Mahika Kai Journal, 1, 1 (2020) 52-95
DOI: 10.34900/mk.v1i1.1156

KNOWLEDGE AND USE OF TRADITIONAL PLANTS BY NGUNNAWAL AND YUIN PEOPLE OF AUSTRALIA: BARRIERS TO KNOWLEDGE AND TRANSMISSION

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Abstract

Objective

The study investigated the knowledge and current usage of traditional food and medicinal plants of the Ngunnawal and Yuin people in South East New South Wales (NSW) and Australian Capital Territory (ACT). Insights to barriers to passing on and retaining Traditional Knowledges were identified allowing for future planning to occur. The Australian National University (ANU) Aboriginal and Torres Strait Islander Heritage Trail, medicinal plants were mapped to.

Design

This Community Based Research used qualitative methods with a sample of Ngunnawal and Yuin people selected through systematic, non-probabilistic and snowball sampling. Ethnographic methods and techniques included informal, semi-structured interviews, participant observation and field diaries.

Setting

The Australian National University campus located in Canberra, ACT. Interviews were conducted at the ANU campus and on South Coast of SE NSW. Interviews and fieldwork took place from December 2018 to July 2019.

Participants

7 Ngunnawal and Yuin Elders, 3 males and 4 females, took part in the study.

Results

The interviewees reported knowledge of traditional food and medicinal plants, including uses and preparation of plants. Some use of traditional plants was maintained. Multiple plants were identified with a variety of uses on ANU Aboriginal and Torres Strait Islander Heritage Trail. Barriers to knowledge acquisition and dissemination to younger generation were reported. Challenges navigating Aboriginal and non-Aboriginal expectations of plant use and lack of young people's engagement with traditional plant use was identified.

Conclusions

Knowledge of traditional food and medicinal plants by the Ngunnawal and Yuin people is still present, however there are still significant barriers in maintaining and retaining this knowledge into the future.

Keywords: Food, Medicinal plants, Traditional knowledge, Ngunnawal and Yuin people (Aboriginal Nations), Australia

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Introduction

The depth and characteristics of traditional Knowledges is heterogeneous throughout Aboriginal and Torres Strait Islander communities and has changed over time. Traditional Knowledges refers to a dynamic system of knowing, acting and being which is culturally embedded (Nakata, 2002). Increased interest and recognition of traditional Knowledges has taken place, resulting in its increasing incorporation in Western scientific knowledge (Uprety et al, 2012). Furthermore, traditional Knowledges and practices have been found to closely link to environmental stewardship, including the protection of food sources, their management and minimisation of pollution (Elliott et al, 2012).

One component of traditional Knowledges is that of food and medicinal plants. Indigenous communities have an array of knowledge of traditional food and medicinal plants, many of which continue to be used today (Olivery, 2013; Maher, 2002; Chenhall, 2013; Packer et al, 2012;

Gaikwad et al, 2008; Palombo & Semple, 2001; Peam, 2005; Tucci & Wilkens, 2016; Prober et al, 2011). Numerous studies have taken place identifying ingredients which are effective in treating a variety of ailments and offer novel approaches to many diseases (Palombo & Semple, 2001, Singab et al, 2013; Nobakht et al, 2017; Packer et al, 2016; Cock et al, 2015; Akhtar eta l , 2106; Jaeger, 2017; Brouwer et al, 2005). The scope and interest in traditional Knowledges for the development of new medicines and approaches to treatment continues to increase (Konczak et al, 2010).

Recently the ACT government has published a reference of traditional plants for medicinal and other uses, titled 'Ngunnawal Plant Use: A Traditional Aboriginal Plant Use Guide for the ACT Region' as part of an ethnobotanical study (ACT Government Canberra, 2014). This resource includes descriptions of the appearance, traditional use of each plant and instructions for growing and using the plants (ibid). In addition, the Australian National University (ANU) developed an Aboriginal and Torres Strait Islander Heritage Trail (ANU, 2017). This was in recognition of the historical significance of the ANU campus to both Aboriginal and non-Aboriginal communities and to maintain knowledge for the future. The ANU Aboriginal and Torres Strait Islander Heritage Trail was created as a dynamic project, to show ANU campus from a different perspective (ibid). The trail does not include reference to traditional plants or medicines present on the trail. Therefore, investigations into what traditional and medicinal plants were present on the ANU Aboriginal and Torres Strait Islander Heritage Trail was proposed to demonstrate the presence of traditional Knowledges in ACT region.

In the wider community, use of complementary and alternative medicine and traditional medicine is more limited, often restricted to native plant oils or herbal supplements (Horneber et al, 2012; Gall et al, 2018; Barnes et al, 2016). However, for many Indigenous communities, traditional medicines and plant use continue to be a central part of life (Oliver, 2013; Maher, 2002; Senior & Chenhall, 2013; Peam, 2005). The Ngunnawal people are the Traditional Custodians of ACT and parts of South East NSW (SE NSW) regions, while the Yuin people are the Traditional Custodians of SE NSW region (Zeppel, 1999; The Living Kniowledge Project, 2008; ACT Government

Canberra, 2019). There have been numerous studies recording the use of traditional medicine in Aboriginal communities in Australia (Packer et al, 2012; Gaikwad et al, 2008; Palombo & Semple, 2001), but there have been very few studies examining the Aboriginal use of traditional medicine in ACT and SE NSW.

Aboriginal views of health are often much more holistic compared to non-Aboriginal views. One such multidimensional framework is that of Social and Emotional Wellbeing (SEWB). This includes connection to land (Country), culture, ancestry, family, and community and acknowledges the linguistic and cultural diversity in Aboriginal and Torres Strait Islander people (Senior & Chenhall, 2013; Kingsley et al, 2013; Gee et al, 2014; Lutschini, 2015). There are nine guiding principles which underpin SEWB. They include: health as being holistic, the right to self-determination, the need of cultural understanding, impact of trauma and loss in history, impact of racism and stigma, and the recognition of centrality of kinship, cultural diversity and strengths of Aboriginal people. Connections between different spheres of SEWB influence the individual's health (Gee et al, 2014). Such examples include concepts of food and its impact on health. Consumption of some food is seen to improve health, providing the idea that food can be regarded as medicine (Saerthre, 2007). It has been argued that, as a result of colonisation and governmental policies, some of these connections have been disrupted which can result in lower SEWB. Similarly, it has been argued that strengthening of these connections and revitalisation of cultural identity can result in higher SEWB (Elliott et al, 2012; Kingsley et al, 2013; Gee et al, 2014).

