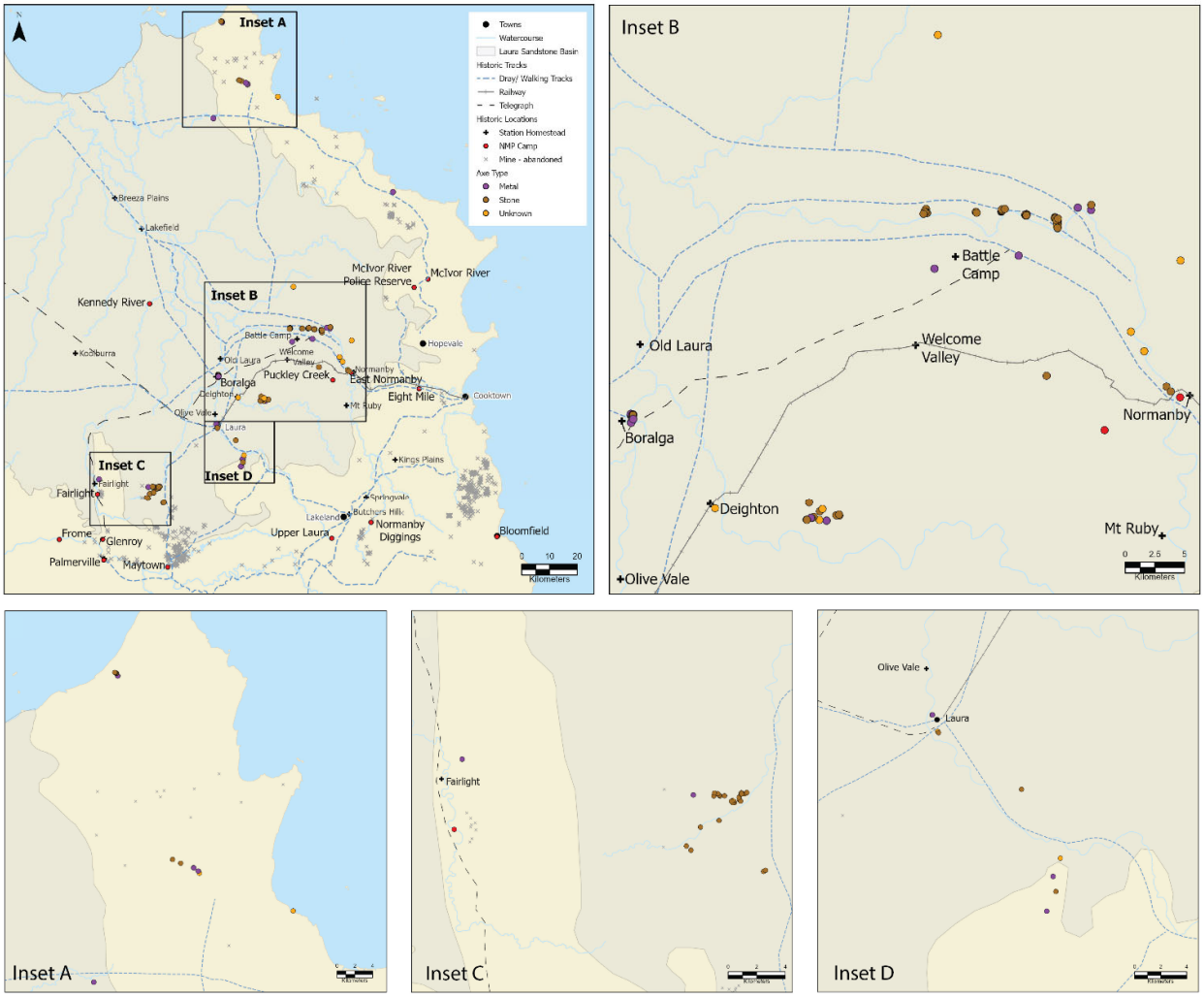

Figure 2. The location of sugarbag CMTs in relation to key historical features.

As pointed out by Colwell (1974:76), the history of the north Queensland mineral fields was different to those further south, where pastoralism had typically already caused substantial disruption to traditional Aboriginal lifeways before prospectors arrived. In southeast CYP, the opposite occurred: pastoralism followed in the wake of mining. Numerous licenses for Crown land were granted after the Palmer was declared, including Butchers Hill and Olive Vale in 1877, Laura in 1879, and Springvale, Lakefield, Koolburra and Kings Plains in the 1880s (Lack 1962:977). The best land (i.e. the lowland plains along larger and more permanent watercourses) was quickly taken up by colonists with hard-hooved livestock, though the region was not well suited to such endeavours. The current system of national parks is largely based on these former (and often unviable) pastoral leases which have slowly been bought back by Government, resulting in conservation being a key land use today (Environment Science and Services 1995:39).

As elsewhere in Queensland, intercultural violence inevitably accompanied the miners, carriers and pastoralists (Burke and Wallis 2019). A detachment of Native Mounted Police (NMP) accompanied the official party of miners and government officials sent to declare the Palmer field open in 1873, engaging in multiple violent interactions along the route before they had even reached the field (HH 1873). Further detachments were diverted to the region as Aboriginal people fiercely resisted the massive influx of outsiders (Cole 2004; Richards 2008; Wallis et al. 2021a). Beginning with Palmerville in 1873, Puckley Creek in 1874 and Lower Laura (Boralga) in 1875, a total of 13 NMP camps were established in or near the ABM Project area, spanning a period of 30 years (Burke and Wallis 2019). While this system became less confrontational from the late 1880s onwards – when NMP detachments with troopers began to be replaced by ordinary (White) police and trackers, and policies of peaceful pacification began to be adopted – NMP patrols were still active in the region until 1903, when the camp at Eight Mile, a short distance outside Cooktown, closed. At the northern extreme of the ABM Project study area, in the vicinity of Cape Melville and Bathurst Bay, later mining activity was associated with the Starcke River in the 1890s (Denaro and Ewers 1995). Although not nearly as intensive as the Palmer, the small township of Munburra and various abandoned diggings represent other key concentrations of European activity.

Violence in the ABM Project area was most pronounced in the early years of the Palmer field. Archival records indicate some 100 known conflict events thereabouts between

1874 and 1880, a minimum number given the characteristic under-reporting of violence against Aboriginal people (Burke and Wallis 2019; Wallis et al. 2021b). Alongside miners, many pastoralists were embroiled in frontier violence, particularly Harry Jones at Boralga, Donald McKenzie at Lakefield and Sinclair Balser at Breeza Plains (Burke and Wallis 2019). Coastal areas were visited by fleets from the pearl and bêche-de-mer industries, which had been established in Torres Strait and on islands off the east CYP coast by 1868; both industries were well-known for kidnapping and forcing Aboriginal people into slavery (e.g. Loos 1974; Meston 1896). Ethnohistoric accounts suggest that Aboriginal people retreated to the high and remote reaches of the escarpment country in order to escape this complex tapestry of violence (Cole 2004; Trezise 1968). In essence, Aboriginal people in this region adapted former seasonal patterns of dry season lowland use and wet season upland use to live mainly in remote upland areas year-round, making only quick forays down on to the river flats (Cole 2004).

Although missions were established in 1886 at Cape Bedford (by the Lutherans) and on the Bloomfield River (by the Moravians) (Evans 1972), some families continued to live independently on their homelands until the 1920s or later, when they finally 'came in' to pastoral stations and fringe camps near towns (Cole 1998, 2004, 2010; Trezise 1968). The struggling Cape Bedford mission subsequently expanded to encompass a second station at Hope Valley (now Hopevale township), which became the sole site of the mission in 1900. The Bloomfield mission closed in 1902, although a reserve was re-established on the river in 1957, becoming the government settlement of Wujal Wujal. Hope Valley continued as a mission until 1942, when its inhabitants were forcibly removed south, and in 1949 was rebuilt at a new site on the Endeavour River (Pearson 1986), where it continued to function as a mission until 1986 when it became an independent community (Ganter n.d.; Ganter and Creswick n.d.).

