Journal of the Anthropological Society of South Australia

Special Edition
Indigenous Australians and Plant Use Studies

VOLUME 43—DECEMBER 2019

EDITORS
Amy Roberts and Paul Monaghan

JOURNAL OF THE ANTHROPOLOGICAL SOCIETY OF SOUTH AUSTRALIA

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JOURNAL OF THE ANTHROPOLOGICAL SOCIETY OF SOUTH AUSTRALIA EDITORIAL ADVISORY BOARD

ISSN1034-4438

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UNDERSTANDING ARCHAEOBOTANY THROUGH ETHNOBOTANY: AN EXAMPLE FROM GOONIYANDI COUNTRY, NORTHWEST, WESTERN AUSTRALIA

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Abstract

During archaeological excavation of Moonggaroonggoo, northwest Western Australia, ethnobotanical survey and botanical collection undertaken in collaboration with Traditional Owners helped to identify which plants were of economic importance, provided information on modern vegetative communities and documented narratives of contemporary Gooniyandi plant use. By extending the project's focus to include traditional ecological knowledge (TEK) in the cultural landscape beyond excavations, we identified distinct ecological areas of economic significance. Excavation in three rockshelters at Moonggaroonggoo revealed late Holocene deposits with limited preservation of plant remains. Therefore, the TEK was applied to another archaeological site located on Gooniyandi ancestral lands: Riwi. Collaborating with local experts to document local botany we contribute narratives on plant use in the present which have important implications for archaeological interpretations of past plant use. By engaging with macrobotanical remains as a form of material culture, we encourage a deeper understanding of plants and their socio-economic role in Aboriginal lifeways.

Introduction

Plants have played a fundamental role in human evolution and dispersal across the globe. Botanical knowledge and plant-based technologies are considered an integral part of the colonising repertoire required for the successful migration from Island Southeast Asia to Sahul (Australia, New Guinea and the Aru Islands) (e.g., Balme 2013). Aboriginal groups entering the tropical north at least 65,000 years ago (Clarkson et al. 2017) encountered some familiar Indo-Malaysian plants (Golson 1971) as well as unfamiliar Australian flora. In some instances new species required the development of specific knowledge and/or skills to be able to successfully incorporate them into people's diets and their plant-based technologies. Ecological knowledge undoubtedly aided the expeditious expansion of people across the Australian continent and played an important role in the colonisation of all major biomes by 40,000 years ago (Balme 2013; Florin and Carah 2018; O'Connell and Allen 2004, 2015).

Two archaeological sites located in the Kimberley region, northwest Western Australia (WA)—Carpenter's Gap 1 and Riwi (Figure 1)—provide exceptionally well-preserved evidence for past plant use. Analyses of the macrobotanical assemblages recovered from these sites show strong cultural preferences for monsoon rainforest taxa (Dilkes-Hall et al. 2019, in press [c]). Selective procurement of food plants from monsoon rainforest ecozones—where many fruiting species cluster—indicate that use of these sites occurred on a seasonal basis during wet/humid periods (Dilkes-Hall et al. 2019, in press [c]). Economic resource patterning plays an important role in the lifeways of Aboriginal groups and macrobotanical remains suggest subsistence strategies were developed to best engage with and exploit known and predictable plant resources.

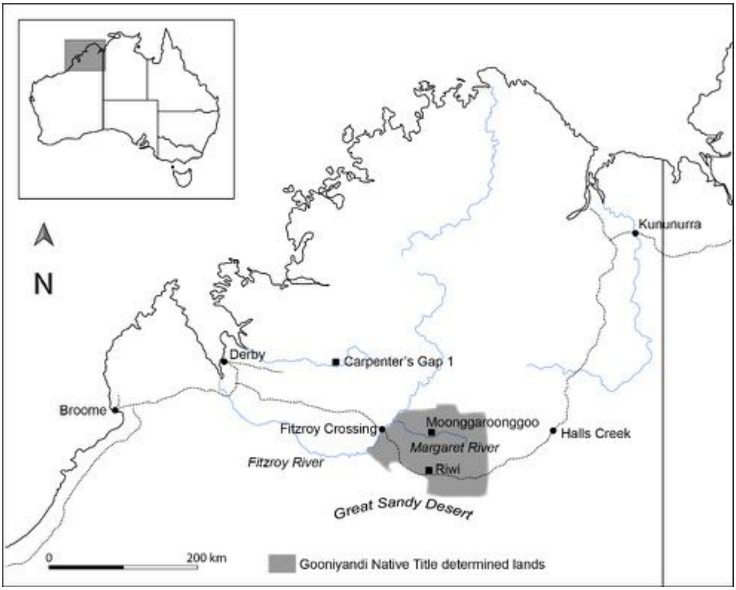

Figure 1 Location of the archaeological sites mentioned in text (modified from Dilkes-Hall et al. 2019). Native title determined lands after Kimberley Land Council (2019).

Today, despite negative impacts from European colonisation post-1788, Aboriginal people across northern Australia, as elsewhere, maintain links and intimate knowledge of Country and traditions associated with plant collection, processing, use and management (e.g., Crawford 1982; Davis et al. 2011; Edgar et al. 1997; Karadada et al. 2011; Nuggett et al. 2011; Paddy et al. 1993; Smith and Kalotas 1985; Wightman 2003). However, ethnobotanical records are disproportionate and, specifically, in the south central Kimberley little information was available for the Gooniyandi language group, constraining interpretations of plant use in the past at Riwi (Dilkes-Hall 2014).

Following the 2013 excavations of Riwi, Gooniyandi Traditional Owners expressed interest in excavating Moonggaroonggoo, a rockshelter located 47 km north of Riwi (Figure 1). During the early stages of the project Gooniyandi Traditional Owners identified ethnobotany[1] as a major focus of any future research (Maloney et al. 2017) presenting a unique opportunity to document the local knowledge and resources to aid in the interpretation of macrobotanical archives from the area.

During October 2016, excavations at Moonggaroonggoo saw six Gooniyandi Traditional Owners come together on Country. An unplanned aspect of the project was that it coincided with school holidays and several families from nearby Muludja community joined us presenting a window of opportunity for elders to engage with and teach children while on Country. Consequently, the ethnobotanical aspect of the project became twofold: to gather information to aid macrobotanical research; and to document Gooniyandi traditional ecological knowledge (TEK) and language.

This paper highlights the value of combining local TEK with archaeological investigations to help extract archaeobotanical information from its original intellectual framework, otherwise dominated by modern Western scientific traditions. We use the results to aid interpretation of Riwi's macrobotanical assemblage and discuss the implications of this research for understanding plant use in the past in the south central Kimberley. Finally, we give consideration to some of the differences between Aboriginal and Western scientific traditions that became apparent during this project in regards to the collection, storage, curation and dissemination of botanical knowledge.

[1] Defined here as the documentation of traditional ecological knowledge and language coupled with the collection of scientific voucher specimens.

Regional Setting

The unique Kimberley bioregion in the Australian Monsoon Tropics biome is one of the most stable and biodiverse landscapes worldwide (McKenzie et al. 1991; Pepper and Keogh 2014; Ward et al. 2005). The climate is dominated by the summer monsoon with high seasonality and high evapotranspiration rates producing distinct wet and dry seasons (Beard 1979; Wheeler and McBride 2005, 2012). Temperatures are high year round and 70% of precipitation is experienced from January to March, with areas in the extreme north exceeding 1300 mm per annum, though the south central Kimberley study area receives on average 500–400 mm of rain annually (Bureau of Meteorology 1996). Generally, vegetation in this intermediate rain fall zone is tolerant to semi-arid conditions and characterised by sparse low *Eucalyptus-Corymbia* woodlands and medium height *Triodia* grasslands (Beard 1979).

The Study Area

Moonggaroonggoo is an isolated limestone outcrop approximately 65 km east of Fitzroy Crossing (Figure 1). Gooniyandi people know the area surrounding Moonggaroonggoo as Larrmarloowa. European settlement of the Kimberley began in the 1880s and today the site is situated within the pastoral lease of Fossil Downs Station. Larrmarloowa is a place of great cultural and spiritual significance and many Dreaming narratives associated with geological formations are embedded within the surrounding landscape. Moonggaroonggoo is described by Gooniyandi Traditional Owners as an important camping area for ancestors who would always return to the site no matter how far they travelled for ceremonies and trade.

In the 1960s Ian Crawford (1964) visited the site with Gooniyandi people and described the rockshelters, rock art panels, ledge burials and collected surface stone artefacts. Moonggaroonggoo has multiple rockshelters around the base of the outcrop (Figure 2a). The three main rockshelters of archaeological interest are east facing and large enough to protect medium-sized groups of people from the elements. Shelters 1 and 2 are at ground level with rock fall forming a boundary between them (Figure 2b). Shelter 3 is situated approximately 35 m above ground level and overlooks the plains to the east towards the Margaret River (Figure 2b). Walls in each rockshelter display paintings, although the most elaborate rock art decorates Shelter 3 and depicts waterlilies (*Nymphaea* spp.) (Figure 2c), suggesting enduring people-plant relationships. An ephemeral creek that flows during the wet season is located approximately 100 m east of the site. A large pool formed by the Margaret River, Mamandaya, is the closest permanent water source during the dry season, situated 1.8 km east of Moonggaroonggoo.

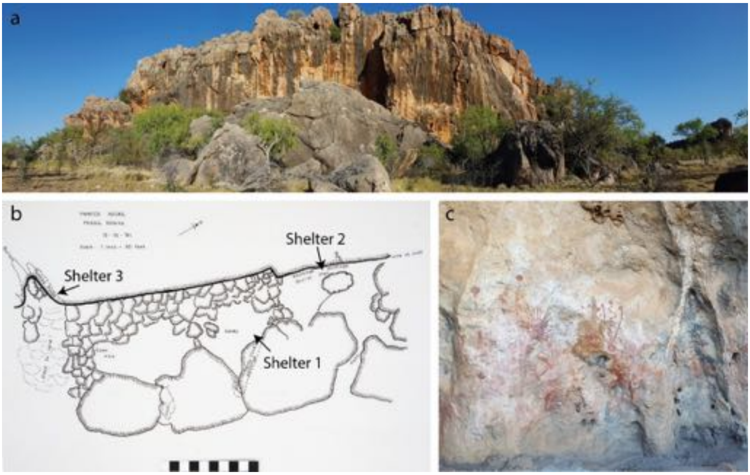

Figure 2 (a) Eastern face of Moonggaroonggoo, (b) Shelters 1, 2 and 3 (modified from Crawford 1964) and (c) Shelter 3 rock art showing painted depictions of waterlilies.

Cultural materials recovered from Moonggaroonggoo's deposits include stone artefacts, vertebrate faunal remains, marine and freshwater shell, avian eggshell, ochre, charcoal and macrobotanical remains (Maloney et al. 2017). Details on the Moonggaroonggoo excavation, stratigraphy and chronology are provided in Maloney et al. (2017). The site dates from the late Holocene (2844–2737 cal BP) to the present (Maloney et al. 2017). Macrobotanical analysis of the Moonggaroonggoo assemblages revealed that only a small number of species were represented (n=6) and preferential preservation of *Celtis* *strychnoides* endocarps (Dilkes-Hall in press [a]). These remains cannot be reliably linked to cultural activities and instead the assemblage is interpreted as reflecting the local vegetation surrounding Moonggaroonggoo (Dilkes-Hall in press [a]).

In contrast, the Riwi site has extraordinary preservation of macrobotanical remains, particularly in deposits dated to the mid- (7421–5905 cal BP) and late Holocene (915–668 cal BP to present) (Balme et al. 2019; Dilkes-Hall 2014; Dilkes-Hall et al. in press [c]), meaning there is temporal overlap between the late Holocene occupation at both Riwi and Moonggaroonggoo. Balme et al. (2019) provided details on the Riwi site, excavation, stratigraphy, chronology and archaeological remains. Analysis of Riwi's macrobotanical assemblage demonstrates that specific types of remains are clearly associated with past human activities, in particular that people targeted monsoon rainforest ecozones to collect food plants (Dilkes-Hall et al. in press [c]). However, the limited ethnobotanical information for the area has restricted interpretations to date, and Gooniyandi narratives are absent.

Methods

Six senior Gooniyandi Traditional Owners, June Davis (JD), Helen Malo (HM), Edna Cherel (EC), Mervyn Street (MS), Willy Cherrabun (WC) and Bobby Cherel (BC), together with archaeologists Tim Ryan Maloney (TRM) and India Ella Dilkes-Hall (IED-H), took part in botanical survey and plant collection during the 2016 excavations at Moonggaroonggoo. TEK of plant use was predominately recorded with the Gooniyandi women although the men joined in some discussions intermittently when relevant to their activities.

At the beginning of this research three primary locales of economic plant foods were identified by elders: the rockshelters and base of Moonggaroonggoo; the surrounding open plains (Birndirri); and Mamandaya waterhole (Figure 3). In the case of Moonggaroonggoo, each rockshelter and the base of the outcrop was surveyed by foot, while the surrounding plains were surveyed by a combination of foot and vehicle, and Mamandaya was surveyed on foot. A few hours per day over seven days of fieldwork were dedicated to discussing plants and recording plant use(s). Photographs, voice recordings, videos and field notes were collected during these sessions.

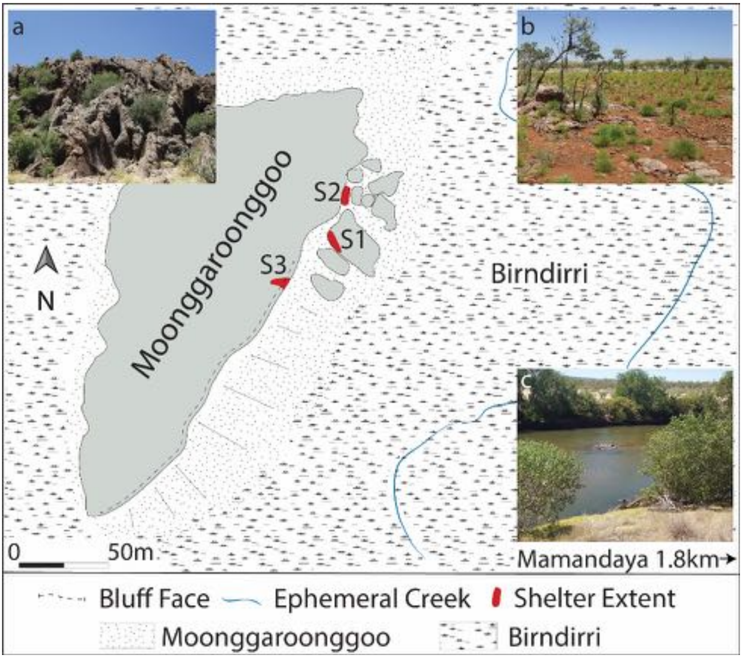

Figure 3 The three ecological zones identified by Gooniyandi elders: (a) Moonggaroonggoo, (b) Birndirri and (c) Mamandaya.

Fieldwork in the Kimberley is seasonal and takes place during the dry season (April to November) when the area is most accessible. However, the types of plants that can be collected at this time of year are restricted, as many plants do not retain flowers (necessary for identification purposes, see later) during these drier months. Plants identified as economically important, but not known to Gooniyandi elders taxonomically, were recorded and photographed before a sample was returned to Perth for identification following collection procedures developed by the Department of Biodiversity, Conservation and Attractions (2016). Field identifications were assigned from a target taxa list compiled from key botanical resources (Beard 1979; FloraBase 2016; Wheeler 1992).

In the following sections taxonomic names are given with common names and Gooniyandi language names (when available) are provided in parentheses (but subsequently privileged) at first instance only at the request of Gooniyandi elders. All botanical information presented below has been provided by the Gooniyandi female co-authors and only where information has been provided by the male co-authors, is it cited as such.

As mentioned above, owing to preservation bias in Moonggaroonggoo's archaeological sites, plants documented as economically important were compared with taxonomically identified macrobotanical remains recovered from Riwi to determine which plants remain in use today, what their contemporary uses are and what types of environments they are collected from.

Results

Moonggaroonggoo

The Moonggaroonggoo rockshelter complex is described by JD as a night-time camp. Many plants growing around the base of the limestone outcrop were identified as economically important species. Fruiting food plants such as *Carissa lanceolata* (conkerberry, *biriyali*) (Figure 4a), *Ficus aculeata* (sandpaper fig, *yimarli*), *F. platypoda* (rock fig, *banggirndi*) (Figure 4b), *Flueggea virosa* (white current, *garn.gi*) (Figure 4c) and *Vitex glabrata* (black plum, *girndi*) (Figure 4d) were recorded in close proximity to all three rockshelters. Each of these plants produce edible fruits. Young *Cochlospermum fraseri* (kapok, *wanggoo*) plants grow around the outcrop and produce roots which are roasted, and eaten. Large *Celtis strychnoides* (celtis, *minthiwili*) trees grow amongst extensive limestone boulders providing shade and fruits which are eaten by birds and sometimes children.

Figure 4 Examples of economic plant species at Moonggaroonggoo: (a) biriyali, (b) banggirndi, (c) young garn.gi plant with HM, (d) girndi, (e) jirndiwili, (f) bambira and (g) rain stick being made by MS from the white wood of bambira.

Species associated with plant-based technologies were also identified. The lightweight woods of *Erythrina vespertilio* (bat's wing coral tree, *jirndiwili*) (Figure 4e) and *Gyrocarpus americanus* (helicopter tree, *jarlarloo*), which grow out from cracks in large rock boulders around the site, are used to make coolamons (carrying vessels), and the leaves of both plants can be burnt to repel mosquitoes. The red seeds of jirndiwili are also collected and threaded onto string for personal ornaments. Fire is created using the traditional friction method with fire sticks made from *Clerodendrum floribundum* and/or *Premna acuminata* (fire stick tree, *goonggala*) plants that grow within Shelter 2. *Atalaya hemiglauca* (whitewood, *bambira*) (Figure 4f) grows amongst the boulders between Shelters 1 and 2 and its timber is used for digging sticks (*gananyi*), fighting sticks (*moowoorroo*) and ceremonial objects such as rain sticks (Figure 4g) created by MS and WC for rain making ceremonies.

Birndirri

At the time of botanical survey Birndirri appeared particularly barren, with a hot fire having recently been through the area (Figure 3b). JD spoke of this late dry season fire as being 'wrong time', 'not good' and 'too hot'. These types of fires have catastrophic effects on undergrowth, shrubs and trees, which in turn affects native fauna populations (Preece 2002).

The Birndirri vegetation comprises scattered *Eucalyptus/Corymbia* tree steppe dominated by *Triodia* grassland, the bright green hummocks signifying regrowth after the recent fire (Figure 5a). *Eucalyptus-Corymbia* species growing on the plains are the major sources of fuel for campfires. Also on the sparse plains *Bauhinia cunninghamii* (bauhinia, *joowoorljidi*), a large sprawling tree, provides pockets of shade and its seeds can also be threaded onto string for necklaces. *Corymbia cadophora* subsp. *cadophora* (twin-leaf bloodwood, *yilangi*) was identified as an important food resource providing sugarbag (honey, *ngalinya*) and galls (bush coconut, *balabi*) (Figure 5b). Although yilangi does not produce edible fruit, balabi, induced by a female scale insect (genus *Cystococcus*), are edible, nutritious and highly sought after.

Figure 5 Examples of economic plant species from Birndirri: (a) *Triodia* grassland with a stand of wiliriny, (b) balabi and (c) lambilambi.

An important medicinal plant, *Senna venusta* (cockroach bush, *lambilambi*) (Figure 5c), grows on Birndirri. Lambilambi leaves and branches are boiled in water and the liquid used to bathe wounds and sores. The burnt bark of *Grevillea pyramidalis* (caustic bush, *wiliriny*) (Figure 5a) is used to darken the skin for ceremonies and the caustic sap is used in scarification rituals. Wooden tools, such as boomerangs and fighting sticks, are made from *Hakea arborescens* (yellow hakea, *booroowa*) trees (MS pers. comm.). Soft *Triodia* species are important sources of resin used primarily in the production of composite tools.

In stark contrast to the many fruiting species recorded around Moonggaroonggoo, not a single fruit bearing species of economic importance was recorded on our survey across Birndirri.

Mamandaya

On the high river banks looking down at Mamandaya the water is so clear that fish are visible swimming below. Mamandaya is described as a dry season day camp by JD with people walking the 1.8 km from Moonggaroonggoo in the early morning to avoid the heat and spend the day by the water collecting bush tucker, catching and cooking up crocodiles, fish, mussels, cherrabun (freshwater prawns) and turtles while relaxing on the terraced river banks. The banks are lined with economic plant species (Figure 6a). Botanical survey of this area was limited by the steepness of the riverbanks; however, riparian taxa that are economically important were pointed out from above.

Figure 6 Examples of economic plant species found at Mamandaya: (a) eastern side of river bank, (b) garn.gi, (c) goorroomba and (d) gooroo.

Food plants growing around Mamandaya include biriyali, garn.gi (Figure 6b), *Ficus* spp. and *Nauclea orientalis* (Leichardt pine, *marroora*). Plants used to manufacture tools include booroowa, marroora, *Melaleuca* spp. (paperbark, *goorroomba*) (Figure 6c), *Terminalia* spp. and *Tinospora smilacina* (snakevine, *jalaroo*). Goorroomba is used primarily for food conservation/storage and cooking. *Barringtonia acutangula* (freshwater mangrove, *gooroo*) (Figure 6d) bark is used as a fish poison and in small doses as a medicinal treatment for lesions. Other plant species important for medicine, fuel and/or shade include *Acacia*, *Corymbia* and *Eucalyptus* species.

Mamandaya also supplies aquatic plants of economic importance. Two species of waterlilies, *Nymphaea macrosperma* (*thanggari*) and *N. violacea* (*garringarri*), produce edible seeds, stems and roots, although these species were not encountered during fieldwork.

Overall, 33 economically important plants across the three ecological zones were identified during survey (Table 1). Twelve taxa were recorded around Moonggaroonggoo, while Mamandaya recorded the highest number of economic plants (n=19). The lowest number of taxa, seven, was recorded for Birndirri. Some taxa are present across more than one ecological zone.

Comparing Ethnobotany and Archaeobotany

Comparison of the results from the modern botanical survey with Riwi's archaeological macrobotanical remains shows that 12 of the 33 economically important plant taxa documented during the survey are identified in Riwi's archaeological record. These represent species from each of the three contemporary ecological zones (Table 1; Figure 7).

Table 1 Economic plants grouped by surveyed ecological zones with Gooniyandi language name, documented use/s, and presence/absence in Riwi's macrobotanical sequence marked X. Key for documented uses: AS-Ashes of bark used for mixing with chewing tobacco; F-Food; FC-Food conservation/storage; FN-Nectar; FW-Witchetty grub; FU-Fuel; IRP-Insect repellent plant; M-Medicinal; R-Ritual/ceremonial; PO-Personal ornamentation; POI-Poison; PBT-Plant-based technologies (e.g., wooden tools, rope, rafts, shelter, cooking, bedding, resin etc.); SI-Seasonal indicator; SH-Shade tree; SL-Sugar leaf; SU-Sugar bag.

Ecological zone	**Taxonomic name**	**Gooniyandi name**	**Uses**	**Riwi**
Moonggaroonggoo	*Atalaya hemiglauca*	Bambira	PBT, R, SI	
(rockshelters and	*Carissa lanceolata*	Biriyali	F, R, M	
base of outcrop)	*Celtis strychnoides*	Minthiwili	SH	X
	Clerodendrum floribundum	Goonggala	PBT	
	Cochlospermum fraseri	Wanggoo	F	
12 taxa	*Erythrina vespertilio*	Jirndiwili	PO, PBT, SI	
	Ficus aculeata	Yimarli	F	X
	Ficus platypoda	Banggirndi	F	X
	Flueggea virosa	Garn.gi	F	X
	Gyrocarpus americanus	Jarlarloo	IRP, PBT, T	
	Premna acuminata	Goonggala	PBT	X
	Vitex glabrata	Girndi	F	X
Birndirri	*Bauhinia cunninghamii*	Joowoorljidi	FN, PO, SH, SU	
(surrounding open	*Corymbia cadophora* subsp.	Yilangi	R, SU	
plains)	*cadophora*	Balabi (gall)	F	X
	Eucalyptus-Corymbia spp.		FU, FW, M, R, SU	X
	Grevillia pyramidalis	Wiliriny	R	
7 taxa	*Hakea arborescens*	Booroowa	FN, M, PBT	
	Senna venusta	Lambilambi	M	X
	Triodia spp.	Ngirri, warloowarloo, warrwa	PBT	X
Mamandaya	*Acacia* spp.		F, FW, M	X
(Margaret River	*Barringtonia acutangula*	Gooroo	M, POI	
waterhole)	*Bauhinia cunninghamii*	Joowoorljidi	FN, PO, SH, SU	
	Carissa lanceolata	Biriyali	F, R ,M	
	Eucalyptus camaldulensis	Bilirndi	M, POI, SU	
19 taxa	*Eucalyptus microtheca*	Goorlaalal	AS, FU, R, SL, SU	
	Eucalyptus-Corymbia spp.		FU, FW, M, R, SU	X
	Ficus coronulata	Joorloowoo	F	
	Ficus virens		F	
	Ficus spp.		F	X
	Flueggea virosa	Garn.gi	F	X
	Hakea arborescens	Booroowa	FN, M, PBT	
	Melaleuca leucadendra	Winthawoorroo	FC, PBT, R, SU	
	Melaleuca spp.	Goorroomba	FC, PBT, SU	X
	Nauclea orientalis	Marroora	F, PBT, SH	
	Nymphaea macrosperma	Thanggari	F	
	Nymphaea violacea	Garringarri	F	
	Terminalia spp.		PBT	X
	Tinospora smilacina	Jalaroo	PBT	

Figure 7 Macrobotanical remains recovered from Riwi documented as economic plants: (a) *Acacia* sp. Type A pod, (b) *Celtis strychnoides* endocarps, (c) *Eucalyptus-Corymbia* gall, (d) *Eucalyptus-Corymbia* capsule, (e) *Ficus* spp. fruits, (f) *Flueggea virosa* seeds, (g) *Melaleuca* spp. paperbark, (h) *Premna acuminata* endocarp, (i) *Senna* sp. seed, (j) *Terminalia* sp. Type A endocarp, (k) *Triodia* cf. *pungens* spikelets and (l) *Vitex* cf. *glabrata* endocarps.