There is little research into possible barriers to the maintenance and transmission of traditional Knowledges to future generations. Some studies (Maher, 2002; Senior & Chenhall, 2013; Lutschini, 2015; McGrath, 2006), have noted a lack of understanding and integration of traditional Knowledges systems and frameworks into Western biomedicine. Other studies (Oliver, 2013; Senior & Chenhall, 2013; Laws & Bradley, 2014) have identified barriers in retaining traditional Knowledges and practices due to lack of access to plants due to industrialisation. This study aimed to investigate what barriers exist in traditional Knowledges regarding medicinal plant

use for Ngunnawal and Yuin people. Such barriers include: have Elders accurately retained knowledge they may have learnt as children; do youth see this knowledge as important; and in a modern world where children are removed from traditional learning environments to a Western pedagogy, what are the mechanisms for passing such knowledge from one generation to the next.

The aim of this study was to gain an increased understanding of the knowledge and use of traditional and medicinal plants, particularly those present on the ANU Aboriginal and Torres Strait Islander Heritage Trail. A second aim was to gain insight into the attitude of Ngunnawal and Yuin Elders about traditional plant knowledge and barriers to how this knowledge should be preserved and passed onto future generations.

Methods

Permissions (ethics)

Ethics was granted by Human Research Ethics Committee of the Australian National University (protocol number 2018/104). Guidelines were followed as required by National Health and Medical Research Council, Australian Government and the Australian Institute of Aboriginal and Torres Strait Islander Studies (AIATSIS). Guidelines for the Ethical Research in Australian Indigenous Research were followed, including principles that ensure rights, respect and recognition of communities, consultation, agreement and mutual understanding, partnership and collaboration with the aim of giving back to communities. The ANU research committee has Aboriginal membership (Guidelines for Ethical Research in Australian Indigenous Studies, 2012). To ensure participants understood what was being asked of them, prior informed consent was obtained from all participants.

Qualitative research design

Qualitative research design, utilising ethnographic methodology and incorporating semi-structured interviews was used (Gupta et al, 2017; Pope & Mays, 1995). This was considered appropriate to exploring and examining the range of social experiences and understanding of traditional Knowledges held by Ngunnawal and Yuin Elders (Starks & Trinidad, 2007; Sutherland, 2017). It

provides a holistic understanding of people through interviews and participant observation (ibid). Grounded theory was the theoretical framework that formed the basis of this approach. It aided investigations into how participants assigned meaning to their experiences and understanding through an inductive method of observation and analysis (Gupta et al, 2017). In grounded theory, subjective meanings, or people's interpretations are held as central, because it is thought that people's actions are based on their own beliefs and interpretations (Gupta et al, 2017; Pope & Mays, 1995; Starks & Trinidad, 2007; Sutherland, 2017; Mays & Pope, 1995; Minichiello et al, 2008). As there are few studies on traditional Knowledges of traditional and medicinal plants and its dissemination in SE NSW and ACT, grounded theory was selected.

Sampling and recruitment

Sampling of individuals appropriate for the project needed to reflect the diversity of Indigenous people and to enable insight into the variation of traditional Knowledges held. Sampling and recruitment was under the auspices of Sutherland, an Aboriginal man, who helped ensure that community based research occurred. Elders who were known in the community were invited to take part in the research project. Systematic, non-probabilistic and snowball sampling was used. This strategy is based on the assumption that specific groups of people hold relevant, specific knowledge and understanding (Gupta et al, 2017; Pope & Mays, 1995; Minichiello et al, 2008). This enabled exploration of traditional Knowledges and barriers to its transmission and to ground research in the broadest set of views relevant to the research question being asked (Gupta et al, 2017; Mays & Pope, 1995). Snowball sampling was placed within the wider set of methodologies and used informally; engaging with one Elder led to contacts with other Elders. This approach reflected the exploratory nature of the research and enabled the researcher to have characteristics associated with being an insider, furthering the grounded theoretical framework (The SAGE Encyclopaedia of Social Science Research Methods, 2004).

Participants were deemed eligible for inclusion if they self-identified as Ngunnawal and had lived or grown up in South Eastern New South Wales (SE NSW) or Australian Capital Territory

(ACT) and were over 18 years of age. This search radius was expanded to include individuals who identified as Yuin people or had grown up or lived in SE NSW and were over 18 years of age. This was due to difficulty in recruitment of Elders. For this study, an Elder is an individual who holds and interprets lore, or a set of knowledge which defines culture, rules and identity (Gee et al, 2014). Three female and two male Yuin Elders and one female Ngunnawal Elder took part in interviews.

Mr Tyronne Bell, a Ngunnawal Elder worked with the team to guide the researchers to map the ANU Aboriginal and Torres Strait Islander Heritage Trail to collate, compare and increase knowledge of traditional and medicinal plants.

Data collection

In-depth, audio-recorded, semi-structured interviews took place in a location that was agreed upon by participants. Interview length ranged from 10 minutes to 90 minutes. Yuin Elders were interviewed by Sutherland and the Ngunnawal Elder was interviewed by Emily Heaney. Within in each interview, ‘yarning’ was used. Yarning is a culturally appropriate way of collecting data through conversation, storytelling and narrative (Bessarab & Ng’andu, 2010). Interviews began by introducing the aim of the project, obtaining consent and initiating questions according to an interview protocol. The interview protocol started with broad questions and narrowed down to specific questions. Questions explored perceptions, knowledge and use of traditional medicine, interaction between Aboriginal and non-Aboriginal cultures and barriers to the transmission of knowledge in the community and through generations. Interviews were transcribed verbatim.

Data analysis

Thematic analysis and tabulation

Thematic analysis took place on the verbatim transcripts, enabling analysis to be grounded in participants’ understandings (Gupta et al, 2017; Minichiello et al, 2008). Content analysis enabled coding and categorisation of all transcripts, through an inductive, systematic approach. Coded textual segments of transcripts were grouped into categories and subcategories, before being developed into common or divergent themes as part of thematic analysis. These were further refined

to ensure all themes were grounded in the data. This enabled exploration of depth of traditional Knowledges and presence of barriers and enablers for its maintenance and dissemination. Quotes included represent individual participant responses.