An overview of Cooktown ironwood

Taxonomy

Cooktown ironwood (*Erythrophleum* spp.) is endemic to northern Australia, being found from the Kimberley region across to north Queensland (Atlas of Living Australia 2024). A recent study has suggested the need for taxonomic revision of the genus, splitting it into three species with different ranges. *E. chlorostachys* – previously considered to be the only species – is restricted to rockier substrates with shallower soils found across 'the eastern Kimberley through the northern third of the Northern Territory (NT; the 'Top End'), into northwestern Queensland' (Barrett and Barrett 2023:402). A separate species, *E. pubescens* – a designation not yet reflected in the Atlas of Living Australia or other literature – is reportedly more widespread, stretching from the western Kimberley eastwards into the deep sandy soils of CYP. A third species, *E. arenarium* was recognised by Barrett and Barrett (2023) as being restricted to the Great Sandy Desert and Dampier Botanical Districts in northwestern Australia. As such, and although it is yet to become common nomenclature, herein we are concerned with *E. pubescens*, the species to which Barrett and Barrett (2023:418) suggested the 'Cooktown ironwood' name should logically be transferred.

Ecology

Much information regarding the ecology of Cooktown ironwoods was drawn together by Taylor (2002) in a commissioned ecological study aimed at identifying sustainable harvesting practices for the tree in the Northern Territory; it seems likely that the papers therein incorporated knowledge of all three species, but the findings remain pertinent here. Generally speaking, Cooktown ironwood is a distinctive semi-deciduous tree with tessellated bark and very dark, small leaves that contain high levels of alkaloids, making them often fatal to livestock (Cribb and Cribb 1981; Griffin et al. 1971). As reported by Boland et al. (1984), it is one of the densest and hardest timbers known in Australia, meaning it is largely impervious to termites. In CYP, ironwoods are easy to identify visually, set against the predominantly lightly-coloured eucalypt and melaleuca trees that dominate the open woodlands (Neldner and Clarkson 1995; see Figures 4a and 6a). The genus is known generally to be long-lived and slow to decay, and even after death an individual tree can remain standing for extended periods of time. Growth rates vary considerably depending on local factors such as soil and water (Taylor 2002:6), but ecologists argue there is a broad relationship between tree girth and tree age. For example, studies of ironwoods in Kakadu National Park, Northern Territory, showed that trees with a diameter at breast height (DBH) of 40 cm (girth ≈ 125 cm) were 'at least 110 years old' (Taylor et al. 2002:6). Other studies, however, suggest that in undisturbed savannah areas trees with an approximately 35 cm diameter (girth ≈ 110 cm) could be up to 300 years old (Cook et al. 2005; see also Taylor et al. 2002).

Indigenous cultural uses

Although the archaeological preservation of CMTs is limited to the late Holocene, Cooktown ironwoods have likely been a key cultural resource for Aboriginal people since shortly after human arrival in CYP, currently considered to be at least 37,000 years ago (David 1993) and not more than 65,000 years (Clarkson et al. 2017). The termite-resistant heartwood was commonly removed for the production of spearthrowers and other wooden artefacts such as 'spear smoothers' as well as to access sugarbag, the sapwood removed to produce medicine, and the bark used for shields, carrying containers, mortuary containers and shelters (e.g. Cole et al. 2020; Hale and Tindale 1933; Khan 1993, 1996, 2003, 2004; Morrison and Shepard 2013; Morrison et al. 2012; Roth 1898, 1899a, 1899b; Tutchener 2018; Tutchener et al. 2019). Resin could also be harvested from the roots for use as a mastic (Matheson and McCollum 2014; Roth 1898; Taylor 2002; Troy Michael, pers. comm., 2024), and the smoke from the burning leaves had a variety of medicinal purposes, also being used to repel rain, spirits and mosquitos, and 'warm' people as a part of welcome to Country events. The latter activities obviously leave no archaeological trace but are still a vibrant part of contemporary cultural practice across the ABM Project area.

Unlike in other parts of Australia, there is currently no evidence to suggest that Aboriginal people in CYP regularly used beeswax to make additive rock art motifs (e.g. Brandle 1968; Nelson et al. 1995). Although Percy Trezise advised Noelene Cole that he had once located a beeswax figure in the vicinity of the Deighton River, none of the authors of this paper have seen the site he referred to, and we have not been able to locate any specific records that appear to relate to it.

In 2023 ABM Project team members recorded a single, large quadruped motif in a rockshelter in the Melsonby Freehold area (immediately west of Gaarraay) created with some form of additive, though it did not bear any visual similarity to beeswax motifs known from the Northern Territory. Destructive sampling of this material has not yet been undertaken owing to cultural constraints, but it is strongly suspected to be resin rather than beeswax.

Cooktown ironwoods are also valuable as the habitat of various animals, such as birds, possums and flying foxes, and hollow trunks are a favoured habitat for native bees, whose sweet honey is a highly sought-after delicacy (Figures 4b and 4c). Sugarbag generally refers to the composite of the wax and honey that is extracted from the hives of native Australian stingless bees (primarily *Tetragonula* [formerly *Trigona*] and *Austroplebeia* spp.) (Dollin et al. 1997; Halcroft et al. 2012; Houston 2018; Zborowski et al. 1995). The bees favour small openings in hollow trunks, allowing for protection from most predators, but these small openings were, and still are, widened by people using an axe to allow for easy extraction. Extraction often involved the use of some form of implement that was inserted through the entrance to 'mop up' the delicacy:

> a handful or two of a particular kind of grass (*Spinifex hirsutis*) … is rubbed up between the hands, with water if necessary, and then dried. It is often to be seen carried about in the dilly bags … *Malaisia tortuosa* is also used for a similar purpose, the extremity having been previously well chewed into its constituent fibres; this is poked up some hole after the sugarbag, and likewise carried from camp to camp (Roth 1898:29).

Likewise, and specifically at Princess Charlotte Bay, Hale and Tindale (1933:112) documented lawyer cane being used for obtaining sugarbag in a similar fashion:

> one end of a long cane is frayed till it forms a brush; the brush like end is inserted into the opening in a tree leading to a bees nest, and is twisted about until a mass of honey and comb is collected on it.

Pleated bark containers from the Bloomfield River area (to the southeast of the ABM Project study area) 'are stated in museum archives as having been used to transport honey' (Langley 2023:121).

Non-Indigenous cultural uses

The characteristic attributes of hardness and density that made Cooktown ironwood trees so attractive to Aboriginal people for artefact manufacture also made them valuable to non-Indigenous people. Macknight (1976) reported that as early as the 1600s ironwood timber was highly prized by Macassan trepang fishermen for use in ship construction. Across northern Australia, Europeans also quickly recognised the value of the timber for fencing, house construction, railway sleepers, boat building, and as a source of firewood and charcoal, as well as for other miscellaneous uses (Lake 2015; Swain 1928). Markets for Cooktown ironwood still exist, despite the 1988 World Heritage listing of the Wet Topics rainforest in north Qld having caused a sharp decline in supply (Hopewell 2001; Suh et al. 2004:1).