Discussion

Archaeobotanical Implications

Gooniyandi knowledge (hereafter *binarri*) documented herein provides valuable narratives on past diet, subsistence strategies, mobility and several archaeobotanical signatures of plant exploitation. Riwi's macrobotanical assemblage offers an opportunity to compare the ethnobotanical results and examine plant use in the past. This approach is not an attempt to ignore the dynamic aspects of socio-cultural systems that stretch deep into the past but rather highlight and acknowledge binarri as a primary source of information to aid in interpretations of archaeological macrobotanical materials.

Plants observed during botanical survey and identified in Riwi's macrobotanical remains serve a variety of purposes, including primary food sources, and also secondary food sources such as sugarbag and witchetty grubs, food conservation/storage, fuel, medicine, plant-based technologies and shade, as well as fulfilling certain ceremonial roles (Table 1). Plants from each ecological zone are represented at Riwi (Table 1) suggesting that people exploited a broad resource base. Of the 12 taxa represented at Riwi that were documented during the survey, five are important food plants (*Acacia* spp., balabi, garn.gi, girndi and figs [*Ficus* spp.]), the latter three of which are monsoon rainforest food plants recorded growing in the immediate vicinity of Moonggaroonggoo (Figure 7f, l and e). Similarly, garn.gi and figs were recorded growing across the limestone range at Riwi (Whitau et al. 2017). In the southern Kimberley, monsoon rainforest plants have a very restricted distribution (McKenzie et al. 1991) and their direct association with limestone ranges and outliers indicates these geological formations were likely important in patterns of subsistence and mobility.

Figs and girndi are abundant in the mid- and late Holocene deposits at Riwi suggesting they were important food plants, while garn.gi was recovered only in small quantities in the site's late Holocene deposits (Dilkes-Hall et al. in press [c]). Dilkes-Hall et al. (in press [c]) suggest use of the site occurred seasonally, as these species fruit during *yidirla* (wet season) (Davis et al. 2011). To prevent spoilage, seasonally abundant fruits were collected and stored dry in paperbark (*Melaleuca* spp.; JD pers. comm.); fragments of the latter were also recovered from Riwi (Figure 7g). Different parts of girndi are represented (whole fruits, whole endocarps, fragmented endocarps and calyces), indicative of fruit processing activities (Dilkes-Hall et al. in press [b]).

Acacia sp. Type A pods (Figure 7a) were recovered from Riwi's mid- and late Holocene deposits, although more numerously in the former (Dilkes-Hall et al. in press [c]). In comparison, very few *Acacia* sp. seeds were recovered. JD says people would gather the beans (pods), cook them in the hot sand and eat the seeds. A cooking and consumption practice such as this would leave only the pods as waste by-product to be incorporated in the archaeobotanical record, as observed at Riwi.

Balabi is an insect-induced gall with a hard outer layer and an edible coconut-like inner lining that is eaten with the grub (Semple et al. 2015; Yen et al. 2016). Balabi have important nutritional value (Miller et al. 1993; Semple et al. 2015; Yen et al. 2016) and JD recalled stockmen relying on balabi when water was not available on long droving trips. Preserved in the late Holocene deposit at Riwi is one hard, woody outer layer of balabi with the distinct small apical hole (Figure 7c).

The retention of ecological binarri to the present, and the archaeological evidence from Riwi, demonstrate continuity of Gooniyandi subsistence practices through time. Specifically, the presence and quantities of girndi and figs in both mid- and late Holocene deposits show a strong cultural preference for these food plants stretching back around 7000 years. By comparing ethnobotanical results with macrobotanical remains that represent food plants we have improved interpretations of which plants were likely used in the past for food and provided Gooniyandi narratives for these macrobotanical remains.

The medicinal plant, lambilambi (*Senna* sp. [Figure 7i]), is represented at Riwi by seeds and papery pods. Lambilambi leaves and branches are boiled to make medicine from this plant. At Riwi, people may have discarded plant parts not used medicinally, leaving seeds and pods as archaeobotanical signatures.

Other types of macrobotanical remains from Riwi provide evidence of plant-based technologies. *Triodia* is represented in the site by spikelets, leaves and roots. *Triodia* species provide resin and the important role of resin production is exemplified by three Gooniyandi words used to differentiate different types of *Triodia* used for resin; *ngirri* (small round spinifex), *warloowarloo* (soft spinifex) and *warrwa* (large round spinifex). To extract resin, whole clumps of *Triodia* are threshed and resin dust is separated from chaff (e.g., large and small plant fragments such as spikelets, leaves and roots) by winnowing and yandying (Pitman and Wallis 2012:112). At Riwi, the different plant parts of *Triodia* may represent waste products from resin extraction also indicated by resin adhering to a tula adze (Balme et al. 2019:44). Alternatively, *Triodia* is used at Riwi as a wrapping (Balme 2000:4) and its presence may also indicate fibre manufacture to create string (Pitman and Wallis 2012), seven pieces of which were recovered from Riwi's Holocene deposits.

Terminalia species produce a gum that does not require processing but is used in similar ways to *Triodia* resin. A variety of *Terminalia* species are known to be economically important food plants to Aboriginal groups in the eastern (Bardi) and western (Kija and Jaru) Kimberley (Edgar et al. 1997; Scarlett 1985; Smith and Kalotas 1985; Wightman 2003). Edible *Terminalia* fruits have a stony drupe which are the only types of macrobotanical remains at Riwi identified from these plants (Figure 7j). Although edible *Terminalia* fruits were not documented with Gooniyandi elders due to seasonal availability *Terminalia* spp. macrobotanical remains are likely to represent the discarded inedible portion of these fruits.

Another important technology is the ignition and use of fire. A common method used to create fire today is the fire-drill, which consists of two separate pieces of wood, one operating as a hearth stick and the other, moving component, the drill (Akerman 1998; Clarke 2012; Davidson 1947). A hearth stick is most often made from a soft lightweight wood, while the twirling drill, requiring more strength, is fashioned from a harder timber (Clarke 2012). A fire drill recovered from Riwi's late Holocene deposits has been identified as Lamiaceae (Whitau et al. 2016). Gooniyandi elders indicate that the wood species is likely to be either *Clerodendrum floribundum* or *Premna acuminata*, both soft lightweight woods belonging to the Lamiaceae family and commonly used in the fire-drill method.

A fragment of a wooden artefact from Riwi, directly dated to 651–557 cal BP (S-ANU 43337), was argued by Langley et al. (2016) to be the trailing tip of a hooked boomerang. Scarce literature available on Gooniyandi boomerang manufacture led Langley et al. (2016) to conclude, perhaps erroneously, that the artefact was probably traded into the region from southeast or northeast Kimberley. This interpretation was discussed with MS who produced photographs of his birth place, a spot on Gooniyandi Country situated underneath a boomerang tree, booroowa (*Hakea arborescens*). The booroowa tree in the photograph has a calloused scar which MS says is where a limb was removed to manufacture a boomerang.

Identification of the wood taxa used to manufacture the wooden artefact by Whitau et al. (2016) was proposed to be *Grevillea/Hakea* sp., corresponding with MS' TEK. Further investigation has brought to light a photograph taken in 1969 of senior Gooniyandi man, Jack Bohemia, making a hooked boomerang (Bohemia and McGregor 1995:6). Five Gooniyandi words are recorded for the different types of boomerangs that are manufactured, including *wirlgi*, a word used exclusively for hooked boomerangs.

Wood shavings, interpreted as evidence for wood working, were also recovered from Riwi (Whitau et al. 2016:540) and a boomerang is stencilled on the wall of the cave. Coupled with MS' narrative suggesting that boomerangs were made on Gooniyandi Country, we propose that it is likely that boomerangs were made in the southern Kimberley over at least the last 600 years, as they were in contemporary times.

Wood shavings, often described as waste products, are one way to observe people's engagement with wooden artefact manufacture in the past that would otherwise remain largely invisible archaeologically. Unfortunately, it was not possible to taxonomically identify the wood shavings recovered from Riwi but their presence may attest to wood working activities occurring on site.

Gooniyandi elders report other uses for these so-called 'waste products'. For example, while preparing a ceremonial rain stick made of bambira (Figure 4g), MS and WC discussed how the wood shavings being removed were traditionally collected and stuck to the body and threaded into hair for ceremonies. Here, the use of wood shavings as body decoration plays an important function in ceremonial activities, a use that is almost impossible to determine without the knowledge of local Aboriginal people.

Activities documented with Gooniyandi elders for this research are unlikely to be identical to those that occurred at Riwi in the past. Instead we suggest that binarri is a primary source of information for the interpretation of archaeobotanical material and provides insights that should not be neglected. Here, collaboration with Gooniyandi elders has recorded narratives which are often overlooked that aid and enrich the interpretations of archaeobotanical remains. Furthermore, we see great value in using ethnobotanical research as a platform for recording and maintaining Gooniyandi language survival, a language described as endangered (McGregor 1990).

Ethnobotanical Implications

The development of the ecological sciences, particularly in northern Australia, is considered relatively young (Horstman and Wightman 2001). Cultural activities and interactions with plants create dynamic relationships that take place in specific landscapes and environments (Hynes and Chase 1982:38). The biologically unique Australian flora is intimately linked to Aboriginal worldviews and much can be learned from engaging with local TEK. The importance of plants in Aboriginal lifeways is demonstrated by their incorporation into rock art (Veth et al. 2018; Welch 2003) and Dreaming narratives (Hercus 2012). Modern Western philosophy that posits humans as having ownership and control over nature can be at direct odds with Aboriginal worldviews that place custodianship above ownership and value interrelatedness (Pierotti and Wildcat 2000). Here we examine some important differences between binarri and modern Western botanical knowledge that were highlighted by this research.

To identify and classify angiosperms a flowering specimen is required to observe species' specific microscopic morphological characteristics (Chong 1994), and thus vouchered herbaria specimens rarely include fruits, seeds, woody plant parts or roots. These incomplete archives are at odds with binarri which places importance on the entire plant (flowers, fruits, leaves, bark, wood and roots) and the different ways in which constituent parts of one plant are used.

Knowledge of a plant derived from diagnostic characteristics of a pressed herbarium sample is very different from knowledge of a plant in its natural environment. TEK encompasses the ability to identify a particular plant across different stages of life, across seasons, with and without defining characteristics such as flowers and leaves. It acknowledges the different properties that the specific parts of a plant may have and how they can be used for different purposes.

Herbaria systematically catalogue plant specimens, and accompanying collection information, in large, closed access storage facilities. At the WA Herbarium a small proportion of the collection is open to the public, with access to the complete comprehensive collection restricted via access protocols aimed at preserving (e.g., temperature control) and quarantining the large botanical collection from outside threats (e.g., insect infestation, disease). In this way the herbarium acts as 'gatekeeper' reserving exclusive access for botanical specialists and researchers.

In contrast, this research demonstrates how inclusive and how a part of everyday life binarri is, particularly in regards to food gathering practices that are deeply embedded in socio-cultural practices. On Gooniyandi Country the 'herbarium' is the surrounding environment and binarri is freely accessed by spending time with knowledgeable elders who maintain, pass down, and share binarri as part of their cultural obligations. No one is excluded and children, both girls and boys, are essentially botanists in their own backyard. Learning about the bush from her grandmother JD recalled:

> She [grandmother] usually picks out the plants even when we used to go out when it's raining. After the rain we used to walk behind Fossil, go and look for bush, little tubers, and I used to ask them what this plant? And they used to give us the names.

Gooniyandi people do not learn about the bush from Western text books and botanical literature, they learn by being on Country with their elders and experiencing the surrounding environment to learn the names and uses of economic plants and understand how plants change through each season. Some plants have important socio-symbolic roles, such as the waterlilies depicted in the rock art in Shelter 3 (Figure 2c) that act as visual representations of TEK.

Access to information provides knowledge and, as mentioned above, physical access to plant specimens housed in herbaria cannot be achieved without permits and permissions. Likewise, botanical literature is often very specific, hard to locate and rarely open access. For Gooniyandi elders, who do not belong to educational institutions, journal subscription costs can be prohibitive. Furthermore, access requires a computer, computer skills and internet access which, for Traditional Owners living in remote communities, is rare and typically not a viable option. Not only is gaining access to these resources challenging, understanding the botanical literature is complicated by the use of botanical Latin and scientific jargon making the knowledge therein cryptic. Furthermore, difficulties associated with changing botanical names, botanical misidentifications, misspellings, typographical errors, common names applying to multiple species, plant attributes changing over the course of a year and the application of DNA has complicated the field of botanical classification (Gott 1989) and makes learning and access to this type of knowledge by Aboriginal peoples in particular incredibly difficult.

Knowledge is also subject to change. The arrival of Europeans to the Kimberley in the 1880s led to rapid and thorough Aboriginal dispossession as lands were quickly taken up for pastoral pursuits (Altman 1980; Smith 2000). Severing Aboriginal connections to Country by removing people from their lands brought about the end of traditional land management practices, which has, and continues to have, serious consequences for TEK, and disastrous consequences on native flora and fauna. Impacts from uncontrolled fire, and the introduction of invasive plants and animals remain genuine concerns of the elders who worry about the continuation of binarri and the next generation. Invasive plants (e.g., *Cenchrus ciliaris* [buffel grass], *Ptilotus nobilis* [mulla mulla] and *Vachellia farnesiana* [prickly mimosa]) are frequently encountered across Birndirri. These plants are constant reminders to Gooniyandi people of the detrimental changes pastoralism has had on the landscape (Australian Broadcasting Corporation 2011).

The implications for changes in land use coupled with climate change have, and will have, on binarri is surely profound, as the ability to predict resources becomes more uncertain (Leonard et al. 2013). This is not considered a problem of the future. Today, plants resonate the real-time consequences of climate change which has wide ranging effects on predictability and the ability to pass on accurate knowledge:

> Food was plentiful all the time, in those days but now it's hard to look for anything, you say oh this the season now, you go and look for that particular fruit, but there's nothing there. And even them bush orange, this is the season for it to, you know, be hanging on a tree and ripening but there's nothing. Had a look last year and they only had flowers and no fruit came on. [JD]

Predictable and reliable plant resources are considered by Gooniyandi elders as important for future generations as they were for their ancestors who utilised plant availability and predictable economic resources to survive harsh landscapes and to pattern their movements (Dilkes-Hall et al. in press [c]). Elders worry that their youth lack engagement with bioculture as they rarely get to spend quality time with elders in the bush because of schooling arrangements and financial pressures, which affects access to Country due to lack of vehicles and transport expenses. We recognise how fortunate we were to be able to engage with younger people through this research, but this is not often the case.

Conclusions

This paper presented the results of documenting TEK with Gooniyandi Traditional Owners to help understand macrobotanical archives. By shifting the focus from the archaeological site to the wider cultural landscape, and conducting botanical survey and collection activities with Gooniyandi elders, we recorded plants of local economic importance and compared them with Riwi's macrobotanical record. Specifically, we demonstrated the applicability of coupling local TEK with archaeobotanical research to deliver more meaningful interpretations formed using Gooniyandi narratives.

This research shows there is great value in collaboration with local Aboriginal groups and we encourage similar collaborative interpretations of archaeological macrobotanical assemblages to develop an improved understanding of the role of plants in Aboriginal lifeways through time. Importantly, this research acts as a reservoir of binarri for younger generations engaged on Country who can continue to record/revisit/re-record Gooniyandi narratives to identify patterns of change and gauge resilience and flexibility of binarri into the future.

Acknowledgements

The authors would like to thank the Muludja community and Gooniyandi rangers for their insight into local knowledge and assistance with project planning, logistics and archaeological field work. This research was funded by the Australian Research Council Linkage Grant (LP100200415) with contributions from the Kimberley Foundation Australia and the Commonwealth Department of the Environment. To record ethnobotanical knowledge and oral histories with Gooniyandi Traditional Owners' ethics approval was granted by the Humans Ethics Office at the University of Western Australia (RA/4/1/8255). All flora was collected with an approved Scientific or Other Prescribed Purposes Licence (SW017894). Special thanks to Kevin Kenneally and Matthew David Barrett for assistance with taxonomic identifications. Thanks to the station managers of Fossil Downs Station, Rick and Stacey Ford. Finally, we thank two anonymous reviewers whose thoughtful comments have improved this manuscript.

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AN ARCHAEOLOGICAL INVESTIGATION OF LOCAL ABORIGINAL RESPONSES TO EUROPEAN COLONISATION IN THE SOUTH AUSTRALIAN RIVERLAND VIA AN ASSESSMENT OF CULTURALLY MODIFIED TREES

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Abstract

This paper explores the individuality and spatial uniqueness of culturally modified trees (CMTs) in the South Australian Riverland to provide new understandings about local Aboriginal responses to European colonisation. As a result of this study 89 CMTs with 99 scars were located and recorded within the floodplain on Calperum Station which can now be monitored and protected for the future. Shield/dish type scars were the most frequent scar types (60%), followed by canoe scars (19%), shelter material or *mybkoo* scars (4%) and European shingle scars (2%). The remaining 15% of scars were the result of resource procurement. Through an analysis of scar attributes, species-specific trends were illuminated that tell a distinctive local narrative of bark use in the Riverland. We conclude that there was an adapta tion of local bark procurement strategies, favouring black box (*Eucalyptus largiflorens*) bark, as opposed to bark from red gum trees (*Eucalyptus camaldulensis*), after a period of sustained European entanglement in the area. Despite this shift, red gum trees remained the target for canoe bark. These trends, when considered in conjunction with the ethnohistoric record of bark use in the region, highlight the continuity in the cultural use of bark by Aboriginal people in the Riverland region, albeit with new technology and transformed procurement strategies which occurred in response to the rapid changes brought by European invasion and settlement.

Introduction

This study explores local Aboriginal responses to European colonisation in South Australia's (SA) Riverland region through an analysis of culturally modified trees (CMTs). As a record of past bark removal and use, CMTs provide tangible, landscape-scale evidence regarding the entanglement of Aboriginal and European societies during the early colonial period. They also provide a means for assessing local Aboriginal agency, particularly in relation to colonial incursions. Additionally, investigations into CMTs, which are typically understudied (cf. Flood 1989; Hiscock 2008; Mulvaney and Kamminga 1999), can add new insights to the myriad of contact experiences of different Aboriginal societies across the continent. Aboriginal people made many decisions in the period following sustained European engagement, not only about the continuation of their bark procurement traditions, but also in relation to the integration of European materials into traditional lifeways, the selection of tree species for bark use and the adaptation of the culture of bark use and procurement to ensure successful outcomes in a landscape that was rapidly being altered by Europeans. As such this study develops a nuanced account of cultural continuity, adaptation and agency inherent in Aboriginal lifeways and responses to colonisation, from the pre (prior to the 1830s) to post (from the 1830s) contact period, as well as contributing to the global recognition of CMTs given their status as a threatened form of heritage (cf. Andersson and Rotherham 2009:225; Morrison and Shepard 2013:144).

This analysis was conducted as a part of the Calperum Station Research Project, a collaborative project between the River Murray Mallee Aboriginal Corporation (RMMAC), Flinders University and the Australian Landscape Trust (ALT). The CMTs recorded are located within the former First Peoples of the River Murray and Mallee Native Title Claim, which was determined by consent (see *Turner v South Australia 2011 FCA 1312* [18 November 2011]) and whose rights and interests are managed by RMMAC.

Calperum Station and the Riverland Region

Calperum[1] Station, in SA's Riverland region, is a 2,428 km^2 former pastoral lease now managed by the ALT. The station is located north of Renmark on the Murray River. The main river channel provides the south eastern boundary of the station, and it is the woodland and associated floodplains of this area where this research took place.

The first probable contact with Europeans in the study area occurred when Charles Sturt travelled down the Murray River during his 1830 expedition (Bull 1878:144; Sturt 1834). From 1838 onwards the station was utilised as a watering and camping point for drovers ('overlanders') moving cattle and sheep. This European incursion into Aboriginal territories led to conflict and violence (Burke et al. 2016; Foster et al. 2001:29–43; Foster and Nettelbeck 2012: 32–39; Hemming 1984). Punitive expeditions followed which ultimately concluded with the Rufus River massacre (Burke et al. 2016). The predominant period of frontier contact and conflict (c. 1830–1841) in the region has been the subject of recent and ongoing investigations (see summary in Burke et al. 2016). However, less attention has been paid to the history and archaeology of the subsequent period of ongoing colonisation.

[1] 'Calperum' likely derived from the Erawirung word *kalparum* meaning 'short cut' or 'branch road' (Tindale c.1934–1991).

The environment and ecology of the region significantly shapes the spatial distribution of living, dying and dead CMTs, and also provides a framework within which interactions between settler-colonists and Aboriginal peoples took place. The Riverland is located in the semi-arid region of Australia (Menzies and Gray 1983:9), where the mean rainfall is approximately 250 mm, and during every month of the year mean evaporation exceeds mean rainfall (Laut et al. 1977:4; Menzies and Gray 1983:1). The Murray River is characterised by a broad floodplain with a low-gradient flow, highly sinuous river system, scroll plains and distributary channels (Westell and Wood 2014:44). Red gum (*Eucalyptus camaldulensis*) woodlands dominate the floodplain (Laut et al. 1977:6, 139; Smith and Smith 1990:215) and black box (*Eucalyptus largiflorens*) woodlands occupy the highest river terraces, generally marking the maximum height of flood waters (Menzies and Gray 1983:28; Smith and Smith 1990:215).

The Murray River was formerly one of the most populated regions of pre-colonial Australia (Pardoe 2003:52; Robinson et al. 2009:206). Archaeological research has been conducted in New South Wales and in the Victorian central Murray region (e.g., Balme and Hope 1990; Bowler et al. 2003; Freedman 1983; Garvey 2013; Ross 1981) and some key areas downstream from Calperum such as Roonka, Fromm's Landing (Tungawa), Devon Downs (Ngaut Ngaut) and the Coorong Region (e.g., Hale and Tindale 1930; Mulvaney 1960; Pretty 1971, 1977, 1986; St George et al. 2013; Wilson et al. 2012). However, less research has been undertaken in the South Australian Riverland region (e.g., Jones et al. 2017; Thredgold et al. 2017; Ross et al. 2019; Westell and Wood 2014). This study, therefore, contributes to addressing this gap in archaeological knowledge of the Riverland's Aboriginal past.

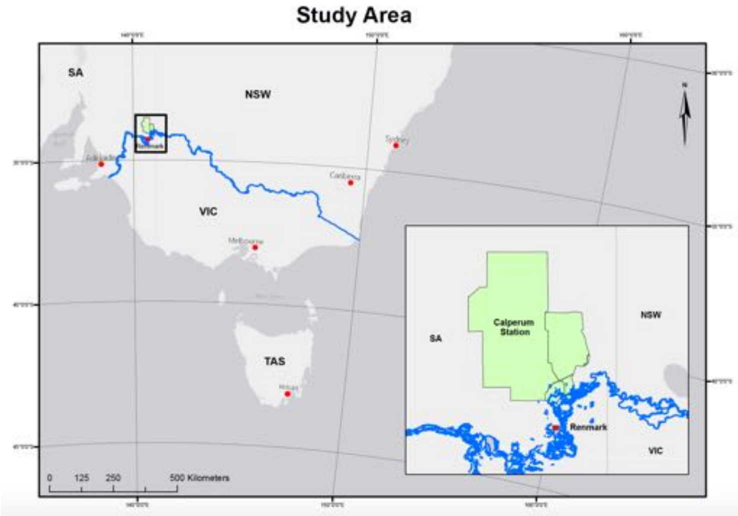

Figure 1 Map showing the location of Calperum Station (created in ESRI ArcGIS).

CMTs and the Archaeology of Colonialism

The myriad of colonial processes that occurred after European invasion and subsequent settlement in Australia have often been overlooked in the discipline of archaeology, where the focus has largely been separated between European or Aboriginal histories. There is, therefore, a need to find new ways to interrogate and explore colonial processes that arose from these interactions. One way of achieving this is through comparative archaeologies of cultural entanglement. The desire for comparative archaeologies of post-contact Indigenous experiences is well-established in archaeology, and particularly historical archaeology (Barberena et al. 2017; Lightfoot 1995; Murray 2004; Roux and Courty 2013; Willey et al. 1955). It is clear, however, that comparisons of Indigenous peoples' experiences are not possible without fine-grained analyses of local processes of colonialism. Indigenous Australia is represented by an array of interconnected cultures, rather than a 'homogeneous', or pan-Australian culture. For this reason, any perception that Australia's contact history can be organised as a single and linear trajectory of impacts and outcomes is naïve, as each and every engagement between Aboriginal peoples and Europeans resulted in a new outcome (Torrence and Clarke 2000:5, 23). Historical records across much of Australia have misrepresented Aboriginal agency, and CMTs, as the local material remains of past Aboriginal land use, can contribute to addressing this bias. This study connects a local narrative of bark use through the period of European engagement to the physical landscape at Calperum Station in an effort to materially re-insert local Aboriginal peoples into the colonial history from which they have often been made absent (after Gill et al. 2005:3).

