The Importance of Campfires to Effective Conservation

Thesis submitted by

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Warning: Aboriginal and Torres Strait Islander readers should be aware that this document contains images and names of people who have since passed over. This dissertation contains names, images and references to deceased persons.

Acknowledgements

In loving memory of *Awu Alaya* Elders

"Me Arromi – Eagle Hawk Man"

20 November 1920 – 8 February 2006

and

"Mey Apillkull wungnarnum" – 20 September 1928 – 29 July 2016

Dedicated to Dr "old man" Musgrave and Dr "old man "George" and their direct descendants and to both my families through blood and kinship and especially my children, thank-you.

The following image, plate P.1 is of Dr George[1] Musgrave and Dr Tommy[2] George at the beginning of the launch of their fire research project taken by Victor Steffensen in 2005. The Elders are holding a bark torch that is used in their cultural fire management practice. Plate P.2 and P.3 are images that represent the language name, *"Me Arromi – Eagle Hawk Man"* for Dr Musgrave and *"Mey Apillkull wungnarnum"* Dr George's nickname which was *Maal* or foot. This image is of a footprint in the ashes following a traditional cultural burn implemented by the research team and younger clan members and was taken by the author of this dissertation on *Tenacull* Maryvalley station in 2007. The fire is cool enough to walk through and into the ashes after it has travelled through without burning you. These images represent the connection between the spiritual ontology of the Indigenous Elders and its presence in cultural practice.

[1] Hereby referred to as "old man" Musgrave or Dr Musgrave out of cultural respect as to speak the name of those passed is avoided unless it is in reference to their namesake or following significant time passing that to do so does not cause disrespect or unsettle their spirit

[2] Hereby referred to as "old man" George or Dr George out of cultural respect as above

Plate P.1 The Elders who initiated this research

Dr Musgrave and Dr George holding a kerosene bark torch

Source: Victor Steffensen 2005

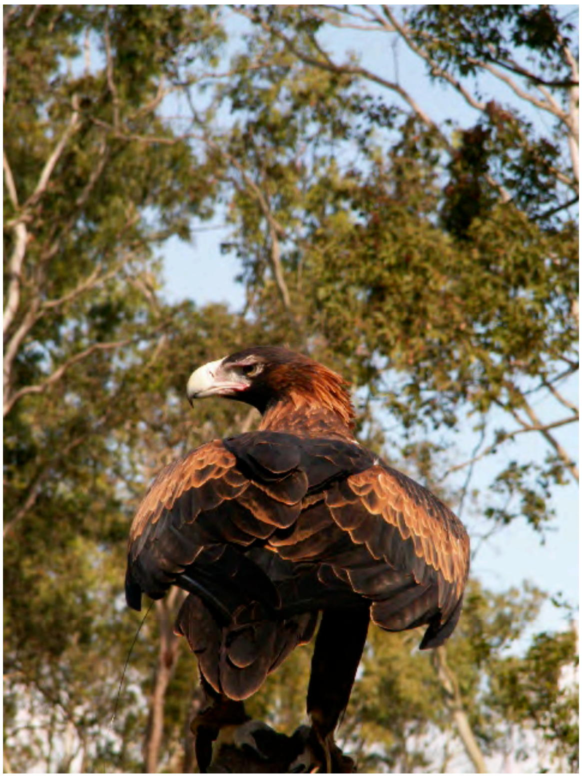

Plate P.2 Me Arromi the Wedge tail Eagle

Source: Peta Standley April 2007

Plate P.3 Maal or foot (print) in the ashes following a cultural burn

Source: Peta Standley 4 June 2007

Other Acknowledgements

I would like to sincerely thank the following people and organisations:

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- James Cook University

Statement of contribution of others

This thesis dissertation would not have been possible without Dr Musgrave, Dr George and Victor Steffensen. Their knowledge and guidance have provided the opportunity to develop this thesis. Without them it would not have been possible. However, this thesis in itself presents a unique body of work of the author.

Copy edit Victoria Lawn

Where the Elders or Steffensen are quoted directly please provide the following citation:

Musgrave, G. (year) [3] in The Importance of Campfires to effective conservation, Thesis Dissertation, James Cook University, Standley, P-M (2019)

George, T. (year) in The Importance of Campfires to effective conservation, Thesis Dissertation, James Cook University, Standley, P-M (2019)

Steffensen, V. (year) in The Importance of Campfires to effective conservation, Thesis Dissertation, James Cook University, Standley, P-M (2019)

Referencing of Chapters 7, 8, 9, 10 Traditional cultural fire knowledge citations

Musgrave, G and George, T. (2019) in *The Importance of Campfires Chapters 7-10.* James Cook University, Townsville.

[3] Year that the quote was recorded in the Importance of Campfires field records

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Abstract

The knowledge base for contemporary fire management in Australia, and indeed Internationally, is not static. However, knowledge generation, for the most part, is dominated by western technical scholarship and constructs of planning, management and analysis. Annual and increasing catastrophic wildfire events leave no doubt that Australia has a fire management problem. There are many ways of knowing about and understanding fire within contemporary fire management practice, and research and Indigenous Australian knowledge systems make a valuable contribution to contemporary fire management. Indeed, some consider that the fire management practices of Indigenous people over 80,000 years shaped the current biota in Australia. This research project provides valuable insight into the depth of fire management knowledge that was held by two senior Kuku Thaypan *Awu Alaya* speaking Elders and fire knowledge holders, Dr George and Dr Musgrave. The Elders wanted to document and demonstrate their Traditional ecological knowledge (TEK) and their cultural practice of fire, their traditional cultural fire knowledge (TCFK) in the landscape for the management of their country and to maintain their cultural obligations. The Kuku Thaypan Elders also desired to increase opportunities that enabled them to be involved in and have an impact on contemporary fire management, particularly in caring for their country in Cape York Peninsula.

Documentation of the Traditional ecological knowledge (TEK) of the Elders classification system as it relates to fire management required analysis of the different ways of knowing and managing fire in Cape York and Australia, more broadly. It was necessary to analyse the political and institutional frameworks and current ways of understanding and practicing fire that exist. This includes discussion on state practice of fire management and Indigenous cultural fire knowledge (ICFK) and its practice. This analysis provides discussion on the theory of Traditional Ecological knowledge in documenting cultural fire knowledge and its practice. Documenting the TCFK of the Elders required the development of a methodology that would enable different ways of communicating that TCFK and its use for fire management. The methodology that was developed for this purpose and is described in this thesis is the CAMPFIRES methodology. The methodology is designed to support agencies,

researchers, fire managers and practitioners to ‘see and act’ in the World differently, while also providing a research practitioner model informed by Indigenous people to assist them in enabling their voice, speaking their knowledge and leading the application, documentation and analysis of their cultural fire knowledge in contemporary fire management and research. This thesis provides discussion on the multiple ways in which Indigenous Australians are engaging in contemporary fire management practice and its research and provides considerations for institutional reform required to fully realise the benefits of Indigenous peoples’ involvement in contemporary fire management through the application of their traditional cultural fire knowledge (TCFK).

Preface A Woman on Fire

Fire and my story

It is customary in Indigenous Australian communities to introduce where you are from when you introduce yourself. Consequently, it felt important for me to preface this work with a description of the writer's origins, a practice which makes clear one's connection and standpoint. I am Peta-Marie Standley; I was born in Townsville on 17 January, 1974. My mother was born Carmel Anne Anderson in Cairns in 1954, and my father was born Stephen Lloyd Standley in Townsville in 1951. I have two brothers, one elder, Russell Leigh Standley, and one younger, Paul Stephen Standley, and now two much loved children of my own, Leo Goddard and Ash Standley. My ancestry is mixed; I have Chinese, Japanese, Scottish, Irish and English heritage with a long family history in North Queensland spanning at least seven generations. My father's mother's grandfather, my great, great, great-grandfather was among the early non-Indigenous settlers in Oonoonba in Townsville. On my father's grandfather's side, my family lineage is still unknown. I grew up mostly in Townsville, but spent some of my youth in Cairns, as this is where my mother's family were from, and ten months in Tennant Creek in the Northern Territory when I was eleven years old. I was lucky enough to grow up with my extended family, Aunties, Uncles, Grandparents and many Cousins close and around me for formative years of my life. I have many fond memories of a childhood spent swimming in the sea and visiting lots of different country during the school holidays. My mother's parents, my grandparents travelled a lot around North Queensland, my grandfather building roads, my grandmother cooking for the camps and me playing with my brothers and the other kids. One of my fondest memories; the smell of the wood burning from the donkey, a bush rig that heats up the water, mixed with the scent of soap, when you were made to take a shower to wash off the day's dirt.

I felt I needed to write this preface to provide insight into the transformative journey of this dissertation research through story, as it has been unfolded for me. In doing so, I hope that the reader may begin to understand the meaning of *the "Importance of campfires."* This may help in guiding the reader through the body of work that is for this dissertation. The dissertation speaks of this research in the necessary academic language and thereby loses something in the translation. The Kuku Thaypan system of knowledge as it applies to fire ***must*** be learnt and practiced on country to be fully applied and understood.

However, if you are reading this then you too are now sharing this journey with me. A journey that has been guided and supported by my Indigenous co-researchers. My co-researchers were Dr Musgrave, Dr George Snr. and their families and Victor Steffensen who is a *Tuguluk* descendant from the Northern Gulf Plains country. My thanks also go to my many Indigenous friends and colleagues across Cape York, the Wet Tropics and Australia.

Part of my role in this journey has been, as it continues to be, to help change the way that contemporary natural resource management and conservation in Australia values Indigenous knowledge of fire and what we understand as ecology and support development of *appropriate* pathways that bring Indigenous knowledge systems of fire and Indigenous people's cultural practice of it, alongside contemporary fire management systems. In the Kuku Thaypan Indigenous knowledge system knowledge is not collected without a purpose, you teach, understand and learn the knowledge in its application. In particular, you cannot properly learn from a collection of knowledge separated from country. In the words of Steffensen, research and partnerships should recognise and respect peoples inherited Traditional Knowledge systems by supporting communities to demonstrate their Traditional Knowledge formula for doing it. "*You have to understand the three sides to Traditional Knowledge to know how to use it as the baseline for applying adaptive management.*" Steffensen, field data (2009).

My role has been informed by what the Elders and Steffensen taught me to understand, which then enabled me to also begin to learn from country. What I want to share with you is a greater understanding of what I have now come to *"believe"* [4] and understand about Indigenous research practice, working as a non-Indigenous researcher in this space and about fire and country. My Indigenous co-researchers heard and reviewed my writings throughout the whole project, and in the early years of this work much of my writing was summarised, simplified and used to support key communication, project reports, media and fund-raising materials supporting the Traditional Knowledge Revival Project (TKRP), later the Traditional Knowledge Revival Pathways (TKRP) project specifically for the Kuku Thaypan Fire Management Research Project (KTFMRP) in co-delivery of the Elders fire research project. I have been in constant conversation with my research partners and their families spanning over fourteen years.

I am confident in my learning and I was able to express this to Dr George when spending time with him at the Laura Dance Festival following the 2015 Indigenous fire workshop which at his request was hosted on his country. That evening I thanked him for all that he had taught me over the years and he expressed to me his gratitude of my taking the time to learn and helping him over the years. The ethics approval for this research has been an on-going dialogue with the holders and beneficiaries of that knowledge beyond the once-off formal approval process demonstrating appropriateness against a set of static criteria.

I want to emphasise that the dissertation findings reflect a connected learning process that became relationship-based practice and acquisition of knowledge through an on-country *Awu Alaya* speaking Elders and knowledge holders guided and staged process, academic study and a professional career spanning nineteen years in natural resource management. These years have been spent working in both government and community sectors.

[4] This concept of belief expressed by Old man Musgrave when he stated in 2004 "*Children em he believe us*" (Awu Laya database). For me this came to be understood as; trying not to look only with the knowledge that I came with, but to try to see what the country was telling me, to learn how to read what it was saying, to listen to the Elders and to believe the "truths" that existed for their people. It was only as I attempted to do this that I began to see and listen differently and began the journey of learning to read country and to understand the Elders knowledge system of fire. I am still learning.

At the heart of this Indigenous-led study was an ontology that required adherence to Indigenous protocol; lore, recognition of the knowledge holders; its authors and support in the development of pathways and tools to recognise and protect their intellectual property. Steffensen, as a co-researcher articulated the identified need of the Elders to undertake their own research project and this dissertation was to support the Elders' research project to demonstrate to outsiders *"the detailed and intricate intergenerational traditional knowledge about fire management and was not to be confused with attempts at validation of burning practices"* Steffensen (2004).

The research thesis dissertation also documents the Elders' and Steffensen's attempts at teaching a non-Indigenous scientist how western science should learn to understand Indigenous Traditional Cultural Knowledge (TCK) of fire, and appropriately research the knowledge of another intellectual tradition. Also of importance was the need to develop new concepts and techniques on fire research so that western based scientists, fire practitioners, agencies and institutions can learn to work collaboratively with Indigenous fire knowledge holders and cultural fire practitioners. What is described in this thesis in part are these research techniques and processes and what is learnt is that in order to appropriately access Indigenous cultural fire knowledge, research needs to be Indigenous led and driven and not disconnected from country and its people. Ray, Kolden, Iii, and Stuart (2012) highlight the importance of developing place based fire management strategies from traditional ecological knowledge in providing solutions to contemporary fire management concerns and Raish, González-Cabán, and Condie (2005) in examining fire practices in America's south west highlight the relevance of Indigenous first nations peoples' knowledge in informing contemporary land managers.

The naming of "The Importance of Campfires"

The naming of this dissertation is important for many reasons; the campfires theme is recurrent throughout this work. *The Importance of Campfires* is an allegory that represents the diversity of uses that the Kuku Thaypan people had for fire and the relationships between fire, people and country. It also reveals a sentiment of the necessarily political nature of this study. It came to me as a suitable name after hearing the Elders talk about the multiple uses of fire; for cooking and for warfare, the relationships intricately described between flowering, timing for fire, and the sap in new leaf shoots, food for fauna. The Elders also discussed the indicators to observe for the changing of the seasons and for reading when country required fire and what type of fire that should be, the places where fire should go and the places it should not. Each of these timed firing regimes whether for daily use, tool and weaponry production, hunting, ceremonial, gathering and propagation had an effect on the landscape, both terrestrial and aquatic, the atmosphere, the biotic and abiotic environment. However, the Elders' TCFK was more than what people think of when they hear the term 'firestick' farming, the management and hunting of game, it was about keeping the balance and ensuring the health of country for all living and non-living things.

The importance of campfires was also evident from an event early in the research project in 2004, before it was officially launched. I was able to go with old man Musgrave, Dale Musgrave, Victor Steffensen, Bruce Rigsby[5] and Noleen Cole[6] to the Kuku Thaypan information contained within the Donald Thomson collection held at the Melbourne Museum. I found myself sitting amongst the Thomson collection listening to old man Musgrave identify, explain and record items in the collection belonging to *Awu Alaya* people, and sometimes neighbouring clan areas that had been incorrectly identified and catalogued. During this visit, I got to view historic photographs of fauna and landscape within the collection, and read notes in Donald Thomson's journals. Donald Thomson was an anthropologist, explorer and photographer who travelled to Cape York on three expeditions in 1928, 1929 and 1932-33. Thomson had noted seeing fire on the landscape in Kuku Thaypan country for camping at night and had remarked on the number of fires in one group camping, some were families; some were separate camps for women and men, others for Elders with family groups.

[5] Professor Anthropology with long history working in East Cape York
[6] Historian who has worked with the Awu Alaya people on History of the Quinkan Galleries and local area

The importance of campfires was also evident from my experiences when on country. Dr George was the Elder that I spent the most time with on country. He would always place me away from the outer edge when we camped, i.e., I was not closest to the edge of the lagoon, or the last person in a camp, often our camps were of circular nature, my tent on the inside of his, this was particularly the case when I was pregnant.[7] He would often stay up the latest, even in his aging years. One of my roles was to make sure that the fire was stoked before I retired to bed and that there was enough good dry wood to stoke the campfire easily available nearby. In his later years, it was ensuring I was up early enough to stoke the fire, make him a cup of tea; two tea bags, 600 ml of boiling water; and a dash of cold water in a pannikin the size of a bowl. When we camped on country with family there were multiple fires and as the fire workshops grew, more and more campfires were being made at the event and then across the continent.

Another event that solidified the title also came early in the research project in April 2005, while travelling through the *Ku akulumbah*[8] *Eucalyptus tetrodonta*, messmate/stringybark sand ridges on Kuku Thaypan country where it was possible to see fire scorch marks as high as the forks in the tallest *Ku akulumbah* forests and large areas where the canopy was still coppicing as a result of hot fires that had travelled through that area in the late dry season in 2000, 2001 and 2004.[9] Messmate/Stringybark trees are tall and straight trees that dependent on soil can grow to 30 metres. Conversations with my co-researchers on this trip were around the Kuku Thaypan fire management system where culturally it is against the law to burn the canopy; certain people only burnt it at very special times for special reasons (Steffensen, 2007) shared on country in 2005.[10] In particular, this knowledge is connected to the right to conduct a ceremony which is only held by particular people. The canopy burning has an effect on the rainfall and climate as well as the function of ecosystems following fire (Beringer et al.,

[7] There were a number of laws to obey, as directed by Dr George when I was pregnant on country. Also note the lagoons where the research area of interest is can and do contain large saltwater crocodiles.
[8] *Ku akulumbah* is the *Awu Alaya* word for *E.tetradonta.* Two different types of Messmate are recongised, one with smooth bark and one with slightly courser bark Dr George (2005) and again re-iterated by Joel Ngallametta (Winchanum – Aurukun/Pompurraw) at the 2011 Hahn River Fire Workshop, recorded on MaryValley station (*Tenacull*).
[9] See Chapter 5.
[10] This is important as it was two years before that the western researcher was able to hear this knowledge, but as the research methodology required, it was not my role at this time to speak of this knowledge. It was later communicated in *"The Fire and the Story"* produced by TKRP.

2003; Beringer et al., 2009). Traditional cultural fire knowledge (TCFK) demonstrated through the Elders' research project defines that different country types are burnt at different times in synchronisation with the season, the weather on the day, adjusting with climate and weather by reading the indicators in the landscape.

The title of the dissertation also represents the importance of sitting around a campfire on country, relaxed, listening to the Elders and family members telling and re-living experiences of country, sharing and re-affirming knowledge, sharing whom we are as people. Sometimes the Elders or Steffensen would ask me questions about what I had learnt during the day, testing me in the lessons of the day, or I would get a chance to check my observations and ask questions. Often there was discussion of the health of country and impacts they were seeing. Mesmerised by the campfire, we would relax, laugh, listen and reflect. The title is also a reference to a paper of Crowley and Garnett (1997) that outlines the importance of cups of tea in order to open communication lines and in building trust and relationships for effective conservation. Their paper describes the importance of building relationships when engaging with station owners on a cattle property in Central Cape York to implement conservation outcomes concerning the Golden Shouldered Parrot. This property is within the expanse of the Kuku Thaypan Estate. The Importance of campfires title embodies the importance of relationships generally when working together to solve complex environmental maladies facing us all today, and the connection between people and fire. As Dr George always said *"We all got to work together"* Steffensen (2006).

In coming to understand the deep knowledge of the relationships between fire and the natural world that is held within the Kuku Thaypan Elders fire knowledge system and other Indigenous knowledge systems across Australia, it became possible to imagine that this knowledge could be applied across the landscape instead of the current lack of use of fire in some instances and the destructive use of fire in others. The importance of supporting people back out on country re-establishing a diverse firing regime, people whose knowledge systems contain a longitudinal baseline of inherent adaptive management spanning well over 80,000 years has become evident, and this thesis is a contribution to supporting the documenting of this knowledge. *'When all the old people die the country too will die.'*

Dr Musgrave field notes (2005). This quote from Dr Musgrave echoes his concern that knowledge of country and how to care for it would be lost if it was not learnt. Dr George and Dr Musgrave wanted to ensure that this did not occur, so they initiated their fire research project in 2004. The Elders' research methodology was their cultural obligation to care for their country and implement their traditional cultural fire knowledge on country, to ensure that this was recorded and importantly passed onto their descendants and others willing to learn. In this way they could ensure that country would be looked after for generations to come. What the Elders taught was how to read country, and this important lesson continues to be taught today *'the knowledge is in the landscape. The Elders have not passed. The land is an Elder too'*Steffensen (2018). This research dissertation offers insight into the different ways we can know about fire and why Indigenous people's traditional cultural knowledge of fire, its cultural practice and governance is critical in providing solution to complex problems encountered in contemporary fire management.

Introduction
People and Place- a problem solving approach

The knowledge base for contemporary fire management in Australia, and indeed internationally, is not static. However, knowledge generation, for the most part, is dominated by western technical scholarship and constructs of planning, management and analysis. Annual and increasing catastrophic wildfire events leave no doubt that Australia has a fire management problem. There are many ways of knowing about and understanding fire within contemporary fire management practice and research, and Indigenous Australian knowledge systems make a valuable contribution to contemporary fire management. The request by Kuku Thaypan Elders to document **their** traditional fire knowledge required a problem-solving approach. This chapter identifies the location of the research, the extent of Kuku Thaypan country and its people. The chapter ends with a short description of the content of each chapter of the thesis.

Research Project Location

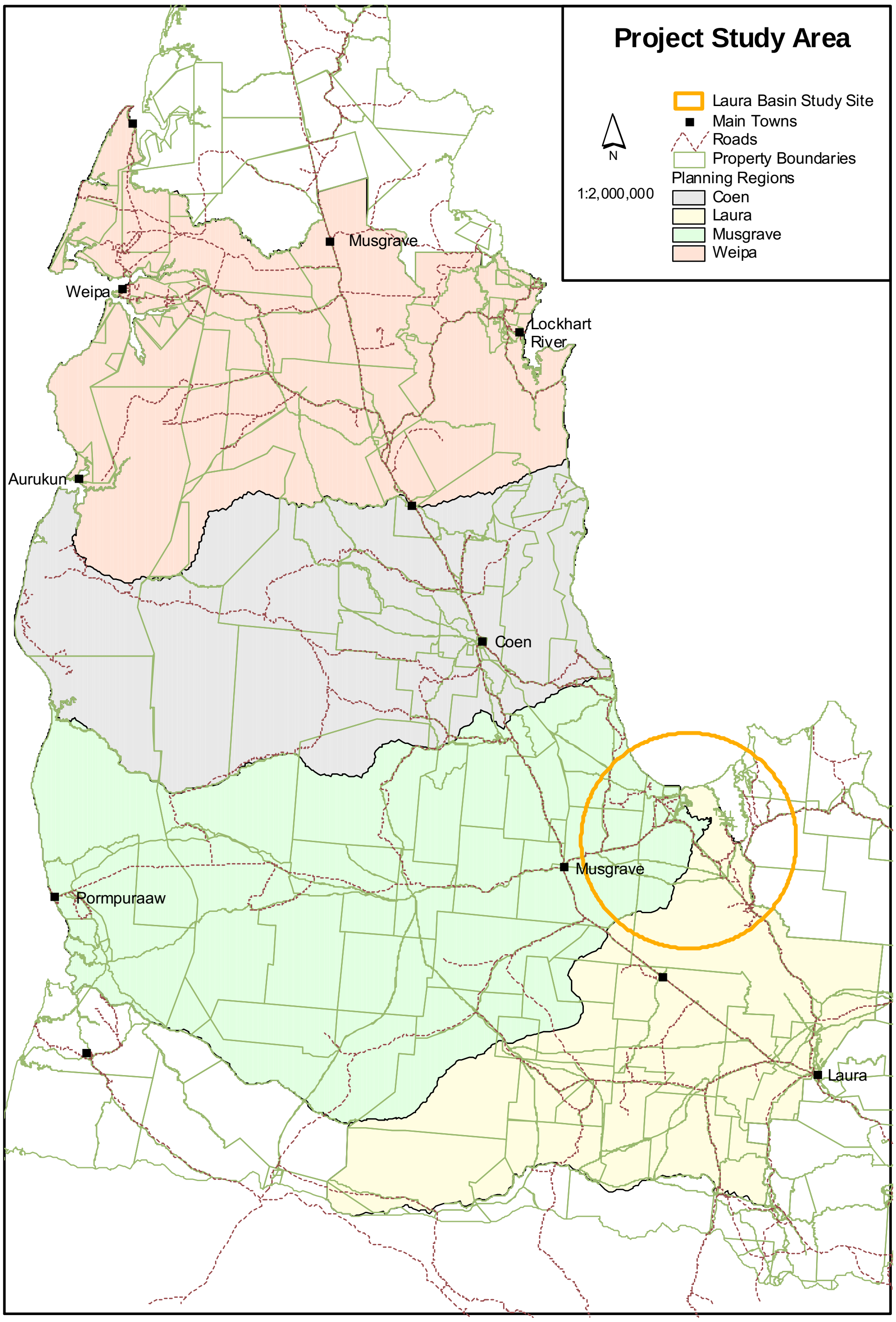
The research project study area, see Map 1.1 is part of the Cape York bio-geographical region, Cook Shire, North Queensland, and contains parts of the Laura Lowlands and Coastal Plains provinces, with the southern extent of the Coen Inlier entering into the site on Artemis station, as described in Sattler P. & R. Williams (1999). *"The Laura Basin currently occupies 18,000 kilometres squared onshore and 16,000 kilometres squared offshore under water depths of less than 200m. The basin comprises approximately 2000 metres of Middle Jurassic to Early Cretaceous sediments and overlies up to 10,000 metres of Permian sediments of the Lakefield Basin"* (Commonwealth of Commonwealth of Australia, 2017) p.1. *"The Laura Basin is a eucalypt savanna that lies in a fairly remote and sparsely populated part of monsoonal North Queensland on the south-eastern section of Cape York Peninsula. Its dry season climate is conducive to fires, with very low rainfall, constant high temperatures, relative humidity and moderate wind speeds"* (Cooper, Thompson, & Russell-Smith, 2003) p.1. Cole (2016) in Verstraete and Hafner (2016) discusses the Indigenous rock art that occurs throughout the lands of the Laura Sandstone Basin from Princess Charlotte Bay to the Great

Dividing Range. Her work indicates that the Rock art exhibits "distinct differences reflective of the diversity of cultural systems and a *"continuum of styles"*; however, there are also *"underlying strands of homogeneity and relatedness"* p.61. This is not surprising given the varying geological ages of the landscape, the extensive trade and resource sharing routes, songlines and exogamous marriage rules that implies actual groups of people living together consisted of members of different clans (Verstraete & Hafner, 2016).

The research project study area includes the localities of *Kating*[11] (Morehead River), *Alpa Kerwendah* (Hann River) and *Gnopail* (Musgrave). The Kuku Thaypan clan estate includes areas of mixed tenure, *Rinyirru* Lakefield National Park (CYPAL June 2011) and leasehold land including primarily Musgrave, Violetvale, *Gnowael* Artemis, *Tenacull* MaryValley, Olivevale and Koolburra stations. However, throughout the years of the research project the actual study area extended well outside of this region as learnings from groups across Cape York, Australia and internationally, contributed to the depth of understanding. In addition, many trips were made on country or visiting other country by Dr George and myself. However, it was my time spent on country with the Elders, their families and Steffensen in undertaking the Elders' research project in the project study area of interest that enabled me to learn how to listen, and how to learn and understand the relationship of the *Awu Alaya* speaking Elders to fire, to learn how to read country, and to begin to become familiar with their country. Direct descedants of the *Awu Alaya* ancestors, Dr George and Dr Musgrave recorded and passed their knowledge onto their direct descendants, the families of whom are custodians of this knowledge. Through the Elders Kuku Thaypan Knowledge Recording Project, their Traditional Knowledge Revival Pathways project (TKRP), their Kuku Thaypan Fire Management Research Project (KTFMRP) and support from this dissertation The Importance of Campfires research, they were able to access country with younger clan members and transfer their knowledge. Research conducted this

[11] *Awu Alaya* words (*Italicised*) for these places as recorded through the TKRP KTFMRP and "The Importance of Campfires." It is important to note that these names are not translations of the non-Indigenous place names for the area or described in the phonetic alphabet. They are cultural markers that map the stories and lore. Where there are places and/or language words that have been recorded by Bruce Rigsby on lists made available the spelling has been cross-referenced.

way ensured the cultural mores of the passing on of knowledge are followed and the places, stages and depth of knowledge shared is guided by the Elders.



Map I.1 Research Project study area

Source: Cape York Peninsula Development Association 2006

Awu Alaya

Awu Alaya is the name of the language spoken by the Kuku Thaypan people. The description for the "naming" of this language group comes from multiple sources. It is a Paman language of central Cape York Peninsula[12], pronounced *Gugu Dhayban* by the *Guugu Yimithirr* people from Hopevale[13], and recognised as being contributed to the English language by *Wik Mungkun*[14] as a translation for the Taipan snake. It is contemporarily recognised as Kuku Thaypan[15] for the *Awu Alaya* speaking people, whose clan estate primarily comprises country between the localities of Laura and Musgrave, Cape York Peninsula, Queensland, Australia. *Awu Alaya* is the indigenous Kuku Thaypan name for their own language; it means "(the) Taipan Snake Language" Rigsby (1974) in Sutton (1976).

People

Several clans once spoke the *Awu Alaya* language. These included those whose countries are located south of the *Gno Unta* Saltwater Creek drainage system from around Musgrave encompassing the *Kating* Morehead River catchments, south to include Sandy creek, Rocky creek and Hahn River catchment downstream onto *Rinyirru* Lakefield National Park to Hahn River crossing (field data 2011). The last *fluent* speaker for the *Awu Alaya* language, Dr George, has now passed over to his spirit country and was buried in Laura cemetery in August 2016 among his family members, including his older brother Dr Musgrave. The *Awu Alaya* speaking people recognise the Taipan snake as an important story being and story place in their country, hence the contemporary translation. *"The Goose Language (Alwangara) was once spoken by one or more clans whose estate was primarily the Morehead River drainage. The descendants of the Goose clan now consider themselves and are considered by others to be part of the Kuku Thaypan named group"* (State of Queensland Land Tribunal, April 1996) p.143.

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[12] Rigsby, Bruce (1974). "Kuku-Thaypan descriptive and historical phonology". In Sutton, P. *Languages of Cape York*. Canberra: Australian Institute of Aboriginal Studies. pp. 68–77.
[13] Frankie Deemal. *Guugu Yimithirr* reference pers. com. 15 July 2007

[14] Joel Nullametta *Wik Mungkun* reference pers. com 15 July 2007

[15] Victor Steffensen and Dr. George Kuku Thaypan Knowledge Recording Project pers. com. 2006

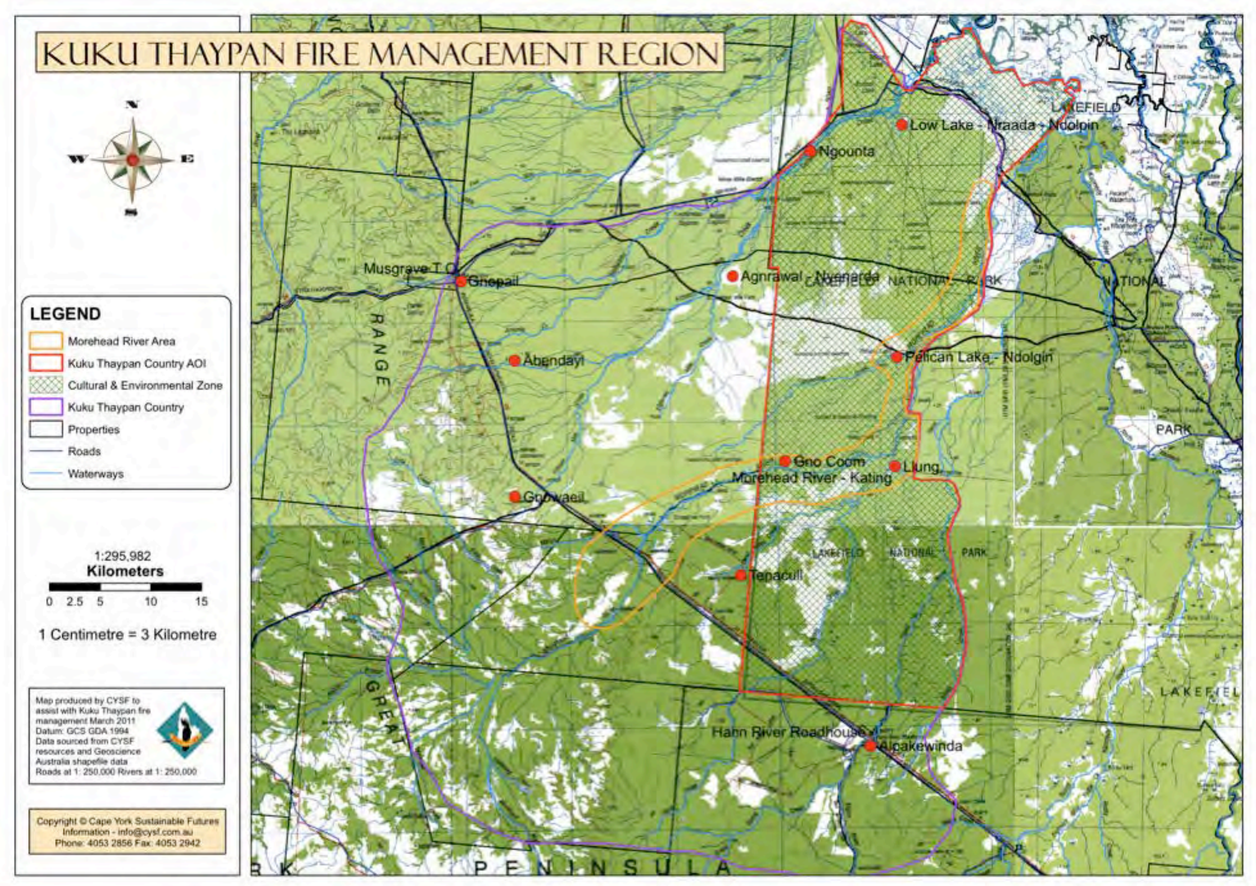
Kuku Thaypan country

The Kuku Thaypan clan estate is situated south of Princess Charlotte Bay on the eastern side of Cape York Peninsula, and includes among it freshwater catchments of the *Kating* /Morehead) River to *Alpa Kerwendah*/Hahn River to Hahn River crossing, where it neighbours Lama Lama language group to *Gno Unta* (Saltwater creek to the North), continuing to Koolburra. The Estate includes songlines, walking trails and named places that extend well beyond this area and include Welcome and Crocodile station, all the way to Kings Plains station through to Cooktown to the North, Sunrise *Yalanji bubu* (country) to the East, and towards Kondaparinga station to the South. Barry Alpher in Verstraete and Hafner (2016) identifies that *"Kuku Thaypan (Awu Alaya) is closely related to other languages of its area and in turn appears to belong in a distinct subgroup, Alaya-Athima, with languages of territories stretching down the Mitchell River almost to the Gulf of Carpentaria"* p.39.

Verstraete and Hafner (2016) in *Land and Language in Cape York Peninsula and the Gulf country*, highlight the patrilineal nature of connection to land for the majority of Cape York that is determined by the main language that you speak defined by your 'bloodline' to your father's country and are therefore recognised as holding title to that language group's Estate. Work by Sutton and Rigsby (1982) highlights the complexities of holding title in Cape York, and indicate that estate entitlement is not necessarily just related to one's patrilineal language group, but also place of birth, dreaming connected to birth, connections to story places and totemic species, bequest and strength of patrilines, to name a few. However, for the majority of places in Cape York it is the patrilineal connection on your father's bloodline that is generally considered "*proper*" country. It is important to understand that people were multi-lingual and simply the capacity to speak a language did not necessarily relate to belonging to that particular language group's estate. This was made evident to me when taking Old Man George to visit Old Man Fischer on his *bubu* in *Yalanji* Estate; both men spoke different languages but also used a common language that they both understood. The two Elders and knowledge holders also referenced an old walking trail that extended between their two language groups' estates. It has also been my experience that family groups are responsible for the care of particular places within a clan estate; for example, particular lagoons, river systems or part thereof. People can also have matrilineal connection to country and although this does not preclude title and enables input into consensus decision-making, the decision generally rests with the patrilineal estate holder in Cape York Peninsula. My experience is that these structures shift as you move closer to the East Coast rainforest country and western areas of Cape York where matrilineal connection can be dominant and matrilineal is 'proper' country in other parts of Australia.

The approximate area of the Kuku Thaypan estate[16] is highlighted in purple in map 1.2 below, with the research project area of interest (AOI) shown in red. The Kuku Thaypan estate is approximately 3477 km2 and the research project area of interest is 1113km2. Balkanu Cape York Development Corporation at the start of the research project provided the original Kuku Thaypan estate shape-file to me[17]. However, throughout the research project, teachings from the Elders, old man George and old man Musgrave outline songlines, story places, shared ceremony areas, landscape features, trade and resource sharing routes and walking trails that extend well beyond this defined area and connect tracks of land that would not necessarily be considered contiguous. The shapefile used on the map below was produced in 2009 by *this thesis* with support from Tegan Koster a GIS consultant. This clan estate boundary is based on field data of the Elders' TKRP and The Importance of campfires recorded with Dr Tommy George, this information resulted in re-drawing the Kuku Thaypan estate shape file[18].

[16] The Estate area map is for general reference only and should not be used as documentation of customary tenure. Named places documented through the research are geo-located.
[17] The original shape file provided by Balkanu at the start of the research project can be seen on fire scar maps discussed later in this chapter
[18] This shape file requires updating again with subsequent information provided from 2009 – 2015 by Dr George.



Map 1.2 Estimate of Kuku Thaypan area outlined in purple and research project area of interest (AOI) in red
Source: Standley, Steffensen, and Felderholf (2011)

The clan estate area extends well to the west of *Rinyirru* Lakefield NP and includes the western part of the park. The area extends from *Ngo Unta* Saltwater creek to about the Possum waterhole southwards to the Hahn River where at the crossing it adjoins *Lama Lama* country. Some named places associated with the Kuku Thaypan sub-group also extend east of the Hahn River towards old Laura, Caulders Lagoon and Echo yard. Significant named places on Kuku Thaypan country within the boundary of *Rinyirru* Lakefield National Park include *Nraada/Ndolpin* (*Awu Alaya*/Lama Lama) Low Lake shared in company with Lama Lama, Sweetwater Lake, *Agnrawal* Eighteen Mile, *Ndolgin* Pelican Lake, *Gno Coom* Saxby Waterhole, *Kating* Morehead River, Rocky Yard and *Lluung* Polly's Lake. Areas such as Packsaddle Lagoon and Gum Hole are held in company with Lama Lama people (QLD Land Tribunal 1996, p.144, KTFMRP 2011).

Historical indicators of people living on country are evident. The *Anatumul* people, a clan of Kuku Thaypan of 1000 or more people, whose main camp was at *Agrnawul* (18 Mile), have been described in historical records as *'tall, fit and strapping'* Thomson in State of Queensland Land Tribunal (April 1996) p.143. In 2005 when I visited this country the existence of people on country could be seen, albeit not easily to those who had not yet "*learnt to see*[19]" that is, to easily identify these indicators of the presence of people living on country. The Elder Dr George explained that at the south east of this lagoon there is a cultural marker[20] that is in the water. The area was now devoid of any people, overgrown and muddied by cattle and pig movements, but still holding many signs of the once abundant human interaction with country. Earth ovens at first seemingly un-locatable, *Ku nari* (charcoal) deposits from Earth ovens still remain but will diminish over time. Birth trees and scar trees are located here, as they are across the landscape including the adjacent *Ku akulumbah* messmate (*E. tetradonta*) woodland on the sandridge country. This is how the area is named after the *Rungol* (hollow logs) that were cut from the *Ku akulumbah* Messmate woodland and used as fish traps. These indicators of people on country will diminish over time without people on country to manage them. For instance, the fish traps located at the bottom of the lagoon are in a state of decomposition, without people on country to cut them and place new ones in the lagoon they will eventually cease to exist and become habitat for turtles and fish. The open structure of the woodland once maintained through selective harvest because *Rungol* (hollow logs) were cut for creation of the fish traps, is now in a process of change. These indicators of people on country are culturally significant to Indigenous people as they are records of their people and their practice.

Indicators of people on country can also be seen in the numerous scar[21] trees and navigational markers that can be found throughout Kuku Thaypan country; from the sustainable use of paperbark (it is re-

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[19] Refer Preface footnote 2

[20] Cultural markers can be made in and of a variety of materials including from timber, living or dead trees or stone and can communicate a story place for the area

[21] Scars can be from harvesting sugarbag (native honey) or resin or for use in tools, weaponry or craft

used, travelled with and buried at the place it was cut from), *Arear* (sugarbag)[22] scars as well as those made for art, craft, tools and weapon construction. There are navigational markers[23] such as the one near *Ndolgin* that is pointing to *Agrnawul.* The absence of people on country can be seen in the decline of faunal species once known to have existed in higher numbers such as *Psephotus chrysopterygius* the Golden Shouldered Parrot or *Arrmorral*, *Trichosurus vulpecula* the Common Brushtail Possum or *Nye Looun* and *Mesembriomys gouldii* the Black footed tree rat, the Northern Quoll *Dasyurus hallucatus* and "the bigger one" (field data 2007) the Spotted Tail quoll *Dasyurus maculatus gracilis.* Dr George also knew the language name for Tree Kangaroo.

This thesis was commissioned by Elders who wanted to document and demonstrate their Traditional Cultural Fire Knowledge and its cultural practice. Examination of this issue required description and analysis of a collaborative exercise in 'knowing' about a topic. In this case the topic is the Elders' (*Awu Alaya* speaking people) Traditional Cultural Fire Knowledge (TCFK) and its practice and benefits for the ecological management of vegetation in the landscape on Kuku Thaypan country, Cape York Peninsula. This in turn resulted in the documentation and development of comprehensive methodologies for the process of documenting TCFK and its cultural practice and how together these methodologies form an understanding of how place based situated traditional cultural knowledge of fire can benefit contemporary fire management practice across Australia and Internationally. Hence, the overarching question of this co-generative research project and thesis is that of - how can TCFK and its cultural practice be known and described?

[22] Sugarbag is generally understood by western science as *Tetragonula hockingsi* a native stingless bee that produces abundant honey. In the Elders knowledge system, the word sugarbag is understood to describe the honey, the hive and the bee as is called in language *Arear.* The Elders taxonomy for Sugarbag considers interconnected elements to the native bee that are later in Chapter 3 and Chapter 6.

[23] Navigational markers can be found in trees, engravings, carvings and landscape features and will be described further in the Kuku Thaypan Fire Management Research Project chapters 7, 8 &9.

To address this overarching question, Chapter 1 discusses research and Indigenous peoples, defining traditional ecological knowledge and providing an analysis of perspectives of research with and by Indigenous people.

Then, Chapter 2 outlines policy, legislative and institutional considerations of how cultural and state fire management practices differ and how policy and legislation interact in a complex way to impact governance of cultural practice of fire. This chapter provides context to barriers and opportunities to enliven traditional cultural fire [24] knowledge and practice that exist.

Despite constraints, in many cases Indigenous people have managed to retain and/or enliven their cultural fire practices. To describe and analyse the traditional cultural fire practices on Kuku Thaypan country required the development of an acceptable methodology. The Indigenous-led co-generative action research practitioner model described through the Importance of Campfires methodology is outlined in Chapter 3 and the CAMPFIRES methodology that emerged through the research process. The chapter also describes how participant observation from outsider to research with my Indigenous co-researchers enabled the description of Indigenous led co-generative action research and the generation of outcomes that benefited country and community. Chapter 3 also examines the development of participatory approaches and their use in the Natural Resource Management NRM and applied research contexts and the limitations of these approaches when engaging with the knowledge sets of others. The CAMPFIRES methodology of the non-Indigenous researcher is presented through describing a research practitioner model, a framework, principles and tools for undertaking co-generative research with Indigenous people. In outlining the research practitioner

[24] The defining of cultural fire is described throughout this thesis. This thesis as a body of work contributes to the defining of cultural fire in the literature. The thesis uses the terminology of traditional cultural fire knowledge (TKFK) instead of the term traditional 'ecological' knowledge (TEK) of fire which is well defined in the literature. However, our understanding of ecology although derived from traditional peoples' knowledges is now a form of scientific discourse that is understood predominately through western institutional paradigms and governance frameworks. As the focus for this research dissertation was identified, led by and informed by Indigenous knowledge holders of cultural fire that had learnt from their Elders on their country, TCFK is used.

model, the case study of the Elders' KTFMRP and their Indigenous identified and led participatory action research project: The Sugarbag project are used to highlight perspectives of participation developed through this research thesis dissertation and demonstrate the multiple pathways that were taken to support the Elders to implement their traditional cultural fire management practice on their country.

Chapter 4 analyses contemporary fire practices in Cape York Peninsula, to show how this influenced the development of the Kuku Thaypan Fire Management Research project and "The Importance of Campfires" dissertation. It also highlights how contemporary fire management practices and western management frameworks continue to impact on the descendants of the Elders and their country. It demonstrates capacity to understand the western scientific context in which the research project sits.

The Kuku Thaypan country fire history in the project study site area of interest is described in Chapter 5 using satellite imagery interpretation interwoven with geo-located field records of the Elders' fire research project on country.

In reporting on this research, the Kuku Thaypan Fire Management Research Project (KTFMRP) Indigenous initiated and led research is described as the topic of the study. The dissertation "The Importance of Campfires" has worked to support the Elders' KTFMRP applying and documenting their methodology that is presented in Chapter 6 and the Elders knowledge map components and elements of cultural fire recorded through this dissertation are described in Chapter 7. The knowledge map components, elements and the knowledge triangle identify understandings required in learning the reading of country and the implementation of traditional cultural fire knowledge (TCFK) and its practice across country.

Chapter 8 highlights some of the detailed, intricate intergenerational TCFK knowledge of the Elders and its application in the management of nine different country types found in Kuku Thaypan country.

The methodology for the Traditional Knowledge Revival Pathways project provided a model for protocol in Indigenous-led research practice. In Chapter 9 this is discussed along with its contribution to the development of the CAMPFIRES methodology that was applied in conducting this co-generative research with the Elders.

The outcomes of this research and the implications for contemporary burning practices are discussed in chapter 10. In addition, the chapter identifies the contribution that the research makes to improved understanding of TCFK components and elements of the Kuku Thaypan Elders the benefits from their Kuku Thaypan Fire Management Research project methodology, and collaborative research with Indigenous peoples. Directions for future research and collaborative activities are also identified.

Chapter 1 Indigenous Peoples, Knowledge and Research

Indigenous peoples recognise they are among the most researched in the World, historically often through the lens of western dominant research paradigms, although thankfully this is changing. Tuhiwai Smith (1999) reflects that *"Research" is probably one of the dirtiest words in the indigenous world's vocabulary"* (p.1). Many Indigenous Australian communities are still attempting to have the bones of their families returned for proper burial from Museums around the World (Bowler & Reeves, Dec 2017), and/or are trying to access cultural artefacts stored at Museums. Some are involved in repatriation programs for the return and safe-keeping of these items and/or involved in projects that will increase their access to those items that need to remain at the Museums for safe-keeping into the future. Others are providing more detailed information on the collections of past anthropologists and historians and/or are reburying bones as a result of climate change and shifting beaches (Sutton et al., 2013) and trying to prevent this loss into the future (Field records 2015). As highlighted by Tuhiwai Smith these collections of knowledge, most often made by non-Indigenous peoples present a collection of "truth" situated in a particular non-Indigenous worldview.

For example, in 2004 Dr Musgrave visited the Donald Thomson collection at the Melbourne Museum and Dr George visited the Roth collections housed at the Sydney Museum. On both of these trips, the discussion sessions with artefacts and artefact images were recorded using AV technology, and were stored in the Traditional Knowledge Recording Project (TKRP) Awu-Laya database, in tape storage, with some recordings later digitised and catalogued. Younger Kuku Thaypan men, Dale and Lewis Musgrave also attended these trips to view the artefacts and have the opportunity first hand to learn from the Elders about the catalogued artefacts. This is important as although the knowledge was being recorded and transcribed by Indigenous and non-Indigenous curators it was also being transferred; this is a critical component of the Indigenous research methodologies that will be described in this dissertation.

As highlighted earlier, I was in attendance at the visit to the Thomson collection, and the information provided by "Old man" Musgrave gave insight into, and a deeper understanding of the artefacts and was additional information to that which was recorded by Thomson himself. Collection curators took down additional notes on Donald Thomson's file cards. I did remark that this seemed inappropriate given the knowledge being recorded belonged to Old man Musgrave and his descendants and that in order to view Thomson's collection permission had to be sought from Donald Thomson's family. Accordingly, it would seem appropriate that anyone wishing to read about "Old man" Musgrave's information should seek the same permissions from his descendants. Sadly, throughout this research journey this was not to be my only experience of where knowledge belonging to Indigenous people was assimilated into the knowledge sets of others without due recognition or appropriate involvement in research or project processes and outcomes. Due recognition as it applies to the Kuku Thaypan Indigenous knowledge system will be described in the research practitioner model outlined in this dissertation's methodology chapter 3, along with respect, reciprocity, roles and relationships involved. This example, describes an observed Indigenous experience of Western science and reinforces the way in which scientific research can inadvertently disempower Indigenous people. It is not surprising that such practise has led to Indigenous peoples having a distrust of the Western scientific process.

This distrust is exacerbated by western views that traditional Indigenous knowledge has been 'lost' due to disruptions to its practice through colonisation, or that which is practiced in a contemporary context it is not 'Traditional' knowledge. This supposition relies on the belief that Indigenous Australian culture is static. For example, this quote from a 1901 historical text examining "The Customs and Traditions of the Aboriginal Natives of North Western Australia" should help to see why Indigenous Australians might feel disconnected from or cautious of the Western Scientific research process:

"The object of this work is to preserve, before civilization has made them obsolete, the traditions and customs of the aboriginal natives of the North- West of Western Australia--particularly those of the Pilbarra district--as accurately as possible, based upon upwards of twenty years' observation. Since

the discovery of gold and the consequent influx of population the natives cannot carry out their traditions as they used to do--most of the young men being in the employment of the whites, prefer to imitate them, caring little or nothing for their elders' teachings. So it is merely a matter of time when they will become extinct" p.1 (Withnell, 1901).

Obviously, Indigenous Australians' knowledge did not become "extinct" despite sincere effort on behalf of successive Governments to assist in this process; the Council for Aboriginal Reconciliation "Learning Circle – Timeline" document published by the Commonwealth of Australia (1999) provides a thorough history of the procedures and policies that Indigenous Australians have had to endure and negotiate, from approval given in 1804 to Tasmania's settlers to "disperse" the natives, up until the brokering of the Cape York Heads of Agreement 1996, see Stevenson (1998). Instead, Indigenous Australians continue to hold their cultural beliefs, practices, *"ways of knowing, being and doing"* (Martin, 2003) and this influences the way in which they undertake research to explore issues, provide explanation, and find solutions to issues within contemporary Indigenous and non-Indigenous society (Langton, 1996; Nakata, 2003; Ward, 1999).

In 2004, in the land management field, the opportunity for Indigenous Australians to demonstrate their Traditional Knowledge was recent and relatively scarce (Scott, 2004). Over the past decade, Indigenous peoples have become increasingly engaged in the Natural Resource Management (NRM) movement, through participation in the Natural Heritage Trust and programs such as the Australian Government *Working on Country* program established in 2007, that supports Indigenous ranger initiatives across the country, and the Indigenous protected area program that sees land managed by Traditional owners as a part of the Protected area estate. State Governments also provide resources to assist Indigenous Australians in the management of their land and sea country, in Queensland the Indigenous Land and Sea Ranger Program and other grants program contribute to supporting Indigenous ranger and Indigenous corporations land and sea management outcomes.

When I started working in Cape York in 1992 it was an often-encountered belief among my colleagues and people that I spoke with on the topic that traditional knowledge of fire, that this existed in the past and/or was by now "surely" pretty much non-existent, wiped from practice by colonisation or held only as knowledge applied in "*burning for cattle/pastoralism*[25]" and as such was lost as a tool to help deal with contemporary fire management concerns. This conveniently served as a basis for justifying the lack of Indigenous involvement in fire management on country and certainly the lack of need for any meaningful involvement in decision-making about how it was implemented across the landscape. I tell you this so that you understand the challenges in implementing this project. In 2005, the year the research project was "officially" launched, "old man" Musgrave was issued a permit to burn his country in the then Lakefield (*Rinyirru*[26]) National Park. This was the first time an Indigenous person in Queensland had been issued a permit to burn their country in a National Park.

Colonisation and subsequent layers of legislation such as the Aborigines Protection and Control of Opium Act, Queensland Government (1897) have necessitated Traditional owners interacting with State and Federal agencies. Land tenure has influenced the level of interaction that Traditional owners are able to have with their Traditional cultural practice of burning country. In Queensland, the establishment of National Parks was used as a tool to resist Indigenous peoples gaining control over land or returning to country through the establishment of outstations (Smith, 2003). The research for this PhD began in Cape York in 2004, at a time when, although increasing, there were few studies that examined the dynamics of the integration of Traditional "Ecological" Knowledge with western science, and even fewer that were led by Indigenous Elders in the field of Environmental or biodiversity conservation and Natural Resource Management (NRM).

[25] Pers. Comm Participant de-identified 2005, Participant de-identified 2005, Participant de-identified 2006
[26] Lama lama word expressing the importance of working together for an area of Cape York Peninsula Aboriginal Land. This name was suggested by Dr George for official handback in 2011 to joint management. Source: Funeral Eulogy from QPWS. Note that this was 15 years after the Aboriginal Land Claim to Lakefield National Park was compiled in April 1996.

I came to be involved in this meeting of Traditional and Western Knowledge early in my career when I was a tutor for a short while at the Gummari Centre at Griffith University, and again when I worked for Queensland Parks and Wildlife Service, overseeing the delivery of the Natural Heritage Trust 1 Bushcare programs in Wet Tropics Northern Gulf. Later, I moved to the Tenure Resolution Unit where I worked for the State Government with Traditional owners in the negotiation over lands dealings, land transfers and acquisitions. It was through my professional employment in tenure resolution on Cape York that I was introduced to Steffensen, who had initiated the Kuku Thaypan Traditional Knowledge Recording Project and had been recording cultural knowledge with the two Elders, Dr George and Dr Musgrave since 1991.

Each of these early career experiences reiterated to me the lack of voice in decision making that many Indigenous people experienced in attempting to engage equitably in institutional processes that supported the "appropriate" inclusion of their knowledge. They also outlined to me the importance of *relationships* and *respect* in understanding "others" world-views. These two words would appear a lot throughout my professional career and are explained further in this dissertation. When I managed the Bushcare program, less than 1% of Natural Heritage Trust 1 investment had supported Indigenous projects in Queensland. To address this lack of engagement, I worked with key Indigenous organisations, agencies and traditional owners to organise forums to inform investment programs that supported Indigenous aspirations to manage country in delivery of the Natural Heritage Trust Phase 2 in the Wet Tropics and Northern Gulf bio-regions (CRC Tropical Rainforest Ecology and Management, 2002).

In the late 1990s and early 2000s in North Queensland, many of my Indigenous colleagues still viewed western science as a colonising agent of their knowledge, arguing that their Indigenous knowledge was not recognised as science by western science and expressed that western science questioned their Indigenous science's validity. However, the emergence of respectful research relationships in co-research frameworks for integrating Indigenous ecological knowledge was emerging. The approach of the co-generative research framework applied through the Importance of Campfires research project and described in this thesis was a key driver in this space in far north Queensland as the problem space necessitated action and learnings were being reviewed and implemented continuously and the methodology shared with others to enable change. A critical part of the methodologies applied co-generatively to change how Indigenous people were engaged in this space.

The role of practitioners in Natural Resource management with ongoing relationships with Indigenous peoples implementing caring for country initiatives is also pivotal. For example, in my role as a professional NRM practitioner, I would talk with Indigenous people of Cape York and the Wet Tropics and support them to make decisions about how they would approach research requests, so that they could ensure a level of equitable engagement in proposed research projects. An example of this is highlighted in my work with *Kuku Yalanji* knowledge holders and traditional owners in my then role as co-ordinator of the Cultural heritage mapping project, that was governed by the then Aboriginal Rainforest Council[27] to support the initiation of the discussion with co-researchers to scope their own research agreements with their non-Indigenous co-researchers to sign, along with them being asked to sign university positioned research agreements. In this way, the holder of the knowledge voice was heard in the research process and requirements for engaging in the project were made clear. This struggle for recognition and appropriateness of inclusion of Indigenous knowledge into western research projects was also being addressed by the then Aboriginal Rainforest council who worked on an Intellectual Property Kit with the cultural heritage mapping project to provide resources to traditional owners in the Wet Tropics region to help them to protect their intellectual property. Indeed, this struggle is ever present in Indigenous peoples' minds as they seek to protect their Intellectual property in a World where its legitimacy is institutionalised to state and nationhood, not governed by cultural protocol and lore.