ANU Aboriginal and Torres Strait Islander Heritage Trail

To confirm and collate findings, the ANU Aboriginal and Torres Strait Islander Heritage Trail was selected with an Elder identifying and explaining different traditional plants and medicinal knowledge. Fieldwork was conducted by one of the authors, Emily Heaney, and consisted of two visits in December 2018 and July 2019, accompanied by Ngunnawal Elder, Mr Tyronne Bell. Mr Bell was chosen because he was known to have expert knowledge of traditional plants by the community. Initial meetings prior to the start of research took place. This allowed collaboration and consultation about the research and to ensure partnership with the community. This Elder was distinct and separate from the other Elders recruited in the previous section of methodology. Fieldwork took place on ANU Campus, following the ANU Aboriginal and Torres Strait Islander Heritage Trail. Mr Bell provided all information, which was then recorded appropriately. Ethnographic methods employed included: field diary reports which included the common name, the Ngunnawal name if disclosed, description of each plant and its use as well as its location. A camera was used to capture and catalogue each plant. Informal discussion and participant observation also took place.

At the completion of fieldwork, a list of common and Latin names was developed. Plants were categorised as either food, medicine, seasonal indicator or other. Data were tabulated and mapped on the ANU Aboriginal and Torres Strait Islander Heritage Trail map. All information was presented in a form that was appropriate for presentation to the Ngunnawal community.

Results

Traditional knowledge and use of food and medicinal plants

Five major themes and subthemes were derived from the thematic analysis and are shown in Table 1. Findings are presented under theme headings, with verbatim quotes from the interviews included.

Themes were identified through using grounded theory with an inductive approach. Key themes identified included family and community, presence of and transmission of culture and knowledge, land and Country, food and presences of barriers. In accordance with research ethics, participants are anonymised.

Traditional knowledge

All participants demonstrated knowledge of traditional foods and medicine. This included preparation of the plant and description on how it was eaten. Once such example was black wattle. One participant noted multiple uses for plants, as both food and medicine.

> *"We'd eat the gum off the black wattle. We used to call it Goolie gum… So, we soak it in a bit of water and sprinkle in some sugar to flavour it up a bit more."* (Female, NSW)
>
> *"I like black wattle because the gum brings back wonderful childhood memories. You can chew the gum… Black wattle is all about that wonderful childhood memory of finding the gum and that sweet yummy taste and rolling it in your mouth. And mixing it with spittle and enjoying that just slow sweetness"* (Female, ACT)
>
> *"[Of black wattle] If you soak it in water and pour that water into a cup and drink it, it actually helps with indigestion. It also helps settle down any funny bowel motions and stuff like that…. But for me, black wattle is all about that wonderful childhood memory of finding the gum and that sweet yummy taste." (Female, ACT)*
>
> *"[Of false sarsaparilla] It's good for tea. Um but for a medicinal purpose you chew on the flowers for liver and kidney complaints" (Female, ACT)*

Importance of transferral of knowledge

All participants believed that transmission of knowledge and culture was an important part of their life and duty to the future generations. Some participants expressed frustration with how these skills are no longer seen as central to the younger generations as it was for them.

> *"I made sure, these things that's like passing on information, sharing that information and culture to the kids and the grandkids becomes important"* (Female, ACT)

"But it's coaching their minds about how to think differently than just getting up going to the shop" (Male, NSW)

"But that knowledge for us, was simply survival. So, it wasn't you learn this or teaching… It needs to be mainstream and seen as a desirable part of life" (Female, NSW)

Barriers

Navigation of Aboriginal and non-Aboriginal worlds

All participants interviewed acknowledged the difficulty navigating between Aboriginal and non-Aboriginal worlds, especially in regards to identity, community and heritage. All identified the need to embrace their Aboriginal identity, culture and history.

"My daughter's children are very proud of their identity. My son's children struggle with theirs because their mum doesn't let them register as an Aboriginal child at school and stuff like that." (Female, ACT)

"Until we're recognised as [unclear] and there's a contract made, we're always going to be – we're always going to be left out" (Male, NSW)

"We don't need to know history. White history. We don't need to know about England and everything else." (Male, NSW)

"Bring them back to the roots of things. That's the – like they used to. You're – and who you are, you're proud to be in Aboriginal land. You're proud of your people." (Male, NSW)

One participant discusses how integral concepts differ between Aboriginal and non-Aboriginal cultures. One such example was differences in ideas and expectations in relationships, including the role of economic transactions.

"Culturally, we never got paid for doing things. Was part of our job, to teach the young for food, any anything else… A lot of things have changed." (Male, NSW)

Tensions between relationships of Aboriginal communities and governmental expectations and practices were also discussed.

> *"They* [Aboriginal community] *want to be able to do abalone farming, fish farming. They want to be able to - they're more hands-on. We're not computer experts… They* [government] *push it out then towards all this technology stuff, they take us further and further away from who we really are."* (Female, NSW)
>
> *"It was going alright, and there's other stuff these days, but – because of the abalone farm. The same thing, obstacles everywhere"* (Male, NSW)
>
> *"And I blame it that on the government, because when anything started successful, they change the goal posts"* (Male, NSW)

Finally, one participant discussed the differences in attitudes towards Aboriginal knowledge and culture tended to be different for different generations of Aboriginal and non-Aboriginal people.

> *"Probably having several generations of White Australia seeing our culture is just like mambo jumbo, but that's actually when people of your [younger] generation and younger… going back in doing almost the reverse of you know… you know, ' hold on we've got all of these natural resources here, we need to understand that, that we need to include them in the daily living.'"* (Female, ACT)
>
> *"Um in some ways I found it inspirational that people are returning to the cultural benefit. You know, things that been thousands of years in the knowledge and I think sometimes we actually need to just accept that there is some more modern way to do things."* (Female, ACT)

Transmission of knowledge

Some participants mentioned how absence of this knowledge and culture has a negative impact on the individual and community as a whole.

> *"So that's the culture. Until you can get that back, and have the community involved in everything, and look at things that – they can all share and do."* (Female, ACT)
>
> *"But I think that's a thing that's missing for the young generation. That ability to see from inside the head… you can't teach that. It almost grows in with you, or grow up within a*

culture… I guess trying to impart a bit of that to young people, would be good" (Female, NSW)

ANU Aboriginal and Torres Strait Islander Heritage Trail

Plants identified on the ANU Aboriginal and Torres Strait Islander Heritage Trail were categorised into four categories: food, medicine, seasonal indicator and other. Collation of results from fieldwork is presented in Table 2. Table 3 summarises proportions of plants found in each category. Table 4 details the proportion of plants which had multiple uses in these categories. Plants were then placed on ANU Aboriginal and Torres Strait Islander Heritage Trail map (Figure 1). Supplementary information is contained in Table 5, with images of plants found on the ANU Aboriginal and Torres Strait Islander Heritage Trail. The common name, Latin botanical name, category and use is provided. The traditional name in Language was not provided due to Language being asleep or under reconstruction, two language groups being included and to respect cultural reasons governing the sharing of names to outsiders.