Methods

Field recording

The ABM Project area includes several national parks (Muundhi, Gaarraay, Biniirr, Juunju Daarrba Nhirrpan [JDN], and Cape Melville), certain parcels of freehold land, and areas in which the Laura Rangers have longstanding cultural responsibilities to care for heritage sites (such as large swathes of the National Heritage-listed Quinkan Country, and parts of the recent Kuku Warra and Possum Native Title determinations) (Figure 1). Recording of CMTs during the ABM Project occurred either during (a) general pedestrian surveys in escarpment country, or (b) deliberate and systematic surveys of stands of ironwood alongside watercourses in valleys and plains. Although the ABM Project team has now completed three years of survey, a large proportion of the extensive study area remains to be comprehensively examined. Given the ruggedness of the topography and the often-dense vegetation, many survey areas are only accessible by helicopter or along existing, though limited in extent, 4WD vehicle tracks.

CMTs were recorded using standardised recording forms on electronic tablets. These forms have been designed to record both tree and scar attributes, and include contextual data (such as location, distance from water, vegetation type, etc), information about the tree itself (such as height, tree girth at approximately 1.5 m above ground, health status, etc), and attributes associated directly with the cultural scarring (such as aperture dimensions, and axe mark type and size). Stone axe marks are generally shallow and oval-shaped, whereas steel axe marks are generally sharp and straight (Figure 7). For details of all attributes recorded and their definitions, we direct readers to Morrison and Shepard (2013) and Cole et al. (2020), as the same approach was applied here. After documentation, an interpretation is proffered as to the scar purpose, being either for sugarbag procurement, large material culture items such as shields or coolamons, smaller material culture items such as woomera or spear/resin smoothers, toe-holds or other/unknown. Digital photographs, including contextual, general and detailed views, of each tree are also recorded. All collected data are stored in a password-protected online database that is accessible to all members of the respective Traditional Owner group.

Distinguishing between natural and cultural scars was sometimes difficult, hence recorders erred on the conservative side when there was any doubt about the nature of a scarring event. All entries were double-checked by experienced CMT recorders to confirm the cultural nature of the scar and its interpretation. Most sugarbag scars were immediately obvious from the presence of clear axe marks around the aperture which left little doubt as to their cultural origin. While numerous trees had other, non-sugarbag scars (such as toe-holds), such features are not considered herein.

Spatial analysis

Mapping and spatial analysis of the collected field data used ArcGIS Pro to further explore the distribution of sugarbag CMTs in relation to waterways, historic places and landform units. The CMT dataset was extracted from the ABM Project database (which includes 'legacy data' from previous projects) and excluded CMTs with inadequate spatial or attribute data.

Waterway data were extracted from a 1:250,000 hydrographic layer created by Geoscience. Land system information and locations of historic mining activities were obtained from Queensland Globe (State of Queensland 2024), and colonial-settler locations were obtained from a variety of sources, including the NMP database (Burke and Wallis 2019), ABM Project database, Queensland Globe, Bonzle (for head station locations) and historic maps. Where relevant, historic maps were georeferenced to re-locate features such as transportation routes, as well as telegraph and railway lines. While georeferencing was done using as many ground control points as possible, given the inaccuracy of many historic maps there is an unavoidable degree of uncertainty relating to some features.

A 'spatial join' analysis allowed an exploration of CMT locations within and across land systems, while distance and intersect analyses were undertaken in order to better understand spatial distributions. The 'Near' tool in the ArcGIS Pro Spatial Analyst toolbox was used to determine the proximity of CMTs to both major (e.g. Normanby, Jack, Deighton, Laura and Little Laura Rivers) and medium (i.e. tributaries of the aforementioned rivers) waterways. The Near tool measures the closest distance between the selected target (in this case, sugarbag CMTs) and the nearest designated features (in this case, waterways). Distance analysis also determined the location of each sugarbag CMT in relation to the nearest historic tracks, drawing concurrently from both line and point data for nearest features. While these analyses are simple and involve little statistical assessment, they assist in building a picture of the ways in which Aboriginal people adapted to European incursions.

Results

Of 288 CMTs recorded in the ABM Project database, 150 are known to contain sugarbag scars (note these figures are as at 1 March 2023; the figure has increased through the ABM Project 2024 field season). Of those, 127 are within the ABM Project area and have had detailed information recorded of their key attributes, allowing their inclusion in this study. Figure 2 shows their distribution. Nearly all (n=125) are Cooktown ironwoods; the other two are dead and too poorly preserved to be confident of their species, but they are likely also to be ironwoods. As shown in Figure 5a, 87 of the trees are alive and standing, while 40 are dead, with 10 of the dead trees having fallen, one only very recently (see Figures 6a–d).

The girths of 122 CMTs are shown in Figure 5b. Nearly three-quarters have a girth of 100–200 cm, with 11% falling between 200–300 cm; one exceptionally large tree had a girth of 382 cm. Average girth measurement is 143 cm.

Collectively, the 127 trees preserve 193 sugarbag scars. Most trees (n=82, 65%) possess only one such scar, while the remainder have up to five scars scattered up their trunks, usually all facing the same direction (Figure 5c). Figure 5d shows that 140 of the scars were made using a stone axe and only 27 using a metal axe; the axe type for the remaining 26 could not be determined because of weathering (see also Figure 7).

Without exception, all trees have a height greater than 10 m. A little under half of the scars (n=87; noting that 10 scars had no data recorded for height above ground) are located on the lower reaches of the trunks (below 1.5 m), suggesting they could have been cut by a person standing on the ground (Figure 5e); 96 are higher and would have required assistance to reach them. This may have been via use of a strategically positioned branch, by cutting deliberate toeholds, or using the lower and older scars as toe-holds to facilitate reaching higher nests.

As summarised in Table 1 and shown in Figure 3, the majority of sugarbag CMTs are located on the Leinster land system, consisting of old alluvial plains vegetated by stringy-bark woodland. The next most common land systems for sugarbag CMTs are Balurga, Starcke and Koolburra, with 28, 24 and 19 trees, respectively. The Starcke land system consists of mountainous terrain and sandstone plateaux, while Balurga and Koolburra consist of low plains and plateaux.

As might be expected, sugarbag CMTs are closely aligned with areas of deep sandy soils, which are often associated with river flats. The minimum distance from a sugarbag CMT to a waterway is 15 m, the maximum is 1225 m, and the mean distance is 385 m. As can be seen in Figure 2, sugarbag CMTs are fairly evenly distributed across the study area, with no significant associations with European activity foci, including the Palmer goldfield and its various travel routes. The maximum distance is 13.5 km, with a median distance of 2.7 km. Most of the sugarbag CMTs possessing metal axe scars are more than 1 km from a known historic site.

The following section considers these results in the broader context of intercultural relations in the nineteenth century, the distribution of native bee populations today, and threats to the continued survival of the Cooktown ironwood and this distinctive site type.

Discussion

Sugarbag CMTs in the landscape

> Bees are hunted by sight. It seems that all these aboriginals [sic] speak of a little- and big-bee sugar bag, the former kind, been considered a special delicacy and reserved usually for the older men. On inquiry from Europeans, who are versed in the matter, I learn that these two kinds do not constitute two species of native bee, but distinguish the young from the old (big bee) brood (Roth 1898:31).

At a general landscape level, and perhaps unsurprisingly given their ecological requirements, the majority (97%) of CMTs with sugarbag scars are within 1 km of a (perennial) waterway. Waterways were significant to Aboriginal people for a variety of reasons. Ethnographic sources indicate rivers were used as pathways for travelling through country, and feature heavily in Creation stories and other oral histories (Roth 1898, 1899a). They were also important places for hunting and foraging, with many aquatic fauna featuring in regional rock art assemblages (ABM Project, unpub. data; Cole et al. 2024). While the distribution of sugarbag CMTs is in part a function of the distribution of the Cooktown ironwood, it is also clearly driven by food gathering activities and travel routes being predominantly along waterways, a practice well-documented in the Normanby River system (Cole et al. 2020; Rigsby and Cole 2007) and Wenlock River to the north (Tutchener 2018:207). When sugarbag extraction is separated into those scars cut with stone axes and those cut with metal ones, however, the situation becomes more interesting. Within the complex cross-cultural landscape of southeast CYP, the low frequency of metal cut sugarbag scars (n=22 or 17% of the assemblage) is surprising, especially in light of comments made by some early Europeans in the region.