[27] The Aboriginal Rainforest Council was formed to provide governance arrangements for the 18 Traditional owner groups of the Wet Tropics bioregion

Knowledge and Natural Resource Management

The Natural Resource Management movement engages with Western Science in an attempt to provide sustainable solutions to environmental issues they are facing, and add to the communities' own historical and contemporary experiential knowledge. Progressively, Indigenous people have been able to increase their involvement in caring for country through programs funded by the Australian Government's Natural Heritage Trust and similar State Government initiatives. The literature over the past decade has therefore increasingly described the important ways that Indigenous people contribute to caring for country and natural resource management practice in Australia (Altman & Kerins, 2012). Also evident is how Indigenous peoples' knowledge is incorporated and applied, and the inherent opportunities, challenges and factors for successful engagement with Indigenous land management organisations (Hill et al., 2013). More recent studies that consulted with Indigenous people practicing fire projects across Australia developed a set of six key protocols to guide Indigenous fire management partnerships (Robinson et al., 2016). While these provide some guidance for non-Indigenous people and institutions wishing to engage in Indigenous fire management practice, Indigenous peoples' protocols for fire management remain culturally contextual and inherently complex, and therefore difficult to "integrate" into western land management and research frameworks. This is because the process of integration that can occur through collaboration is at risk of assimilation of the knowledge of others, often without intent. Raven (2010) although highlighting the importance of protocols discusses the assumption that everyone will enact protocols in the same way and the importance of ethical positions between actors in research relationships.

Indigenous and non-Indigenous people are involved together in "natural resource management and conservation", in "caring for country", or indeed "caring for "our"[28] countries[29] across our

[28] "Caring for "our" Country refers to the change from the Natural Heritage Trust two (NHT2) an Australian environmental and land management funding initiative made possible through the sale of TELSTRA (a once Australian Government owned infrastructure service) to the "Caring for "our" Country" program
[29] Recognising the many Nations, language, clan and family estates belonging to distinct places across the Australian continent and its Indigenous Traditional custodians.

wonderfully diverse continent. The growing number of collaborations led by and with Indigenous people across Australia and the ways in which they are engaging in contemporary management practices and applying their traditional knowledge and Indigenous governance are highlighted in Hill et al. (2013). A search on social media, YouTube, Vimeo, Facebook, Instagram, twitter, in books and journals reveals numerous Indigenous programs and projects nationally and internationally that contribute to management of land and sea country.

This growth in the recognition of the role that Indigenous people play in contemporary resource management and environmental conservation is reflective of the achievements and the efforts of Indigenous people worldwide to gain recognition of their cultural rights, and share with others the importance of the protection and practice of these rights. This achievement is signified in the adoption of the UN Declaration on the Rights of Indigenous peoples, United Nations 107th plenary meeting (13th September 2007). Subsequently there has been an increase in policies and programs internationally and in Australia that mandate recognition of Indigenous peoples' rights in how they and their knowledge are engaged in the management of the environment.

However, in reviewing Indigenous bio-cultural knowledge documentation (IBKD) Ens et al. (2015) found an *"exponential growth since the 1970s"* with *"typical involvement of non-Indigenous researchers. Indigenous authorship remained negligible until the 1990s when there was an obvious increase, although only 14% of IBKD to date has acknowledged Indigenous authorship*" p.139

Defining Traditional Ecological Knowledge

The 1992 International Convention on biological diversity signed by 169 Nations, including Australia, was a defining International instrument in the recognition of Traditional knowledge. The defining of traditional ecological knowledge has hence been of academic concern and the study group on Science and Traditional Knowledge of The International Council for Science ICSU Study group on Science and Traditional Knowledge (2002), deliberated the relationship between science and traditional knowledge (TK) and highlights that scientific knowledge as we commonly understand it in a western context was based on observations of local and Indigenous knowledge. Nevertheless, the defining of Traditional ecological knowledge in the literature has primarily been with and not by Indigenous people and hence does not necessarily translate into recognition or valuing contemporary science theory and practice alongside traditional knowledge in the same way. It is acknowledged that researchers often categorise Indigenous Knowledge as divisionally encompassing many “types” of knowledge: Traditional, Historical, and Contemporary; naming Traditional ecological knowledge, Indigenous ecological knowledge; Bio-cultural knowledge as specific knowledge sets that define Indigenous peoples’ intricate knowledge of and relationship with nature over time in the creation of cultural landscapes.

A Report by The International Council for Science ICSU Study group on Science and Traditional Knowledge (2002) defined TK as *“a cumulative body of knowledge, know-how, practices and representations maintained and developed by peoples with extended histories of interaction with the natural environment. These sophisticated sets of understandings, interpretations and meanings are part and parcel of a cultural complex that encompasses language, naming, and classification systems, resource use practices, ritual, spirituality and worldview”* (p.9). Berkes, Colding, and Folke (2000) developed a working definition of Traditional Ecological Knowledge (TEK) as *“a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment* (p1252). This Traditional Ecological Knowledge definition encompasses local, farmers, communities, and indigenous people’s knowledge. What this definition of TEK does not address by their admission is the spiritual component of TEK as it is determined that this is outside the role of ecology noting that taboo places may have an ecological role. However as highlighted by Stanley Kalkayoorta (see below) in Indigenous Australian contexts the holding of traditional knowledge is within the wisdom of the creation spirits provided to the ancestors during the dreaming that determines the governance of cultural knowledge and practice. It is this definition of traditional knowledge that distinguishes it from our understanding of ecology.

Wik Mungkan Elder Stanley Kalkayoorta (2006) in the Traditional Knowledge Revival Project film "The Water We Know" describes Traditional Knowledge as " *the balance, if you respect it, then you'll know the balance, this law from start to end never changes, white fella law changes all the time, right now they are making a new law. The river is part of the lore, the land, everything is, beginning to now, never changes, if you lose that knowledge, everything collapse. If you lose it they'll never find it, archaeologist will have to dig for the lore."*

Closely related to the concept of Traditional Ecological Knowledge in the literature is Indigenous Adaptive Management. Cullen-Unsworth, Hill, Butler, and Wallace (2011) suggest that *"adaptive co-management frameworks incorporating both Indigenous and scientific knowledge systems having a greater capacity for success than frameworks embedded in a single world-view"* (p.1). Adaptive management is a cyclic process that combines management, research, monitoring, and reflection as a means to improving management prescriptions (Holling, 1978). It relies on the recognition that people do not have complete control over, or understanding of, the natural environment and has been promoted in Natural Resource Management fields for many years in response to dealing with complex ecological processes (O. J. H. Bosch, 2003). Smith, Felderholf, and Bosch (2006) highlight that adaptive management is part of participatory design and analysis and is useful in collaborative learning projects. The use of 'learning by doing' and reflecting in and on action has been recognised in various fields from education to human-computer interaction to increase learning and possibilities for solution making (Schon, 1991). This is a rational approach when dealing with complex and modified ecological and social systems such as those surrounding fire management. Smith et al. (2006) p.568 cite the benefits of adaptive management as twofold;

1. *It allows for decisions and actions to be based on experience and*
2. *It engenders a culture of continuous improvement by consciously reflecting on previous management outcomes.*

Traditional Knowledge systems of Indigenous Australians inherently include an extensive 'cumulative' longitudinal baseline from which to construct its management decisions. This system of oral lore has been passed down through cultural practice and remembrance of ceremony and kinship, and is governed by law and relationships. The Australian continent is home to hundreds of Indigenous Australian cultures. While some of the characteristics of these cultures may be seen as similar, each is unique. Land and seascape features were created during the Dreaming and the caretaking or lore for these places and their inhabitants, animate and inanimate[30] were given to its people through the Dreaming spirits and their ancestors. Indigenous traditional or cultural knowledge of country is critical for biodiversity conservation.

It is because of this intricate interconnected and unique knowledge embedded in culture and country that Indigenous Australians should be supported to collaborate in contemporary NRM and biodiversity conservation management and research within a culturally appropriate framework where they are responsible for maintenance of their cultural responsibilities alongside the provision of essential services that support healthy ecosystem function and biodiversity conservation for public good. These contractual services should include the implementation of Traditional Knowledge based prescriptive cultural fire management practices which would enable the application of and reconnection to the intrinsic resource management of Indigenous Australian Traditional Knowledge systems that have shaped the biota of this continent. This is alongside the use of western fire management and monitoring tools and techniques.

Indigenous Australians are active managers of vast areas, across differing tenures and some of the most biodiverse places in the World, and if supported, are able to participate in opportunities for

[30] Within Indigenous culture things that western science tends to view as inanimate or abiotic, such as geological features are often believed to contain spirit and life force.

maximising solutions for species decline, biodiversity conservation, and climate change. Indigenous Australians at the time of colonisation had extensive song-lines and resource sharing[31] routes, linking law, language, and resources communicating across local, regional and continental/national networks. In this way, extending understanding of potential patterns in ecological occurrences and ensuring the remembrance of random events assisted them to absorb and accommodate for the future, maximising resilience and survival. Nunn and Reid (2015) presented the documentation of sea level rise by Indigenous Australians and the longevity of the description of these events through their cultural record.

The documentation of knowledge through oral tradition and other forms of remembering such as story, dance and song requires responsibility, obligation, practice and study no different to the recall of “facts” tested for in a written or oral exam. However, the significance of this experience and understanding of the World in cultural practice, ceremony and spirit was reiterated to me time and again throughout my study of fire with the Elders and Steffensen. The importance of the practice of dance and song in remembering was expressed by Dr George at the 2012 Indigenous fire workshop on Kings Plains station. During a night of Corrobboree at the workshop, he sang a new song and asked the different dancers present from across Cape York to dance to this song. They expressed that they did not know that dance, his response to them was I am the singer you are the dancers, make up a dance. The song was about his visit to Lockhart River and the work he did there with Steffensen and the children and Elders, practicing, dancing and recording some of their traditional songs. I recently recalled this at the 2016 Indigenous fire workshop in *Wujul Wujul* with one of the dancers who was also present that night and reflected with him the meaningfulness of that song. The writing down of

[31] The concept of trade routes is re-interpreted here as the act of trade is today typically understood to be a commercial transaction involving “the transfer or exchange of goods or services, usually of equal value and is usually immediate.” The origin of the word relates to track which better interprets “resource sharing” routes as navigational rights with rules enabling the sharing of resources during times of abundance and/or in reciprocity during marriage and/or in relation to kinship rights or ceremony, was mostly reciprocal but may not necessarily be of equal “value” but were equally valued. This description was further defined after conversations with an Indigenous colleague “Oliver Costello” and co-researcher of cultural fire and cultural practice about cultural practices during a visit to my house following the 2017 National Indigenous Fire Workshop. See Chapters 6 and 7.

new knowledge and its expression in Indigenous culture still occurs in the same way, the significance of the practice of culture to Dr George in today's world was so important that he wanted to remember and share its importance in the same way. Dr George and other Indigenous people across the Wet Tropics, Northern Gulf and Cape York have shared with me their knowledge of sea level rise and documentation of this through stories, song and dance along with markers in the landscape of this and other significant processes such as volcanic eruptions and those documented across Australia by (Nunn & Reid, 2015).

Learning by observation and doing as understood in western pedagogy is similar but different to the experiential on-country guided learning stages encountered when acquiring knowledge of Indigenous cultural ways of knowing, being and doing whilst coming alongside a differing world view (Martin, 2003). Further, reflection on research practice whilst undertaking management actions provides opportunities for research and management paradigms to be reconstructed, creating a multiplicity of dimensions through which to re-envision contemporary environmental managements' wicked problems. This ensures a greater depth to the development of solutions that assist in dealing with complex social and ecological systems (Brown, Harris, & Russell, 2010). This can also assist to address risk and uncertainty as highlighted by Balint, Stewart, and Desai (2011) in acknowledging that western management systems *"knowledge of complex ecosystems is incomplete and no one can know with certainty the long-term impacts of management strategies"* p.20. They establish that solutions to current environmental resource wicked problems must include cultural values.

Environmental management faces 'wicked' problems as categorised by Rittel and Webber (1973) in dealing with developmental and natural resource management issues that have negative impacts on people and places (Windsor & McVey, 2005). Wicked problems are those that are inherently inseparable from their solutions and typically each attempted solution casts new light on the problem to re-shape the problem space. Cullen-Unsworth et al. (2011) identify *"cooperative problem framing* *as one of the most important determinants in assisting equitable convergence of IEK and contemporary natural resource management"* p1.

Research with Indigenous people

The need for this research project evolved out of the Elders' experience of historically marginalising processes that have generated mistrust of Western scientific research and land management approaches. The communication methods traditionally used by the dominant Western management scientific paradigms often assume that Traditional Knowledge (TK) needs the validation of non-Indigenous research and environmental practice knowledge systems (Baker, Davies, & Young, 2001; Langton, 1998). Further, western research systems are communicated primarily as non-Indigenous constructs and the theoretical foundations and underpinnings for the development of methodologies and methods are based in non-Indigenous world-views (Tuhiwai Smith, 1999). Thankfully and increasingly as highlighted in Chilisa (2012) and (Neale, McKinnon, & Vincent, 2014) Indigenous research methodologies are providing transformative paradigms in research theory and practice.

Undoubtedly, the post-positivist traditions of critical theory, feminism and social science in critiques of positivist western science in fields such as education, health, natural resource management and conservation and Indigenous research have also provided spaces in western research paradigms for the centring of Indigenous worldviews. Nevertheless, *"while post-modern/poststructuralist perspectives help us immensely in seeing through the myth of the modernist world, they do not help us move beyond the problems it has produced"* Reason and Bradbury (2006) p.6. Therefore, this research project utilised processes that enabled an experience of other worldviews and it did this to privilege Indigenous-led methodologies and centre country (Bird Rose, 1996), Traditional Knowledge and the Elders' voices in the description of their research methodology to take action to heal and manage country.

The non-Indigenous researcher examined a variety of theoretical underpinnings of participatory forms of enquiry and action research such as the works of Frier (1972) "Pedagogy of the Oppressed" whose work promotes the co-creation of knowledge in empowering those who are marginalised by society and the power relationships that exist between teacher and learner.

Whilst theoretical underpinnings of participatory research have informed the development of the non-Indigenous researchers' methodology they did not really fit the Indigenous worldview that was being shown to me for description and they did not influence the way in which the Elders and Steffensen undertook their Indigenous led research that was embedded in their ontological and epistemological worldview that is country and culture. Aikenhead and Ogawa (2007) highlight different cultural ways of knowing nature that exist.

The roles of non-Indigenous participants in Indigenous research domains, including the principal researcher engaged in this research project must focus on the necessary emancipatory imperative of Indigenous led research (Martin, 2003; Robertson, Dyson, Norman, & Buckley, 2002; Sillitoe, 2000, 2007; Tuhiwai Smith, 1999). This researcher argues that Indigenous knowledge is best accessed and managed when there is equitable opportunities and provision of space in contemporary research and management constructs that provide the holders of that knowledge the ability to lead the implementation and research of their cultural practice of land and sea management. This commitment by non-Indigenous people engaging in Indigenous knowledge research and management domains assists Indigenous Australians to build pathways towards self-determination. Such a commitment from non-Indigenous researchers also enables the opportunity for co-generative approaches to inquiry, investigation and solution-making that provide Indigenous peoples with the support and means to take systematic action and lead the resolution of problems that are also of Indigenous community concern. As highlighted by Frier (1972), empowering the marginalised enables the transformation of the structures and this researcher would argue subsequently the *"solution generation space"* and subsequent management interventions.

Co-generative action research focused on Indigenous knowledge led solution making to the malady of contemporary fire management and biodiversity loss allows co-learning from each other and generates new ways of doing science and natural resource management that benefit both knowledge systems. It is within this space that the Importance of Campfires has worked with the Indigenous developed and led TKRP and the KTFMRP to support Indigenous Elder initiated research to reposition perspectives of Indigenous fire management on Cape York Peninsula.

Bohensky and Maru (2011) state *"Modern problems cannot be consistently solved with singular, mechanistic, science centred solutions as a plea expressed for some time by Agrawal (1995) and Holling and Meffe (1996) and others, but one that largely remains unheard in natural resource management and Indigenous policy"* p.2. Hill (2003) states "*that imposing a scientific only basis to ongoing fire management results in cultural homogenization, and is a form of neo-colonialism* p182*."* Research by Crowley and Garnett (1997) demonstrates the importance of building trust and developing inclusive research methods to achieve successful conservation outcomes. Cullen-Unsworth et al. (2011) promote adaptive co-management frameworks that incorporate both Indigenous and scientific knowledge systems as having the capacity for greater success than frameworks embedded within a singular world-view. Cullen and her colleagues' research identify *"that it is a major challenge to identify pathways for the integration of these knowledge systems"* p.1. Mauro and Hardison (2000) in reviewing International law and policy regarding the rights of Indigenous peoples and local communities, indicates the strength to which Indigenous people are defining the role of traditional and indigenous knowledge in the management of biodiversity.

Research by Indigenous people

There are many Indigenous knowledge systems across Australia and their ontologies while having shared stories also are unique. This dissertation focuses on the place based traditional Indigenous Traditional Cultural Knowledge of Fire (TCKF) of the Kuku Thaypan Elders knowledge systems; and draws attention to examples of Indigenous people from other regions that I have worked with through the mentoring of the projects' methodologies spanning fourteen years, my professional career in Natural Resource Management in North Queensland for twenty years and as a co-presenter at the delivery of the Indigenous led fire workshops spanning over a decade. This research is not only important in itself for what it has documented and supported in the enabling of communities across Australia and Internationally but it also provides critical approaches in informing generalized assumptions about Indigenous fire management found in contemporary resource management practice and literature.

The three research projects; the Elders' Kuku Thaypan Fire Management Research Project (KTFMRP), the TKRP (Traditional Knowledge Revival Pathways) project led by Steffensen and this dissertation The Importance of Campfires Research, working alongside each other have co-generated multiple pathways for indigenous and scientific knowledge and addressed the challenge of the need for "integration" of these knowledge systems because the research was led by Indigenous people, the Elders and knowledge holders and thereby avoid the risk of assimilation of the knowledge of Indigenous people into western research paradigms, programs and priorities. In this way, through adherence to cultural protocols and mores, and recognising the integrity and legitimacy of Indigenous worldviews, their practices and forms of inquiry are maintained along-side western research practices.

Bradley (2005a) below articulates a number of important points, which this researcher recognises are embedded in Indigenous protocol and lore. Indigenous people in enacting the lore will not speak for the country of others and culturally will defer to those with authority to do so. They will also not speak for another person's totem. How to represent Indigenous knowledge issues at various scales has been a perennial problem for the dominant culture in Australia as Indigenous Australians have not until relatively recently had the opportunity to drive research agendas and represent themselves in the contemporary research and natural resource management space. An example of how this plays out in research agendas is provided. We ask a question at a workshop designed to gather information on what people know about a particular species. People may share that they know the species, however if the person who speaks for this animal, plant or place is not present you will most likely not find out additional information. Additionally, if that person is present, they may not tell you what they know or all that they know.

Readers are asked to consider; the pitfalls of knowledge hybridisation, “cherry picking” knowledge for convenience; the variable scales at which knowledge applies; and the risks associated with undermining confidence in traditional world views and practices which are in fact the lived practices that managed country until the land and peoples were disturbed (Standley & Roberts, 2007). Indigenous knowledge does not need to be validated “un-earthed” or re-discovered for it to have meaning if it exists as a “truth” that is known and lived. Human civilisation is constantly upon a quest for knowledge, none-the-less, validations, unearthing and re-discoveries in the Indigenous domain should not only be informed by Indigenous people. Those whose knowledge systems are being studied should also have the opportunity to identify, lead and derive meaningful and equitable benefit from such research.

…Historically IK has been and continues to be, generalised, misinterpreted and reduced to suit the demands of environmental managers and other practitioners operating out of a western scientific tradition. These efforts to type cast IK typically involve translating those elements deemed useable, that is ‘rational’, into a language and framework that can be appropriated and used for various purposes (such as GIS tracking) considered more valuable in more ‘conventional’ NRM approaches. Invariably this hybrid mix effectively undermines the authority of the holders of IK and becomes the authoritative reference source on any given land or sea management issue. In the process, the holders of IK are systematically excluded from decision making and lose control over the ownership and application of this knowledge. As a result of this repetitive trend Indigenous people often lose interest in ‘collaborative’ projects as well as the saliency of their own knowledge systems. The answer to

reversing this trend lies in acknowledging that there is no single model for IK: there are as many forms of IK as there are Indigenous cultures. Therefore, each group must be approached in full recognition that the form and content of their knowledge will be bound by particular rules of kinship and social protocol. These rules and protocols may be as unique as the country to which they belong…it is these context and site specific aspects of IK that distinguish Aboriginal land and sea management practices from those based on other knowledge systems and thus demonstrate the singular value of Indigenous Knowledge (Bradley, 2005b) pp.157.

However, there are roles and responsibilities for non-Indigenous Australians in Indigenous research and management spaces and this research dissertation represents just that. The ethical practice and protocols by which non-Indigenous researchers and practitioners engage in this space dramatically influences the outcomes for Indigenous people. The co-generative research process of this dissertation has struggled in academic circles to describe a research process and methodologies that are distinct from each other, embedded in differing ontologies but connected in their shared vision to have the voice of Indigenous people heard and their cultural fire practice encouraged in the management of country, applying their ancient knowledge system. The research process must acknowledge up-front as part of protocol and lore that a description of some of the components and elements of the Elders' traditional cultural fire knowledge and its role in the management of natural systems is not possible without the Elders and other Indigenous people's that have shared with me their wisdom over the past 20 years. This is their traditional cultural knowledge and is acknowledged as such.

Chapter 2 will highlight how different ways of knowing impact how we know and what we can understand about fire and how different forms of knowledge are used to influence power in decision making. Fire management is a social and political issue and we need to understand how legislation and policy impacts people's capacity to act and in-turn the impact that this has on the environment.

Chapter two Knowledge, Power and Land management

The previous chapter discussed the defining of Traditional Ecological Knowledge (TEK) in natural resource management, science and biodiversity conservation research and how TEK until relatively recently has primarily been defined by the dominant research paradigm. Further, Institutions can overlook the important cultural considerations of research with Indigenous people and agencies have different levels of cultural competency. Policy and how it is implemented, impacts on how Indigenous people participate in, collaborate on, engage with or lead and undertake their TCFK research. Agencies with authority and responsibilities for fire management across Australia are situated in different organisational cultures with different ways of knowing, understanding and legislating fire. These different ways of knowing about fire impact how we know and what we can understand about fire and how different forms of knowledge are used to influence power in decision making.

The thesis introduction provided insight into the politics of research for Indigenous people, and (Sutton, 2001) provides a history of Indigenous policy in Australian since the 1970's to the 21st Century. Policy and legislation interact in a complex way to impact governance of cultural practice of fire. Often these legislative frameworks dis-empower cultural fire practices, often unwittingly, sometimes through inculturation in dominant colonialist social paradigms. More recently State based fire authorities and agencies with a responsibility for the management of fire such as local fire authorities, rural fire services, emergency services, environmental agencies, local government are seeking alternative frameworks to percentage-based hazard reduction targets to protect life and property, and rigid burn prescriptions for managing ecological communities. Consequently, the defining of cultural fire practice is being sought by agencies and Institutions as Indigenous people across Australia assert their cultural obligation to maintain and revive their traditional cultural fire knowledge. While broader Australia seeks alternative solutions to the complex malady of fire management issues facing us; from risk to life and property, health impacts from smoke, loss of biodiversity and reduction in greenhouse gas emissions to reduce the speed of Global warming and the acidification of our Oceans. This will be discussed further in Chapter 4. This research project contributes to the defining of cultural fire as it is required to 'describe' the traditional knowledge based cultural fire practice of the Elders and the depth of their connection to the knowledge of their ancestors. Across Australia Indigenous people still hold significant knowledge of the natural environment and continue to practice and hand down their culture. So, the training in and practice of cultural fire through its revival on country led by Indigenous communities, where knowledge is mentored by knowledge holders and restores the capacity of people to read the story of fire that country holds, builds new generations of cultural fire practitioners are ensures 'traditional' cultural fire knowledge and its practice is maintained.

Elements of the Elders' traditional cultural fire knowledge (TCFK) and its practice are described in Chapters 6, 7 and 8. Figure 2.1 describes requirements for TCFK and practice from the Elders' point of view, where Country is central to decision making that includes Indigenous and wider community in addressing issues of fire management concern. Where cultural knowledge holders lead and those being mentored and are both critical to its demonstration. When cultural fire adheres to local protocols, is mentored by Indigenous knowledge holders and practitioners and, critically, is governed by lore in its transfer, the potential for co-generation of solutions to our contemporary complex fire problems occurs. When these requirements are present in the engagement of Indigenous people in their traditional cultural fire knowledge and practice, the contribution to contemporary fire management, while maintaining adherence to lore is enabled.

Policy and legislation drive State based fire management practices and the opportunities for Indigenous people to implement cultural burns, not lore and adherence to cultural protocol. The decision-making frameworks for implementation of State based fire management differ from traditional cultural fire knowledge (TCFK) practice. Table 2.1 provides a typology of current fire management practices for Cape York Peninsula and a comparative between the differing ways of knowing about fire that exist.

Figure 2.1 Requirements for Cultural Fire from the Kuku Thaypan Elders' point of view

Source: Data analysis 2017

Buizer and Kurz (2016) highlight that to depoliticise fire management *"sustains specific types of relationships between people and nature while delegitimising others and obscures the fundamentally* *different notions about relationships between humans and non-human nature upon which the debate ultimately pivots"* p. 1. They argue that improving wildfire management by science-based approaches alone, without recognition that this has vulnerabilities and impacts, is a highly modernistic approach**.** In *Seeing Like a State,* Scott (1998) reflects that confidence alone in high modernity exercised by the state has had implications for resource management and that it *"has also taught us that such maps of legibility and con-trol, especially when they are backed by an authoritarian state, do partly succeed in shaping the natural and social environment after their image"* p.348. On visiting areas in Australia in 2011and 2012 that have been repeatedly ravaged by wildfire in the Victorian high country I have witnessed communities, country and ecosystems in a condition where repeat events are likely to occur.

In part, this is because there is a change in the vegetation structure from previous intense wildfire events. The amount of standing dead timber remaining in these areas and the shrubby undergrowth is high, making the vegetation fire prone. There remains the continuation of pre-dominantly state-based fire management of these areas of land that are managed primarily to reduce fuel loads and meet percentage area reduction targets. This aim of fire management in this context is the reduction of fuel and as such highly impacted landscapes may result. There remains a fear of fire that exists in the community as a result of experiencing intense wildfire events and the significant loss of life and property across large areas. The scars are not only in the landscape but they are held within the people who have experienced such catastrophic wildfire events.

Scott's (1998) analysis that the authoritarian state partially succeeds in shaping the natural and social environment in its image reflects my Indigenous colleagues' premise that the wildfire problems we have today are a direct result of the way in which both vegetation and fire have been managed and controlled since colonisation. Indeed (Mooney et al., 2011) in a quantitative scientific research that examines 223 sedimentary charcoal records in Australasia suggests "an increase in biomass burning in the last 200 years may have been exacerbated or influenced by humans" p.1. Further, my colleagues also argue that often when we are looking at a system, we are looking at a system that is already highly modified from its desired state.

Uncontrolled fire has resulted because the country was removed of its people who were skilled in fire management practice. Indigenous traditional cultural fire knowledge of fire happens from a micro to macro scale through the implementation of fire in response to cues in the environment and the utilisation of resources as well as country types, neighbouring clan and language groups and kinships systems. Indigenous clan groups progressively implemented fire according to seasonal patterns and their daily life consequently ultimately resulting in landscape scale fire management that limited uncontrolled fire.

Table 2.1 outlines some of the key drivers for current fire management practices and offers a comparison between contemporary state-based fire management decision making practices and policies, methods and tools currently being implemented at a macro scale compared to the Elders' application of their Kuku Thaypan TCFK that is implemented from a micro to macro scale. A description of aspects of the Elders' TCFK are outlined in the table and are described in detail in chapters 6, 7 and 8. Table 2.1 examines the purpose, desired outcome, planning and assessment tools and methods, the scale, validation methods, inter-relationships, monitoring tools and results of four different drivers for fire management practice, including Kuku Thaypan Fire Management to highlight the distinctly different drivers and values that each hold.

Western State driven fire management constructs target assets, threatened species or ecological communities, prescribed burns for species or ecological conservation, planned burns, wildfire mitigation and suppression, fuel reduction and hazard mitigation and more recently in Northern Australia Savanna burning methodologies to abate and sequester carbon.

The administrative ordering, of vegetation and fire management in the control of nature in paradigms of contemporary wildfire management show patronage to highly modernist approaches to suppression and control and involvement of local community and even more so the Indigenous community in providing solution to contemporary fire management concerns.

This is important because policy and legislation impact societies' ability to interact with and improve their understanding of TCFK and its practice. TCFK is not stuck in the pre-colonisation past, nor are Indigenous people as discussed in Chapter 1. This knowledge of reading country has and continues to be transferred from generation to generation. Traditional cultural fire knowledge and its practice is not static. This premise as discussed so eloquently by Neale (2018) is a perception and when TCFK is viewed through this lens alone has risks for Indigenous peoples *"practical empowerment within land management to a subset who are considered correctly and verifiably cultural"* p. 87.

This in turn impacts peoples' experiences of cultural fire and capacity to accumulate new knowledge of fire that could shift the way we understand and encounter new and relevant knowledge of fire. Wildfire or uncontrolled fire and its management is not the problem, it is the result of the problem of the lack of knowledge of how to manage landscapes with fire. In the face of mega-fires, we all now face this lack of knowledge in how to deal with the problem society has created. Even when agencies, institutions and individuals want to learn they find it hard to let Indigenous traditional cultural fire knowledge holders demonstrate their knowledge as they are contained within their understanding of its control and order. An example of this would be the burning of a significant *Themeda sp.* grassland in Victoria's North East, where less than 1% of native grasslands remain. This small patch of grassland also contained significant rare and endangered orchids that were being intensely monitored. There was much discussion and meetings at this area to enable its first 'cultural' burn. However, when it occurred the other agencies that were there thought it was taking too long and increased the speed of the burn by joining up the single spread apart ignition points (see Chapter 8). This in turn lead to the fire increasing in speed and intensity, changing the outcome entirely.

Table 2.1 Typology of current Fire Management Practices for Cape York Peninsula

Typology of current Fire Management Practices

Typology of Fire Management	**Hazard reduction burns**	**Conservation burns**	**Savanna Fire Management**	**Kuku Thaypan Fire Management**
Primary purpose	Reduce groundcover biomass	Manage CYPAL (Cape York Peninsula Aboriginal Land) jointly with traditional owners. Burn to reduce risk and implement conservation burns	Reduce greenhouse gas (including carbon) emissions into atmosphere	Maintain cultural protocol, ceremony, lore and responsibility for country
Desired outcome	Reduce hazard to life and property	Reduction of late season wildfire risk and burns targeting specific species based on burn recommendations.	Reduce rate of climate change, income incentive	Maintain health of country (plants, animals, soil, water, weather)
Planning	Satellite imagery, maps and data, prediction and spread models, submitted burn plans	Satellite imagery, maps and data, conservation advices, recovery plans and ecosystem burn recommendations, annual burn plans	NAFI, eligible vegetation communities, % of burns conducted in early dry season, satellite fire history	On-country assessments, permission to burn from knowledge holders, reading of season through known indicators
Assessment	Targeted percentage reduction in area to be burnt	Review of results annually based on submitted burn plan	Artificial (fixed) cut-off dates	Responsive to seasons, weather, climate, species and vegetation systems, resource utilisation, daily living, country types, vegetation types, soil types, landscapes, aquatic systems, neighbouring clan and language groups and kinship system
Tools and Method	Aerial incendiary burns, driplines, mechanical and natural features fire-breaks Multiple linear ignition points, GPS, Weather monitoring systems, analysis of fire history	Aerial incendiary burns, driplines, mechanical and natural features fire-breaks Multiple linear ignition points, GPS, Weather monitoring systems, analysis of fire history	Aerial incendiary burns, Multiple linear ignition points, driplines, mechanical and aquatic and natural features fire-breaks, vegetation photo points,	Bark torches, burning systems within and across systems Multiple spaced single ignition points Observing weather conditions throughout the season and throughout the day, navigational markers, knowledge of country, vegetation

			GPS, Weather monitoring systems, analysis of fire history	curing fire breaks, protection of aquatic resources, knowledge of how to read fire in the landscape, reading of country indicators, timing of season and day.
Scale	Landscape scale – multiple runs, limited on-ground burning	Landscape scale – limited number of aerial runs some, limited on ground burning	Landscape scale – limited number of aerial runs at different times, some on ground burning	Micro to Macro resulting in landscape scale
Validation	Satellite/aerial mapping, on-ground monitoring	Satellite mapping, limited on-ground monitoring particularly in remote areas	Satellite imagery (variable on-ground monitoring)	Elders and knowledge holders assess before, during and after a burn
Inter-relationships	Life and property	Species and ecosystems based	Eligible Vs non-Eligible vegetation	Plants, animals, seasons, climate, place, people. See elements table.
Monitoring	Satellite imagery, maps and limited site data	Satellite imagery, maps and limited site data	NAFI, Auditing procedures	On-country assessments across fire area, assessments of health of country
Result	Varied – reduction in late season wildfire	Varied – reduction in late season wildfire	Varied – shifts in early vs late season	Maintenance of culture - holistic fire management, multiple species benefit

Source: Peta Standley Importance of Campfires Field records: 2016

Table 2.1 Typology of current Fire Management Practices for Cape York Peninsula cont.

Restricting access

Tenure of lands plays a crucial role in enabling or excluding Indigenous peoples' capacity to enact their cultural obligations to manage country and equitably access areas to burn. In Northern Australia vast tracks of lands are Aboriginal owned. Although there are various forms of Aboriginal owned tenure depending on how the State has managed earlier land rights and more recent native title hand back of land. For example, Aboriginal Freehold in Queensland does not hold the same legal tenements as ownership of freehold land. This limits the way in which the land can be mortgaged, revenue raised and management implemented, there are also inter-generational risks inherent in both approaches. There are also large areas that are managed jointly with the State for nature conservation. Policy legislation and tenure impact access to country, even when lands are transferred back to Indigenous communities across Australia through a combination of land tenure legislation such as Indigenous land use agreements, Native Title, through the Cape York Peninsula Cultural Heritage Legislation 2007, Aboriginal freehold through return of lands that were formally Deed of Grant in Trust to Indigenous councils, Aboriginal freehold through State legislation, lands transferred during land rights pertaining to the Land Rights Act, general freehold, leasehold held by Indigenous corporations, Settlement agreements to name a few. Table 2.2 outlines State by State for the Eastern Seaboard of Australia the Agencies and organisations whose legislation and policy have an influence in decision making and capacity to implement and know about traditional cultural fire management.

Indigenous decision making remains secondary to those of the State particularly when natural resources are involved, mineral, gas and forestry. The primary role for decision making on the management of land and sea country remains allocated through State and Federal policy and legislation and how it is enacted. The long-time struggle over Kakadu for not only management but Uranium mining, the right to close climbing of Ayres Rock, the Waanyi people of western Queensland's long battle over Zinc mining and recent sit down and registration of contemporary cultural sites on Lawn Hill, all provide examples of the subjugation of Indigenous traditional owner rights in decision making for the management and use of country. Haynes (2013) provides an analysis of joint management of Kakadu National Park, one of the longest jointly managed parks in Australia and although the legislation and policy enable a sharing of power his analysis is that western governance structures still dominate decision making processes and '*the State retains the upper hand on most issues'* p. 206. He also notes that Aboriginal people assert themselves in day to day decision making in the Park but not at the board level, despite being on the board. The joint management arrangements between the State and Traditional owners varies across Australia depending on how the State enacts legislation, policy, the time at which lands were handed back, the stage at which lands are at in the land tenure resolution process and the capacities of staff and Traditional owners to engage. Table 2.2 highlights the complexity of agencies and organisations whose legislation and policy determine how land is governed and how traditional owners engage in the implementation of their traditional cultural fire knowledge across States on the Eastern seaboard of Australia. For the most part the state still influences how these areas are managed with fire.

A Cape York example of how legislation and policy impact our ability to understand different ways of knowing about fire

The history of the establishment of National Parks in Cape York could in itself be viewed as an act of dispossession and on-going state control, as from the 1970s to the 1990s, environmental conservation legislation and policy instruments were used to prevent Indigenous traditional owners from legally acquiring and using land. In 1976, the late John Koowarta of the *Winychanam* group of Cape York, with the assistance of the Aboriginal Land Fund Commission, signed a deed to acquire the Archer River pastoral holding lease, located on his traditional country in central Cape York. The sale and transfer of the lease at the time was subject to the approval by the lands Minister in Queensland, who refused to grant approval of the sale of the lease. Queensland government policy explicitly prevented Indigenous traditional owners from obtaining large areas of land and the pastoral lease was gazetted as a national park; Archer Bend National Park (Perkins, Langton, & Atkinson, 2008) later to be called

Mungkan Kanjuu National Park and more recently following transfer to Traditional owners *Oyala Thumotung* Cape York Peninsula Aboriginal land (CYPAL).

It wasn't until 1996 that the landmark Cape York Heads of Agreement was signed by the Cape York Land Council, The Peninsular Regional Council of ATSIC, the Cattlemen's Union of Australian Inc., the Australian Conservation Foundation and the Wilderness Society. This agreement was considered historic in benefiting Reconciliation and the then Aboriginal Council for Reconciliation cited significant benefits for all key stakeholders. This agreement outlined terms that:

- recognised that Traditional owners were the original inhabitants and were entitled to access to areas of traditional significance,
- that pastoralists had legal rights and concerns related to their industry and lifestyle, and
- all parties acknowledged the natural heritage significance and encouraged negotiations between the State Government and Pastoralists in relation to an East Coast Wilderness Zone.

In 1998, both the Commonwealth and State Governments committed $40 million to invest in the Cape York Management Trust Plan, primarily in property planning, additional resources for managing the National Estate, endangered species including the Golden Shouldered Parrot and co-investment with the State Government towards the Cooktown Interpretative Centre. The majority of this funding was delivered through the State, and a report reviewing the value of the Natural Heritage Trust investment to implement the Cape York Management Trust Plan with regards to conservation outcomes found that little had been achieved (Hill & Schneiders, 2003). It took until 2001 for the State Government to become party to the agreement; until this time the position of the State was that it would not be party to the agreement while it was fighting claims in the High court regarding the *Wik Waya* determination (Stevenson, 1998).

In Queensland, Land Trusts are statutory land holding bodies under the Aboriginal Land Act (1991). However, land trusts can hold land across multiple tenures such as CYPAL (Cape York Peninsula Land) under the Cape York Peninsula Heritage Act (The State of Queensland, 2007) that is applied on joint managed land within the National Protected Area Estate and Aboriginal freehold held over native title lands and lands where ILUA's have been negotiated or where Deed of Grant in Trust lands (often former mission communities) have been transferred to local government areas. More recently prescribed body corporates have been established where native title has been determined or is lodged with the National Native Title Tribunal. Fien (2015) highlights achievements and challenges in realisation of joint management of national parks in Cape York and how having to navigate state-based tenure, legislation and policy is a pre-requisite in being able to implement cultural fire practices on country.

Subsequent government policies and funding priorities and negotiations between the parties have achieved the intent expressed in the Cape York Heads of Agreement. A research bulletin by the Queensland Parliamentary Library on the Cape York Peninsula Heads of Agreement published in 1998 (Stevenson, 1998) states that *"60 percent of Cape York Peninsula is under pastoral term lease"* with *"15 percent under Aboriginal control."* Examination of a current tenure map for Cape York estimates approximately 60 percent is under some form of Indigenous tenure and a significant reduction in pastoral leases. The tenure rights of pastoral leases in Cape York have remained relatively unchanged since the heads of agreement. Maps 2.1 and 2.2 clearly show the changes in Land Tenure in Cape York from 2004, when we started development of the co-generative research process, to 2017. This change demonstrates the increasing assertation by Indigenous people of their rights and the need for the State to respond to legal rulings and balance their desire for management of significant natural areas for both resources and biodiversity. It is both Indigenous peoples' assertion of their rights and their deep cultural obligation to look after country that now require navigation through complex legislative and policy processes to enable decision making and management of their lands.

Currently there is a whole-of-Cape-York, Cape York United Number 1 One claim lodged on the register of Native Title Claims on the 06/02/2015 http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/RNTC_details.aspx?NNTT_Fileno=QC2014/ that covers areas of land already under Aboriginal Land tenure of various kinds, but excludes those that have already had native title determined, which are the majority. However, the pre-dominantly state based governance structures that are in place for these areas of land do not necessarily reflect traditional governance structures and decision-making processes (McKenna, 2018). Further, the governance structures that would result from the success of the one native title claim would also control local Indigenous language and clan group decision making if only one prescribed body corporate (the legal entity for native title corporations) was required to make decisions as was quoted by McKenna *that "the Queensland government said in a submission to the court that its interpretation of the claim was that it was drafted to only enable a single PBC. The claim sought "exclusive'' native title — the highest form of rights under federal law — ensuring full consultation and negotiation on compensation and how development goes ahead."*

Clearly, even where State legislation and policy has enabled shared power in decision making, western governance structures can still disempower traditional owners who are holders of traditional knowledge because decisions can be made for their country by people who are not culturally able to speak for that particular area, or by processes of government authority and legislation. This is not to say that Indigenous people are not able to be multi-lingual within these structures just that there needs to be a standard of cultural competency as different agencies have different cultural attitudes to Indigenous participation, collaboration, decision making and leadership.

So how did legislation, policy and power impact the research project?

Understanding the policy and legislative contexts and the complex layers and inter-agency requirements in which the research project operated is essential as this dramatically influenced how the research project was able to take place. The research project study area of interest (AOI) see, map

3.2 is the intersection of a part of the Kuku Thaypan language group estate and *Rinyirru* (Lakefield) National Park (NP). In 2004, at the start of the study the location was legislated a restricted access area with access being limited to Traditional owners; this in part was due to its remoteness and absence of a suitable road network. However, in 2017 I was informed at a meeting with Queensland Parks and Wildlife Service (QPWS) and Traditional owners that it is now considered to be under the same access permissions as the remainder of the park.

Through the efforts of the Elders and Steffensen, in 2003 *Rarda – Ndolphin* (Low Lake) was made a restricted access area authorised under the provisions of the Nature Conservation Act (NCA) (QLD) 1992. This area is a significant cultural site shared between the Lama Lama and the Kuku Thaypan people, and the establishment of the restricted access area was to support these groups in managing this area collaboratively. The outstation at Saxby Lagoon was established through the provisions of the then Section 32 Management Agreement under the Nature Conservation Act (NCA) (QLD) 1992, while I was still employed at QPWS in the tenure resolution unit. However, it was only allowed to be seasonally occupied. This was the same instrument that established the outstation at *Langai*, working with old man Lawrence on then *Mungkan Kaanju* NP now *Oyala Thumotang* CYPAL. The instrument that enabled the establishment of these seasonally occupied areas was within the NCA at that time and has since been superseded with the requirement to develop an Indigenous management agreement for Cape York Peninsula Aboriginal Land under the Cape York Peninsula Heritage Act (The State of Queensland, 2007).

At the commencement of this research project, the project study area was not actively visited on ground by Queensland Parks and Wildlife park managers and was being burnt by aerial incendiary as part of their burn program. Until the initiation of the research project, the area was largely unmanaged other than by adjoining landholders for cattle production. Pig hunters and fisherman frequently visited the area and accessed the lagoon systems throughout Kuku Thaypan country. *Rinyirru* (Lakefield)

National Park is a popular recreational boating, camping, fishing, 4WD, grazing and unsolicited pig hunting area. There are now 11 Indigenous rangers and a Ranger in Charge (RIC) of the CYPAL area. When the research project began on country there was one RIC at Lakefield Ranger base and a ranger at New Laura and no Indigenous ranger positions. As the years went on an Indigenous specified ranger position was posted at New Laura.

As a result of the Elders' efforts supported through this research project, they were able to negotiate for a boundary fence to be installed along the western boundary of the park. This took three years of meetings resulting in over 114 records of correspondence engaging QPWS from 2006– 2009 alone. The Elders' intention was to fence out *Gno Coom* Saxby lagoon from cattle to protect this cultural area and water quality. There should have been a tri-partite agreement on the installation of the fence, between QPWS, the adjoining leaseholders and the traditional owners as it is a future act under the *Native Title (Queensland) Act* 1993 and this was also in line with QPWS policies at the time. However, the contract for fencing was given to the neighbouring lessee. The fence was not installed where the vegetation was cleared for the fence-line and the fence remains in an alternate location to this day. Many meetings were had between the old people and QPWS to get commitment to install the fence. One of these meetings involved a QPWS employee and adjoining lessee's discussing the matter with Dr George at a workshop for fire management that was intended for a completely different purpose. The intention on the discussion at this meeting was to get agreement from Dr George on where the fence should go. As indicated the establishment of a boundary fence could be considered to impact on future native title under the *Native Title (Queensland) Act* and therefore must be referred to Traditional owners for consent.

Following on from the fire management of pastoral properties fire workshop delivered by Cape York Peninsula Development Corporation, Dr George made efforts to contact the Land Council to discuss the fence prior to the State being able to proceed with it going ahead, Steffensen and I also followed up with the Land Council. More formal meetings were held in Cairns with QPWS staff from the Indigenous engagement unit on more than one occasion discussing where the fence line was to be installed to fence cattle out of the lagoon. However, a follow up visit to Laura by me some weeks later resulted in the opening of an outdated letter from the Land council. It was among other mail sent to Dr George, who had very low literacy and would often get me to read his mail to him when I visited. The date for the required response to the proposed future act that the proposed boundary fencing triggered and hence, the ability to influence how and where the fence would be erected had by that time passed.

This process was only one of the many negotiations that occurred with QPWS through the research project that didn't always achieve the intended aim. The Elders had developed comprehensive management strategies for their country and were supported to present this on a number of occasions to QPWS, but collaboration opportunities were limited and sadly they both passed away without seeing the full realisation of their aspirations.

In the past, only extremely limited "joint" management occurred with Traditional Owners; the stated aim of the then Queensland Parks and Wildlife Service (QPWS) Master Plan (2001) was to, *"Consult" with Indigenous peoples at district and park level to: "advise" on management issues; coordinate approaches to park-specific issues; and advise and assist where necessary in resolving regional and local issues."* Multiple annual negotiations with QPWS staff during the active research project period from 2003 – 2010 were challenging, and at times downright disabling. From 2003 – 2010 only two Queensland Parks and Wildlife Service staff members ever attended a fire management research field trip, and on that field-trip they only remained a few hours. A QPWS staff member also recorded video footage on this trip, we never saw the footage or the finished product. It was not until 2016 that QPWS staff attended the Indigenous Fire Workshop hosted by *Yalanji Nyungkul Bama* supported by *Jabalbina* Aboriginal Corporation Rangers and the Wujul Wujul community. These Indigenous fire workshops, that have been attended by Indigenous groups and non-Indigenous agencies involved in fire management nationally have evolved over the past decade out of the work of the Elders and Dr George was involved in the decision making about and attended every Indigenous fire workshop since the very first informal workshop with Lockhart Elders in 2008 to its formalisation in 2009 where it was held at Bizant outstation on *Rinyirru*.

The fire workshop in 2009 that was held on Bizant outstation fulfilled a wish of the Elders of both the *Awu Alaya* and *Lama Lama* Language groups to "work together" to manage their country within the boundary of *Rinyirru* CYPAL (audio recording TKRP 2002). The Elders' Traditional Knowledge Recording project undertaken with Steffensen and their KTFMRP undertaken in cogeneration with *The Importance of Campfires* was a vehicle to support the Elders in their engagement with QPWS and pastoral neighbours. It could have been considered that with the recognition of the Elders through their honorary doctorates in 2005 and their listing as co-researchers in a western academic research project that negotiations should have been smoother.

The report of the Land Tribunal established under the Aboriginal Land Act (1991) Aboriginal Land Claim to Lakefield National Park (State of Queensland Land Tribunal, April 1996) was submitted on the 18th of April, 1996. However, it was not until The Cape York Peninsula Heritage Act (The State of Queensland, 2007) came into effect that the entire park was handed back to Traditional owners in 2011, recognising their native title rights through an Indigenous land use agreement (ILUA), twelve years later. *The legal framework for this to occur was based on provisions in the Native Title Act 1993 (Cth) (NTA), the Nature Conservation Act 1992 (Qld) (NCA) and the Aboriginal Land Act 1991 (Qld) (ALA). The NCA and ALA were amended in 2007 to provide the current legal framework, through the Cape York Peninsula Heritage Act 2007; this Act and other legislative amendments have streamlined transfer of land on Cape York Peninsula* (Fien, 2015) p.2, but not without presenting significant challenges in the delivery of effective practical implementation of the governance and implementation of joint management.

In 2011 at the time of hand-back there were eight main clan groups comprising approximately seventy-five families whose country is within and outside of *Rinyirru* National Park boundary. The governance arrangements for decision making remain dominated by western constructs that do not adequately support traditional cultural governance frameworks. Traditional Cultural Knowledge holders do not necessarily gain a say in decision making or employment opportunities and the process of navigation through these governance systems to conduct projects on country is fraught with obstacles and layers of consent.

Over the years, both Steffensen and myself have had numerous requests from members of the claimants for the area and broader for access to the knowledge that has been recorded and documented by the Elders. However, the correct way to access this information is learning from the people who hold this knowledge on country, including the younger direct descendant clan members who travelled with us on many of the trips out onto country where the Elders transferred their knowledge to them, family group members through kinship within the same language group who came on country with us and those from neighbouring language groups in a way that is culturally appropriate. The recorded and documented knowledge of the Elders is their legacy left to their direct descendants and will be accessed and shared by them in undertaking management of their country on *Tenacull* (Maryvalley station) and the project area of interest on *Rinyirru* CYPAL. This is the protocol for the Elders *Awu Alaya* Traditional Knowledge Recording Project. I am not the cultural authority of this knowledge, nor is this thesis.

Despite some areas of Kuku Thaypan country being inside the Protected area estate, there are many threats that Kuku Thaypan country faces, both inside and outside CYPAL lands. The entire Kuku Thaypan Estate contains different tenure types including CYPAL, Nature Refuges and pastoral lease that is subject to the management practices of the lessee and grazing pressure.

In 2010, Kalinga station was returned to Aboriginal freehold, and in August 2014, Maryvalley *Tenacull* station was handed back to the Kuku Thaypan people as a combination of Aboriginal freehold and *Payrrape* Nature Refuge on the Morehead River. These lands were handed back through an ILUA process facilitated by Balkanu Cape York Development Corporation Land Tenure Unit between the Traditional Owners and the Cape York Tenure Resolution Program delivered through the Department of Aboriginal and Torres Strait Islander Partnerships (DATSIP). The Department of Aboriginal and Torres Strait Islander Partnerships provides *"whole of government leadership in Aboriginal and Torres Strait Islander policy, coordination and monitoring, and the delivery of services to Aboriginal and Torres Strait Island people* (Queensland Government (Department of Aboriginal and Torres Strait Islander Partnerships), 2010-2019). Currently, the land is governed by a Land Trust that is facilitated by DATSIP.

Instead of *Tenacull* Maryvalley station becoming a separate land trust, the area is governed through the *Kerwendah Thingkal* Land Trust that also holds title to Kalinga station. Different family groups have different country affiliations within the Estate. Direct descendants of the Elders wished to set up a separate corporation to govern *Tenacull* and Hahn river drainage complex, along the lagoon complex of the Morehead to the boundary with Lama Lama, to *Gno Unta* Saltwater creek in the North and earlier in 2017 registered the *Awu-Laya* Traditional Land Management Corporation with the office of the registrar of Indigenous Corporations (ORIC) so as to establish that they should be spoken with and hold rights to decisions made on their behalf by the *Kerwendah Thingkal* Land Trust. Figure 2.1 below is a digital copy of the certificate of registration of the *Awu-Laya* Traditional Land Management Corporation.

Australian Government
Office of the Registrar of Indigenous Corporations

CERTIFICATE OF REGISTRATION
OF AN ABORIGINAL AND TORRES STRAIT ISLANDER CORPORATION

This is to record that

AWU-LAYA TRADITIONAL LAND MANAGEMENT ABORIGINAL CORPORATION

INDIGENOUS CORPORATION NUMBER: 8688

is a corporation registered under the
Corporations (Aboriginal and Torres Strait Islander) Act 2006.

The date of registration is 11 August 2017

James Rose
Delegate of the Registrar of Aboriginal and Torres Strait Islander Corporations

Certificate issued under section 32-1(c)

CORPORATIONS (ABORIGINAL AND TORRES STRAIT ISLANDER) ACT 2006

Figure 2.1 Certificate of registration of the Awu-Alaya Traditional land management aboriginal corporation 11 August 2017

The project study AOI is within the CYPAL lands; however, it has experienced relatively heavy grazing pressure up until 2015, when a feral cattle eradication policy began to be enacted by the Queensland Department of National Parks, Sport and Racing. The area is still subject to grazing pressure and significant pig impacts. Access to this area is easiest via travelling through Artemis station and consent was always sought to access the area from Artemis leaseholders and long-term pastoral family of Cape York. When the project began, although *Llung* Polly Lake was already within the park boundary, we were required to negotiate with the Grazier who held the agistment lease on

Tenacull Maryvalley station to run cattle, see (Steffensen, 2007). This was a part of the tenure transfer process which generally includes a term-lease for management of stock and subsequent de-stocking of the area prior to a specified agreed date. The agistment included cattle access to *Llung* Polly Lake and surrounding country and permission was required from the agistment holder and Cape York Tenure Resolution Unit to implement fire management. This area is now fenced into the park and out of the *Tenacull* Maryvalley lease.

In addition to managed and feral cattle, threats posed by introduced flora and fauna that have been recorded in the project area of interest and those that are identified as problem species in one or more locations in northern Australia and pose a potential risk in Kuku Thaypan country are presented in Appendix 6 Table 6.2. Significant impacts are occurring to country from feral pigs and exotic weeds, including; Weeds of National Significance Rubber Vine (*Cryptostegia grandiflora)*, increasing Sicklepod (*Senna obtusifolia*) and the existence of significant areas of Grader Grass (*Themeda quadravilus)* that has the potential to replace entire systems of native grass. *Hymenachne amplexicaulis cv. Olive* is also present in lagoons on Kalinga station upstream from the *Rinyirru* National Park, along with known fire transformer species Gamba grass *Andropogon gayanus*. Impacts from boats on small and seasonally dry water courses exacerbate land-based erosion, visitation impacts from net fishing and waste management due to access to the Park via alternative entrances are of significant concern to the Elders and their descendants.

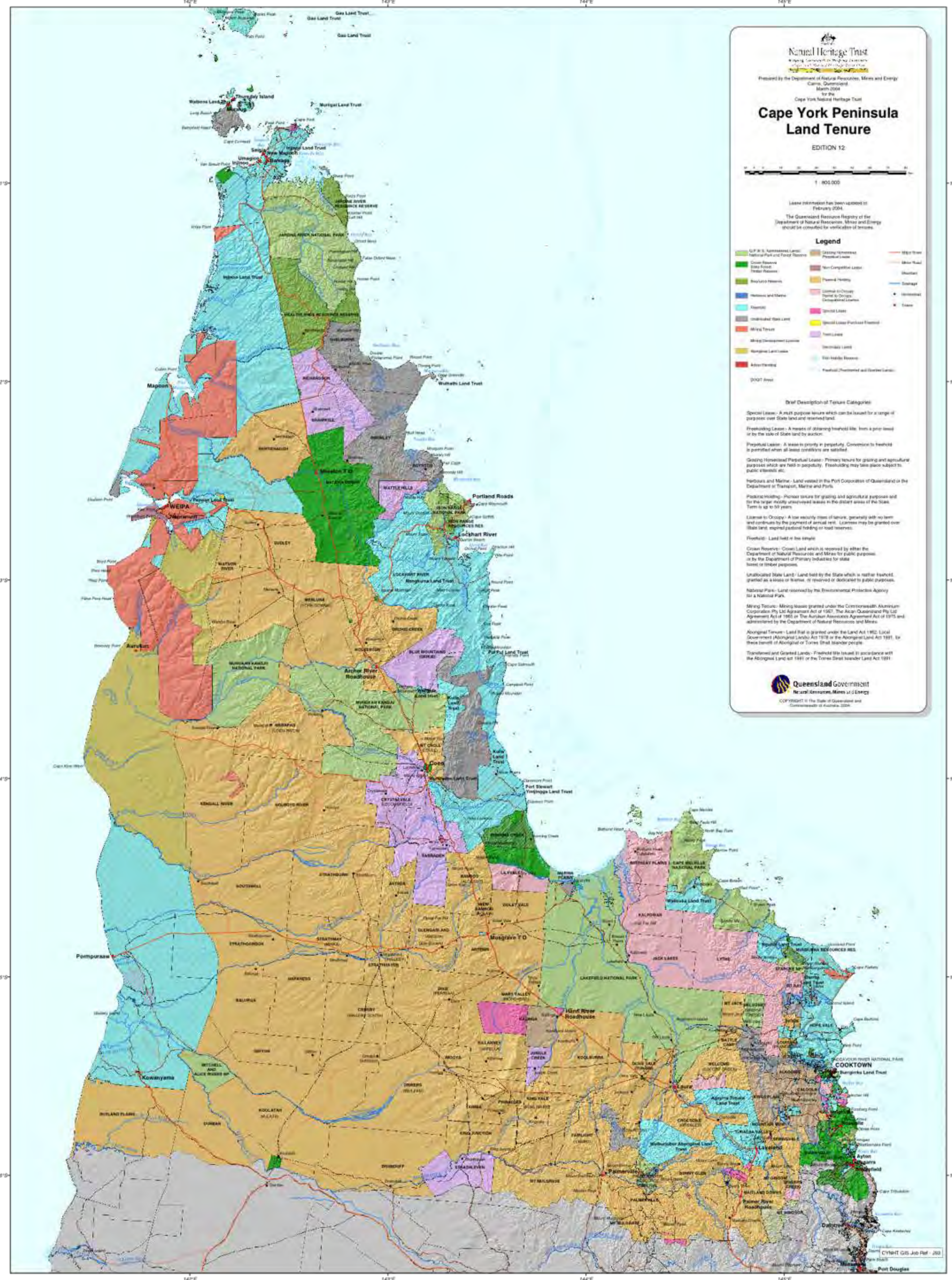
However, over the past decade I have witnessed this process in a continuum of slow improvement as alternate world views come together to navigate through the management of large areas of land and as traditional owners assert their custodial obligations to look after their land and sea country.