On the ANU Aboriginal and Torres Strait Islander Heritage Trail, 34 plants were identified. It was found that most plants belonged to the other (50%) and food categories (28.8%) while seasonal indicator and medicine categories had fewer plants (7.7% and 13.5% respectively). A large proportion of plants in the other category demonstrates how diverse the uses of plants are and how their uses belong in many parts of life. Excluding scar tress, it was found that 55.2% of plants had one single use, while 44.8% of plants had multiple uses. This relates to concept of holistic approach to health by Aboriginal people (Nakata, 2002; Oliver, 2013; Maher, 2002; Senior & Chenhall, 2013). Of these plants identified, several plants were identified on the trail that were not recorded in the 'Ngunnawal Plant Use: A Traditional Aboriginal Plant Use Guide for the ACT Region'. These include: Bush rice, bulbine lily, cauliflower plant/bush, native mistletoe, apple box, kangaroo grass, karrajong, bottlebrush, austral indigo, dianella, and paper daisies.

On the ANU Aboriginal and Torres Strait Islander Heritage Trail, plants were located at all regions on the trail. However, the majority of plants were located close to University House, Hedley Bull and HC Coombs buildings.

Discussion

Overall summary of findings

In the study, participants displayed clear knowledge about traditional medicinal plants and their uses. This was reflected in the identification of plants on the ANU Aboriginal and Torres Strait Islander Heritage Trail. Table 2 presented traditional plants that were already known to be present in the ACT region and recorded in the 'Ngunnawal Plant Use: A Traditional Aboriginal Plant Use Guide for the ACT Region' but also identified plants that had not been recorded in this resource. However, many participants noted barriers to transmitting this knowledge, citing difficulty navigating Aboriginal and non-Aboriginal worlds and the lack of governmental understanding of community needs and wants. In addition, many noted the importance of transferring this knowledge to younger generations, citing importance of culture and concepts of land and Country, as well as regaining what was lost during colonisation (Nakata, 2002; Kingsley et al, 2013).

Traditional Knowledge in SE NSW/ACT

The study investigated the knowledge and current usage of traditional food and medicinal plants of the Ngunnawal and Yuin people in the SE NSW and ACT regions.

In all interviews, participants displayed knowledge on a wide variety of plants and could recall multiple uses for many plant species. Participants noted that one part of a plant could be used for medicine, while another part could be used as food. On the ANU Aboriginal and Torres Strait Islander Heritage Trail, 34 plants were identified, of which 26 were unique. All were found to be used in a variety of uses, of these four included medicinal usage, while 13 had uses in multiple categories. This reflects the knowledge obtained in the interviews and the broad knowledge system of the Ngunnawal and Yuin people. One such example was false sarsaparilla. The leaves of the plant are used as tea for enjoyment and relaxation but can also be used for mouth ulcers. The

flowers of false sarsaparilla can be chewed for kidney and liver complaints (Packer et al, 2012; ACT Government Canberra, 2014). These findings correlated with information found in the 'Ngunnawal Plant Use: A Traditional Aboriginal Plant Use Guide for the ACT Region' (ACT Government Canberra, 2014). Furthermore, this supports the holistic approach to health used by many Aboriginal and Torres Strait Islander people (Nakata, 2002). It supports the notion that medical pluralism exists and that Aboriginal knowledge systems differ from Western knowledge systems (Nakata, 2002; Oliver, 2013; Maher, 2002; Senior & Chenhall, 2013).

Our study showed that knowledge about traditional plants and medicine was still present. All participants could name (in English) and describe the use and preparation of traditional plants. In total, 34 plants and their uses were identified on the ANU Aboriginal and Torres Strait Islander Heritage Trail. Elders interviewed were able to name many of these plants and discuss when and how they are used. This correlates with findings from other studies that have shown that traditional Knowledges still exists in communities, and that many plants have multiple uses (Packer et al, 2012).

Use of plants were found to change over time in response to the environment or the introduction of new disease to the community. Returning to false sarsaparilla, its use had been adapted to include the treatment of kidney and liver diseases due to increased prevalence of these diseases in the community. Similar findings have been found in multiple studies (Nakata, 2002; Oliver, 2013; Palombo et al, 2001; Shahid et al, 2010). Furthermore, in studies of the Yaegl people in Far North Queensland (Packer et al, 2012), uses of plants have evolved in response to the introduction of new diseases to the community. Similar responses have been found with the use of traditional medicines in cancer treatments (Oliver, 2013; Shahid et al, 2010). Therefore, these findings support those from Nakata (2002), that traditional Knowledge is dynamic; it adapts to changes over time and is multi-layered (ACT Government Canberra, 2014).

All participants explained the importance of food and traditional medicines to retaining and maintaining culture, identity and health. Many noted how traditional views of health are more

holistic, including encompassing the ideas of Social and Emotional Wellbeing. Other studies (Maher, 2002; Senior & Chenhall, 2013; Shahid et al, 2010) have found that communities find traditional medicines to be more effective and more familiar, as well as maintaining and retaining health and identity. One such study by Shahid et al (2010) found that use of traditional medicinal plants were used for stress relief and to retain connection to culture and identity while undergoing cancer treatment. Studies by Maher (2002) and Senior (2013) found that use of traditional medicines reflected a cultural worldview of maintaining health, in holistic way.

Passing on knowledge

Our findings suggest that all participants had strong ideas about the importance of passing on traditional Knowledges to future generations. Participants noted that passing on traditional Knowledges allowed ideas of culture and identity to be transmitted and maintained. This indicated to researchers the importance of both knowledge itself, but also the process of continuation and acquisition. Ideas of culture and identity also played a crucial role in their retention of knowledge and passing on this knowledge to those around them. Environments, both social and physical, played a role as either or both an enabler or barrier to knowledge and use of traditional plants.

A study conducted by Laws et al (Packer et al, 2012), indicated the importance of transmission of traditional Knowledges in a variety of Aboriginal communities across Australia. Our study correlates with these findings.