Although sustained European incursion into the ABM Project area was unknown before 1872, sporadic contacts with Europeans had occurred as early as 1770, when Captain James Cook gave gifts of iron to people at the Endeavour River (now Cooktown) (Jack 1921:86). Peter Good, the gardener on Matthew Flinders' 1802 journey north along the CYP coastline, described meeting Aboriginal people near Cape Bedford who 'knew iron well & called it tooree. It was most desired by them' (Edwards 1981:98). Flinders' party also gifted iron hatchets to Aboriginal people further around the coastline, probably near Princess Charlotte Bay, on 20 November 1802 (Edwards 1981:102).

Edmund Kennedy and party were the first Europeans to travel overland through the region, skirting the western edge of the ABM Project area in 1848 on a route that took them from Rockingham Bay (Cardwell) in the south, to Temple Bay near Cape Grenville, and then on to the tip of Cape York. Even at that date, William Carron, a member of Kennedy's party, noted that Aboriginal people at Rockingham Bay 'had frequently seen' white men before, 'as parties have landed on the beach from surveying vessels' (Carron 1965:3). Despite this, Carron made no mention of metal in any of the Aboriginal camps they entered north of Rockingham Bay, although he did note 'some pieces of glass bottle' in a camp near Princess Charlotte Bay (Carron 1965:59). Following the disastrous end of the expedition, the final base camp near Weymouth Bay was abandoned, and its contents almost immediately 'rifled' by Aboriginal people (Carron 1965:88). The other two early European overland expeditions – Ludwig Leichhardt's in 1845 and Alexander and Frank Jardine's in 1864 – travelled to the south and west of the ABM Project area, providing little information on activities or toolkits of direct relevance to this study. In the wider region, however, the Jardines observed the 'neat cutting' of marks on trees near Cape Grenville that indicated the presence of 'good iron tomahawks' (Byerley 1867:51) and within the space of a year, John Jardine was able to comment that at Somerset stone axes had been 'now nearly superseded by iron axes obtained from the Europeans' (Byerley 1867:83).

In 1872 William Hann (1873) was the first European to focus exploration on portions of the ABM Project area. A group of people unexpectedly encountered by Hann in the country between the heads of the Normanby and Daintree Rivers dropped all their possessions and fled, leaving tomahawks behind that were 'all of iron'. In a camp at the head of West Normanby River Hann found other pieces of iron, including a rod that had been used as a digging stick. Two years later, perhaps 100 km from Cooktown, prospector James Mulligan reported in November 1874 that 'nearly all the tomahawks' carried by local Aboriginal people were 'of English make' (Mulligan 1875:26). That same year Mulligan raided an Aboriginal camp near Princess Charlotte Bay, recovering '[a] hammer made of stone [and] a tomahawk ground out of a piece of inch iron' (Jack 1921:462). Writing from Lower Laura, NMP Sub-Inspector Stanhope O'Connor (1877) noted tomahawks in Aboriginal camps 'made of all kinds of iron such as: bolts, pieces of tines, guard irons, old chisel etc.' (see also Cole et al. 2020). The fact that the Aboriginal group Hann encountered in 1872 had completely replaced their stone axes with iron ones suggests there was an ample supply of these objects, although whether sourced from European outposts in the south (e.g. Einasleigh and Georgetown), north (Somerset) or west (e.g. Normanton) is currently unclear. Other possible sources are people engaged in the coastal trepang and pearl fisheries.

The low frequency of metal-cut sugarbag scars is therefore surprising. Elsewhere in CYP, such as on the Wenlock River (Tutchener 2018:210) further north, metal-cut sugarbag scars outnumber those of stone by nearly four to one. As the peak Palmer gold rush (1874–1878) would have provided far more opportunities for Aboriginal people in the southeast to acquire metal axes, regardless of whether by stealth or negotiation, the disparity with the situation in the north is anomalous. Although many Cooktown ironwood trees may have simply failed to survive to the present to be recorded, this on its own is an insufficient explanation, given that fire regimes, clearing and other forces impacting their survival are broadly similar across the Peninsula. Further, there is no reason to expect that the Aboriginal people of southeast CYP were any less creative in incorporating European materials and items into traditional toolkits than other groups elsewhere.

We suggest there are three possible explanations for this divergent pattern. First, it is possible that refined sugar may have become more easily available to Aboriginal people after European incursion, and they therefore largely ceased sourcing their sugarbag from Cooktown ironwoods. However, if this was the case, we would expect this to be similar across CYP. Other research, however, suggests that sugarbag extraction elsewhere became more, rather than less, common in response to European presence. Morrison and Shepherd's (2013:155) work around the Weipa mission, for instance, found a 'positive relationship between proximity to settlements and high collection intensity' of sugarbag as part of an increased economic imperative to trade honey to the mission in return for credit (Morrison et al. 2010). This was especially the case in the first few decades of the twentieth century when the use of small metal hatchets increased, and after the 1940s, when larger, long-handled axes were used to fell trees to remove greater quantities of honey (Morrison et al. 2010). Tutchener (2018:255–259) similarly found a spatial correlation between the use of metal axes for sugarbag extraction and historic 'hot spots' on the Wenlock River, where, after 1900, metal-cut sugarbag scars increased in number and clustered around European places of employment, such as stock yards.

A second possible explanation is that the intense and extended cross-cultural violence known to have characterised the ABM Project area decimated local Aboriginal communities far more so here than in western CYP, subsequently reducing the number of people able to forage for sugarbag, and placing other restrictions on people's movements where they did survive. Spatially, a comparison of the distribution of metal-cut sugarbag scars here and elsewhere on CYP provides some insight. Twelve of the 22 metal-cut scars are located within 2 km of a historic feature; only one is more than 10 km away. This suggests that, unlike the situations on the Wenlock River and at Weipa, Aboriginal people in southeast CYP were avoiding European nodes, at least in terms of their foraging activity. Other local evidence for changing resource procurement behaviour, possibly as a result of European incursion, is a shift in rock art style and pigment in the most recent art phase of the region (Cole 1988:159; Trezise 1971:129).

In this sense the soundscape may have been important: the sound of any axe cutting into the dense timber of the Cooktown ironwood rings out loudly and clearly, and can

travel more than 1 km, and is therefore an activity best avoided near settlements if people's movements and presence are to be kept quiet. Moreover, there is no suggestion that this situation changed in the late nineteenth or early twentieth centuries after conflict had wound down. Unfortunately, it is not possible to (a) provide any further temporal resolution to the sugarbag scars, and (b) as ABM Project data on aperture size have not been reliably captured, closer comparisons with Morrison and Shepard's (2013) or Tutchener's (2018) data are precluded. Morrison and Shepard's concentration on a mission landscape is also outside of the ABM Project's remit, since the closest mission is at Hopevale near the eastern coast, where little archaeological research has been undertaken. A previous project documenting the Lower Laura (Boralga) NMP camp recorded 31 CMTs around the margins of the police camp, two of which had sugarbag scars cut with metal and stone axes (Cole et al. 2020:26). The metal-cut scars were consistent with the use of small hatchets (tomahawks), and were possibly cut by troopers, especially given that portable tomahawks were standard NMP issue. The specific circumstances of their production therefore make them less useful for comparison.