Trees modified for cultural purposes have been recognised as unique sources of information regarding past land use and Indigenous knowledges, as exemplified by studies undertaken internationally in western North America and Scandinavia. In North America, Styrd and Feddema (1998:8) investigated the varied use of different parts of cedar trees for clothes, food, medicine and dye, and Kawa et al. (2015) considered the use of trees as a medium for art and explored how 'trail trees' were used as living signs and symbols or 'signposts' indicating tracks through the countryside. For the Indigenous Samì people of Sweden, research in the Boreal forested landscapes of Scandinavia revealed that the bark of Scot's Pine was an important food source, whilst 18th century cattle herders in Scandinavia stripped bark from trees to act as markers of socio-political borders and routes through the landscape (Andersson et al. 2005; Andersson et al. 2008; DeKoninck 2003; Östlund et al. 2002; Östlund et al. 2003). In these studies CMTs were used to demonstrate detailed aspects of past lifeways that could not be accessed through more conventional archaeological data sources. The organic nature of bark and wooden products means these features of past Indigenous lifeways are often underrepresented or absent from archaeological assemblages. CMT studies, when combined with oral histories and ethnohistoric narratives, provide unique insights into the use of tree products in the daily life of Aboriginal peoples (Gottesfeld and Johnson 1992; Östlund et al. 2003; White 1954).

In Australia large-scale published studies of CMTs are rare—most records are compiled as part of field surveys for commercial heritage reports or their presence is simply mentioned in regional studies without further analysis (e.g., Czerwinski 2002; Gill 1973; Godwin et al. 1999; Pardoe 2003; Rowland et al. 1994). The most meaningful contribution to CMT research in Australia, beyond methodological studies that discuss diagnostic features (Irish 2004; Lees 2010; Long 2003, 2005), are those studies focussed on the distribution patterns of CMTs within the landscape. These studies have largely taken place in south eastern Australia (Rhoads 1992; Webber and Burns 2004) and in the western Cape York Peninsula (Morrison and Shepard 2013).

Rhoads' (1992) research in south-western Victoria systematically analysed 299 scars to explore cultural behaviours and environmental factors influencing the distribution patterns of CMTs. Webber and Burns (2004) collected data on the total availability of bark resources within their study area to understand Aboriginal resource use patterns within the landscape. In the Cape York region of north-eastern Australia Morrison and Shepard (2013) highlighted the applicability of spatial analyses of landscape-scale data from CMTs to explore wider patterns in Indigenous landscape use, specifically in relation to Aboriginal lifeways in colonial settings.

The abovementioned studies provide examples of CMT research that produced unique insights into past Aboriginal behaviours. This paper seeks to contribute to this body of knowledge by exploring the individuality and spatial uniqueness of CMTs in order to provide new understandings about local Aboriginal responses to European colonisation in SA's Riverland region.

Methods

Understanding Past Bark use Through Ethnohistory

A desktop study was fundamental to this research in determining the historical trajectory of Aboriginal bark use in the Riverland, including how this changed with European settlement and the taphonomic factors that affect the modern distribution of CMTs. Major archives and cultural repositories were investigated, including the State Records of South Australia, the South Australian Museum Accession Register and Archives, ethnohistoric accounts, Trove and online museum collections across Australia.

Archaeological Field Surveys

Targeted field surveys for this research were conducted over two field trips in April and September 2018 with the specific goal of recording as many CMTs as possible within the timeframe and funding available. As the survival of living CMTs is restricted to the last 500 years (Rhoads 1992:200) the Holocene Murray Land System, as defined by Prendergast et al. (2009), was targeted for suitable survey areas. Ethnohistoric accounts and archaeological research suggested a spatial association of CMTs with water availability, as well as procurement of bark from red gum and black box eucalypts (Edwards 1972; Goodwin et al. 1991:31; Rhoads 1992:215; Webber and Burns 2004:43). Using current satellite images of the Calperum floodplain, sourced from Google Maps, ten survey locations were chosen that were adjacent to permanent and/or intermittent water sources and within large stands of red gum or black box species (Figure 2). A systematic and purposeful survey strategy was employed using a non-random sampling technique (Burke and Smith 2004:67). Two landscape attributes; floral (red gum or black box) and water sources, were targeted, along with locations already known by Calperum Station staff and Flinders University researchers to have CMTs present.

Archaeological recording for this project used an adapted version of a standard pro forma for CMT recording which was developed for an Australian context (Burke et al. 2017:135) (Table 1). Supplementary fields were incorporated that were specific to the analysis undertaken in this research, especially recording features that allowed insights into tree and scar maturity, as this was vital to determine the continuity and adaptation of local practices of bark use brought about by European colonisation. Tree attributes, such as a classification of the tree's health or condition and its maturity within its immediate stand, were recorded as the size of eucalypt trees is dependent on local environmental conditions (e.g., the availability of water, competition and nutrients in the soil). This assessment allowed the relative maturity of a CMT to be measured in comparison to only those trees subjected to the same environmental constraints and conditions. Scar attributes recorded included an analysis of scar length, width, regrowth width and depth, as well as the type of axe used to cut the bark. Sharp and defined steel axe marks were easily identifiable on CMT heartwoods (Figures 3 and 4), however stone axe marks were invariably harder to identify. Other additional fields included an assessment of a scar's physical condition for heritage management reasons. The length, type and number of axe marks were also recorded as the steel hatchet was quickly integrated into Aboriginal toolkits and steel axe marks in traditionally shaped scars provide significant insights into cultural entanglement. It is acknowledged that while the attribute data collected during this study is not always the best indicator of tree and scar maturity given differential rates of growth and healing, it does provide a means to make comparable and relative comments on trends. The multiple lines of evidence provided by these attributes were combined with the ethnohistoric record compiled for the region to build a local narrative of bark use. This triangulation of data was necessary as without more scientific and destructive procedures, such as radiocarbon dating and dendrochronology, chronological organisation of CMTs is problematic.

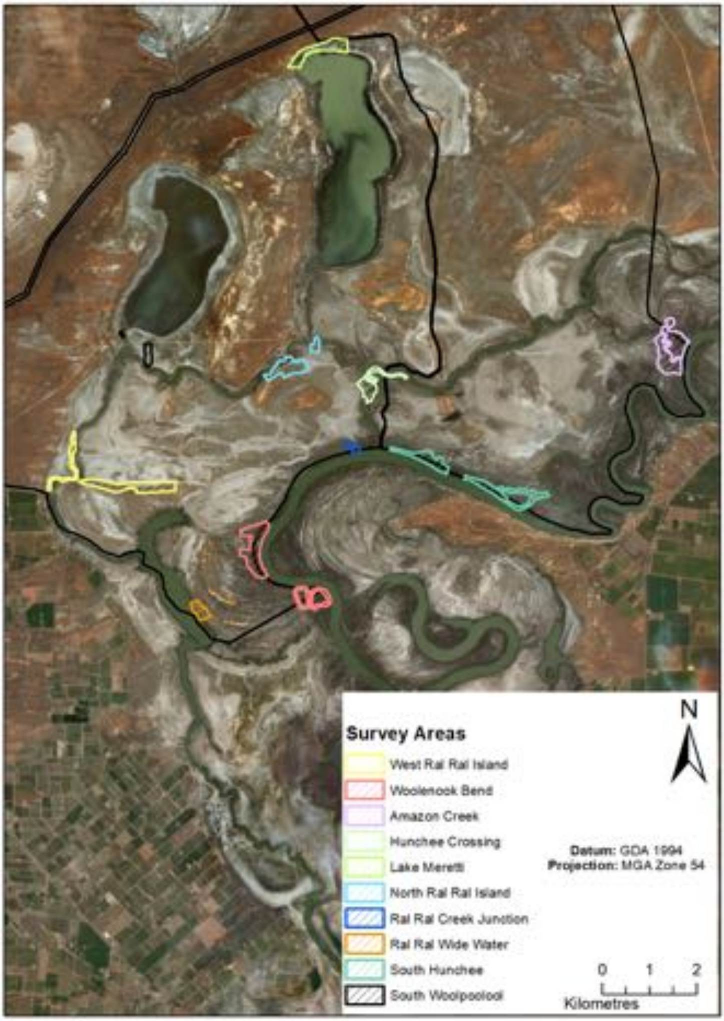

Figure 2 CMT survey areas (created in ESRI ArcGIS).

Table 1 Attributes of CMTs recorded during this study.

Features Recorded	
CMT	**Scar**
GPS location	Perceived origin (Aboriginal, European, natural)
Tree species	Scar height from ground level
Tree context	Condition of heartwood (smooth or rough)
Perceived health (dead, stressed, living)	Scar condition (poor, fair, good)
Tree maturity within its immediate stand	Dimensions (length, width, regrowth depth and width)
Circumference at 1 m from the ground	Location on tree
Number of scars	Presence of an epicormic stem
	Scar orientation
	Presence of axe marks (derivation, number and length)
	Typology (shelter, shingle, shield/dish, canoe)

Figures 3 and 4 The sharp edges of steel axe marks in scars are easily identifiable at Calperum Station. Recorded on west Ral Ral Island (21/09/2018 and 19/09/2018). Photographs by Matthew Boulden.

Results

A Cultural Trajectory of Bark use in the South Australian Riverland

Below we outline the results of our ethnohistorical research relating to bark use in the Riverland and adjacent regions. This information is essential as it provides the context for Aboriginal bark use and therefore the trajectories of this aspect of Aboriginal material culture.

Canoes

Canoes were one of the most noted material aspects of Aboriginal culture on the Murray River in ethnohistoric sources. Ethnohistoric accounts suggest that canoes were formed from a single sheet of bark harvested from red gums (Mitchell 1839a:331, 1839b:223; Roth 1908:161; Smyth 1878:407, 410; Spencer 1922:138; Sturt 1963:201) and that they were 'poled' for propulsion by spears or long sticks (Eyre 1845a:313, 264; Mitchell 1839a:223; Sturt 1834:201). The harvesting of bark for these objects has left significant and valuable evidence of their manufacture in the form of large scarred trees (Edwards 1972:71) (Figure 5).

Aboriginal canoes and associated navigation skills were paramount to the success and survival of early European colonists in South Australia (Castella 1987:128; Curr 1883:90; Dunderdale 1870:280; Foster 2000; Hardy 1976; Mitchell 1839b:331; Stevens 1969:28; Wardiningsih 2012). There are numerous historical accounts of Aboriginal people guiding and ferrying Europeans and stock across rivers and flooded creeks (Castella 1987:128; Curr 1883:90–91; Hardy 1976:82; Mitchell 1839b:33; Stevens 1969:28; Wardiningsih 2012) and of saving Europeans from drowning (Dunderdale 1870:280). Bark canoes of Aboriginal origin were at the forefront of colonial activities and their production was driven in the early years of European engagement by European needs as well as ongoing Aboriginal traditional activities. Bark canoes were also identified in the 1860s as a fundamental tool for Aboriginal livelihoods particularly in relation to fishing and by enabling access to a wide range of aquatic resources and environments (*Adelaide Observer* 1860:5; Foster 2000; Renard 2003:pl.5,6; *South Australian Weekly Chronicle* 1860a:1, 1860b:4). For this reason, the government supplied small boats and canoes to Aboriginal groups and individuals from the 1860s to the late 1880s, after which time those able to work were required to pay half the cost of the canoe's construction (Fowler et al. 2016:6). The records of these transactions and correspondence are held at the State Records of South Australia, Government Records Group (GRG) 52. Hundreds of pieces of correspondence in (GRG 52/1) and out (GRG 52/7) of the Department of Aboriginal Affairs (or equivalent) between 1866–1968 preserve the requests of Aboriginal people for canoes in the Riverland region. This correspondence shows that both men and women applied for and received canoes (e.g., GRG52/1/1890/329; GRG52/7/1887/319b) and that canoes were expected to be shared between members of Aboriginal groups for their collective subsistence (GRG52/7/1890/786a). When individuals passed away their canoe was re-issued to another individual (GRG 52/7/1894/145b). Having been denied access to suitable red gum trees for the production of their own canoes (GRG 52/1/1884/8; *South Australian Register* 1860:3), Aboriginal peoples engaged with the colonial government in a new way to obtain the resources they needed to continue their traditional aquatic hunting, gathering and fishing activities.

Figure 5 Two canoe scars on red gum trees recorded during this study. Left: Tree located on northern Reny Island less than 10 m from the water's edge of Ral Ral Creek (12/4/18). Right: Tree recorded on the north eastern corner of Hunchee Island near Amazon Creek (17/09/18). Photographs by Matthew Boulden.

Dishes and shields

Beyond canoes, a variety of other uses of bark by Aboriginal Australians are recorded in ethnohistoric accounts. In an extensive volume that synthesised the use of Australian plants by Aboriginal people, Clarke (2012:150–162) noted that bark was used for provisional containers/dishes along the Murray River, which needed to be made quickly and could only be used for a short period of time (as opposed to similar but more substantial objects made of wood) (Angas 1847; Kamminga 1988; Renard 2003:pl. 8).

Bark shields were also made for short-term use in South Australia and parts of Victoria (Hemming 1991; Smyth 1878:332) and were designed mostly for deflecting the lightweight spears thrown in organised battles (Cawthorne 1844/1926:6; Eyre 1845b:165; Jones 2007:58; Smyth 1878:330–334; Worsnop 1987:137–139). Due to the similarity in the size and shape of these scar types, it is not possible to determine function from the negative impression left behind from bark removal.

Shelter material

Aboriginal bark shelters and dwellings were a prominent cultural feature prior to European settlement (Memmott 2007). During Sturt's 1830 expedition, he recorded the use of bark huts along the Murray River when he wrote that during a storm 'we surprised a small tribe in a temporary shelter…they sat shivering in their bark huts' (Sturt 1963:199). Worsnop (1987:47), wrote that *wurlies* (Aboriginal huts) along the River Murray were covered in bark to provide protection from the weather. Clarke (2012:70, 161) noted that the sturdier bark from the red gum tree was the preferred bark used in southern South Australia for windbreaks, roofs and walls of shelters, although, Griffin and Cooper (2019) have evidenced a preferred use of bark from box species in south eastern Australia. It is likely that both red gum and box bark was targeted for shelter material in the study area, as both species were prominent in the environment and both trees have stretches of unblemished bark from which slabs could be removed.

Mybkoo

Ethnohistoric accounts highlight that, at the time of European engagement, grubs acquired from both the ground and gum trees were a prized foodstuff for Aboriginal peoples (Beveridge 1880:20; Eyre 1845a:268; Miller et al. 1993:226; Parkhouse 1923:6; Smyth 1878:207). To collect this resource bark was 'stripped' along grub tracts in trees (Long 2005:77) or a bark dish, known as a '*mybkoo*', was manufactured and then used to loosen soil in the search of grubs (Angas 1847:pl.50, fig.32) (Figures 5 and 6). While Angus (1847) does not provide any indication as to the size of *mybkoo* dishes it is evident from his illustrations that when the bark for *mybkoo* are cut from a suitable tree, the imprint of the bark removal would be similar to the square-like imprint left by Aboriginal cut shelter material.

Figure 5 *Mybkoo*, illustrated by Angas (1847:pl.50, fig.32).

Figure 6 A shelter or *mybkoo* scar recorded on Hunchee Island on a red gum tree (17/09/2018). Photograph by Matthew Boulden.

Toeholds

Tree scars in the form of toeholds are the result of Aboriginal access to tree tops in the process of possum hunting (*Adelaide Observer* 1845:2; *Chronicle* 1897:37; Eyre 1845b:280; Renard 2003:pl.1) and accessing suitable bark for implements and canoes (Edwards 1972:33,62; Renard 2003:pl. 4). A later account by Spencer (1922:138) stated that a man 'ascended the tree by chopping holes with his stone tomahawk for his toes as he proceeded'. The small aperture size of toeholds provides a significant barrier to the contemporary identification, as they quickly healed leaving no visible trace of their existence (Clarke 2012:160).

European Influence on Scars in the Landscape

Steel hatchets were likely introduced to Aboriginal groups in the Riverland region as early as the 1830s with Sturt's expedition down the Murray. Sturt was known to exchange tomahawks (and other metal objects, such pieces of iron hoop) with Aboriginal people in order to diffuse tensions, negotiate safe passage and in exchange for food supplies (Sturt 1963:41, 96, 113; Woolmer 1986:11).

Steel axes were also distributed at depots throughout the colony for many of the same reasons as with the provision of foodstuffs, blankets and other tools. This was done to assimilate Aboriginal peoples into European economic structures, to placate people and as a means of providing them with the tools for cutting firewood and their *wurlies*, so as to reduce the cost of provisions throughout the colony (Foster 2000:21). The use of introduced steel axes to cut traditional bark objects thus provides a significant example of cultural entanglement and continuity. Steel axe marks in cultural scars represents the active decisions of Aboriginal people to continue their bark procurement traditions with a different tool. Steel axe marks, therefore, can be conceptualised in the Riverland landscape not as 'assumed acculturation' but as an active continuation of traditional activities.

As European settlement increased, following the initial periods of invasion and frontier violence, profound changes were wrought on the environment, and trees were impacted in a variety of ways. For Europeans bark was a commodity used as shingles to weatherproof houses and as slabs in the process of tanning (Long 2005:29). These scars manifest in the landscape today as rectangular or elliptally-shaped tree wounds, generally cut from black box trees with steel hatchets or full-sized axes (Long 2005:30).

Extensive logging along the Murray River for European industries, such as sawn lumber, railway sleepers, piles, poles, fence posts, wood chips, craft work, fuel, WWII logging camps and riverboats, also affected the availability of bark for Aboriginal use (Bonhomme 1990:21; Long 2005:29; Mackay and Eastburn 1990:234) (see Figure 7). The riverboat industry provides a useful example of such logging with enormous amounts of wood cut for on-board boilers of the steamboats, as well as in ship building (Allen 1853/1976; Bennett 2004; Cadell 1855; Christopher 1948/2008; Drage and Page 1976; Hawker 1899/1975; Roberts et al. 2017). This colonial enterprise played a significant role in the development of SA by allowing the expansion of trade networks, providing an easier means of supplying provisions to the colony and increasing the speed of communications with north eastern colonies. The riverboat industry also epitomises cultural entanglement as Aboriginal people worked in this industry, both on boats and in wood cutting (*Adelaide Observer* 1853:5; Roberts et al. 2017; Westell and Wood 2016:4).

Two Aboriginal men are noted to have worked on the *Lady Augusta* paddle steamer for her maiden voyage (Kerr and Kerr 1975:26; Tucker 1985:25) and the *Adelaide Observer* (1853:5) highlighted that Aboriginal people and other crew from *Lady Augusta* subsequently engaged in cutting huge amounts of wood for fuel at Chowilla Station, immediately adjacent to Calperum Station. An account of the life and experiences of John Theodore Schell noted that 'he' built a house on Chowilla Station made from 'gum slabs' and with a reed roof that was cut and carried by Aboriginal people (*Murray Pioneer and Australian River Record* 1924:1). Colin Cook, an antecedent of current RMMAC community members, also recalled Aboriginal labourers in the 'woodcutting' business—not only for riverboats but for European men who supplied wood to local businesses (Hemming and Cook n.d.:55). A recent paper by Roberts et al.

(2017) demonstrated the local intangible heritage values that are associated with *Crowie,* a wrecked barge submerged beneath the Murray River in South Australia. The study discussed the role of various known Aboriginal peoples who worked as bargemen, navigating steamers along the Murray River. The paper also explored the multiple layers of attachment that local Aboriginal peoples have with the European barge *Crowie*, which could be argued was an instrument of colonisation, but which now forms a part of their cultural landscape (Roberts et al. 2017).

Modern agricultural activities along the Murray River have had adverse effects on the survival and distribution of CMTs. Increased water storage, harvesting and regulatory structures along the Murray have fundamentally changed the hydrology of the river system and its adjacent arid landscapes, resulting in a diminishing river and associated declining ecosystem health (Barnett 1989:205; George et al. 2005; Menzies and Gray 1983:36). Dams, locks and irrigation technologies have resulted in a decrease in the flow of water down the Murray, an increase in water recharge rates and a decrease in the frequency, duration and height of natural flooding events (Barnett 1989:205, 208). In the Mallee region, water diversion in the Murray-Darling Basin has removed up to 56% of the mean annual discharge from the river and widespread clearing of native vegetation along the Murray River for agricultural pursuits has seen a reduction of 38–42% of eucalypt woodlands, dominated by river red gum and black box species—those species targeted for cultural bark removal (George et al. 2005).

Figure 7 Large timber pile on the bank of the Murray River near Woolenook Internment Camp (50 km southwest of Calperum Station). Courtesy of Australia at War Research Products.

CMTs on Calperum Station

Across ten survey areas, a total of 89 (n=89) CMTs and 99 (n=99) scars were identified and recorded in the landscape as being of anthropogenic and of likely Aboriginal manufacture. All survey areas exhibited significant anthropogenic/European modification of the environment through felling and wood-cutting. The distribution of CMTs was broadly established by the habitat of appropriate tree species that are mature enough to have been available for bark procurement at the time of European colonisation. For this reason, all (n=89) of the CMTs were located in woodlands adjacent to water sources as the floodplain and high-water mark is the preferred habitat of red gum and black box trees (Menzies and Gray 1983:28; Smith and Smith 1990:215). Fifty-four percent (n=58) of the recorded CMTs were black box and 46% (n=41) were river red gums. A staggering 67.5% (n=61) of trees were identified as either stressed or dead and 85% (n=83) of scars were deemed to be in poor or fair condition, both trends with significant implications for heritage management (Figure 8). Fifteen (n=15) of the recorded scars are related to bark procurement for resources such as the widening of holes to collect possums or the stripping of bark from grub infested trees (Eyre 1845a; Kerle et al. 1992; Renard 2003). These types of CMTs can provide detailed insights into past Aboriginal lifeways (see Morrison and Shepard 2013). This study, however, focuses on CMTs specifically related to functional bark removal and therefore these 15 CMTs will only be analysed to evidence floodplain health and overall trends in CMT contexts.

The circumference of CMTs at 1 m height was recorded to assess tree maturity and contribute to the overall narrative of bark use in the Riverland. Of the recorded trees, 5% (n=3) had a circumference over 500 cm and 32% (n=22) had a circumference less than 200 cm. While no comparative data was found for red gum trees, 12 black box trees of known ages from Overland Corner on the Murray River were analysed by Klaver (1998) to provide insights into black box tree age relative to circumference. By plotting the amount of radial growth per year, Klaver (1998) subsequently argued that healthy black box trees in Riverine environments with circumferences of less than 150 cm would not be old enough to be related to Aboriginal land use in the early 19th century. Of the tree circumference ranges presented in Table 2, all those circumferences identified at less than 200 cm are located on dead trees and therefore are still relevant for consideration in this study. While red gum trees have different growth rates to black box, they do have greater circumferences in this dataset and all those CMTs with circumferences less than 300 cm were dead. It is inferred then that all red gum CMTs could also be the result of Aboriginal land use in the 19th century.

Figure 8 A canoe scar recorded in the main channel of the Murray River, on the southern side of Hunchee Island (20/9/18). This CMT is permanently inundated and will soon be lost forever. Photograph by Matthew Boulden.

Table 2 CMT circumferences at 1 m from ground level.

Tree Circumference	Red Gum	Black Box	Total
<200	4	18	**22**
200–299	6	8	**14**
300–399	16	4	**20**
400–499	9	0	**9**
500–600	0	1	**1**
>600	2	0	**2**

As noted previously, two tree species were selectively harvested for bark in the Riverland: red gum and black box trees. By exploring scar attributes of different species, trends in the cultural use of bark specific to those individual species become clearer and provide insights into the selectivity of bark for different resources (Tables 3 and 4). Forty-five percent (n=17) of the red gum scars are related to the procurement of bark for canoe production compared to only 4.5% (n=2) of black box scars. Shield/dish scars made up a significant number of scars on both tree species but accounted for 91% (n=41) of bark use from black box trees. Only a limited number of shelter scars were found, with 10.5% (n=4) on red gum trees and 4.5% (n=2) on black box trees. Red gum trees exhibited scars that were, on average, 2.6 times longer and six times wider than that of black box scars, and tended to occur on larger (more mature) red gum trees. The width of regrowth on black box trees is greater than for red gum trees, but the interior scar width is significantly less than red gum trees. Regrowth depth ranges are again dominated by red gum scars which exhibit a 10 cm greater depth range than black box trees.

Table 3 Results of scar dimensions for the two targeted tree species.

	Circumference (cm)		Regrowth Width (cm)	Regrowth Depth (cm)	Interior Length (cm)		Interior Width (cm)		Area (m^2)	
	Av.	Range	Range	Range	Av.	Range	Av.	Range	Av.	Range
Red Gum	358.4	121–615	4.5–45	2–25	194	38–500	32.3	4–70	0.7	0.045–2.8
Black Box	211.5	90–507	5.5–50	2.2–15	73	23–214	20.3	7–35	0.12	0.0161–1.6

Table 4 Numbers of scars of each typology recorded during this study.