Similar conclusions were found in this study looking at Ngunnawal and Yuin people as knowledge also had a deep cultural element to its transmission. As explored earlier, traditional Knowledges enabled individuals to retain and maintain their cultural identity, and relay a more holistic health and cultural worldview. Multiple studies have found that in other Aboriginal communities this is also an important component of traditional Knowledges (Elliott et al, 2012; Laws & Bradley, 2014). Furthermore, Uprety et al (2012) in Canada investigated the use of medicinal plants of First Nations people in the boreal forest of Canada. Uprety et al found that traditional medicinal knowledge is passed down through oral traditions and has rich cultural,

spiritual connections and a strong relationship to land (ibid). This demonstrates that traditional Knowledges has a strong cultural component which is in common with other Indigenous people worldwide.

Transmission of traditional Knowledges, including health and medicine between generations, also takes place within communities. Most participants in interviews explained how their father and other male relatives transmitted knowledge and culture. This correlates with conclusions from literature where men traditionally transmit information regarding medicine and healing (Peam, 2005; Laws & Bradley, 2014). However, some participants noted how their mother passed on traditional Knowledges. This correlates with research stating that health knowledge transmission has been shared and given to mothers, due to changing roles of parents in response to industrialisation of society and employment (Laws & Bradley, 2014). Our study did not explore whether knowledge holders had changed from fathers to mothers or vice versa, nor the changing role of parents as a result of industrialisation and modernisation.

Barriers to traditional Knowledges

Navigating worlds

In our research, barriers to traditional plant use included navigation between Aboriginal and non-Aboriginal worlds, as well as the removal of traditional Knowledges from its central position. We found that most participants had some knowledge of traditional medicinal plants, however that sometimes it was hard to navigate the duality of Aboriginal and non-Aboriginal worlds. Individuals used both Western and traditional medicine, and some preferred to use traditional medicine which is also reflected in the literature (Oliver, 2013; Palombo & Semple, 2001; Prober et al, 2011; Shahid et al, 2010).

Participants also cited tension with governmental structures and separation from culture as key barriers. Such examples included expectations of local government regarding use of land and resources or difficulty in practising and accessing traditional food sources and practices. This was echoed in the literature. Laws et. al. (2014) found industrialisation and colonisation had changed

knowledge transmission practices. Similarly, Senior & Chenhall (2013) found that individuals in Arnhem Land were more comfortable using traditional remedies than using Western medicine and medical centres.

Transmission

Participants noted that the place of traditional Knowledges had changed from being central to daily living, identity and of survival to one that was separate, requiring a larger onus on the individual to learn and practise. Many noted the lack of enthusiasm from younger generations, and gave possible solutions. One such solution was enabling traditional Knowledges, culture and tradition to be incorporated into mainstream Australian society. In addition, participants discussed in interviews, that knowledge must be passed in a way that is actively learnt. Examples of active learning given by participants included exposure to tradition and cultural practices with emphasis of gaining knowledge of traditional foods to be secondary and not the focus of the exercise, allowing more organic acquisition of knowledge. The introduction of cultural workshops in partnerships with Aboriginal communities has seen some success in sharing knowledge with Aboriginal and non-Aboriginal people (Browne et al, 2016).

Weuffen et al found that cultural workshops were seen as innovative, engaging and worthwhile (Weuffen et al, 2016). The informal and accessible environment of workshops allowed a dialogue between individuals. Historical context and information was shared with the group before learning how to prepare and eat foods made from traditional produce. Participants stated that it encouraged them to put theory into practice, indicating that it could be used more frequently in the future. This sentiment of engaging, active transmission of knowledge to younger generations was also suggested by a participant in the study indicating that this technique could be used to protect and improve knowledge acquisition in generations to come (ibid).

ANU Aboriginal and Torres Strait Islander Heritage Trail

The ANU Aboriginal and Torres Strait Islander Heritage Trail focused on the historical significance of areas of the ANU Acton Campus. This study built on this knowledge with the identification of

medicinal and other traditional plants, and their uses. Numerous plants were identified as being used by Ngunnawal people, with most being native to the Canberra region. Information gathered complemented the 'Ngunnawal Plant Use: A Traditional Aboriginal Plant Use Guide for the ACT Region' and also built upon the plants identified in this guide. Improved links between these two resources as demonstrated in this study, enables information and culture to be shared with the wider community. This provides greater significance and understanding to the region and enables culture to be protected for future generations.

This study demonstrates that traditional Knowledges, including of medicines, is still present in Ngunnawal and Yuin people of SE NSW and ACT. Identification of plants and their uses on the ANU Aboriginal and Torres Strait Islander Heritage Trail and independent recollection from participants in interviews shows that traditional Knowledges is evolving and present in communities.

Limitations and future directions

One limitation of qualitative research is that the researcher will assume that the participants have identical understanding to the question, and as a result may not ask crucial questions. In this case, the researchers were not insiders in some of the interviews, but instead outsiders, so trust was not immediately present. However, in other interviews, where the researchers were seen as insiders, rapport and trust were rapidly developed. This may have influenced how much information was disclosed in interviews.

Recruitment of participants proved to be difficult, especially with ensuring that participants reflected a variety of social, cultural and linguistic beliefs and experiences. There were limited participants who were recruited into the study for interviews. Because of this small sample size, it is difficult to extrapolate and determine whether depth and breadth of knowledge is same throughout the community. The Ngunnawal and Yuin people, much like other Aboriginal communities are heterogenous, with different family and clan groups each with separate knowledge sets. Future

research would be needed to identify whether the views expressed in these interviews are shared by a wider variety of individuals.

Studies focusing on the level of traditional plant use are also essential to determine the extent of knowledge throughout the wider Ngunnawal community. One such direction includes comparing perspectives from Elders and younger generations and between genders, and identifying the extent of knowledge in all ages of the community and possible barriers or differences in attitudes present. With increased engagement with Ngunnawal Elders and wider Ngunnawal community will provide increased understanding of the current ANU Aboriginal and Torres Strait Islander Heritage Trail, allowing for the safeguarding and sharing of this knowledge within the Ngunnawal community.

Further investigation should be taken to determine how barriers to traditional Knowledges could be overcome and forming a more inclusive framework to record and protect traditional Knowledges. This could include looking more closely at the use of traditional medicines currently, and how to integrate their use or further familiarity of knowledge of non-Aboriginal healthcare workers into the wider Australian Healthcare system.