Last, it is also possible that the cultural significance of sugarbag encouraged the re-use of older hives, rather than a constant search for new ones. The cultural significance of sugarbag is reflected in its use as a language name. Agu Aloja (Sugarbag) language was the local dialect of Kuku Thaypan used 'towards Laura' (Rigsby 2003:2; see also Rigsby 1976). Information shared by now deceased senior Kuku Thaypan man Dr Tommy George made it clear during discussions with Cole that sugarbag trees were not randomly gathered and were 'owned' by specific families/people, who would return periodically and monitor the hive. Tommy George related to Cole how, in the Storytime, a young girl vanished into a lagoon after failing to follow protocols of collecting sugarbag, such as carefully washing one's hands. Part of the cultural protocols involved curating cut holes, ensuring they were covered over with a mixture of mud and grass after sugarbag extraction:

> put it [grass] underneath. Stop the hone. They would build hive over. You shut him kwerl enyal apun [with a wad of softened sugarbag grass fasted to the end of a stuck]. Aerei boyl. He shut up next. The eye is still up there, he stop there … If the axe mark is big and a lot taken, bees will go next somewhere else (as cited in Standley 2019:355).

Thus, if people were careful in how they made the hole and treated it afterwards, it was possible for the same sugarbag source to be returned to repeatedly. As a result, even though metal axes had been acquired, people may have continued to use older holes cut with stone axes. Despite the seismic sociocultural and economic upheavals affecting Aboriginal people's everyday life after invasion, the different marks made by stone and metal axes record a scenario in which cultural methods and protocols for harvesting native honey continued. These traditional sugarbag extraction methods were sustainable and generally encouraged the survival of the hives, unlike felling.

Depictions of sugarbag in painted rock art

The cultural value of sugarbag is also demonstrated in the iconography of rock art, where circular/oval motifs with dot infill have been advised by Traditional Owners as representing hives and bees (Cole 1988; see Figure 8). Such motifs are painted widely across the central and southern half of the ABM Project study region, echoing the abundance of sugarbag CMTs, on rockshelter walls and ceilings and occasionally on exposed rock faces. They sometimes occur in specialised situations, such as long flat wall panels and recessed or indented sections of the rock face that conform to the shape and dimensions of the subject, suggesting careful, non-random placement.

Sugarbag motifs are stylistically distinctive, consisting of elongated oval forms that characteristically have a small pipe-like projection jutting out from the side or end, the latter representing the often-times distinctive entrance tunnels of hives (Figure 4c). Many, though not all, sugarbag paintings are depicted alongside clouds or swirls of dots, often swarming from the projection or one end of the beehive, that Traditional Owners have identified as bees. Occasionally bees are even depicted naturalistically with wings. Sugarbag motifs are often painted in bichrome colours following the usual style of Quinkan pigment art (Cole 1988, 1995, 1998), i.e. the paintings are in red/maroon with white accents/outlines, and less often feature yellow. Interestingly, sugarbag motifs are frequently involved in superimpositions with other motifs, particularly super-sized figures (in this case c.150–300 cm in length) of the type Trezise (1971:9) identified as 'totemic ancestors'.

Age of trees

Although Cooktown ironwood trees can live for hundreds of years, being largely impervious to termites (see above), even the healthiest tree will ultimately succumb to old age and die. This means that CMTs are a diminishing resource. Unfortunately, there are no reliable methods for ascertaining when a scar was made. Here we start with two assumptions. The first is that the circumference or girth of a tree can function as a proxy for its age, assuming that larger (thicker) trees are older, in line with ecologists' arguments. This, however, only tells us about the potential age of the tree, rather than the scar that was cut into it. While this method is fraught with problems, it is currently the only, non-destructive method available for broadscale relative dating of CMTs (Dardengo et al. 2019; cf. Morrison et al. 2012). The second is the broad assumption that scars made with a metal axe in this area will post-date 1872.

As noted above and shown in Figure 5b, most CMTs recorded for the ABM Project are well over 90 cm in circumference, suggesting they are generally hundreds of years old, based on the findings from ecological studies of ironwood tree growth rates. Given that 15 of the recorded CMTs in our study have girths of over 200 cm, it is perhaps not unreasonable to suggest that these particular trees might be up to 1000 years old.

Although limited data are available, sugarbag scars made with metal axes tend to be on older trees with a girth of 128–200 cm, although it is unclear why this should be so, and it may be an artefact of sampling. Unlike harvesting most items of material culture, which require a tree big (and thus old) enough to have a sufficiently large tract of clean heartwood or bark available for removal, harvesting sugarbag requires only a suitable hole to a section of hollowed trunk in the tree for a bee population to make their hive. A study by Braithwaite et al. (1985) of 183 ironwood trees with a diameter of 10 cm or

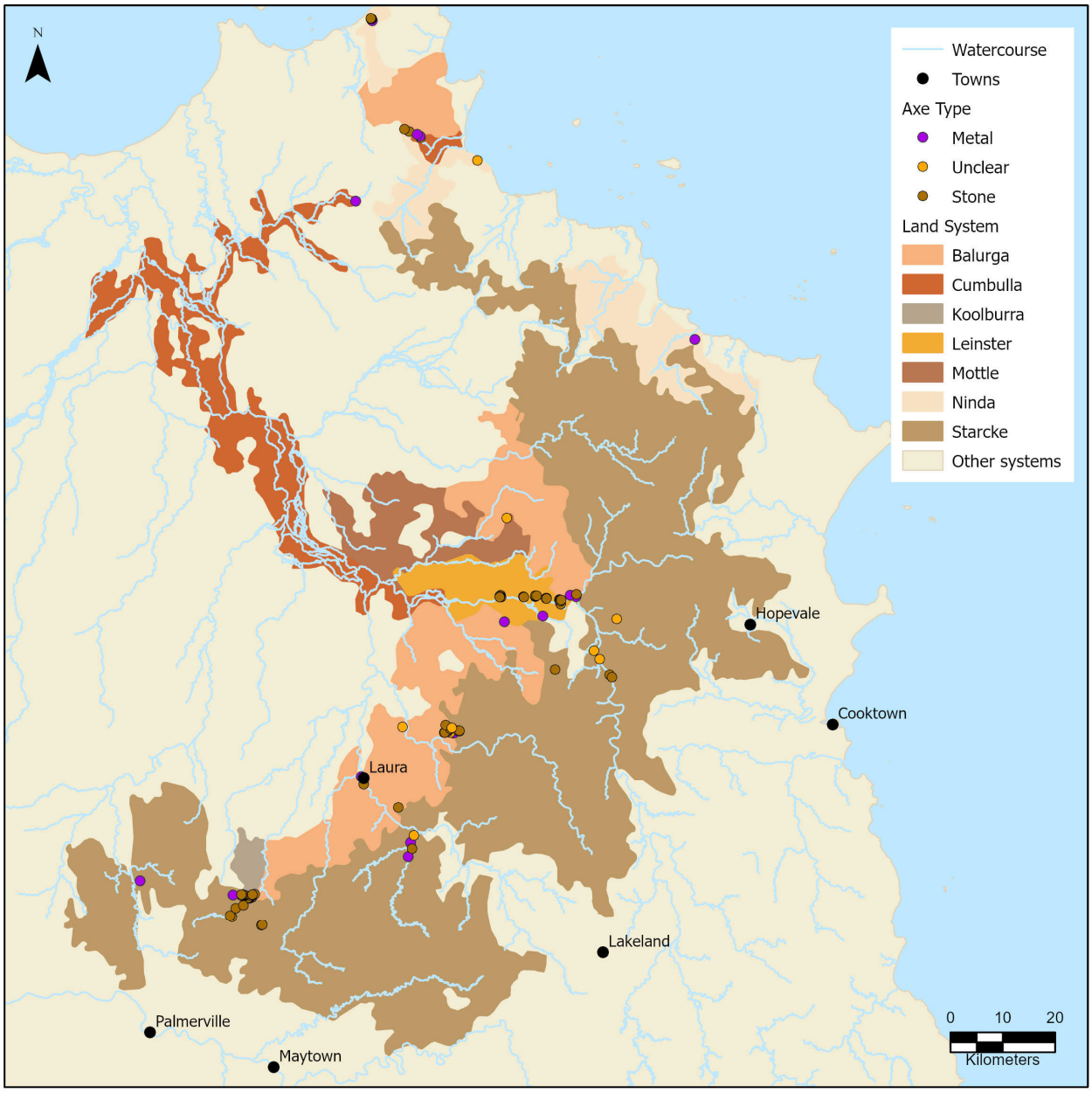

Figure 3. Map showing the location of sugarbag CMTs in relation to land systems.