Once such initiative supported by Cape York NRM to improve consideration of cultural governance processes, the concept of which has left a legacy as a model for improved decision making was the

Indigenous reference groups project (Cape York Natural Resource Management, 2017). This framework was developed to support cultural governance frameworks as a model that could inform the western driven governance constructs that governed land trusts at the time. The investment to develop this process was available prior to Wild Rivers legislation being repealed in 2014. Despite this, the current situation of multiple types of tenure; the legal processes required from governing these differing types of tenure; the addition of native title rights requiring the delineation of fixed boundaries; custodial rights and obligations; and inadequate resources for engagement and on-ground management all compound complexity.

Although improving there are still complexities with governance and implementation of traditional cultural fire practices on primarily state managed lands for conservation. However, across Australia increasingly Indigenous led community fire projects are partnering with private land managers and organisations to support burning for cultural and environmental outcomes. Although this motivates the social action required to improve fire management across Australia, fire does not know boundaries created on maps and as outlined by Dombeck, Williams, and Wood (2004) '*learning to live with fire remains primarily a social issue that will require greater political leadership, agency innovation, public involvement and community responsibility*' p.1. Unless we enable Indigenous traditional cultural fire knowledge holders and practitioners space to demonstrate and practice their knowledge we will limit the ways in which we can know and experience fire. Perhaps one day the term wildfire will no longer need to be in use.

While the impacts of what can be described as institutional and structural racism in land management are perhaps gradually being ameliorated, the Elders saw a need to bridge the gap by having their practices documented in a way that would be acceptable to western science. To document and analyse their knowledge required the development of an appropriate methodology. Chapter 3 outlines the methodology of The Importance of Campfires and the Indigenous led co-generative action research that led to description of the researcher practitioner model that emerged through the process. It examines Indigenous led participatory research methods to build an understanding of the differences between participation, collaboration and co-generation, so that researchers may see and act in the world differently.



Map 2.1 Cape York Peninsula Land Tenure 2004
Source: Queensland Department of Natural Resources, Mines and Energy and the Commonwealth of Australia 2004

Map 2.2 Cape York Peninsula Land Tenure 2017

Source: Queensland Department of Natural Resources and Mines 2017

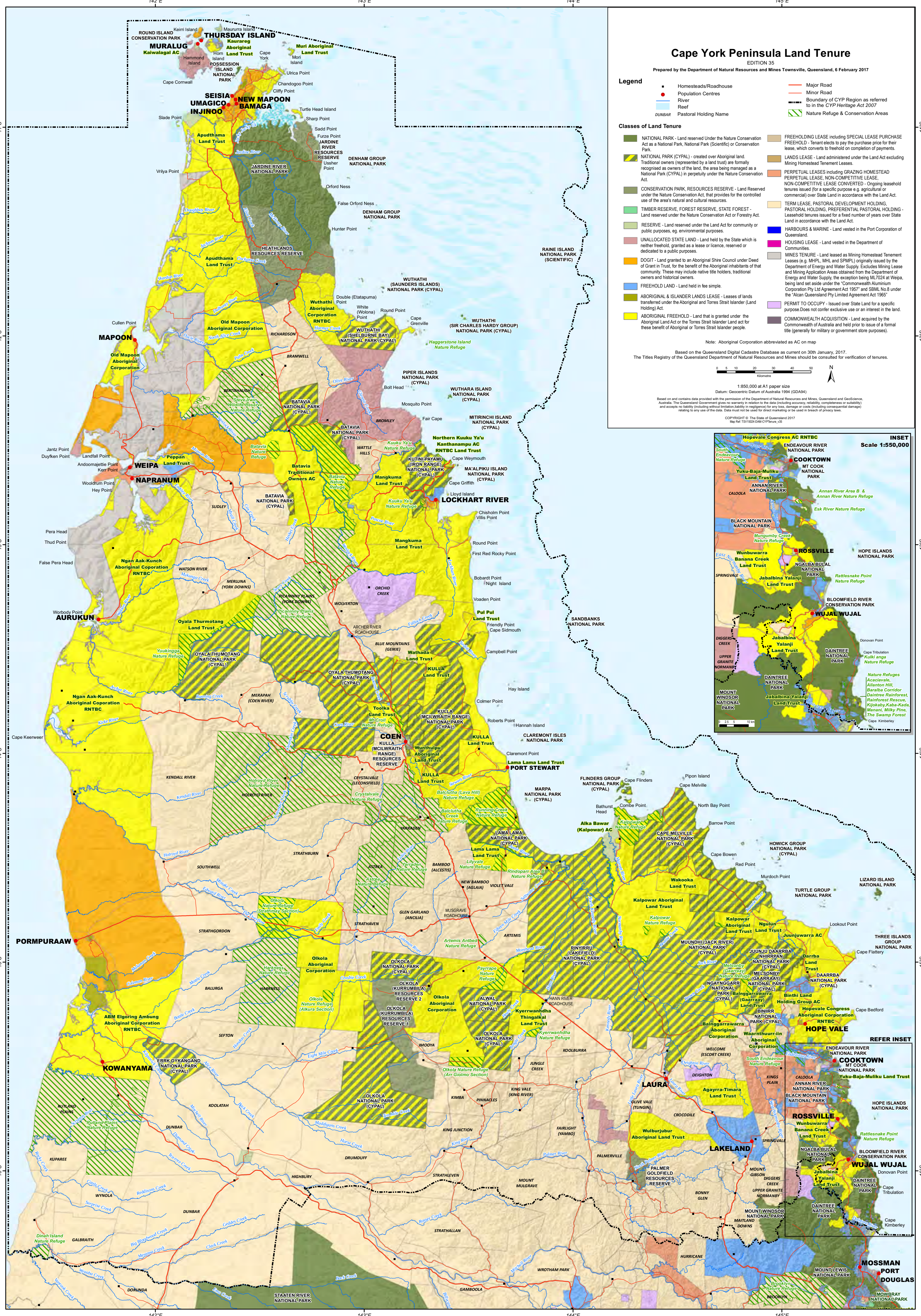


Table 2.2 Agencies and organisations with a role in fire management legislation, policy and procedures

Queensland		NSW		Victoria		ACT		Tasmania
Department of Environment and Science https://www.des.qld.gov.au/	https://www.npsr.qld.gov.au/managing/fire_management.html https://www.npsr.qld.gov.au/managing/pdf/fire-mgt-mission-statement.pdf Plan burn guidelines https://www.npsr.qld.gov.au/managing/planned-burn-guidelines.html NAFI Bi-annual planning meetings Centralised burn plan finalisation	NSW Office of Environment and Heritage https://www.environment.nsw.gov.au/	https://www.environment.nsw.gov.au/topics/parks-reserves-and-protected-areas/fire	Parks Victoria https://parkweb.vic.gov.au/	https://parkweb.vic.gov.au/park-management/bushfire-management https://parkweb.vic.gov.au/park-management/aboriginal-joint-management	Environment Planning and Sustainable Development Directorate – Environment ACT Parks and Conservation service Fire https://www.environment.act.gov.au/ACT-parks-conservation	Fire suppression capacity Bushfire operations plan Aboriginal fire management officers - cultural fire (Fire, forests and roads) https://www.environment.act.gov.au/ACT-parks-conservation/bushfire_management	Tasmania Parks and Wildlife Service https://www.parks.tas.gov.au/
Queensland Fire and Emergency Services https://www.qfes.qld.gov.au		Fire and Rescue NSW https://www.fire.nsw.gov.au/		Emergency Management Victoria https://www.emv.vic.gov.au/		ACT Emergency Services Agency http://esa.act.gov.au/	Prescribed burns Fuel Management Total Fire bans	State Fire Commission http://www.sfmc.tas.gov.au/organisation/tasmania-fire-service
Queensland Rural Fire Service https://www.ruralfire.qld.gov.au/Volunteering/Pages/default.aspx		NSW Rural Fire Service https://www.rfs.nsw.gov.au NSW Rural Fire Service Association http://www.rfsa.org.au/		CFA Victoria https://www.cfa.vic.gov.au/home Metropolitan		ACT Rural Fire Service http://esa.act.gov.au/actrfs/		Tasmania Fire Service https://www.fire.tas.gov.au/

Department of Natural Resources		NSW Office of Water http://www.water.nsw.gov.au/home Department of Primary Industries		Victorian State Government Department of Environment, Land, Water and Planning https://www2.delwp.vic.gov.au/ https://www.forestsandreserves.vic.gov.au/land-management/managing-crown-land		Environment Planning and Sustainable Development Directorate – ACT NRM https://www.environment.act.gov.au/act-nrm		Department of Primary Industries, Parks Water and Environment https://dpipwe.tas.gov.au/
Offsets https://www.qld.gov.au/environment/pollution/management/offsets		NSW Office of Environment and Heritage offsets https://www.environment.nsw.gov.au/biodiversity/offsetsscheme.htm		Victorian State Government Department of Environment, Land, Water and Planning https://www.environment.vic.gov.au/native-vegetation/native-vegetation/offsets-for-the-removal-of-native-vegetation/i-need-to-secure-an-offset		ACT Government Environment, Planning and Sustainable Development Directorate - Planning https://www.planning.act.gov.au/topics/design_build/da_assessment/environmental_assessment/offsets_register	http://www.environment.act.gov.au/cpr/environmental-offsets-policy	
Carbon Farming in QLD https://www.qld.gov.au/environment/climate/carbon-farming		Decentralised carbon funding under relevant Australian Government methodologies						

Department of Prime Minister and Cabinet https://www.pmc.gov.au/	Land Councils PBC's Native Title ILUA CYPAL Aboriginal Freehold Land Trusts Registered cultural heritage bodies (Department of Environment and Science)	Native Title NSW Aboriginal Land Council Local http://alc.org.au/ Aboriginal Land Councils (120) http://alc.org.au/land-councils/lalc-boundaries--contact-details.aspx		Victorian Aboriginal Heritage council https://www.aboriginalheritagecouncil.vic.gov.au/ Registered Aboriginal Parties Victorian State Government Justice and Regulation https://www.justice.vic.gov.au/your-rights/native-title Traditional owners settlement Act https://www.justice.vic.gov.au/your-rights/native-title/traditional-owner-settlement-act https://www.aboriginalheritagecouncil.vic.gov.au/		Office of Aboriginal and Torres Strait Islander Affairs http://www.communityservices.act.gov.au/atsia Community services directorate http://www.communityservices.act.gov.au/atsia/committees/ngunnawal_issues		Aboriginal Land Council of Tasmania Tasmanian Aboriginal Centre (TAC) http://tacinc.com.au/

Chapter Three – Developing a relevant methodology
CAMPFIRES Methodology – Indigenous led cultural burning and co-generative action research

Introduction

As indicated in the Introduction to this thesis, a mix of research methods was necessary to undertake the research on the Traditional Cultural Fire Knowledge (TCFK) of the Kuku Thaypan Elders. This chapter will focus on the theoretical discussion of the development of a relevant and appropriate methodology for the documentation of TCFK.

A Co-generative Approach

The underlying approach to the development of the CAMPFIRES methodology is one of co-generated research. The co-generation process has typically been applied in educational contexts to enable students a voice in the education process. In health contexts the use of Participatory action research or PAR, the theoretical underpinnings of co-generative action research, has provided insights into the power relationships that exist in institutional and research relationships (Dickson & Green, 2001). Gaudet (2014) in the use of PAR explores the 'ways in which PAR either re-inscribes or challenges dominant relations of power' p.1. and Stanton (2014) writes of the importance of shifting decolonising theory, such as PAR into practice. Chapter 1 explored the defining of Traditional ecological knowledge (TEK) and Chapter 2 the legislative constraints in practicing cultural burning. Neale et al. (2014) in bringing together discussions on Indigenous and cultural studies remind us that the 'post' in post-colonial studies contains suggestion that we still exist in a state where there remains present a perpetuation of colonial relations. Clearly, in engaging in the knowledge sets of others, identifying, understanding and finding ways to address power relations is critical.

The co-generative learning method is applied to understand roles and power relationships. It is important to understand the role that Institutions and researchers play in supporting the maintenance and revival of cultural burning and recognise the power relationships that exist within dominant cultural paradigms for understanding and managing the World and fire as discussed in Chapter two. If cultural burning is governed and enabled through dominant western driven frameworks alone, without the guidance of Indigenous Elders, knowledge holders and practitioners then what defines cultural burning can be misinterpreted and absorbed into the knowledge sets of the dominant cultural paradigm.

It is the co-generation process in research problem identification, exploration, definition, hypothesis, design and delivery that is pivotal to the success of collaborative research projects and maximises opportunities for discovery and innovation. However, often the decision making for these processes are outside of the control of Indigenous people in the investigation and communication of their knowledge. Collaborative projects are at high risk of sliding towards the spectrum of participation of Indigenous people in “others” consultation processes and research projects, as the distribution of resources are often inequitable disabling capacity for all involved to be active participants, motivate action and meet the needs of all participating or collaborating.

Further, as illustrated in Figure 3.1 numerous legislative processes, policy initiatives and current social processes to improve fire management and outcomes for society and the natural world contain limited governance by Indigenous people, where this is the case, systems of governance must necessarily utilise dominant cultural norms. Figure 3.1 shows an arrow pointing to the line where initiatives often stop at; expecting participation by or collaboration with Indigenous people and their knowledge in the delivery of State, external agency, or institution designed and based outcomes. The potential for co-generative space is limited by the lack of Indigenous led collaboration where culturally appropriate and relevant protocols are developed and the sharing and demonstration of how TCFK can increase benefits in the delivery of outcomes for the socially desired initiatives, policies and legislative processes. However, when these programs are designed with Indigenous people leading protocols and mentorship as highlighted in the diagram then their TCFK is able to be demonstrated as it is Indigenous TCFK holders, supported by and involving their communities implementing outcomes that benefit country and culture. Indigenous people leading the governance of the mentorship of their TCFK delivers outcomes to each of the areas highlighted in the diagram. When Indigenous people determine protocols in mentoring their own knowledge and practice the potential for co-generation occurs where Indigenous led programs generate collaborative opportunities that enable co-learning and provide new ways of delivering outcomes benefiting culture, the environment, society and the economy. Benefits are not just contained in Indigenous communities alone there are significant broader public benefits that will be discussed further in Chapter ten.

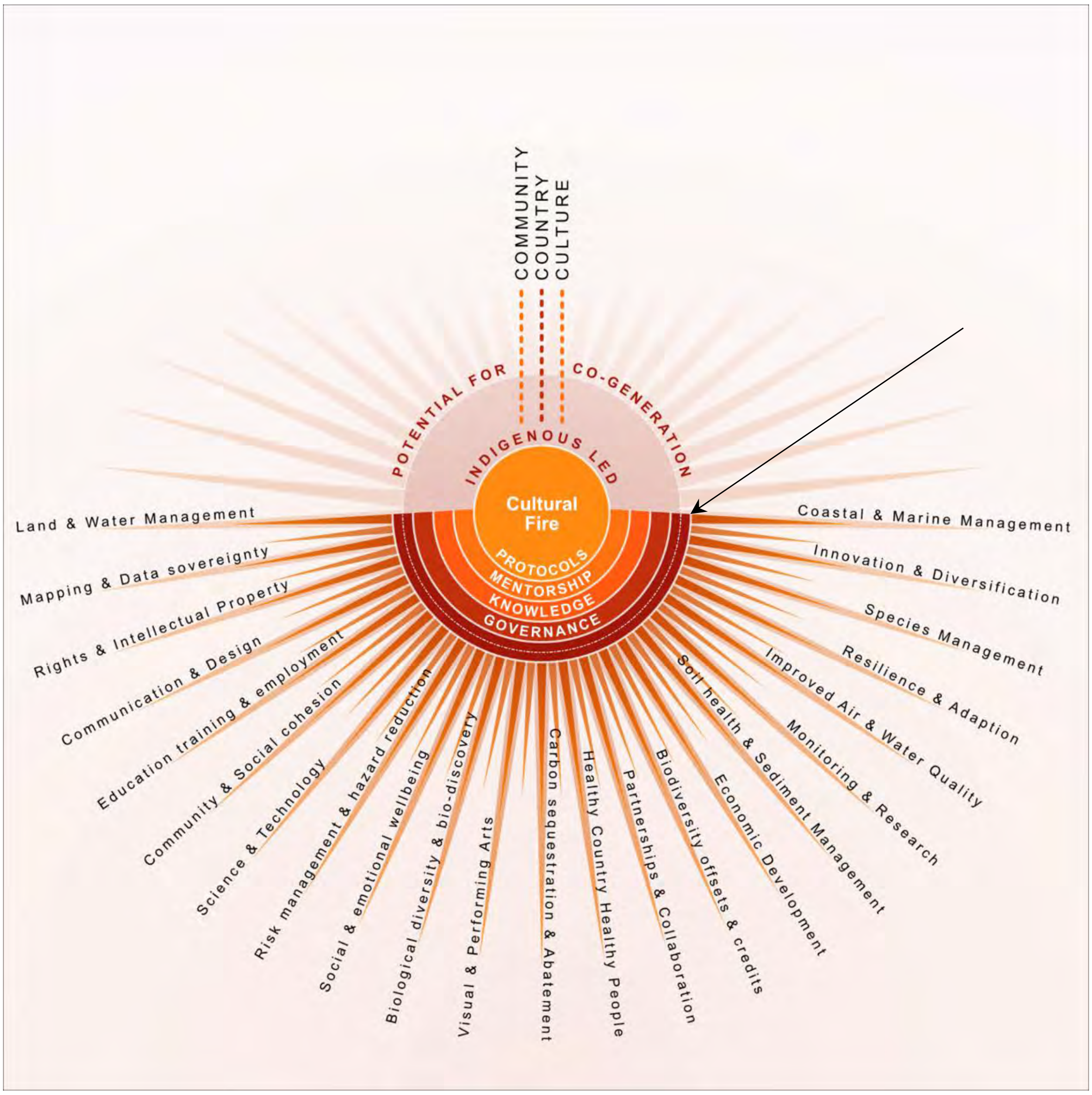


Figure 3.1 Diagram of how Indigenous led TCFK can deliver co-generative outcomes for multiple policy, legislative and social initiatives for improving fire management and benefits for natural systems.

Source: Standley 2018

Often, Indigenous people are marginalised from the outset in the demonstration and research of their knowledge. Those operating in traditional governance systems even more so, where the very programs that are designed to generate benefits do not engage with Indigenous governance across the complex but necessary scales in their development, implementation and review. Cultural governance systems are no more complex than contemporary systems of governance that seek to govern societal systems such as education and economies, however they are often overlooked in the development, implementation, delivery and review of programs designed to assist in improving outcomes for Indigenous people and society as a whole. Hence, this research project sought to assist in articulating what a co-generative Indigenous led research and management project is, including highlighting what it is not so that a researcher, institution or agency applying the model may reflect on the totality of their research practice and its impacts on Indigenous people and their knowledge systems. In order to understand what a truly collaborative research process is that does co-generate multiple beneficial outcomes or discoveries it is necessary to understand further the nuances of participation.

Understanding participation

There are various types of participatory research, management and engagement and it is important to recognise that "participatory" approaches operate on a spectrum (Arnstein, 1969). In 2017 the International Association for Public Participation convened a series of forums to review the IAP2 Public Participation Spectrum (International Association for Public Participation, 2017) which 'assists with the selection of the level of participation that defines the public's role in any community engagement program' (International Association for Public Participation Australasia, 2016). Given that efforts to describe the differing levels of participation exist when engaging with the public in problem solving and the levels to which they can provide input to and influence decision making demonstrates that different levels of involvement by decision makers are desired and as highlighted by the spectrum result in different outcomes. Arnstein (1969) ladder of participation, sees the public or citizens in control of decision making at the top of the ladder, see figure 3.2 and the IAP2

International Federation (2014) spectrum highlights that when the public is empowered that the decisions of the public will be implemented, see figure 3.3.

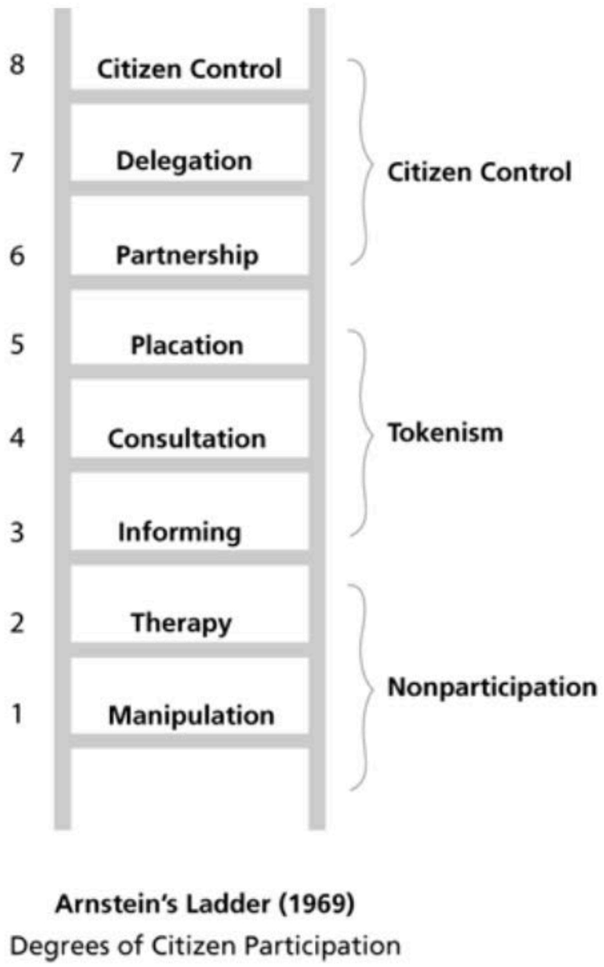
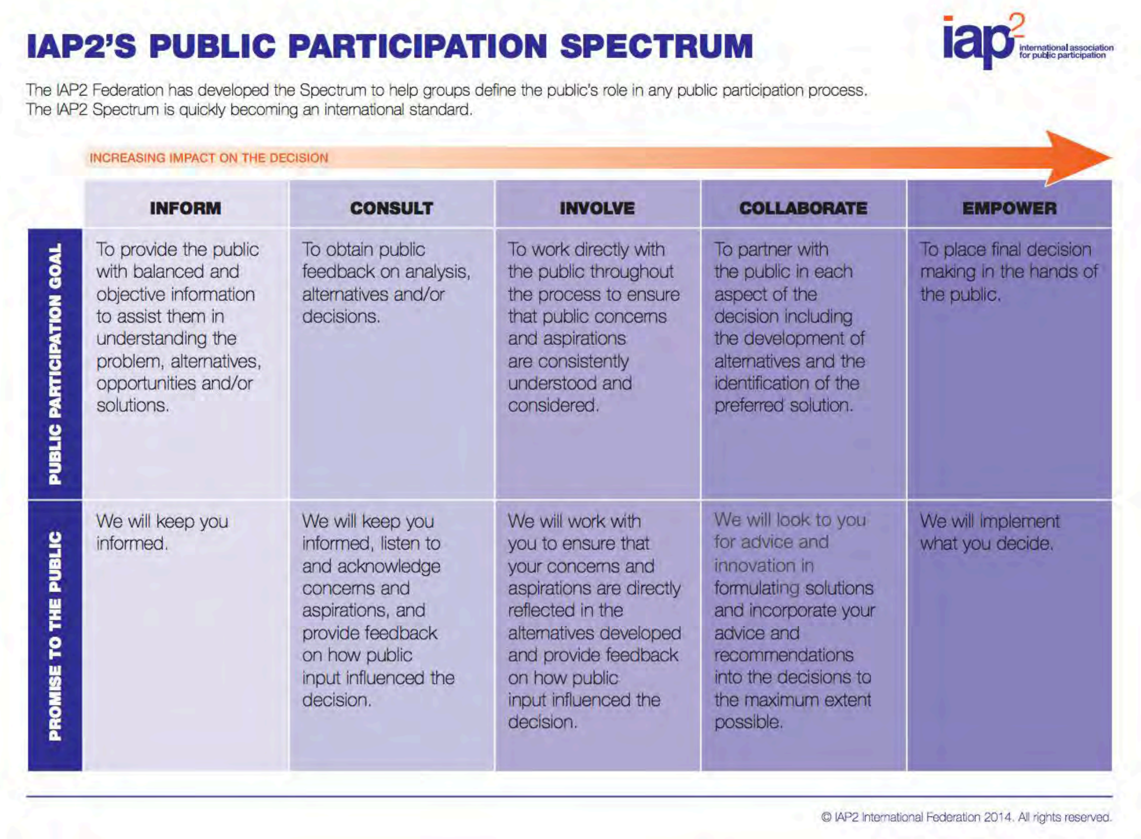


Figure 3.2 Arnstein's Ladder of Citizen Participation

Source: Arnstein (1969)



IAP2'S PUBLIC PARTICIPATION SPECTRUM

The IAP2 Federation has developed the Spectrum to help groups define the public's role in any public participation process. The IAP2 Spectrum is quickly becoming an international standard.

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

Figure 3.3 IAP2 Spectrum for public participation

Source: IAP2 International Federation (2014)

These models of participation and engagement highlight that participatory processes can contain pluralistic or singular objectives. It is important to consider the motivation of the governing organisation that orchestrates the "participation or engagement." Participation can insist on the one-way transfer of western tools or management interventions deemed necessary to assist Indigenous peoples in the "sustainable use" and management of their natural resources. Equally, participation can include engagement in western research "problems" where Indigenous Australians are approached with a research question and asked for their Traditional knowledge to assist in "filling the gap" to knowledge that is missing from western scientific world view (Bradley et al., 2006; Burbidge & McKenzie, 1989).

When this type of participation occurs it limits the way in which “participants and or collaborators” can influence decision-making processes (Head, 2007; McKinney & Harmon, 2004). Therefore, in reality these projects can contain elements of extraction or consultancy. This type of approach to participation and collaboration retains control and ownership of the knowledge produced outside of those communities being studied or engaged. As highlighted by Bohensky and Maru (2011) on analysing the learnings from a decade of work on the integration of IK and western science *“scientists that engage with IK need to understand the international law and policy contexts in which IK is situated and implications for access to knowledge*” p.5. Evans, Hole, Berg, Hutchinson, and Sookraj (2009) suggest that a fusion of Indigenous methodologies and Participatory Action Research is possible by refocusing the object of inquiry directly onto the institutions and structures that Indigenous people face and that this can transform Indigenous people from the objects of inquiry to its authors. Hill et al. (2012) provide a typology of engagement with Indigenous people in environmental management from an analysis of the literature. The typology describes four types of engagement: Indigenous governed collaborations; Indigenous driven co-governance; agency-driven co-governance and agency governance. The findings indicate that Indigenous governance and Indigenous driven co-governance provide better prospects for the integration of IEK and western science for sustainability of social-ecological systems. Gaudet (2014) in re-thinking participatory research with Indigenous peoples identifies that participatory research can *‘re-inscribe or challenge dominant relations of power’* p.1.

Clearly it is critical to understand who is leading the participation, who is participating, who or what is benefiting and why in order to understand the roles, relationships, responsibilities and power relationships of parties involved in partnerships and collaborations. The concept of integration of knowledges also needs to be reflected on as there is a risk of appropriation or homogenisation. In the ecological sciences we understand that homogenisation is not desirable. TCFK can be attempted to be utilised by others without necessarily benefiting the holders of the knowledge and knowledge is at risk of being assimilated into the dominant western knowledge and management system. Western governance frameworks utilised to engage Indigenous people in fire management should also consider acknowledgement to customary lore on who and how decisions are made. Otherwise, there is potential to impact on cultural protocol and practice and disempower Indigenous people now and into the future. As highlighted in Chapter 1, the term Traditional ecological knowledge itself describes the knowledge sets of others with the understanding of the dominant paradigm. Hence, the use of the term 'cultural' knowledge as this is the closest description in the English language that embodies the system of knowledge; its ontology, epistemology and methodologies.

I would argue that it is challenging for non-Indigenous researchers or those educated entirely in western educational institutions to work with Indigenous people and their knowledge systems and be critically reflexive to see how their dominant cultural paradigm influences their perspective of integration and equitable benefit. Further participatory research can ignore the political motivations and power relations of actors and although they may appear to share a common purpose, for example the maintenance of biodiversity, the reduction or sequestration of carbon, fuel hazard reduction, risk mitigation the agreed methods for achieving this may not be reconcilable or equally understood and individuals or organisations may easily find themselves at cross purposes. As outlined in diagram 3.1, Indigenous cultural burning provides outcomes that benefit all of these socially desirable outcomes but the drivers and motivation for action are not the same as highlighted in chapter two.

The type of "participatory" research which the Elders express disenchantment at having experienced limited their ability to demonstrate the application of their TCFK to contemporary environmental issues (Bodkin, 2004; Davidson, 2005; Langton, 1996; Langton, 1998). Furthermore, these types of Western dominant participatory research and management processes, although acknowledging TCK, do not empower Indigenous people directed by their Elders to access the resources and information needed to exercise their cultural obligation to implement management across their Traditional country. As stated by the International Institute for Sustainable Development, "Participatory Action

Research" is fine if you understand the local power structure and the issues. It is best reserved for situations where the external agent is aware of the potential for damage, both to themselves and, more importantly, to the dis-empowered in the community. It also works best where the external agency has a clear status and relationship with the community and can command resources for a long-term commitment (International Institute for Sustainable Development (IISD), Duraiappah, Roddy, & Parry, 2005).

For example, I have seen research projects where fire management practice is considered appropriate for inclusion in contemporary conservation management to recover a declining native species that is understood by western science to respond positively to fire. The desire to recover the species and involve Indigenous people in the burning of the area was considered important as it was understood that Indigenous people burnt the area historically. However, when fires were implemented kerosene drip torches were used that increase the intensity of fires. Analysis of the results of the burn, attributed the increased intensity to the build-up of thatch (dead and live grass), which would certainly have influenced the intensity of the fire, however this would also have been aided by lighting it with an accelerant using linear fire ignition. Under traditional cultural fire knowledge (TCFK) management practices of the Elders the number of ignition points, the time of day and year would have been considered in implementing the right type of burn in an area that was long unburnt or was modified from how it should be. There is a strong interdependency between fire severity and ecosystem response. People are often heard stating, and research papers often propose that fire has a specific impact on the environment and species assemblages, but it is the type of fire, that determines what affect fires have on the biotic and abiotic environment. Often the type or the conditions of the fire are not described in studies examining the resultant effects. However, the specifics of the 'type of fire' that is implemented or occurred are important in drawing conclusions on the impacts of fire events, prescribed, controlled, planned or otherwise.

Nonetheless, the fires in this particular fire management research project described above benefited the system from a western science perspective and this practice was then shared through the literature and young Indigenous people in other areas were trained in western fire management practices and asked to burn significant headlands in an effort to re-introduce *Themeda sp*., another western scientific research project then evaluated the effect of the 'cultural burn.' This could be considered a participatory or even collaborative process where Indigenous people may have derived some benefit from being involved, but clearly were participating in western research projects to draw conclusions on the practices of Indigenous people by 'others.' This type of participatory approach to understanding Indigenous knowledge and practice, surrenders it to being measured, evaluated and assumed by the dominant research paradigm. A way in which western research can avoid this type of approach to understanding Indigenous cultural knowledge of fire and empower Indigenous people and their knowledge in providing solution to contemporary fire management is outlined in this chapter.

As highlighted, the Kuku Thaypan Elders and their community had limited support from external agencies and had to mobilise resources themselves through their TKRP and later with the support of this non-Indigenous researcher. However, this enabled them to avoid the risks of involvement in 'others' spectrums of participation. As a result, the Elders were supported to form collaborations with individuals or organisations whose value systems and reasons for involvement were aligned with the Elders' purpose, empowerment and adherence to cultural protocol. There are times when individuals and organisations appear to have shared purpose but the misalignment of values can occur and as a result inequitable outcomes result. It is through these lessons that the articulation of respectful collaboration is possible. When working with people and partners who are removed from the Elders, it is easy for them to *"run away with the concept"* Steffensen (Field notes 2005). Indigenous led co-generative action research ensures that this risk is mitigated, although not entirely eliminated.

Greenwood and Levin (2007) highlight that Participatory Action research (PAR) should not only be evaluated as having been successful through the achievement of solutions to the identified problem but should also aim to inform scientific discourse. The challenge is when the problem is intractable, such as the wicked problem of fire management, every new solution situates the problem differently and further action is required to be taken to continue to improve opportunities where Indigenous people are leading the sharing and implementation of their TCFK and its practice.

Like the elements of the Elders' traditional cultural fire knowledge (TCFK) system the TKRP, the KTFMRP and the thesis research dissertation "The Importance of Campfires" are interconnected, however in order to present them in a western research dissertation they must necessarily be categorised and dissected. The need for this research project evolved out of the Elders' experience similar to that of other Indigenous peoples of historically marginalising processes that generated mistrust of Western scientific research and land management approaches (Ockwell, 2008). The theories, methodologies and methods traditionally used by the dominant Western management scientific paradigms often assume that Traditional Knowledge (TK) and subsequently TCFK needs the validation of non-Indigenous research and environmental practice knowledge systems (Baker et al., 2001; Langton, 1998). Gratani et al. (2011) propose a framework for collaborative validation of Indigenous knowledge. The purpose of this research dissertation is not to validate TCK of fire and biodiversity with western science. This has meant postponing academic demands for sharing the various inter-related components of the knowledge system before the Elders or their TKRP were recognised for that knowledge, wanting access to the "indicators" was a common challenge throughout the research project. It was wrongly assumed that access to this transcribed knowledge would translate into knowledge of how to practically implement the TCFK of the Elders. Differentiating between the "project" and the "thesis" has also been challenging as the research spans across disciplines, worldviews and requirements for legitimacy.

Given the enormity of the complexity of the research practice that we were involved in, multiple methods of data collection were used, including over time permissible access to data collected by the Traditional owners themselves through their TKRP. This assisted to develop ways of thinking for the non-Indigenous researcher, enabling time for critical reflexivity when I was on my own, reminded by the Elders themselves through watching them and listening to them speak. Time spent on country together with the Elders and Steffensen over the years and having Dr George stay at my home for many months, including times I cared for him when he was unwell, ensured that as the principal non-Indigenous researcher I was constantly ethical, humble and respectful that I was a co-researcher with them but also an experiential learner in an Indigenous led project.

As highlighted in Chapters 1 and 2, the ontological and epistemological foundations of our research and fire management practices differ. Through our process of collaboration led by the Elders and Steffensen I was able to develop CAMPFIRES; a co-generative research methodology, the description of which became a further focus of this research. The co-generative methodology provides a component part of a model for researchers, practitioners, agencies and institutions for collaboration with Indigenous people in Natural Resource Management (NRM) and specifically cultural fire management, monitoring and research. It emerged as a way of defining and communicating the process of working with the Elders and Steffensen and learning how to know about Indigenous traditional cultural fire knowledge and its practice. It was only through the direct experience of the Elders' and Steffensen's methodologies that I was able to develop the CAMPFIRES methodology that allowed for the primary purpose of the research. That is, to offer insight into the different ways we can know about fire and why Indigenous peoples' traditional cultural knowledge of fire, its cultural practice and governance is critical in providing solutions to complex problems encountered in contemporary fire management. The next Chapter 4 will describe the CAMPFIRES methodology.

Chapter 4 The CAMPFIRES Methodology

Documenting the Kuku Thaypan Elders' TCFK and its practice has enabled the application and traditional transfer of this knowledge on their country. The CAMPFIRES methodology contributes to addressing the Elders' and Steffensen's concern over how their Traditional cultural fire knowledge and its practice can be known and contribute to contemporary fire management and that is through active demonstration by Indigenous cultural fire practitioners and knowledge holders on country.

The CAMPFIRES methodology forms a part of a research practitioner model that acts as a guide for agencies, researchers, managers and institutions wishing to engage with Indigenous knowledge systems and holders of knowledge, and describes tools that were developed through the Indigenous led co-generative methodology that can support Indigenous people to document their Indigenous led research practice on their TCFK.

The TKRP described in chapter nine and the Elders' KTFMRP described in chapters five, six, seven and eight were pivotal in influencing the development of the methodology of the non-Indigenous researcher collaborating within an Indigenous led research project. The methodology of the non-Indigenous researcher is described here to enable considerations that a non-Indigenous research approach should reflect on when engaging in Indigenous knowledge domains. This methodology emerged as a direct result of the direction of my Indigenous co-researchers, the Elders, Steffensen and other Indigenous knowledge holders and is described to assist researchers, agencies and institutions and managers of fire to 'see and act' in the world differently.

Despite the differences in the research teams ontological and epistemological foundations of our research practice, it was necessary for the non-Indigenous researcher to learn about the ontology of another knowledge tradition and recognise certain cultural principles or guidelines resulting from that ontology and by which the research was to take place. The ontological and epistemological foundations of the Elders' research are discussed further in their Kuku Thaypan Fire Management Research Project (KTFMRP) methodology Chapters 6 and 7. These cultural principles, described here illustrate the way in which the knowledge was shared by the Elders and knowledge holders with me and how this 'research' was able to be translated when working with other partners. When these principles were acknowledged and adhered to by me, I was able to articulate them and more importantly demonstrate them, this changed how I was able to know about traditional cultural fire knowledge. It was through my time spent on country with the Elders, their family members and Steffensen in conducting this research project that I am able to articulate these principles.

These cultural principles include:

- Understanding "Plenty time"[32]
- Belief in inherited wisdom and respect for lore
- The importance of guidance by knowledge holders
- Research integrates with and contributes to daily life
- There exists interconnectivity between all things and that all things are animate and sentient, all things, the tree's, the grass, stone and water, the air, fire, the stars, us, everything
- Recognising and respect for local knowledge and kinship
- Knowledge is not static and is passed and acquired through time without sacrificing cultural belief, spirituality, cosmology or ontology
- Ensure place-based practice and right way connection to country and decision making for country

[32] Murri (a recognised term used to refer collectively to a North Queensland Indigenous person) time or TI (Torres Strait Islander) time is not running late as often constructed in western interpretation but translates as, at the right time, when it is meant to happen

- Recognising different ways of knowing what it is, knowing what it does, and knowing how to do it
- Knowledge is shared, practiced and embedded on and in country
- Contribute to the oral record and its presence in the landscape – practically apply knowledge and skills

Table 4.1 outlines the relationship between the CAMPFIRES methodology, the cultural principles by which the research project operated and how together these enable the articulation of the requirements for research with Indigenous people in the implementation of their cultural fire on country. This co-generative research practitioner model was able to be described through the co-generative process of exploring together in an Indigenous led research project, and how adherence to the principles by which the research projects operated, the research methodologies of the TKRP, the Elders' KTFMRP, and the Importance of CAMPFIRES applied together translated into the requirements for the Elders Kuku Thaypan Fire Management Research Project and their traditional cultural fire knowledge application and practice on their country. Importantly, the cultural principles and requirements for traditional cultural fire knowledge application on country informed the development of the CAMPFIRES methodology for conducting research with Indigenous TCFK holders and provides a framework from which to co-design research with traditional cultural fire knowledge holders.

Table 4.1 Cogenerative Research Model

Co-generative Research Practitioner Model			
Co-generative Research Practitioner Model	**CAMPFIRES Methodology**	**Cultural principles**	**Requirements for traditional cultural fire knowledge application (TCFK)**
	Co-generative research supports collaborative action and collective learning	COMMUNITY Integrates with and contributes to daily life	Community identified Indigenous led Outcomes benefiting community and country
	Action	APPROACH Understanding plenty time	Fire practice Training

			Indigenous designed and led accreditation and the development of cultural fire practitioners and researchers
	Multiple Knowledges	MENTORSHIP The Importance of guidance by knowledge holders	Multiple benefits Monitoring & research
	PEOPLE ON COUNTRY	RESPONSIBILITY Ensure place-based practice and right way connection to country and decision making for country SHARED PURPOSE Recognising and respect for local knowledge and kinship	Place People Country Practitioners Partnerships Pathways
	Fire	CULTURE Belief in inherited wisdom and respect for lore There exists interconnectivity between all things and that all things are animate and sentient, all things, the tree's, the grass, stone and water, the air, fire, the stars, us, everything	Indigenous led management of cultural fire knowledge
	Implemented management	INDICATORS Knowledge is shared, practiced and embedded on country	Reading and assessing country
	Respect	PROTOCOL Recognising different ways of knowing what it is, knowing what it does, and knowing how to do it.	Roles Responsibility Reciprocity Recognition Risk management
	Empowered	ELEMENTS	Elders

		(Knowledge map) Knowledge is not static and is passed and acquired through time without sacrificing cultural belief, spirituality, cosmology or ontology	Cultural fire knowledge holders practitioners and researchers Indigenous Voices
	Solution generation	ON-COUNTRY Contribute to the oral record and its presence in the landscape – practically apply knowledge and skills.	Space for demonstration

The campfires research practitioner model uses the acronym CAMPFIRES to describe a research methodology and its' multiple methods that enabled the co-generation of solutions to contemporary fire management concerns and supported the application and documentation of the Traditional Cultural Fire Knowledge (TCFK) of the Elders on country. The following research practitioner model outlines a methodology for undertaking co-generative research with Indigenous people. In describing the parts of this model, the methodology of the non-Indigenous researcher is presented along with a discussion of the limitations of participatory and collaborative approaches and their use in Natural Resource Management NRM and applied research contexts when engaging with the knowledge sets of others. The case study of the Elders' KTFMRP and their Indigenous identified and led participatory action research project: The Sugarbag project highlight perspectives of participation and demonstrate the multiple pathways (methods) that were taken to support the Elders to implement and document their fire management practice on their country. The methodology, the cultural principles that govern the research practice and the resultant requirements and outcomes for TCFK on country together form a model for Indigenous led co-generative action research. Each part of the methodology, the principles and the requirements for traditional cultural fire practice on country will be discussed further.

C is for Co-generative

Community: integrates with and contributes to daily life

The CAMPFIRES research practitioner model was developed through a co-generative process; we worked together as a team to generate new solutions to contemporary problems that acted to disable Indigenous people from implementing and practicing their traditional cultural fire knowledge and research. Working alongside the Elders and Steffensen on country, over time I gained an understanding of the knowledge system; the knowledge triangle and came to understand aspects of the knowledge map and its interconnected elements and how they relate to accessing the Elders traditional knowledge formula for managing country. However, this was and still is a staged learning process, guided by Elders and knowledge holders who determine when I am ready and at what stages I should have access to information as it is important that I understand how to act accordingly. In this way, I have learnt what it is to define “culturally appropriate” research as an “outsider” with access to the knowledge system of Indigenous peoples and how researchers should behave in this context. This methodology informs the western scientific discourse on further defining participatory, collaborative and co-generative research so that their differences are better understood in Indigenous contexts. In doing this it also recognises and respects that Indigenous communities and knowledge systems are different and as Indigenous cultural lore dictates appropriate protocol must be followed when engaging and accessing country and knowledge specific to place. As such Protocol is a component of the model and is discussed later.

Co-generative research in Indigenous research domains should support collaborations that are led by Indigenous people, research should benefit community identified Indigenous led outcomes that integrate with and contribute to daily life. In this context of this research with the Kuku Thaypan Indigenous Elders and Steffensen, country is central and places kin and connection to community at the heart of its delivery. When collaborations and partnerships are led by Indigenous people in engaging their knowledge in practices, programs and research that are primarily driven by dominant knowledge paradigms, these engagement approaches can transform and space is generated for innovation to occur resulting in co-learning. Country was burnt with members of the families, clan, language group and extended community and inter-twined with practicing other aspects of culture, hunting, fishing, weaving, sharing knowledge, dancing, singing, assessing and managing country.

Evening talks around the campfire and talks at breakfast reviewed the day's actions and considered the following day's work-plan. Discussions were held in the car throughout the multiple trips taken to country and across country, or visiting other country on what was being seen and what was happening, on country and walks assessed country before fire was implemented, when fires were happening and when flames subsided. Knowledge was practically shared through demonstration, interwoven with the sharing of language names for plants, animals and places. Creation stories and songlines were shared and repeated when there was no way to take notes; these stories were to be remembered. There were a few that went to paper in later years, for example the week I spent with Dr George at his house in Laura learning the stories of the "*Awu Laya* songlines" and translating them out for the Elders' CD cover see Plate 4.1. Others that were recorded and transcribed are in the *Awu Alaya* database connected to their elements and places.

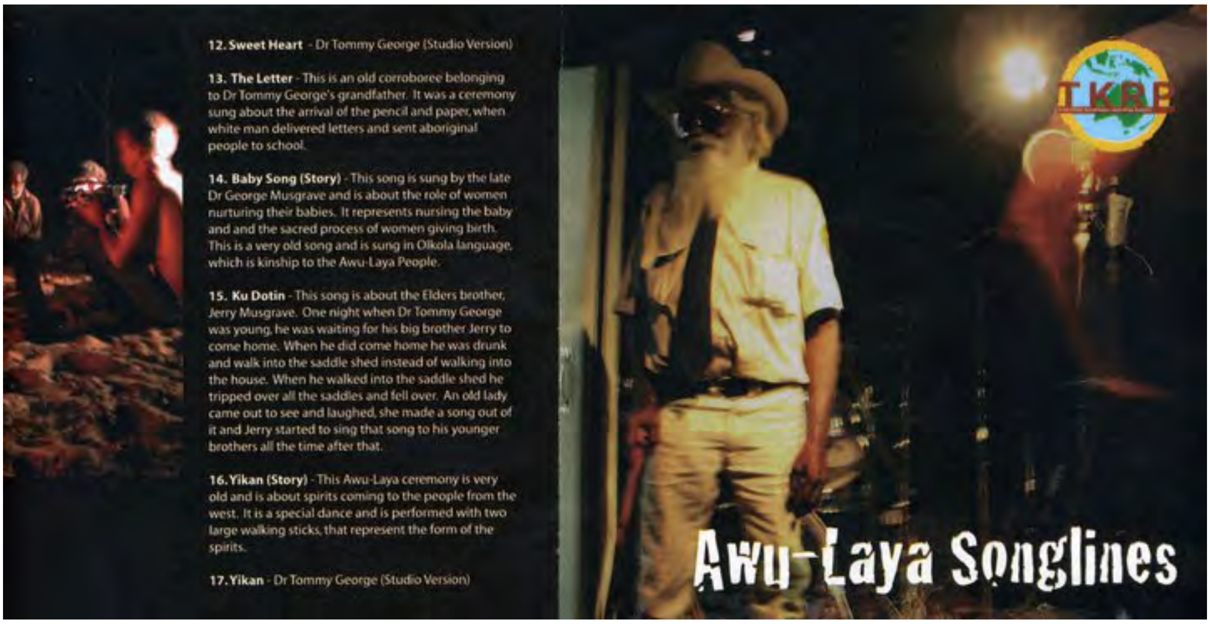


Plate 4.1 Awu Laya Songlines CD cover

Source: Field Records 2006

The research dissertation recorded the Elders and younger clan members' efforts to generate new solution spaces for the creation of sustainable cultural, environmental, social and economic futures centred around traditional cultural fire management and biodiversity conservation practices. The thesis informs the scientific discourse through describing an Indigenous led co-generative action research process; the Indigenous led research methodologies of the TRKP and the KTFMRP and their non-Indigenous colleague. The methodology and associated monitoring tools developed through the research process can inform and support further the multitude of Indigenous fire projects that are developing across the country inspired in part by the work of these co-generative research projects. These Indigenous initiated projects are at risk of being railroaded by non-Indigenous organisations and Institutions that either offer some money to community and then shift the way that projects are governed, evolve, and delivered, and/or are drawing conclusions about cultural burning from a homogenised and westernised worldview.

The other important aspect of engaging with this knowledge system is learning how to listen. We have a lot to learn and Australian non-Indigenous culture is not very good a listening, particularly to

Indigenous voices. Part of learning with the Elders and Steffensen was learning how to listen. We talk a lot, non-Indigenous people but if you listen and practice and learn instead how to listen, then you will begin to learn, instead of expecting that every time you ask a question you will get an answer or not listening long enough to understand that the first answer you get may not contain all the information you need to know. If you do this you will start to also be able to listen to country, determine its fire history and know what 'right fire' the country needs. In the words of Steffensen, *'There is only one fire, and that is the right fire, for the right country'* (2016). From a mainstream land and fire management perspective, this phrase 'there is only one fire' could be misinterpreted as meaning there is only one type of fire. However, according to *Awu Alaya* fire knowledge there are different kinds of fire recognised in the knowledge system; each fire is considered in relation to particular qualities and needs of Country and specific conditions.

The nature of the research dissertation methodologies and their inter-connectedness over time naturally produced outcomes where, as the non-Indigenous researcher I assisted the Elders and Traditional Owners to co-generate practical outcomes benefiting their community and country. I employed the following methods of practice, against which the success of the research project from the Indigenous participants perspective can be measured:

- Secured funds to support them to implement their aspirations for demonstrating on country and applying their own fire management knowledge system, research and continued TK recording.
- Communicated to those outside the knowledge system to help provide a negotiating space for the Elders with government and other parties responsible for contemporary fire management practice on their country.
- Facilitated and documented meeting details and/or not attend at Traditional owners' discretion. Including respect for lore practices and places I could and could not go.

- Enabled employment and training of their younger clan members in Traditional and contemporary fire management practice and continuation of their TKRP.
- Demonstrated research practice that was guided by the Elders with regards to any sharing of their Intellectual Property and share this research protocol and approach with others.
- Ensured co-authorship on all materials produced and provide access to the content of materials in a number of ways.
- Communicated internally through extended dialogues with Elders and younger clan members to ensure they understand and confer with the actions being undertaken.
- Shared my own ways of knowing, being, doing, professional experience and reflective processes to assist others engaged in the 'wp' of fire management to conceive the problem space differently.
- Helped organise and accompany Traditional owners on field trips and apply contemporary observation instruments including: field notes, fire behaviour and effects, data records, photo-point and photographic records, video footage and interviews, GPS localities and remote sensing records to assist in communicating other ways to conceive solutions to the 'wicked problem' of fire management.
- Built the skill base of younger clan members in the observation instruments outlined above through formal and informal training and application in the field.
- Documented the process and communicated it with approvals.

Later in the research process, when Dr George and I had spent significant time together and following four years of my study including although limited, time with his brother Dr. Musgrave, Steffensen, younger clan members and other Indigenous knowledge holders on country, in 2009 he gave me his blessing to travel and share the research process and outcomes beyond Kuku Thaypan country. I must be clear here that this is different from sharing TCFK, when this knowledge is shared it is led by Indigenous people. What I share is ways I have learnt to document this knowledge, apply monitoring methods in the reading of country and ways in which Indigenous people can, if they wish, use western scientific tools to monitor their traditional cultural burns, the monitoring and interpretation of which should be led by Indigenous people.

In order for co-generation to occur more than one community member is involved, and communities of people and practice can exist across partnerships, it is a collective of people coming together to strengthen outcomes. Multiple outcomes may not be immediate and when resources are scarce, determination and prioritisation of non-Indigenous priorities and actions should be upon approval of Indigenous co-researchers. There were times throughout the study period that I was unemployed (despite two Tertiary degrees and significant work history and experience) while I worked to ensure resources that were available in the budget were directed to on-ground actions that supported the Elders' research priority to be on country and implement their traditional cultural fire management.

Co-generative research supports Indigenous people to lead and generate collaborative partnerships that support them in delivery of outcomes for community and county. Importantly the contribution to daily life that research projects enable is the ability to be on-country practicing culture. There was never a trip on country that did not involve hunting, fishing, navigation, assessing the health of country, implementing fire management, describing animal behaviours, transferring knowledge, dancing, singing, speaking language and implementing culture.

A is for Action research

Approach: Understanding "Plenty time"[33]

[33] Murri (a recognised term used to refer collectively to a North Queensland Indigenous person) time or TI (Torres Strait Islander) time is not running late as often constructed in western interpretation but translates as, at the right time, when it is meant to happen

It is essential to understand that the acquisition of this knowledge is not a short term, one off experience from which to draw ultimate conclusions. New knowledge was shared with me as time went on and the Elders considered it appropriate for me to obtain. My questions were not always readily answered and responses were often given over varying time lengths. Sometimes I was given enough information for me to feel I had gained a response, sometimes it wouldn't necessarily be the answer to the question I had asked. Often, I had a job to do in addition to the one that I thought they had asked me to do. I was required to clear tracks, collect fire wood, navigate on car bonnets learning how to give hand instructions for navigation through tight spaces, organise logistics, carry field equipment, document communication requirements, and any other actions that needed to occur to support their research project. Earlier in my research on trips together with the Elders I understood what it felt like to be a participant in a research project. My requirements although given consideration where not necessarily imperatives to be delivered. I had plenty time to learn, they did not have plenty of time to teach, therefore it was important that I listened. It was crucial that this research dissertation supported the Elders in their aspiration to implement their traditional cultural fire management on their country while recording and transferring their knowledge to younger clan members and to enable this to continue beyond the confines of a "research" dissertation. As the collaborative researcher in an Indigenous led project I had to learn that there are stages, places and levels of learning and that not all knowledge is universal, for example mens and womens knowledge. Not everyone has access to the same knowledge and knowledge cannot be demanded or learnt out of context. In demonstrating my understanding of this I was able to develop the capacity necessary to understand what the Elders and Steffensen were demonstrating.

As discussed TCFK cannot be learnt from a book alone; it must be practiced to fully realise its benefits and maintain cultural practice. Indigenous action research is the seeking, learning, practice and review of this cultural knowledge. Indigenous science is within and external, it is reflected in all aspects of cultural practices and their evolution, understands what is within the Earth and beyond its boundaries, reflects an extensive knowledge of the origin and structure of the universe, and cosmology. In undertaking this research action that enabled fire to be implemented on country by knowledgeable Indigenous people and have them involved in its documentation; action was inherent, however enabling change to the way in which traditional cultural fire knowledge was documented and led also required specific sets of action.

There is a growing resurgence of desire for 'cultural' fire practice of country and with this comes the need to ensure that Indigenous people are not only leading its re-application on country but that knowledge holders are at the helm of the development of appropriate research, training and accreditation methods to build professional Indigenous cultural fire practitioners.

M is for Multiple knowledge sets and pathways

Mentorship: The importance of guidance by knowledge holders

As the research project was Indigenous led, no actions were taken, assumptions made or conclusions drawn without conferring with the Elders or other Indigenous participants in the project. In essence, the principal non-Indigenous researcher as described by Elder Dr George at a land tenure negotiation meeting at Kulpa station in 2003 *'hee hee hee she is working for me'* in response to my then still current supervisor at the Environment and Heritage Protection (EHP) Tenure resolution unit as to why I had offered to make Dr George a cup of tea and not my actual boss. I was still at that time employed by EHP but outside hours was seeking funding and support to assist the Elders TKRP with their aspiration for a formal research project and had been meeting with the Elders and Steffensen.

Between 2003 – 2010, numerous phone calls, meetings, planning sessions, media releases, communications; letters, emails, and funding proposals were written and projects implemented, monitored and reported directly on Kuku Thaypan country. Prior to the research project being officially launched in 2005, the methodology of this research was driven by the Elders and Steffensen through the TKRP and this included ensuring the awarding of the Elders Hon. Doctorates to enable their ability to be listed as co-researchers on this research thesis dissertation project. These meetings and discussions continued when fishing and making and maintaining the camp and preparing the evening meal, they continue with Steffensen and other Indigneous Traditional cultural fire knowledge holders across Australia today. In addition to formal academic ethics requirements being met (HREC #2134), ethics approval was and still is an on-going process, including guiding where we went on country and how the project was conducted.