Conclusion

Traditional medicinal plants and their use reflect upon a holistic view of health and wellbeing. Use of traditional plants by Aboriginal people in ACT and SE NSW is documented historically and contemporarily. Interviews with Elders from the Ngunnawal people as well as the Yuin people found that knowledge regarding traditional foods was present, and that significant barriers regarding its transmission and application are still present. Documentation of plants on the ANU Aboriginal and Torres Strait Islander Heritage Trail shows that traditional plants are still known and that this location on the ANU campus still holds significance to Ngunnawal people. Further investigation is required to develop a more thorough understanding of plant use and possible systems that could be put in place to safeguard knowledge and enable more effective land stewardship for generations to come.

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Tables and figures

Table 1: Themes and subthemes that were derived from thematic analysis of data

Major themes	Subthemes
Family and community	Nostalgia and memories of childhood Relationships between family Wider relationships e.g. kinship relationships in community Intercommunity cooperation and conflict
Presence of and transmission of culture and knowledge	Holding and transmitting knowledge and culture an important part of life Transmitting culture as a duty to future generations Absence of knowledge has negative impact on individual and community Differences in attitudes of different generations towards Aboriginal knowledge and culture
Land and Country	Importance of land and Country to identity and community Changes in seasons and weather over time
Food	Preparation and description of plants Identification of plants having multiple uses in variety of spheres (food, medicinal, other)
Presence of barrier	Navigation of Aboriginal and non-Aboriginal worlds and identities Differences in integral concepts between Aboriginal and non-Aboriginal cultures Tension between relationships of Aboriginal communities and governmental structures

Table 2: Summary of traditional plants and their uses located on the Aboriginal and Torres Strait Islander Heritage Trail.

	Common name	Latin name	Category	Use
1	Bulbine lily	*Bulbine bulbosa*	Food	Tubers used for food
2	Bullrush/bush rice	*Scirpus* spp.	Food	Seeds can be cooked like rice Fruit eaten when turn red/orange in November/December
3	False sarsaparilla	*Hardenbergia violacea*	Food Medicine Season indicator	Leaves used in tea for calming effects Vines used for mouth ulcers Purple flowers bloom in July/August
4	Soap bush (blackwood)	*Acacia melanoxylon*	Other Medicine	Crush leaves and add water to give soap Soap used to wash hands, moisturiser and prevent ageing
5	Kangaroo apple	*Solanum linearifolium*	Food	Member of nightshade family, berries picked and eaten
6	Sheoak	*Casuarina* spp.	Other Season indicator	Red berries attract black cockatoos which tell individuals that they are ready to eat Cones used to make beads for necklaces and to make toys Eat/chew cones to aid saliva production Root systems can be used for clapsticks and boomerangs
7	Cumbungi (river reed)	*Typha domingensis, Typha orientalis.*	Other	Leaves used for weaving baskets Feathers used for ceremonial clothes Hollow stems used for flutes Spikes used for firestarters
8	Malaburk	*Banksia marginata*	Other Food	Spikes used for brushes and firestarters Flowers can be soaked in water with the juice drunk for energy

	Common name	Latin name	Category	Use
				Flowers can be used as paintbrushes
9	Cauliflower plant/bush	*Cassinina longifolia*	Medicine Food Other	Leaves used as sticky plasters (Band-Aids) to heal and seal cuts Leaves can used as a seasoning similar to pepper. Leaves are used in smoking ceremonies Flowers can be used in tea
10	Native mistletoe (snotty gum)	*Amyema quandong*	Food Other	Fruit are eaten when white/yellow Bulbs can made into clubs
11	Scar tree	Unknown	Other	
12	Kurrajong	*Brachychiton populners*	Food Other	Seeds in the pods are roasted to give food similar to popcorn Pods can be made into toys Bark is used for rope Root systems contain and store water which can be collected and drunk
13	Kangaroo grass	*Themeda australis*	Food	Grind seeds to produce flour and make bread
14	Silver wattle	*Acacia dealbata*	Season indicator	Start coming out at in July/August which indicates spring
15	Apple box	*Eucalyptus bridgesiana*	Other Medicine	Peel off the bark and use for warming up material and heat absorption Leaves can be infused in water and inhaled for colds and sinusitis
16	Bottlebrush	*Callistemon* spp.	Food Season indicator Other	Juice can be used from pods/seeds
17	Karrajong	*Brachychiton* spp.	Other	Remove bark and use for rope
18	Bottlebrush	*Callistemon* spp.	Food Season indicator Other	Open up seeds/pods can be used for drink (high energy) When flowers bloom, the birds and bees start coming which tends to be in July/August, indicating that the seeds are now ripe Bristles can be removed from the pods and used for painting (brushes)
19	Austral indigo	*Indigofera australis*	Other	Purple flowers can be used for dye Leaves can be crushed and then added to a deep, still water course which stuns fish Plant itself contains arsenic so is not eaten
20	False sarsaparilla	*Hardenbergia violacea*	Food Season indicator Other	Purple flowers come into bloom on July/August Leaves are used for tea Vines are used as rope
21	Wattle	*Acacia* spp.	Season indicator	Seasonal indicator as flowers bloom in July/August
22	Scar tree	Unknown	Other	
23	Fire scar tree	Unknown	Other	
24	Bottlebrush	*Callistemon* spp.	Food Other	The juice inside the pods/seeds can be drunk The bristles on the pods can removed and used for painting
25	Bullrush/bush rice	*Scirpus* spp.	Other Food	Leaves are used for weaving Seeds can be cooked like rice Fruit eaten when turn red/orange in November/December

	Common name	Latin name	Category	Use
26	Dianella (flax lily)	*Dianella revoluta*	Other	Leaves have been used for weaving, to create rope and string Leaves used as a snake whistle Can eat the fruits when blue (ripe)
27	Bracket fungi	*Laetiporus portentosus*	Other	Pull off fungi and place on campfire to keep mosquitoes at bay Use to carry fire from one location to another
28	Scar tree	Unknown	Other	2 different scars that are now serve as bee hives
29	Kangaroo apple	*Solanum laciniatum*	Food	Member of nightshade family, berries picked and eaten
30	Fire scar tree	Unknown	Other	Small scar high up tree, with bees Base may be a result of fire or intentional scar
31	Anstral indigo	*Indigofera australis*	Other	Purple flowers can be used for dye Leaves can be crushed and then added to a deep, still water course to stun fish Plant contains arsenic
32	Paper daisies	*Xerochrysum* spp.	Other	Flowers later in year
33	Silver wattle	*Acacia dealbata*	Other	If the gum has become hard, it can be used as glue for attaching stone to handle of axes using rope
34	Grevillea	*Grevillea diminuta*	Other	Comes out July/August Stops snakes from entering the area

Table 3: Comparison of different categories of plants found on ANU Aboriginal and Torres Strait Islander Heritage Trail. Percentages are given to 1 decimal place.