Table 1. Sugarbag CMTs and their associations with land systems across the study area (authors' data and Queensland Globe).

Land System	Description	Count
Ninda	Colluvial and alluvial apron and fans; texture-contrast soils; mostly paperbark woodland but very variable.	10
Cumbulla	Alluvial plains in part actively forming and largely flooded in the wet season; texture-contrast soils; paperbark woodland.	2
Starcke	Mountains on volcanics, granite, greywackes and other sediments; deeply dissected plateaux on quartz sandstone; shallow rocky soils; ironbark or mixed eucalypt woodland.	24
Balurga	Extensive plains on weathered terrestrial sediments; sandy red and yellow earth and uniform sandy soils; bloodwood-stringybark woodland, some paperbark woodland.	25
Mottle	Extensive plains on weathered terrestrial sediments, siltstone and alluvium; massive earths; paperbark or bloodwood-stringybark woodland.	1
Leinster	Extensive uniform old alluvial plains; leached grey and brown massive earths with hardpan; paperbark or bloodwood-stringybark woodland.	46
Koolburra	Plains and low plateaux on weathered Tertiary sandstone; sandy red earths; bloodwood-stringybark woodland, some paperbark woodland.	19

Figure 4. (a) General view of a Cooktown ironwood tree, with Lynley Wallis and Mia Dardengo in view. (Photograph: Samantha Lowdown); (b) a contemporary native bee hive in a Cooktown ironwood tree in Cape Melville National Park (Photograph: Tony Pagels); and (c) detailed view of the small entrance to a contemporary native bee hive in a Cooktown ironwood tree on Jowalbinna Station (Photograph: Heather Burke). These holes are often specifically shown on painted motifs of sugarbag scars where they are a defining feature (see Figure 8).

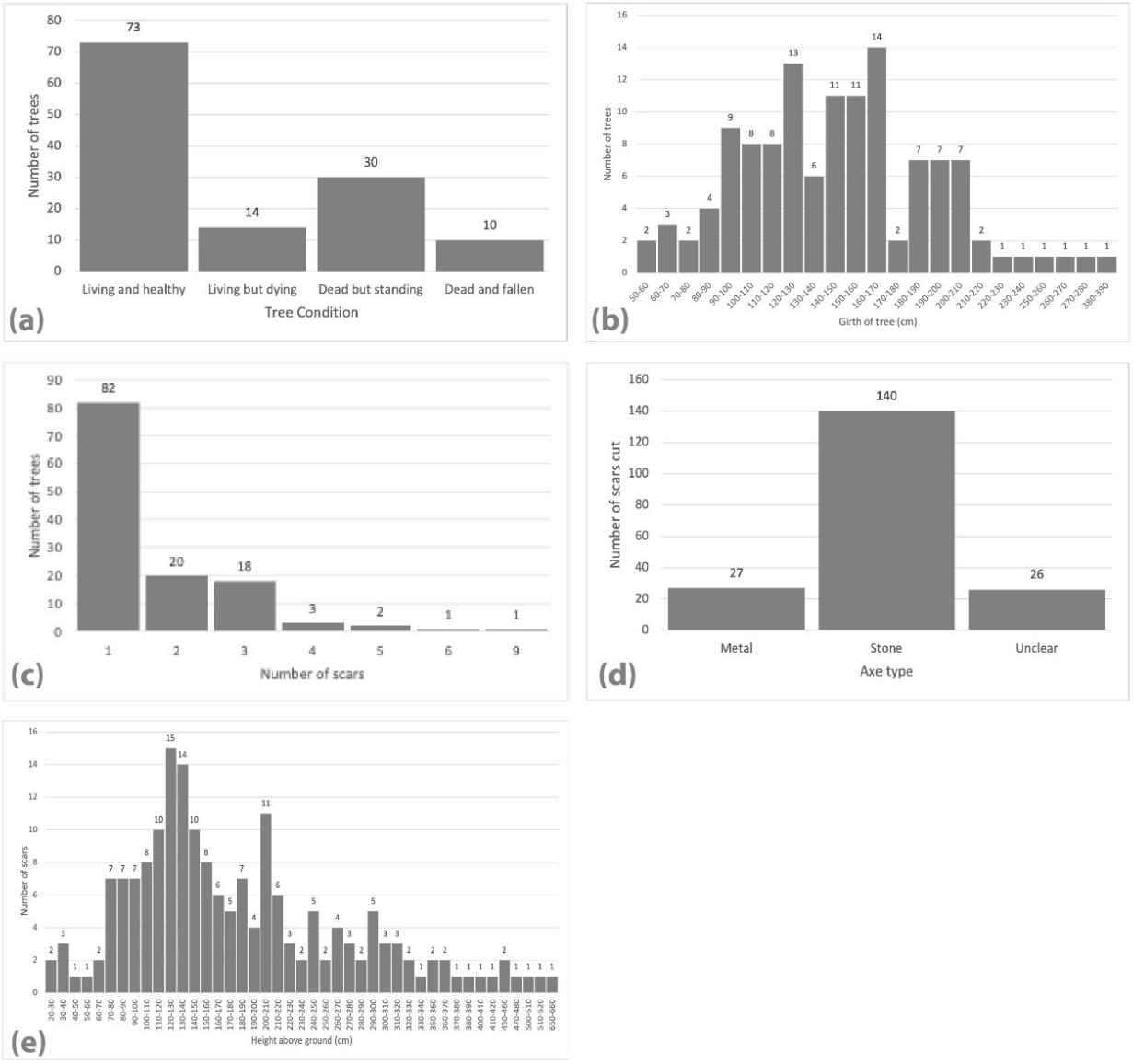

Figure 5. Graphs showing (a) status of trees with sugarbag scars; (b) girth of trees with sugarbag scars; (c) the number of sugarbag scars per tree; (d) the number of scars per axe type; and (e) the height above ground of sugarbag scars.