	Canoe	**Shelter/*Mybkoo***	**Shield/Dish**
Red Gum	17	4	17
Black Box	2	2	41

Axe marks adorning the perimeter of scars provide several insights into cultural entanglement and continuity in Australian CMTs. Instead of the model of technological determinism advocated by assumed acculturation, steel axe marks in cultural scars within the Riverland represent a continuity in tradition despite the 'dominance of colonial powers' (Torrence and Clarke 2000:11). Steel axe marks were easily identifiable at Calperum Station and indicate the continuation of bark procurement strategies altered only by the use of a new tool type. On red gum trees, steel axe marks were associated with the scars on seven trees, 86% (n=6) of which were dead. Two (28.6%) were found on shelter/*mybkoo* scars and five (71.4%) on shield/dish scars. Steel axe marks were more prevalent on black box CMTs and may indicate a greater reliance on black box trees in the period following sustained European engagement in the area. Fourteen scars with axe marks were recorded with a relatively even number of trees recorded as living and dead. Twelve (86%) were on shields/dishes and two (14%) were recognised on shingle scars.

Discussion: Local Responses to Colonial Engagement

Floodplain Health

Despite the abundance of CMTs located and recorded on Calperum Station during this study, it is clear that taphonomic factors, such as agricultural pursuits, both modern and historical, the riverboat industry and aforementioned wood-cutting camps have had substantial and irreversible effects on the distribution and preservation of CMTs today. Those trees still standing are highly susceptible to changing environmental dynamics and anthropogenic activities and need to be protected for the future. The most poignant indication of degrading floodplain health at Calperum Station is the number of dead and dying trees recorded during this study. A total of 67.5% (n=60) of recorded trees were either stressed or already dead. These numbers are slightly less than those reported in Wood and Westell (2016:14) for the Chowilla Floodplain immediately upstream of Calperum, where 83% of the recorded trees were classified in this way. A higher relative portion of red gum trees were identified as 'dead' in comparison to black box (as illustrated by Figure 9), perhaps indicating that greater stress has befallen river red gums over the years. The high number of dead and dying trees of both species highlights how little time is left before the entire class of heritage known as CMTs for this area is lost.

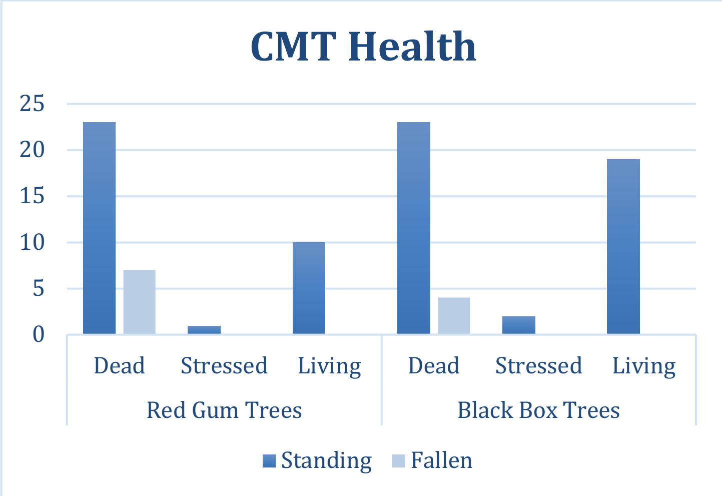

Figure 9 Overall health of CMTs on Calperum Station.

A Story from the Living Archives

European contact with Aboriginal peoples in the Riverland region began with the exploration of Charles Sturt (Bull 1878; Sturt 1834) and was followed by frontier conflict, European settlement and the marginalisation of Aboriginal peoples from their land. CMTs present in this very same landscape tell a new local narrative that highlights cultural continuity, adaption and entanglement, revealing Aboriginal peoples as active agents.

Prior to European invasion and subsequent settlement bark was widely used by Aboriginal peoples in their everyday lifeways. The diversity in the properties of bark from different species saw selectivity for different functions, whether this be the durable nature of red gum for canoes, *mybkoo* or shields, to the versatile and easily removed bark from black box for more emphemeral bark utensils and slabs. Red gum trees dominate accounts of CMTs in ethnohistoric literature for the Murray River (Carver 2001; Edwards 1972; Hemming 1991; Mitchell 1839a:331, 1839b:223; Roth 1908:161; Smyth 1878:407, 410; Spencer 1922:138; Sturt 1963:201), especially for the production of single sheet bark canoes. Most (but not all) of the cited literature pertains to the production of canoes which leave highly distinct and obvious scars in the landscape.

The intensification of European settlement saw an increase in agriculture and the subsequent clearing of much land to make it habitable for sheep and cattle. The opening of the riverboat industry and wood cutting for personal and industrial fuel in boilers or for the war effort saw a significant depletion in river red gums from the river's margins (Allen 1853/1976; Bonhomme 1990:21; Cadell 1855; Drage and Page 1976; Hawker 1899/1975; Piper 2014; Mackay and Eastburn 1990:234). The largest, most mature red gum trees were initially targeted by European wood-cutters in the same way that large red gum trees with unblemished stretches of bark were targeted for Aboriginal canoe production. Despite the pressure on red gum trees as a resource for both Aboriginal and European lifeways, the larger area of scars on red gum trees (0.7 m^2 vs 0.12 m^2) evidences a continuity in the traditional selection of red gum bark for the making of canoes. Steel axes were regularly distributed at ration depots, as was the provision of canoes, in an effort to reduce the cost of supplies at depots throughout the colony (Foster 2000:21). The shingle scar typology was introduced into the landscape as Europeans learned to use large bark sheets to weatherproof their houses. The local knowledge and skills of Aboriginal peoples contributed to the success of European industries. This is especially true for the riverboat industry where Aboriginal workers participated in a range of roles from cutting wood to fueling the boilers to navigating vessels on the Murray River (*Adelaide Observer* 1853:5; Hemming and Cook n.d.:55; Roberts et al. 2017). Aboriginal people also engaged with the construction industry (*Murray Pioneer and Australian River Record* 1924:1) and the broader wood cutting industries (Hemming and Cook n.d.:55; Linn 1995:14). Despite the effective engagement of Aboriginal peoples with European material culture and in European dominated industries, traditional activities (such as the removal of bark) did not cease.

Changes in bark procurement strategies also occurred with the entanglement of European and Aboriginal cultures. It is the analysis of axe marks that provides the greatest evidence for these changing strategies in the Riverland. Steel axe marks unequivocally date cultural scars to the period following

European invasion and have been determined to have an Aboriginal origin because their morphology reflects traditional typological shapes in Australian Aboriginal archaeology. Steel marks were recorded on the heartwood of 24.5% of red gum scars and 44% of black box scars (e.g., see Figures 8 and 9), numbers that attest to the ready adoption of steel tools into Aboriginal toolkits and use in cutting traditional bark implements from trees (Sharp 1952:18). The number of steel axe marks in each tree species, taking into consideration tree health, highlights a number of trends in bark procurement strategies.

A total of 82% of the axe marks located on red gum trees were found on trees classified as dead, most likely the result of tree death before the marks were covered by regrowth. However, on black box trees, the spread of marks is consistent between living and dead trees. The higher percentage of steel axes used on black box trees in general and visible marks on living black box trees specifically, indicates a likely change in resource procurement strategies favouring bark from this species in the period of sustained European settlement. This change in strategy can potentially be explained by taphonomy and the prevalent use of red gum in European industries, reducing access to large red gum trees suitable for bark procurement. Alternatively, it may not reflect a change in strategy at all, but rather the elimination, through felling, of a large number of scarred red gum trees in the landscape. In either case, these results indicate that traditional bark use by Aboriginal peoples in the Riverland continued after European colonisation, but the species targeted for procurement of this resource likely changed to emphasise the use of black box trees which were certainly more readily available for use. An exception to this change is the continuity in canoe production strategies. Despite the changing landscape and reduction in available red gum trees, they continued to be targeted for the construction of large canoes. It is evident that despite colonisation, cultural decisions regarding the procurement and use of bark in the Riverland region persisted as Aboriginal peoples actively navigated a rapidly changing physical and social landscape.

Conclusions

European attitudes and social norms at the time of invasion and settlement in Australia saw the exclusion of Aboriginal peoples from their countries and from many written histories. This study has shown that CMTs are a rich source of information that can be used to evidence local Aboriginal responses to European colonisation and enrich ethnohistoric accounts with new perspectives. It is also evident that past and modern European activities, such as logging for riverboats, timber and fuel, and the degrading floodplain health have significantly reduced the survival rates of this cultural resource. Despite taphonomic processes, the CMT record at Calperum Station has told a local story of active Aboriginal negotiation of power relations as they capitalised on their traditional skills to contribute to European industries. Aboriginal people made many decisions in the post-contact period, not only about the continuation of their bark procurement traditions, but also in relation to the integration of European materials into traditional lifeways, the selection of tree species for bark use and the adaptation of the culture of bark use and procurement to ensure successful outcomes in a landscape that was rapidly being altered by Europeans. This study has revealed a local narrative of Aboriginal responses to European colonisation and continued engagement in the Riverland region as they have manifested in the attributes of CMTs in the landscape.

Acknowledgements

This research was made possible through the permission and participation of the Directors of the River Murray and Mallee Aboriginal Corporation (RMMAC), RMMAC cultural heritage advisors and Calperum Station Rangers. Particular thanks must go to Jarrade Abdulla, Frank (Matthew) Boulden, Marc Fairhead, Kane Johnson, Bob Jones, Kyle Payne, Jordan Ralph, Craig Westell and staff at the State Records of South Australian for their support and assistance. This research was funded through an ARC Linkage Project (170100479) and the South Australian Murray-Darling Basin Natural Resource Management Board, through funding from the Australian Government and the Natural Resources Management levies. The project was also supported by the Australian Landscape Trust (Calperum Station). This project gained ethics approval as part of the broader 'Calperum Station Research Project' from both RMMAC and the Social and Behavioural Research Ethics Committee of Flinders University, Project Number 6618.

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RE-INVIGORATING CULTURAL BURNING PRACTICES IN VICTORIA

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Abstract

The importance of Australian Aboriginal Traditional Owner knowledge in relation to fire as a tool for ecological sustainability is, for the most part, well recognised in western scientific discourse.[1] The centrality of fire in the lives of the pre-colonial peoples within the boundaries of contemporary Victoria, can be seen in the Dreaming stories recorded by the early European amateur ethnographers, who were themselves a part of the colonisation of Australia. This paper discusses the creation of the Victorian Traditional Owner Cultural Fire Strategy (the strategy) between 2018 and 2019 and seeks to understand how this strategy might carry the cultural, social, and spiritual significance of fire for Victorian Aboriginal people into the future on a state-wide policy platform.

[1] For an introduction see Gammage (2011), Gott (2005:1203–1208, 2012:56–60), Hateley (2010), Jones (1969) and Pyne (1991).

Introduction

Aboriginal families and communities across Victoria recognise the changed nature of the landscape and the deficit between the health of the different ecological regions before and since colonisation. This paper discusses the Victorian Traditional Owner Cultural Fire Strategy which has emerged through their commitment to rehabilitate country to a safer and more culturally acceptable state (The Federation of Victorian Traditional Owner Corporations 2019). The strategy provides a set of principles and strategic priorities to facilitate greater self-determination for Traditional Owners and provides a policy and practice framework for effective Traditional Owner-led cultural fire management in Victoria. The strategy will aid the policy directive and framework across Victoria's fire agencies to support Traditional Owners to undertake cultural burning for the range of cultural values entailed by caring for country. The paper also examines the nature of the deep links between Aboriginal peoples in Victoria and their country and sheds light on why, for them, healing country is a robust strategy to heal communities and address some of the challenges still faced by their families and communities.

Throughout the paper the authors refer to many actors in the Cultural Fire space and how they interact post the release of the strategy. The Traditional Owner Fire Knowledge Group (the Knowledge Group) is made up of 50 Traditional Owners and Aboriginal fire knowledge holders from across the state. The Knowledge Group largely drove the strategy development by sharing their knowledge about fire and country. The term 'Traditional Owner' is used to refer to Aboriginal people who are custodians of and hold responsibility for areas of country now known as Victoria. This category is distinct from other Aboriginal peoples (including Aboriginal Victorians) who may have connection to country outside of Victoria but know about fire and country in Victoria through family or social connections. The main stakeholder from the Victorian State Government is the Department of Environment, Land, Water and Planning, referred to most commonly as DELWP. DELWP hold the portfolio of fire and land management and coordinate the Catchment Management Authorities (CMAs) among other services. They work closely with Parks Victoria (PV), now a statutory authority in their own right that have specific remits over land holdings, mostly National Parks. Over the last ten years there has been progress in the form of more Aboriginal people and Traditional Owners being hired by these stakeholders, which can influence relationships. The people who participated in the Knowledge Group only had small overlap with Traditional Owners working for government.

The paper illustrates the way that knowledge and practice of Traditional Owner cultural burning is being reinvigorated through the recent pilot of a Traditional Owner fire Knowledge Group and trialling cultural burns on appropriate country in Victoria. The paper is structured to provide an overview of historical accounts of Dreaming stories about fire from early European ethnographers. This is followed by a discussion of how these powerful Dreaming stories have re-emerged through the Knowledge Group and progress the push for cultural burning. The process of knowledge sharing and applying the stories in action is articulated through the Wurdi Youang case study. Field notes and observations from the case study have been analysed to describe how Traditional Owners are becoming once again empowered to conduct 'burns' on their own country. The paper culminates in a discussion of culturally informed fire management as the new operational setting and the outcomes of the positive shift of institutional support.

Fire Dreaming

The Dreaming stories of Traditional Owners of Victoria stretch back many thousands of years and are situated in the ecological and environmental realities of south-eastern Australia. Indeed, the narratives presented herein talk clearly of the country through which they range, from the Murray River and its plains to the mountainous Gariwerd (Grampians) and the temperate rainforests of Gippsland. These ancient narratives hold within them the truth of fire and its uses for an interlocking group of societies that have developed an intimate knowledge of country. Each of these stories below is contextualised over an area of country which contains multiple environmental settings, all of which are affected and changed by the skilful use of fire by Traditional Owners. Furthermore, these stories travel across country to which multiple Aboriginal groups belong. They pass from one country to another in the hands of knowledgeable elders and they, in many cases, contain different levels of knowledge—the deepest of which are only given to the most senior people in each of these groups. In other words, the practical aspects of this knowledge is available even to children but the more complex spiritual, sacred and secret knowledge must be earned through an appropriate education delivered by people of gravitas and authority.

The importance of Australian Aboriginal Traditional Owner knowledge in relation to fire as a tool for ecological sustainability is, for the most part, well recognised in western scientific discourse (see Gammage 2011; Gott 2005:1203–1208, 2012:56–60; Hateley 2010; Jones 1969; Pyne 1991). Yet, the cultural, social, ritual and spiritual significance of fire for the Aboriginal peoples of the lands now known as Victoria is less well-recognised. The central place of fire in the lives of the pre-colonial peoples within the boundaries of contemporary Victoria can be seen in the Dreaming stories recorded by the early European amateur ethnographers, who were themselves a part of the British colonisation of Australia. The following discussion weaves together a variety of stories recorded from the 1860s through to the 1960s.

One such individual who published several articles on Aboriginal ethnography in the latter years of the 19th century and early 20th century was A.L.P. Cameron. Cameron provided an example of the central nature of fire in the life world of Aboriginal people in the pre-colonial central Murray riverine region. In his account of Wadi Wadi belief, a creator being in the form of a cod fish called Pandowinda possessed fire which he used exclusively with the assistance of Kerambin, the water rat. The other animal beings, reportedly called 'Bukumurri' by Cameron's informant, grew increasingly angry at Pandowinda for keeping the secret of fire to himself and banded together to obtain it. After a long series of conversations in which various plans were put forward and rejected, Keridka the hawk determined to fly to the sun on his own and bring back fire for everyone (Cameron 1903:46).

Fraser (1930) presents another account of the same story recorded by Cameron in which the cod Pandawinda and the water-rat Koorambin were Bookoomuri creator beings changed into animals. As in the previous story, Pandawinda and Koorambin jealously guarded the secret of fire until one day Karigari, the hawk, saw them in a reed bank cooking mussels and caused the fire they were cooking on to blaze out of control by flapping his wings and causing a whirlwind to scatter burning ashes and coals among the reeds. This not only gave the secret of fire to the other animals. It also resulted in a conflagration which burned all of the trees near the river and created the plains that surround the Murray River to this day (Cameron 1885:368).

The Tati Tati version (neighbours of the Wadi-Wadi) is reproduced below:

> The Ta-ta-thi, another tribe of the same region, tell a similar tale. They say that a water-rat, whom they call Ngwoorangbin, lived in the Murray River and had a large hut, where he kept fire to cook the mussels which he brought out of the water. This fire he jealously guarded. But one day whilst he was down in the river gathering mussels, a spark flew out and was caught by Kiridka (a small hawk), who then used the spark to burn down Ngwoorangbin's house and a large tract of forest. Thus, Kiridka also created the plains along which the Murray River now flows. (Cameron 1885:368)

In the north-western region of Victoria, another story of the sun was recorded by squatter and pastoralist Peter Beveridge in the 1880s in recollections of his years in the Swan Hill and Tyntynder areas. In this story, the *nowie* (sun) was a large fire which was 'kindled in the *tyrrily* (sky) by *Ngondenont* (their good spirit) daily' (Beveridge 1889:111). Before this, the only light was from the '*mitian* (moon) and *toorts* (stars)' and there were no humans, only animals on the '*tungie* (earth)' (Beveridge 1889:111). The sun was formed during a fight between a Kurwie (emu) and a Koortinie (native companion) in which Koortinie threw one of Kurwie's eggs up into the sky where it 'broke over a large pile of firewood, which Ngondenont had seemingly prepared to that end' (Beveridge 1889:111). This resulted in the ignition of a great fire which spread light across the world. Ngondeet (the good spirit), saw that this was good for the world and resolved to build a fire to light the earth each and every day from that time forth. To reflect this, the morning is said to be cold because fire had just been kindled and did not give out much warmth as yet. By midday, the fire is burning well and the day becomes hot. In the afternoon the fire burns lower and lower until it burns out and darkness resumes (Beveridge 1889:111).

The work of amateur ethnographer and pastoralist James Dawson, who lived for many years near Camperdown in Victoria, and was appointed Protector of Aborigines in the Western Districts, also reports of stories of fire. Dawson (1881) wrote that the crows inhabiting the Grampians were the sole keepers of fire and jealously guarded it from all others. A firestick was taken from the crows by Yuuloin keear ('fire-tail wren') and was in turn stolen by a hawk called Tarrakukk who then set the country alight and brought fire to all (Dawson 1881:54). Squatter and grazier Edmund Curr partially recorded accounts of fire from central northern Victoria and from Gippsland. Curr (1887), who himself relied on information supplied by the Rev. John Bulmer, first manager of the Lake Tyers mission station, reported that the bringer of fire in Gippsland was Bimba-mrit ('the fire-tailed finch') (Curr 1887:548).

Beveridge (1889) also recorded a Wadi Wadi story concerning the role of fire in relation to how the Mitthean (which he identified as the red-breast(ed) robin) gained its distinctive markings. Beveridge describes how Mitthean became angry and threw a burning coal on to the breast of his brother-in-law, thus giving him a distinct red mark on his breast (Beveridge 1889:71).

Drawing on the early Scottish colonial and missionary, Christina Smith, Fraser (1930:10) presents a creation story concerning fire from the Maar speaking people of 'the extreme south-eastern corner of South Australia'. While Fraser, after Smith, identified these people as Booandik, the following stories are more than likely also associated with the Gundidj Mara, the Maar speaking people immediately on the Victorian side of the border. In Fraser's version of Smith's account, Mar the cockatoo kept the secret of fire to himself but the secret was revealed after he was spied upon by his fellow cockatoos while lighting a fire to cook a kangaroo that they had given him. Later, fire was stolen from him by one of the other cockatoos as he lay sleeping. In response to this, Mar became angry and 'set the grass on fire, and burnt the whole country from Mount Schanck to Guichen Bay' (Smith 1880:21). Croom, the musk duck, then 'clapped and shook his wings, and so brought the water that fills the lakes and swamps' (Smith 1880:21). Fraser also reported another, more detailed, version of this story in which humans are transformed into animals by their actions and according to their intentions in the acquisition of fire (Smith 1880:19–21).

Fraser reported the stories of the procurement of fire originating in Gippsland. In this story, fire, or Toŋ-er-a, was in the possession of two women who guarded it very closely until it was stolen by a man who had feigned affection for them. The man brought a fire-stick from the two women's camp to the rest of the people and afterwards turned into a little bird that has a red mark over his tail, which is the mark of the fire (Smyth 1878:458).

British miner and later Chair of the Board for the Protection of Aborigines, Robert Brough-Smyth, presented a further two stories recorded from the Kulin people he came into contact with in Melbourne. The first of these concerns the people of the Yarra River. In this account, the ability to make fire, or Weenth, was possessed by a woman called Kar-ak-ar-ook, who kept fire in the end of her yam-stick. In order to obtain fire from her, Waung the crow filled an ant nest with snakes who then attacked Kar-ak-ar-ook when she dug into the nest in search of ant eggs. Kar-ak-ar-ook hit the snakes with her yam-stick and, as she did, fire fell onto the ground and was picked up by Waung who then coveted it as jealously as Kar-ak-ar-ook had done. This eventually came to the attention of the great being Pund-jel (or Bunjil) who encouraged the people to scold Waung for his selfishness. Waung then became angry and sought to burn them by setting fire to the country. The people were then able to obtain fire and use it thereafter (Smyth 1878:459). Waung was then burned to death by two young men, Tchert-tchert and Trrar, who were lost or consumed by the fire and now appear as two large stones at the foot of the Dan-den-ong mountain (Smyth 1878:459).

The second story concerns their coastal neighbours, the Bunurong. In this version, two women were digging for ant eggs when they were attacked by snakes. One of the women struck at a snake and broke her *kan-nan*, or fighting stick, which then caught on fire. The fire was, however, then stolen by Waung the crow who was duly chased by two men called Toordt and Trrar. During the chase, Waung dropped the burning stick onto the earth and caused a great conflagration in which Toordt and Trrar disappeared. Pund-jel spoke to the people and warned them that, now they had fire, they should be careful never to lose it. He then showed Toordt and Trrar to them one more time before taking them into the heavens where they became stars.

As time went on, the people lost the ability to make fire and the country was infested by snakes (Ood-yul-yul Kornmul). Pal-yang, who had created women from water, sent Kar-ak-ar-ook down from the heavens to guard the women from the snakes. Kar-ak-ar-ook went around the country killing the snakes with a very long fighting stick, called a *nerrim-nerrim kan-nan*, which also broke and burst into flame. Again, Waung the crow stole the burning stick and flew away with it.

When Toordt and Trrar came back to visit the people, they were told of this and that Waung had taken the fire to a mountain called Nun-ner-woon. They then flew to the mountain and took fire from Waung. Trrar brought fire back to the people by keeping the fire safely alive in the bark of trees he had pulled off in order to keep the fire, 'as is usually done by the Aborigines when they are travelling' (Smyth 1878:459–460). Toordt, on the other hand, burned to death on a mountain called Mun-ni-o attempting to keep the fire alive. It appears he made the fire too close to a tree Brough-Smyth recorded as a *mello-an* tree and the inference is that the tree caught on fire and burned him to death (Smyth 1878:459–460). Brough-Smyth added that some 'sorcerers or priests' claim Toordt was placed in the heavens by Pund-jel and is now the planet Mars (Smyth 1878:459–460). After all of this, Kar-ak-ar-ook again warned the women not to lose the secret of fire and Trrar took the men to a mountain where wood suitable for fire-sticks could be found and taught them how to make fire of their own (Smyth 1878:459–460).

Brough-Smyth also mentioned a fire story, told to him by one Mr Stanbridge, of the people of the Mallee near Lake Tyrrell in which the Boorong of the Mallee in the vicinity of Lake Tyrell recalled that fire was brought to earth by Waung the crow (who is also the star Canopus) (Smyth 1878:460). He also related the story of fire from the people of Lake Condah in south-western Victoria in which fire was brought to earth after a man named Eun-nerct threw a spear into the sun to which a string was attached. The man then climbed to the sun and brought fire back to earth with him. Eun-nerct later transformed into a bat (Smyth 1878:462).

These narratives highlight the centrality of fire and practices relating to fire in the culture of the different Aboriginal societies of pre-colonial Victoria. In them, fire is life. Fire can clear country and free it of snakes, fire can cook food and cast light. It is a sacred thing that comes from the sky and must be carefully nurtured and controlled here on the earth. Fire is something that affects all of the people, all of the animals, all of the creator beings across all of the land.

Importantly, these narratives have not been consigned completely to history. They are a window into the cultural importance of fire, an importance that is very much alive in the knowledge and traditions of Aboriginal Victoria. During the course of research conducted for the creation of the Victorian Traditional Owner Cultural Fire Strategy, a significant fire Dreaming narrative was recorded which spanned country on both sides of the Victoria-South Australia border. However, due to the nature of its content, we do not have permission from the Traditional Owner to reproduce it here. The fire Dreaming narratives perform the same function and contain many of the themes discussed in the narratives above. They continue to form a body of important knowledge that is held by senior people with restricted dissemination beyond those authorised to hold that knowledge.

Championing Fire Dreaming Stories for the Strategy

Throughout the research engagement with Traditional Owners across Victoria for the Victorian Traditional Owner Cultural Fire Strategy, it became evident that much of the knowledge about country and fire is culturally sensitive and passed on by senior people generationally within families and communities. As with other forms of culturally contextualised knowledge held by Aboriginal peoples across the continent, this occurs within the context of a living culture and a landscape of spiritual power which must be navigated with care. As previously emphasised, in the life-world of the Aboriginal peoples of Victoria, all things are in some way connected to fire. This means necessarily that the aspects of fire knowledge appropriate for public presentation belie the richer knowledge that is not.