From 2003 Indigenous research project leaders; the Elders, Steffensen and I discussed actions and partnerships in relation to this research project and how the Elders wanted it to proceed. From 2008 to 2016 when we planned the delivery of the annual Indigenous fire workshops, Dr George, Steffensen and myself would discuss where the workshop would be and who was involved ensuring Dr George was happy with what was happening where and how things were proceeding.

Complex problems require solution generation that applies multiple knowledge sets in providing ways to influence research, policy, legislative and management practice change that does benefit the sustainable use and management of the environment. This requires Western and Indigenous knowledge systems. Chapter two outlined the complex legislative environment through which Indigenous people must navigate in implementing cultural burning on country. Diagram 3.1 described various program and policy areas including contemporary land and sea management that Indigenous people provide their knowledge and skills to across Australia. More recently there are changes to State based policy, such as the NSW Office of Environment and Heritage Cultural Fire Management Strategy, (State of NSW and Office of Environment and Heritage, 2016) and the developing Victoria Traditional owner Cultural Fire Strategy developed to *'to reinvigorate cultural fire through Traditional Owner led practices across all types of Country and land tenure; enabling Traditional Owners to heal Country and fulfil their rights and obligations to care for Country'* (The Victorian

Traditional owner Fire knowledge group, 2018) p5. There is also an DRAFT Fire and Rescue NSW (2017) Cultural Fire policy. These policies are emerging as a direct result of the increasing assertion by Indigenous people of the rights and benefits of their cultural fire practice. It is important that agencies with a responsibility for natural resources, environment and fire management ensure that these policies do not further disable the ability of Indigenous cultural fire knowledge holders to undertake cultural practice of fire by containing its control within state based Institutional contexts alone. In 2017 CSIRO consulted with some of the current Firesticks Alliance Indigenous Corporation (FAIC) directors and associate directors in the development of a National Framework to Report on the benefits of Indigenous Cultural Fire Management (CSIRO Australia, 2018). The development of this framework was commissioned by the Australian Government Department of Environment.

In order to achieve the change required in these areas and enable Indigenous peoples' TCFK to be included alongside other forms of contemporary fire management, to be implemented and evaluated by Indigenous people there is much work to be done and Indigenous cultural fire knowledge holders need to be leading this change. Maintaining, expanding and reviving Indigenous led cultural practice of fire in Australia requires the hands, hearts and minds of many.

Throughout the research project many pathways consisting of multiple actions were established with different partners and communities, working in different ways but towards the shared purpose of empowerment of Indigenous people in contemporary fire management research and practice, importantly the maintenance and revival of the application of Indigenous cultural knowledge of fire. The results of this can be seen in the increase in recent years in the revival of cultural fire practices across Australia and subsequent increase in the desire to research and understand it.

Funding throughout this research project was a mix of government funding through environment streams and philanthropic donations which often enabled a broader scope to outcomes sought than government or organisational funding that was often tied to a specific set of priorities designed and desired for that investment. The research project received investment from multiple sources and multiple outcomes utilising multiple methods were delivered, bringing together multiple knowledge sets on country. Once such pathway where the CAMPFIRES methodology was applied was the Sugarbag or Stingless bee project depending on your area of expertise or interest. This case study is a sub-set data of the thesis research and was identified as a project requiring investigation as a result of the existing on-country assessments of the Elders, Steffensen and this research project. The results of the sugarbag project are presented in Chapter seven. The case study is described here to highlight perspectives of participatory research, how different levels of participation influence the balance of power in decision making, the benefits that are derived from outcomes and how knowledge is able to be known.

Nye Arear (Sugargbag) Mor (Fire) and people

The co-generative research methodologies of the three research projects that are described in this dissertation had collected existing data in 2007 across Kuku Thaypan country using video-graphic recordings of the Elders cultural knowledge of sugarbag, GPS datum, photographs and field data to understand the historic and present abundance of sugarbag and the relationship between fire regimes. While undertaking their traditional cultural practice and research of fire the Elders had indicated the decline in active sugarbag hives. Plate 3.2 below highlights the density of scars to active hives found in a two-hour search in 2009. There were 2 active hives and 13 scar trees a number of which had multiple harvest entry points, as can be seen in plate 3.2.

Plate 4.2 Google Earth map overlayed with trees with sugarbag scars, active and/or dormant hives

Source: Field Records 2009

Sugarbag honey from native bees is produced in abundance by two genera (*Tetragonula, Austroplebeia*) in long-lived hives situated in tree hollows and when present is considered a good indicator of environmental health. It is a significant resource – spiritual, cultural, dietary and medicinal - for Indigenous people on Cape York Peninsula, who hold cultural knowledge about its production, harvest, inter-relationships with other species and use of fire to manage it. The flowering trees and shrubs that supply sugarbag, are also resources for other insects, birds and mammals, and are influenced by fire regimes. Understanding the relationship between sugarbag, plant health, flower and nectar production and fire regimes enabled the examination of this as a consideration for using sugarbag as a monitoring indicator by Indigenous people to report on the benefits of fire management. The project aimed to bring together Indigenous and non-indigenous knowledge to build the foundations for developing an Indigenous-based method of monitoring biodiversity health.

Significant “Sugarbag” knowledge is held by Elders across Northern Australia and is unique to each group. However, linkages exist between these differing knowledge sets. There is also shared value for the significance of sugar-bag in mythology, ceremony, as an important food resource, as part of the ecosystem and in art and craft use. Sugarbag use by the Kuku Thaypan Elders is evident in the (State of Queensland Land Tribunal, April 1996) Land Claim to Lakefield National Park (p169). An opportunity arose for investment through the Australian Governments Envirofund Program and our application to develop protocols for on country mapping and monitoring of sugarbag resources by Indigenous land managers was successful; the “Threats to native bees “sugarbag” mapping and monitoring project. However, a condition on this funding was to increase the involvement of western scientific specialists in native bees. An opportunity to document and demonstrate multiple outcomes arose and so the “Threats to native bees “sugarbag” mapping and monitoring project” was adjusted to meet the desires of the funding agency and re-designed to demonstrate an Indigenous led participatory action research project.

“The Sugarbag project – threats to native stingless bees and their potential as an indicator for biodiversity health” was a case study within the Elders’ KTFMRP that not only documented the issue of concern to the Elders of the decline in native sugarbag (honey) and active hives and their TCK classification of the bees, their habitat, behaviour and honey, language names, and taxonomy but also developed a monitoring system based on both TCK and western science with the support of “the Importance of campfires’ researcher.

Importantly the case study also demonstrated an Indigenous led participatory action research project. This was to demonstrate the difference between participating in someone else’s project and undertaking Indigenous led research. The project produced the following outcomes:

- A report

- Two short video trailers on TKRP YouTube channel (Steffensen 2008) https://www.youtube.com/watch?v=Vj-DAWYzEAM&t=6s
- A short case study film and a CD Rom Powerpoint Presentation
- GIS mapped layer of recorded sugarbag hives and scars
- Identification of the stingless bees involved in the production of sugarbag
- Development of a TCK and Western Science field monitoring method of sugarbag and fire management suitable for incorporation into i-tracker for use in the assessment of landscape health into the future
- Identification classification of active hives;
- Identification and classification of non-active hives (scars) and indication of age based on scar type
- TCK classification of bee types, biology and behaviour and language names for bee's their hives, recording of the way in which sugarbag was harvested, distributed and managed to ensure healthy hives and production of honey.

Importantly though it gave the Elders and co-researchers the opportunity to engage specialist bee scientists in their research project and spend time together on country. The scientists provided additional specialist information specifically on the bee species they found, an estimate of relative density and a short report on the value of the bees as indicator species for biodiversity. The researchers who were asked to be involved in the project were funded to a level commensurate to the value of their expertise and to ensure costs incurred for involvement were covered.

A western taxonomic scientist at the Melbourne Museum provided identification of the bees collected and provided this at no cost to the project as it enabled a greater understanding of the bees and records of their distribution to western science. Indigenous and non-Indigenous knowledge systems have different ways of recording, naming, validating, evaluating, monitoring and communicating information. The sugarbag or stingless-bee project was created to assist in demonstrating these differences and show how the two knowledge systems can work together to provide solution to issues of shared concern or common interest. The sugarbag project applied an Indigenous led PAR participatory action research methodology to design a mapping and monitoring system for sugarbag or stingless bees and engaged western scientists to determine their suitability of (*tetragonula hockingsi*) native stingless honey producing bee species as a potential indicator for woodland biodiversity health while we continued recording the TCFK of the Elders and, critically, this Indigenous led PAR project enabled the continued burning of country. Thereby, applying the CAMPFIRES methodology to address an issue of community concern, led by Indigenous people to co-generate knowledge on the focus of their research, applying the research practitioner model. The sugargbag project was mentored to neighbouring language groups Lama Lama and was guided by knowledge holders. There were multiple benefits resulting from the monitoring and research.

The Sugarbag project was able to demonstrate an Indigenous led PAR participatory action research project that provided opportunities for the sharing of knowledge between two differing knowledge systems. Importantly the holders of those knowledge systems retained management over how information was shared. This created a cross-cultural learning environment that generated the initiation of partnerships that may have over time developed into long-term relationships. This was necessary to allow for diversity in development and delivery of projects to address environmental and natural resource management concerns faced by the Elders. Indigenous led delivery and the co-generation of multiple projects provided solution to issues of shared concern to re-imagine the problem spaces currently governing communication between country and people.

The sugarbag project provided an opportunity to communicate the link between the increase in inappropriate fire regime on country and the reduction in the abundance of sugarbag (Steffensen, 2007). The project confirmed the Elders', Steffensen's and Standley's hypothesis that the density of old sugarbag scars on country was higher than active stingless beehives. However, in 2010 it also showed that the sugarbag or stingless bee *Tetragonula hockingsi* species was not a good indicator of biodiversity as they were in such low densities. Rather, that our existing monitoring of scorch heights was a good surrogate for biodiversity as with lower intensity fires there would be less chance of impact to the bee hives and over time as appropriate fire management was implemented on country the bee numbers should increase. The western scientists who participated in the project on country agreed that scorch height was a good surrogate for biodiversity as the height of the scorch marks on the bark and leaves of the trees as a result of unmanaged fires remains evident across the landscape for many years, albeit differently on different tree species.

The project developed an appropriate methodology for a monitoring program that engaged non-Indigenous researchers in supporting the Elders to report on the link between sugarbag, fire and environmental health. Importantly the members of the existing co-generative research team were also able to further the recording of the Traditional cultural knowledge surrounding Sugarbag including aspects of related food species phenology, and applied the CAMPFIRES methodology to document the Elders' TCFK of sugarbag as it relates to the elements of their TCFK map elements and monitor 'sugarbag' on country, the results of which are presented in Chapter 7. We were able to conduct intensive surveys to map the density of sugarbag and the number of active and non-active hives. We were able to demonstrate and document protocols for bringing together Indigenous and non-Indigenous knowledge to build an Indigenous based method of monitoring biodiversity health and highlight the differences in monitoring approach. The project enabled an assessment and prior burning in preparation for the 2010 Indigenous fire workshop located at Bizant and the formal mentoring of the KTMRP to neighbouring clan group Lama Lama, fulfilling a long-held aspiration of the Elders from both language groups. Importantly the resources it provided also enabled time out on country to implement cultural assessments and conducting of burns across the project study area. The findings and results of the study are presented in Chapter 7.

P is for People on country

Responsibility: Ensure place-based practice and right way connection to country and decision making for country

Indigenous Australians have been constant in their criticism; positive and negative of research and management agencies rationale and since colonisation have been insisting that they have something to offer in the management and understanding of land and sea country. Indigenous people living on country have an excellent comprehension of ecosystem connectivity, land and sea interfaces beyond those of our current shore and geological timelines and the unique and endemic human and spiritual scaffolding underpinning their cultural positioning, explaining their existence and the existence and function of the environment (Standley & Roberts, 2007). It is our view that it would be counterproductive to draw from this complex reality from a western research perspective alone, and that experience at the local scale through relationship-based practice over longer time periods than what is normally expected from scholarly study is required as the building and maintenance of relationships, ongoing ethics and clear lines of protocol and consent are established. This is particularly the case where those who hold the opportunities, infrastructure, capital, etc., to support communities to undertake "collaborative" projects fail to recognise the potential for the misappropriation of knowledge. It is also important to ensure that Indigenous people lead decision-making on these matters, have understanding of what prior, free and informed consent is, and be given the opportunity to discuss and consider the ways in which cultural practice may be impacted. In recognising and acting on these issues, research collaborators are able to ensure that research considers the terms and priorities of Indigenous peoples, mitigates risks to culture and community cohesion and ensures equitable acknowledgement and benefit to Indigenous research partners.

Recognising and respect for local knowledge and kinship

In order for research with Indigenous peoples to achieve the empowerment necessary to ensure a legacy of ethical and transformative research practice; the design, delivery and direction must be at the discretion of the Indigenous Elders, knowledge holders and custodians and be led by them. If this occurs then the project is an Indigenous-led project. Resources made available for this type of investigation should not be tied to the investment source requirements alone but should be directed by protocols, processes and requirements designed by Indigenous people. Ultimately, it is Indigenous people's intellectual property and they should have the legal right to derive an economic benefit from this knowledge, just as intellectual property laws protect individuals and knowledge and any resultant economic rights from plagiarism.

It is often expected that Indigenous people be participants in research projects or programs that tend to be driven from dominant research and/or management paradigms and thereby must be delivered within the rules and constraints of that governance structure. This confines the way in which the project is delivered, the information collected and how it is interpreted. Meaningful investigation is best served by asking first prior to formal finalisation of a research proposal (Martin, 2008) and is most effective where Indigenous people are active in setting research priorities and processes. Opportunity should be provided for Indigenous peoples whose knowledge will be the subject of or significantly contribute to the findings of research to lead or form part of an equitable research team. Input into protocol development and requirements is critical and enabling resources for Indigenous people to make these explicit is paramount.

The Sugarbag project was just one of the pathways using multiple methods that we delivered over the research projects most active years on Kuku Thaypan country. Often investors or potential investors in the projects were invited to spend time out on country with the research team. Spending time out on country with people provided the opportunity to build the relationships necessary to make things happen. The opportunity that being on country brings is the ability to communicate with people and for people to communicate with country, training and sharing knowledge together, mentoring the knowledge of the Elders and the maintenance of cultural practice. Often when people are removed from country, the situated knowledge that this brings is difficult to convey to others who cannot share this experience.

When you visit and spend time at a place often enough you become familiar with the cycles and the fauna and flora, you begin to know the direction you are to travel to reach your destination and you recall named places and landscape features.

Being on country increases our ability to connect to the shared value described earlier and strengthens this connection, this is important in forming strong partnerships that lead to collaborations that have the ability to cogenerate outcomes that are culturally appropriate. However, sometimes this could not always occur in the development of products to support the Elders to communicate their story of fire on their country. One such partnership that continues to collaborate on communication design products in cogenerating outcomes that benefit community and country is with Dr Jacqueline Gothe and UTS design students. The results of these collaboration specific to this research dissertation have been the development of:

- a children's story book in 2007, see Plate 3.3 for an example below that is now ready for release with support from Ben Lister in 2017;
- postcard artwork to try to gain wider support through Avant card and the general public in 2007; see Plate 3.4
- Posters showing the fire scar data in different ways with key communication messages of the Elders' KTFMRP and a test of an online data visualisation tool to show the Elders travels on country using GPS in 2010, see Plate 3.5 and 3.6

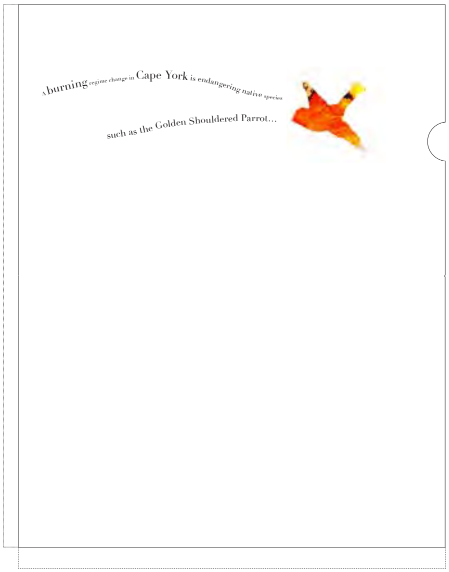
- Involvement in documenting the mentorship of the Elders' Kuku Thaypan Fire Management Research Project and the Importance of Campfires to NSW through the Firesticks Importance of Campfires Poster, see Plate 3.7 and Plate 3.8
- Contribution to the supporting the development of Firesticks Alliance Indigenous Corporation

This co-generative partnership continues to this day and Gothe has undertaken extensive communication design work supporting the Firesticks project, now Firesticks Indigenous Fire Alliance. Although Gothe and the students were not able to spend time on the Elders' country in Cape York Peninsula. Gothe and the students did participate in TKRP training in the lead up to the Laura Dance Festival that is held in the town where the Elders and many of their families reside. Away from country, Gothe and the students were able to be situated to place through the videos of the Elders, recorded by Steffensen in conducting their traditional knowledge recording project, through stimuli such as grasses and leaves, data collected and communicated by this research dissertation and time spent working with them in Sydney.

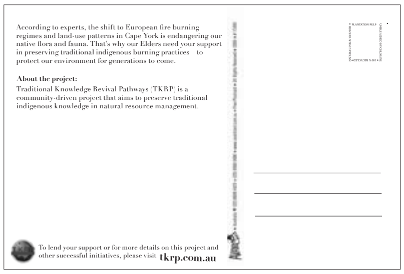
Plate 4.3 A children's story book developed on the project

Source: field records (2007)

Artwork files



Postcard Sleave with die-cut
Stock:100 gam Paper
Size 152 mm x 102 mm



Postcard
Stock: 300 gsm Card
Size 151 mm x 101 mm

Plate 4.4 A proposed Avante Card postcard design of the project

Source: Field records (2007)

Plate 4.5 A poster depicting late season fires in Kuku Thaypan Clan Estate from October to December 1999-2009 from NAFI data

Source: Field records (2010)

Plate 4.6 A poster depicting earlier season fires in Kuku Thaypan Clan Estate for May and June 1999-2009 from NAFI data

Source: Field records 2010

The collaboration between two non-Indigenous researchers and academics working in this space culminated in the design and production of the Firesticks and Importance of Campfires poster that communicated key components of the Knowledge Triangle, the TKRP recipe for undertaking a cultural burn on country and elements of the Elders' knowledge recorded through their KTFMRP and documented and communicated in the poster through "The Importance of Campfires," see plate 3.7. This poster has persisted as an artefact since its creation and people involved in the Indigenous fire workshop are encouraged to sign their attendance and comments on a AO print of the poster. An example of this practice from the 2016 workshop is shown at Plate 3.8. This poster importantly recognises those that had been involved in the project up until the Inaugural NSW Firesticks meeting held at University of Technology (UTS) in 2011.

Plate 4.7 Communicating fire, building relationships and creating change poster – mentorship between the Elders KTFMRP, The Importance of Campfires and Firesticks

Source: Field data 2011

Plate 4.8 Communicating fire, building relationships and creating change poster – mentorship between the Elders KTFMRP, The Importance of Campfires and Firesticks signed by people involved in the 2016 Indigenous fire workshop hosted on Yalanji Nyunkul Warra

Source: Field data 2016

If a project is truly collaborative than actions will be discussed together and solutions implemented to achieve a shared purpose. This shared purpose needs to be clear otherwise blurring can occur and collaborative ‘actions’ can easily be at odds and partners may not equitably share in the benefits of the outcomes of the collaboration.

When a shared purpose is clear, actions are developed with input from collaborators, however when engaging with the knowledge sets of others then the final decisions on action should rest with the knowledge holders. When this occurs, then partners begin to move towards co-generation. Actions may be undertaken independently but they are shared and discussed, assessed on their merit and involvement determined by movement towards achieving the shared purpose. In the case of this research dissertation the shared purpose was and still is the empowering of Indigenous people in fire management practice across Australia and ensuring the application of traditional cultural knowledge of fire by Indigenous people alongside western fire management knowledge systems of savanna burning, hazard reduction, wildfire mitigation and suppression, environmental management and conservation.

Different pathways maybe taken by co-researchers to reach the shared purpose, and different but equitable benefits derive. The pathways are inter-connected by adherence to cultural protocol and more than one solution (pathway) is being generated at the same time. When there is misalignment of the shared purpose, intent and outcomes sought there is potential for collaborators to become participants in a study. When actions are developed that contribute to achieving a shared purpose multiple pathways, partnerships and solutions result but control of, access to and communication of Indigenous knowledge is determined by the knowledge holders.

The governance of multiple knowledge sets and people working towards a shared purpose means the development of partnerships and collaborations, how effective these partnerships and collaborations are and how long they last depend on multiple factors. Mostly though; partnerships that have sustained the years and enabled new Indigenous and non-Indigenous partnerships with people in the process are a result of the shared purpose that was outlined earlier and respect for cultural protocols.

Solving the complex problem of fire management in Australia and indeed Internationally does not require the integration of knowledge sets. What is required is a transformation of the understanding of the problem space and the predominantly western driven solutions that are being applied across all areas of contemporary fire management research, policy and practice. Enabling Indigenous people the opportunity to demonstrate, document and communicate their cultural fire knowledge on country is critical to understanding its role in contemporary fire management concerns.

Through the co-generative effort of the TKRP, the Elders' KTFMRP and "The Importance of Campfires" the voices of the Elders were heard and they re-positioned fire management perspectives on Cape York Peninsula and importantly across Australia. The Elders' legacy includes the Indigenous fire workshops have been held annually[34] from 2008 – 2017 in Cape York. Table 3.2 below outlines the dates, locations, hosting groups and number of attendees at each workshop from 2008 – 2017. These workshops are Indigenous led, driven, delivered and documented and demonstrate what Indigenous-led research embodies and the empowerment that results. Table 3.2 also contains links to films of the events. These short films contain the voices of the Indigenous and non-Indigenous people who have been involved. Plate 3.9 shows people involved in the 2017 workshop hosted by *Balnggarrawarra Gaarraay* Land Trust.

[34] 2013 we were not able to secure enough foundational funding for the workshop to proceed

Plate 4.9 people involved in the 2017 Indigenous fire workshop hosted by *Balnggarrawarra Gaarraay* Land Trust

Source: Field records 2017 Image credit Ben Lister Cape York NRM

The methodology and methods applied by the KTFMRP are the Elders' responses to the wicked problem of fire management on their country was their cultural obligation to care for country to ensure that their knowledge was passed on to their descendants to ensure their country was looked after for generations to come and that culture was maintained. This was their Indigenous led action research project.

Table 4.2 Indigenous fire workshop dates, location, hosting groups and attendees

Source: Field records

Date	Location	Hosting group	Number of people involved	url to fire workshop films
14-16 July 2008	KTFMRP country Rinyirru NP	Kuku Thaypan	10	
7-9 July 2009	Bizant Outstation Rinyirru NP	Lama Lama Lizzy Lakefield	35	https://www.youtube.com/watch?v=qk5Up0IRjug
24 May 2010	Bizant Outstation Rinyirru NP	Lama Lama Lizzy Lakefield	50	https://www.youtube.com/watch?v=SjlnffnxWbA
12-16 July 2010	Chuulung un Ngachi	Kuuku I'yu Northern Kaanju Chuulungun	64	

		Aboriginal Corporation		
11-15 July 2011	*Awu Alaya* country Rinyirru NP	Kuku Thaypan - Hahn River Roadhouse	75	
13-15 July 2012	Kuku Yalanji	Daryl and Linda Paradise Gibson and Wallace families	90	https://capeyorkfire.com.au/
14-18 July 2014	*Taepithiggi* country Steve Irwin Reserve	Steve Irwin Wildlfire Reserve *Taepithiggi* people Mapoon Land and Sea Rangers	94	https://capeyorkfire.com.au/
14-17 June 2015	*Tenacull* Maryvalley station	Kuku Thaypan	160	https://capeyorkfire.com.au/
22-26 August 2016	Yalanji Nyunkul Warra	Yalanji Nyunkul Warra Wujul Wujul Aboriginal Shire Council Jabalbina Aboriginal Corporation	150	https://capeyorkfire.com.au/
3-7 July 2017	Melsonby station	*Balnggarrawarra Gaarraay* Land Trust	130	
13-15 July 2018	Bundanon Trust	*Yuin Country Djuwin Mudjingaalbaraga* *Firesticks men's group*	296 masterclasses 86 additional on cultural fire open day	https://www.firesticks.org.au/bundanon-2018/ and see https://firesticks.app.box.com/s/okl4pc5v9x6yd9q2cymx1ses4acbwi0u for report

F is for FIRE

Culture: Belief in inherited wisdom and respect for lore

The principles of how to read country and the protocol by which one learns to read country and how this is shared were taught to me through a process of listening to the rules that were being demonstrated, through observing practices and by providing support to the research project leaders aspirations. The Elders determined where and when learning took place. Fire is sacred and the knowledge of when and how to manage fire is not universally accessible in the same way, at the same time by all individuals. Harnessing and generating fire and knowing what fire is, what it does and how to use it are different things. For example, in the Kuku Thaypan knowledge system lore holding for fire knowledge is patrilineal, considered “men’s business” so willingness of the Elders to share knowledge with a non-Indigenous woman was not immediate, even though they wanted me to work for them and Kuku Thaypan Indigenous women hold lore for, knowledge of and can and do burn. Knowledge was shared with me as the relationship and trust grew and they could see that I was supporting them to deliver their aspirations to implement their Traditional Knowledge Recording project and their Kuku Thaypan fire management research project (KTFMRP) on country and ensure opportunities for transfer of their knowledge on country with their younger clan members.

Examination of how TCFK can be known and described in order for it to be understood alongside western scientific knowledge required description and analysis of a collaborative exercise in ‘knowing’ about a topic. In this case, the topic is the Elders’ (*Awu Alaya* speaking people) TCK about the use of fire for management of all of the resources in the landscape. In coming to understand parts of this complex knowledge system it was apparent that the depth of knowledge concerning the interaction of fire with all of the other elements of the system and the skill and confidence with which fire was implemented, held value in its own right to be researched and practiced by Indigenous people alongside western fire management constructs. The results of the focus of this study to describe the Elders’ TCFK system is presented in Chapters 6, 7 and 8, and describes aspects of the Elders cultural fire knowledge.

Culture: There exists interconnectivity between all things and that all things are animate and sentient, all things, the trees, the grass, stone and water, the air, fire, the stars, us, everything

Relationships between fauna, flora, places and people were often described as they were observed or remembered in country and referred to their creation stories. It was not until the fourth year of the project that I formally interviewed my research partners and younger clan members on country, this was in relation to how they felt about seeing country unwell and not being able to use fire as much as they wanted to (Field data Mickey Finn 2007). '*When all the old people die the country too will die*.' (Dr Musgrave (field notes 2005). This quote from Dr Musgrave echoes his concern that knowledge of country and how to care for it would be lost if it was not learnt, taught and practiced. Dr George and Dr Musgrave wanted to ensure that this did not occur, so they initiated their Kuku Thaypan fire management research project in 2004. The Elders' research methodology was their cultural obligation to care for their country and implement their cultural fire knowledge on country, to ensure that this was recorded and importantly passed onto their descendants and others willing to learn. In this way they could ensure that country would be looked after for generations to come. What the Elders taught was how to read country, and this important lesson continues to be taught today '*the knowledge is in the landscape. The Elders have not passed. The land is an Elder too.'* Steffensen (2018). As a researcher it was critical for me to understand that within the Elders' and knowledge holders' TCFK there exists interconnectivity between all things and all things are animate and sentient, all things, the tree's, the grass, stone and water, the air, fire, the stars, everything and that knowledge is embedded and read in country and carried by people.

I is for Implemented management on country

Indicators: Knowledge is shared, practiced and embedded on country, reading and assessing country

One of the key considerations of actions taken through the research project from the Elders priority was; did it enable travel and stays out on country and support the implementation of the Elders fire management practice. As a non-Indigenous researcher in this space, my role was mostly to listen to the aspirations and support the Elders and Steffensen to secure resources, organise and document meetings, attend and support logistics for on-country field trips, assist in logistics for delivery of the TKRP and the KTFMRP and learn as best as I could in order to understand their ontologies, epistemologies and methodologies for accessing and communicating appropriately their knowledge of country and fire management.

I came to understand that my role as researcher was to learn how to document, monitor and communicate using western scientific instruments, the Elders' understanding of fire management. This was to include how to monitor their indicators and interpretations of healthy country from their point of view. Through the staged process I learnt what it was like to participate in Indigenous led research. Then I learnt how to collaborate with my Indigenous researchers and guide other partners to engage appropriately and assist to translate this knowledge into western science explanations. Then I was able to move into co-generative delivery with my research partners in their knowledge spaces, share my knowledge of ecosystem function from a western science perspective, and to collaborate on delivery of partnerships and actions required with other parties to take action for the Elders to implement their TCFK on their country. I also experienced the difference between participating, collaborating, and co-generating and how this shifts capacity to act.

Since 2003 - 2016 my Indigenous co-researchers and I have worked alongside each other to provide solutions to the appropriate recognition of Indigenous knowledge and people in contemporary fire management and research practice in Australia. Through this process I too have been transformed as a person, my view of the World, my place in it and my relationship to it and to others has changed. Co-generation is the work that we continue to do together, Steffensen and other Indigenous cultural fire practioners, knowledge holders and younger Indigenous people being mentored as part of the now Firesticks Alliance Indigenous corporation registered in 2018 that supports communities and partners in empowering Indigenous people back into Indigenous led cultural fire management across Australia applying appropriate methodologies for cultural fire and research alongside western fire management.

A role of the principal researcher in undertaking the dissertation was initially as a participant and then as a collaborative and co-generative colleague, moving alongside my co-researchers guided to this point by them so as not to remain an external researcher comparing knowledge sets and views, with research program priorities to deliver on that were inconsistent with theirs. However initially the naivety of the western scientific experimental research design was presented as an option to examine, compare and contrast knowledge sets, see Figure 4.1. This was not what my Indigenous co-researchers wanted to demonstrate or undertake. It was also practically impossible with the resources we had available to us.

When we first went out on country, I had this idea in my head before-hand on what the Elders and Steffensen were asking me to do. In my head, I thought I could lay out an experiment and have control sites and then they would burn these areas of land in a certain way. I would then be able to measure that with my scientific methods and measurement tools and test my assumption that changes will be detected that are indicatively better for biodiversity than those in the control sites as a result of the Elders burns, see Figure 4.1. If my assumption was satisfied than I would undertake a MANOVA Multi –variate statistical analysis on data. If my assumptions were not valid than I would do separate kruskal-wallis tests. Some of the application of the Elders' knowledge could be measured in this way some of it cannot, but it is much more than that. It became obvious to me straight away, the first day on country that I was very much a participant in their research project and my role was to support them to be heard, communicate with others and ensure that their research was acknowledged. The implementation of the Elders research was landscape scale, with fire management implemented in the Morehead catchment but spanned beyond with fire being carried through Indigenous mentorship, across Australia.

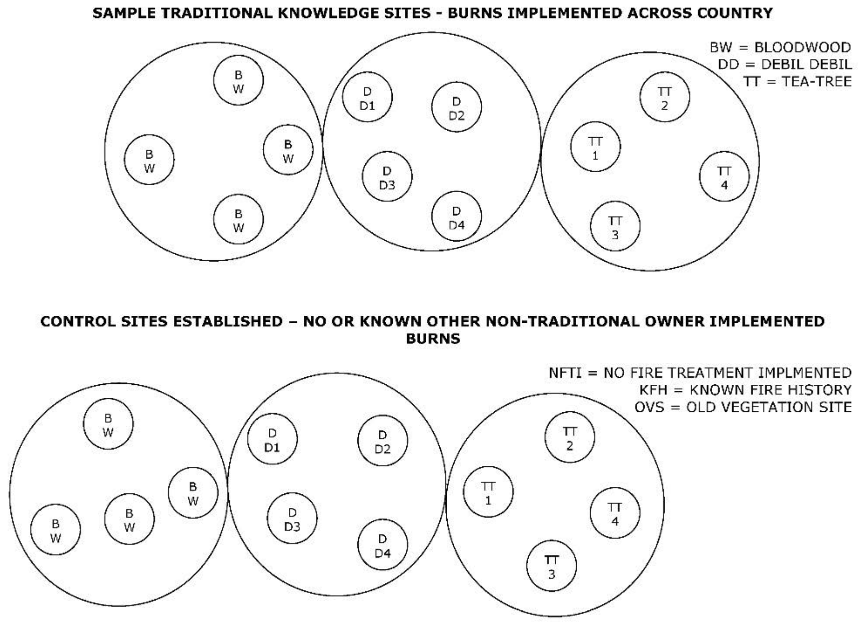


Figure 4.1 experimental design developed at the initial stages of engagement with the Elders TKRP and KTFMRP

Source: Standley June 2005

Working in Indigenous knowledge domains is both a challenging and rewarding space to work in, and it is confronting for non-Indigenous people because it is a different way of knowing than how western research contains and accesses knowledge. Accessing knowledge in the knowledge systems of the Elders is earnt knowledge, it is something that requires experience and practice with knowledge holders. Traditional cultural fire management knowledge requires practice on country. It can unsettle non-Indigenous research partnerships and institutions because it can challenge the dominant knowledge system in how to conduct these types of collaborations and importantly the burns on country.

The research process led by the Elders, facilitated inside and outside science (Tuhiwai Smith, 1999) and enabled me to work closely with the Elders and Steffensen in the field, accompanying them on their field trips and assisting them with recording and monitoring their fire management research. The research project worked with the Indigenous-led TKRP to form partnerships that assisted the Elders to be able to demonstrate and record their knowledge, undertake their own fire management research and educate and train others. The dissertation researchers'[35] roles were to help in "translating" and "communicating" the benefits of TCK of fire and biodiversity and to foster change in the way in which this knowledge system was incorporated into contemporary management and research practice. Through this process knowledge of how to record the Elders' fire knowledge using contemporary monitoring methods and their limitations emerged in documenting the complexity of the Elders' traditional cultural fire knowledge system.

The way that knowledge is expressed through language is also important as the dominant language of western science and understanding of how things work is also inadequate to explain simply what is understood within the Elders' traditional cultural fire knowledge system. For example, take the following sentence fragment "physiology of fire". Within the western worldview fire does not have a physiology, it cannot it is considered inanimate, it has physiological effects, fire itself is not considered to be alive. However, in the Elders' knowledge system it is alive, it has physical and chemical properties and function and a mutualistic symbiotic relationship with people and the environment. Fire also has the potential to be parasitic causing negative succession, creating fire prone vegetation and conditions benefiting fire frequency and intensity. If I can deconstruct the way in which western science describes its understanding of the word and re-apply it to the Elders Indigenous understanding of fire, perhaps this may help others to understand what is known about fire within their knowledge system. Fire is very much alive in the Elders' knowledge system, it contains spirit and can generate its own breath through its interaction with other living and non-living things fire itself interacts with these things in such a way as to promote itself, resulting in uncontrolled wildfire if it is not managed responsibly.

[35] Researchers' was meant here as plural as we worked together and the dissertation is a result of this co-generative action

In order to place the voices of the Indigenous leaders and co-generators of the Importance of Campfires research project at the centre of decision making about fire management practices on their country the methodology applied by the non-Indigenous researcher in the project supported the TKRP in delivery of its pilot research project the Kuku Thaypan Fire Management Research Project (KTFMRP) to describe an Indigenous led methodology and practice while providing tools to assist in the implementation of fire by the Elders in the study area that enabled the communication space and fire patterns to change.

The Elders implemented fire management research on country sustained their cultural transfer of knowledge on country. In order to understand how the Elders implemented management impacted the health of country you need to understand the three sides to the knowledge triangle as described by Steffensen in Chapter 9, “knowing what it is” translated in western ecological knowledge this could be interpreted as understanding plant and animal species biology. “Knowing what it does” familiarity with population ecology, environmental cycles and ecosystem function. “Knowing how to do it” understanding how to implement fire in the landscape and measure the resultant effects of our interactions as part of the system. If we understand the three sides to the knowledge triangle it enables responsive management practices that can sustain healthy and resilient ecosystem services capable of adaptation to change. However, it is not as simple as a theoretical comparative with our western way of understanding and describing the world, illustrated in table 3.3. The ability to know what it is, what it does and how to do it inherent in TCFK is a longitudinal baseline of knowledge that spans 80 000 years or more and is embedded in lore. To understand this practice, this research project worked alongside TCFK holders supporting them to demonstrate and document this knowledge for many years.

Table 4.3 Comparative of the TCFK triangle and ecological knowledge

Source: Field data 2017

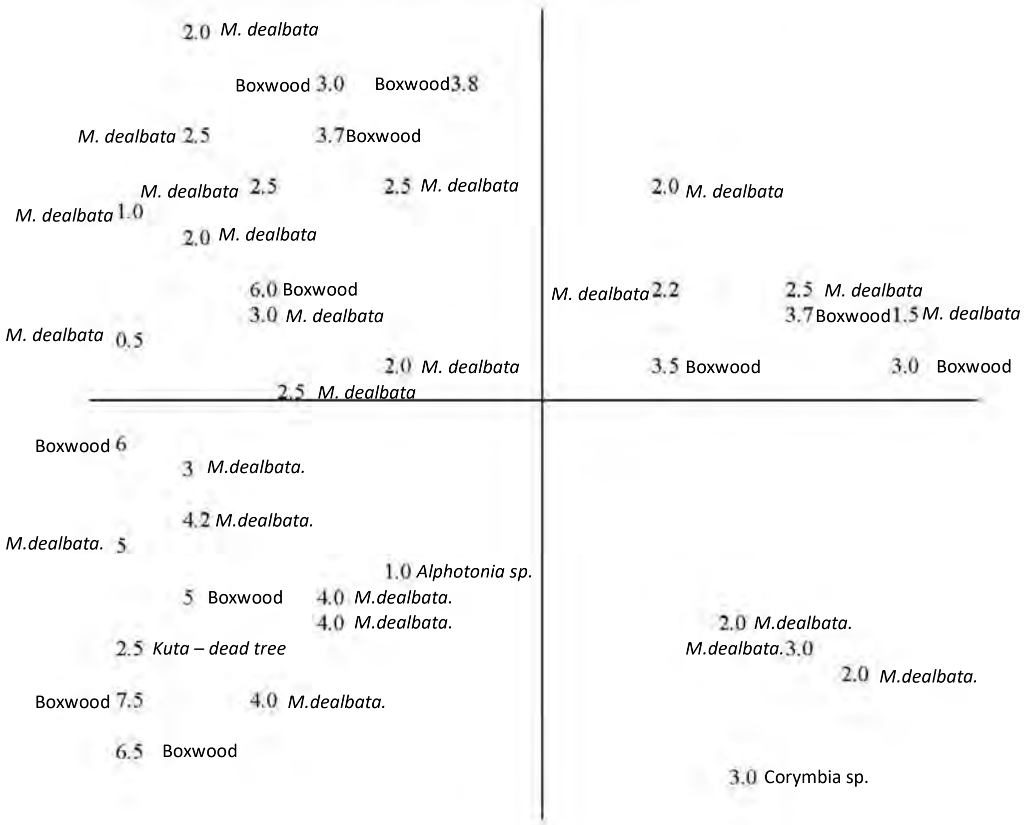
Traditional cultural fire knowledge	Ecological Knowledge
Knowing what it is	plant and animal species biology
Knowing what it does	population ecology, environmental cycles and ecosystem function
Knowing how to do it	implement fire in the landscape and measure the resultant effects of our interactions as part of the system

Monitoring and assessing country using western science tools

Learning the best ways to use western science to support the monitoring of the Elders knowledge evolved through the years of the project. One of the methods that "The Importance of Campfires" research utilised was remote sensing and its limitations in documenting the Elders fire management is demonstrated in analysis discussed in Chapters 4 and 5. Initial designs for on-ground monitoring were overly complex and time consuming and considered monitoring all layers in the ecosystem, see appendix 3.1. This was not practically possible to implement across the landscape with the resources we had available to us and significant replicate sites would need to be established across the landscape. The second iteration was a much simpler design that could be easily replicated and completed in a shorter space of time, making it easier to implement multiple sites. I established four of these vegetation sites within the AOI and others across Cape York and Australia at fire workshops and training sessions. This method established a 25 x 25 m transect in a cross shape, with a star picket in the centre, a photo was taken in a NESW direction from the centre of the site, later photos were taken from each cardinal point into the site also resulting in 8 images (4 looking out and 4 looking in). The top three dominant trees that were within each quadrat were included or excluded using a basal wedge and the scorch height on each tree measured, ground cover was also noted. This method would enable two key changes to be documented over time, the density and mix of the vegetation and the height of the scorch marks. Figure 4.2 below highlights data resulting from this method.

BS5FS1MOB.31.08.05WAY43 Study site
Boxwood site 5
Fire Scar 1
Management Other Burn
31.08.05
Way 43

Top three dominant trees in a 25m x 25m transect were recorded and the fire scar height on each tree was measured, using a 2.5m (5ocm increment) marked measure, across the site. A photo was taken using no zoom on a Konica Minolta Digital Camera, from each outside point looking into the site. A GPS location was taken on a GARMIN 12 using Datum WGS 84



Notes: Left to right
10 M.delbata, 4 Boxwood + 6 Alphotonia sp. 13+ M.delbata suckers
3 Boxwood (average height of tree 13m), 4 M.delbata + M.delbata suckers 40+, 5 Alphotonia sp.
6 M.delbata,, 4 Boxwood + 1 Alphotonia sp., 1 dead tree
3 Melaleuca + 1 Corymbia sp, 40+M.dealbata suckers

Figure 4.2 Second site monitoring design developed during the research project

Source: Field records 2005

What the above method did not document that was a critical element in the first method was the phenology of species and this is important in monitoring the health of the canopy, the % of canopy scorch, leaf drop and recovery time, these were included in later methods. The sugarbag project further enabled opportunity to adapt and modify monitoring to include indicators the Elders were interested in recording. Figure 4.3 below shows the monitoring method that was developed that would easily allow a quick assessment of sugarbag scars and nests when travelling through country. This method included an easy way to GPS and record what was required with little error by the use of tick boxes and was shared with other traditional owners from Kuku Thaypan clan family groups and neighbouring traditional owners from Lama Lama who were able to be involved through the project, plate 4.10.

Plate 4.10 Peta Standley working with Lama Lama traditional owner Lizzy Lakefield, Kuku Thaypan Leechu family members William and Danny Leechu

Source: Field records 2008

Kuku Thaypan Sugarbag Recording Sheet

Site area no: 1
Scar/s: 1 & 3 total
Live Hive: 1
(please circle and number)

State: QLD   Coordinates: -14.9414160 Latitude   +143.8019509 Longitude
Location: Gno Coom (Saxby Lagoon) Lakefield NP   GPS datum code: Way 4

Date: 26/5/09

Time: 10.36 am
Survey duration: 1 hr inc filming

Recorder/s:
Dr. Tommy George
Victor Steffensen
Charlie Leechu Snr.
William Leechu (trainee)

Type of sugarbag recorded (please tick)
☑ *Arear kun* (big one/short nose entrance to nest)
(sweetest honey/long nose entrance to nest)
☐ *Arear ninjo* (little one/on ground/crevices, ant beds, tree, rock, flies a long way/little or no honey)
☐ *Arear woonba* English bee
☐ *Arear awombul* Funnel sticking out with flowers on it entrance to nest.
Other ___
Arear woonba –Dr. Tommy George remembers seeing them from little boy

Specimen collected
☑ Yes Specimen number: 2 (as collected by CDU staff)
☐ No
Site features (please tick):
☑ at nest
☐ at flowers
☐ other please describe ___

Scar/Nest characteristics
☐ Height from ground ___4.5____m approx and please circle below
- < 50 cm
- 50 cm – 1 m
- 1 m – 5 m
- 5 m – 10 m
- < 10 m

☑ More than one scar/nest in tree if so number of scars/nests ____1 nest / 2 scars_____

Other notes: The active hive in the tree (dead) was present in an old scar that was made by a stone tommyhawk. This was explained as evidenced in the smooth shiny round chips at the entrance as opposed to those that (see plates) made by a steel axe.

☑ Language name
Kumatal
☑ Botanical name
Erythrotheum cloryostachys – Cooktown Ironwood
Identified in field
☑ Yes (Identified by Tommy George)
☐ No
Specimen taken
☐ Yes
☑ No (Dead Tree)

Method of Recording
☑ TKnowledge recorded Yes/No (please circle)
☑ Video footage taken
☑ GPS datum
☑ Photographic image of entrance
☑ Photographic image of scar/s
☑ N/S/E/W Photographic image from Scar/Nest Tree

Country type:
☐ Tea tree
☐ Mixed Tree
☑ Messmate
☐ Grassy Plain
☐ Gum
☐ Boxwood
☑ Ironwood
☑ Bloodwood
☐ Other please describe ___

Land form:
☐ Sandstone
☐ Sand Ridge
☐ Flat/Plain
☑ Lagoon
☐ Creek
☐ River
☑ Other ___adjacent to Gno Coom (Saxby Lagoon)

Fire Management
Source of burn
☑ TO – Traditional Owner Burn
☐ BO –Burn Other
(QPWS/Wildfire/Pastoralist) IF you are sure of the source then use QP/W/P) otherwise just leave as BO
Age of Burn
☑ NB – New Burn
☐ OB – Old Burn if
OB then + a number for age in weeks of burn e.g. 2 = burnt 2 weeks ago + W
Burn implemented
☑ Yes
☐ No
GPS Code:
-14.9414160 Latitude +143.8019509 Longitude

Other burn notes:
Fire one: 11:00 am

Scorch height
☐ < 50 cm
☑ 50 cm – 1 m
☐ >1 m
☐ 1 – 5 m
☐ 5 – 10 m
☐ < 10 m
☐ Canopy
Flame height
☐ < 50 cm
☑ 50 cm to 1 m
☐ < 1 m
☐ 1 – 5 m
☐ 5 – 10 m
Colour of smoke
☐ White
☑ Light grey
☐ Med grey to brown
☐ Dark grey to black
Rate of spread

<table>
<tr><td>Temp: 29.7°C
Wind Speed
Max: 4.8
Av: 1.8
Relative Humidity: 60.7
Dew Point: 21.5
Altitude: 212 m</td><td>☑ Slow
☐ Med
☐ Fast</td></tr>
<tr><td colspan="2">Other notes: eg. Wax, honey, preferred flowers to feed, trees to nest, distance travels for food, relationships to other animals/plants</td></tr>
<tr><td>Field identification of bee/hive/scar
☑ made by Dr. Tommy George observing in a jar see language name (please write)</td><td>Identified by:
Dr. Tommy George</td></tr>
<tr><td>☑ Sent for taxonomic identification:</td><td>Identified by: Ken Walker</td></tr>
</table>

Kuku Thaypan Sugarbag Recording Sheet

<table>
<tr><td rowspan="2">Site area no: 1
Scar 3 & 4
Live Hive
(please circle and number)</td><td colspan="3">State: QLD Coordinates: -14.9420910 lat +143.8021899 long
Location: Gno Coom (Saxby Lagoon) Lakefield NP GPS datum code: Way 5</td></tr>
<tr><td>Date:
26/5/09</td><td>Time: 11.59 am
Survey duration:
10 min</td><td>Recorder/s:
Peta Standley
Lizzie Lakefield
Alwyn Lyall</td></tr>
</table>

<table>
<tr><td>Type of sugarbag recorded (please tick)
☑ Arear kun (big one/short nose entrance to nest)
☐ (sweetest honey/long nose entrance to nest)
☐ Arear ninjo (little one/on ground/crevices, ant beds, tree, rock, flies a long way/little or no honey)
☐ Arear woonba English bee
☐ Arear awombul Funnel sticking out with flowers on it entrance to nest.
Other ……………..</td><td colspan="2">Specimen collected
☐ Yes Specimen number:
☑ No
Site features (please tick):
☑ at nest
☐ at flowers
☐ other please describe</td></tr>
<tr><td>Scar/Nest characteristics
☑ Height from ground 3m approx and please circle below
➢ > 50 cm
➢ 50 – 1 m
➢ < 1 m
➢ 1 m – 5 m
➢ 5 m – 10 m
➢ < 10 m
☑ More than one scar/nest in tree if so number of scars/nests
2 scars

Other notes:</td><td colspan="2">☑ Language name
Kumatil
☑ Botanical name
Cooktown Ironwood
Erythrophleum chlorostachys

Identified in field
☑ Yes
☐ No
Specimen taken
☐ Yes
☑ No</td></tr>
<tr><td>Method of Recording
☑ TKnowledge recorded Yes/No (please circle)
☑ Video footage taken
☑ GPS datum
☑ Photographic image of entrance
☑ Photographic image of scar/s
☑ N/S/E/W Photographic image from Scar/Nest Tree</td><td>Country type:
☐ Tea tree
☐ Mixed Tree
☑ Messmate
☐ Grassy Plain
☐ Gum
☐ Boxwood
☑ Ironwood
☐ Bloodwood
☐ Other please describe</td><td>Land form:
☐ Sandstone
☑ Sand Ridge
☐ Flat/Plain
☐ Lagoon
☐ Creek
☐ River
☐ Other</td></tr>
<tr><td>Fire Management
Source of burn
☐ TO – Traditional Owner Burn
☑ BO –Burn Other
(QPWS/Wildfire/Pastoralist) IF you are sure of the source then use QP/W/P) otherwise just leave as BO
Age of Burn
☐ NB – New Burn</td><td colspan="2">Scorch height
☐ < 50 cm
☐ 50 cm – 1 m
☐ >1 m
☐ 1 – 5 m
☐ 5 – 10 m
☐ < 10 m
☐ Canopy</td></tr>
</table>

Figure 4.3 Sugarbag monitoring sheet developed through the research project

Source: Field records 2009

Every year at the Indigenous fire workshops this non-Indigenous researcher delivers training in Indigenous led research methodologies in the cultural monitoring and indicators masterclass. These have necessarily evolved over the years of delivery. Training is provided in different methods that can be used to monitor elements of the knowledge map and indicators of country for different systems as described by the Elders but how understanding and practicing the observation and monitoring of these elements and indicators enables you to read country. This is why many of the methods are relevant across different country types. These elements and indicators are discussed further in chapters 6 and 7. Moving into different ecosystems and considering the best approach to monitor the management concerns of Indigenous land managers to support them to document changes as a result of their implemented fire management practices has also informed the current digital version of the data record sheets that are used in delivery of this training. However, it is the co-development of methods within the application of the entire CAMPFIRES research practitioner methodology and model that enables the co-generation of appropriate Indigenous led research methodologies and methods.

The monitoring method that is described below is delivered at the Indigenous fire workshops annually and can assist groups to implement fixed monitoring plots that can evaluate fires over time. However, as described earlier fire does not travel uniformly across the landscape, western fire science understands that fire requires four elements; fuel, oxygen and heat and the chemical reaction between them. This is called the fire or combustion triangle, if one of the elements changes it impacts the other, for example if one is taken away the fire goes out, or decreases in intensity, if one increases the behaviour of the fire changes having a differing impact on the environment. Figure 4.4 illustrates the western science described fire or combustion triangle.

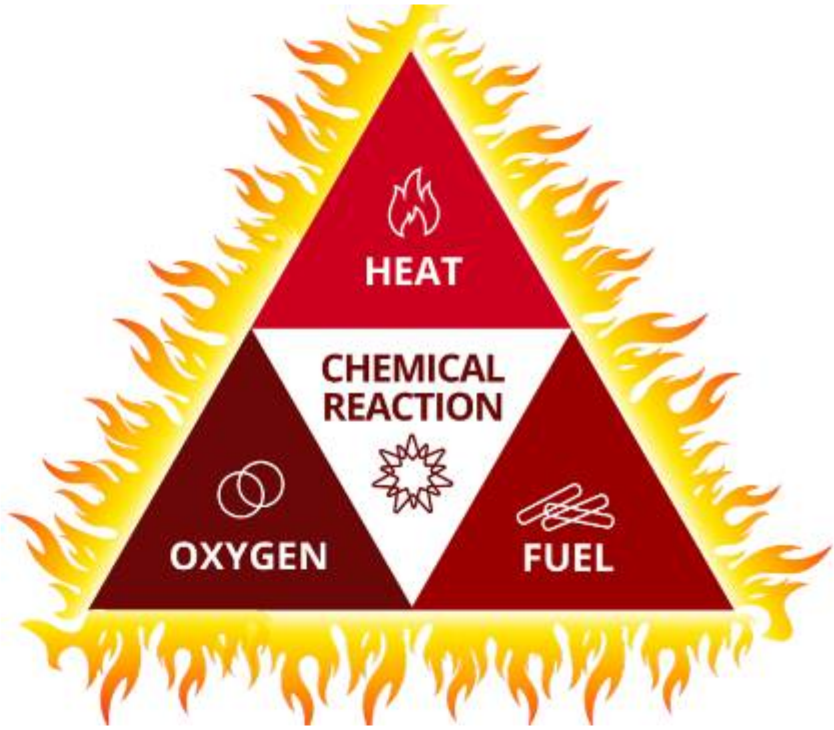


Figure 4.4 Western fire science representation of the combustion or fire triangle

Source: www.firerescue1.com

Therefore, multiple monitoring plots are required to statistically derive meaning from results. The behaviour of the fire during the burn also needs to be recorded. Nonetheless, western empirical management processes often require such data in order to understand the change attributed to management actions, so the following is presented as way to monitor the impact of fire management by focusing on the indicators that were shared by the Elders.

These visual cues will also be discussed in the outlining of the monitoring methods below. Training resources have been developed, see plate 3.11 to assist people involved in the workshops to read indicators that are important in the Elders' ICFK such as the direction and speed of the wind. At the workshops people learn how to use western tools as described here but also by reading country and responding to cues provided in the environment.

Plate 4.11 an example of training materials developed for the Indigenous fire workshops

Source: Field records 2015

Changes in these indicators are able to be visually assessed over time when the evaluation is based on familiarity with the landscape that itself generates the ability to assess its responses, both positive and negative. As such photo-points can form the basic requirement to document change with additional indicators, elements and components of the knowledge map recorded from there.

At least three field data monitoring sites need to be repeated within the same vegetation community where a management practice change is being implemented and away from any edge effects, including change in ecosystem. It is important that they have similar fire history baselines. NAFI fire scar maps can assist in understanding fire history of areas along with local agency and knowledge records. Field knowledge in being able to read the age of fire scars, the type of scorch marks that are left on the vegetation depending on the type of bark on trees present, the density and curing of understorey, the height and percentage of canopy scorch, the direction fires have travelled all assist in establishing vegetation sites with similar fire histories.

A steel star picked is established at least 25 m from any edge and at least 250 m apart from the last monitoring point. A steel tag with the number engraved assist with longevity of the site and the steel picket is sprayed with high-vis spray paint. A measuring tape is extended for 25m, 12.5cm from the centre of your site in a North, South direction using a compass to find magnetic north. A second tape is extended to form a cross from East to West, also using a compass and each end is marked with flagging tape. A 25 x 25 metre diameter length is ideal for most locations, the radius will be 12.5 metres in each direction from the centre post. The steel picket can now be hammered into the ground at the centre of the site.

A photo is taken in the NESW direction from the centre of the site then taken back inwards from each cardinal point in the same order, (e.g. from north looking back at the post, then east, south and west). This provides two sets of images looking from inside out and outside into your site. The date, number of the site and images can be recorded on a paper sheet. However, currently this photo-point monitoring and KTFMRP form is built in software called Fulcrum app, a mobile form building and data collection software that can be used on digital devices and tablets to collect data in the field that is geo-located and can be synced when back in Wi-Fi range to store data digitally.

The field data sheet that the KTFMRP digital field monitoring form is built from is provide in Appendix 5.1. Note that not all field are required to be completed at each site, depending on what the identified fire management concern is and what changes are being monitored. Plate 3.12 shows an example of photo-point monitoring data entry in Fulcrum recorded during delivery of training at 2017 National Indigenous fire workshop. Plate 3.13 Example of KTFMRP field data sheet developed through the research project being used in monitoring the reduction of serrated tussock (a weed of national significance) under the implementation of cultural fire management by traditional owners from Orange Aboriginal Land Council who have been involved in the mentorship of the project from Cape York to Orange.