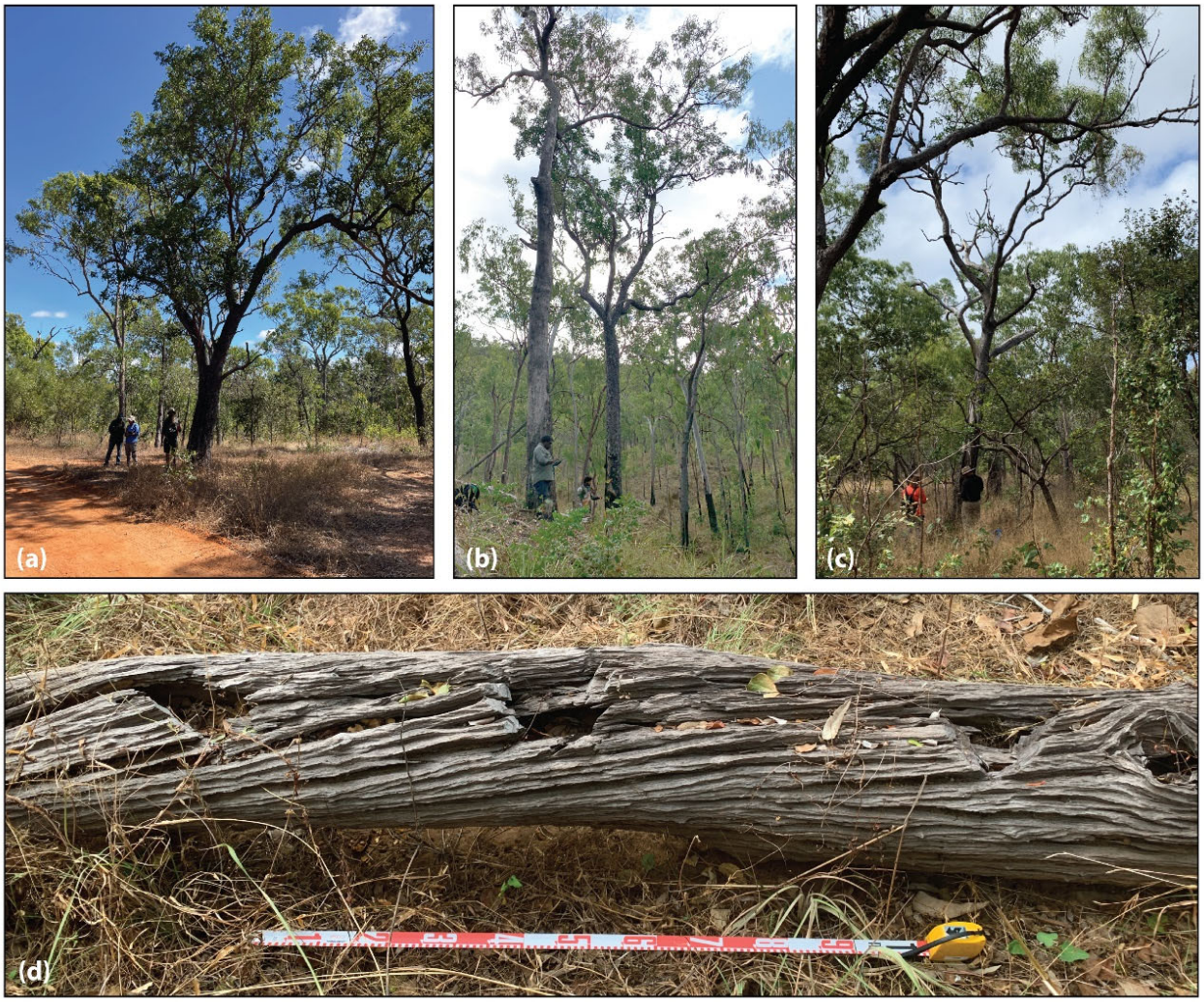

Figure 6. Photographs showing the status of sugarbag CMTs: (a) living and healthy (Photograph: Ellenore Lowdown); (b) living but dying (Photograph: Heather Burke); (c) dead but standing (Photograph: Lynley Wallis); and (d) dead and fallen (Photograph: Lynley Wallis).

Figure 7. The differences between (a and b) a stone cut sugarbag hole (LAUR00156) (Photographs: Mia Dardengo) and (c and d) a metal axe cut sugarbag hole (CMFH00136) (Photographs: Tony Pagels).

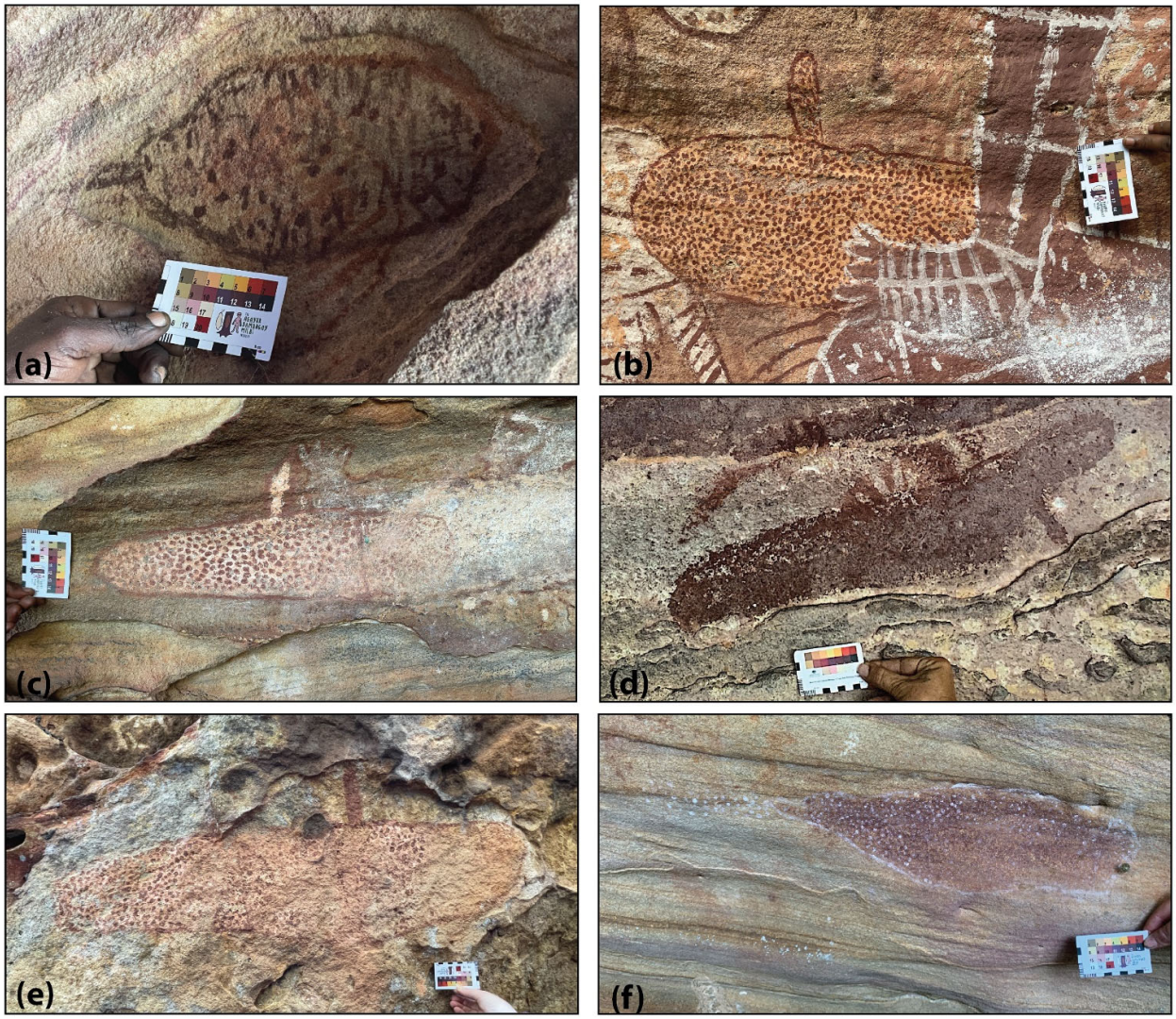

Figure 8. Sugarbag motifs depicted in rock art of the study area: (a) BALN00087 Panel 1 Motif 1; (b) LAUR00070 Panel 5 Motif 16; (c) LAUR00070 Panel 1 Motif 1; (d) Culture Hero (Site B1) Panel 8 Motif 25b; (e) LAUR00071 Panel 2 Motif 2; and (f) LAUR00181 Panel 1 Motif 3 (Photographs: Lynley Wallis).

more in the Northern Territory, indicated that ironwoods support an average of 1.5 small (<20 cm diameter) openings per tree, meaning that bees can nest in even very young ironwoods. Taylor (2002:93) suggested that Cooktown ironwoods (and other species) have a comparable proportion of small (i.e. <5 cm diameter opening) hollows, despite having a smaller number of medium or large diameter hollow openings (not used by native bees) and that dead ironwood trees appear to support more hollows than live trees (Taylor 2002:98). These studies indicate that there should not be a correlation between the girth/age of a tree and the type of axe mark; certainly, contemporary sugarbag collection is not dictated by the maturity of the tree, merely the presence of a hive.