While many aspects of Aboriginal culture have been suppressed by the colonial experience, the stories about, and understanding of, fire throughout Aboriginal Victoria have continued to the present day. The purpose of the Victorian Traditional Owner Cultural Fire Strategy was to begin to piece together Victorian Aboriginal knowledge of fire and environment in order to provide a policy platform aimed at a more sustainable, healthier and safer fire environment.

The fire Dreaming narratives included above provide a framework for how current members of the Aboriginal community can go about re-engaging with cultural burning practices. They include the practical considerations such as when to burn, what to burn, how to burn and who can burn. In these stories, fire is a gift from the heavens which must be used as a tool for Aboriginal people. Fire is not something to be afraid of, unless it is used carelessly, such as in the Woiwurrung tradition when Waung the crow threw fire at his enemies to burn them, or when Mar the cockatoo set fire to the grass between Mount Shank and Guichen Bay in his anger at having the secret of fire stolen from him.

These Dreaming narratives tell of the devastating power of fire but also of its uses in creating safe habitats that are amenable to sustaining stable populations over millennia. Such is the case in the Wadi Wadi tradition in which Kargari the hawk fanned the flames of Pandawinda the cod and Koorambin the water-rat to spread the secret of fire among the people, thus creating the plains along the Murray River in the central Murray region. In these narratives, fire is also carefully guarded because it is recognised as a way to manage resources and to enhance the lives of those with the knowledge to use it wisely. Thus, when Bunjil/Pund-jel came down from the sky to urge the Bunurong not to lose the secret of fire that had been won back from Waung the crow by the brave efforts of the young men Toordt and Trrar.

In its current form, it is intended that the Victorian Traditional Owner Cultural Fire Strategy will provide an effective platform for the future transmission of cultural traditions and culturally appropriate knowledge. The strategy may also encourage the development of more effective ways to link modern fire management with traditional burning practices and seed the emergence of a sophisticated and evolving knowledge base capable of adjusting to climate change and its many challenges.

Wurdi Youang Case Study

The following case study was recorded by one of the authors during the course of work undertaken for the Victorian Traditional Owner Cultural Fire Strategy. It recounts the activities and preparations for a fire management event which took place in May of 2018. The event was convened at Wurdi Youang (near Geelong), a grassland adjacent to one of the most recognised Aboriginal cultural sites in Victoria. It was organised by Aboriginal fire knowledge holders who live in the local area (which includes the City of Geelong) and Traditional Owners from the Knowledge Group. This site is managed by a number of

Traditional Owners and other Aboriginal people. They were assisted by non-Aboriginal members of the local community invested in 'bringing the country back' to the condition they imagine it would have been in prior to the dispossession of Aboriginal people and the advent of European agricultural practices. Importantly, one of these men was a photographer interested in documenting the ongoing efforts of the group while another was an experienced horticulturalist keen to share and increase his knowledge of local flora.

While there is much to be said about the significance of the site, our focus is how culturally informed fire management practices are being re-imagined as part of the Victorian Cultural Fire Strategy. The fire management event was to begin at 9:30 am, but, due to the intensity of the wind that day, didn't occur until around 5 pm. During that interval, there was much discussion of the aims of the planned controlled burn and about what the ground might look like after the burn had taken place. One of the main topics was the state of the country and the difference that traditional fire management practices could make to it if Aboriginal people were once again able to carry them out, albeit in a modern context.

The senior Aboriginal person involved in the fire management event spoke of culturally informed burning as part of a larger system of management practices involving country. He explained that this system of country management also included the beliefs and ceremonies performed by Aboriginal people in order to keep their world intact, with each action and the belief that compels it is a part of a finely tuned system aimed at a sustainable reproduction of conditions favourable to abundance.

It is important to note that, in the Victorian context, cultural burning events offer opportunities for both a transmission of traditional knowledge and a re-knitting of that knowledge into the life-worlds of the participants. In order to do this, it is not uncommon for Aboriginal people to explore examples of cultural burning in other locations across the continent to bridge any knowledge gaps they may have and to make the knowledge they do have deployable as practice.

Accordingly, the men spoke about several examples of senior men burning country on Youtube and then about the creation of their own short films which documented burning events which had been supported by the Corangamite Catchment Management Authority. Much of the ensuing discussion concerned reading the environmental conditions of the day in order to understand when there might be optimal conditions for the burn.

There was also speculation that the ground contained a number of small ephemeral water holes called *gilgais* by the men. While it seemed that knowledge of this phenomenon was sourced from the internet (Wikipedia 2019 'gilgai'), the men speculated that that these *gilgais* were used by the Traditional Owners of the area (the Wathaurung) to farm yams and other edible (or otherwise economically useful) flora and as a habitat for eels, yabbies and other edible fauna. They are further convinced that these *gilgais* have been, 'human altered, subtly' (Senior Aboriginal Knowledge Holder pers. comm. 2018).

They were of the opinion that the black soil around these *gilgais* has been scraped into a series of walls in order to terrace the countryside and retain water. This transformed landscape was, they further suggested, then used to grow plants such as *Walwhalleya proluta* (coolah grass) and *Panicum decompositum* (native millet). These two plants are of particular importance to the current custodians of the site as they hope to farm them using what they term 'traditional fire management practices' and to develop a system of harvesting them in order to sell their seed. In doing so, they hope to be able to employ a large number of Aboriginal people from the Wathaurong Co-operative in Geelong and to develop this crop commercially.

Importantly, one of the senior Aboriginal people spoken to hoped to look after country and people at the same time. In their estimation traditionally based fire management practices can also be seen as a mechanism for the cultural re-invigoration of his community. Furthermore, as fire appears the only way of promoting these species of native grasses while inhibiting other introduced species, he saw this as further proof that the country and the community alike need a culturally-informed burning regime to once again be healthy. We recognise here that the burn and activities were conducted solely by men on this occasion.

There needs to be more research undertaken to ascertain the role of women burning for cultural purposes in Victoria.

As a group, the men (both Aboriginal and non-Aboriginal) agreed that the soil nearby had been altered by generational fire activity near the site as people gathered seasonally to attend ceremonies. As the senior Aboriginal man explained:

> You've got the Wurdi Youang, and that tells its own story. They'd do a burn and it will create all of this native grass seed for the summer solstice, so when they would come there would be a food source, and the same with the winter solstice. They would have done a burn to produce enough food to be here for different things [events]. It's slapping us right in the face. It's there…and so, all the burning that people done was to produce food.

The men also theorised that deposits of kaolin (kaolinite) that are abundant throughout the property are further evidence of the landscape being transformed by fire. One of them related that the kaolin only transforms into rock-like lumps after it has been fired (prior to this it exists as a powder in the round).[2]

Of his plans to provide a sustainable economic resource for his community, the senior Aboriginal person present explained:

> And so, we're trialling how to put back all these arable areas back into native grasses. And, so with that, we stumbled across the seed source by...We got it tested by the National Measurement Institute and the CSIRO and we found that the native grasses have more protein than wheat, barley and oats, 28 more times digestible protein. It's gluten-free and it's a drought tolerant plant. So, what I say to everybody is, in 30 years, what are your kids gunna be eating?

[2] This fact has not been substantiated by participants or authors.

As for his goal in managing the property, he stated:

> The goal of this land is to for all of these arable areas to be cropped back into native grasses…by using fire. We have to do it by using fire. The seeds are still in some of that soil, it just takes a burn to bring it up. It was by accident, because Alfie done a burn…and it just took off, but, where that happened, the amount of native grass down there, and we'll show you, is incredible.

He also surmised that the drought resistant nature of the plant will only make it more valuable when the impacts of climate change are more keenly felt throughout the region:

> It's growing on a 2 million-year-old volcanic plain…Aboriginals used fire to renew it and remake it, and its story just keeps going.

He also spoke of growing and testing other native plants (chiefly grasses) for their nutritional and medicinal properties. He related that the endangered status of the natural grasses and grasslands makes their work on the property even more urgent.

With regard to the correct conditions under which fire knowledge should be shared, he related that grasslands were the best contexts in which fire events should be undertaken when seeking to teach culturally-informed fire management practices. He further explained some of the benefits of burning on the Wurdi Youang property:

> This is the value of this weekend because I've been trying to get people out here, and we've got safe rocky rises with plough lines all around them and we can actually teach them [the people]. And it's very safe. Like you don't start at the top, like doing major bush fires. You start at the bottom…This is why this is a safe place to start burning.

What is interesting and compelling about this case study is that it references many of the intersections between culture, tradition, science and knowledge underpinning the re-invigoration of cultural informed resource management practices in south-eastern Australia.

As a group, the men draw upon fire knowledge sourced from all over the country through the internet and through their own relationships with different Aboriginal communities and people. They contextualise this within the realities of the grasslands they are working with and have knowledge about and with the particular species of plants they are attempting to either reduce or encourage. They are also considering the present qualities of the soil of the land and the features that lie underneath the current vegetation.

In addition, there is a socio-political aim to strengthen the local Aboriginal community through the preservation of culturally informed fire knowledge and, indeed, the expansion of this knowledge into an increasingly modern context. While the scope of this paper does not allow for more than a cursory acknowledgement of the complexities underlying these intersections, the potential for further research into knowledge, ways of knowing and contemporary cultural identity in Aboriginal Victoria should be acknowledged. Furthermore, the intersection of culturally informed practice and generally western science-based practice that appears where communities of Aboriginal people and non-Aboriginal people collaborate is also particularly worthy of further attention as it is an arena which is dynamic and expanding.

Culturally-Informed Fire Management

Cultural understanding of country is intrinsically concerned with fire and other Aboriginal land and water management practices. Fire is one of a range of practices used to manage country, but its use as such by Aboriginal peoples in Victoria has been either restricted or banned since colonisation. Additionally, the policies of the State have had a profound impact on the present condition of the landscape. For more than 100 years, the State has been managing fire as a risk to life and property and has concentrated its resources on building lines of containment and safety (bare earth buffer strips) and on emergency management. It has also implemented policies that aim to reduce fuel loads, through prescribed or planned burning. Consequently, the natural and built environment have changed considerably since pre-colonial and early colonial times.

Despite this, through the authors' engagement with the Knowledge Group, it is understood that culturally informed burning continues to occur in different parts of Victoria. As with other aspects of cultural practice, knowledge related to cultural burning has been transmitted generationally within the Aboriginal families of polity that dominate the Victorian context (O'Kane 2017). While we cannot say that this knowledge has continued to descend uninterrupted and substantially intact despite the processes of colonisation, our research suggests that the information and knowledge which emerged in interviews and Knowledge Group discussions was firmly encased in a cultural logic consistent with the documented social organisation and knowledge systems of the Aboriginal peoples of south-eastern Australia. In light of the tenacity of this knowledge and continued practice by different communities within Victoria, we would argue that the Aboriginal peoples of Victoria have demonstrated considerable ability to protect the essential elements of fire knowledge. This provides a suitable foundation to re-apply fire knowledge and practice in both the planning and management of Country in contemporary settings. The Victorian Cultural Burning Strategy is therefore a *deployable strategy*.

The success factors in once again operationalising cultural fire in Victorian landscapes are the creation of Country Fire Strategies (as a planning tool, described above) and Knowledge Groups (as a governance tool). Knowledge Groups are a contemporary expression of Indigenous governance arrangements to safeguard and further develop knowledge and practice.

In the case of fire (and possibly other areas of knowledge and practice) ancient knowledge and more contemporary expressions of knowledge and practice have been safeguarded in other parts of Australia. Victorian Traditional Owners have been re-engaging with this information through an Aboriginal fire practitioner network, which is essentially an extension of the Victorian Knowledge Group (Firesticks Alliance Indigenous Corporation 2019). Gatherings of this larger group take place at least once a year in different parts of Australia and offer an ideal opportunity for Victorian Traditional Owners to reconnect to ancient contemporary knowledge and adapt it to a Victorian context.

Traditional Owner groups have also been applying practice on areas of land that they either control directly (e.g., as Aboriginal freehold that has been secured under the *Native Title Act 1993* (Cth) and/or areas that they can leverage sufficiently enabling partnership arrangements with fire management agencies to be able to redeploy their practice).

In order to operationalise and institutionalise the management of country through the application of cultural fire practice once again, significant reform is required to the operating, institutional and regulatory arrangements that have been established during the colonial period. Achievement of this will require some practical interim arrangements, to be able to heal country in a context where the social and ecological environment is significantly changed, so that cultural fire can be applied safely and beneficially across all environmental fire conditions.

Table 1 was developed by one of the authors to represent an environment in transition. It was developed during some of the first Knowledge Group meetings held for the Victorian Traditional Owner Cultural Fire Strategy. This concept underlines the logic of first needing to bring the system back into balance before being able to understand culturally informed burning practices as ‘traditional’. This speaks to a broader vision of how Aboriginal people in Victoria understand the impact of colonial farming and land management practices on the physical landscape and the work they feel is needed to return country to a state manageable by practices they understand to be ‘traditional’. Clearly, there is a far larger discussion to be had concerning the issues just raised and the authors suggest that this would be a profitable area for future research.

Table 1. Transitioning to cultural burning in Victoria.

Sick Country	Transition	Healthy Country
Landscapes with high fuel load	Creation of firm policy and structural governance relationships reflecting partnership with appropriate bodies (DELWP/CFA/MFB/Parks Victoria etc.)	Landscapes with normal fuel load
Public safety is the first consideration	Development of complementary practices and processes	Public safety is the first consideration
Management to largely a single objective (fuel reduction)	Reducing harmful effects on country due to 'hot burns'[3]	Management to multiple objectives and values (healing country and culture)
The risks of introducing a cultural burning regime are high	Development of culturally appropriate learning (education, training) and research relationships	The risks of introducing a cultural burning regime are low
Practices need to be developed in order to reduce fuel load while lessening the impact on country	Development of practices in order to transition to cultural burning whilst working with fuel reduction regimes	Authentic cultural burning on a country level involving groups of Traditional Owners as part of a Community of Practice

[3] Traditional Owners consider some Government planned burns to be too hot i.e., 'Not Right Fire'—the fire behaviour may be too intense and can be damaging to country. To some extent this is also a consequence of a changed environment, making initial conditions difficult to effect a cool burn (Department of Sustainability and Environment 2003).

The introduction of two new institutions are seminal to achieving this transition and embedding practice. The first is the presence of a Traditional Owner Fire Knowledge Group as an enduring, perpetual institution to both incorporate learning (for adaptive management) and to guide the further application of practice in the planning and management of country provides a sound basis for the ongoing re-activation and redeployment of culturally based Aboriginal fire practices within Victoria. The second is the development of a co-governance group for cultural fire, in which Traditional Owners and senior cultural burning practitioners from the knowledge group join with the State Government (fire agency leaders such as DELWP) to resolve institutional and policy issues as they arise from the application of practice. To this end, the current Project Control Group will reform as the Fire Co-Governance Group as we move into the next stages of implementation of the Strategy.

Conclusions

The Victorian Cultural Fire Strategy is an ambitious policy as it straddles the area between conventional natural resource management (NRM) and Aboriginal cultural knowledge and practice. Clearly, these two things are qualitatively different and the meshing of the two approaches in a modern governmental setting will take time to evolve and mature. One of the most obvious differences between the two methods (if that term is broad enough to be appropriate here) is that the linkage of country—to people—to families—to kinship networks amongst the Aboriginal peoples of Victoria locates and defines their identity in a way that is unparalleled in areas of the broader community. A science based NRM perspective does not include reference to foundational narratives, nor does it envision a landscape filled with spiritual power which must be navigated carefully and tended to unceasingly.

While much structural change has been wrought to Aboriginal social organisation through the processes of colonisation in Victoria, the Dreaming stories described in this paper present a window into an older, pre-colonial reality in which a stable and predictable fire environment existed. This environment was a physical expression of the stability and durability of Aboriginal social organisation which, over thousands of years, proved practical and sustainable. Even on the most superficial level (that of stories recorded by European colonisers with little understanding of their deeper context), the narratives concerning fire in what is now become Victoria highlights this relationship between social organisation and the management of country through fire.

As was evident in the Wurdi Youang case study, the re-invigorating and re-constituting of Aboriginal fire management practices in the modern Victorian context may well prove to also be a vehicle for the re-emergence of the connection between country and people (in areas where this connection has been deeply impacted by colonisation) and the strengthening of this connection where Aboriginal communities have visibly maintained association with their country. As is noted above, the people engaged in the strategy's Traditional Owner Knowledge Group have seen, and continue to see, culturally informed fire management events as opportunities to re-engage with each other in a direct and authoritative relationship with country which is recognised by the NRM agencies of the Victorian State government as both valuable and necessary.

There is also a great potential for formal recognition of the traditional ownership of country in areas not presently recognised[4] as government departments and policy developers identify the need to work with the Aboriginal peoples of specific areas to further ensure the evolution of effective fire management regimes. This will be an incredibly rich area for anthropological and broader social research in the near future,

[4] Formal recognition in Victoria presently includes native title recognition, recognition as Traditional Owners under the *Traditional Owner Settlement Act 2010* (Vic) or recognition as a Registered Aboriginal Party for cultural heritage management purposes.

as those engaged (both in the Aboriginal and non-Aboriginal stakeholder communities) continue to find more effective ways to deploy Aboriginal fire knowledge and practices through a State governmental policy framework, which already utilises modern western science based NRM. While the authors have not been able to address here many of the complexities involved in enmeshing these two knowledge/practice systems, we feel it is important to flag the opportunities for ethnographic description and analysis in their emerging confluence.

Acknowledgements

The authors would like to acknowledge the Traditional Owner elders and other fire knowledge holders and practitioners, who participated in the Knowledge Group and development of the strategy, as their contributions are invaluable. This paper was conceptualised during the work to complete the Victorian Traditional Owner Cultural Fire Strategy in 2018 and 2019. Our perspectives and ideas in relation to the process of re-invigorating cultural burning are principally informed by the stories shared by members of the Traditional Owner Fire Knowledge Group. Senior anthropologist, Dr Michael O'Kane, conducted the interviews with Traditional Owners during the Knowledge Group gatherings to progress the strategy. Consent was provided by interviewees for the stories to be used in a general sense as part of the strategy and related documents. Interviewees requested that their names and identifying information be withheld.

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'SCARRED FOR LIFE': A PRELIMINARY COMPARATIVE FUNCTIONAL ANALYSIS OF CULTURALLY MODIFIED TREES AT KROMELAK (OUTLET CREEK), ROSS LAKE AND NORTHERN GURU (LAKE HINDMARSH) ON WOTJOBALUK COUNTRY, WESTERN VICTORIA, AUSTRALIA

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Abstract

Barengi Gadjin Land Council Aboriginal Corporation (BGLC), Cooper Heritage Management (Cooper HM) and the Wimmera Catchment Management Authority (WCMA) recently recorded 172 culturally modified trees (CMTs) during Stage 1 of a targeted archaeological survey that formed a component of the Lower Wimmera River Aboriginal Water Project. Stage 1 included an assessment of the entirety of the waterway known as Outlet Creek (Kromelak), the section of the Wimmera River (Barringgi Gadyin) that runs between Lake Hindmarsh (Guru) and Lake Albacutya (Ngalpakatia/Ngelpagutya), as well as Ross Lake, on Wotjobaluk Country, western Victoria. Of the 172 CMTs recorded, only 28 were registered on the Victorian Aboriginal Heritage Register (VAHR) resulting in 144 new registrations. This paper examines some of the findings and commonalities derived from a preliminary comparative analysis of the data and suggests an updated list of functional categories that can be employed when recording CMTs.

Introduction

The Lower Wimmera River Aboriginal Water Project (LWRAW Project) is funded by the Australian Federal Government's National Landcare Program and the Victorian State Government's Department of Environment, Land Water and Planning (DELWP). The project's primary objective is to assess the Aboriginal cultural values of the Barringgi Gadyin through the recording, collating and mapping of Traditional Owners' (TOs) stories and connections to this waterway, which is central to Wotjobaluk culture and Country. Barringgi Gadyin is the Wergaia name for the entirety of the Wimmera River; *barringgi* = track (of or belong), *gadyin* = water.[1]

The project is managed by Barengi Gadjin Land Council Aboriginal Corporation (BGLC) and the Wimmera Catchment Management Authority (WCMA) and driven by Wotjobaluk TOs working at these organisations. In order to achieve the project's aims, a number of smaller programs are being undertaken. These include anthropological and cultural values recording, cultural mapping and virtual reality reconstructions of the cultural landscape called River Yarns; as well as other intangible heritage assessment projects in partnership with Aboriginal Victoria (AV) (BGLC 2017:15; McMillian et al. in press). A targeted archaeological survey was also initiated and this paper examines the results of Stage 1 of the survey.

[1] Wergaia words and names are used according to the orthography in Reid (2007).

Barringgi Gadyin, Wotjobaluk Country

The Barringgi Gadyin is a major waterway in western Victoria, approximately 278 km long (Figure 1). The river originates in the Pyrenees Ranges and flows across the northern foothills of Gariwerd (the Grampians) before travelling north and ending at Guru (Lake Hindmarsh), which, when filled, is the largest freshwater lake in Victoria. In times of peak flow, water travels north from Guru into Kromelak (Outlet Creek) and reaches the Ramsar-listed Ngalpakatia/Ngelpagutya (Lake Albacutya). Prior to the impact of European farming practices on the hydrology of the area, it is estimated that Ngalpakatia/Ngelpagutya filled with water every one in 17 years, with Kromelak filling up more frequently. The last time Ngalpakatia/Ngelpagutya and Kromelak contained any water was in 1996 and Ngalpakatia/Ngelpagutya was previously filled in 1975 (BGLC 2017:9, 41; DSE 2003:11).

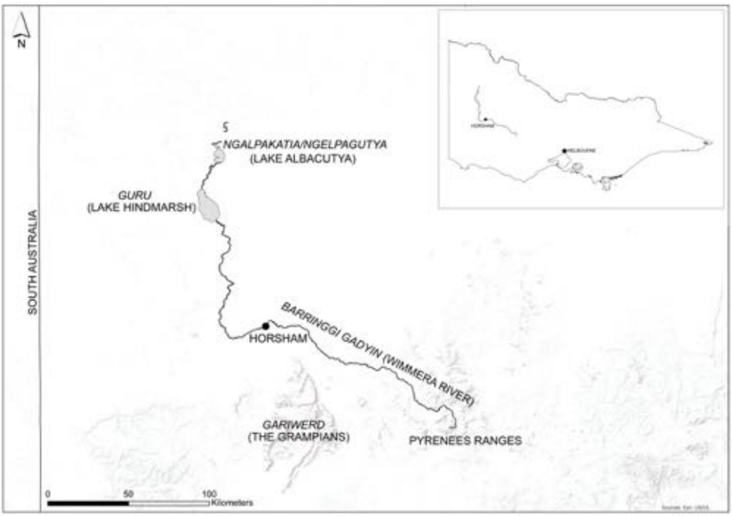

Figure 1 Location of the Barringgi Gadyin (Wimmera River). Map by Abby Cooper.

The Barringgi Gadyin is at the heart of the traditional lands of the Wotjobaluk, Jadawadjali, Wergaia, Jaadwa and Jupagulk Peoples, collectively known as the Wotjobaluk Nations. These peoples traditionally spoke Jadawadjali and Wergaia (and associated dialects). The Wotjobaluk Nations were forcibly moved onto Ebenezer Mission, a Moravian run mission station established in 1859 on the site of a traditional ceremonial and meeting ground called Bunji-bunag, located on a bend on the Barringgi Gadyin, near the township of Antwerp (Figure 2). Although the mission officially closed in 1904, the descendants of these peoples continued to live along the Barringgi Gadyin, mostly in fringe-camps at Antwerp, Dimboola and Horsham (BGLC 2017:5–7; Lydon 2009).

The continuous occupation of the Barringgi Gadyin resulted in the Wotjobaluk Nations being the first Aboriginal group to achieve a successful native title consent determination in south eastern Australia on 13 December 2005 (*Clarke on behalf of the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagulk Peoples v Victoria [2005] FCA 1795*). The Federal Court of Australia recognised the strong spiritual and social connection of the Wotjobaluk Peoples to the Barringgi Gadyin and its surrounding cultural landscape. Central to this continuous spiritual connection are the 'Dreaming' stories describing the creation of the Barringgi Gadyin. Within the subject area this includes creation narratives about Purra (the kangaroo), Duan/Doowan (the sugar glider), Werrinbool/Wirnbullain (the spider), Tchingal (the giant Emu) and Waa (the Crow). All these creation stories form part of the larger Dreaming story/cycle of the Bram-bram-bult Brothers (BGLC 2017:2–4).

Targeted Archaeological Survey Aims

The primary aims of the LWRAW Project are to capture the significant and ongoing Aboriginal cultural connections to the Barringgi Gadyin as well as to assess the cultural health of the lower sections of the river, and make recommendations regarding how the environment can be improved in order to protect and enhance Aboriginal cultural values. For the purposes of the LWRAW Project, the lower Wimmera River is considered to include the water, bed, banks and associated land, from Bogambilor (Horsham) to Ngalpakatia/Ngelpagutya.

The archaeological surveys evolved from the targeted waterway assessments and inspections carried out by Wotjobaluk TOs at specific points along the lower Wimmera River, as part of the River Yarns program (BGLC 2017:15; DELWP 2017:274–281). To aid in these assessments the TOs requested more detailed information on the tangible cultural heritage associated with this section of the Barringgi Gadyin. In order to assist the implementation of the archaeological survey program, the LWRAW Project study area was divided into Stages. Stage 1 is the northern most section of the study area, from Guru to Ngalpakatia/Ngelpagutya.