	Food	Medicine	Seasonal indicator	Other	Total
Raw counts	15	4	7	26	52
Percentage (%)	28.8	7.7	13.5	50.0	100.0

Table 4: Comparison of plants identified on the ANU Aboriginal and Torres Strait Islander Heritage Trail that had single or multiple uses. Percentages are given to 1 decimal place.

	Plants with single use	Plants with multiple uses	Total
Raw counts excluding scar trees	16	13	29
Percentage (%)	55.2	44.8	100.0

(Figure 1)

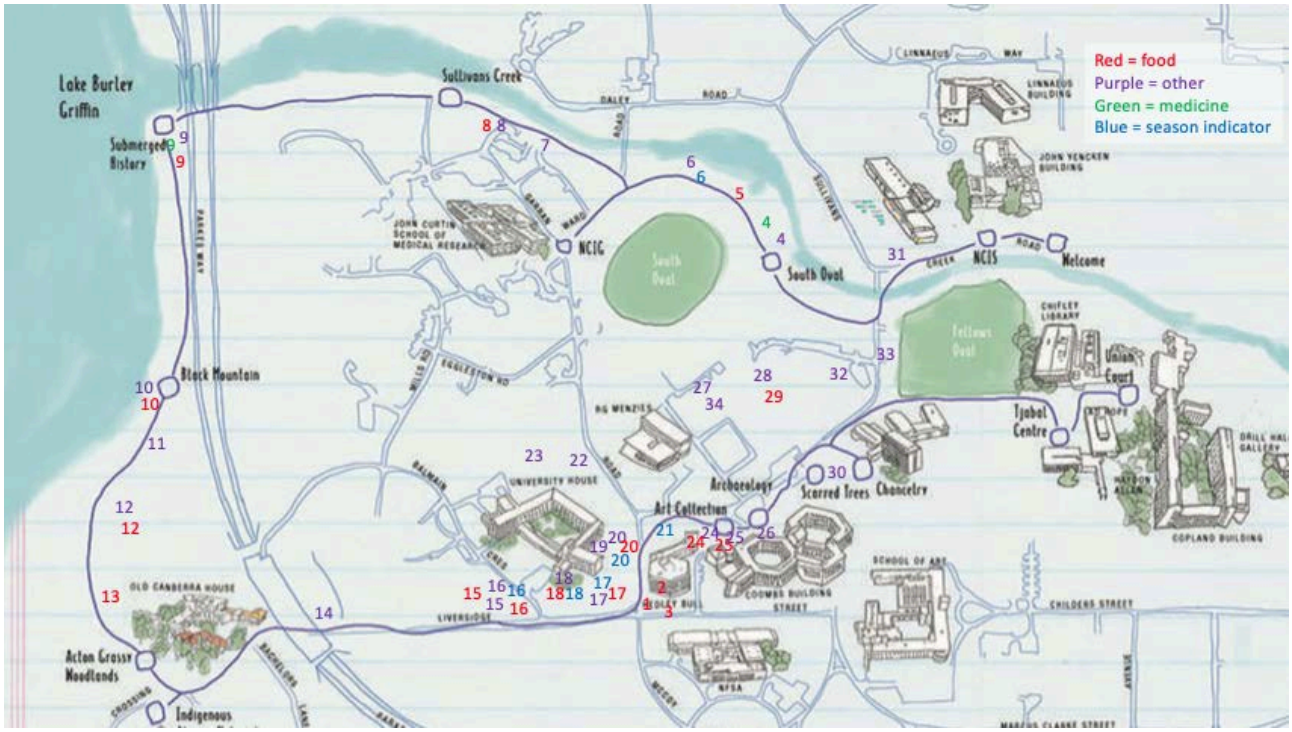


Figure 1. Location of traditional plants identified on the ANU Aboriginal and Torres Strait Islander Heritage Trail. Each number is correlated with plants identified in Table 2 and each colour is correlated with a plant category identified in Table 2.

Supplementary Material

Table 5: Summary with images of traditional plants and their uses located on the Aboriginal and Torres Strait Islander Heritage Trail.

	Common name	Latin name	Category	Use	Image
1	Bulbine lily	*Bulbine bulbosa*	Food	Tubers used for food	
2	Bullrush/bush rice	*Scirpus* spp.	Food	Seeds can be cooked like rice Fruit eaten when turn red/orange in November/December	

	Common name	Latin name	Category	Use	Image
3	False sarsaparilla	*Hardenbergia violacea*	Food Medicine Season indicator	Leaves used in tea for calming effects Vines used for mouth ulcers Purple flowers bloom in July/August	
4	Soap bush (blackwood)	*Acacia melanoxylon*	Other Medicine	Crush leaves and add water to give soap Soap used to wash hands, moisturiser and prevent ageing	

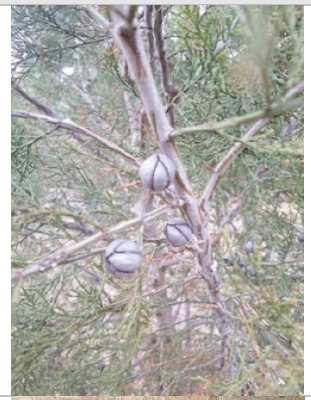
	Common name	Latin name	Category	Use	Image
5	Kangaroo apple	*Solanum linearifolium*	Food	Member of nightshade family, berries picked and eaten	
6	Sheoak	*Casuarina* spp.	Other Season indicator	Red berries attract black cockatoos which tell individuals that they are ready to eat Cones used to make beads for necklaces and to make toys Eat/chew cones to aid saliva production Root systems can be used for clapsticks and boomerangs	

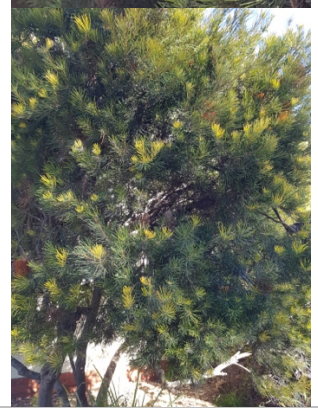
	Common name	Latin name	Category	Use	Image
					