Native bee populations and bushfires

One element in understanding sugarbag production past and present is grasping how the contemporary distribution of native bee populations maps on to the distribution of sugarbag CMTs from the past. Across our study area only four contemporary hives have been located; interestingly, at Mount Jack, where over 90% of CMT scars are from sugarbag extraction, no contemporary hives were seen. Our data, scant though they are, suggest there has been a substantive shift in native bee populations in southeast CYP, although the fact that there has been so little research into native bee populations locally makes it difficult to draw any firm conclusions.

Discussions with fire ecologist Dr Peta Standley, who worked closely with Dr Tommy George and Dr George Musgrave, suggest that changing fire regimes, and specifically a reduction in cultural burning practices (i.e. controlled, cool, gentle burns with low scorch heights), may have impacted native bee populations. Standley specifically observed native bee behaviour during at least one cultural burn and noted that the smoke had little impact on the bees, in contrast to hot bushfires that generated large quantities of smoke and scorched trunks above and beyond the level of many sugarbag scars (Peta Standley, pers. comm., 6 February 2024).

As elsewhere in Australia, fire has been a critical part of the long-term vegetation history in CYP, and Traditional Owners across the region routinely used fire as a management tool throughout the dry season (e.g. Crowley and Garnett 2000; Fensham 1997; Standley 2019:165, Figure 5.1; Steffenson 2020). The broadscale removal of Aboriginal people from southeast CYP following European incursion, however, has clearly affected these patterns, with other stakeholders, such as pastoralists and the Queensland Parks and Wildlife Service (QPWS), now playing a key role in fire management, although not necessarily with complementary fire regimes (Reardon-Smith in press). One study demonstrated that, on average, 43% of CYP burns in any one year (Felderhof and Gillieson 2006) and data from Standley (2019:202, Map 5.4) over the period 2000–2016 further suggested that large areas of CYP experience fires annually. When such fires are cultural burns they pose little threat to Cooktown ironwoods or the native bee populations they support. When they are hot fires, however, both tree and hive are endangered. Traditional Owners involved in the ABM Project are strong advocates for the re-introduction of cultural burning regimes into their traditional lands.

Other threats

Other serious threats to CMT survival in CYP come from logging and land clearing. This improved after November 2007 when the Queensland Government amended legislation to recognise a new class of protected area known as 'National Park (Cape York Peninsula Aboriginal Land) [CYPAL]' (Leverington 2012). Much of the ABM Project study area falls under this form of land tenure, in which Aboriginal corporations jointly manage areas with the QPWS. Outside National Parks, however, logging still occurs, and in 2017–2018, the vegetation clearing rate for CYP was 2,000 ha/year, with remnant woody vegetation clearing making up 57% of that 2000 ha (Department of Science 2020).

Given current reporting systems it is impossible to know how many Cooktown ironwoods have been felled in CYP, either legally or illegally. At a minimum, at least 8,000 Cooktown ironwoods from southeast CYP are known to have been harvested and shipped offshore in recent years (Martinelli 2021a, 2021b; see also Cluff 2022). In one widely publicised incident, a pastoralist was charged with damaging cultural heritage when he undertook clearing of 500 ha of vegetation on Kingvale Station (ABC 2021) to the northwest of the ABM Project study area. Although the charges were subsequently dismissed, given the prevalence of CMTs across the region, it seems likely that CMTs were harmed during this clearance. In 2022, 113 trees were illegally cut down in Rinyirru National Park (Department of Science 2022), and following complaints about CMTs being legally logged on Kalinga, Mary Valley and Lakefield Stations, a State Government investigation found that at least some of the ironwoods felled contained cultural scars. In both these cases, charges were successfully laid (Alwyn Lyall, pers. comm., 2023).

Digital recording

Given that CMTs have a finite lifespan, coupled with the added threats caused by fire, logging and land clearing, a key concern of Traditional Owners is how best to manage CMTs. Although inadequate in many regards, systematic survey, site recording and documentation remain key weapons in the CMT management toolkit. Although to date we have focussed on traditional recording techniques, such as standard photography, the release of LiDAR capable tablets and phones in 2020 has offered an easy and affordable way to pursue three-dimensional recording (Balado et al. 2022; Teppati Losè et al. 2022). A comparison of the results derived from such user-friendly technology against professional laser scanner elsewhere found that 'LiDAR sensor integrated in the smartphone device can create high quality 3D datasets that can be used in … cultural heritage conservation just as much as professional laser scanners' (Ruskovsi et al. 2023).

As James (2022) found for CMTs around Weipa, the ABM Project has confirmed that LiDAR capable tablets are a generally effective means by which Traditional Owners can quickly and easily document CMTs, with our preferred App at present being Scaniverse (noting that new apps are being developed regularly and so by the time of publication Scaniverse may no longer be the optimal app for reliable CMT scanning with a tablet). However, this is only the case when: (1) such records are supplemented with useful contextual information about the trees; and (2) the recorded scans can be systematically and securely archived and retrieved. At present, technical glitches or limitations in the recording can also cause a less than ideal result. In addition, only a section of the trunk can be captured by such means, and only if it is relatively near to the ground; sugarbag scars that can only be accessed by climbing are generally not able to be adequately documented in this way.

We have also experimented with photogrammetry as a means of high-quality 3D recording, whereby, with minimal training and using a mobile phone or tablet with camera app, Traditional Owners are able to take overlapping photographs of a CMT that are subsequently processed by a photogrammetry specialist. There are several points of potential failure in this approach, a key one being that, if during field recording insufficient numbers of photographs are captured or the degree of overlap is inadequate, the subsequent photogrammetry record will be poor quality; even a short delay between photography capture and post-data processing to identify data quality issues can impact the output, and the remote nature of the study area often precludes further photographs being taken to rectify shortfalls. As such, it is not a viable method that can be rolled out for all CMTs, and we have adopted it only for individual trees that are of high cultural value to local Traditional Owners and that are at imminent risk of destruction.

Conclusion

For thousands of years Aboriginal people have used Cooktown ironwoods for a variety of products. In southeast CYP, metal axes became available in the latter half of the nineteenth century, either through direct contact with isolated Europeans or via Aboriginal trading networks. Thereafter, people quickly adopted the new technology into their toolkits, giving them a more efficient means by which to cut into the dense, hard ironwood timber. Once sustained European incursion into southeast CYP occurred after 1872, however, the tenor of relations between Aboriginal and non-Aboriginal people turned violent, a situation that was sustained through a protracted war of resistance. The spatial distribution of metal-cut sugarbag scars in the ABM Project area suggests that intercultural relations in this part of CYP were mediated by

avoidance, a situation that appears to have changed little even in the twentieth century. The high cultural value of sugarbag is also reflected in its regular depiction in the painted rock art of the region. Although wooden artefacts are rarely made today, sugarbag remains a highly sought-after delicacy, and is still primarily procured using small tomahawk-style axes.

Much research is still required to understand the ecology of Cooktown ironwoods and the causes of their patchy distribution (John Clarkson, pers. comm., September 2023), as well as of native bee populations in the region. Future initiatives of the ABM Project may look to partner with entomologists and ecologists to explore such issues. Despite the hardy and resilient nature of Cooktown ironwoods, ultimately even the healthiest trees must yield to old age, eventually dying, falling, and succumbing to the cumulative effects of fire, termites, and general decay. Thousands of the trees have also been logged in recent years, including ones known to have contained cultural modifications. Accordingly, despite their once extensive distributive, CMTs are an ever-diminishing resource, suggesting that their documentation should be a priority.

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