The specific aims of the survey program are to assess the condition and location of previously recorded Aboriginal places, and record any new Aboriginal places, focusing on areas not previously archaeologically surveyed. Another important aim of the survey is to provide training and field experience for TOs in standard archaeological fieldwork techniques and AV site recording standards.

A further objective is to use this opportunity to commence a comprehensive archaeological survey of the Wotjobaluk Peoples' native title area. This area essentially comprises Crown land either side of the Barringgi Gadyin for the majority of the river's length. This objective aligns with the aspirations of the Wotjobaluk Peoples to manage the cultural values and assets on their Country and protect their native title rights and interests, as detailed in their Country Plan (BGLC 2017:37,41).

BGLC and WCMA are engaged in ongoing discussions with AV regarding the LWRAW Project. The main purpose of this dialogue is to ensure that the cultural interests and obligations of the Wotjobaluk Peoples are protected, and the requirements of the Victorian *Aboriginal Heritage Act* 2006, especially in regards to cultural heritage reporting and registration, are satisfied throughout the duration of the project.

Survey Area

The survey area, referred to as Stage 1, is located in semi-arid western Victoria approximately 440 km north west of Melbourne. It comprises approximately 28.5 km of creek line along Kromelak between Guru and Ngalpakatia/Ngelpagutya, as well as approximately 70 ha of mature vegetation surrounding Ross Lake and 33 ha of mature vegetation north of Guru (Figure 2). The survey area covers Crown land reserves in these locations, which is also the area of native title for the Wotjobaluk Peoples. This area is on average 200 m in width either side of Kromelak, from the bed of the creek to the edge of the reserve (although there are sections either side of the creek that are up to 700 m wide). Some locations within Stage 1 are over 1.5 km from the creek to the edge of the reserve, such as at Ross Lake and north of Guru. The land in Stage 1 is managed under a Co-operative Management Agreement between the Wotjobaluk Peoples and the State of Victoria (through DELWP/Parks Victoria), and the water within the creek and lake systems is managed by the Wimmera Catchment Management Authority (WMCA).

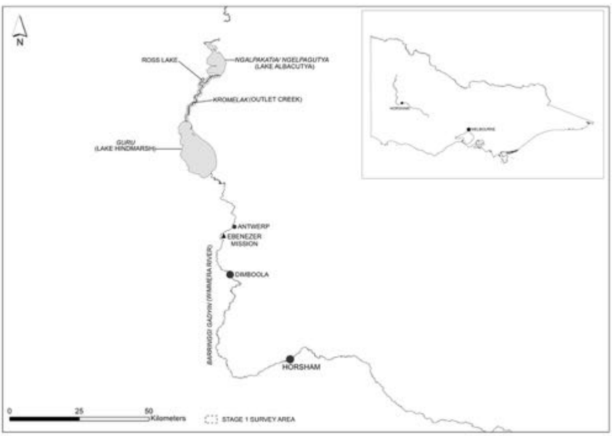

Figure 2 Stage 1 survey area, Lower Wimmera River Aboriginal Water Project. Map by Abby Cooper.

Prior to European interference, vegetation along Kromelak and north of Guru comprised 'Intermittent Swampy Woodland', a pre-1750s Ecological Vegetation Class (EVC) consisting of large tree species, such as *Eucalyptus largiflorens* (black box) and *Eucalyptus camaldulensis* (river red gum), which dominated the landscape. *Eucalyptus macrocarpa* (grey box) was also present, though not typical of this EVC, or of the now depleted 'Riverine Chenopod Woodland' that once flanked it (DELWP 2016). Understorey included *Muehlenbeckia florulenta* (tangled lignum), remnant native grasses and invasive weeds, such as *Opuntia stricta* (prickly pear).

Large tree species around Ross Lake included black box, which is typical of the 'Northern Wimmera Riverine Chenopod Woodland' pre-1750s EVC (DELWP 2016), as well as grey box. Understorey mostly occurred on elevated terraces confined to heavy clay soils and was dominated by various species of saltbush, as well as remnant native grasses and weeds.

Remnants of these native vegetation classes can only be found within the Crown land reserves that comprise the Stage 1 survey area. Outside this area almost all native vegetation has been cleared, and the properties surrounding the survey area are predominantly heavily cropped paddocks.

Methods

The surveys and training (led by the authors) were undertaken over 19 days between June 2017 and July 2019. Dave Johnston (Aboriginal Archaeologists Australia) also trained TOs in archaeological site identification and recording during the survey of Ross Lake and north Guru in mid-2017. Nine local TOs and one local Aboriginal resident participated in the Stage 1 survey. Three of the participants had existing experience in archaeological site recording gained through employment as field representatives at BGLC and having completed the Certificate IV in Aboriginal Cultural Heritage Management delivered by La Trobe University.

Standard archaeological survey transects, where survey team members walk parallel to each other as described in Burke et al. (2017:89), were employed across the entire area. The landscape within the survey area is largely flat and open, and it was quickly established that the dominant Aboriginal place type was CMTs. Therefore, a relatively a low intensity pedestrian survey was employed, which would achieve the aims of the program and cover the most amount of Stage 1 possible within the constraints of the LWRAW Project. The intervals between individual survey members (transect widths) were 20 m, with each surveyor effectively scanning 10 m either side of them.

The survey team entered data for each CMT directly on to hard copies of AV's standard recording forms for scarred trees, in accordance with AV's (2008) *Standard's for Recording Victorian Aboriginal Heritage Places and Objects*, which sets out the requirements for preparing forms and records for entry on the VAHR. The team also utilised Long's (2003) *Scarred Trees: An Identification and Recording Manual*, which remains the standard reference for the identification and recording of scarred trees in Victoria. Each CMT was sketched, photographed and coordinates recorded using Trimble handheld DGPS devices (Juno and GeoExplorer). Spatial data was post-processed using Trimble software to achieve centimetre-level positioning accuracy.

Initially, the survey team sought to relocate the 96 CMTs registered within the Stage 1 survey area, the majority of which were recorded in 1992 by Roger Luebbers under the Victorian Archaeological Survey (VAS) program (see Rhoads 1992:203–207 for a description of methods used for these surveys in south west Victoria). However, information on the original site cards was often too brief and coordinates on the VAHR mostly inaccurate, as these locations were recorded prior to the use of GPS. It was decided a more effective method was to record all CMTs identified within the study area and undertake a cross-check at the conclusion of the survey to determine which CMTs were already registered on the VAHR.

Results

A total of 172 CMTs were recorded in the Stage 1 survey area (Figure 3). Of these, 28 CMTs had been previously registered on the VAHR, resulting in 144 new registrations. Survey participants were unable to locate the remaining 68 previously registered CMTs recorded in 1992, which meant there was a total of 212 CMTs (144 new registrations and 68 existing registrations) recorded in the survey area (Figure 3).

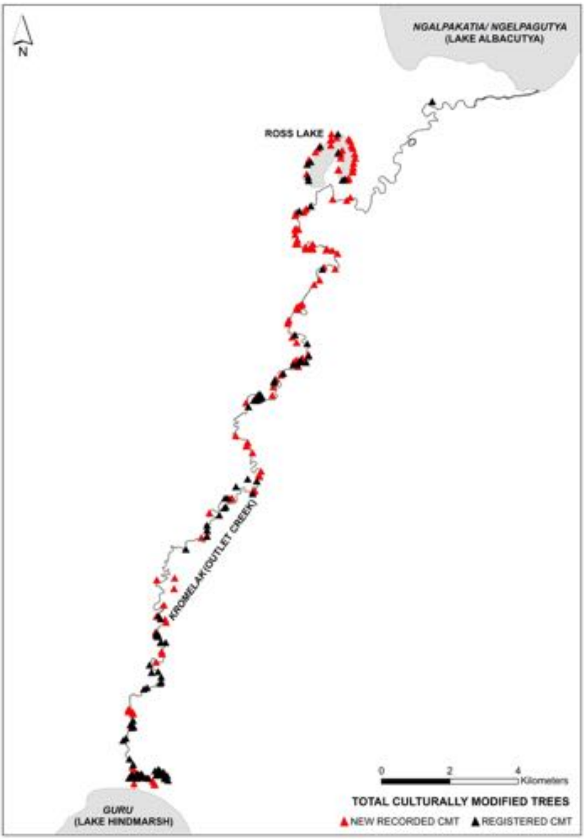

Figure 3 Total number of CMTs in Stage 1 survey area. Map by Abby Cooper.

One possible reason for the absence of the 68 previously registered CMTs in the survey area is demonstrated by the results at Ross Lake where the detailed survey failed to relocate two CMTs that had previously been recorded. In addition, two of the seven CMTs previously registered at Ross Lake relocated during the survey were in an extremely poor condition (Ross Lake ST4, VAHR 7226-0053 and Ross Lake ST6, VAHR 7226-0055). In both instances the tree had fallen over and deteriorated, and the heartwood was almost completely rotten (Figure 4). A subsequent analysis of the original site cards for the 68 CMTs unable to be relocated during the survey revealed only 20.83% were deemed to be in 'good' condition at the time of recording. The remainder were noted as being 'dead' (11.45%), 'dying' (17.70%) or in 'poor' (20.83%) condition.

It is therefore likely that the majority of previously registered CMTs are in a similar condition to the two CMTs relocated at Ross Lake. Since 1992, it appears they have died, become rotten and/or fallen over, making them difficult to relocate. Some of them may have disappeared from the landscape altogether, as being exposed on the ground in this deteriorated state increases their susceptibility to complete destruction from impacts such as bushfires, firewood collection and natural decay. The fact that such a significant number of registered CMTs can entirely disappear from the landscape within this relatively short time period highlights the vulnerability of this Aboriginal place type in the contemporary landscape of south eastern Australia.

Figure 4 Ross Lake ST4 (VAHR 7226-0053), view looking east.

Tree Species Selection

An analysis of species targeted for use as CMTs within Stage 1 is shown in Table 1. These figures clearly demonstrate that box species were preferred far above any other tree species, with black box constituting over half of the CMTs recorded during the survey. The trees recorded as 'uncertain' were all dead and therefore their species could not be definitively determined, but it is likely that the majority of them were also box species. One of the possible reasons for this preference is proposed by Servaes and Prendergast (2002:7). They note that across Australia the numerous species of Eucalyptus that had stringy-like bark, including box species, were considered by Aboriginal people to be the most suitable for building shelters and making drawings and paintings. They state that although these species are not necessarily taxonomically close, they all have similar bark characteristics, including firm, durable, supple, knot-free bark that can be relatively easily removed from the trunk (Servaes and Prendergast 2002:7).

Table 1 Tree species of CMTs within the Stage 1 survey area.

Tree Species	Number	Percentage
Black Box	89	51.72%
Grey Box	46	27.01%
Red Gum	13	7.47%
Other Gum	1	0.57%
Uncertain	23	13.22%
TOTAL	172	100.00%

It is possible that it was these characteristics that were sought after by Aboriginal people within the survey area, and the box species subsequently targeted. The only other species represented in any significant number was red gum. These results are comparable to data collected on CMTs from similar large-scale surveys conducted in the region, the most relevant being Rhoads (1992:207–208) and Webber and Burns

(2004:39–44). These two investigations demonstrate similar results for tree species type and percentages selected for use as CMTs.

Cultural information gathered from the Aboriginal participants in the survey program, and Wotjobaluk TOs involved in the LWRAW Project, suggest that Aboriginal selection criteria for tree species used for CMTs is predominantly based on function. The type and ultimate function of the bark being removed from the CMT, or the type of resource being extracted from the CMT, was the main determining factor for selecting a particular tree species. For example, the general perception of the Aboriginal participants was that the bark from box species were used for housing and the bark from red gums was used for canoes. The results shown in Table 1 were believed to support this as traditionally there were more bark huts than canoes.

A more detailed reference to cultural knowledge and tree species selection is indicated in the following quote from Wotjobaluk Elder, the late Uncle Jack Kennedy:

> …beal the redgum and bullitch the Black Box make fine canoes but not bep, white gum (manna). [This is because] Long ago when trees were men, Bep could not swim so he sunk and he drowned. His bark still sinks today.
> (Brown 2001:186)

Function of CMTs

In order to test these generalised assumptions that tree species selection criteria is directly related to CMT function, each of the 172 CMTs recorded during the survey was assigned a function. The functional categories for CMTs most commonly used in Victoria were found to be too course-grained to be able to provide any useful insights into CMT function and selection. These functional categories mainly focus on scarred trees formed by bark removal, and provide little information relating to the vast number of practical, ceremonial, ritualistic and recreational uses of trees by Aboriginal societies.

An updated list of categories that was detailed enough to allow some level of functional analysis, but was still directly relevant to the survey area was required. To create this list the authors used a combination of data from a number of sources. This included CMT functional types described in studies most directly related to Wotjobaluk Country including Builth (2017:32–34), Carver (2001:79–105), Long (2003:12–15) and Rhoads (1992:198–202). These were combined with cultural information relating to CMTs provided by Wotjobaluk TOs, Aboriginal people participating in the project and other secondary sources of ethno-historical information relevant to south eastern Australia. Information gained from other surveys where CMTs were recorded by the authors and TOs in other parts of Wotjobaluk Country was also used to complete the list of functional categories.

These categories are listed in Table 2 and explained below, in addition to the number and details of CMTs recorded during the survey assigned to each of these categories. These categories list the functions for CMTs most commonly recorded on Wotjobaluk Country, and directly relevant to surveys for CMTs undertaken in south eastern Australia. It is not an exhaustive list of all the different functions ascribed to CMTs in Australia. The list does not include functions for CMTs that have not been previously recorded in Wotjobaluk Country, and/or are unlikely to survive in to the contemporary archaeological record. These include trees with modifications resulting from the removal of bark, or other resources, used in burial procedures (Coutts 1981:103–104); medicinal applications; or for grub procurement (Long 2003:14). Other forms of resource extraction modifications, such as for the collection of sap for resin production and use; and trees that have been used for specific activities such as arboreal burials and look-out trees have not been listed. These types require further detailed investigation to understand the nature and extent of these activities and if the modifications resulting from these activities can be determined, identified and recorded in the field, and added to the list.

Table2 Functions of Culturally Modified Trees within the Stage 1 survey area.

Category	Category Name	Number
1	Ring Trees	2
2	Habitation Trees	None
3	Marked and Carved Trees	1
4	Resource Extraction and Preparation Trees	
4a	Toe hold scars	6
4b	Smoke holes	2
4c	Access holes	10
4d	Smoking/Cooking preparation holes	None
5	Bark Removal Trees	
5a	Curved (pre-form) bark removal	105
5b	Bark slab/sheet removal	77
5c	Possum skin curing boards	4
5d	Bark strip removal	1
5e	Wood removal	2

1. Ring Trees

Ring trees are recorded in Wotjobaluk cultural tradition as trees that have had their limbs manipulated by human intervention during the tree's growth so that the limbs fuse together and form a circle or ring. It is believed these trees were used as markers: to signal the boundary of ceremonial grounds, cemeteries and burials; clan, totemic or religious boundaries; and Dreaming tracks or song lines. This cultural tradition is shared amongst most of the TO groups in south eastern Australia, including the Wotjobaluk Peoples' neighbours to the north (see Power 2018). There is little archaeological data on these types of CMTs and more research is required to construct a database for this category so that common and accepted attributes can be determined, to assist future researchers recording these CMTs in the field.

Two CMTs within the Stage 1 survey area were recorded as ring trees. One of these is a red gum at Kromelak, that also contains a 'possum hole' at the base. The other is the Purra Ring

Tree, which is the CMT located nearest to the junction of Kromelak and Ngalpakatia/Ngelpagutya, as shown in Figure 3. This CMT is already registered on the VAHR as an Aboriginal Cultural Place (VAHR 7226-0169). Wotjobaluk TOs believe the Purra Ring Tree is connected to the Purra Creation Story (pers. comm.). This section of the Bram-bram-bult Brothers Dreaming Story describes the creation of Guru, Kromelak and Ngalpakatia/Ngelpagutya by Purra the Kangaroo. Other 'Dreamtime' beings, such as Duan/Doowan (the sugar glider) and Werrinbool/Wirnbullain (the spider), are associated with the creation of Guru, Kromelak and Ngalpakatia/Ngelpagutya. There are a number of different versions of these creation stories, which the Wotjobaluk Peoples continue to celebrate and pass on to their future generations. One of these versions is presented in the Wotjobaluk Peoples' Country Plan (BGLC 2017:41). Two different versions were recorded by amateur ethnographers, Mathews (1904) and Stone (1911:463), in the early 20th century.

2. Habitation Trees

These CMTs are categorised as a naturally occurring or culturally produced hole at the base of a hollow tree that creates a large enough space for at least one individual to inhabit comfortably for a short period of time. Sometimes the hollow space has been further opened up and widened through cultural manipulation, such as through the use of fire or scarring, in order to produce a larger area for more people to reside over longer periods of time (see Builth 2014:277, 2017:11–17; Carver 2001:100–101).

One of the activities that may have taken place within these habitation trees is childbirth, and in Victoria these types of CMTs are also referred to as birthing trees. Although no habitation trees were recorded during the survey of Stage 1, an example of this type of tree is currently in the process of being registered on the VAHR at Bun-nah (MacKenzie Creek), south west of Bogambilor (Horsham). It was recorded by the land managers (Department of Environment, Land, Water and Planning) with the assistance of, and on the advice from the authors, Wotjobaluk TOs and AV staff. The cultural information associated with this tree comes from a Wotjobaluk Elder who was given this information by her mother.

3. Marked or Carved Trees

These are trees where patterns, designs, shapes or markings have been carved into sections of the trunk. These may be incised directly into the bark, or a section of bark removed and the designs carved into the heartwood. These types of CMTs, also referred to as dendroglyphs, are well known in central and western NSW (see Etheridge 2011). According to Long (2003:14–15), these types of trees were also documented in Victoria in the 19th century, but no surviving evidence of them has been located. Hope (2014:132) declares that no carved trees have been recorded archaeologically anywhere else in Australia other than NSW and a small number around Cairns. The dendroglyphs from NSW were used to mark ceremonial grounds, cemeteries or individual burials, as depicted by William Blandowski after John Oxley and Charles Sturt in 1833 (Allen 2010:137, Plate 188).

One possible marked or carved tree was identified during the survey, on a healthy black box at Ross Lake. A bark slab, with scar dimensions of 2.23 m x 0.16 m, had been removed from the south west face of the trunk. There were four steel hatchet axe marks at the top of the scar where some dieback had occurred. The rest of the scar was subject to extensive regrowth, obscuring most of the heartwood below. However, enough of the dry face of the scar was visible, showing parts of the heartwood had been carved and pieces of wood removed, producing what appeared to be three shapes in relief, possibly comprising a dendroglyph design (see Figures 5a, 5b and 5c).

Figure 5a Possible marked or carved tree on black box at Ross Lake, view looking north.

Figure 5b Scar detail, mid-section, view looking north.

Figure 5c Scar detail, lower section, view looking north.

If confirmed, this is the only known marked or carved tree on Wotjobaluk Country, and the only archaeological example in Victoria. The steel axe marks indicate this tree was carved during the historical period, and this may be the archaeological record of the last carved tree made by Wotjobaluk People.

4. Resource Extraction and Preparation Trees

This class of trees includes those that have had resources extracted from them, such as possums, birds, eggs, honey/comb/wax, or where resources have been prepared in them, such as eels. The different functions for this type of CMT are divided in to four sub-categories:

a) Toe hold scars—where small notches were cut into the tree trunk to facilitate the movement of people to the upper sections of the tree to access and extract resources (see Allen 2010:64, Plate 131; Carver 2001:98; Long 2003:13). Six toe hold scars on four separate trees were noted during the survey, all made with a steel hatchet.

b) Smoke holes or 'possum holes'—where naturally occurring holes or holes deliberately cut at the base of a hollow tree have been used to light a fire in this space in order to smoke animals (usually possums) out of the hollow tree (see Allen 2010:64, Plate 131; Carver 2001:91; Long 2003:13). Only two 'possum holes', both located at the base of red gums at Kromelak, were recorded during the survey.

c) Access holes—holes cut into the trunk or limb of a tree in order to directly access a resource, such as animals or bee hives (Long 2003:13). Ten trees with access holes cut in to them were recorded during the survey, all produced using steel hatchets. All four trees recorded with toe hold scars also had access holes, indicating that the functions for producing these cultural modifications are closely related.

d) Smoking/Cooking preparation holes—similar to birthing, habitation and 'possum hole' trees this class of trees has a natural or culturally produced hole at the base of a hollow tree which has been used to place, store or prepare resources. For example, 'eel smoking trees', where harvested eels have been placed in the hole and various types of timber and plant material burnt inside the tree in order to smoke them, the resource is subsequently stored there (Builth 2014). Another example are earth ovens, a traditional oven commonly used throughout south eastern Australia to cook game and tubers, which uses a hollow tree as protection against bad weather (see Builth 2014:274–276, 2017:18–21; Campanelli et al. 2018).

5. Bark Removal Scarred Trees

Aboriginal societies in south eastern Australia used bark for a vast number of different purposes. This category includes all the types of CMTs where bark has been removed from the tree, separated into five main groups:

a) Curved (pre-form) bark removal—includes all scars resulting from bark that was removed from a particular part of the tree in order to take advantage of the shape of the bark in that location, and manufacture a suitable product. These bark pieces could be any shape, but were most commonly circular, oval or oblong (Carver 2001:82; Long 2003:3,12).

The most well-known of these curved or pre-form shapes is the canoe (*yunguip*), but there are numerous other pre-form shapes used to make a range of items, including: different types of shields (*butwil/malkarr*) (Figure 6); containers (food vessels, coolamons, dishes, receptacles for carrying possessions, cradles for babies, etc.); shovels; canoe paddles; children's toys; floats used on fishing nets and crustacean traps; discs used for hunting waterfowl with nets (in much the same way a returning boomerang was used); discs and other bark pieces used in sport and games; and the large water bowls (*tarnuks*) made from the burls that can grow on Eucalypt trees (Carver 2001:88, 90, 92, 94,95, 97, 98; Long 2003:11–12).

Figure 6 Black box north of Guru which represents the most common type of CMT recorded during the survey—curved (pre-form) bark removal. This was identified as a shield scar by the Aboriginal survey participants. View looking east.

As pointed out by Carver (2001:76) and Long (2003:6, 12), it is not usually possible to determine categorically which of these items was the intended product from the surviving scar, as both the position and pace of regrowth normally obscures the size and shape of the original scar (see also Beesley 1989:25). Generally, the smaller the scar, the further down the trunk it is located, the healthier the tree when scarred, the greater the likelihood the original scar will be obscured by overgrowth (Carver 2001:115, 118; Long 2003:6, 12, 33). Larger scars, such as those for canoes, shields and coolamons, can generally be identified, but even the function of these become less certain as the size of the scar decreases. Long (2003:4, 11) has argued that any cultural scar longer than 3 m is most probably the result of canoe manufacture, and would invariably be Aboriginal in origin. Carver's more detailed analysis of canoe scars, however, suggested the most common canoe length, even along the River Murray, was 1.2 m to 2.4 m (Carver 2001:63).

This category was the most common CMT type noted during the survey with 105 curved/pre-form bark removal scars recorded. Some CMTs had more than one of these types of scars, and a number of trees with curved/pre-form bark removal scars also had modifications in different categories. For example, one of the CMTs recorded at Ross Lake had five separate curved bark removal scars on the stems of a black box, all taking advantage of different pre-formed shapes of the tree, including a scar where a burl appeared to have been removed. Long (2003:11) states that this characteristic of modifying a single tree over more than one or two episodes is generally indicative of Aboriginal use of the landscape.

Of the 105 curved bark removal scars recorded, there were two that were almost certainly used for the construction of canoes. These were both identified by the Aboriginal survey participants as definitely being canoe scars based on their size, shape and tree species. Both scars are over 3 m in length, on a curved bole, with pointed ends at the top and base of the scar, and located on red gum trees. Both these trees are located at Kromelak and are 5 m and 3.3 m in length (Figure 7). The regrowth around the 3.3 m length scar is visible in the photograph, clearly indicating the shape of the original scar. This is the pointed ellipsis shape most commonly used for canoes in Wotjobaluk Country. These shaped bark canoes were being cut and used by Wotjobaluk Peoples during the historical period. Historical photographs of the Dimboola Rowing Regatta in 1922 show Wotjobaluk TOs standing in bark canoes that match the size and shape of the bark removal scar in Figure 7 (Brown 2001:186).

Figure 7 Red gum at Kromelak showing a curved (pre-form) bark removal scar for a canoe, view looking east.

Wotjobaluk Peoples have continued these cultural practices to the present day. Many Wotjobaluk TOs today remember seeing Uncle Jack Kennedy cutting bark from trees along the Barringgi Gadyin near his house at the Antwerp Fringe Camp ('The Block') when they were young (pers. comm.), and the scar from one of these episodes can still be seen on a black box adjacent to the Antwerp tennis courts (pers. obs.). Over the last six years Wotjobaluk TOs have attempted to cut three separate bark canoes from red gums located on the Barringgi Gadyin at Antwerp and near Dimboola. Wotjobaluk TOs involved in these Yunguip cultural events, and the survey of Stage 1, feel confident that they can positively identify a canoe bark removal scar.