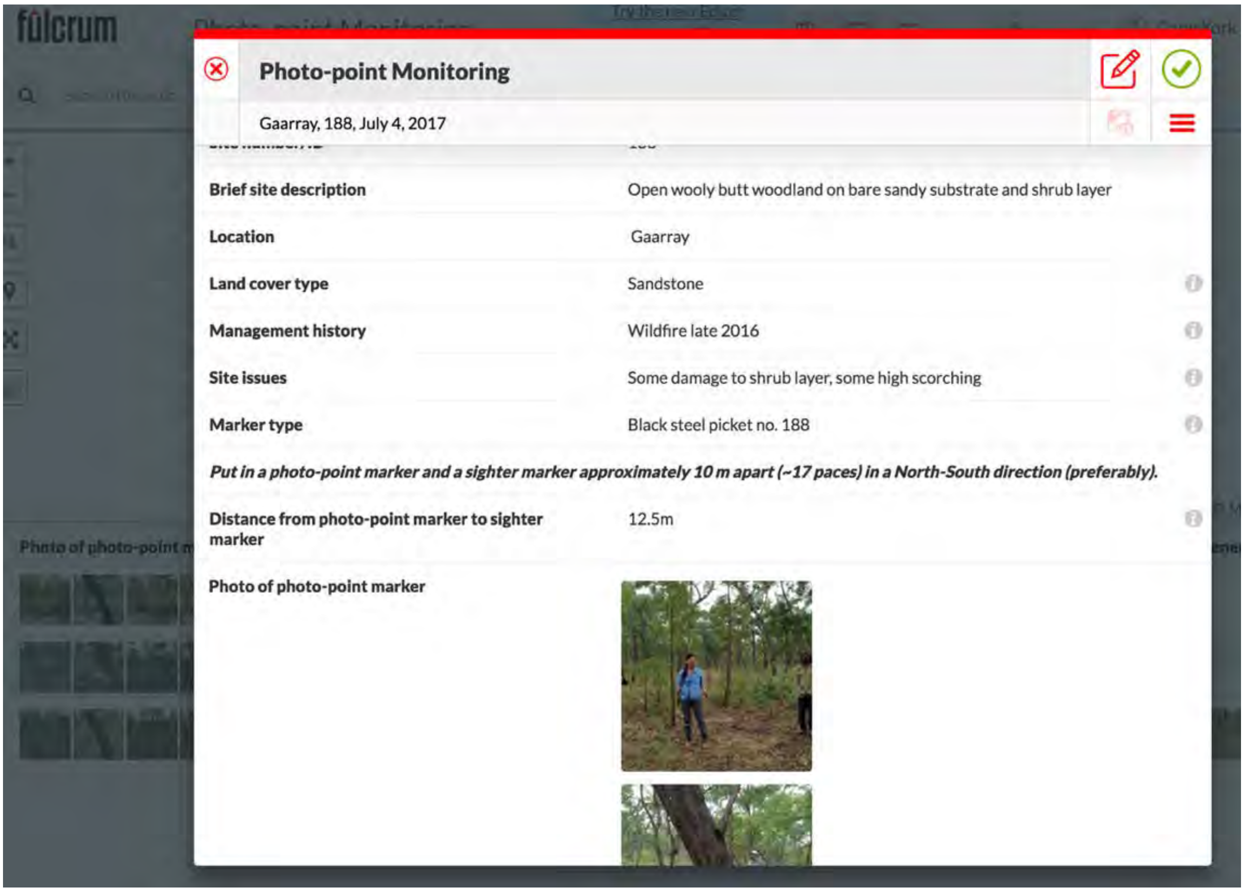


Plate 4.12 Shows an example of photo-point monitoring sheet used in delivery of training at 2017 National Indigenous fire workshop

Source: Field records 2017

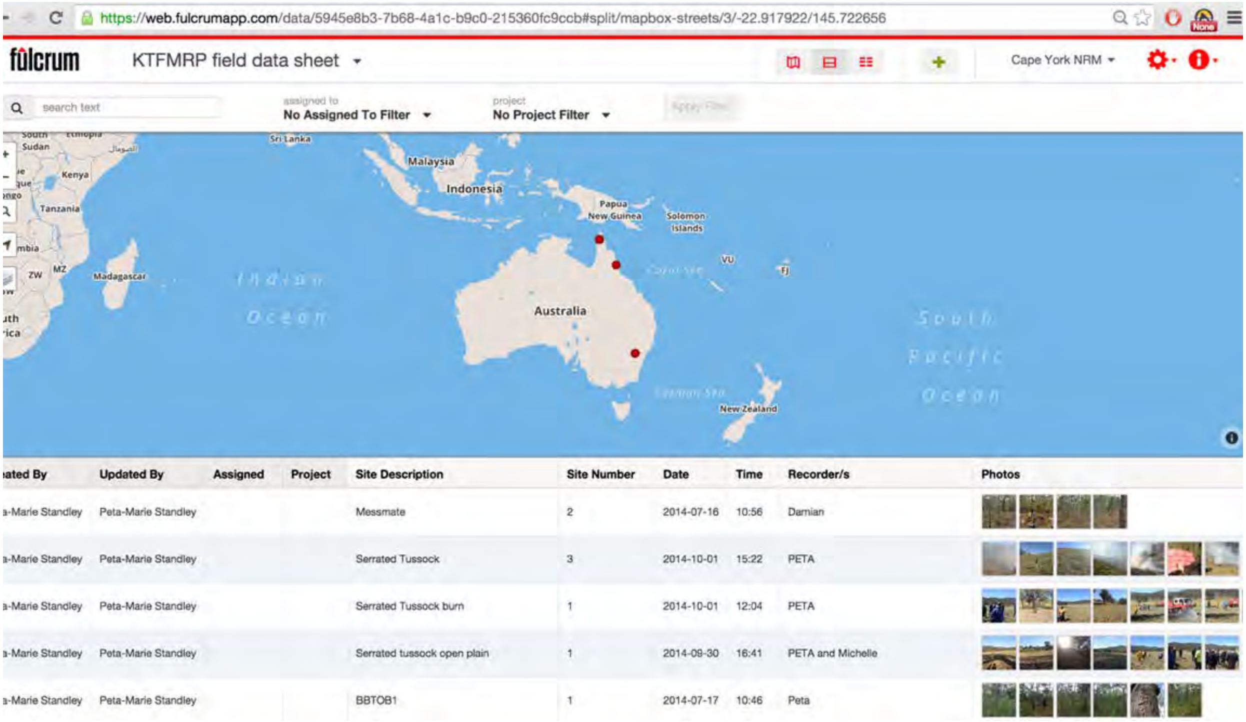


Plate 4.13 Example of KTFMRP field data sheet developed through the research project being applied in other landscapes

Field records 2014

Each quarter of the quadrat can be used to record different layers within the system, depending on the system and what management practice change is being implemented. For example, transects can be used to record ground layer, shrub layer, canopy cover, a basal wedge can be used to estimate density of trees and changes to structure over time, it can also be used to consistently record a reduction of fire scorch heights on bark of trees.

On each trip on country with the Elders their ignition points were documented using a GPS and from 2008 coded for documenting and assessing burns, see Table 3.4. In order to improve documentation of burns in the landscape in a consistent way a series of codes were developed to support NAFI and on-ground mapping interpretation and assessments of burns. This system of codes to enter into GPS records is outlined in Table 3.4.

Table 4.4. GPS codes for monitoring ignition points and assessments

TKRP KTFMRP GPS codes				
Code 1 **Whose burn?**	**Code 2** **Age of Burn**	**Code 3** **Country type**	**Code 4 Landform**	**Code 5** **ID of scar**
TO Traditional Owner Burn	NB New Burn	B = Boxwood	F = Flat	IF you are mapping more than one burn in the same vegetation community use consecutive numbers for each new ignition point. e.g. TONBBF1 or TONBBF2
BO –Burn Other (QPWS/Wildfire/ Pastoralist) IF you are sure of the source then use QP/W/P) otherwise just leave as BO	OB – Old Burn if OB then + a number for approximate age in weeks of burn e.g. 2W = burnt 2 weeks ago	TT = Tea Tree	R = Riparian (River)	
		GP = Grassy Plain	SR = Sand Ridge	
		MT = Mixed Tree		
		L = Lagoon		
		G = Gum		

Photographic images were taken at key locations within the study AOI, before, during and after the Elders' burns to document the intimacy, scale and process of burning and other elements of the Elders' ecological knowledge that they would share. Field notes were taken on these trips of conversations, video interviews were conducted, monitoring sites were established. The temperature, dew point, humidity and wind speed and direction were able to be documented in later years when I was able to secure resources for a Kestrel weather meter and compass.

What should be made clear here is that the Elders saw no reason for them to learn how to monitor their burns using western scientific methods. They felt it would be good for their young people to learn. The Elders' inquiry and evaluation was watching and reading the response in their country while practicing their cultural knowledge on country. In 2006, I showed Dr George his country on Google Earth at my house, his response was that it was "good for me and good for young people, I see my country" (field notes 2006). Throughout the life of the research project training opportunities in western scientific methods was provided to younger descendants of the Elders. In 2017, these now older descendants have asked that I train them often in these monitoring methods so they can be increasingly implemented across Kuku Thaypan country. What is also important to understand is that this site based western approach to data collection is not sufficient on its own to monitor changes in the landscape that result from the practice of traditional cultural knowledge. Documentation and monitoring of the knowledge map elements as described in Chapters 6 and 7 along with seasonal calendars, drawing out of core benefits such as to health, community cohesion, social welfare, alongside western science 'empirical' data collection can provide tools to monitor cultural fire and its practice by Indigenous people in the landscape.

R is for Respectful research

Protocol: Recognising different ways of knowing what it is, knowing what it does and knowing how to do it

Western academic research methodologies operate within the bounds of their epistemological and ontological positions and require acknowledgement of previous research when building upon knowledge in the development of new ideas and generating new understandings. There are rules and requirements that exist within different research disciplines that need to be met in order to maintain validity. Different research paradigms understand universal truths that are queried to disprove or reject the null-hypothesis in the generation of new knowledge and understanding of relationships between phenomena. Through my western academic education, I had internalised these processes and ways of understanding and explaining the world. The western research vessel is porous and has the potential to absorb Indigenous knowledge into the dominant paradigm, acknowledging others as the source and hence eroding or evaporating the holders of that knowledge. Paradoxically it also has the ability to sieve through elements of cultural knowledge acknowledging only that which it sees as valuable. As such it is unable to contain some of the elements of country and culture that Indigenous people understand by virtue of who they are. This limitation needs to be accepted as a real limitation (Langton, 1998). Indigenous information is by its nature holistic, complex and owned at various scales, therefore translating this into a series of ‘indicator’ sets is a complex and long-term project that should follow a holistic framework formula ensuring leadership and decision making of Indigenous people in their research and how this should be applied in contemporary environmental management. Unlike a large number of research projects where hypothesis testing is a linear process, undertaking this research dissertation was not.

As the non-Indigenous principal researcher in this project I have through an Elder led on-country embedded process of learning, developed greater understanding and support for an Indigenous world view, through relationships with the Elders and their community which has situated me as part of their family network, including my children. Bringing with it all the responsibilities and commitment required to maintain family relationships and an obligation to bring to fruition the vision of the Elders and their descendants to have their own rangers managing the Morehead and Hahn River complexes from *Thenacull* (Maryvalley) and *Gno Coom* (Saxby) outstation to their Northern boundary of Saltwater *Gno Unta* creek to the boundary at Hahn River crossing with Lama Lama. See Figure 4.5 below the Awu Laya traditional land management ranger logo.

Figure 4.5 Awu Laya Traditional Land Management logo

Source: Field data 2004

The requirement to develop clear KTFMRP research project goals together to review and communicate changes, and understand different ways of relating necessitated a process of constant dialogue with my Indigenous co-researchers and the development of external support systems for myself as the non-Indigenous collaborator. This is because my role has had multiple levels of connectedness both as insider and outsider in the research process and this shifted over the years as I learnt how to research with my co-researchers. Support systems and constant dialogue are necessary to ensure a process of professional reflection in action (Schon, 1991). Ultimately, the non-Indigenous principal researcher is accountable to the community as a member with different sets of roles and responsibilities, status and position to that of a researcher employing outsider research methods that can silence Indigenous voices and often escape accountability. Conducting the type of research approach outlined requires the researcher to live with their processes and findings which can unsettle beliefs, values, relationships and knowledge (Smith, 2012). As a result, ethics approval is an ongoing process.

The role of the principal researcher in the thesis dissertation was not singular; as a co-generative action researcher, I worked closely with the Elders in the field, accompanying them on field trips, recording and monitoring their fire management on country using western research methods to help describe the TKRP and the KTFMRP as a tool for bringing TEK of fire and biodiversity into western research management and practice. I also played a role supporting the Elders' KTFMRP working with other partners to secure resources, develop communication materials from research data and form partnerships that assisted the Elders to be able to demonstrate and record their knowledge, undertake their fire management research and educate and train others.

The Elders and Steffensen are primary knowledge holders of the TCFK presented in this thesis and should be acknowledged as co-authors. However, this would challenge the western notion of knowledge and how ownership of knowledge is managed, including the need to provide a unique contribution to the field from a single mind in order to achieve doctorate level recognition in academic discourse. However, once reaching post doctorate level of academic study it is expected that researchers demonstrate the knowledge and skills to collaborate ethically and effectively with multiple research partners to increase investment to and outcomes from research, this includes Indigenous research partners. As highlighted this research was necessarily Indigenous led from its inception. The action research process over time has enabled articulation of the diversity of each of the research methodologies, the roles and responsibilities that each carried with them in cogenerating actions towards the shared purpose of empowering of Indigenous people in fire management practice across Australia and ensuring the application of traditional cultural knowledge of fire by Indigenous people alongside western fire management knowledge systems.

Knowing what respectful research involves is central to being able to conduct it. Respectful research practice with the Elders in undertaking this research meant learning to understand the following:

Roles

TCK of fire is defined by the responsibility that you carry with regards to knowledge, your bloodlines and your practice of knowledge. Not everyone has the same role or the same knowledge, however each role is valued. This is not dissimilar to the chain of command on a fire front and the roles that individuals play in understanding and containing the spread of the fire. In the application of fire on the landscape you need to know who is lighting where and how this will influence the overall behaviour of the fire in relation to variables listed in chapter 4.

Responsibility

It was not the desire of the Elders to have their knowledge recognised, but their deep feelings about their obligations to care for the country that weighed upon them and influenced the need to bring western scientific approaches to fire management and research alongside their Indigenous knowledge system. Cultural responsibility to look after country is not negotiable in the Elders' knowledge system. This responsibility is akin to looking after people, just as culture and nature are, people and country are analogous, therefore impacts to country are believed to impact the spirit and health of people (field notes[36]: 2003).

Reciprocity

Reciprocity is inherent in the Elders' knowledge system and somehow in contemporary concepts almost intangible. Very few social transactions contain altruistic behaviour. However, the TCFK system of the Elders through the enlivening of respect give back not only to humans but to plants, animals and country as its health is part of their identity.

[36] Wind story place on Lama lama country and *Undun* mist story of Awu Alaya country

Recognition

Respect is about recognition of who's knowledge it is and who's country, it is about acknowledging when people carry out their role with pride. It is about recognition of knowledge transfer and decisions of Elders to transfer that knowledge and preside on consensus. It is about respect of country and familiarity with it and with each other. It is about respect for the value of the knowledge of young people and what they contribute to the future.

Respect often requires the acknowledgement of an "other's" way of being. Respect interpreted through the lens of the Elders is knowing that there is a difference between respect that is given and respect that is earnt. Their knowledge system also shows respect to country, an example being the calling out to ancestors in language when entering country and sacred areas and the use of human smell to welcome strangers so that spirits of the ancestors who are present in country will not bother them. I never ceased to be amazed by the incredible tenacity of the Elders to deflect disrespect and continue with their way of being. Often disrespect was met with silence or a simple "oh yeah" and a nod. The layers of respect in the Elders' knowledge system also pertain to knowledge of and your relationships in the kinship system.

Risk Management

Well the first thing is that knowledge is safety. And the safest thing you can ever have on country when it comes to fire is knowledge. You can have fire trucks and boots and all the things in the world that protect you from fire, but nothing can protect you more than knowledge (Steffensen, 2018) in (Scolaro, 2018). Risk management was and is a constant process, risks include; risks to loss of knowledge and the right way transfer of knowledge, risk to health of country, risk of ability to maintain and practice culture, risk of not acting, risks of acting. The Elders' assessment of risk includes that which may damage their cultural competency, their ability to manage and protect their knowledge and country. This assessment of risk was and is constant as it is multi-generational, with a governance system designed to mitigate risk. If damage occurs to story places and totemic species on country it is believed that damage will occur to oneself or kin.

E is for Empowered

Knowledge is not static and is passed and acquired through time without sacrificing cultural belief, spirituality, cosmology or ontology

There are significant differences between a bioregional, biodiversity type approach preferred by Western science and the holistic country-based approach preferred by Indigenous people. Many Traditional Owners are wearied of trying to explain difference and context as articulated by David Claude a Northern Kannju man in (Morphy & Smith, 2007) *"we are tired from talking."*

Indigenous traditional cultural fire knowledge is not static. Although its values and knowledge are based in lore and the lore never changes as quoted by Stanley Kalkayorta in Chapter 1 (Steffensen, 2006) it was established in the 'dreaming.' Cultural application of fire is inherently adaptive responding to changes in the environment. The Elders knowledge was embedded in reading country and the knowledge is embedded in country of what it needs to be healthy.

However, a focus of this research was the documentation of the Elders' traditional cultural fire knowledge and as a result the Elders' knowledge map as it relates to traditional cultural fire management was able to be drawn. This is presented in Chapters 6 and 7. Further, an important outcome of the action research process was to develop the capacity to monitor the elements and related cultural practice of fire. The knowledge map components and their elements along with their relationship to the knowledge triangle are presented in table 3.4 below. This research project documented the knowledge map elements as they relate to the Elders' TCFK through the application of the co-generative research practitioner model described in this chapter and the CAMPFIRES methodology, each element of the Elders' TCFK is outlined and described in Chapters 6 and 7, which was also an objective of this research dissertation. They are presented here as it is through the process of co-generative action research together on-country that the components and elements of the Elders' knowledge map are able to be described.

Table 4.5 Components of cultural fire, knowledge map elements and connection to knowledge triangle

Source: Field Data 2016

Knowledge Map components of cultural fire	**Knowledge Map elements**	**Connection to knowledge triangle**	Understanding the three sides to TK to know how to use it as the baseline for applying adaptive management
Wisdom	**Sun**	Knowing what it does/Knowing how it works/Knowing our responsibility	
	Moon	Knowing what it does/Knowing how it works/Knowing our responsibility	
	Stars	Knowing what it does/Knowing how it works/Knowing our responsibility	
	Ceremony	Knowing what it does/Knowing how it works/Knowing our responsibility	
	Spirit	Knowing what it does/Knowing how it works/Knowing our responsibility	
Governance	**Lore**	Knowing what it is/Knowing what to do/Knowing who we are	
	Story	Knowing what it is/Knowing what to do/Knowing who we are	
	Kin	Knowing what it is/Knowing what to do/Knowing who we are	
	Law	Knowing what it is/Knowing what to do/Knowing who we are	
	Clan	Knowing what it is/Knowing what to do/Knowing who we are	
	Language	Knowing what it is/Knowing what to do/Knowing who we are	

Custom	**Medicine**	Knowing what it is/Knowing what to do/Knowing who we are	
	Navigation	Knowing what it is/Knowing what to do/Knowing who we are	
	Gathering	Knowing what it is/Knowing what to do/Knowing who we are	
	Weaponry, tools, craft	Knowing what it is/Knowing what to do/Knowing who we are	
	Hunting	Knowing what it is/Knowing what to do/Knowing who we are	
	Art, Dance and Song	Knowing what it is/Knowing what to do/Knowing who we are	
	Trade and resource sharing routes	Knowing what it is/Knowing what to do/Knowing who we are	
Phenomena	**Fire**	The Knowledge Map and interconnected elements accessed through the Knowledge Triangle	
	Water	Knowing who we are/Knowing our responsibility/Knowing how to do it	
	Dew	Knowing who we are/Knowing our responsibility/Knowing how to do it	
	Mist	Knowing who we are/Knowing our responsibility/Knowing how to do it	
	Rain	Knowing who we are/Knowing our responsibility/Knowing how to do it	
	Smoke	Knowing who we are/Knowing our responsibility/Knowing how to do it	
	Wind	Knowing who we are/Knowing our responsibility/Knowing how to do it	
	Earth	Knowing who we are/Knowing our responsibility/Knowing how to do it	
	Air	Knowing who we are/Knowing our responsibility/Knowing how to do it	
Features	**Grass**	Knowing what it is/Knowing what it does/Knowing how to do it	
	Canopy	Knowing what it is/Knowing what it does/Knowing how to do it	

	Food	Knowing what it is/Knowing what it does/Knowing how to do it	
	Trees	Knowing what it is/Knowing what it does/Knowing how to do it	
	Soil	Knowing what it is/Knowing what it does/Knowing how to do it	
	Ash	Knowing what it is/Knowing what it does/Knowing how to do it	
	Plants	Knowing what it is/Knowing what it does/Knowing how to do it	
	Animals	Knowing what it is/Knowing what it does/Knowing how to do it	
	Inter-relationships	Knowing what it is/Knowing what it does/Knowing how to do it	
Signs	**Indicators**	Knowing what it does/Knowing how it works/Knowing our responsibility	
	Place	Knowing what it does/Knowing how it works/Knowing our responsibility	
	Cycles	Knowing what it does/Knowing how it works/Knowing our responsibility	
	Season	Knowing what it does/Knowing how it works/Knowing our responsibility	
	Timing Assessing and Reading country	Knowing what it does/Knowing how it works/Knowing our responsibility	
Protocol	**Respect**	Knowing what it is/Knowing what to do/Knowing who we are	
	Responsibility	Knowing what it is/Knowing what to do/Knowing who we are	
	Reciprocity	Knowing what it is/Knowing what to do/Knowing who we are	
	Recognition	Knowing what it is/Knowing what to do/Knowing who we are	
	Roles	Knowing what it is/Knowing what to do/Knowing who we are	

Solution Generation

On-Country: Contribute to the oral record and its presence in the landscape - practically apply knowledge and skills

As described, two senior Kuku Thaypan Elders, the late Dr Musgrave and his brother the late Dr George who began recording their knowledge on country with the support Steffensen in 1999. Steffensen began the application of his early interest in Traditional knowledge in 1995 when he *"realised the urgent need to record the invaluable wisdom of the Elders before it was lost. Over many years through love of the arts, film making, culture and environment this has developed into his life's work; re-engaging traditional practices through creative community projects"* (Mulong web site 2016).

The organising systems and methodologies for the Elders' research applied in their Traditional knowledge recording project (TKRP) is described in chapter 9 and the Elders' Kuku Thaypan Fire Management research project (KTFMRP) is described in chapters 6, 7 and 8. The Kuku Thaypan Elders initiated their research project out of concern for fire management practices on their country that result in fires in the landscape that were "at the wrong time, in the wrong place and were too hot" (Standley, Bidwell, George, Steffensen, & Gothe, 2009). The Elders, seeing their country "sick"[37] wanted to demonstrate the benefits of their fire knowledge, practically implementing it to heal country while teaching others and recording it for generations to come.

The KTFMRP was grassroots Indigenous Elder initiated and led action research that combined the inherent adaptive management and action research of their Traditional Cultural Knowledge

[37] Sick refers to seeing the country that did not contain healthy functioning ecosystems. The Kuku Thaypan methodology chapter in this dissertation outlines the characteristics (indicators) of country that were recorded that described the country as being unhealthy.

TCK system with contemporary technology to demonstrate Indigenous research methodology and practice focused on fire management. The inherent adaptive management framework of the Elders' TCK system can be viewed as a culturally, spiritually and country embedded formula for dealing with complex ecological processes and accounts for experience-based decisions and actions actively reflecting on previous management outcomes (Berkes et al., 2000).

For many years the Elders had been involved with assisting environmental management strategies and research projects that were developed and delivered through the dominant Western scientific paradigm. The Elders expressed disenchantment at their countless experiences of Western science attempts to manage and talk for Kuku Thaypan country. These management actions only allowed a small presence of Indigenous TCK, usually referred to *"as a vital component"* to successfully delivering contemporary land management recommendations, but this type of research had not created the opportunity for the approach required to ensure positive cultural, social, economic and environmental outcomes for the entire community (Steffensen, 2004). This 'Indigenous presence' required that the Elders participate as a minor part in western land management paradigms and frameworks preventing them from demonstrating their extensive cultural fire management knowledge.

As indicated, the Kuku Thaypan Elders were demonstrating, recording, transferring and securing their Traditional Knowledge and cultural practice and importantly wanted to re-instate their burning regimes to heal country. As a result of the inherent adaptive management and action research of their TCFK system they were in a process of continual assessment of the prescribed burns and unmanaged fires that occurred on their country. Every year there is an obligation to make sure country is visited and fire implemented in response to the needs the country expressed, now the Elders are gone it is the responsibility of their descendants and knowledge holders to ensure this occurs.

Part of the methodology developed through the TKRP demonstrated through the Elders' KTFMRP was to articulate respectful research practice. This resulted in James Cook University awarding honorary doctorates to Dr Musgrave and Dr George in 2005, see Plate 3.14 below. This process was integral to the thesis research proceeding. It was a negotiated process, required in order for the dissertation research to proceed. This recognition was important as it acknowledged the invaluable contribution that these two Elders had made to cultural education and research throughout their lifetimes (Steffensen, Rigsby, Cole, & Langton, 2004). It also enabled the Elders to be officially listed as co-researchers on this thesis research.

Plate 4.14 Dr George, Steffensen, Peta Standley and Dr Musgrave at awarding of their honorary doctorates in 2005

Source: Field records 2005

Indigenous fire management practices are considered *"central to the formulation of appropriate strategies for the conservation of the nation's biodiversity"* (Bowman, 1998). Participatory research and management is promoted as a means to integrate these practices into mainstream biodiversity conservation (Sillitoe, Dixon, & Barr, 2005). Calheiros, Seidl, and Ferreira (2000), p1., in their study of limnological phenomenon in Brazil, recommend that ecologists recognize that *"local understanding can be greater than that of "others."*

Co-generative engagement over fire management research and practice allowed co-learning from each other and generated new ways of doing science and natural resource management to demonstrate how both knowledge systems can benefit. In Indigenous Australian society, fire is sacred, it is alive and its use governed by complex laws. In a contemporary management context, fire is a multidimensional social ecological system. At its heart, fire management is about interactions between all the elements; country and people. Fire problems in Cape York are socially constructed problems. The emergent Indigenous led action research methodologies and the CAMPFIRES researcher practitioner model described in this dissertation outline the Elders attempt to demonstrate agreed ways of undertaking contemporary research and management practice that readily incorporated a rich body of ancient knowledge.

Indigenous centred research involves Indigenous people as the focus of research but outcomes may not immediately appear to benefit Indigenous people, research methodology, analysis and conclusions tend to utilise western constructs of knowledge.

Indigenous driven research maybe agency funded and maybe directed and delivered by Indigenous people with priorities set by Indigenous people but the research may also be expected to deliver on priorities of "other" knowledges and agencies.

Indigenous-led research to discover or document their own knowledge empowers Indigenous people in the demonstration and management of their own cultural knowledge. Research is

Indigenous-led if it is initiated, designed, directed, delivered and communicated by Indigenous people.

Indigenous-led co-generated research is initiated, designed, directed and implemented by Indigenous people, engages with non-Indigenous research and utilises western science tools directed by Indigenous people.

All of these approaches to engaging with Indigenous people and their knowledge have legitimacy in generating solution to contemporary fire management concerns. However, each also delivers different outcomes.

SPACE for demonstration

Research by (Crowley & Garnett, 1997) demonstrates the importance of building trust and developing inclusive research methods to achieve successful conservation outcomes. However, in 2004 in Australia's northern tropical savannas of Cape York Peninsula, very few western scientific studies or natural resource management projects existed that provided the opportunity for Traditional Owners to demonstrate their TCK on their own terms, as inclusive co-generators that contributed to the development of the project from the beginning and as final decision makers that set priorities for attention. Limited opportunities existed at the initiation of this research project for Traditional owners to undertake their own studies to compile and provide evidence of their knowledge, changed fire regimes on the landscape, vegetation change and associated fauna and flora species decline. Although this has increased over the past decade a lot of Elders were lost before the benefits of their knowledge could be fully realised on country. Today, younger Indigenous people are continuing to connect with country across Australia and strengthening their knowledge through cultural practice and connection with country. The Indigenous led methodology documented through this research project is providing solution to Indigenous communities across the Eastern seaboard and further abroad in supporting the management of country by its traditional custodians.

The Indigenous-led co-generative action research of the Traditional Knowledge Revival Pathways (TKRP), Kuku Thaypan Fire Management Research Project (KTFMRP) and the CAMPFIRES research practitioner model enabled Indigenous knowledge of fire and biodiversity[38] to be implemented on country to reshape the wicked problem associated with contemporary fire management and research practice. Participatory and collaborative processes developed and led by non-Indigenous peoples on their own are inadequate for solving complex environmental, cultural, social and economic sustainability issues facing society. The methodology of the non-Indigenous researcher was informed by the Indigenous led research of the Elders and their TKRP to help, researchers, land managers, policy makers and others "to see and act in the world differently" to recognise and respect cultural resource management that also brings people together to generate new solutions to complex problems, transforming the problem space (Brown et al., 2010).

'The Importance of Campfires' research worked co-generatively (Greenwood & Levin, 2007) with the Elders' KTFMRP to help create a space to produce new frameworks, describe Indigenous led research methodologies, facilitate training and logistics and apply mixed methods to increase understanding of Traditional ecological fire management practices of the Kuku Thaypan Elders in the Laura basin, Cape York Peninsula. It did this to document the value of having Indigenous people implement their knowledge and lead their own research in

[38] There is no distinction between fire and biodiversity in the Elders TCFK they are interconnected. IEK encompasses what western knowledge systems define as biodiversity, however on its own biodiversity does not encompass what is understood within the Elders TCFK system, nature and culture as connected.

order to provide diverse outcomes in current contemporary terrestrial and aquatic resource management.

“The Importance of Campfires” research project was designed to support translation of key principles and indicators of the Elders’ knowledge systems that inform fire management practices using western scientific instruments. It was to do this while ensuring that the TKRP and the KTFMRP were supported in achieving outcomes that the Elders indicated were a priority. In this way, the Traditional ecological fire knowledge holders could be recognised as such and resources enabled to benefit country and community. The Importance of Campfires research process acknowledged the need for conceiving methodologies and frameworks for research and engagement that co-generated opportunities for mutual respect, where different ways of knowing, being and doing were able to come together (Martin, 2003; Smith, 2005, 2007; Stillitoe, 2007). Indigenous ways of knowing, being and doing are unique. This unique knowledge system has much to contribute to a greater understanding of sustainable use of our natural resources (Berkes et al., 2000; Kimmerer, 2002).

The Elders’ knowledge system builds on millennia of situated knowledge on country and ancient cultural practice that has its own ontology, epistemology and methodological tradition based in Lore and cultural practice. Importantly though the Elders recognised the opportunity of being able to articulate the importance of their knowledge in the mainstream epistemological position, it would also provide to them with the capacity to enact their knowledge on country. Just as it had taken six years of study to obtain undergraduate and postgraduate masters qualifications and the immersion of myself in the western academic tradition, undertaking research with the Elders and Steffensen resulted from years of experience gained in attempting to understand another epistemological position in order to assist “others” to see and act in the world differently and ensure that the Elders fire knowledge was acknowledged as their fire knowledge while also enabling diversity to contemporary fire management frameworks and models that are constructs of primarily state driven western fire knowledge systems.

Importantly, as a result of this enduring commitment that demanded that culturally appropriate processes were applied throughout the research, alongside science was able to occur, it is now possible to describe and share elements of the Kuku Thaypan knowledge of fire and cultural indicators for reading of country documented through this Indigenous led co-generative action research project. This knowledge is critically important part in creating healthy landscapes and functioning ecosystems to mitigate impacts from inappropriate fire management, including prescribed and hazard reduction burns and uncontrolled fires. In an Indigenous led project, when co-generation occurs, the ability to truly collaborate takes place. The Elders knowledge and its application is an invaluable contribution to contemporary fire management. Contemporary society need solutions to reduce negative impacts from fire and Indigenous traditional ecological knowledge and its cultural practice and Indigenous led research are critical elements in providing solution to complex fire management concern that exist in Australia and indeed Internationally.

The following chapter examines available western science and an examination of 18 years of fire history mapping for Cape York Peninsula to position the wicked problem of contemporary fire management and the Elders' research project. This examination demonstrates understanding of western fire management research ways of knowing in Cape York Peninsula and situates the Elders' research project in the context of contemporary fire management knowledge and practice.

Chapter 5 Fire in Cape York

This research on traditional and contemporary fire practices in Cape York Peninsula requires and understanding of the environment and currently available data on the occurrence and behaviour of fire in the region.

Cape York Peninsula is remote, the northern most part of Queensland, Australia. Mackey, Nix, and Hitchcock (2001) recognise its outstanding natural values and similarly it is recognised for its enduring cultural values (Sutton, 2011) with significant areas identified for future World Heritage listing (Valentine, 2006). The Cape York region is globally significant as one of the last great Wet/Dry tropical systems in the World (Halpern, 2008). It is often referred to as one of the largest un-spoilt wilderness areas in the World. Although this is partially true, there are many threats faced by the country and the people of this amazing place. It is certainly relatively intact in that it has almost continuous tree cover, and has little development compared with many parts of Australia, but it is not devoid of people or management, as wilderness is commonly understood to mean.

The Wet/Dry monsoon tropics of Australian savanna includes areas of Cape York; savanna systems are particularly prone to high fire frequency, intensity and severity particularly if left unmanaged due to the high seasonal rainfall and resultant accumulation of grassy understorey that acts as a source of fuel as the environment dries out over the year (Gill, Bradstock, & Williams, 2002). Every year large areas of Cape York Peninsula burn at the wrong time, affecting the health and function of the landscape and often places that should be protected from fire burn. The impacts of ongoing poor fire management in Cape York are not well studied and extrapolation of negative effects of poor fire management impacts on the landscape are mostly made from studies in other parts of Australia and Internationally. The impacts of poor fire management are multiple, affecting the atmosphere, vegetation, fauna, soils, aquatic resources, places of significance and cultural practice. What follows below is an analysis of fire history in Cape York Peninsula from 2000-2016. It must be noted that this analysis and interpretation of satellite imagery is informed by studying with my co-generative researchers on-country from 2005 and learning from the Elders and Steffensen in the field, along with my analytical capacities as a research scientist and natural resource management practitioner.

Cape York Fire History

Climate, seasonal variability and vegetation curing strongly influence fire patterns in Northern Australia. Weather such as rainfall, temperature, wind speed and direction change according to the location, throughout the day and year and across seasons, influencing fire behaviour. Dew point or atmospheric moisture also shifts throughout the day and across seasons and influences fire behaviour and patterns. Soil type and moisture, vegetation type, elevation, time since last burnt—which influences fuel loads—also change how fires behave throughout the day and night, and combined with the characteristics of weather, are all factors contributing to if, and how far, a fire will spread and how hot it will be.

The Wet/Dry monsoon season influences fire behaviour in Cape York Peninsula, but its effect varies from South to North, East to West[39] (The State of Queensland Department of National Parks & Racing, 2012). As the dry season escalates and vegetation cures prior to the onset of the Monsoon season, fire risk increases. At that time of year, anthropogenic causes of fire and frequency of cloud to ground lightning strikes can result in disastrous outcomes, impacting culture, livelihoods and ecosystem function. As the season dries out, several thousands of square kilometres can burn, often extremely hot. Although it is well understood that the majority of fires in Northern Australia are grass fires (Crowley, 1995; Gill, 1999), it is less understood that fires at this time of year have a huge impact on the canopy of vegetation,

[39] Steffensen (2010), Northern Kaanju Traditional owner (2010) pers com de-identified

thereby having flow-on influences for the entire ecosystem (Musgrave, George, Steffensen, and Standley field records 2005). For example, canopy scorch and burn result in flowers being destroyed, thereby impacting on successive seed production and nectar and pollen availability for insects, causing flow-on impacts on insectivorous bird species and nectar eating species such as small marsupials, mammals and bats. Canopy scorch and burn causes excessive leaf drop, impacting on vital habitat and food resources for a myriad of species. Excessive leaf drop impacts transpiration rates of vegetation, transpiration assists to regulate climate. Loss of the canopy causes increased heat to the ground increasing soil temperature affecting germination and shifting carbon flux in the system (Beringer et al., 2003) and influences competition between recruiting species (Crowley & Garnett, 1998). Excessive leaf drop also inhibits species recruitment following a fire, smothering grasses and increasing bare ground in following seasons, and depending on the rate of decay can increase fuel loads for the current or following fire season.

Fires at any time of the year, even in the Early Dry Season (EDS) can result in similar effects depending on the multitude of variables that influence fire behaviour described earlier. Early Dry Season fires do not necessarily equate to lower fire intensity. Early season fires that behave in the same way as a later season wildfire may result in long periods of bare-ground and negative feedback loops on vegetation structure. This is particularly the case if grazing pressure from cattle cannot be managed because this combines with grazing pressure from native species, influencing species composition post fire events and can increase bare ground for much longer periods of the year. Late season wildfires often result in larger areas of bare ground prior to the onset of the monsoon season, both situations can increase potential for erosion and sediment movement, decreasing water quality.

Every year large areas of Cape York Peninsula burn often through uncontrolled wildfire in the late dry and storm seasons with little burning carried out throughout the early dry season. As outlined in Figure 5.1 below, up to a total of eight million ha can burn annually. Up to seventy percent of Cape York can burn hot annually in the late dry season from August until the monsoon Wet Season rains. Map 5.1[40] illustrates the spatial extent of wildfires that have occurred at this time of year over the past 16 years. Every year large areas of Cape York Peninsula burn in the late dry season (LDS) affecting the health and function of the landscape. Many places burn hot that should not and often places that should be protected from fire also burn. Some of these impacts will be discussed below.

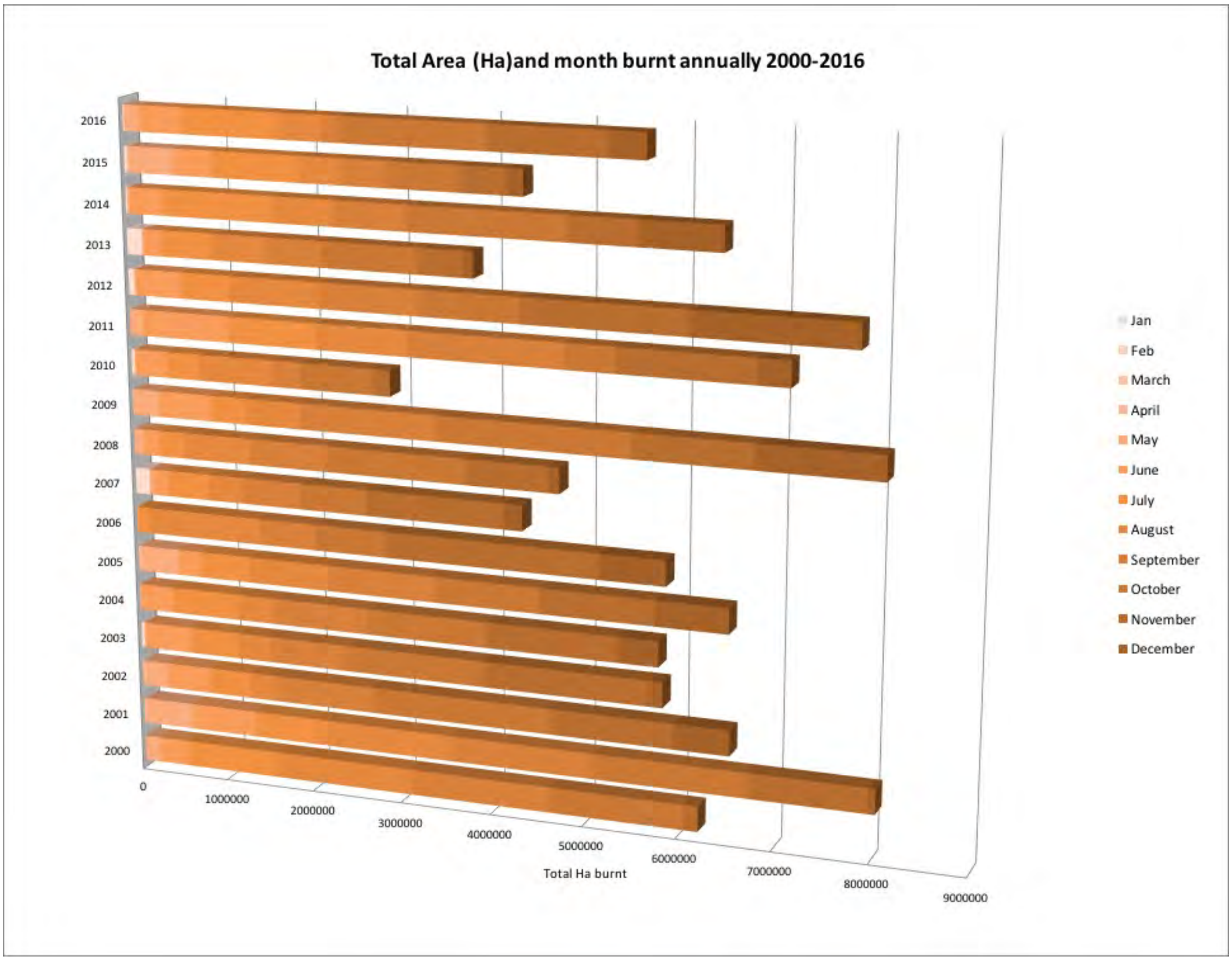


Figure 5.1 Total area and month burnt annually in Cape York Peninsula

Source: Graphed by Peta Standley from NAFI data

[40] For ease of reading, all maps are located at the end of the chapter.

Analysis of fire mapping data derived from satellite imagery highlights that vast areas of Cape York have high fire frequency, with large areas experiencing fires annually for the past 17 years, see Map 5.2 derived from Northern Australia Fire Information site (NAFI) data sets that use MODIS (Moderate Resolution Imaging Spectroradiometer) satellite imagery. Areas that have been burnt repeatedly over the past 16 years include significant watercourses and catchments in the Mitchell, Coleman, Holroyd, Watson, Archer and Wenlock Basins on the West Coast of Cape York and the headwaters of the Olive Pascoe and Lockhart, and wetlands and watercourses of the Stewart and Normanby Basins on the East Coast.

On the East Coast of Cape York there are large areas along the coast line known by people to have been burned, but these burns are not detected by satellite imagery as represented by Map 4.2. There are many reasons why detectability of fires from satellites in this area is an issue; landscape features including the density of the wooded vegetation, the high percentage of cloud and/or smoke cover and the time and line of the satellite pass play a role. The intensity of fires at the time of satellite pass may also influence ability to detect fire scars from MODIS imagery as a weak heat signal resulting from lower intensity fires may make determining a fire more difficult. The size of the fire also plays a role in ability to detect and map a scar. It has been suggested among mapping practitioners that lower intensity burns may not be of a large enough area to be detected; however, land managers report that the fire/s they have implemented are large enough in area to be detected. (pers com[41], pers com[42], pers com[43]).

At the start of this study in 2004 and 2005, fires implemented by the Elders were unable to be detected and were mostly evident when fires occurring later in the year stopped at the edge of the area where the Elders had burned. This was reported to the organisation undertaking the

[41] Conservation area Manager de-identified 2014
[42] Ranger Coordinator de-identified 2016
[43] Grazier de-identified 2014

mapping at the time. Other potential reasons for fire not being detected include the time of year when images are taken because fires closer to the wet season or that receive light winter rain and heavy dews recover with green ground cover quickly following a fire, influencing ease of mapping a fire scar. Detectability is also influenced by the ability of the mapper to distinguish fire scars from naturally occurring soils that look like a fire scar. However, this is not just an issue for the east coast of Cape York with land managers reporting non-detectability of fires that are implemented across other parts of Cape York, including the central and west coasts.

This lack of detectability is important because large areas of the east coast of Cape York that contain fire sensitive vegetation are assumed to not be burning. The East Coast of Cape York Peninsula contains significant areas of diverse rainforest notably the McIlwraith and Iron ranges and Lockerbie scrub at the Tip of Cape York. *"The Rainforest of the Laura Basin and adjacent coastal areas contain rainforest patches that occur in a large number of relatively small areas"* Stanton and Fell (2005*)* p6. Rainforest is understood to be fire sensitive by western science and the Elders Indigenous fire knowledge; however, the way in which fire is used to protect and keep these areas healthy differs. Map 5.3 shows the spatial extent of rainforest in Cape York Peninsula.

The East Coast of Cape York also contains significant areas of heath, wet sclerophyll forest, sandstone and wetlands that require careful fire management. The effect of wildfire on these forest types is long lasting and can negatively impact on the health of these systems for many years. Impacts also include damage to cultural practice as evidence of people on country is destroyed and plants and animals used to maintain culture become increasingly impacted. For example, damage to ancient rock art sites, can be easily understood by many to have obvious impacts to culture; however, what may not be immediately evident, but is equally significant, is the loss of flora and fauna.

Not being able to detect fire in these areas by satellites means that on-ground monitoring and reporting systems by land managers is critical. To understand what is happening regionally requires coordination with an agreed organisation, and agreement to share on-ground data by land managers. Cape York NRM is currently working with land managers to improve report-ability and detectability in this area. The NAFI service is also working constantly to improve mapping. For example, new three hourly hotspot feeds and improvements to resolution of hotspots and an algorithm to reduce the reporting of false positives have been developed. The NAFI service is an invaluable tool in understanding fire behaviour, history and patterns. It is now also an essential tool required to support development, implementation and auditing of savanna fire management and savanna burning carbon abatement methodologies.

For the majority of Cape York there has been little interval between fire events with very few areas experiencing long unburnt periods. Map 5.4 highlights that very few areas of Cape York have experienced long unburnt intervals with many areas burning hot annually. This is important because there is mounting scientific evidence that contemporary fire regimes of frequent intense late season wildfire that tend to be larger in area play a role in species decline (Russell-Smith, Murphy, & Lawes, 2015).

The NAFI fire scar data for the past sixteen years for Cape York presented in Figure 5.2 below highlights that fires begin to increase by May continue to peak in July, then mostly take a steep drop in August and September, increasing again to a peak in October then mostly decreasing again in December and January, except for a few large fire season years that extended well into December. As temperatures increase the potential for higher intensity fires increase, causing them to be larger in area and more severe, leaving little unburnt. These types of fires negatively impact on terrestrial and aquatic ecosystems, limit available food resources and habitat, accelerate erosion and lead to poor water quality at a time of year when water is becoming scarce. This is only relieved by the onset of the monsoon rains, however these types of fires over time dramatically shift the structure and function of systems that are impacted.

Over the past sixteen years, October is the month that has had the largest combined total area of fire scars, see Figure 5.3. October is also one of the driest months of the year with high ambient air temperature and maximum temperatures averaging 30 degrees over the last thirty years as illustrated in Figure 5.4 this is compounded by little average rainfall compared with other months as highlighted in Figure 5.5 below that shows mean rainfall over 30 years. At this time of year, tree species naturally begin to drop their leaves to retain moisture and later shed their bark in preparation for the onset of the wet season and this leads to an increase in fuel loads.

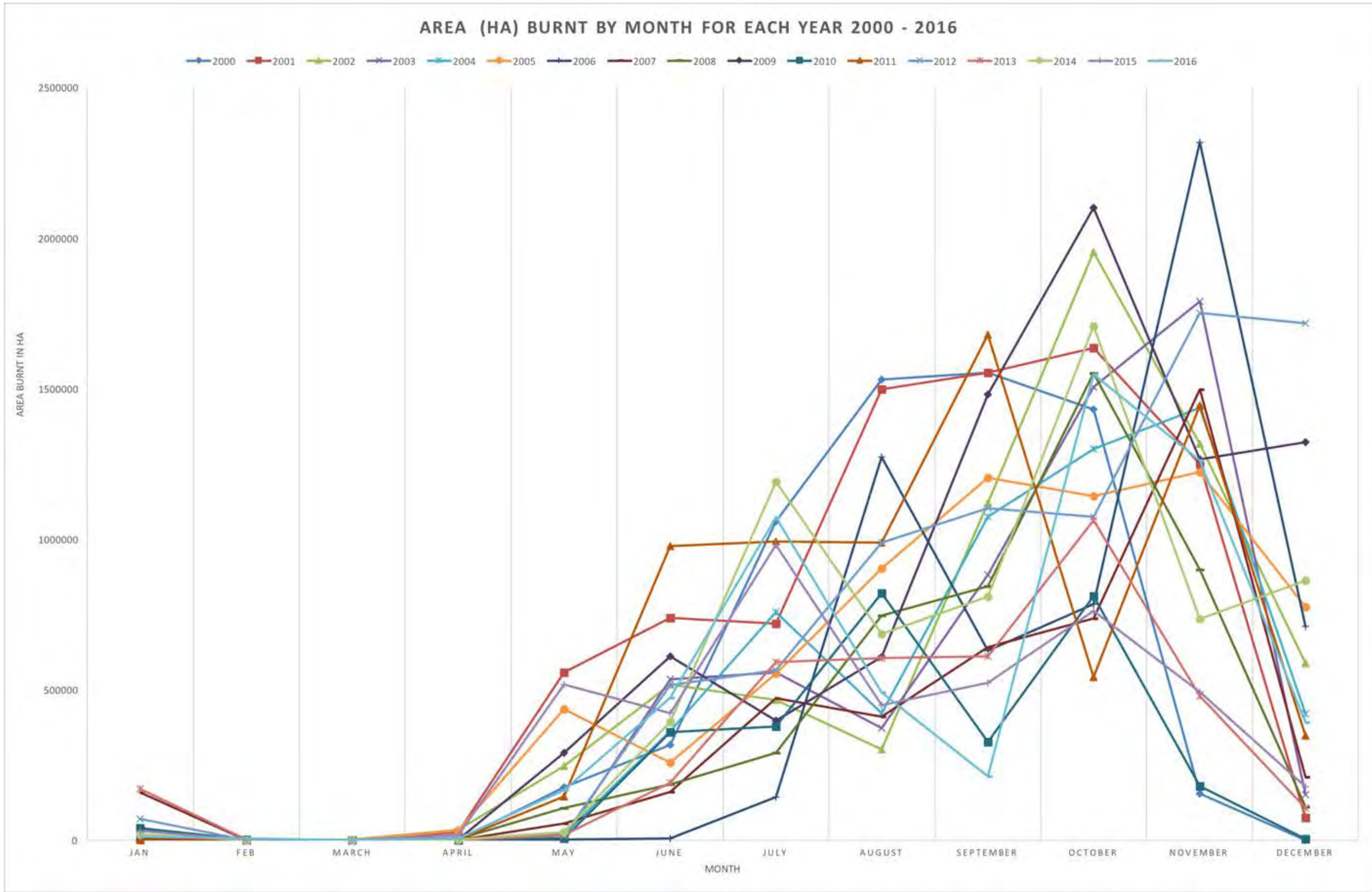


Figure 5.2 Area mapped as burnt by month for each year 2000 – 2016

Source: Graphed by Peta Standley from NAFI data

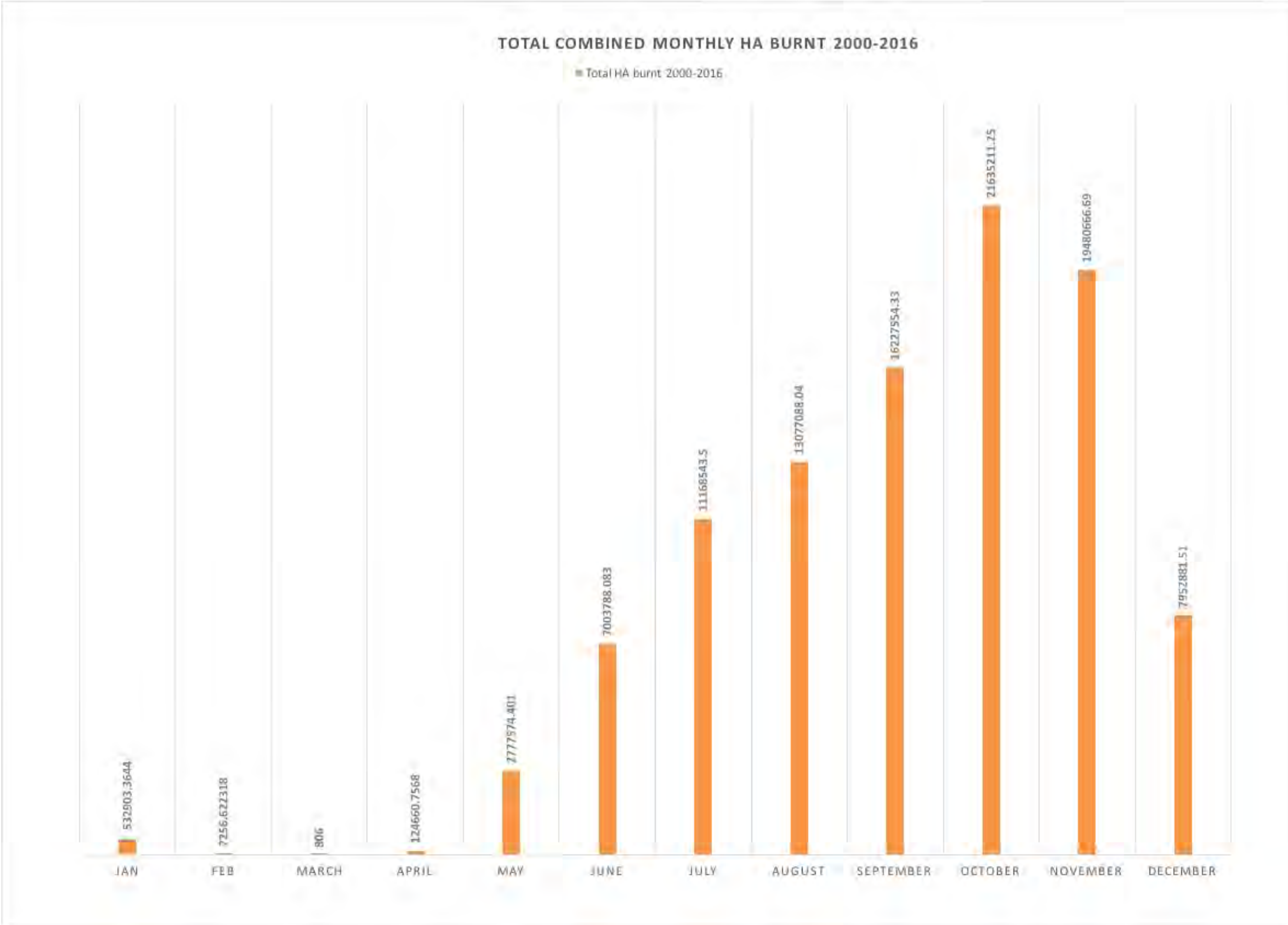


Figure 5.3 Total combined monthly area burnt over 16 years in Cape York

Source: Graphed by Peta Standley from NAFI data

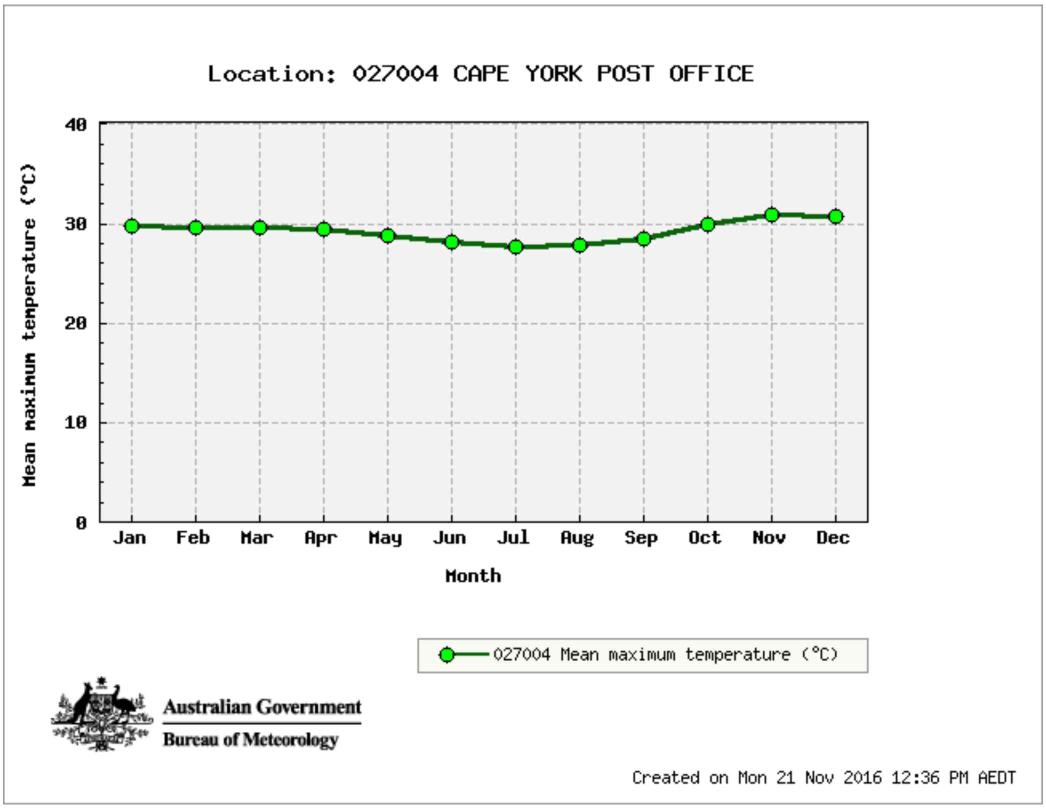


Figure 5.4 Mean maximum temperature at Cape York Post Office 1941 – 1970

Source: Bureau of Meteorology accessed 21 November 2016
http://www.bom.gov.au/climate/averages/tables/cw_027004.shtml

Although early dry season (EDS) burning is carried out, it is often insufficient to create the breaks required to stop late season wildfire, and areas that have been burnt in the early dry season may re-burn due to the intensity of late season fire fronts; a combination of curing, fuel loads and weather conditions. Map 5.5 shows the spatial extent of early dry season burning January to July from 2000 – 2016.