7	Cumbungi (river reed)	*Typha domingensis, Typha orientalis.*	Other	Leaves used for weaving baskets Feathers used for ceremonial clothes Hollow stems used for flutes Spikes used for firestarters	

	Common name	Latin name	Category	Use	Image
					
8	Malaburk	*Banksia marginata*	Other Food	Spikes used for brushes and firestarters Flowers can be soaked in water with the juice drunk for energy Flowers can be used as paintbrushes	

	Common name	Latin name	Category	Use	Image
					
9	Cauliflower plant/bush	*Cassinina longifolia*	Medicine Food Other	Leaves used as sticky plasters (Band-Aids) to heal and seal cuts Leaves can used as a seasoning similar to pepper. Leaves are used in smoking ceremonies Flowers can be used in tea	 

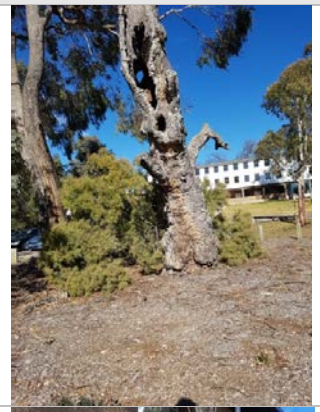
	Common name	Latin name	Category	Use	Image
10	Native mistletoe (snotty gum)	*Amyema quandong*	Food Other	Fruit are eaten when white/yellow Bulbs can made into clubs	
11	Scar tree	Unknown	Other		
12	Kurrajong	*Brachychiton populners*	Food Other	Seeds in the pods are roasted to give food similar to popcorn Pods can be made into toys Bark is used for rope Root systems contain and store water which can be collected and drunk	

	Common name	Latin name	Category	Use	Image
					
13	Kangaroo grass	*Themeda australis*	Food	Grind seeds to produce flour and make bread	
14	Silver wattle	*Acacia dealbata*	Season indicator	Start coming out at in July/August which indicates spring	

	Common name	Latin name	Category	Use	Image
15	Apple box	*Eucalyptus bridgesiana*	Other Medicine	Peel off the bark and use for warming up material and heat absorption Leaves can be infused in water and inhaled for colds and sinusitis	
16	Bottlebrush	*Callistemon* spp.	Food Season indicator Other	Juice can be used from pods/seeds	 

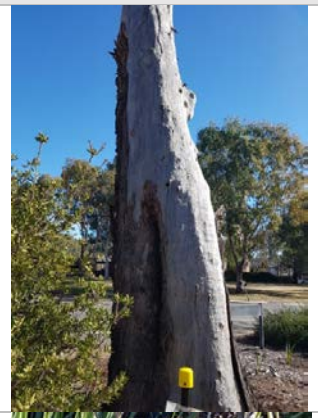
	Common name	Latin name	Category	Use	Image
17	Karrajong	*Brachychiton* spp.	Other	Remove bark and use for rope	
18	Bottlebrush	*Callistemon* spp.	Food Season indicator Other	Open up seeds/pods can be used for drink (high energy) When flowers bloom, the birds and bees start coming which tends to be in July/August, indicating that the seeds are now ripe Bristles can be removed from the pods and used for painting (brushes)	
19	Austral indigo	*Indigofera australis*	Other	Purple flowers can be used for dye Leaves can be crushed and then added to a deep, still water course which stuns fish Plant itself contains arsenic so is not eaten	

	Common name	Latin name	Category	Use	Image
20	False sarsaparilla	*Hardenbergia violacea*	Food Season indicator Other	Purple flowers come into bloom on July/August Leaves are used for tea Vines are used as rope	
21	Wattle	*Acacia* spp.	Season indicator	Seasonal indicator as flowers bloom in July/August	
22	Scar tree	Unknown	Other		

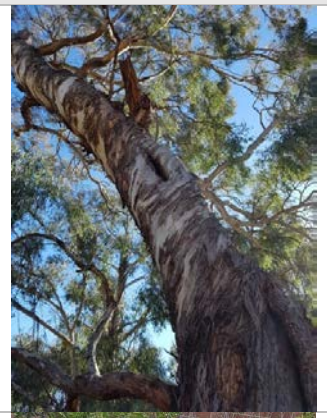
	Common name	**Latin name**	**Category**	**Use**	**Image**
23	Fire scar tree	Unknown	Other		
24	Bottlebrush	*Callistemon* spp.	Food Other	The juice inside the pods/seeds can be drunk The bristles on the pods can removed and used for painting	

	Common name	**Latin name**	**Category**	**Use**	**Image**
25	Bullrush/bull rice	*Scirpus* spp.	Other Food	Leaves are used for weaving Seeds can be cooked like rice Fruit eaten when turn red/orange in November/December	 

	Common name	Latin name	Category	Use	Image
26	Dianella	*Dianella revoluta*	Other	Longer leaves than the plants which are from SE NSW/ACT region Leaves have been used for weaving, to create rope and string Leaves used as a snake whistle Can eat the fruits when blue (ripe)	
27	Bracket fungi	*Laetiporus portentosus*	Other	Pull off fungi and place on campfire to keep mosquitoes at bay Use to carry fire from one location to another	

	Common name	**Latin name**	**Category**	**Use**	**Image**
28	Scar tree	Unknown	Other	2 different scars that are now served as bee hives	
29	Kangaroo apple	*Solanum laciniatum*	Food	Member of nightshade family, berries picked and eaten	

	Common name	Latin name	Category	Use	Image
30	Fire scar tree	Unknown	Other	Small scar high up tree, with bees Base may be a result of fire or intentional scar	

	Common name	Latin name	Category	Use	Image
					
31	Austral indigo	*Indigofera australis*	Other	Purple flowers can be used for dye Leaves can be crushed and then added to a deep, still water course to stun fish Plant contains arsenic	

	Common name	Latin name	Category	Use	Image
32	Paper daisies	*Xerochrysum* spp.	Other	Flowers later in year	
33	Silver wattle	*Acacia dealbata*	Other	If the gum has become hard, it can be used as glue for attaching stone to handle of axes using rope	
34	Grevillea	*Grevillea diminuta*	Other	Comes out July/August Stops snakes from entering the area