Other scars that the Wotjobaluk TOs identified as being most likely for canoes included a red gum at Kromelak that was 2 m in length, and another, also on a red gum at Ross Lake that was 1.5 m long. Carver (2001:58) concluded that the smallest length for a scar that can be considered to have been for a canoe is 1.2 m. This is the smallest length for a one-person canoe and coincides with historical references, and the approximate size of the smallest modern surfboard (Carver 2001:58).

b) Bark slab/sheet removal—this type of bark removal scar differs from curved/pre-form types in that long, flat sections of the tree were selected for removing large rectangular or square sheets or slabs of bark. These bark sheets were predominantly used in the construction of Aboriginal domestic architecture. There are historical sources that suggest that bark slabs were also used when constructing burial chambers in the ground for the deceased, but as these archaeological places are not well documented, it is difficult to know what kind of bark slab was used and therefore the characteristics of the resultant scar (Coutts 1981:103–104; Carver 2001:96–97; Clarke 2015:239–240).

In south eastern Australia, Aboriginal domestic architecture ranged from simple windbreaks favoured during the summer months and comprising a small number of rectangular bark slabs placed against a wooden frame (see Allen 2010:33, Plate 181; Rhoads 1992:201), to more substantial huts constructed from bark slabs and thatched with foliage, turf, sand, shells etc. There were three main architectural types used in south eastern Australia, which generally reflected the seasonal movements of peoples within their clan estates and language group boundaries; a temporary camp, a shelter or hut, and a winter house (Carver 2001:95–96; Clarke 2015:224). Major Thomas Mitchell (1839:194) recorded the latter type of architecture on the banks of a salt lake south east of Dyrruite (Mount Arapiles), in Wotjobaluk Country, when he passed through the area in 1836. He described large, circular houses made from straight rods meeting at an upright pole in the centre; the exterior was covered with bark slabs and grass, and then entirely coated over with clay. Each hut had a doorway entrance and a chimney at the top above a central fireplace positioned on the internal floor. The interior of some huts were probably decorated, as demonstrated by the Lake Tyrrell bark etching. This is a section of bark slab collected from (Direl) Lake Tyrrell, Wotjobaluk Country, in the 1850s. On the inner side of the bark a picture has been incised on to the surface, which has been blackened from smoke inside the bark hut. The Lake Tyrrell bark etching has been stored at Museum Victoria (Ethnographic Objects Collection # X 001520) since 1874. This artefact is extremely rare and significant, as it is the only surviving example of the interior decorations that adorned traditional domestic Aboriginal architecture remaining in Australia (see Massola 1958:125; Servaes and Prendergast 2002:7–8; Smyth 1878 vol. I:286).

The size of bark slabs used for the construction of domestic Aboriginal architecture is notably uniform across south eastern Australia; 1.5 m to 2.5 m in length and 0.5 m in width (Long 2003). Although, as Long (2003:12) pointed out, any large, flat and defect-free part of the tree could be used, so the resultant bark sheet shape could vary, and traditional Aboriginal domestic architecture comprised bark slabs of various shapes and sizes.

Long's information is consistent with the results of this survey. A total of 77 bark slab removal scars were recorded, the second most common CMT in the survey area. The majority of these scars fell within Long's (2003) standard dimension range (n=51). Only three scars were longer than 2.5 m, but a significant number were shorter. Twenty were between 1 m to 1.5 m in length, and three of these were shorter than a metre (all 900 mm in length). It was therefore noted during fieldwork that the most important feature required to distinguish this scar type from a curved/pre-form bark removal scar is the presence of a large, flat, blemish-free section of the tree with a corresponding flat scar, rather than the length of the scar.

The scars for this CMT type are easily recognisable because of the size and shape of the slabs removed, combined with the location of the scar principally positioned in the middle of the main trunk, the largest, flattest and most conspicuous part of the tree (see Figure 8a; Rhoads 1992:199; Webber and Burns 2004:40). Sometimes the scar remains rectangular, but more often it is ellipsis in shape because more accelerated regrowth occurs at the sides of scars and dieback usually happens at the top and bottom (Long 2003:7). This dieback has the potential to reveal axe marks on the heartwood that were made when the slab was cut from the tree, adding to the archaeological information that can be obtained from these types of CMTs, and subsequently their scientific and cultural significance.

Figure 8a Black box at Kromelak, view looking north—typical example of bark slab/sheet removal.

Figure 8b Detail of steel axe marks at the top of the scar.

Figure 8c Detail of stone axe marks at the base of the scar.

As with most places in south eastern Australia, when Europeans first moved in to Wotjobaluk Country they copied and were taught by TOs techniques for removing bark slabs for constructing their early bark hut residences (Marsden 1989:1). For this reason, bark slab removal scars made by Europeans are similar to those of Aboriginal origin. One of the differentiating factors is the use of steel axes, but this does not mean that all scars with steel axe marks are of European origin (Long 2003:15, 16, 35). The use and adaptation of European material culture in Aboriginal society is long and complex. For example, in Wotjobaluk Country steel hatchets were traded in by at least the mid-1830s, as documented by Major Mitchell (1839) who travelled through Wotjobaluk Country in 1836, often trading hatchets and other European items in exchange for Aboriginal knowledge and guidance about the landscape and its resources (see also Dardengo et al. 2019). Aboriginal people lived and worked on European pastoral stations in Wotjobaluk Country from this time up until at least the early 20th century (Porter 2004:77–90). Bark slabs were used in the construction of many of the buildings at Ebenezer Mission from 1859 until its closure in 1904 (BGLC 2017; Lydon 2009).

These examples of Wotjobaluk Peoples using traditional bark removal techniques up to the modern era are typical across south eastern Australia. Long (2003:10, 35) therefore suggests that most bark removal scarred trees surviving today will date from this historical period and will have been made by Aboriginal people. For a bark slab removal scar to be confidently declared solely of European origin, Long states it must have all of the following characteristics: 1) The slab size must be larger than the standard slab size, either longer than 2.5 m or wider than 0.5 m; and 2) The top of the scar must have steel axe marks in the cross diagonal or 'zig-zag' pattern, which was a technique introduced by Europeans, but not favoured by Aboriginal people. Europeans favoured the use of the full-size woodsman's axe, especially at the base of the scar. These axes have a long blade and will therefore leave axe marks that are 100–150 mm in length. These axes are so powerful that they will often destroy the base of the scar completely. These axes were also not favoured by Aboriginal people, who preferred to use the smaller and more versatile steel hatchet (Long 2003:16, 17, 35).

The majority of the bark slab removal scars with discernable axe marks recorded during the survey were steel only (n=32). These were all made with steel hatchets. Full-size woodsman's axe marks were noted on trunks that had been ringbarked, felled or generally vandalised in some way (there was evidence at the base of some of these trunks that suggests they had Aboriginal cultural modifications on them), confirming Long's (2003:16, 17, 35) assertion that these types of axes were almost exclusively used by Europeans. A smaller number of bark removal slabs had stone axe marks only (n=19), but interestingly, a similar number had both stone and steel axe marks (n=15). In all of these cases, the stone axe marks were at the bottom and the steel axe marks were at the top (see Figures 8a and 8b). This indicates that there was a long period of cross-over between the use of stone and steel hatchets by Aboriginal people and that ground-edge stone axes may have been used by Aboriginal people on Wotjobaluk Country well into the historical period, perhaps even in to the 20th century. Using both types of hatchets must have provided an improved technique for removing bark slabs; the lighter and more versatile steel hatchet being able to reach the top of the slab and therefore more effectively for use with an outstretched arm, while the stone hatchet was better at producing more powerful blows required at the base of the slab.

Three bark slab removal scar trees were recorded displaying the 'zig-zag' steel axe pattern at the top of the scar. As stated above, this alone does not prove the scar was made by Europeans, but, two of these trees exhibit more evidence characteristic of a European origin. Both trees are black boxes located at Kromelak. Both trees displayed evidence of two slabs removed adjacent to each other on the flat surface of the trunk, that had been removed at different times. The original scar had stone axe marks at the bottom, and the more recent scar had been removed with a steel hatchet at the top using the zig-zag pattern, and a full-size woodman's axe at the base, causing serious damage to the heartwood. The second scar also appeared more recent as the dry face was smooth and less weathered than the scar adjacent to it. This evidence suggests that the original scars on both trees were Aboriginal in origin and the more recent scars next to them were made by Europeans. The reason for this is not immediately apparent, but perhaps this is the archaeological signature of attempts by Europeans to copy Aboriginal bark slab removal techniques.

c) Possum skin curing boards or 'Bunya Boards'—this type of scar was also created by the removal of rectangular or square sheets of bark from a flat, defect-free section of tree. This type of CMT differs from the two previous categories because the typical dimensions of these sheets are 0.3–0.6 m x 0.3–0.6 m. They are therefore too small and flat to be included in either the slab or curved/pre-form bark removal categories, and their function is unique enough to warrant a separate category.

These small bark sheets were cut out of trees to be used as boards for the drying, curing, stretching and preparation of possum skins, an integral part of the manufacturing process for making possum skin cloaks. Possum skin cloaks were an important part of Aboriginal society in south eastern Australia, not only providing a source of warmth, but also used as baby carriers, coverings at night and for burials (AIATSIS 2019). Cloaks were also used as drums during ceremonies, as observed by Wimmera pioneer, William Candy (1999:7), who in 1865 witnessed a corroboree along the Yarriambiack Creek, a distributary of the Barringgi Gadyin, at the present-day site of Warracknabeal, where the females '…had opossum rugs folded up in their laps and on these beat…a continual boom…' . The industry behind the production of these essential cultural items would have had a significant impact on the landscape (Carver 2001:91–92). These impacts are identifiable archaeologically by the presence of this CMT type and the resource extraction CMTs mentioned previously. The scars found on these CMTs, such as toe hold scars, smoke holes and access holes, are all used to hunt and procure possums (for an excellent visual representation of this manufacturing process see Blandowski's composite drawing in Allen 2010:64, Plate 131).

The objects made from these CMTs were named 'Bunya Boards' by the TOs participating in the fieldwork in reference to Bunya, the ring tail possum who appears in the Tchingal creation story and is punished for his cowardice by the Bram Bram Bult Brothers by forcing him to forever live in the treetops and hide in the hollows of trees (see BGLC 2017:2–3).

Because the function of this type of CMT was to produce a curing board which needed to be relatively flat, the scars will typically be located on the main trunk of a tree. Four definite Bunya Board scars were recorded during the survey. One of these, located at Guru on a dead, standing grey box, is the best example, shown in Figure 9. This image clearly shows the shape of the rectangular bark board that had been removed, despite the regrowth almost completely covering the scar.

Figure 9 Upper trunk of a dead grey box at Guru showing a 'Bunya Board' scar, view looking west.

d) Bark strip removal scars—these scars are produced when fibrous sections of bark are removed from the tree. Bark fibre was used in Aboriginal manufacturing processes for a wide range of items, including: fishing line, nets, fire brands for carrying fire between camps, blankets, bedding and clothing accessories, such as slippers; and as tinder to make fires (Clarke 2015:231, 237, 239; Long 2003:14). Because only the fibrous exterior of the bark was needed for these purposes, the heartwood was rarely scarred and the relatively shallow and small scars would have healed over quickly. These types of CMTs are therefore rare to observe in the archaeological record.

One potential bark strip removal scar was identified during the survey on a black box along Kromelak. The scar measured 0.3 m x 0.15 m and features steel axe marks in the centre (Figure 10). This potential bark strip removal scar and the example provided in Long (2003:14) are the only images the authors have ever seen of these types of scars. In both instances, these scars have survived because the person procuring the bark strip has cut deeply, leaving steel hatchet marks on the heartwood.

Figure 10 Bark strip removal scar at Kromelak, view looking west.

e) Wood removal scars—these scars occur when bark is removed so that the underlying sapwood can be accessed and removed. Functions for these pieces of wood include shields (*butwil/malkarr*), boomerangs (*gatim gatim*), clubs/waddies and secret/sacred artefacts (Carver 2001:88, 90, 103). These types of scars are also rare. Long (2003:15) states the reason for this is that in most cases removing the wood to make these artefacts involved removing an entire limb, or the deep but narrow scars produced by this activity quickly healed over and therefore the only way these types of scars can be recorded is through oral traditions (if the activity has been undertaken recently) or if the tree died soon after the scar was produced.

However, two wood removal scars were recorded during the survey, both on living, healthy trees. The first was a grey box at Ross Lake with bark missing from one face of the trunk. It was difficult to determine if this bark had been removed culturally or naturally because of damage to the tree and scar, including extensive dieback at the top of the trunk. An access hole was also cut into this upper trunk, at the base of one branch, with a steel hatchet. In the middle of the trunk, within the dry face of the bark removal scar, an oblong-shaped timber removal scar (0.24 m x 0.1 m x 0.50 m, length x width x thickness) had been cut out of the sapwood, leaving a distinct scar.

It is possible the wooden artefact that was removed from this tree was a secret/sacred object. The thin, oblong shape is similar to objects described by Carver as totem boards, which were restricted for use by appropriately initiated Elders during specific ceremonial events. Carver (2001:103) mentions that these long thin wooden boards were approximately half a metre at their shortest, and the wooden artefact removed from Ross Lake is half that length. The shape is reminiscent of another sacred/secret object from Wotjobaluk Country, described by Howitt (2001:363) as a 'small spindle-shaped piece of wood called a Guliwil, usually of the Bull-oak', which was used as an item of sorcery by the Wotjobaluk. The magical properties of this object were imbued with power through the acts of marking it and roasting it over a fire, and Howitt (2001:363) claims he saw large numbers of these hanging in the homestead kitchen chimneys on the large pastoral stations where Wotjobaluk People were employed.

The second wood removal CMT was a black box at Guru with an unusual shaped scar on one of the tree's main exposed roots. This was immediately identified by the Aboriginal participants in the survey as a wood removal scar for a boomerang (*gatim-gatim*) (Figure 11). Historical and contemporary sources suggest that both bark and wood were used to make boomerangs and the most common wood used for this purpose was sheoak (*Allocasuarina* spp.) (Carver 2001:90).

Figure 11 Exposed root of a black box at Guru showing a possible boomerang scar.

Clarke (2015:231) has argued that the collection of Aboriginal artefacts in the South Australian Museum from the south east of South Australia indicates a preference for sheoak timber to make boomerangs, and denser Eucalyptus woods for making clubs and club-parrying shields. Clarke (2015) also used examples of continuing cultural traditions from the contemporary TOs of south east South Australia, many of whom have kinship and cultural connections with TO groups in western Victoria, including the Wotjobaluk. These TOs outlined a preference for using sheoak timber to make boomerangs and European axe-handles. As this wood could be brittle, however, the technique they used was to cut it when green and bury it in the ground for a year before shaping it. They also stated that the willow-like wood of box trees could be used to make boomerangs and that timber from the roots of trees was selected for making most wooden artefacts. One TO stated that he preferred to make boomerangs from the naturally bent timber of the 'swamp sheoak' (drooping sheoak) where the root joins with the trunk (Clarke 2015:231).

Conclusions

Although this paper presents a very preliminary analysis of the functions of the CMTs recorded within the Stage 1 survey area, a number of emerging patterns can be recognised. The number of different functions identified during this investigation suggests that traditional Aboriginal tree species selection was more complex than previously understood from the ethno-historical literature. The presence of stone and then steel axe marks on the same types of CMTs suggests that Aboriginal modification patterns did not significantly alter during the contact and historical periods. European technologies were successfully adopted and adapted into the Wotjobaluk Peoples' rapidly changing world, and traditional cultural modifications to trees continues up to the present day. These patterns require further examination through the collection of data on CMTs in the remaining stages of the targeted archaeological survey of the lower Barringgi Gadyin, and a more detailed comparative analysis with other CMT data recorded within Wotjobaluk Country and the wider region in order to draw more substantial conclusions regarding Aboriginal societies in south eastern Australia. Most significantly this study demonstrates the importance of the connections between these Aboriginal places, the Wotjobaluk Peoples and the Barringgi Gadyin, which continues to provide the TOs with not only their physical, but also their spiritual and cultural, sustenance.

Acknowledgements

The authors would firstly like to thank the peoples of the Wotjobaluk Nations for their participation and support in this project and acknowledge that comments, opinions and values expressed by individual Wotjobaluk people have been reflected in this paper. In particular the authors would like to thank the following Wotjobaluk Traditional Owners and Aboriginal people participating in the survey: Ben Muir, Aunty Sandra Knight, Michael Douglas, Belinda Marks, Tyson Secombe, Jordon Secombe, Geoffrey Marks, Tracey Rigney, Gavin Reid, Laurie Norman, Stuart Harradine, Damien Skurrie and Suzy Skurrie. The authors would also like to thank Dave Johnston, participating staff from BGLC, WCMA and Parks Victoria, in particular, Joel Boyd and Brandon Galpin, as well as the reviewers of this paper and editors of this volume for their helpful comments and advice.

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SHORT REPORTS

Indigenous Australian Palm Containers: An Initial Review, Discussion and Assessment

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Abstract

In this paper the literature relating to Indigenous Australian palm containers is critically reviewed and discussed. A sample of 100 palm containers from online museum collections was then compared with this literature to analyse key attributes including: general descriptions, distribution, functions, raw materials/species used, manufacture methods, styles, decoration, traditional names and other aspects of cultural importance. The research revealed that these objects of material culture were/are made from a single palm sheath, which is either folded and stitched or scrunched and tied forming an impermeable container that is easily transported. Palm containers were/are primarily used to carry water or a mixture of water and honey, to sustain children and adults while gathering food, however they were/are also multi-purpose. Results demonstrate that palm containers are distributed from at least Shoalhaven in southern New South Wales, north along the coast to the 'Top End' of Australia, including the Torres Strait Islands and on to Cygnet Bay in Western Australia. Six botanical species were/are used to make palm containers across Australia, with *Archontophoenix cunninghamiana* and *Gronophyllum ramsayi* being the most commonly used. Six styles of palm containers are identified and available Indigenous language names have been collated.

Introduction

Accounts in the literature of Indigenous Australian palm containers (henceforth 'palm containers') are dispersed. While there have been some detailed studies of baskets and dilly bags within Australia (e.g., Hamby 2010; West 2004), there is a dearth of academic literature on palm containers. These objects are not woven like baskets nor twined like dilly bags, rather they are impermeable, made from a single palm sheath (Figure 1). This paper collates information on these containers to gain new insights into an otherwise poorly described object of material culture. A sample of 100 palm containers, available through open access online museum collections, has also been analysed.

Figure 1 Palm container (Museum Number 1884.7.70) housed in Pitt Rivers Museum, Oxford University. Reproduced with permission of the Pitt Rivers Museum.

Methods

A systematic review of the literature on palm containers was undertaken for this research which included written accounts from a range of sources. These sources comprise of early ethnographic and botanical documentation (e.g., Cunningham 1818; Davidson 1937; Goodale 1959; Roth 1901; Roth 1904; Spencer 1928; Thorpe 1928) and early non-Indigenous explorer and settler recordings (e.g., Leichhardt 1843; MacGillivray 1852a; MacGillivray 1852b; Petrie 1904). Indigenous accounts are included where available (e.g., Puruntatameri et al. 2001; Roberts et al. 1995) along with recent ethnobotanical research (e.g., Clarke 2012).

A sample of online open access museum collections that house palm containers was also reviewed. These museums included: Pitt Rivers (Oxford University); British Museum; National Australian Museum; Museums Victoria; and the University of Queensland Anthropology Museum. Data was gathered and additional public information was sent by museum curators from their collections (Pitt Rivers; Kew Gardens; University of Queensland Anthropology Museum; and South Australian Museum). All information was collated into an Excel database. Database fields included: location, date of collection, collector, general description, measurements, recorded function, raw materials/species, manufacture, style, decoration and traditional names. All known locations were mapped on Google Earth Pro. Several palm containers had location data that was not specific, with the location simply listed as ‘Australia’. One such palm container had an Indigenous language name listed on the object tag, which allowed a location to be proposed.

Results

One hundred Australian palm containers were identified in the sampled online open access museum collections (Pitt Rivers Museum [Oxford University]; Kew Gardens; University of Queensland Anthropology Museum; Museums Victoria and the University of Queensland Anthropology Museum). The results of the database analysis are presented below.

Descriptions

The palm containers analysed in this study varied in size from small cup-like objects to 800 mm in length (University of Queensland Anthropology Museum). They can be rectangular, with the average sizes being 200 mm in length by 85 mm in width and 180 mm in height (NMAa n.d.). Others are square with average sizes being 120 mm in length by 110 mm in width and 130 mm in height (MVa n.d.).

Palm containers are referred to within the literature by different names, for example, 'containers' (Hamby 2011:227; Khan 2008:177), 'receptacle' (Davidson 1937:199), 'water carrier' (Khan 1996:45; Khan 2004:42, 82), 'water basket' (MacGillivray 1852b:20) and a 'leak-proof bucket' (Goodale 1959:159). Online museum databases show a wider variety of terminology such as (but not limited to): 'palm leaf container' (NMAb n.d.), 'palm leaf basket' (NMAc n.d.), 'basket' (UQAMa n.d.), 'toy basket' (BMa n.d.) and 'food container' (UQAMb n.d.).

Distribution

The distribution and geo-locations of palm containers have been variously recorded. Davidson (1937:199), for example, noted that palm containers, which he called receptacles, originated from Liverpool River in Arnhem Land, Port Stewart (Coen in Cape York), Cygnet Bay in the Dampier Peninsula and Luxmore Head on Melville Island. Clarke (2012:156) stated that the objects were made on the central east coast of Australia, northern Queensland and in the 'Top End' of Australia. Thorpe (1928:235–236) recorded that the palm containers were made in 'Tropical' Australia. Davidson (1937:186, 191) plotted the distribution of palm containers to the coastal regions owing to a lack of the necessary materials in the interior of Australia.

A review and collation of the available literature demonstrates the known distribution of palm containers (see Figure 2). This research thus indicates that the distribution of communities making palm containers extended along the coastal regions from Shoalhaven in southern New South Wales (Cunningham 1818), north to and including Cape York (Roth 1904), onward to Muralug (Prince of Wales Island) in the Torres Strait Islands (Haddon 1912:123; MacGillivray 1852b:20), and across the 'Top End' of Australia to the Dampier Peninsula in Western Australia (Davidson 1937:199). Due to the large range of botanical species that can be utilised for making palm containers, it is currently unknown if the distribution of these objects overlaps with the botanical species distribution range. Additional research to clarify this issue would be beneficial.

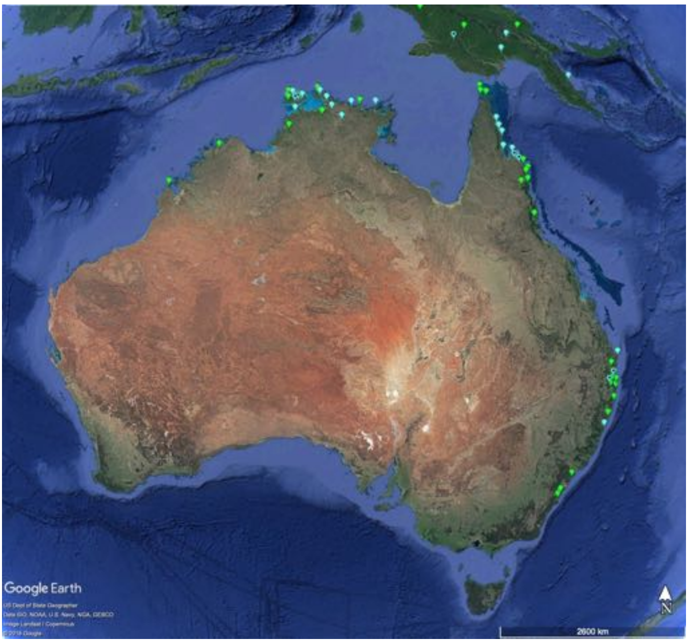

Figure 2 Distribution of Indigenous Australian palm containers (and adjacent regions).

Functions

The function of palm containers is key to understanding the context and cultural importance of these objects. Palm containers can multi-functional, however, their main purpose is for carrying water (Clarke 2008:72; Cunningham 1818; Field 1825; MacGillivray 1856a:146; Roth 1904:31; Symons and Symons 1994:36; Thorpe 1928:235-236; Watson 1944:35; Westaway in Curr 1887:138). The earliest written recording of Australian palm containers being used for carrying water is from Allan Cunningham in 1818. When collecting plant specimens for Kew Gardens at Merrimorra River Farm, near Shoalhaven on the south coast of New South Wales, Cunningham observed that Aboriginal people had fresh water in containers made from the sheaths of a palm, which they called *bangla* (Cunningham 1818; Clarke 2008:75). Five years later in 1823, Field (1825:464-465) commented that he saw *Seaforthia elegans* in the Illawarra area of New South Wales and that Aboriginal people made water-buckets from the palm by tying up each end, similar to their bark canoes. In 1827, P.P. King (1827a:111–112) recorded that Melville Islanders were using palm vessels to carry water. Later, in 1843, Eipper, an early German Missionary, stated that the palm sheath vessels he viewed in Brisbane could were used to hold a gallon of water (Symons and Symons 1994:20).

Nine years later, in 1852, MacGillivray (1852a:146; 1852b:20) recorded that the peoples of Cape York, Muralug in the Torres Strait Islands and Port Essington on the Cobourg Peninsula, made containers from the *Seaforthia* palm. In the early 1880s, Westaway, an early 'settler' in what is currently known as the Sunshine Coast, commented that Aboriginal people from Brisbane to Gympie made bags out of palms to carry their water (Symons and Symons 1994:36; Watson 1944:35; Westaway in Curr 1887:138).