As stated earlier many areas of Cape York have burnt annually for the last sixteen years. For the vegetation types where the majority of this burning is occurring, The State of Queensland Department of National Parks and Racing (2012) planned burn guidelines recommended fire frequency every 3-6 years in the early dry or storm season as outlined in Map 5.6. The reality is vastly different from the prescription. Generally, fires that occur later in the dry season are more intense as the vegetation has cured as a result of the decreasing rainfall, the drying effects of the south-east trade winds and increasing temperatures following the cooler winter months; the vegetation continues to get drier and temperatures increase until the “build-up” to the wet season period begins generally around October, November and December. At this time, there is an increase in lightening frequency that is variable across Cape York as indicated in Map 5.7. Lightening can ignite fires as fire risk progressively increases until the onset of the Monsoon. Fire risk also increases at this time of year as a result of anthropogenic effects such as arson, rubbish, hunting or from escaped planned burns. Fires can continue to burn until the onset of the monsoon wet season which can start as early as October on average in December and as in the recent, 2014-15 and 2015-16 years, it has been a delayed until as late as February, March and April.

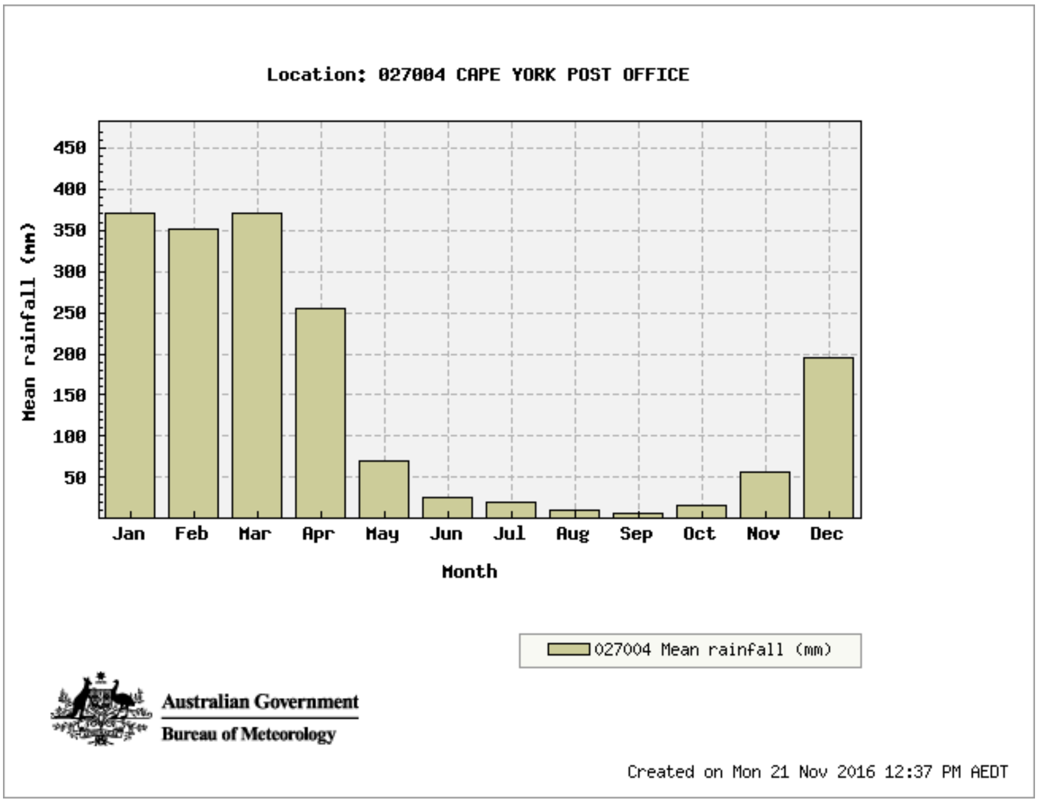


Figure 5.5 Mean rainfall at Cape York Post Office 1940-1970

Source: Bureau of Meteorology accessed 21 November 2016
http://www.bom.gov.au/climate/averages/tables/cw_027004.shtml

Fire, Aquatic Resources and Soils

It is important to understand how landscapes function and how fire interacts with these processes in order to know how to implement appropriate fire management that maintains biodiversity and ecosystem function. Cape York soils are ancient, dating back millions of years (Biggs & Phillip, 1995). There are distinct regolith landforms that provide a complex deposition of soils across the landscape (Pain, Wilford, & Dohrenwend, 1995). Recent advances in mapping these areas enables a much deeper understanding of the distribution of sediments in the landscape, and identifies areas of erosion and land degradation (Wilford, Pain, & Dohrenwend, 1992). LIDAR mapping has been used in the Normanby Basin by Brooks et al. (2013) to measure hillslope erosion rates and assist in understanding the role of gullies in sediment contribution and decreasing water quality in aquatic systems feeding into Princess Charlotte Bay. These data layers can be overlain with bare ground index, fire history and land forms to gain a greater understanding of how fire history may influence sediment movement and nutrient distribution. However, further field work is needed in understanding this complex relationship.

The Cape York Peninsula region contains fourteen IBRA[44] sub-regions with distinct landforms and vegetation communities Sattler and Williams (1999). One hundred and thirteen different soil types have been mapped by Biggs and Phillip (1995). Cape York Peninsula Natural Resource Management (NRM) region contains *13,139,133 Ha* of Wetlands that are identified as nationally significant (Cape York NRM, 2016). Cape York rivers, wetlands, lagoons, and springs provide numerous ecosystem services including habitat, fresh water, and stepping stones for migratory species both aquatic and terrestrial (Preece, van Oosterzee, Dungey,

[44] IBRA is the Interim Biogeographic Regionalisation for Australia. It provides the planning framework for the systematic development of a comprehensive, adequate and representative 'CAR' National Reserve System. IBRA was developed in 1993-94 and is endorsed by all levels of government as a key tool for identifying land for conservation.

Standley, & Preece, 2016). Little is known about Cape York springs in the scientific record as they are poorly mapped and surveyed; although better represented, the same could be said for the wetlands of Cape York. Surveys of these areas often reveal plant and animal species previously not described, not well understood by western science or reveal range extensions of known species. Despite this, rivers, wetlands, lagoons and springs are places of cultural, spiritual and environmental diversity; they are refugia areas during the dry season and seed to the surrounding landscape come the wet season. They are connected to the surrounding landscape and must be protected from disturbance from late season wildfire and intense grazing during the early dry and late dry seasons as these aquatic systems are subject to soil erosion. The wetland and spring aquatic habitats of Cape York are important breeding grounds, migratory pathways and filtration systems that feed rivers and ultimately influence both coastal and marine health of the Gulf of Carpentaria and the Great Barrier Reef. Map 5.8 below overlays fire scar histories for each month from 2000-2014 with wetlands in Cape York. The map clearly highlights that wetlands in Cape York are burning mostly in the late dry season starting in October and accelerating through to December when the wet season rains begin (see Figure 5.5 highlighting mean rainfall for the past 30 years for Cape York). It can be assumed that these fires are also of high intensity and severity as they are large in area, occurring in the hottest months of the year following the driest months that results in an increase in vegetation curing and flammability. See Figure 5.4 for mean maximum temperature for Cape York.

Map 5.8 shows monthly fire patterns from 2000 - 2014 and water bodies and riparian areas of Cape York. Analysis of this map highlights that the majority of wetlands, riparian areas and plateaus that contain significant spring communities have burnt almost annually for the past 14 years in the LDS. This level of fire frequency, extent and intensity prior to the onset of the monsoon wet season has the potential to negatively impact on vegetation health and water quality in a number of ways. Doerr and Shakesby (2006) found that key parameters determining post-fire hydrology in addition to terrain and vegetation characteristics are fire severity and timing and magnitude of rainfall events. Their analysis of the literature found that post fire hydrological responses can be increased by up to two orders of magnitude impacting on sediment and peak discharge particularly in areas with high levels of evapotranspiration prior to fires, as is the case for late dry season fires in Cape York. A study quantifying hillslope runoff and erosion processes before and after a wildfire in steep, wet Eucalypt forest in North East Victoria found that rill erodibility on 27° slopes increased immediately following the fire by a factor of 540 times, they found that high soil K-saturation played a role in preventing rill erodibility in the catchment and that most sediment in infiltration-excess overland flow reaching streams in the catchment was produced from within several metres of the stream edge and that the transported sediment was generated by interrill processes. Of further interest in this study was the importance of large seasonal oscillation in soil water repellence (Sheridan, Lane, & Noske, 2007).

The relationship between bare ground immediately following a fire and the onset of precipitation was found by Son, Kim, and Carlson (2015) to influence instream total nitrogen and total phosphorous concentrations following a wildfire in Colorado. In lab studies, Jiménez-Pinilla et al. (2016) found that relative humidity (RH) and increasing temperatures in burnt soils increased soil water repellency (SWR); this has implications for how moisture is taken into the soil following a fire event and an increase in RH. These conditions are common in Cape York in the lead up to and following storm events. This is significant as in Cape York Peninsula, as previously highlighted, there are high levels of bare ground late in the year as a result of wildfire RH increases in the build-up to the Monsoon period where high volumes of rain can fall in single events, providing conditions suitable to accelerating soil erosion.

As indicated earlier, sandstone escarpments are a significant landform of Cape York Peninsula, feeding aquatic systems to their East and West. These sandstone areas contain unique plants and animals, some of which are fire sensitive, and these areas have been experiencing high fire frequency for the past 16 years. *"Wildfire can lead to considerable hydrological and geomorphological changes… directly weathering bedrock surfaces"*p.1 with deposition from weathering feeding into downstream systems (Shakesby & Doerr, 2006).

Savanna systems are adapted to fire and as a result of the monsoon rainfall, reach peak growth period during the wet season with cover returning relatively quickly compared to southern Australia. However, the intensity and frequency of fire also impacts on the health and structure of understory vegetation influencing recovery and changing species composition and can result in an increase in bare ground in following seasons. It can also influence the way in which vegetation intercepts, and stores rainfall (Shakesby & Doerr, 2006) and how the system undertakes evapotranspiration and nutrient uptake. Low understory vegetation increases potential for overland flow during peak rainfall events and increased sediment and nutrient flow into aquatic systems. Wildfire is also found to influence sediment aggregation and water quality in river basins (Blake, Wallbrink, & Droppo, 2009). In a study of Australia's tropical savannas in the Northern Territory, Townsend and Douglas (2004) found little effects of fire on water quality; however, they attributed this finding to the *"timing of the wildfire and the low intensity relative to fires later in the dry season (September). The retention of canopy cover and the accumulation of leaf litter following the wildfire, and the catchment's gently undulating terrain all contributed to the negligible impact on water quality"* p.1.

Cape York Peninsula contains soils that have the potential for high erosion and sedimentation and naturally experience times of high inundation from the monsoon system, increasing soil movement through overland flow. Cape York is transformed during the wet season with aquatic habitats becoming connected and as waters recede springs, wetlands and lagoons act as natural sediment traps, protecting rivers and coastal systems. However, due to the contemporary impacts highlighted, they are filling up and will eventually cease to provide this ecosystem service, increasing likelihood of future pressures on the Great Barrier Reef and Gulf of Carpentaria.

The Great Barrier Reef outlook report (GBROR) produced by the Great Barrier Reef Marine Park Authority (2014) highlights the significance of connectivity between saltwater and freshwater ecosystems, with 78 GBR marine and estuarine fish species known to use freshwater systems for part of their life cycle—and the number is likely to be higher as our knowledge of how these systems function increases. The GBR outlook report indicates *"aquatic connections between freshwater and marine environments are still functioning largely undisturbed in the Cape York area"* p58. However, land use practice changes, including the increase in banana farming in high risk catchments, the current and latent future impacts from feral and unmanaged cattle, long term gully erosion as a result of past poor management practices, poor placement of fence-lines, tracks and roads and poor fire management practices, all of which impact on water quality. Left without intervention incentives, these environmental impacts will see a deterioration of Cape York marine receiving waters and reef health into the future.

The cumulative impacts on species that require freshwater and saltwater interactions as an important component of their biology are currently not well understood. Freshwater inflow to the Reef and estuaries is an important component of ecosystem function. This is evidenced by the number of freshwater springs that can be found flowing to the ocean on Cape York's east coast. The Wet Tropics region is scientifically understood to deliver freshwater consistently to the GBR throughout the year. However, although Cape York's hydro-ecological systems are identified as containing World Heritage values due to *"high ecological integrity, possessing a diverse and unique array of aquatic, riparian and terrestrial biodiversity, near-natural flow regimes, and relatively intact riverine landscapes*" (Cook, Kennard, Ward, & Pusey, 2011) p.4. Still, little is known of the hydro-ecology of Cape York (Leblanc et al., 2015). Therefore, there is an opportunity to improve our understanding of how relatively intact systems function, and to improve the success of management interventions and system repair into the future.

Despite the lack of detailed western scientific studies in Cape York, it is well understood that perennial flow and seasonal inundation are significant hydrological characteristics of Cape York systems, as described in the Atlas of Groundwater Dependent Ecosystems, State of Queensland Department of Science Information Technology and Innovation (2016), and that they play a key role in retaining diversity of aquifers, springs, rivers and wetlands, and are of particular importance to the health of estuaries and the GBR lagoon in this region. Recent studies in the Wenlock River area highlight the importance of the bauxite layer, which has high infiltration rates that provide re-charge from monsoon season rains to the sandy aquifer that feed the unique springs found in this basin (Leblanc et al., 2015). Through conversations with many traditional owners, visits to their country and areas they have shown me, it is apparent there are areas along the East coast of Cape York where freshwater springs flow onto the beach and into rivers that feed the Great Barrier Reef.

An important component of resource management that affects water quality and protects soils from erosion is the management of vegetation through the application of appropriate fire. The relationship between fire management practices and water quality on Cape York, and in Australia more broadly, are not well understood; however, larger landscape scale, higher intensity fires are known to impact on a range of catchment values (Smith, Cawson, Sheridan, & Lane, 2011). Fire and water are connected at both a global and local scale. Understanding how relatively intact systems function improves our chances at repairing systems that are in a state of decline.

The current eWater Ltd Source Catchments modelling framework for Cape York (McCloskey, Waters, Ellis, & Carroll, 2014) used to calculate sediment, nutrient and herbicide loads entering the GBR does not currently include impacts from late season wildfires as a data layer and, therefore, improved fire management cannot be calculated as contributing to meeting reducing sediment and nutrients reaching the GBR. Not as yet being able to include these data in the modelling and report improvements in Reef report cards means that improved fire management incentives cannot currently be funded from Reef investment to assist landholders to improve fire management.

Fires that are too hot and too frequent can negatively impact on water quality in a number of ways by:

- removing vegetation and changing soils increasing vulnerability to flooding and erosion,
- removing the amount of fine and course woody debris that is present immediately following a fire and can therefore protect soil from erosion and provide a source of organic matter to soil,
- impacting the soil seed bank and below ground microbial activity that is important in enabling woodland plants to fix nitrogen,
- increasing leaf drop from canopy species, this process protects the soil but smothers grass recovery impacting the amount of bare ground the following season,

- increasing leaf drop also reduces trans-evaporation and the nutrient cycle impacting the nitrogen cycle and capacity of vegetation to uptake nutrients following a fire event,
- impacting denitrification and soil health,
- the wettability of soil once rains begin and available moisture for re-generation,
- removal of phosphorous from the soil,
- infilling of wetlands,
- deoxygenating water leading to death of aquatic species,
- smouldering of vegetation in certain wetland complexes.

Interestingly, Stoof et al. (2013) examined the current understanding that as fire intensity increases, so does soil temperature. This understanding is mostly based on laboratory experiments; however, they found that in the field, damage to soils can occur even at low temperatures and that sparsely vegetated areas with < 61.5% vegetation cover experienced higher temperatures than more densely vegetated areas. They found that soil temperatures were higher for north-eastern aspects, fuel loads and intensity of the fire increased where soil was of a greater depth; however, soils that were shallow and degraded had higher soil temperatures immediately following the fire. In the Normanby and Laura basins there are catchments that contain large areas of open woodland and grassy plains and large areas of ancient sodic soils from the Cretaceous and Permian period (Biggs & Phillip, 1995) that are subject to regular late season wildfire followed by monsoon rainfall, significant flood levels and overland flow. Fire can facilitate a multitude of outcomes, having both a positive or negative impact on the nitrogen cycle, soil biota and redistribution of nutrients. For example, Ball and MacKenzie (2010) found a positive correlation between fires, charcoal deposits and an increase in nitrifying organisms that convert soil ammonia to nitrate, usable by plants.

Based on the data and studies discussed, it is evident that an improvement in fire timing, frequency and intensity can potentially contribute to a reduction in sediment, nitrate and phosphorous entering the catchment and ultimately the marine receiving waters of the Great Barrier Reef. Higher intensity fires are more likely to impact the nitrogen cycle of systems, whereby cooler fires generate less carbon, retain organic matter and vegetation close to the burn, are patchy leaving vegetation unburnt and able to take up the increase in available nitrogen immediately following a fire, enabling benefits for soil and vegetation. Severe fires impact the distribution of nutrients in the system across much bigger areas of the landscape (Cook, 1994). The volume and timing of rainfall events following a fire also play a role in determining the amount of sediment, nitrogen and phosphorous entering the aquatic system. Given though that the majority of fire in Cape York is still late season wildfire with high severity that result in opening up large areas of bare ground, it is highly likely that fire management plays a critical role not only in the prevention of gullies forming, but also in generating conditions conducive to erosion through overland flow, deposition in-stream and wetlands following the on-set of the heavy monsoon rainfall.

Frequency, intensity and intervals between fires influence the health and structure of vegetation; the canopy, shrub layer, grass layer and inter-tussock species. Fires that are too hot can destroy the soil seed bank and reduce germination of new tussocks and inter-tussock species or destroy canopy species. Fires that are too severe and too frequent can impact the structure, composition and function of entire vegetation communities and resultant faunal species assemblages. Different ecosystems cure at different rates, as do species within ecosystems. Timing of burns is important in ensuring that it targets native species life cycles and influences management of these species to achieve the desired state for that system.

Fires that are low in intensity leave fine and coarse woody debris, organic matter and ash remaining at the site increasing soil carbon, pH and nutrients. When light precipitation occurs following a fire it can provide the right environment for nutrients to remain on site and the opportunity for uptake of nutrients by remaining vegetation. This is important in nutrient deficient soils such as those across much of Cape York as it assists soil particles to stay together and supports micro-organic activity decreasing erosion potential. Fire can have a profound impact on soil ecosystems, either positive or negative, depending on the type of fire. Fires that are followed by torrential rain can accelerate erosion as a result of increased bare ground. Winter fires generate patchy rain in Northern Australia and dew point is also relatively high providing the right level of moisture to support organic matter remaining after a fire to return to the soil and uptake of the increase in nitrogen that occurs immediately following a fire, by re-sprouting and regenerating vegetation.

Burning to the conditions

Fire management in Australia is polarised by the use of terminology that simplifies our understanding of its inherent complexities. Typically, the good vs bad fire typology is the only one present in western management frameworks such as; hazard reduction (HR), wildfire mitigation (WM) and early dry season (EDS) burning. Although this can help when communicating with audiences that have experienced bad fire to describe a fire as good – it is too simple a construct with which to understand fire behaviour and results.

Hazard reduction burning is important in a fire prone continent particularly given recent increasing wildfire events and changing climate futures—unequivocally espoused by many as necessary and good. Equally, early dry season burning has been shown in a northern Australian context to reduce greenhouse gas emissions and the severity, intensity and scale of uncontrolled late season wildfire. Recognised internationally as an important tool in the carbon economy, the use of EDS fires are also generally regarded as good. The corollary is that late season fire is bad. Wildfire mitigation is necessary for the protection of lives and property and fire in this context is seen by many as good as a tool in fire suppression to prevent fire spread, but bad because of the negative social, cultural, environmental and economic impacts.

These examples typify the good vs bad fire typology and limit our capacity to understand the importance of diverse fire regimes for diverse environments and desired outcomes. Interestingly, the importance of early dry season or winter burning and cool fires emerges from studies of, and increasingly over the last decade, with indigenous peoples. In the *Awu Alaya* fire management knowledge system (see Chapters 6-9), although it is true for most communities, both human and landscape that hot fires are not desired, some plants in vegetation communities were burnt hot to produce a desired outcome but not all of them all of the time, and the surrounding landscape was also managed. Western science recognises that some plant species require hot fires for seed germination. However, in TCFK it is the smoke that it considered the key driver to stimulate seed dehiscence. In contemporary management decision making in the Elders TCFK systems some areas that are long unburnt or have been burnt too hot repeatedly may require an initial modified management practice, such as burning slightly earlier in the season and later in the day until a certain condition is reached. Historical and contemporary accounts of Indigenous Australian fire management clearly show fire was/is used all times of the year for a multiplicity of purposes. The sensitivity and purpose of fire management understood within Indigenous cultural fire knowledge systems can help inform current frameworks implementing and evaluating the impacts of fire in the landscape.

Traditional owners, Indigenous rangers and non-Indigenous land managers in Cape York are making substantial efforts to implement fire management practices using a combination of methods. However, fire management practice is still primarily driven by western management methods despite Indigenous people increasingly involved in implementing them. More investment in building skills in the implementation of fires is still required, and a move towards savanna sequestration projects in the future will result in requirements for lower intensity fires. In order to improve fire management in Cape York and for fire abatement and sequestration projects to be successful, clusters of land managers will need to work together, building both Indigenous and non-Indigenous fire managers that have both cultural and western management fire management skills. In remote areas such as Cape York where there are large tracts of land and few people, this would provide a real solution. At a recent Cape York Fire Forum in 2016, attended by over 100 Cape York land managers, it was identified that there needs to be trained teams of Indigenous and non-Indigenous fire managers applying both knowledge sets to support all land managers across Cape York to implement fire management throughout the fire season. This skilled team would also be available to assist to fight fires in the late fire season Coghlan (2016). However, it was raised that if Indigenous cultural knowledge of fire was also applied more broadly, by people working together then there would be a decrease in the area, frequency and intensity of late season wildfire. There is a need to move away from terminology that links EDS/LDS fire as good/bad to a framework for fire management that reflects co-generated action, understanding the baseline, burning to conditions, desired states and specific outcomes and developing and sharing monitoring tools to assist to inform future actions.

As highlighted earlier, this is particularly true for the East Coast flowing catchments of Cape York. The complex vegetation communities of the East Coast and cloud cover make it difficult to see fires that are occurring in these areas. However, we know from traditional owners (Cape York NRM, 2017) and land managers that areas are burning and are not detected on NAFI mapping. The impacts of fires that are too hot and fires at the wrong time of year for wetlands, springs, rainforest, coastal vine forest, sandstone escarpments and rivers is significant. These areas are important areas for speciation and refugia during the dry season, provide vital stepping stones for migratory animals and are home to unique species representing Australia's evolutionary history. In 2010 the Cape York Peninsula Fire Management Strategy (CYPFMS) developed by Cape York Sustainable Cape York Sustainable Futures (CYSF) (2010) recommended using riparian areas as natural barriers, and highlighted that an analysis of NAFI mapping over the past 12 years indicated that they were “effective in being a natural barrier to fire” p.14. Although they do sometimes provide an effective break to slow fires down or to fight fires from, the CYPFMS cites an Indigenous elder from the Kimberly that their burning was commenced early in the season *“from the edge of rivers and creek beds*” p.8 to support the use of natural water bodies as fire breaks. It is understood through this research project that these areas were burnt away from early in the season to protect them from later, hotter fires. In addition, depending on the vegetation present at the water course of body defines if they are burnt up to or away from. In the Elders TCFK system they were not used as natural fire breaks as the management of soil and nutrients around these areas is important for maintaining water quality for human consumption. This is a significantly different approach from wildfire burning into these systems in the late dry season. As already highlighted heavily wooded vegetation does not easily enable detection of fire via remote sensing. If frequent high intensity and severity fires large in area are able to burn up and into to these areas repeatedly, they experience greater edge effects, changes in structure, species composition and a reduction in diversity and water quality. Examining fire frequency for the East Coast reveals that the sand ridges, open woodlands and grass plains have burnt repeatedly along entire catchments over the past fifteen years, see Map 5.10. and importantly also at the top of catchments also such as the Hahn, Normanby, Stewart and Pascoe rivers. These sandstone escarpments, sand ridges, open woodlands, heathlands and grass plains contain significant springs, wetlands and water courses and soils that are prone to erosion and fire sensitive vegetation communities.

In 1995, although fire management in Cape York was considered to be an important issue, little was known of its regional impact as there was no NAFI mapping, which began following the undertaking of the Cape York Peninsula Land Use Study of Fire on Cape York Peninsula. In this study Crowley (1995) it was thought that there was little impact from Cape York fires on carbon dioxide emissions as this was *“negated through re-absorption through re-growth after fires.”*

Over the past decade, there has been a stronger emphasis on early dry season (EDS) burning across much of Northern Australia, including more recently Cape York. This is as a result of the increase in the development of Savanna burning projects as Cape York people participate in the carbon economy as part of the Australian Governments Emissions Reduction Fund. The Emissions Reduction Fund was established to help achieve Australia's 2020 emissions reduction target of five percent below 2000 levels by 2020. The savanna burning methodology aimed to shift the pattern of late season wildfire in Northern Australia to early dry season to reduce the level of Greenhouse gases being released into the atmosphere. *"This Methodology Determination applies to a project to avoid the emission of methane (CH_4) and nitrous oxide (N_2O) through the use of strategic early dry season fire management across the savannas in Australia that receive more than 1000 mm long-term annual average rainfall"* Australian Australian Government (2012) p.5. Recently in 2015 the Emissions Abatement through Savanna Fire Management Methodology Determination repealed the savanna burning methodology. The *Guide to emissions abatement through savanna fire management method Emissions Reduction Fund (2015)* outlines *where strategic fire management has been implemented within the project area for a period of at least one year, but no more than six years immediately prior to a project starting, the baseline emissions can be estimated as the 10 years preceding the period prior to the start of strategic fire management.*

Map 5.9 identifies the extent of registered Savanna Burning and Savanna Fire Management projects on Cape York and the date of registration. Table 5.1 outlines the project title and the date of registration. Figure 5.6 shows fire history for July from 2000-2016 with an increase in July burning in 2014 and 2015 (see Figure 5.6) that coincides with eighteen of the thirty-four projects currently occurring in Cape York being registered and where strategic fire management could be accounted for in the year of project registration.

Table 5.1 Registered savanna burning projects in Cape York Peninsula and date of registration

Savanna burning project	Date of registration
Piccaninny Plains Carbon Abatement	21/02/2014
Southwell Station	21/07/2014
Artemis Station	26/08/2014
Merluna Station	3/09/2014
Bramwell Station	4/09/2014
Fairlight Station	12/09/2014
Merepah Fire Project	18/09/2014
Drumduff Station	23/09/2014
Highbury Station	23/09/2014
Astrea Station	24/09/2014
Mapoon Carbon Project	14/10/2014
Raak Nguunge	14/10/2014
Holroyd Station	5/11/2014
Strathburn Station	9/12/2014
Yarraden Station	16/12/2014
Olkola Ajin Olkola Fire Project	22/12/2014
Kendall River Station	23/12/2014

Wolverton Station	23/12/2014
Springvale Station	8/01/2015
Investment Ready Project CY Pilot Aurukun	9/01/2015
Oriners & Sefton Savanna Burning Project	22/01/2015
Vanrook Station	30/06/2015
Bamboo Station	1/07/2015
Inkerman Station	1/07/2015
York Downs Station	1/07/2015
Harkness Station	22/07/2015
Stirling Lotus Vale	31/07/2015
Balurga Station	7/08/2015
Watson River Station	7/08/2015
Steve Irwin Wildlife Rsve Savanna Burn Prj	6/10/2015
Batavia Savanna Burning Project	22/10/2015
Mt Mulgrave Savanna Burning Project	22/10/2015
Kimba Station	10/12/2015
Kings Plains, South Endeavour & Alkoomie Stations	11/02/2016

Source: http://www.cleanenergyregulator.gov.au/ERF/project-and-contracts-registers/project-register. Accessed February 2016

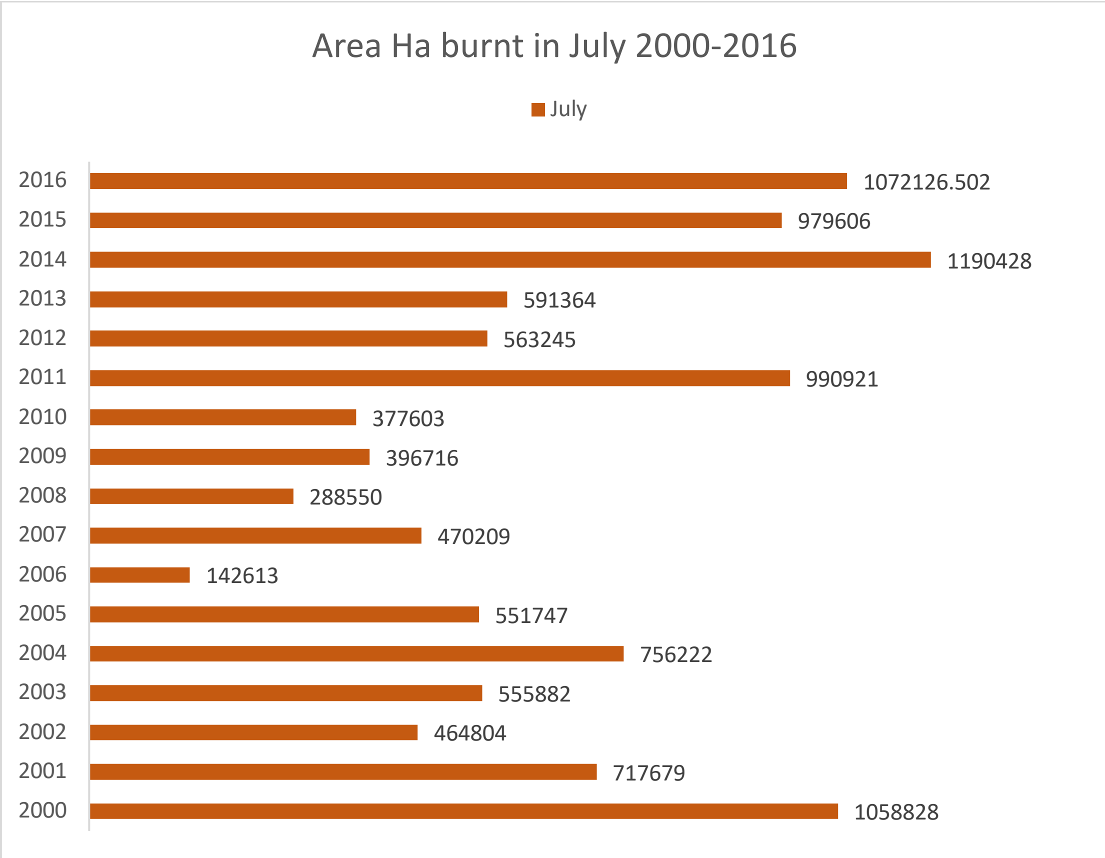


Figure 5.6 July fires occurring in Cape York Peninsula from 2000 to 2016 and hectares burnt

Source: Graphed from NAFI data by Peta Standley February 2017

Figure 5.6 also highlights high total areas of July burning in 2000, 2004 and 2011 that can be co-related to availability of investment to implement early season aerial incendiary burn programs across Cape York (Lawrence, 2013). The increase in early season burning in 2014, 2015 and 2016 in Cape York can be directly co-related to the increase in Savanna fire management and Savanna burning projects. While there is enormous potential in Savanna Burning economies there is also potential for perverse outcomes from Savanna burning and Savanna fire management projects in that fire management becomes homogenised forcing early season burning of large areas of country to meet an artificial 1 August cut-off date for accounting purposes, and the burning of ineligible vegetation communities in executing early season burn programs that may have diffing fire regimes. Operationally, these ‘in-eligible’ vegetation communities are being burnt at the same time to reduce wildfire risk later in the season. Limited on-ground burning occurring prior to implementation of aerial incendiary programs means that fire sensitive areas and cultural sites cannot be well managed, except where these areas are easily accessible or on-ground burning is given priority along with aerial incendiary programs, unfortunately in Cape York in 2017, the opportunity for on-ground burning is still limited.

Widespread early burning using only aerial incendiaries can lead to significant changes in vegetation structure, composition and function just as repeated late season wildfire can. If cattle predation of re-generating species cannot be managed there is the potential to have bare ground for longer periods of time before the on-set of the Monsoon season. Figure 5.7 below presents the NAFI data that was analysed to determine which month the largest total area of Cape York burnt in the EDS and in the LDS over the past sixteen years. It can be seen that July is predominately the month during which the majority of fires have occurred over the past sixteen years and that this has increased since 2013. In 2001, 2002 and 2009 the largest total ha burnt in the EDS occurred in June as shown in Figure 5.7 below. This may have been a result of the occurrence of an earlier than usual dry season. Over the past sixteen years, the month with the highest total area burnt was October. Interestingly, what the Figure highlights is that while the majority of burning is still occurring in the late dry season, the balance is shifting.

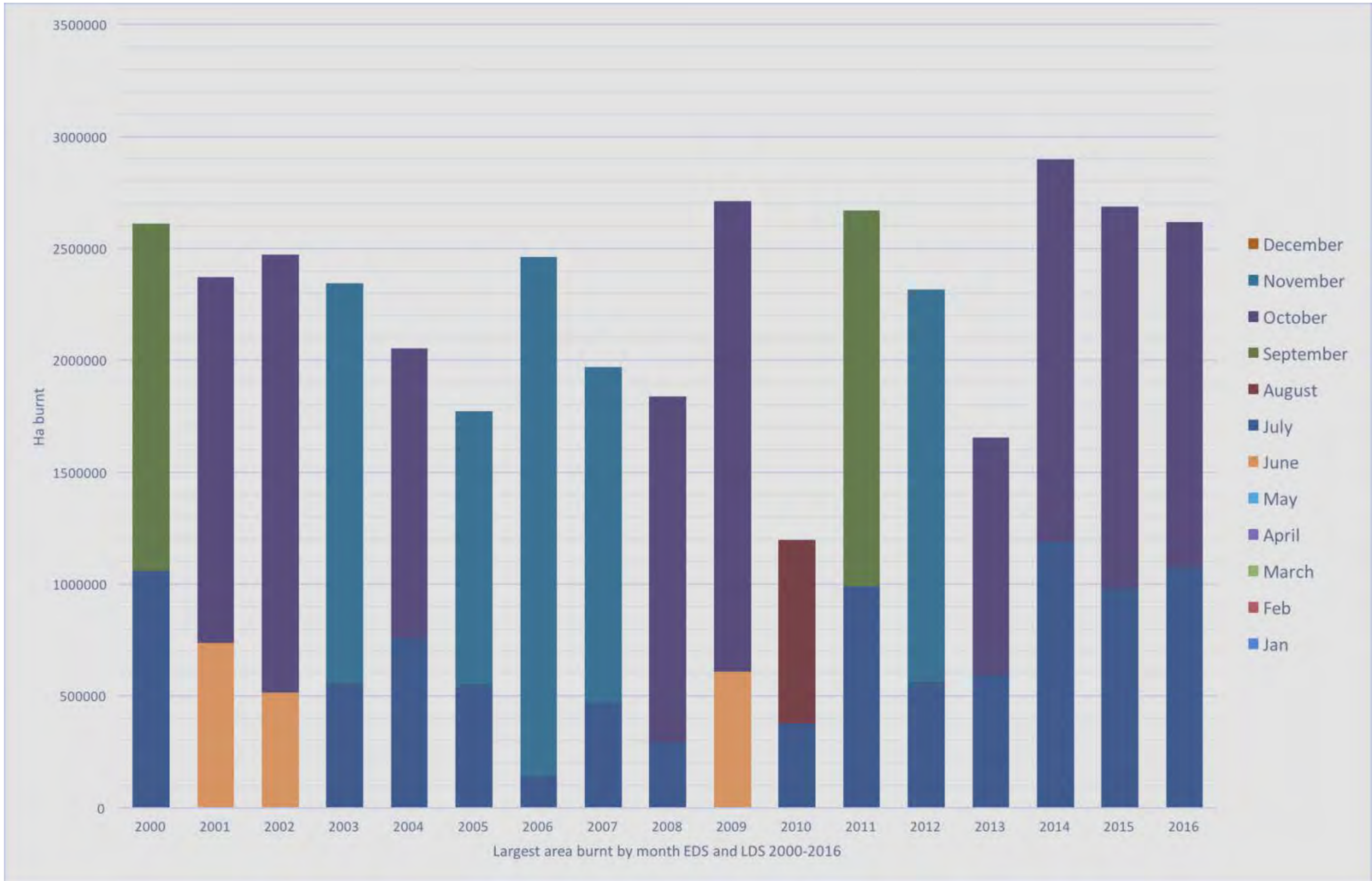


Figure 5.7 Largest area burnt by month in the early dry season and the late dry season 2000-2016

Source: Graphed by Peta Standley from NAFI data

Data for this chapter have been presented along the division for Early Dry Season and Late Dry Season dates as defined by the Savanna Fire Management Methodology and examination of monthly and annual fire statistics. In the fire management methodology EDS is defined as 1 January to 31 July, and LDS as 1 August to 31 December in any given year. Fire statistics for Cape York have previously been grouped by EDS, LDS and Storm Season and more recently, late wet season, EDS, LDS and late wet season fire classifications have been used when mapping fires in Northern Australia as outlined in table 5.2 below. It is important to understand this, as there is a strong relationship between flammability and fire patterns. Annual weather patterns are already variable in northern Australia and this influences landscape curing patterns. There is significant variation between and within biogeographic regions (Crowley, 1995) with regards to ecological considerations necessary to implement appropriate fire management, burning to the conditions in any given season is important to maintain species diversity.

Table 5.2 Varying Fire season classification dates

2000-2012 Fire Season Classification			**2013 – 2015 Standard Fire Season Classification**			**Savanna Fire Management Methodology Classification**		
Month	Duration	Season	Month	Duration	Season	Month	Duration	Season
1 February - 31 July	6 months	Early Dry Season	1 January-29 February	2 months	Late Wet Season	1 January - 31 July	6 months	Early Dry Season
1 August - 16 November	4 months	Late Dry Season	1 March-31 July	5 months	Early Dry Season	1 August - 30 December	6 months	Late Dry Season
17 November-1 January	2 months	Storm Season	1 August-31 October	3 months	Late Dry Season	November - April		Wet Season overlap
			1 Nov- 31 December	2 months	Early Wet Season			

Source: Peta Standley from available mapping from 2000-2015 produced by Cape York Sustainable Futures

Conclusion

The problem space of fire management in Cape York Peninsula described highlights issues central to contemporary fire management practice and illustrates why an alternative approach to managing and communicating fire management practices is important ecologically, socio-culturally and economically. Further, research bodies and management organisations need to assist by calling for the provision of adequate resources that allows for input from Indigenous-led fire management initiatives alongside western management practices —thereby creating increased opportunities for demonstration by and listening and learning from the holders of Indigenous knowledge systems. As stated by Andersen (1992), Bowman (1998), and Crowley and Garnett (2000), Indigenous practices are not well understood by others outside that knowledge system. We propose that what informs and validates management actions within the Indigenous Traditional knowledge system can be best accessed through grassroots Indigenous-led, action orientated co-generative research projects. The opportunity for re-establishment of fire regimes applying Traditional Cultural Knowledge TCK systems, by Traditional owners themselves in areas where it is still ecologically and practically possible must be considered a matter of urgency if we are to increase knowledge capacities and maximise chances to minimise further species decline.

Being able to implement and examine fire from a macro scale such as the methodologies outlined for mapping fire scars and carbon abatement methodologies is important as it provides the capacity to understand fire behaviour and the effect that fire has on the environment from landscape through to global scale as well as attempt to mitigate these effects. As such, it is useful in informing management decisions across these scales. However, contemporary fire management practices and tools have predominantly evolved to respond to the needs of managing uncontrolled fire. This is significantly different to the evolution and application of Indigenous Traditional cultural fire knowledge.

This is evident in the case of the use of aerial incendiary programs where vast tracks of country are burnt from the air as they are now unoccupied by people. These fires are justified as providing significant breaks to late season wildfire. A differing perspective is offered by Chullungun traditional owner David Claudie (2013) in McConchie (2013) "…*the benefit from managing from the ground means you can see, from the air fair enough you can see a big patch, but what actually burns in there on that ground, you can't see that from the air. What actually will be affected or impacted by that fire you got to have people that know the ground and what fuel loads are there and how they will be affected by that fire… "The grass that's the fire starter, patches of grass can be all over the place, before you go and burn it you got to go and identify it, to know what to do"* p. 160.

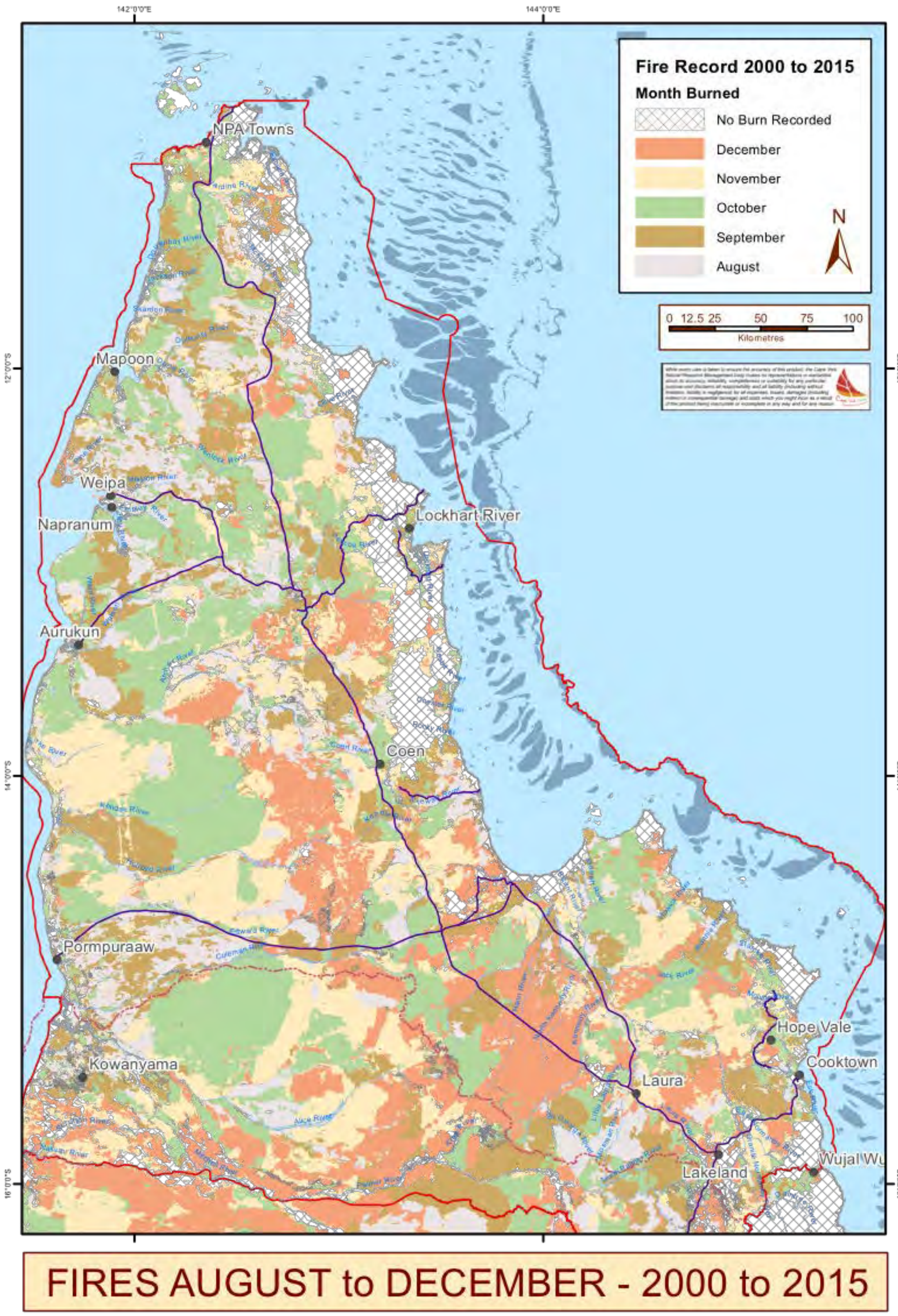
The use of drip torches and linear fire patterns is also common in contemporary fire management practice. These fires often result in linear fire fronts that feed themselves through an increase in ambient air temperature as a result of the heat from combustion this accelerates the intensity, height, speed, combustion rate, size, and severity of the fire. The elliptical fire behaviour pattern typical of hand tendered Kuku Thaypan Traditional Cultural Knowledge burns is implemented by using single ignition points, wind direction and a physical assessment of vegetation and weather cues where the fire will burn back on itself travelling slowly and burning itself out as it travels through the landscape. This type of burning enables the targeting of cured grass within systems over different spatial and temporal periods. Burning in this way is intimately connected to the ecology of all species and their interactions with the biotic and abiotic environment. The result maintains diversity and heterogeneity of the understory within and across systems. It is important to the Elders direct descendants and the people who have been given responsibility to carry and pass on this knowledge within the clan that their fire management is able to be implemented according to cultural protocol and lore. Dwayne Musgrave at a recent meeting with Queensland Parks and Wildlife service about the continuation of the burning program for Morehead River complex within *Rinyirru* and

Maryvalley for 2017 that *"no aerial incendiary program be carried out across the areas of Awu Alaya country that were identified"* (Field data 2017).

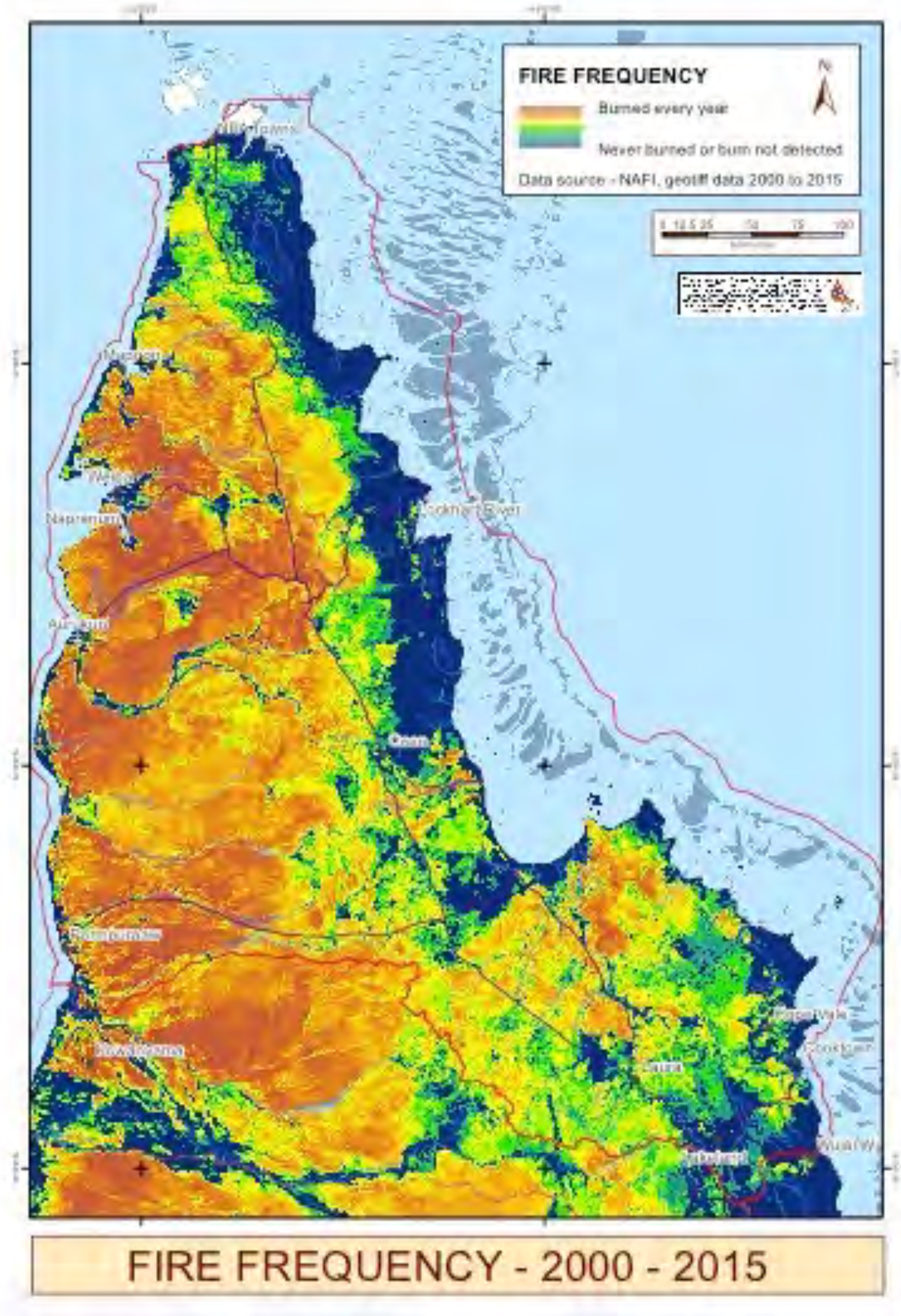
The benefit of bringing western science tools to unite with Indigenous-led practices in the way in which this research process has, is that the knowledge holders were supported to communicate with western land management practitioners and scientists in a language that the dominant cultural paradigm better understands and also finds more difficult to challenge. The methodologies outlined in this co-generative research process were applied to ensure that the Elders as knowledge holders retained responsibility over their cultural knowledge, that they were and are recognised and acknowledged by others that may learn from the sharing of their knowledge and critically that their direct descendants were enabled to continue to implement this practice on their country.

The next chapter examines fire in the project study area of interest during the years leading up to and during the research project from 1999-2010.

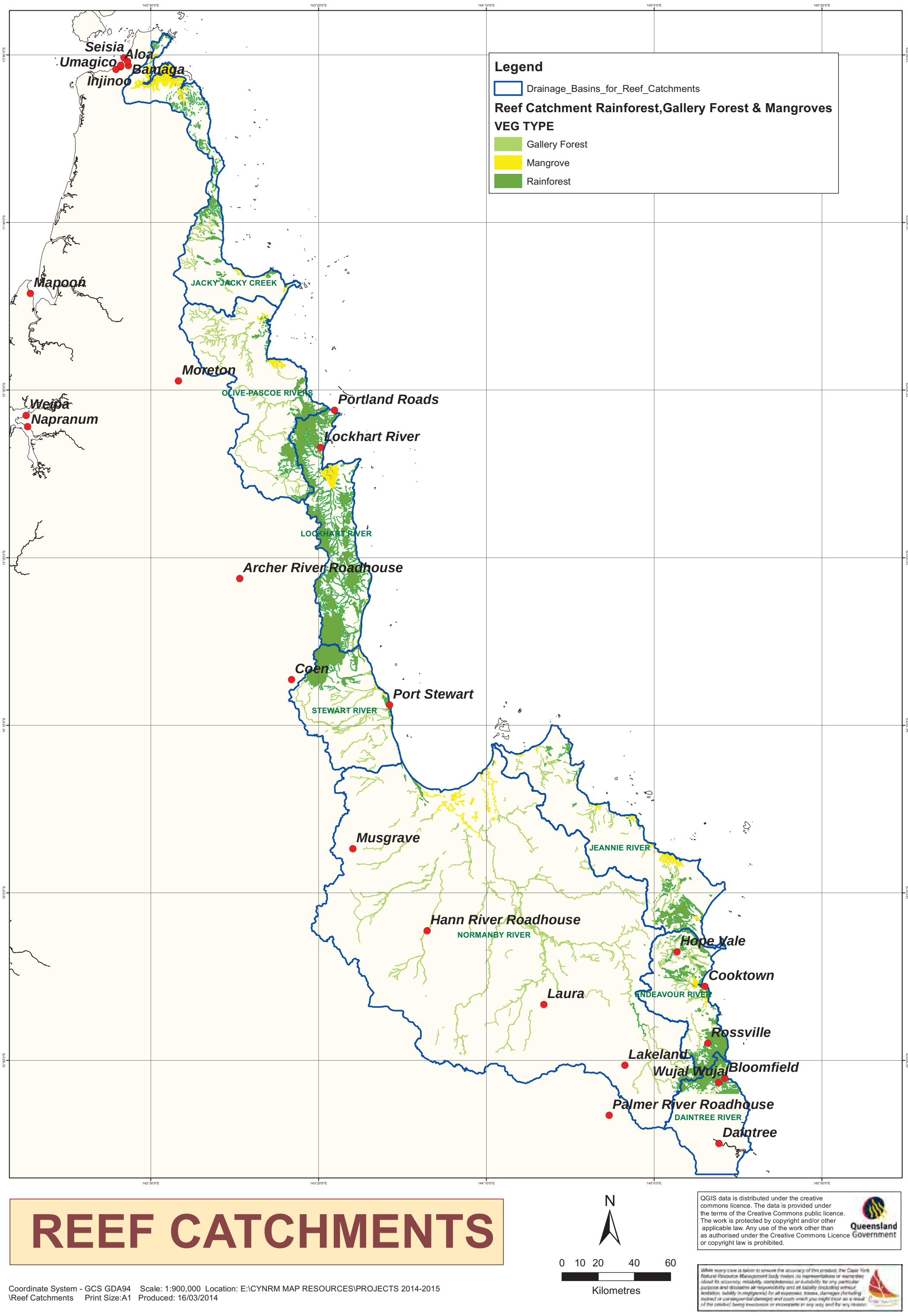
Appendix 5



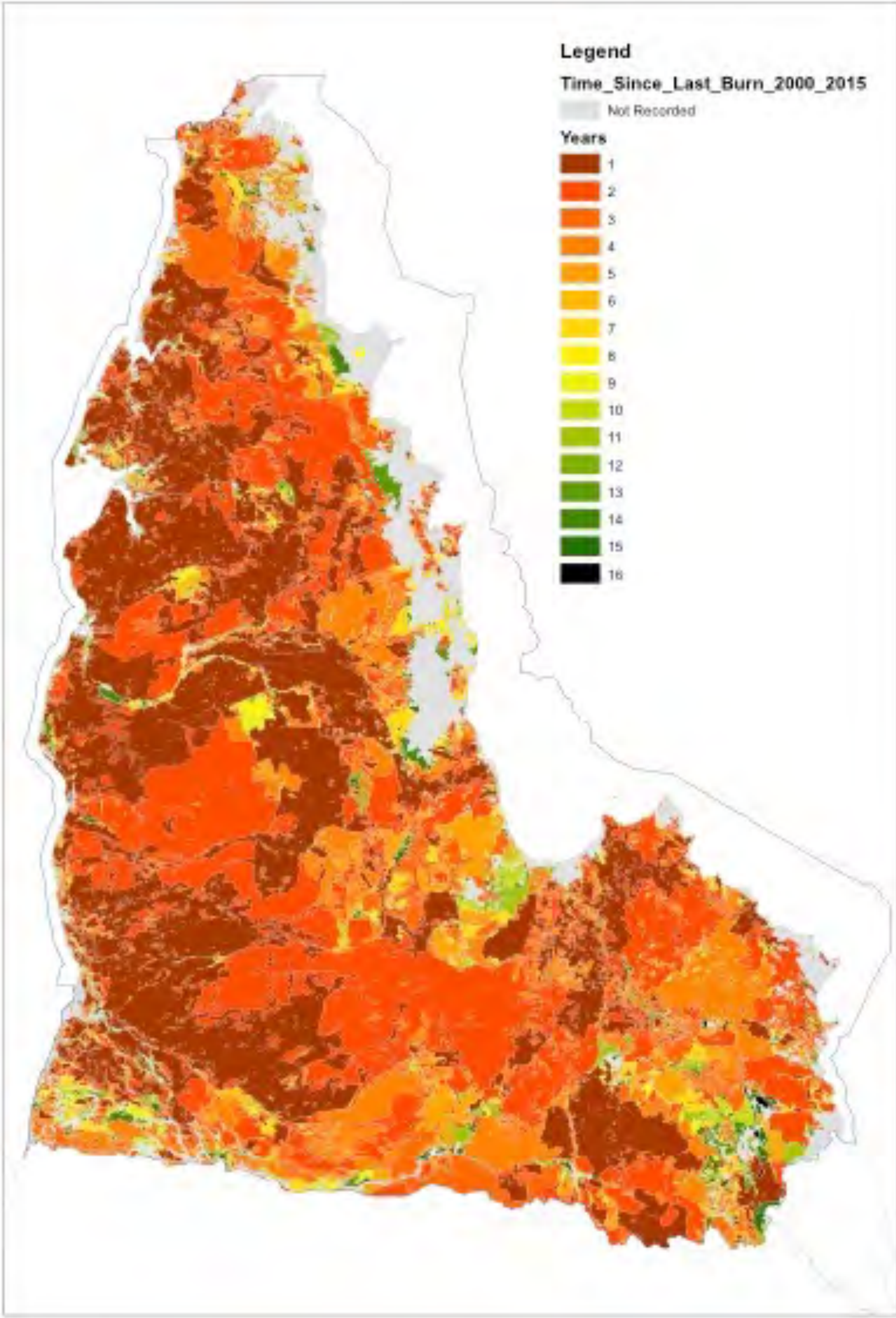
Map 5.1 Spatial extent of LDS wildfires 2000 – 2016
Source: Cape York NRM 2016



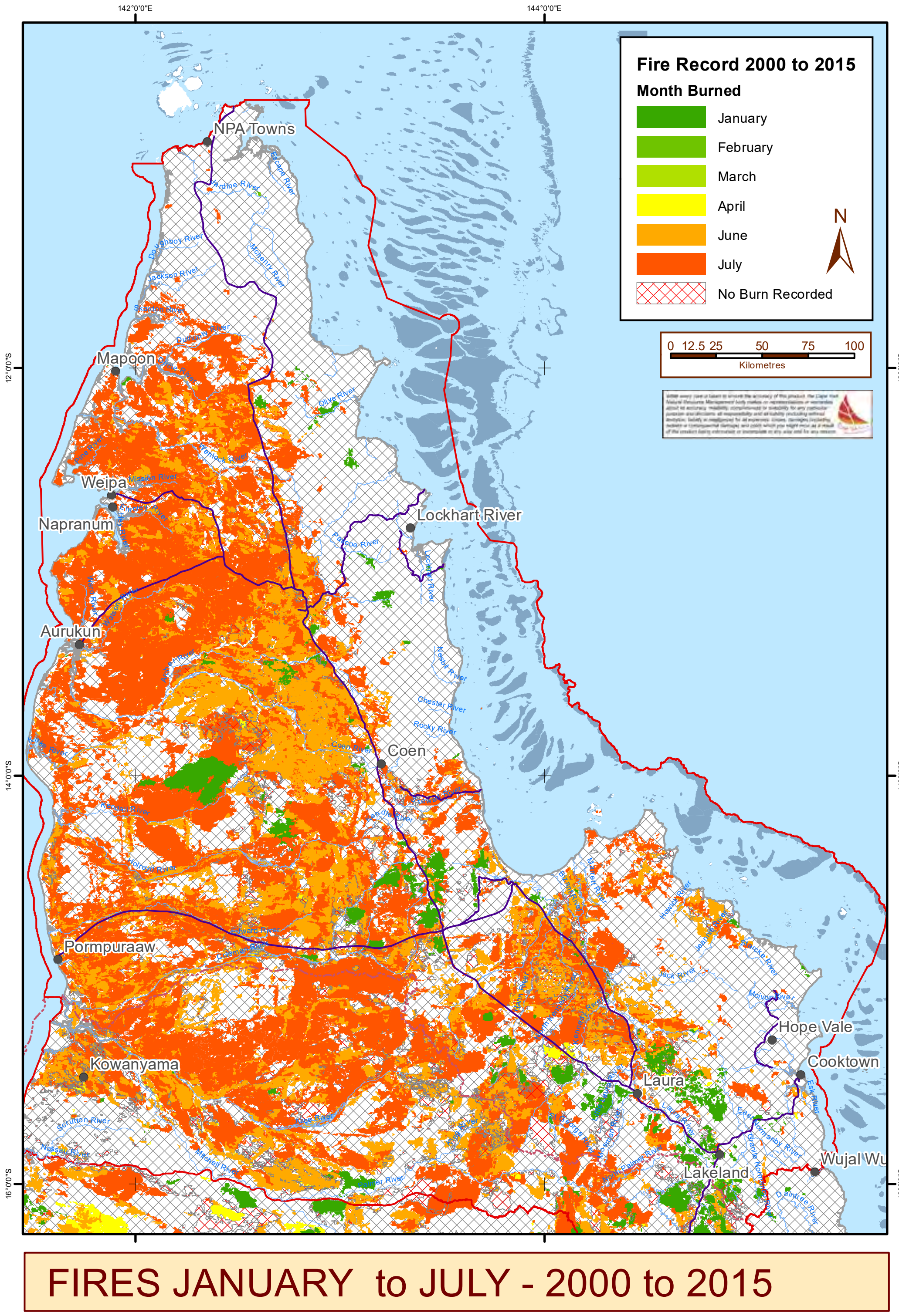
Map 5.2 Frequency of fires occurring in Cape York Peninsula from 2000-2015 shows large areas are frequently burnt.
Source: Cape York NRM 2015



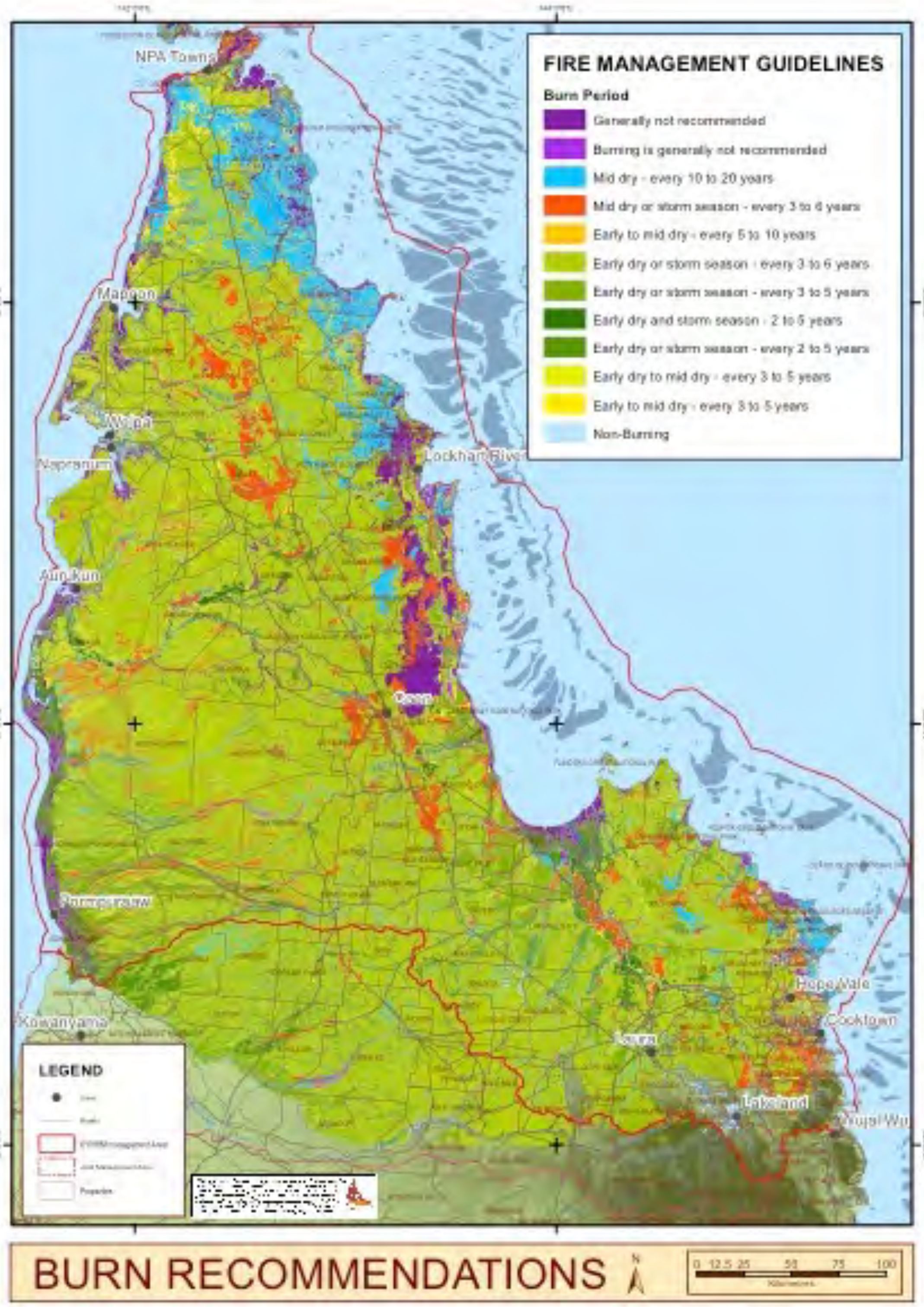
Map 5.3 East Coast Cape York Rainforest, Gallery forest and mangroves
Source: Cape York NRM 2014



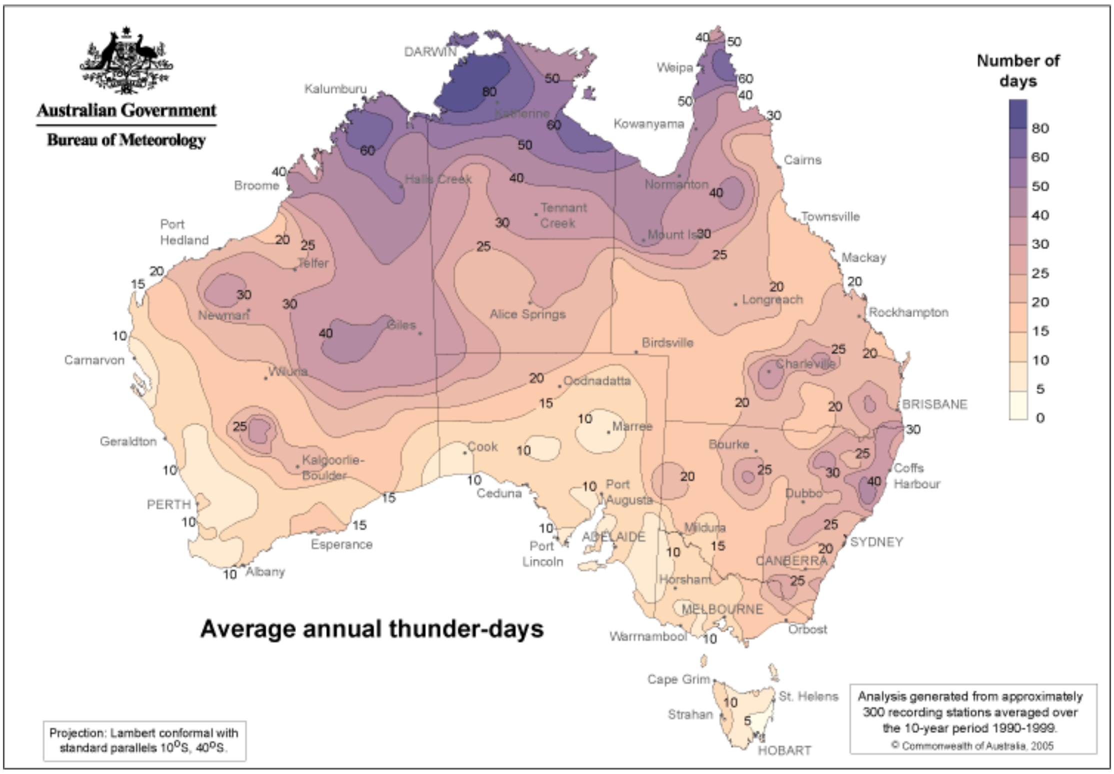
Map 5.4 Time since last burn highlighting little interval between fire
Source: Cape York NRM 2015



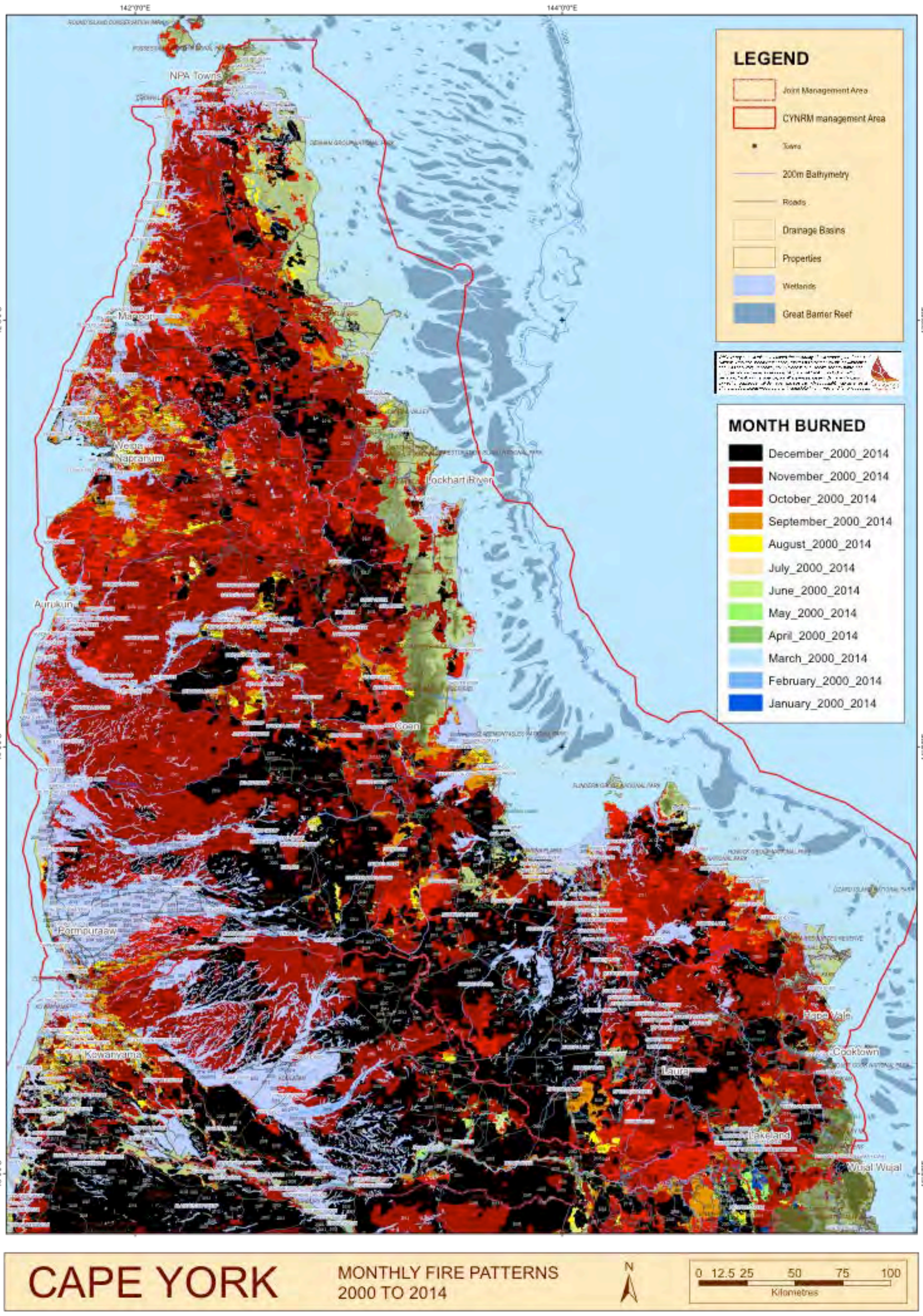
Map 5.5 Spatial extent of EDS wildfires 2000 – 2015
Source: Cape York NRM 2015



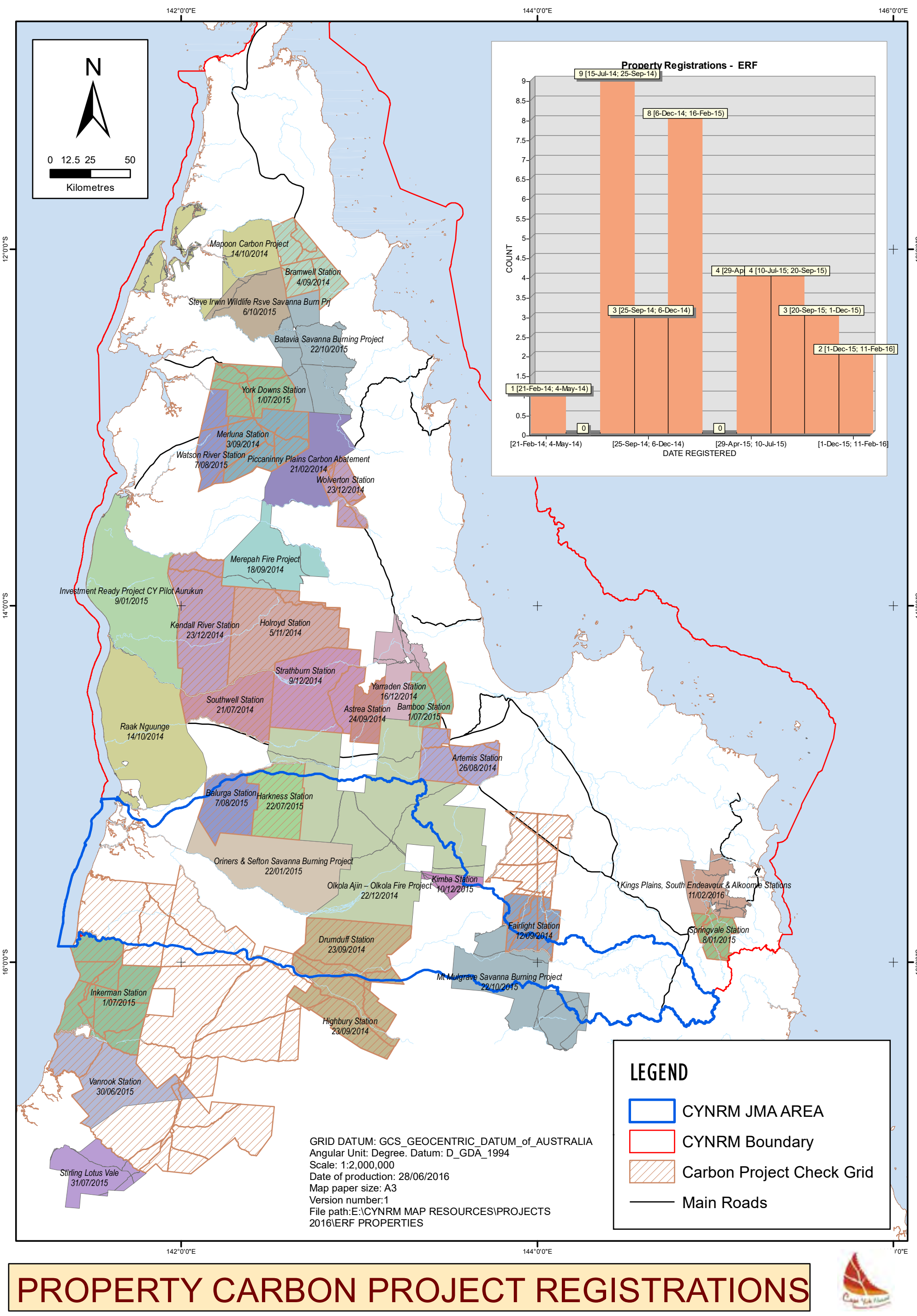
Map 5.6 Fire frequency burn recommendations
Source: Cape York NRM 2015



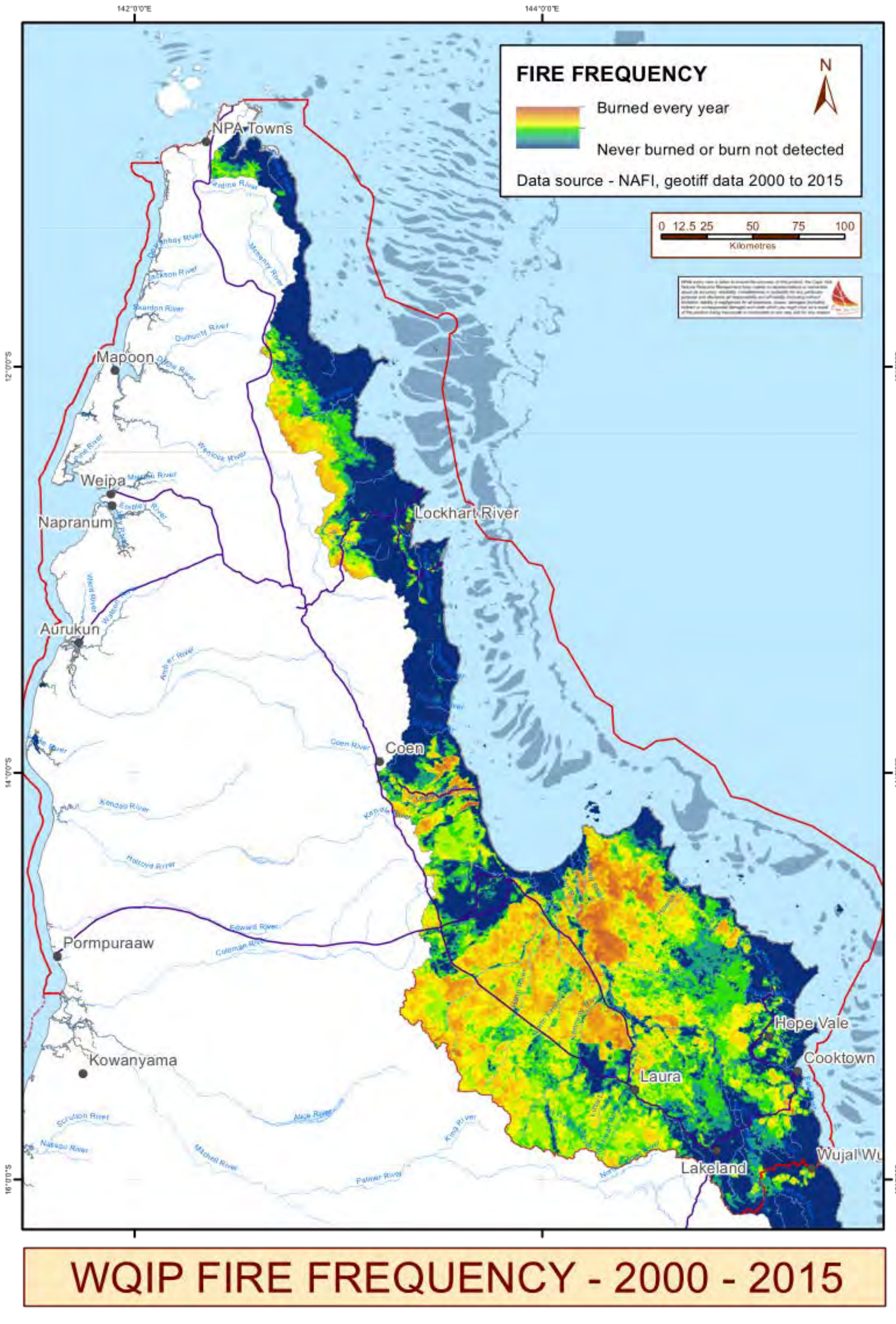
Map 5.7 Annual variation in thunderstorm and lightning activity across Australia
Source:



Map 5.8 Monthly fire patterns highlighting significant late dry season burning of areas immediately adjacent to wetlands, springs and riparian areas and in plateaus and escarpments
Source: Cape York NRM 2014



Map 5.9 Location and date of registration of savanna burning projects in Cape York
Source: Cape York NRM 2016



Map 5.10 Fire frequency 2000-2015 in East flowing catchments feeding marine receiving waters
Source: Cape York NRM 2015

Chapter 6 Understanding the history of fire in Kuku Thaypan country

Introduction

Utilising remote sensing and literature analysis alone restricts our capacity to fully comprehend the benefits of Indigenous cultural knowledge systems of fire and how these can provide multiple benefits to contemporary social, environmental and economic fire management concerns as highlighted in chapter three. Examining the Elders’ TCFK using these methods alone limits our capacity to readily understand the depth and details of the Elders’ traditional cultural fire knowledge system, components of which will be presented in chapters six, seven and eight. Nonetheless remote sensing provides valuable information on fire history as outlined in chapter four. This chapter presents a western science analysis of fire history on Kuku Thaypan country using fire scar mapping data derived from the Northern Australia Fire Information site (NAFI) data sets that use Moderate Resolution Imaging Spectroradiometer (MODIS) satellite imagery and discusses its strengths and limitations in documenting cultural burns. A conservation assessment of the study area of interest in Kuku Thaypan country is presented along with an analysis of contemporary fire history of the field research study area of interest (AOI) from 1999-2010. These were the most active years of the research project on Kuku Thaypan country, although it continues to be burnt every year by Steffensen and direct descendants of the Elders.

The analysis time period includes the years of active implementation of the field research of the Elders’ Kuku Thaypan Fire Management Research Project (KTFMRP) and this research dissertation on Kuku Thaypan country from 2005-2010. In 2010 the field research of this research dissertation ended on Kuku Thaypan country and the efforts of this researcher re-focused to supporting the mentorship of the Indigenous led co-generative action research methodology of the Elders’ KTFMRP, the work of Steffensen and this research dissertation to other Indigenous communities, including to NSW communities through initiatives of the

Firesticks project. This shift was in part driven out of the Black Saturday Bushfires in Southern Australia in 2009, where 173 people lost their lives and the need to communicate more widely the work of the three research projects in order to influence legislative policy and practice to empower Indigenous people in providing the solution of their traditional cultural fire knowledge to contemporary fire management and its research. As such the beginning year of the formalisation of the Indigenous fire workshops and this mentorship, held on Kuku Thaypan country in 2010 is presented as this is an important aspect in the results of this research dissertation.

Interestingly this chapter speaks in the language of the dominant scientific paradigm to support the translation of the Elders concerns that poor fire management practices were impacting on cultural practice, artefacts, sites and the health of country. Further these impacts remain inadequately considered or documented as part of best practice fire management decision making conducted by agencies and authorities responsible for fire management as outlined in chapter two.

Conservation assessment of Kuku Thaypan country

General climate

Kuku Thaypan country has a tropical savanna climate, with a distinct wet season followed by a dry winter. The nearest weather stations within Kuku Thaypan country are at Lakefield National Park and Musgrave. However, Musgrave records are incomplete and Lakefield records not easily accessible. Historical records at Cooktown airport indicate an average annual maximum temperature of 32.3ºC and an average annual minimum of 18.1ºC from 2000 – 2017. Mean maximum monthly temperatures are highlighted in Figure 6.1 (Bureau of Meteorology 2017). Rainfall records via Rainman StreamFlow at Musgrave station show an average annual rainfall over a 30 year period of 752mm, see Figure 6.2. (Standley et al., 2011).

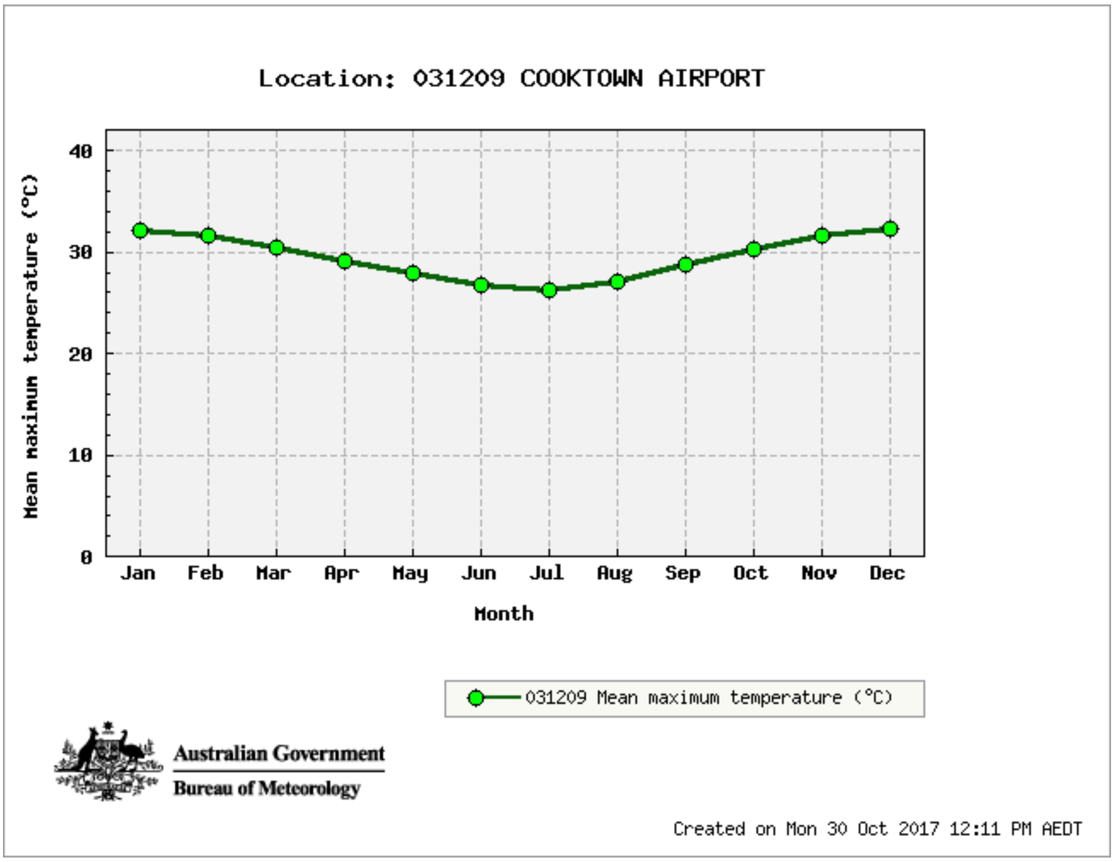


Figure 6.1 Average maximum monthly temperature recorded at Cooktown Airport from 2000 - 2017

Source: Bureau of Meteorology

http://www.bom.gov.au/climate/averages/tables/cw_031209_All.shtml#temperature last accessed 30 October 2017

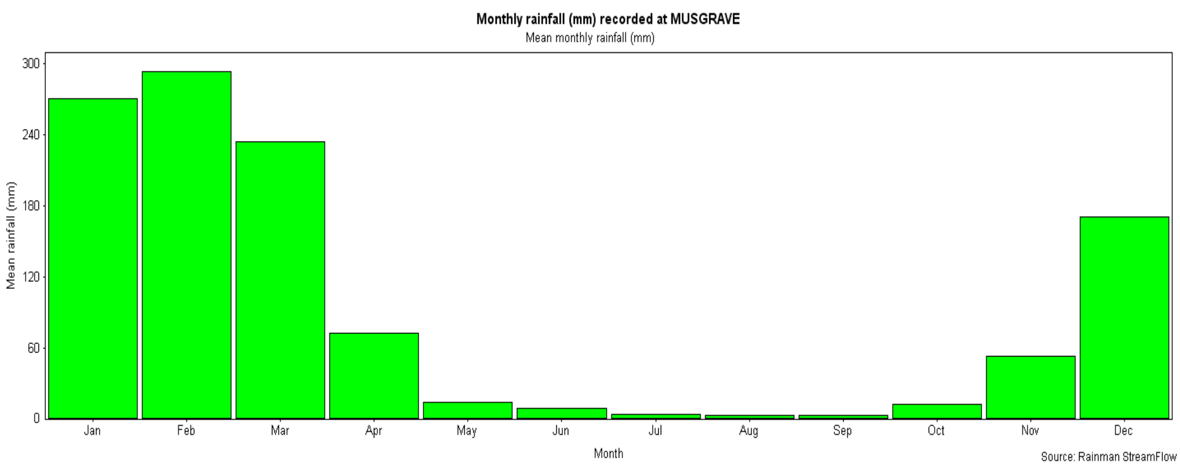


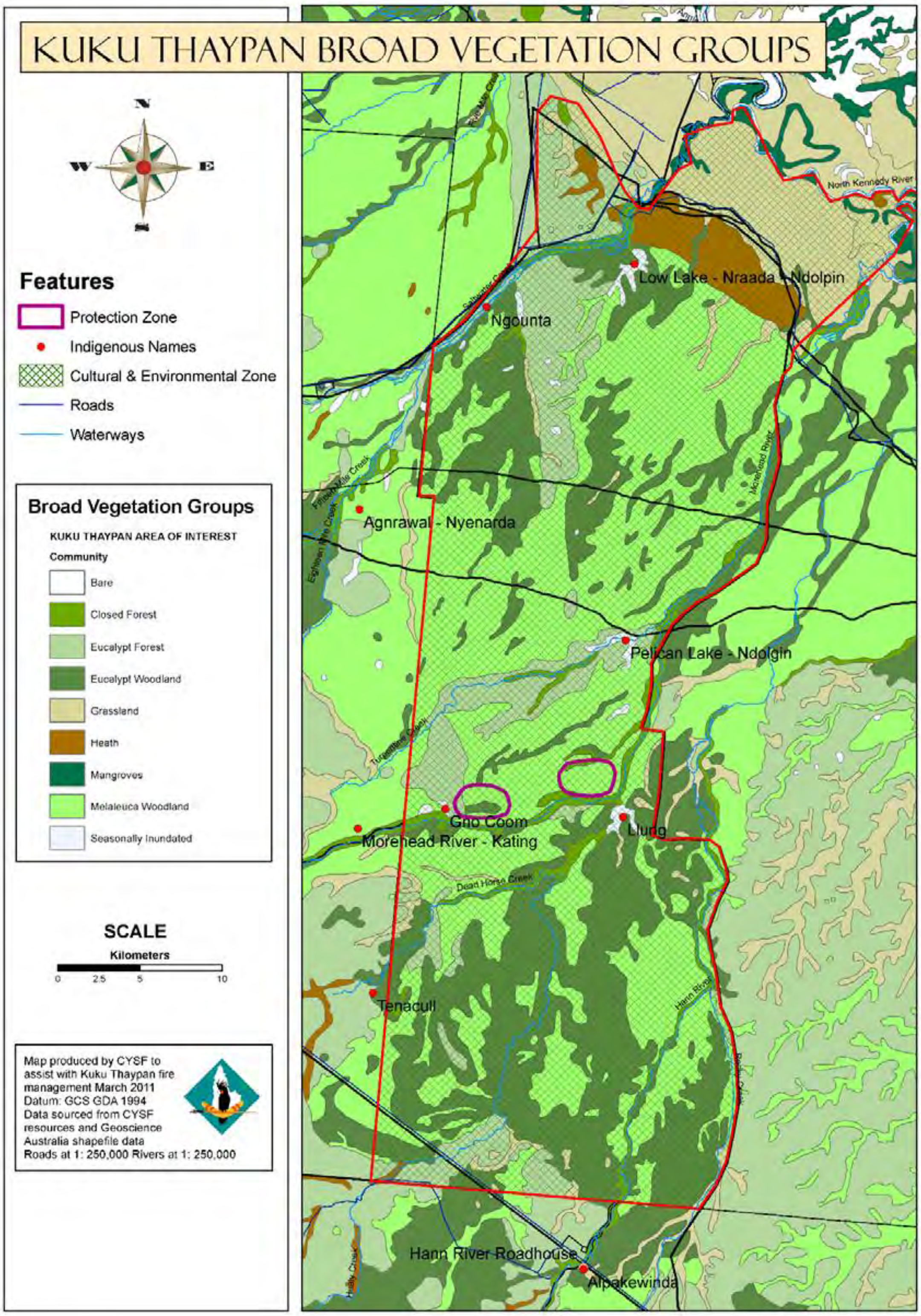
Figure 6.2 Average monthly rainfall recorded at Musgrave

Source: (Standley et al., 2011)

Rain falls mostly in the wet season, which commences in November/December and continues until March/April. It rains reliably at this time of year but the amount of rain varies from year to year. There can be long and extended dry seasons or flooding rains. This seasonal variation influences the pattern of fire each year. A mean rainfall of 1164 mm at Musgrave station with an annual rainfall range between 1000-1400mm (Standley et al., 2011), with an elevation: 0-100m Above Sea Level (Commonwealth of Australia, 2001). During the wet season, this region is one of the cloudiest of the savannas (Savanna CRC 2011) http://www.landmanager.org.au/#sort=sort_title%20asc&nid=521076 last accessed 30 October, 2017.

Vegetation of Kuku Thaypan country

The study area of interest comprises tall *Eucalyptus tetrodonta* woodlands on sandridges, seams of *Corymbia sp*. woodlands with grassy tussock understories infilled by *Melaleuca* woodlands intersected by large and small wetland complexes along the Morehead River and its drainage complex, freshwater springs that seep into rivers, unique rainforest pockets, grassy plains and open *Eucalypt* woodlands and areas of heath where Kuku Thaypan country adjoins Lama Lama country. Broad vegetation groups mapped by Neldner and Clarkson (1995) outlined for the study area of interest in Map 6.1 below show some of the diverse vegetation communities and aquatic systems that feed into Princess Charlotte Bay. These areas provide an abundant array of food and living resources for the Kuku Thaypan people.



Map 6.1 Broad Vegetation groups on Kuku Thaypan country within the study area of interest
Source: Cape York Sustainable Futures (in (Standley et al., 2011)

Species of significance

There are a number of species of significance to western science, vulnerable and endangered flora and fauna species, pests and potential pests recorded in or adjacent to Kuku Thaypan country, see Appendices for Chapter 6, Table 6.2 – Table 6.5. Presented in the appendix for reference and ease of reading. There are over 100 entries on significant cultural faunal species recorded within the database for the Kuku Thaypan Fire Management Research Project (KTFMRP) that rely on diverse fire regimes to ensure optimum breeding biology. Some of these are presented in Table 6.1 below. A more comprehensive summary of species of cultural significance are provided in Chapter 8 as part of the detailed description of the knowledge map elements.

All species are considered important in Kuku Thaypan Traditional ecological knowledge and have a role to play in the ecosystems which they are known to inhabit and/or utilise. They have relationships in story which relate to their characteristics and biology including to each other and place. There are also many notable fauna such as the *Nhye enara* estuarine crocodile (*Crocodylus porosus*), numerous frogs, reptiles, and fish, especially large Barramundi (>50cm) *Nhye wayaeng* and smallBarramundi (<50cm) *Nhye dulka*. Western science recognises that the following endangered and threatened species occur in *Awu Alaya* country including:

- Habitat of *Arrmorral* golden shouldered parrot *Psephotus chrysopterygius*
- Red goshawk *Erythotriorchis radiatus*
- Lakeland downs mouse *Leggadina lakedownensis* and the
- Starfinch *Neochima ruficauda clarescens*

Table 6.1 *Awu Alaya* scientific names of cultural species of significance

Source: KTFMRP recorded by TKRP and The Importance of Campfires

***Awu Alaya* Scientific Name**	**Common name**	**Western Scientific name**
Nhye raeel/Nhye areeba	Emu	*Dromaius novaehollandiae*
Mey Arromi	Wedge tail eagle	*Aquila audax*
Nhye arsteuide	Black headed python	*Aspidites melanocephalus*
Alcaan	Water python	*Liasis fuscus*
Nyge Wann	Magpie goose	*Aspidites melanocephalus*
Nhye geaba	Brolga	*Grus rubicunda*
Nhye chiilpa	Jabiru	*Ephippiorhynchus asiaticus*
Nhye woongara	Burdekin duck	*Tadorna radjah*
Arrsteeyung	Whistling kite	*Haliastur sphenurus*
Nhye arrayl	Brown Falcon/Fire bird	*Falco berigora*
Arrumcom	Black kite	*Milvus migrans*
Arr	Black Cockatoo	*Calyptorhynchus banksii*
Nhye quin	White Cockatoo	*Cacatua alba*
Unknown language name but TEK recorded	Northern Quoll	*Dasyurus hallucatus*
Nye Looun	Common Brushtail possum	*Trichosurus vulpecula*
Unknown language name but TEK recorded	Black footed tree rat	*Mesembriomys gouldii*
Nhye mulpa	Yellow spotted goanna	*Varanus panoptes panoptes*
Nhye chulpa	Sand goanna	*Varanus gouldii*
Unknown language name but TEK recorded	Tree goanna	*Varanus panoptes*
Nyen bae	Little brown (red) fruit bat	*Pteropus scapulatus*
Nyen ungongul	Fruit bat black one	*Pteropus alecto*
Arear Kun	Sugarbag bee	*Trigonia hoskingsi*
Arear algah	Sugarbag nest all species	

Arear awombul	Sugarbag bee	*Tetragonula clypearis*[45]
Arear nenjo	Sugarbag bee	Unknown
Arrmorral	Golden Shouldered Parrot	*Psephotus chrysopterygius*

Additional unique historical records of faunal species of significance recorded by western science in Kuku Thaypan country are outlined in Table 6.4 in the Appendix. The *Arrmorral* golden shouldered parrot *Psephotus chrysopterygius* is an important species for *Awu Laya* speaking people and its management concerns being connected with responsibilities of kin and lore. In the Elders' TCFK it is understood that the parrot requires a fire regime which maintains healthy age class *Melaleuca viridiflora* and prevents native woody weeds such as *Acacia sp*. from changing woodland structure. It is also understood this helps prevent native and non-native predators (incl. birds of prey, cats) from ambushing parrot nests. Native *Alloteropsis sp.* grow during the wet season so storm burns need to be implemented carefully. In the Elders' TCFK endangered species requirements are considered but do not dominate decisions for fire management, their management is recognised holistically as part of the system and requirements for its survival result from those considerations. Elder Dr George shared his knowledge of the parrot in 2007 while having a morning tea and coffee at the Quinkan cultural centre including its dreaming site and distribution. The sharing of this knowledge also included discussion of culturally appropriate management of a degraded spring and story place on a station further North. Dr George indicated that it should be fenced well away from and implement erosion control well away to keep spring from infilling, to keep cattle out and not to excavate it as it was a lore story place.

[45] Could be *Tetragonula clypearis* based on size description and entrance tunnel both recorded by WS and TCK. However nesting behaviour recorded by WS was more reflective of the TEK nesting description for *Arear ninjo*. This was not able to be confirmed in field.

Contemporary Fire History

Kuku Thaypan people were systematically removed from their country as a result of the impacts of colonisation including logging, the gold rush, native mounted police, squatters opening up grazing lands, and missions. However, well into the 1950s people were still living on country. As children, the Elders were fortunate enough to maintain connection with their cultural lands by working as stockmen. Dr Musgrave was later a police tracker as he held significant knowledge and skill in tracking. They were able to apply their cultural knowledge of fire in practice as workers for non-Indigenous pastoralists. With the declaration of National Parks as described in Chapter two, they were further restricted from practicing their culture. However, this did not stop the Elders from maintaining, sharing and practicing their cultural knowledge as was recognised through the awarding of their honorary doctorates in 2005.

It wasn't until the start of their *Awu Alaya – Thaypan* knowledge recording project in 1999 that they began the videographic recording of their knowledge that also enabled increased opportunities for the transfer of their knowledge on-country to younger clan members. At times the recording of knowledge was obstructed by the poor health of their country; for example, not being able to locate story sites due to areas being over-grown or markers unable to be located due to contemporary management practices resulting in increased sedimentation. In 2004 the Elders began to re-implement their fire knowledge on their country and demonstrate how to reverse the poor fire management practices that their country had been experiencing, launching their Kuku Thaypan Fire Management Research Project (KTFMRP) in 2005. Features of cultural significance that can be damaged by wildfire and prescribed fire including aerial incendiary include but are not limited to:

- Rock art sites

- Grinding grooves through the deposition of sediment as a result of poor management practices including wildfire
- Ceremony story places
- Navigational markers
- Scar trees (plate 6.1 below)
- *Arear algah* sugarbag nests (plate 6.2 below)
- Nesting hollows and dens's
- Ground nests of totemic species such as the Emu
- Food resources and their production
- Water sources and aquatic resources

These places and species can be negatively impacted by wildfire, managing from the air it is not possible to manage each one separately. These features of cultural significance could be protected if appropriate on-ground fire management was also carried out across the landscape. Best practice contemporary fire management for environmental purposes should also seek to protect these resources.

Plate 6.1 Sugarbag scar made by Stone Tommyhawk *Arrlonomen.* Elder Tommy George described how he knows this from the way the timber holds the story of how the axe flakes the timber away from the harvesting entry point

Plate 6.2. *Arear algah* nest. Steffenesen showing CDU research scientist a traditional method of reaching sugarbag nests. Note burn areas around base of tree from the low intensity burn implemented by the Elders the previous day

Fire season

Like other areas on Cape York Peninsula, the main fire season commences straight after the wet season, as soon as the country is ready to burn, although the timing for this varies across Cape York. The Kuku Thaypan country in Princess Charlotte Bay Basin country is still very green and would be considered by western fire managers as “too wet” to burn. Burning begins anywhere between April and July, depending on the strength (and length) of the wet season and the capacity of land managers to get access to implement fires at the local scale. *Awu Alaya* timing for initiating ecosystem burns following the monsoon rains is altered according to seasonal conditions and the capacity to implement fires according to cultural practice. Traditional cultural fire knowledge (TCFK) timing of different country type burn prescriptions depends on the colour, consistency and moisture present in soils, the parent tree and mix of tree species present, their phenology (flower development and timing), *nyekeel* bark shedding, elevation, geology, presence or absence and curing of *kwern* grasses, drainage, and climactic conditions, including the presence of *Ngo oilten* (winter rain), dew and other sources of moisture, faunal presence, absence and movements, resources required e.g resin, gum, the need for young shoots to list a few considerations.

The Elders’ TCFK promotes burning throughout the year in response to indicators read in country, under conditions where scorch heights are kept low, and in some instances, leaving little or no evidence of scorch marks on the bark of trees. However, in contemporary environments sometimes the scorch marks are higher in some areas than others due to excessive fuel build up. That said, I have witnessed fires skilfully implemented by the Elders and Steffensen under conditions where contemporary fire management plans would not be approved due to risk of an uncontrolled fire; result in minimal scorch heights. Fires that scorch and burn the tree canopy are to be avoided. Canopy burns are prohibited under Kuku Thaypan traditional lore, and burns are conducted with awareness of the biological requirements of the flora and fauna that inhabit these areas. For example, in Boxwood communities' possum breeding season and tree flowering times are considered before burning.

Traditional cultural fire knowledge demonstrated through the Elders' KTFMRP requires that different country types or ecosystems are burnt at different times throughout the year. This detailed knowledge of when to light a fire responds to ecological cues and seasonal indicators present in the natural environment and the ability to read the country.

The early dry season (EDS) in Northern Australia is marked by the end of the wet season and for the South-Eastern coast of Cape York this is usually in April or May, depending on the length and severity of the preceding wet season. At this time of year, country begins to dry out as rainfall decreases and the South-East winds begin to increase. Days are marked by clearer blue skies and hotter temperatures. Insect life, notably native *Arear kun Tetragonula hoskingsi* and *Nye yelia* butterfly species begin to increase in number and activity. At this time of year as temperatures and the SE winds increase, the large open woodland *Corymbia sp.* plains begin to dry out. Rainfall is still present but has been replaced by light, patchy intermittent 'knock-em-down rain'. *Kwern umbayal* Tall Spear grass (*Heteropogan triticius*) seed stalks begin to fall down and native grass seed begin to be knocked off the plants by the rain, making them ready for fire, smoke and germination. Burning all year round was intimately connected to the curing of vegetation across all vegetation strata, burn history and climactic and weather conditions. This minimised late season wildfires that cause substantial loss of habitat and impact on native flora and fauna. Cool earlier season fires move slowly through the landscape, leaving areas unburnt, helping to create a heterogeneous landscape capable of sustaining greater diversity. Timing not just seasonality, but including time of day and time since last burn, and time of species curing are all very important considerations in creating the 'right fire' for each ecosystem type.

Sometimes this requires progressive burning within one habitat type across space and time. For example, in Boxwood *Kuwronga* communities, grass species are targeted at different times depending on curing. Some species (e.g. annual grasses) cure earlier than others. These species are targeted for early burns and the heat that is generated from these fires helps to cure adjoining species. A follow-up fire is then implemented in the same boxwood community to create a mosaic of fire with differing age classes and burning conditions. These fires conducted in quick succession are not implemented in all years. This approach is taken when country is "unwell" but once the composition of the ground cover has increased in diversity and stabilised longer fire intervals are acceptable. The resulting mix of species has potential for supporting a greater diversity of fauna. Furthermore, fauna have access to a mix of resources. Fire treatment varies depending on the type of ecosystem and where it occurs in the landscape. For example, the same broad vegetation type may be burnt differently depending whether it is on a river flat or flood plain, the soil, the mix of species present, the current health of the ecosystem, the time of year, the purpose of burning, climactic variables and the time of day.

The late Kuku Thaypan Elders Dr George and Dr Musgrave initiated their KTFMRP project in response to fires that were too hot, at the wrong time and in the wrong place and done the wrong way. In the words of Victor Steffensen in 2016, "*there is only one type of fire and that is the right type of fire, for the right county* (NIFW video Wujul Wujul 2016 and KERB 2018)." From a mainstream land and fire management perspective this phrase 'there is only one fire' can be misinterpreted as meaning there is only one kind of fire. However, according to the Elders' TCFK, there are multiple kinds of fires that were applied in the knowledge system, each fire is considered in relation to particular qualities and needs of country and specific conditions and is the *'right type of fire'* for that ecosystem.

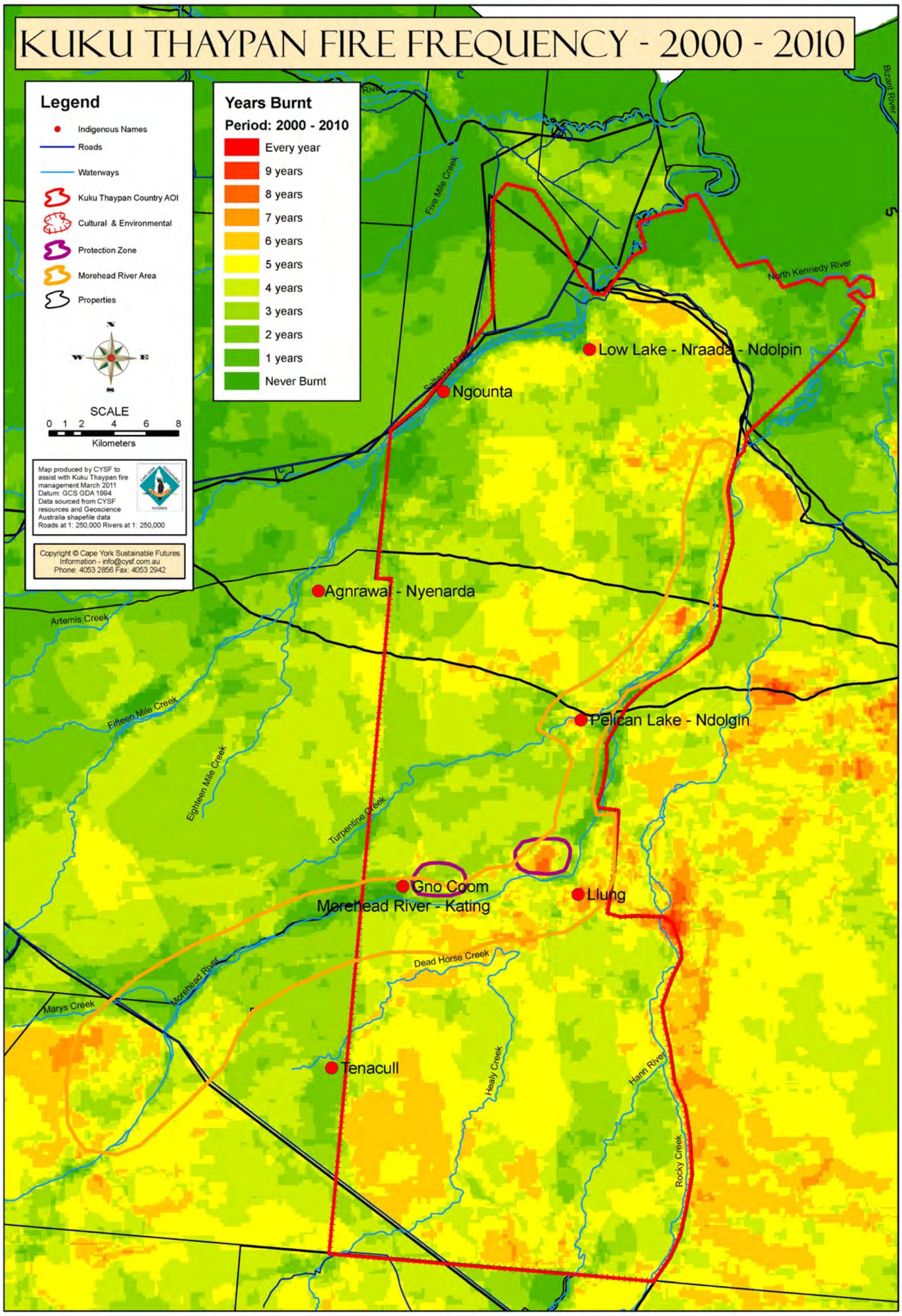
The next section of this chapter discusses contemporary fire history on Kuku Thaypan country and presents fires scar maps derived from satellite imagery between 1999 – 2010. It provides deeper perspectives of the fire history for the KTFMRP and the Importance of Campfires research project AOI, including data from field notes, videographic footage and GPS records of fires implemented through the Elders fire research project from 2005 through to 2010, when the most active field work for the Elders KTFMRP and this dissertation was occurring on Kuku Thaypan[46] country. It does this to contextualise the reader to the place where the research occurred and the fire management wicked problem that the Elders were faced with. It also enables discussion of some of the political, policy and legislative constraints that the Elders were faced with in implementing their traditional cultural fire knowledge on country.

Contemporary Fire History on Kuku Thaypan Country

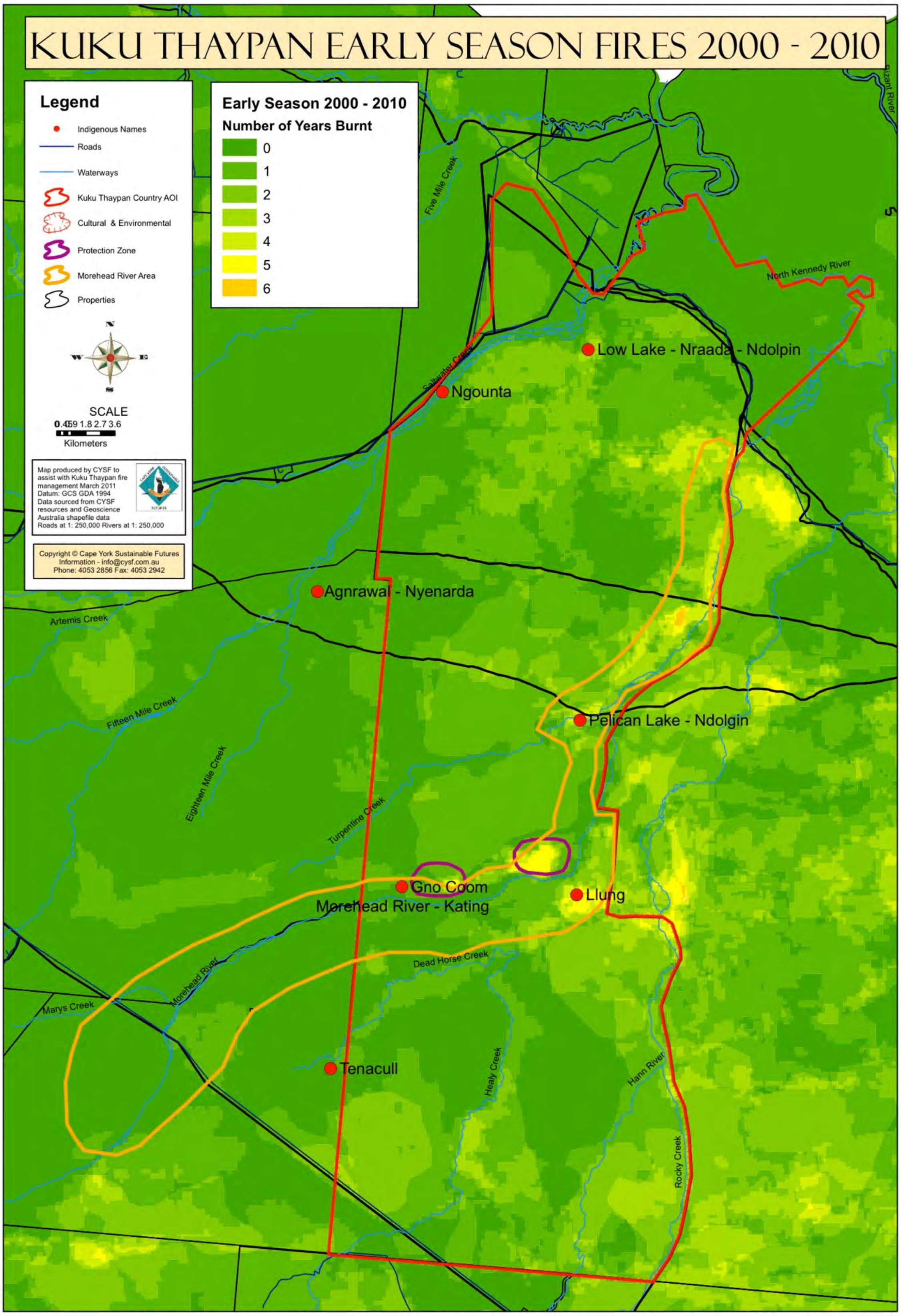
The main fire management concerns on Kuku Thaypan Country are inappropriate fire frequency, intensity and timing, as well as the large wildfires that occur late in the dry season. There are parts of the Kuku Thaypan clan estate, including in the study AOI, which burnt almost annually between 2000 and 2010, and other areas that had not experienced fire at all. This is illustrated in the Fire frequency map for the study AOI from 2000-2010 in Map 6.2 below that shows total fire frequency for the project study AOI. Map 6.3 shows early season fire frequency for the study AOI, map 6.4 late dry season fire frequency and map 6.5, storm season fire frequency for the research project area of interest (AOI) over a ten-year period, including the five years of the field study period on Kuku Thaypan country from 2005 - 2010.