In 1907, Basedow (1907:38) recorded that communities from the Daly River and Darwin were making water carriers out of the fan-palm. In 1928, Thorpe (1928:235–236) documented that palm sheath receptacles were formerly in use on the Northern Rivers of New South Wales. Spencer (1928:845–6) and Davidson (1937:199) both recorded palm containers collected from Melville Island and Kakadu that functioned as water carriers.

Harold Shepherdson collected a palm leaf container in the 1930s from Cape Stewart, in North East Arnhem Land (Clarke 2012:156). In the same decade, Davidson (1937:199) states that palm containers (which he calls receptacles) were found at Cygnet Bay, in Western Australia and these were used for carrying water. Eighteen years later, in 1948, five 'stitched palm' containers were collected as part of the American-Australian Scientific Expedition to Arnhem Land (Hamby 2011:227). Whilst in the Tiwi Islands in 1959, Goodale (1959:113–114) documented that palm sheath water containers may or may not be included in the everyday hunting equipment. This depended on whether it was the wet or dry season and the proximity of fresh water supplies to the hunt location.

In a recent publication in 2001, the people of the Tiwi Islands describe palm containers as a leak-proof bucket called *tulini* which is made from the palm sheath of either *Carpentaria acuminata* or *Gronophyllum ramsayi* and used to carry honey, mangrove worms and water (Puruntatameri et al. 2001:35, 57, 145 and 147). Two years later, in 2003 at Yarrawarra Aboriginal Corporation at Corindi in New South Wales, a palm container was made which is housed in the National Museum of Australia (NMAd n.d). Twelve years later, in 2015, two palm containers were made on the Cobourg Peninsula by Queenie Cunningham, Kathleen Cunningham and Ningoldie Blyth for the Encounters Exhibition at the National Museum of Australia (NMA 2015). This documentation in the literature of the recent manufacture of palm containers, demonstrates a continuity of cultural practices.

As noted above palm containers were used to gather honey (BMb n.d.; Clarke 2012:156; Goodale 1959:113; Steele 1984:52; Symons and Symons 1994:20), additional records also reveal that they were utilised to hold a drink mixture of water and honey and/or flower nectar (NMAa n.d.; Petrie 1904:74). For the Moreton Bay region in south-east Queensland Petrie (1904:74) provided an insightful description of a local palm container which he refers to as a *pikki*:

> Another sweet concoction was made in summer time, when the grass tree and what we call honey suckle were in bloom. Early in the morning, when the dew was on the grass, and the air sweet with perfumes, the old men and women would go forth, each carrying a "pikki" full of water, while the younger people went to hunt. Wending their way, some to the ridges where the grass-trees grew, others to the low flats where the small honeysuckle would be found, they went from flower to flower despoiling them all of their sweetness by dipping them up and down in the "pikki" of water till the latter became sweet. Then they turned them campwards, and, arriving there, would gather in groups to enjoy themselves- all, young and old alike, having their turn with the rag. A drink might be taken from the "pikki", but this used the precious fluid up too quickly. It was greatly relished, and was called "minti" after the small species of honeysuckle (*Banksia amula* [sic]), whose flower was used in its manufacture.

Another reference from an Elder from the Cobourg Peninsula demonstrates the function and cultural significance of a palm container.

> The Palm Container '[Marruny] were really important because they could carry water…Every billabong we would fill it up again, walking for days. We would put honey and water…stir it up and drink it to keep us kids going.
> (Ningoldie Blyth, Minaga Elder 2015 in NMA 2015:81)

These references demonstrate that the mixture of water and honey or water and native flower nectar within the palm container is of significance as it allowed children and adults to continue hunting or gathering. Thus, the palm container appears to have been an important everyday item in Indigenous Australian tropical coastal lifestyles to sustain life.

In addition to the functions noted above palm containers have been recorded as being used to carry infants, grubs, ochre, a range of unspecified foods and were also used as toys (BMa n.d.; Clarke 2012:156, 164; Graebner 1913:4; Leiper 1984:16; Leichhardt in Lang 1847:375; Leichhardt in Lang 1861:326; Roberts et al. 1995:15; Spencer 1928:846; Symons and Symons 1994:36; Wesson 2005:35).

Raw Materials/Species

When documenting the botanical species used in manufacturing palm containers, problems arise in early accounts as many palm species were given the same common name. For example, in some museums the name 'cabbage palm' is assigned to many palm containers as the material used. Yet historically the name cabbage palm has been attributed to numerous palm species, as it is well documented that Indigenous Australians ate the heart of many palms (Roberts et al. 1995:27).

The botanical species recorded in the literature and museum collections are all from the same subfamily—Arecoideae (Dowe 2010). Palms identified as Arecoideae usually have a long crownshaft which creates a long leaf sheath. These are ideal for the manufacture of palm containers. This research has found that the two species most predominant in the literature are *Gronophyllum ramsayi* (Akerman et al. 2014:200, 210; Goodale 1959:113; Puruntatameri et al. 2001:35, 57, 145, 157) and *Archontophoenix cunninghamiana* (Cunningham 1818; Petrie 1904:74, 95, 96; Watson 1944:35, 69). Other species included *Carpentaria acuminate* (Puruntatameri et al. 2001:35, 57, 145, 157*)*, *Archontophoenix alexandrae* (Roth 1904:31), *Normanbya normanbyi* (Roberts et al. 1995) and *Ptychosperma elegans* (Haddon 1912:123).

Cunningham recorded *Seaforthia elegans* as the palm from which the people of the Illawarra area made palm containers (Cunningham 1818). Cunningham noted this species growing in other areas such as south-east Queensland during his trip with Oxley in 1824 (Symons and Symons 1994:8) and Backhouse (1843:411) observed them growing in Port Macquarie. MacGillivray, during his voyage on the 'Rattlesnake' between 1846 and 1850, recorded a species of *Seaforthia* growing at Cape York and on Muralug in the Torres Strait (MacGillivray 1852b:20, 146). *Seaforthia elegans* is a synonym for *Archontophoenix cunninghamiana*, with *Archontophoenix cunninghamiana* often being sold in the early 1900s in plant nurseries as *Seaforthia cunninghamii* (Bailey 1912:573). Other species utilised for making palm containers are included in Table 1, with the original botanical names used in the literature.

Table 1 Recorded botanical names and functions of palm containers.

Botanical Name	**Common Name**	**Area**	**Function**	**Reference**
Archontophoenix alexandrae	Alexandra Palm	Tully River, Bloomfield River and Cape Bedford	Scoop vessel	Roth 1904:31
Archontophoenix cunninghamiana	Piccabeen Palm	Moreton Bay	Collecting nectar to make a mixture with water called *minti*	Petrie 1904:74
Archontophoenix cunninghamiana	Piccabean Palm/ Bangalow Palm	Moreton Bay/ Sunshine Coast	Water and food carrier	Symons and Symons 1994:36
Archontophoenix cunninghamiana	Piccabeen Palm	Sunshine Coast	Carrying water	Watson 1944:35
Archontophoenix cunninghamiana	Bangalow Palm	Illawarra	Baby carrier	Wesson 2004:69
Archontophoenix cunninghamiana	Bangalow Palm	Illawarra	Carrying utensil	Wesson 2004:69
Archontophoenix cunninghamiana	Bangalow Palm	Tweed	Sheath was used to catch honeycomb, then placed in sheath vessels	Steele 1984:52
Archontophoenix cunninghamiana	Bangalow Palm	Corindi	Water carrier	NMAd n.d
Carpentaria acuminata	Carpentaria Palm	Tiwi Islands	Leak-proof bucket used for food, water, honey	Puruntatameri et al. 2001:35
Drymophleous normanbyi	Black Palm	Bloomfield River	Scoop vessel	Roth 1904:31
Gronophyllum ramsayi	Kentia Palm	Cobourg Peninsula	Water carrier	Akerman et al. 2014:200, 210
Gronophyllum ramsayi	Kentia Palm	Tiwi Islands	Leak-proof bucket used for mangrove worm	Puruntatameri et al. 2001:57
Kentia spp.	Kentia Palm	Tiwi Islands	Water carrier	Goodale 1971:159
Normanbya normanbyi	Black Palm	Kuku Yalanji Country at the Mossman Gorge	Carrying vessel	Roberts et al. 1995:15
Ptychosperma elegans	Seaforthia Palm	On Muralug in the Torres Strait Islands	Water vessel	Haddon 1912:123
Seaforthia elegans (Archontophoenix cunninghamiana)	Bangalow Palm	Around Shoalhaven	Water carrier	Cunningham 1818; Field 1825; Clarke 2008:72
Seaforthia spp.	Seaforthia Palm	On Muralug in the Torres Strait Islands	Water carrier	Landtmann 1927:39 in Haddon 1935:301
Seaforthia spp.	Seaforthia Palm	Cape York, Muralug in the Torres Strait Islands	Water container	MacGillivray 1852b:20.
Seaforthia spp.	Seaforthia Palm	Stradbroke and Moreton Islands	Water carrier	Watkin and Hamilton in Curr 1887:222, 223
Seaforthia spp.	Seaforthia Palm	Moreton Bay	Water carrier	Leichhardt 1843

Manufacture

Palm containers are manufactured from a single palm sheath. Palm sheaths form the base of the palm leaf frond, which wraps around the heart of the plant (Cunningham 1818). In the Illawarra district of southern New South Wales, the Bangalow Palm sheath was/is cut green and the ends are sewn together with cabbage tree palm string (Wesson 2005:69). In the Tiwi Islands, the dry year-old leaves are gathered off the ground (Goodale 1959:113–114). The sheath becomes quite stiff when dry (Florian et al. 1990:118), but soaking it makes it pliable. The Iwaidja from the Cobourg Peninsula leave the sheath in the water until it is soft, and the sheath is then cut, with some people leaving the stem attached to form a handle (Akerman et al. 2014:200). The sheath is then either folded and sewn (Thorpe 1928:235–236) or scrunched and tied and moulded into a watertight container (Goodale 1971:159; Clarke 2012:163). Where the frond stem has been kept, it is bent over, tied or sewn in. If the frond stem has been removed, a stick made from a sturdy wooden material is attached through the ends to form a handle (Davidson 1937:199; Petrie 1904:74). Other palm containers do not include a handle and resemble a 'punt' shape (Roth 1904)—see section below on styles.

Some palm containers were/are manufactured for 'throwaway' use and others are for more long-term use. In 1898, Roth collected a sample piece of palm sheath container from the Stracke River in Queensland, this sample was in the process of being repaired (Khan 2004:82-83; Roth 1901:12). This demonstrates that not all palm containers were created to be 'throwaway' objects. Where this particular sample palm container was split, six small holes were created either side of the split and granny knots were tied on strands of string, these were threaded through each following knot, to prevent them loosening (Khan 2004:82–83; Roth 1901:12).

Styles

Walter E. Roth, a well-known ethnographer, museum collector and the Queensland Government Chief Protector of Aborigines, published a series of detailed ethnography bulletins (Roth 1904; Satterthwait 2008:34). Roth referred to palm containers under the heading 'water-carriers'. He stated that they were made of palm-leaf sheath-stalks and included two styles: punt or scoop-shaped (Roth 1904:31). Roth also mentions *pikkis*, another style from the Moreton Bay Region, but these are included under bark containers as more of a side note (Roth 1904:30). It is clear from the literature and from the 100 palm containers assessed in this study that there are more styles than the three mentioned by Roth. Six styles in total were identified and names have been attributed. The six styles are: punt-shaped, scoop-shaped, *pikki*, hi-punt-shaped, canoe-shaped and handbag. These are discussed in greater detail below and are illustrated in Figure 3. Three of the six styles, punt, hi-punt and the handbag have a similar fold at the ends. All of the objects were either square or rectangular and some include a handle.

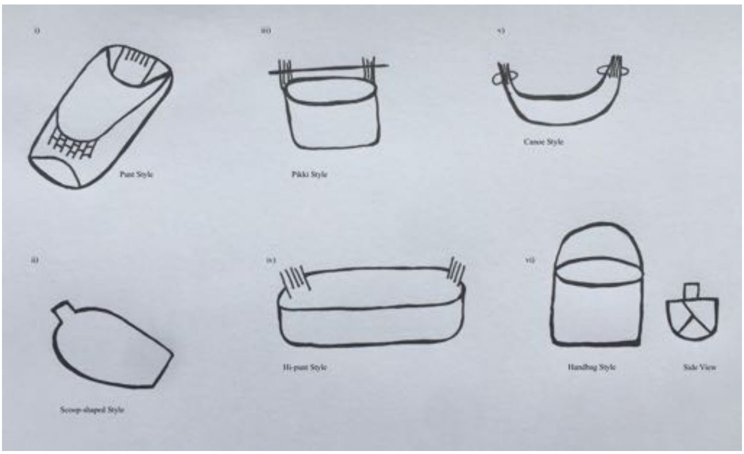

Figure 3 Australian palm container styles.

The punt style (Figure 3:i) has two smaller folded sides that are top stitched (Khan 2004:42; Roth 1904). This style is known to occur from the Moreton, Ducie and Lockhardt River regions and also from Port Stewart area in Queensland (Roth 1904:31; Khan 2004:42; National Museum of Australia 1985.0113.0017; South Australian Museum A13647). Roth also collected two punt-shaped palm containers in 1900 from Peak Point Telegraph Station, at the tip of Cape York (Khan 2004:42).

The scoop-shaped style (Figure 3:ii) is very simply made, with the sheath-stalk being cut off and that end pleated and tied with hand-spun string to form a handle, the base of the sheath then forming the mouth of the scoop (Khan 1996:45; Khan 2004:82-83; Roth 1904:31). The scoop-shaped style is from Palmer River, Tully River, Endeavour River, Bloomfield River, Cape Bedford and Starcke River in Queensland (Khan 2004:42; Roth 1904:31).

The *pikki* style (Figure 3:iii) has the ends of the palm sheath scrunched and bound, and a long stick passes down the centre and through both of the ends to form a handle, which is held in place by string (Petrie 1904:95-96; Roth 1904:30). This was observed and recorded in Brisbane by Eipper in 1843 (Symons and Symons 1994:20) and by Petrie in south-east Queensland (Petrie 1904:95–96). The British Museum displayed a basket in this style in the exhibition 'Baskets and Belonging: Indigenous Australian Histories' (Bolton 2011). Figure 1 shows a photograph of this style of palm container housed in the Pitt Rivers Museum.

The hi-punt style (Figure 3:iv) is very similar to the punt style, with the two smaller sides folded in. However, the ends are usually higher than the rest of the container. A single stitch and a knot hold the folded ends in place, although this style can also be multi-stitched and top-stitched in sections. The style is known for its oblong shape (Clarke 2012:164). A palm container in this style from Corindi in New South Wales includes a handle made from the palm frond stem, with cane or string used for stitching (NMAd n.d.). Another example of this style was collected from Port Stewart in Cape York in Queensland and is housed in the South Australian Museum (Davidson 1937:199).

The canoe style (Figure 3:v) has two pleated ends that are bound. Etheridge (1893:249) describes two palm containers from Port Essington in the Northern Territory as being strong, open, well made and rectangular, with stiff handles. J.J. Byrne who lived in the Tweed area of New South Wales from 1869 described how Wollumbin Johnnie/King Johnnie used to collect honeycomb, throw it across a billabong to the boys and the women, who would put it into watertight bangalow palm sheath vessels, which were shaped like small toy boats (Steele 1984:52). Field (1825:464–465) documented that the style was in use in the Shoalhaven area, with both ends tied similar to a canoe from the area. The University of Queensland Anthropology Museum holds three palm containers (26044, 26045 and 26046) made in this style in the late 1980s by Rick Roser, a Bigambul man from the New South Wales and Queensland border region (UQAMc n.d; UQAMd n.d; UQAMe n.d).

The handbag style (Figure 3:vi) is almost square and has a handle attached. This style is quite different from the others as quite a few of the samples reviewed included the use of gum to secure the handle and are often decorated. When manufacturing this style, the sheath is cut to size, folded and the sides drawn in, which produce three pleats (Akerman et al. 2014:200). In the Tiwi Islands, the leaf sheath is folded over, similar to wrapping a parcel and sewn tight with pandanus (Goodale 1959:113-114; Goodale 1971:159). In Darwin, Daly River, Kakadu, the Tiwi Islands and Cobourg Peninsula in the Northern Territory, the stem is angled over and stitched into place with an awl and fibre from the leaf (Akerman et al. 2014:200; Basedow 1907:38; Goodale 1971:159; Spencer 1928:846). Spencer (1928:846) noted that the size of these palm containers varies. One object of this style identified in Spencer (1928:846) is 280 mm in length and 200 mm in width, with a depth of 230 mm. A study of material culture from Melville Island in the Northern Territory included seven palm containers, which were between 150 mm and 230 mm in height (Graebner 1913:4). This style can also be very small and may also function as a toy (Spencer 1928:846).

Decoration

Containers made from palm sheaths are sometimes painted with ochre and pipe clay (Spencer 1928:846). A unique palm container housed in Museums Victoria (X16859) is painted with red and yellow ochre and white pipe clay and has tassels made from the tuft of a dog's tail affixed with beeswax (Spencer 1928:846). This infers this container had more meaning to the maker than a 'throwaway' item. Museums Victoria states that Spencer '…collected an extraordinary array of bark and leaf containers from Bathurst and Melville Islands in the Northern Territory each painted with a unique design using natural pigments' (MVb n.d.). One palm container, A22148, housed in the South Australian Museum was collected in the 1930s from Cape Stewart in northeast Arnhem Land and is decorated in what looks like painted emu or other bird footprints (Clarke 2012:156). A photograph of a palm 'spathe' container from Night Island, near Lockhart in North Queensland, was included in a paper on water carriers (Thorpe 1928:236). This object has circles painted on the outside. Another example has yellow, red and white ochre designs as line drawings painted on it (NMAe n.d.). In the sample database created, just over a quarter of the sampled objects were decorated. Therefore, palm containers could have more cultural importance and significance than previously documented.

Traditional Names

Language is an important part of culture, giving association, connection and meaning to objects of material culture. As might be expected there are many language names for the different palm containers. Those that are named in the literature together with botanical species are listed in Table 2.

Table 2 Indigenous Australian langauges names for palm containers.

Botanical Name	Language Name	Area	Part (vessel or plant)	Reference
Archontophoenix cunninghamiana	*Pikki* (originally) *Pikkibean* (later years) *Pikki*	Moreton Bay	Palm Vessel	Petrie 1904:74, 95, 96 Petrie 1904:74, 95,96
Archontophoenix cunninghamiana	*Piccabeen* *Piccabeen or Pikki*	Moreton Bay	Palm	Bailey 1888:121 Bailey 1912:573
Archontophoenix cunninghamiana	*Pik'ki*	Kabi Language	Palm	Watson 1944:35
Archontophoenix cunninghamiana	*Pi-i*	Kabi Language	Vessel	Watson 1944:35
Archontophoenix cunninghamiana	*Pik'ki*	Yugarabul Langugae	Palm	Watson 1944:69
Archontophoenix cunninghamiana	*Wal-garri*	Cairns	Palm	Bailey 1912:573
Archontophoenix cunninghamiana	*Bangalow*	New South Wales	Place name meaning; Palm Tree	McCarthy 1952:5
Archontophoenix cunninghamiana	*Bangla*	Merrimorra River Farm (near Shoalhaven)	Leaf Sheath; Vessel	Cunningham 1818; Clarke 2008:72
Archontophoenix alexandrae	*Koobin-karra*	Dunk Island	Palm	Bailey 1912:573
Archontophoenix alexandrae	*Borum-bru*	Cairns	Palm	Bailey 1912:573
Archontophoenix alexandrae	*Ko-pangara*	Tully River	Palm; Scoop-shaped style vessel	Bailey 1912:573; Roth 1904:31
Archontophoenix alexandrae	*Birla*	Cape Bedford	Scoop-shaped style vessel	Roth 1904:31
Archontophoenix alexandrae or *Drymophleous normanbyi*	*Y-al*	Bloomfield River	Scoop-shaped style vessel	Roth 1904:31
Archontophoenix alexandrae or *Drymophleous normanbyi*	*Bokol-bokol*	Endeavour River	Scoop-shaped style vessel	Roth 1904:31
Archontophoenix alexandrae or *Drymophleous normanbyi*	*Kundari*	Starcke River Palmer River	Scoop-shaped style vessel	Roth 1904:31
Carpentaria acuminate	*Tulini*	Tiwi Islands	Vessel	Puruntatameri et al. 2001:35, 57, 145 & 147 Goodale 1959:113
Gronophyllum ramsayi	*Tulini*	Tiwi Islands	Vessel	Puruntatameri et al. 2001:35, 57, 145 & 147
Gronophyllum ramsayi	*Marr-o-in* *Marruny*	Iwaidja of Cobourg Peninsula	Palm; Vessel	Akerman et al. 2014:200, 210
Normanbya normanbyi	*Duwar*	Kuku Yalanji	Palm	Roberts et al. 1995:15
Ptychosperma elegans	*Lulko*	Muralug in the Torres Strait Islands	Vessel	Haddon 1912:123
Seaforthia elegans	*Banglay*	Illawarra	Palm	Macarthur et al. 1876:70 Macarthur received information about Illawarra trees from Doctor Ellis an Aboriginal person in 1840s (Organ 1990:419–420).

Figure 1 is a photograph of a *pikki* style palm container housed at Pitt Rivers Museum, in Oxford University. This particular object is part of the founding collection. Details of its locational data are not specific, being 'Australia unknown'. The author believes there is strong evidence to support a view, based on language similarities, that this palm container is from northern New South Wales or south-east Queensland. '*Peegee*' which is written on the object label of Figure 1, links to what Petrie (1904:95-96) described as the *pikki* (see above). Of note, is that the K and the G are used interchangeably in Kabi (Watson 1994:101). Therefore, it is believed this particular palm container comes from the place where people call it *pikki*/ *pi'bin*/ *punjun*/ *bigi* [*pi'gi*]/ *piggabeen*/ *bee'been* [*pee'been*], between the Wide Bay area in south-east Queensland and northern New South Wales (Bell 1994:13, 14, 99; Gresty 1947:71; Hanlon 1935:257; Lang 1861:341; Mathew in Curr 1887:202; Petrie 1904:96; Ridley 1866:50; Steele 1984:293; Watson 1944:35). Table 2 also demonstrates that the name *pikki* is from a certain geographical area of northern New South Wales and south-east Queensland and did not extend throughout Australia. *Pikki* is also the name for the piccabeen palm from this area (*Archontophoenix cunninghamiana).*

Discussion and Conclusions

Palm containers represent an area of material culture that has not benefited from focused research in the past. By providing a new collation and analysis of data this research has developed a more robust understanding of these objects as well as identified areas for future research as outlined below.

The study has revealed that palm containers can be different sizes from cup-sized to quite large (800 mm in length). From the research it is evident that palm containers are an impermeable object made from a single palm sheath, which is folded and stitched or scrunched and bound, and some include a handle.

Following this research it can be stated that palm containers are distributed from at least Shoalhaven in southern New South Wales, north along the coast including the 'Top End', the Torres Strait Islands and continuing west along the coast to

Cygnet Bay in Western Australia. However, in relation to distribution it is noted that more research is required in areas where there are no (or very limited) recordings in the literature and the museum collections. For example, palm containers are not well described from regions such as Western Australia. Widening the collections search and discussions with Indigenous communities could assist to fill gaps in the data.

Research has shown that palm containers were/are important for some Indigenous communities to carry water and a mixture of water and honey, in order to sustain children's and adults' energy levels when out gathering and hunting for food. Apart from being used predominantly to carry water/honey, palm containers were/are also used as a general food container (including mangrove worms and grubs), for carrying infants, a toy and to carry other objects such as ochre. Future studies could explore, in collaboration with Indigenous communities, other uses associated with palm containers.

Six botanical species were identified in this study that were used to make palm containers: *Archontophoenix cunninghamiana*, *Carpentaria acuminate*, *Gronophyllum ramsayi*, *Archontophoenix alexandrae*, *Normanbya normanbyi* and *Ptychosperma elegans.* However, in relation to raw materials more analysis also needs to be undertaken into the museum objects that have been labelled as being made from the palm 'spathe' as opposed to the palm 'sheath'. The spathe is the section that covers the palm flower and not the sheath that is from the base of the leaf. Further research into material analysis could correct the museum databases and thus the overall status of these objects.

Six styles the palm containers were identified in this study: punt, hi-punt, *pikki*, scoop-shaped, handbag and canoe. The term *pikki* is a traditional language name as is *tulini*.

This research has revealed that palm containers were/are manufactured from a single palm sheath. However, we know little about the associated objects that were/are used to create palm containers. For example, what material was/is used for the string for tying and to make the handles? What tools were/are used to cut the palm sheath?

Over one quarter of the 100 palm containers studied were decorated—the extent of these decorations reveal that more research is required into their social significance. A comparison of designs and symbols painted on the palm containers, with other designs on bark, canvas and also rock art could be instructive. Such comparisons could also potentially assist with locational information of palm containers collected and housed in museums.

Importantly, Indigenous Australian fibre artists continue to make these objects, showcasing cultural continuity. Through continued cultural practice palm containers will remain an important part of the material culture assemblages for Aboriginal and Torres Strait Islanders into the future.

Acknowledgements

Thank you to the Tiwi Land Council for giving permission to use information contained in Puruntatameri et al. (2001). Thank you to Pitt Rivers Museum at Oxford University for permission to reproduce Figure 1. The author is especially indebted to Associate Professor Michael Rowland and also to Associate Professor Andrew Fairbairn, Marisa Giorgi and Associate Professor Patrick Nunn for reviewing drafts of this paper. The author is very grateful to two anonymous referees and Associate Professor Amy Roberts for their useful comments and editing.

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