[46] Sites within the project study AOI have continued to be burnt by the Elders descendants, Steffensen and Standley every year since 2004.

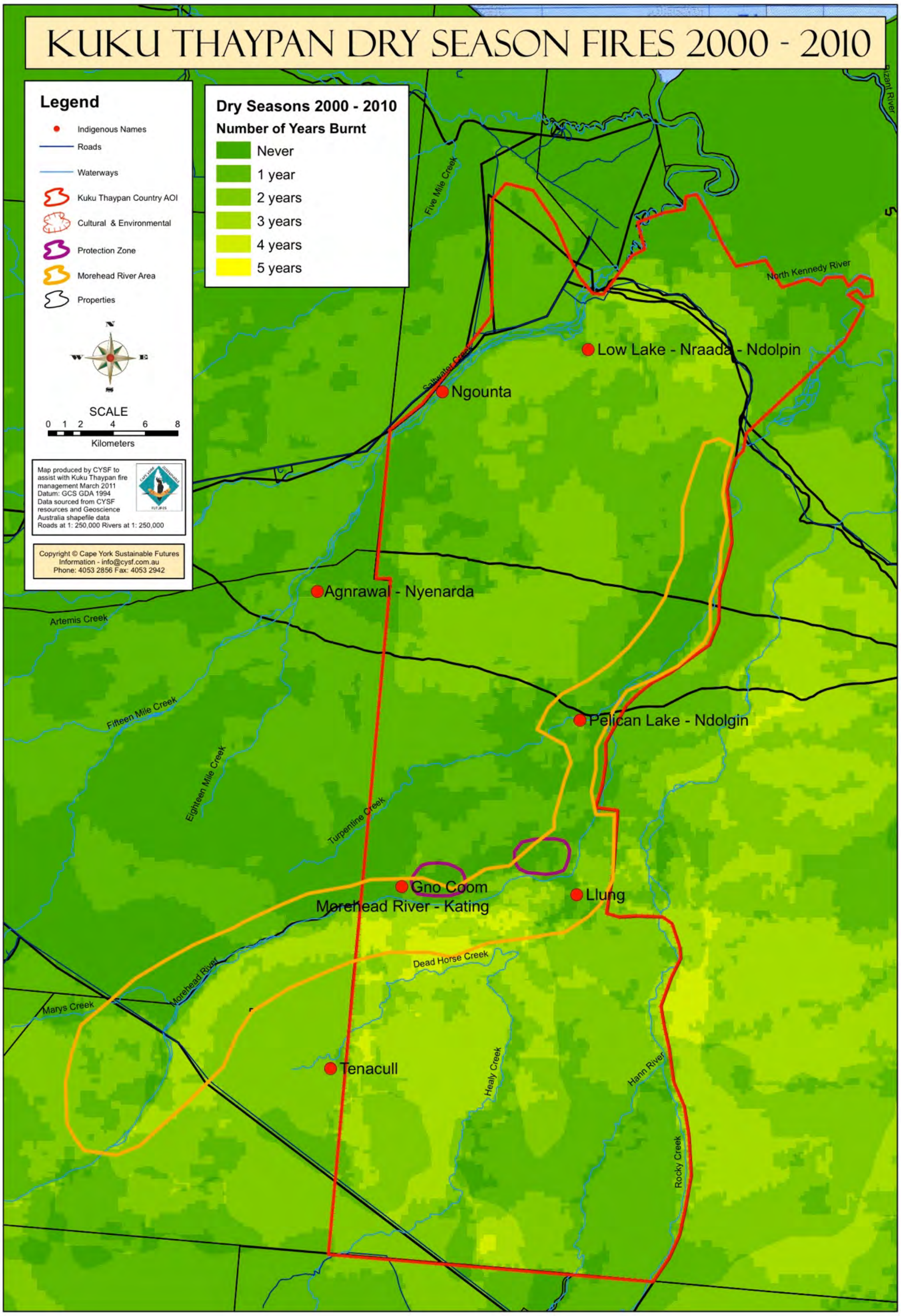
Fire frequency maps for Kuku Thaypan country 2000-2010



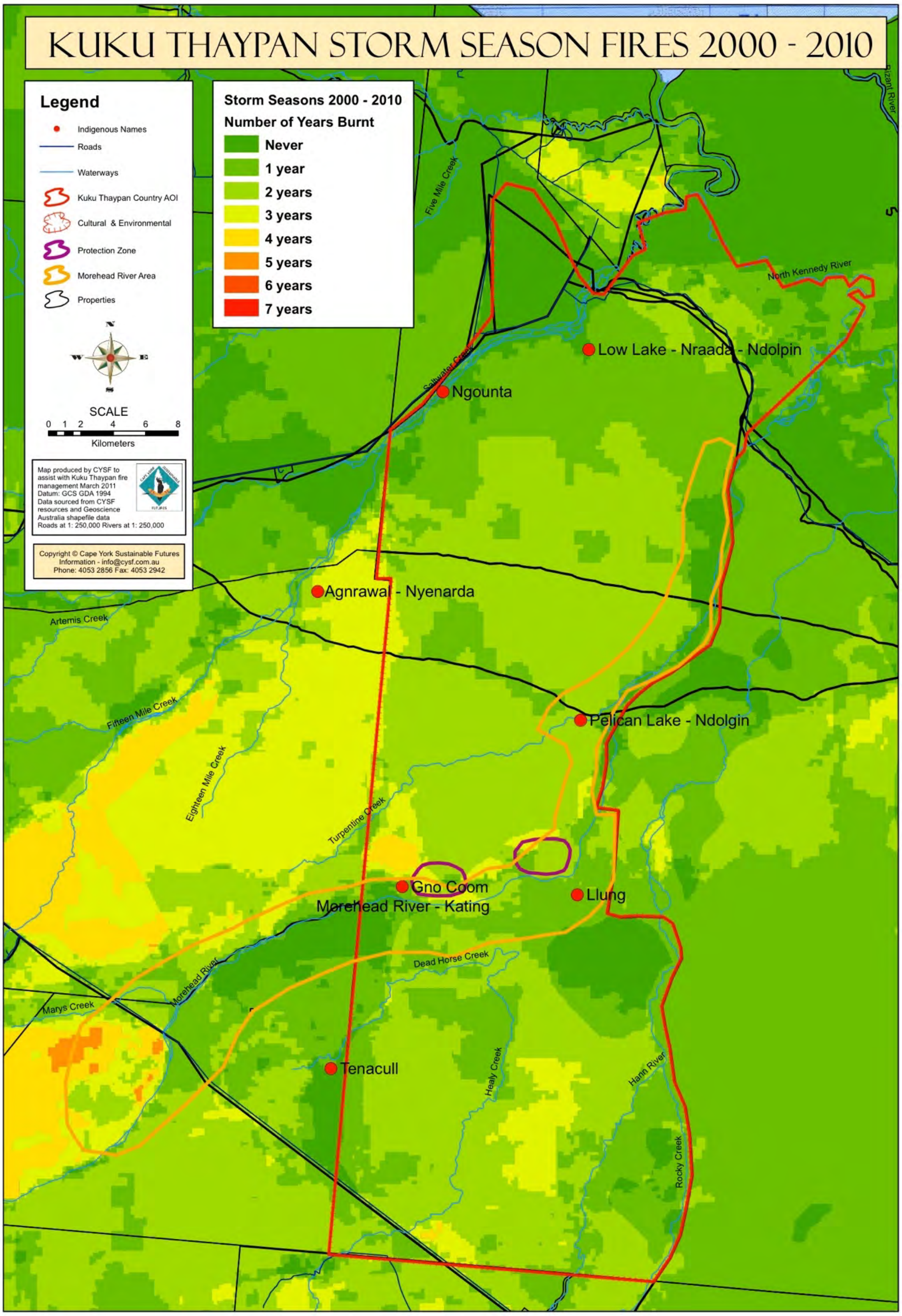
Map 6.2 Fire frequency in the study AOI 2000-2010
Source: Cape York Sustainable Futures (in (Standley et al., 2011)



Map 6.3 Early season fire scars mapped in the study AOI 2000-2010
Source: Cape York Sustainable Futures in (Standley et al., 2011)



Map 6.4 Dry Season Fires mapped in the study AOI 2000-2010
Source: Cape York Sustainable Futures in (Standley et al., 2011)



Map 6.5 Storm Season Fires mapped in the study AOI 2000-2010
Source: Cape York Sustainable Futures(in (Standley et al., 2011)

These maps are presented to provide a snap-shot of mapped fire frequency on Kuku Thaypan country leading up to and during the study period and highlight the Elders concern regarding large areas of late season wildfire on their country. The early season fire scar map 6.3, highlights that within the project study AOI the majority of country surrounding water bodies and courses on the Morehead River was burnt at least three times and up to six times in the EDS within the ten years. In the late dry season LDS, some of these areas are mapped has having been burnt at least twice in ten years, with areas to the south east being burnt up to four times over the same period.

The storm season map 6.5 highlights large areas frequently burnt between November and January 2000-2010. The fire season classification dates for mapping as at 2011 when these maps were produced are outlined in table 6.2 below. Remember as outlined in Chapter 4 the western science mapping classification dates for mapping fire scars changed over the life of this research dissertation.

Table 6.2: Dates for Fire Season Classification 2000-2012

Month	Duration	Season
1 February - 31 July	6 months	Early Dry Season
1 August - 16 November	4 months	Late Dry Season
17 November-1 January	2 months	Storm Season

Annual fire scar maps are discussed below in order to provide a clearer understanding of the challenges of scale in undertaking this research project, including the use of remote sensing as a tool to document the Elders' burns. The work of this dissertation "The Importance of Campfires" in recording ignition points, field data and monitoring sites that enabled an examination of the mapped fire scars and determine those that were a result of the Elders' fire research project and those fires that were not in each year from 2005-2009 is presented. The fires that were not from the Elders' burns are a result of either aerial incendiary programs, prescribed fires for conservation management, mustering, anthropogenic wildfires or those caused by lightning strike. Together they help to understand the story of what fires occurred in the project study AOI leading up to and during the implementation of the Elders' Kuku Thaypan Fire Management Research Project (KTFMRP) and this dissertation and provide a surrogate for understanding the impacts that the different types of fires have on the environment. With late season fires tending to be larger in area and higher in intensity as outlined in Chapter 5.

In the savannahs of Cape York, the grassy understorey grows every year due to the reliable wet season rainfall providing an accumulating source of fuel. Therefore, fires will occur every year, and fire risk increases throughout the year as the seasons become drier. In areas where fires don't occur, fuel loads continue to accumulate and can render areas stagnant, due to the age, depth and curing of the fuel in these areas, increasing wildfire risk.

As understood from earlier discussion in Chapter 5, from a contemporary western fire management perspective, to reduce carbon a larger number of early season burns are desirable to reduce fuel loads with the intention of reducing the extent of late season fire and emissions across the landscape. In order to achieve a co-benefit for biodiversity conservation fire needs to occur across a diverse array of ecosystems each one requiring *'the right type of fire'* to create differing age classes with respect to time since last burnt. Therefore, cultural co-benefits can be derived from implementing fire across different country types that also benefits biodiversity and additional environmental and social outcomes as highlighted in diagram 3.1 in Chapter 3. As the diagram illustrates in carbon abatement and sequestration can be an outcome delivered from cultural burning practices despite those outcomes being driven from very different motivations. Fire management in the Elders' TCFK is also about using fire to protect certain areas, vegetation and species from fire. In order to achieve best practice fire management within contemporary management frameworks the argument against on-ground burning is that significant resources are required. However, fire management is significantly cheaper than fire-fighting and significant resources go into fighting fires when fires threaten life and property. In remote areas this is less the case, in recent years this is changing as a result of the Savanna burning economy. However, both approaches do not specifically address fires required that benefit biodiversity.

The health and function of the landscape can be significantly impacted by fires that are too intense and/or too frequent. Fires of high intensity and/or are too frequent can transform ecosystems. There is still much that needs to be done to enact the Elders' fire knowledge comprehensively across the entire study area, greater collaboration between management parties and investment into full-time skilled fire managers trained both in Indigenous traditional cultural fire knowledge and western fire management is required to manage the magnitude of the area.

The maps presented in this chapter highlight recorded fire scars in and surrounding the project study AOI from 1999-2010 and demonstrate that western science ways of knowing about fire history in Kuku Thaypan country substantiate the concerns of the Elders regarding the management of fire on their country.

During the study period, most mapped fires come from outside the research study area of interest and were pre-dominantly a result of aerial incendiary programs, mustering burns or wildfires started by anthropogenic causes or lightning strike. There are a number of late season "storm" burns that occurred in November within or adjacent to the research project AOI (area of interest), see Map 6.7. The TKRP and KTFMRP implemented burns in the study area of interest from 2004 that are not always able to be seen on the maps as will be discussed in each year below. The size and scale of these burns varied according to capacity to visit country, issuing of permits and cultural protocol. However, as highlighted in Chapter 5, early season fires are not always able to be detected via NAFI mapping. An example of how cultural protocol influences capacity to implement burns on country, occurred in 2006 following the death of Dr Old Man Musgrave when the country was closed for a year after his passing. This means that people are to stay away from the area. At the request of the family, access to the area was limited. However, Steffensen and I were given permission to go and burn around the small shed to protect it from wildfire in June 2006. As such in that year, we were guided by the families and were told that fires were only to be implemented at *Gno Coom* Saxby and Rocky Plain to act as a fire break to slow later season wildfires. We were given permission to camp at Rocky Plain away from *Gno Coom* out of respect to this cultural protocol. We were not to stay longer than necessary, returning to Laura the following morning and were not to visit other places, fish or hunt.

The size of the fire scars that the Elders KTFMRP burns left on the landscape varied and as mentioned earlier were not always able to be detected by remote sensing. They were large enough in area to be detected. However, the Elders' burns were characteristically low in intensity, patchy, left areas within the burnt area that were not burnt and did not burn the canopy. For the most part, as will be discussed in conjunction with the following maps, the Elders' KTFMRP burns were not detected via NAFI mapping. When fire scars occur in the research project AOI that could have resulted from fires from the research project due to their location and date ranges, GPS dates and parameters for fire scar mapping have been compared and at times there is mis-alignment. In all years of the KTFMRP and this dissertations' active research on country scars in the research project AOI were detected via satellite imagery, however not all burns detected were as a result of the research project, some detected where, however the majority of the burns implemented by the Elders' KTFMRP were not detected. A series of maps are used to discuss each year's fire scars in the research project AOI and surrounding landscape from 1999-2009 and their relationship with the Elders' KTFMRP. These maps (6.6 to 6.25 and 6.27 to 6.29) are presented in the appendix for Chapter 6 because of their large size and to allow ease of reading.

From 2005-2009, the maps include an estimation of the percentage burnt by the Elders' research project. This was estimated from GPS locations recorded through this research dissertation overlayed with data from NAFI fire scar mapping to determine if the Elders' ignition points corresponded with mapped scar dates. Where fires scars were not detected from the Elders' burns these are also highlighted. The map legend shown at Figure 6.3, provides an explanation of how to read the map. The fire scars within and surrounding the project area of interest map legend shows:

- Kuku Thaypan country – the boundary of the Kuku Thaypan estate for reference purposes only
- Property boundaries that make up and adjoin Kuku Thaypan country
- The intersect of the Kuku Thaypan estate and Rinyirru CYPAL (Lakefield NP) the research project AOI
- Main Roads
- Main Rivers
- Vegetation Sites established by The Importance of Campfires
- Water bodies, and
- from 2009 sugarbag sites established through the Elders' Indigenous-led participatory action research project as discussed further in Chapter 4 and 8.

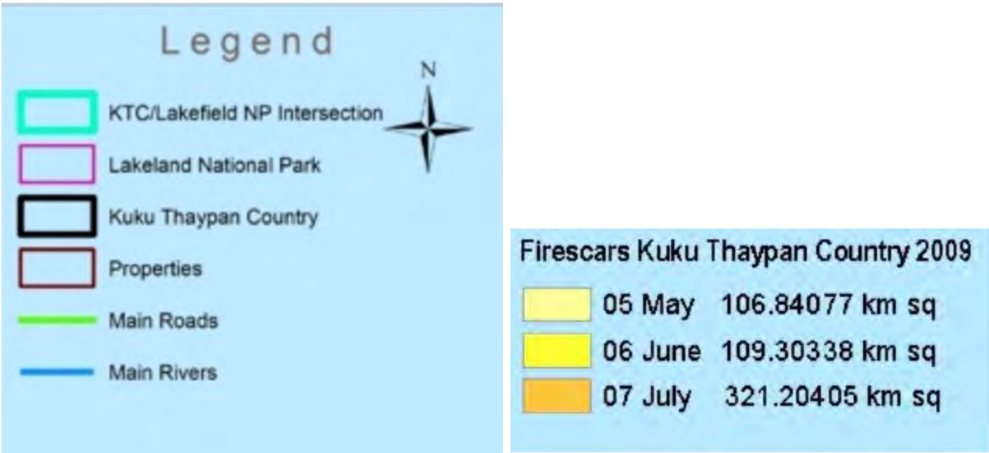


Figure 6.3 KTFMRP fire scar map legend showing key features and boundaries month and total area burnt in that month

Source: The Importance of Campfires 2009

The legend also shows the month and the total area burnt by km sq sourced from NAFI data that uses remote sensing imagery to map fire scars, see figure 6.4 showing burns in May, June and July and the total area of the landscape was burnt within the Kuku Thaypan clan estate.

From 2005, the maps show ignition points of fires implemented by the Elders' fire research project and recorded by the Importance of Campfires. The area of fires implemented by the KTFMRP are calculated from ignition point data taken with a GPS, co-related with MODIS burn scar imagery mapped for that date or date range. The legend shows a different colour for the different dates of ignition points that were a result of the Elders fire management see figure 6.4. This makes it easier to show where an obvious alignment or misalignment of timing of ignition points and mapped scars within a month occurs. Alignment, or lack of it, was able to be determined by an analysis of the NAFI fire scar data ranges for that particular fire scar and the ignition point data from the Elders fires recorded on a Garmin 12 GPS through this research dissertation where they appeared to correlate. Where there was a significant difference in these date ranges it was concluded that the scar was not a result of the Elders' implemented KTFMRP. Where this is the case it is discussed in the relevant year.

Figure 6.4 Legend shows ignition points of the Elders Kuku Thaypan Fire Management Research project (KTFMRP)

The legend also contains information on the total area of Kuku Thaypan Clan Estate that was burnt, not burnt and was burnt by the Elders' research project in each year based on the mapped data alone and is presented in kilometres squared and as a percentage of the total area of the estate or the project AOI, see figure 6.5 below. The area of fire scars resulting from the Elders' KTFMRP were calculated by determining any corresponding ignition points and NAFI mapped fire scars that were an exact date match or within the same date range as to be highly likely to be a fire scar as a result of the Elders' ignition point. The total area of the correlated ignition points and fire scars were then added together and presented as the area burnt by the project in kilometres squared (km sq) and as a percentage of the total area burnt of the entire Kuku Thaypan clan estate[47].

[47] Not the project study AOI by the entire clan estate

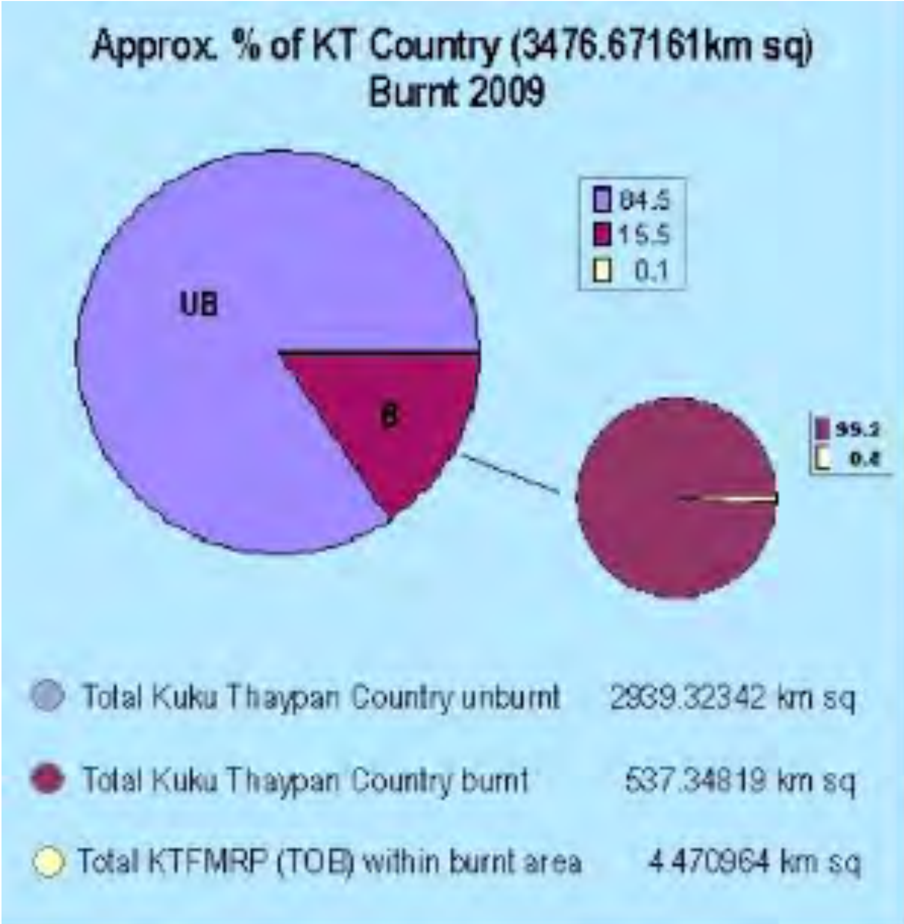


Figure 6.5 Legend showing the total are of the Kuku Thaypan clan estate burnt and unburnt and the area that was burnt by the Elders fire research project in the study AOI

The first map presented in each year shows fire scars in and around the Kuku Thaypan clan estate by month. The second map in each year shows fire scars by month and area within the research project area of interest (the intersect of the clan estate and *Rinyirru* CYPAL). Each map shows estimated calculations for the total area burnt and not burnt in that year for each map focus area; either the clan estate or the clan estate intersect with *Rinyirru* (Lakefield) National park, the research project study AOI.

Fires in and around the Kuku Thaypan clan estate and the research project AOI 1999

In 1999, storm season burns occurred in November on Kuku Thaypan country, evident in Appendix 6. map 6.6 along the Morehead River through Artemis station. A July burn can also be seen in and surrounding the Kuku Thaypan estate. Given the extent and shape of similar mapped July burns outside of the clan estate and the National park boundary, they appear to be coordinated. Unfortunately, I was unable to obtain aerial incendiary data for the research project until 2009 and so cannot confidently verify if they were part of a coordinated aerial incendiary run. Nonetheless, the burns can be seen on the map in addition to large wildfires in September and October surrounding the clan estate boundary.

Map 6.7 shows a closer examination of the study AOI where areas of late season fire in the storm season in November 1999 are evident along the Morehead River within the Artemis boundary and extending into the study AOI. There were also large areas burnt by wildfire within the study AOI in September and October that year.

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2000

The following year in 2000, (see Map 6.8) a large late season wildfire is mapped inside the clan estate boundary. Earlier July burns can also be seen that could have been part of a sub-regional aerial incendiary program given the number and shape of July burns outside of the clan estate running on linear boundaries. These may also be burns implemented for mustering purposes and/or a combination of the two. A closer examination of map 6.9 shows that fire burnt almost the entire area of the project study AOI and large areas to the East and North East on Jack Lakes and Kalpowar were also burnt in October, 2000.

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2001

In 2001 late season burns in December occurred on Artemis station with areas of *Tenacull* Maryvalley station also burning late in October. A closer examination of the study AOI in

Map 6.10 shows early fires along the Morehead River in June with large wildfires across much of the surrounding country to the East and North East occurring in October. Notably that year there were a large number of May and July burns conducted in the National park and the surrounding landscape that looks as if they are part of a coordinated program. 6.11?

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2002

In 2002, a large June fire occurred in the study AOI that was likely of high intensity to have burned an area this large at that time of year, see map 6.12. This was followed by a late season wildfire burning through much of the study AOI later that year in November, see map 6.13. However, this fire was stopped by the earlier June fire.

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2003

In June and July 2003, earlier season burns of larger area were beginning to be implemented through the middle of the park (see map 6.14 and 6.15). Areas outside the study AOI were burnt to the South East in July. However, as can be seen little fire occurred surrounding the study area of interest that year.

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2004

It was in June 2004 when the Elders began to implement cultural fire on their country to enable them to record their knowledge through their Kuku Thaypan Fire Management Research project (KTFMRP). This cultural obligation to burn to make healthy country so that they could demonstrate and record their cultural knowledge led to the need to develop and launch their Kuku Thaypan Fire Management Research Project and this research dissertation in 2005. Although the initial fires the Elders lit in 2004 were small in nature, they were big in presence. When these fires occurred, I was still an employee with QPWS, and I received emails regarding them. I was sent images of the burn that had pink flagging tape around pieces of *Hyptis suaveolens*, a common non-declared weed in Cape York. The sentiment of the email was that the fire was not hot enough and had left these weeds standing, that now would spread as a result of the fire. Western science has recorded that this species has a >70%

mortality rate in adults if subject to 100% leaf scorch as a result of a burn (Savanna CRC 2004). On discussion of the fires with the Elders and Steffensen they indicated that by targeting the native grass curing over time this weed would be outcompeted by recovering native grass species.

In 2004, early season burns were implemented in June along the Morehead River most likely via aerial incendiary given the linear nature of these fires across the landscape (see map 6.16). In the study AOI there are also earlier fires to the East that were implemented on the park in July. Significant areas of country were burnt in November in 2004 and although this is outside the KTFMRP study AOI, it is most definitely traditional *Kuku Thaypan* country on which the Elders hold significant knowledge, (see map 6.17). These late season fires were still evident in the vegetation when travelling through the country in 2005. Storm season burns were promoted in land management at this time as a way of dealing with vegetation thickening (Garnett, Crowley, & Trueman, 2006).

It can be seen in the fire scar maps from 1999-2004 that fire was mostly broad scale with fires that were large in area occurring across the Kuku Thaypan clan estate including the study AOI late in the dry season and storm season. Fires can also be seen to be pro-actively implemented in June and July, within and surrounding the research project AOI. As highlighted in chapter four fires at this time of year are intense burning large areas, turning the ground black, mature trees to ash and increasing bare ground prior to the onset of the monsoon wet season increasing sedimentation of highly dispersive soils.

KTFMRP Fires in the Kuku Thaypan clan estate and research project AOI 2005 -2009

Details of field work will be discussed throughout the following chapter with data from field notes. A brief summary of remote sensing of fire scar mapping from 2005-2009 is provided here to provide context to the wicked problem of fire in Kuku Thaypan country, the social context in which the Elders' KTFMRP, and hence this thesis, was operating., The summary also indicates the scale of the research project, and the challenges with the use of remote sensing alone when mapping cultural burns.

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2005

In 2005, the Elders fires and assessments were implemented at *Gno Coom* (Saxby) travelling across Rocky crossing through to Rocky Plain then onto *Ndolgin* (Pelican) Lake in May, June, July, August and November, 2005. The permit to burn was issued for three months to Dr George Musgrave as highlighted in Chapter 1. This was a landmark occasion in Queensland as it was the first time that a traditional owner had ever been issued a permit to burn within a national park. These fires are detected in the scars and are shown in Map 6.19 in the zoom in area in the bottom corner. It can be seen that the ignition point dates coincide with the mapped scar date of the 18th and 19th of May respectively. Burns that were implemented on the same date around *Ndolgin* were not mapped until the 28th which is within a two-week window of the burns and within which scars are mapped, so date ranges can vary. However, given the extent, pattern and the same mapped date of areas that are burnt in the surrounding landscape it is likely that these fires were a part of a planned aerial incendiary run. Interestingly these fires were implemented over the top of the Elders' burns at *Ndolgin* (Pelican) Lake.

In map 6.20 it can be seen that together these fires stop a late season fire in September stops to the North North-West (NNW) and (N) North of the area mapped as not burnt and circled in Map 6.19 and Map 6.20. Ignition points of the research project are highlighted in Map 6.20

and show where fires lit by the research team at the eastern edge of *Ndolgin* Pelican Lake in June were burnt into by the September wildfire later that same year, see ignition points under vegetation sites at edge of September wildfire fire on *Ndolgin* (Pelican Lake). Fires were also implemented along the Morehead River, across Rocky Crossing, Rocky Plains to *Gno Coom* spanning across four months, however, did not result in any fire scars that were able to be detected by satellite, mapped and presented as monthly fire scars on the NAFI site. Plate 6.3 and 6.4 show the Elders' fire management burns being implemented at *Ndolgin* (Pelican Lake) in May 2005.

Plate 6.3 Fires implemented by the Elders' research project at Ndolgin (Pelican Lake) May 2005

Source: Field data 2005

Plate 6.4 Fires implemented by the Elders' research project at Ndolgin (Pelican Lake) May 2005

Source: Field data 2005

Maps 6.19 and 6.20 show large amounts of aerial incendiary burning that occurred to the NNE, E and SE of the study AOI in the park in May and June, with an area to the SE side of the Morehead River, within the study area also being burnt in June, 2005. This was despite requests from the Elders not to burn the area. It can be seen that the Elders' implementation of early, fine scale, low intensity burns over large areas including plains and open woodlands, are not always detected by remote sensing. Plate 6.5 shows recovery of an area burnt in the previous May by the research project with adjoining areas ready to be burnt in July. Country, according to country type, was burnt and therefore had a varying age class of recovering areas, including areas that had not yet been burnt. This approach is not able to be detected or understood via interpretation of mapped fire scars.

Plate 6.5 showing recovery of the edge of a Boxwood system that was burnt in May assessed in June 2005. The adjoining tea-tree system was ready to burn in early July.

Source: Field data 2005

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2006

In 2006, very little fire occurred until July and August in the project study AOI and surrounding landscape, with the Elders' fires in June not resulting in any fire scars. As can be seen large areas were burnt from a wildfire in November and December in the study AOI. This was due to Cyclone Monica and there being an extended wet season and a large accumulation of fuel that cured very quickly following the cessation of the Monsoon season. In western management the window for being able to burn this year was shorter than it had normally been.

From Map 6.21 it can be seen that the Elders' KTFMRP burns were not detected via satellite. As highlighted earlier, limited burning was carried out this year by the research project in the AOI due to the cultural closure of the area following Dr Musgrave's passing, ignition points can be seen in Map 6.22 below for fires implemented by the research project team in June 2006. It is re-iterated here that the research project did not have permission to burn outside of the research project AOI as the majority of Kuku Thaypan Estate is pastoral lease. The intention of these burns was to provide protection to Gno Coom and the small shed facility that had been established there and importantly the area itself. Map 6.21 and 6.22 show the massive wildfire that occurred in November that year that burnt almost the entire clan Estate and 50% of the project study AOI. This large late season wildfire did not burn into *Gno Coom* (Saxby) where the small outstation is and it also did not burn along the Morehead River where fires were implemented on 25 and 26 June 2006.

The source of the 2006 wildfire was also a topic of discussion with Elder Dr George, the Ranger in Charge (RIC) and adjoining landholders. In May 2007, the research team travelled on country to undertake assessments, burning and training to refine the fire plan for the year and Dr George re-iterated that *"the fire did not start on Lakefield and it was not from lightening"* (Field notes May 2007).

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2007

The result of field trips in this year can be seen on map 6.25 showing the ignition points for 22 May 2007 outside the study AOI. Map 6.26 shows zoomed in areas where training and assessments were undertaken outside the project AOI. Wetland burning training and knowledge sharing was transferred on this field trip, see plate 6.6 and an assessment of a fire that was not a result of the Elders research project that had occurred near horseshoe lagoon see plate 6.7 and 6.8 that show the level of canopy damage and the extent of the understorey that was burnt, indicating that although this fire was early in the season it was still high in intensity. Note that the fire that was assessed in plate 6.7 and 6.8 is not evident on the map.

Plate 6.6 younger Mugrave and Ross family members assessing lagoon and implementing an early season protection burn

Source: Field data May 2007

Plate 6.7 Assessment of the fire that occurred in the area showing extent of canopy scorch

Source: Field data May 2007

Plate 6.8 Assessment of the fire that occurred in the area showing extent of understorey burnt

Source: Field data May 2007

Plate 6.9 Dr George showing Victor Steffensen the multiple empty sugarbag scars in an old *Ku Morteall* Cooktown ironwood tree *Erythrophleum chlorostachys*

Plate 6.10 Image of the same old *Ku Morteall* Cooktown ironwood tree *Erythrophleum chlorostachys* showing multiple scars made from multiple harvest entry points made by stone tommy hawk over a number of years in a now extinct nest

Plate 6.11 Image of the same old *Ku Morteall* Cooktown ironwood tree *Erythrophleum chlorostachys* showing multiple scars made from multiple harvest entry points made by stone tommy hawk over a number of years in a now extinct nest

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2008

In 2008, the burn program began by conducting a burn near Laura community working with the local rural fire brigade. In June 2008, the research project hosted potential investment partners on country as it did on a number of occasions visiting both *Gno Coom*, *Ndolgin* and *Tenacull* implementing burns and demonstrating the aspirations of the Elders. Field trips did not only focus on the implementation of fire, they also always included making assessments of the condition of the vegetation for the next burn trip on country. It was in 2008 that the project began sharing knowledge of the Elders on country with visiting communities. Lockhart River Elders and Rangers from the Lockhart community were invited by the Kuku Thaypan Elders for the KTFMRP with support from *"The Importance of Campfires"* to attend the burn program and undertake training from the 14 – 17 July, 2008.

Fires were implemented by the research team in June, July and August in the research project AOI in 2007 and although no fire scars are evident, they assisted in slowing a November late season wildfire from entering the research project AOI. Fires that were lit in June were conducted on the same field trip that was also attended by Peter McChoncie, a photographer and colleague of Steffensen, who came to photograph and produce a book on the work of Cape York Elders in fire management (McConchie, 2013).

What can also be seen in map 6.24 is a lot of ignition points that were implemented across the park in June 2007 in response to QPWS implementing burns in bloodwood ecosystems in the park earlier that year. At the May meeting with QPWS Steffensen had mentioned an indicator of timing for burning, being the flowering of bloodwood trees. This indicator signifies when another ecosystem type is ready for burning. However, following the KTFMRP burn plan meeting when this was mentioned, QPWS had implemented burns in a number of bloodwood systems throughout the park. This act was seen as deliberately trying to take the knowledge of the Elders and implement it without them. A further act of colonisation. In response to this spot fires were lit throughout the park travelling from *Gno Unta* (Saltwater creek) all the way through Micky Finn and on Dingo plain on the way out. None of these fires resulted in fire scars as can be seen on the map; they did however, result in visible scars on the ground and aroused discussion among QPWS staff and the wider community that I have heard about one or twice in my professional career in Cape York spanning 15 years.

It was on the July field trip in 2007 that we began to record TCFK of sugarbag see Plate 6.10, as Dr George had noticed numerous empty nests and began to explain how to tell the difference between the implements that were used to harvest them by the shape and number of the entrance holes, see Plate 6.10. The recording of this knowledge led to the development and realization of the Indigenous led participatory action research project on Sugarbag in

2009 when funding was secured for this project through the interim Caring for Country biodiversity funding managed through the then Queensland Government Environment and Heritage Protection Agency.

I had also organised for Cape York Peninsula Development Association (CYPDA) to attend and shared the mapping code that the campfires research project had developed to support the Elders to document their fire management as can be seen in map 6.26. Part of the logic in getting CYPDA involved was so that staff could experience first-hand the practical reality with mapping fire scars on-ground and that we required access to equipment such as quad bikes in order to traverse larger areas of country. Map 6.26 demonstrates how larger areas can be covered through access to a quad bike as the areas that shows up in the fire scar were not able to be accessed by the project in previous years. I worked with CYPDA to support them to access funding to attend. It is important to understand that just because an area shows up as being burnt, the entire area does not experience fire in the same way and depends on available fuel, wind speeds, temperatures, available moisture, aspect, slope which all influence the intensity and the severity of fire on vegetation. Impacts from fires can be highly variable and depends on a myriad of conditions as further outlined in Chapter 2. The area that was burnt as a result of this field trip had not experienced fire since 2004 and experienced 4 growing seasons so was much higher in intensity. The analysis of fire scar maps and research project data highlights the challenges with detection of the Elders burns.

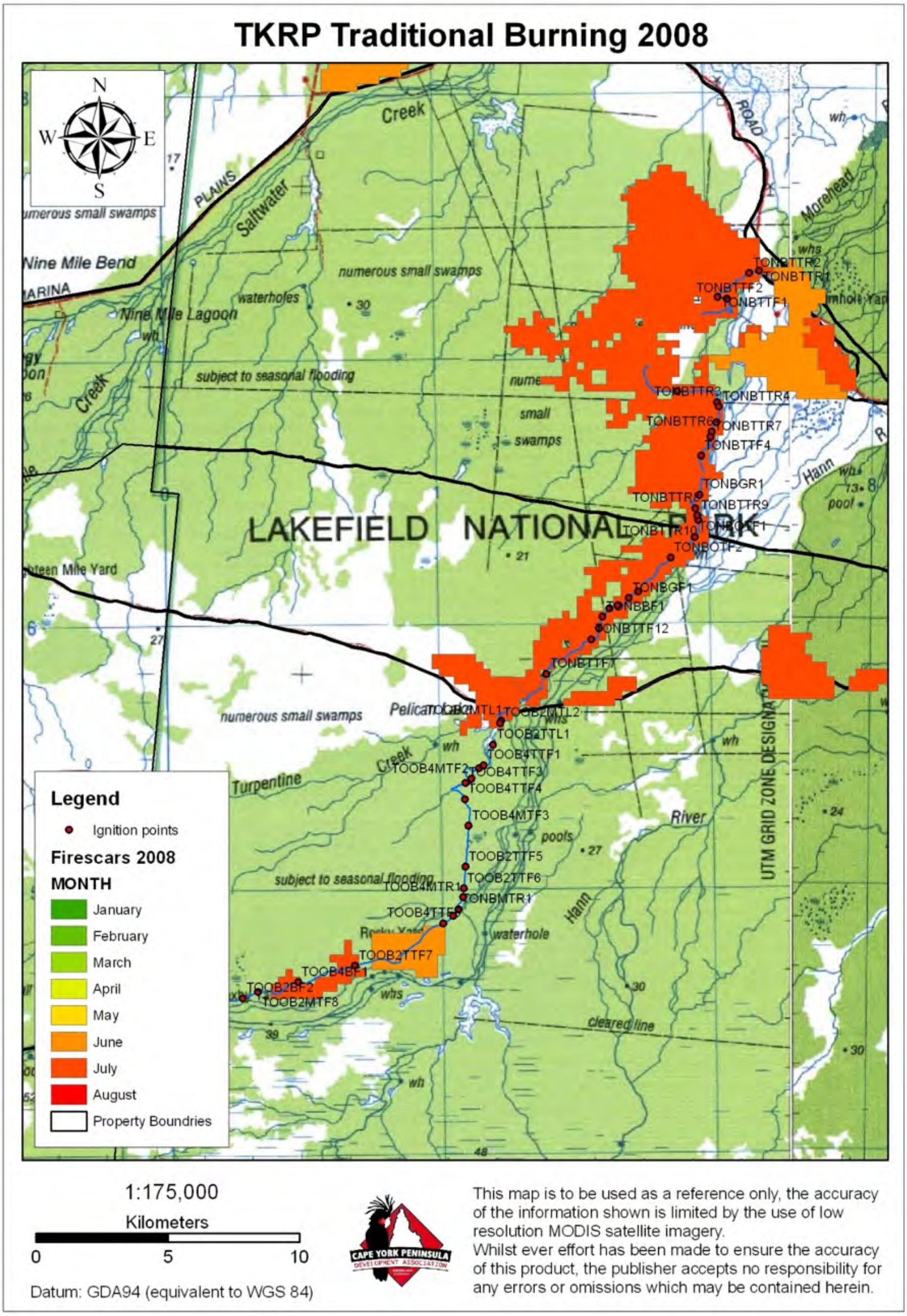
QPWS attended this trip for a short time, conducted interviews and filmed the burning program, see plate 6.12 QPWS staff member and Kawadji/Kanidji Land and Sea Ranger and Elder Blade Omeenyo visiting from Lockhart to be a part of the training and learn about the Elders' fire research project and plate 6.13, QPWS staff member and *Kawadji/Kanidji* Land and Sea Ranger and Elder Blade Omeenyo.

Plate 6.12 QPWS videographer and Kawadji/Kanidji Land and Sea Ranger and Elder Blade Omeenyo

Source: CYPDA 2007

Plate 6.13 QPWS staff member and Kawadji/Kanidji Land and Sea Ranger and Elder Blade Omeenyo

Source: CYPDA 2007



Map 6.2 Close up of fire scars implemented by the research project team and visitors in 2008
Source: Cape York Peninsula Development Corporation 2008

It was this year that Dr George said that he *'wants to see this happen every year where communities meet to do work and training'*

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2009

The sugarbag Inigenous led participatory action research project sites can be seen on the 2009 fire scar map 6.27 that shows the zoomed in mapped burn resulting from the July 2009 fire workshop, the second biggest fire scar that the project generated. At the fire workshop we had a number of additional people who also implemented additional ignition points over a short space of time. Increasing the size of the fire through multiple ignition points over larger areas.

In 2009, the research team officially launched the Indigenous fire workshops on Rinyirru on Lama Lama country at Bizant outstation on then Lakefield National Park from the 7-9 July, 2009 fulfilling an aspiration of the Lama Lama and Kuku Thaypan Elders (TKRP 2002). This burn scar can be seen in Map 6.27 below as a large footprint looking scar. This was not the first observance of traditional phenomenology that I experienced during the research project, nor would it be the last. This first Indigenous fire workshop was with Cape York and Wet Tropics traditional owners and was a huge success for the participants (Steffensen 2009).

Ignition points implemented by the research project team in the AOI in 2009 can be seen in Map 6.28 below. Interestingly the zoom of the fire scars for Gno Coom and Rocky in Map 6.29 highlights the date range for fire scars mapped in June as spanning from 25/05/09 – 08/06/09 at *Gno Coom* and Rocky Plain. Ignition points were implemented from the 25/05/09 to the 26/05/09 by the KTFMRP so fall within the mapped fire scar range and could potentially co-relate with the fires implemented by the research team in late May. However, as can be seen in the map, June fires also occurred well away from ignition points of the project. There are a number of possible explanations for this; possibly the fires that were implemented by the research team continued to burn into June, although fires were always assessed to ensure that they were out; the Elders' burns were added to a week or so later by local managers for mustering purposes or the fires were started by being carried there by the fire bird, the brown falcon *Falco berigora***.** These additional fires are separate to but surround the fire scar that align with the Elders' research project ignition points. The additional fires are dated in late May but mapped as June, and are potentially mustering fires given the locations and shapes of the fire mapped fire scars.

Fires in an around the Kuku Thaypan clan estate and the research project AOI 2010

It was in 2010 that the research project partnership that the TKRP had previously developed with the University of Technology Sydney (UTS) expanded and I began to engage with Jacqueline Gothe (Senior Lecturer Visual communication school of design) to support communication aspirations of the Elders' KTFMRP. Previously the partnership between TKRP and UTS had focused on digital design training to support the TKRP, improving the database design and working with communities on sound, video and editing training. It was through this collaboration on communication design products of the KTFMRP that I was introduced to a young Indigenous research fellow at Jumbunna, Oliver Costello, who had been discussing the mentorship of the KTFMRP to NSW with Steffensen. It was through this collaboration that the NSW Firesticks project began in 2009 and together Firesticks, UTS and the TKRP KTFMRP and The Importance of Campfires sought funding through the Biodiversity Alive Program in 2010 an initiative of the NSW government to further develop Firesticks.

In 2010, an Indigenous fire workshop was again held at Bizant, within the KTFMRP and this research projects study AOI. This was the first time that Indigenous and non-Indigenous fire managers from NSW that had been engaging the Firesticks project in NSW attended the Indigenous led fire workshops along with Cape York land managers. See Plate 6.13 of attendees at this Indigenous fire workshop. At this and subsequent workshops the learnings that have been presented in this chapter along with the monitoring methods that have been presented in Chapter 4 were taught to other Indigenous and non-Indigenous people sparking their own Indigenous led research projects across Australia. These two workshops are presented here as they are significant in the outcomes of the Elders' KTFMRP and this research dissertation and lead us into the next Chapter 6 – the Elders' KTFMRP and its research methodology.

Plate 6.13 Indigenous fire workshop attendees Bizant 4-7 May 2010

Source: Field data 2010

Later that year an additional Indigenous fire workshop was held at *Chuulungun Ngachi,* country of the Northern *Kaanju* people of Cape York, see Plate 6.14 of attendees at this Indigenous fire workshop. One of the aims of extending the research project methodology and methods beyond Kuku Thaypan country was to increase involvement from Indigenous land managers and non-Indigenous land management agencies across Australia. It was hoped that this would influence non-Indigenous *Rinyirru* (then Lakefield CYPAL) park managers and decision makers of the value of the project and improve the opportunities to increase support for the Elders to fulfil their aspiration to gain rangers to work on their country.

Plate 6.14 Indigenous fire workshop attendees Chuulungun Ngachi 12 – 16 July 2010

Source: Field data 2010

Conclusion

Mapping the fire scars of the Elders' KTFMRP using remote sensing was not the only challenge the project had in bringing together western science and western land management practices with the Elders' TCK application and recording of fire. As can be seen in this chapter, documenting the Elders' on-ground fire management using remote sensing alone is insufficient. What can also be seen in this analysis is that fire can and was used as a tool of dispossession and a tool of warfare. The scale and intimacy with which the majority of burns implemented applying the Elders' Indigenous traditional cultural knowledge system of fire required documenting through a combination of on-ground methods. Documenting the variability of the fires implemented by the Elders and the resultant impact on the environment would have benefited from a team of researchers. However, it was documented by the Elders' TKRP using videography assessments and the Importance of Campfires using GPS records, NAFI fire scar data, photos, photo-points, field notes, interviews, vegetation transects, KTFMRP GIS system and Google Earth.

It is hoped that the reader has gained a perspective of the size of the area that the research was conducted over and the logistical challenges that this presented when being implemented by a very small team of people with an old hilux 4WD vehicle, no winch, no fridge, no personal protection equipment and an old Garmin 12 GPS that took a long time to initialise and find a satellite. Throughout the time of the research project actively being conducted on country the non-Indigenous researcher developed monitoring systems that are effective in using western scientific methods to assess and monitor the TCFK of the Elders knowledge map elements, indicators, vegetation change, other burns, the current condition of country and changes resulting from fire practices, these methods are shared every year at the monitoring and indicators masterclass that has been developed and delivered by me, supported by Indigenous colleagues as part of the now National Indigenous fire workshop.

The following chapter outlines the Elders’ methodology for how they implemented their traditional cultural fire knowledge on country the results of which have been presented in this chapter through the lens of western science constructs and methods.

Chapter 7 The Elders KTFMRP Kuku Thaypan Fire Management Research Project

Introduction

James Cook University conducted interviews with Elder Dr Old Man Musgrave at the University on the day of the Elder's graduation ceremony. An interviewer questioned Dr Musgrave "Now it's time for you to be the one?" He responded with his quick wit *"And I'm really happy about that." "What are you going to do now?"* the interviewer questioned him, and his response speaks volumes of his aspirations for connecting with and managing his country *"Nothing can push me when I get back to the station no white man, no one can say get out, no"* JCU Graduation day 14/05/2005 (audio clip field data:2005). Dr Musgrave and Dr George receive their honorary doctorates in April 2005 and the story is published in JCU Outlook in Plate 7.1.

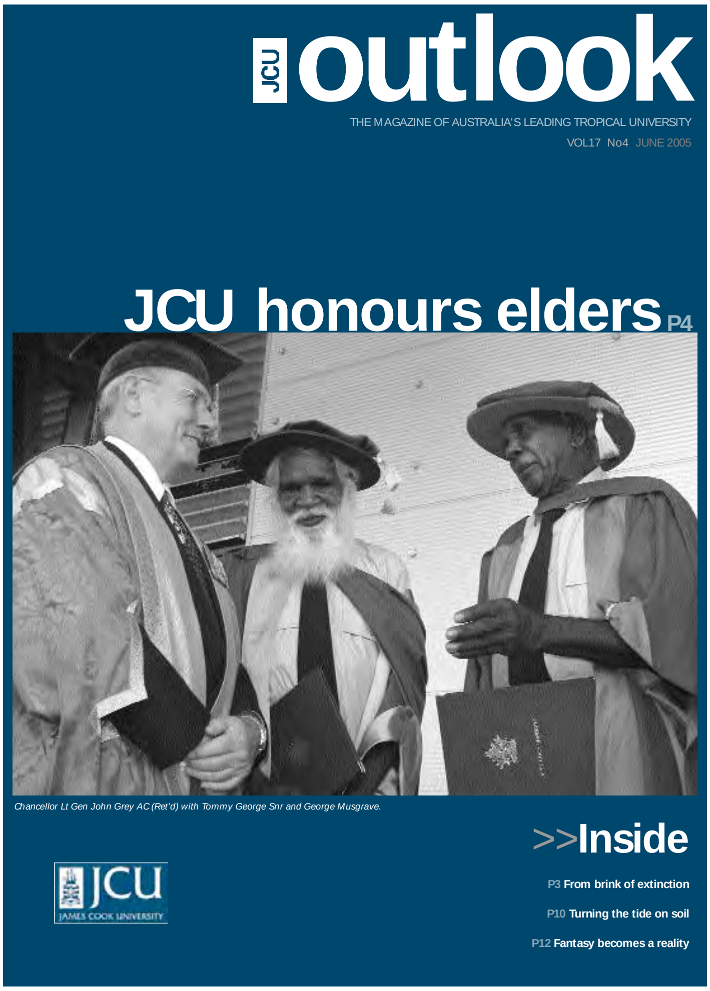


Plate 7.1 JCU Magazine Cover Dr George Musgrave and Dr Tommy George

Source: Field records 2005

Chapter 6 described the Elders' Kuku Thaypan fire management practices utilising western scientific constructs and methods analysed by the Importance of Campfires research dissertation. This chapter presents a description of the Elders' methodology, the implementation of their traditional cultural fire knowledge (TCFK) on their country in Cape York Peninsula and its description through the knowledge triangle and their knowledge map elements as they relate to fire (see below). The *Awu Alaya* speaking Elders' knowledge map components, elements and language name descriptions have been derived from field data recorded by their Kuku Thaypan Fire Management Research Project (KTFMRP), the Elders' Traditional Knowledge Revival Pathways (TKRP) project co-researcher Victor Steffensen and the Importance of Campfires co-researcher. It has been compiled and analysed for this thesis, the Importance of Campfires.

The Australian continent is home to hundreds of Indigenous Australian cultures. While some of the characteristics of these cultures are shared, each is also unique. Land and seascape features were created during the Dreaming and the care taking or lore for these places and their inhabitants, animate and inanimate[48] were given to its people through the Dreaming spirits and their ancestors. As articulated by a *Yalanji* man even the English word "Dreaming" is inadequate to explain what Indigenous people understand of its cultural meaning (Gibson pers com. 2008). In order to document the Elders' TCFK the Campfires methodology, developed for this thesis research required immersion in their cultural context (see Chapters 3 and 4).

Understanding their cultural context required recognition that each Indigenous Australian person has 'markers' of their life on their country that itself has physical markers, the land, waters and everything in it[49]. Further, each person is connected to their distinct cultural group but also connected to others through marriage and kinship. Markers include navigational markers including the stars, stone

[48] Within Indigenous culture things that western science tends to view as inanimate or abiotic, such as geological features are often believed to contain spirit and life force.
[49] This persists despite acts of colonisation to disconnect people from their lands

formations, engravings, carvings, etchings, placed dead trees, placed living trees, birth trees, burial places, scar trees showing varying shapes of scars depending on the use, stone tools, grinding and sharpening grooves, to name a few. Landscape features and its inhabitants are imbued with stories. Story places are across the entire landscape having varying scales of lore and cultural practice required to maintain them. For example, Plate 7.2 shows a Red Kangaroo *Nye alarrambi* (*Awu Alaya* language) extent boundary marker and story place, a large single vertical column sticking out from surrounding rock, its contemporary name is Lighthouse Mountain, and the *Whumbul* Owl story is shown in plate 7.3. These known named markers are well away from the Elders clan estate but demonstrate that knowledge of named places and navigation that exists through language connection, resource sharing routes and songlines.

Plate 7.2 Red Kangaroo *Nye alarrambi* Boundary marker and story place

Source: Field records (2005) Image 2015

Plate 7.3 *Whumbul* Owl story marker

Source: Field records 2007 Image 2015

Indigenous culture recognises the interconnectedness of these places and its inhabitants, shared through lore, language, kinship, song-lines and resource sharing routes, maintained through cultural practices such as stories, dances, art and crafts and management obligations. A diverse array of management rules and prescribed behaviours apply to these places and can include consideration of age, gender, person/s through kinship relationships, be clan specific or use related. Further, each of these places and its people have been observing over incredibly long-time periods, much greater than contemporary western scientific or natural resource management observation instruments. These observations involve a myriad of conditions of these places, prior to current land use pressures and before significant changes resulted from present day impacts. Abiotic and biotic organisms were and still are monitored through management and use and communicated between Indigenous peoples when changes are apparent.

Recent archaeological discoveries in Kakadu have extended the "known" length of time that Indigenous people "have been" in Australia, with the research team being *"able to say precisely that the area was occupied 65 000 years ago"* with some of the artefacts *"potentially as old as 80 000 years"* (Davidson & Wahlquist, 2017). This knowledge held by Indigenous Australians includes the use of fire and hence, the Elders research project took action to heal their country and demonstrate their traditional cultural fire knowledge. According to the Kuku Thaypan Elders, the current condition of country is in a state of decline due to contemporary land management practices. The Elders described a very different condition of county from how they remembered it and how it was taught to them. The Elders held knowledge of country before significant changes resulting from present day impacts occurred.

Traditional cultural fire management

In Indigenous Australian society, fire is sacred, it is alive and its use governed by complex laws. In a contemporary management context, it is a multidimensional wicked problem embedded in a social ecological system. At its heart, it is about interactions between all the elements, country and people. Fire problems in Cape York are socially constructed problems. *"No amount of technical or biological scholarship to physically or biologically define or control fire can solve fire management problems without the support of people"* (Pyne, 2007). Traditional knowledge of fire management and country held among Indigenous people of Cape York is important in providing solutions to current fire management issues facing Australia. Although fire management of Cape York is improving, applying fire management and monitoring its effects is not a simple task. Understanding how systems respond to fire, how and when to implement burns and when to keep fire out requires knowledge and skill. A myriad of perverse and destructive outcomes can result from fire on terrestrial, aquatic and atmospheric biomes. Conversely there are a myriad of positive outcomes that can result from the 'right type of fire' being applied across diverse ecosystems and landscapes, this includes the careful management of areas that contain fire sensitive vegetation. In the fire management system of the Elders TCFK is also about areas and plants that should be protected from fire and implementing fire in such a way that it enables protection of fire sensitive species and vegetation.

Kuku Thaypan Fire Management Research Project KTFMRP: The Elders Indigenous led research methodology

In order for a project to be Indigenous-led it does not have to be Indigenous identified, but when the two combine together as they did in this research project it becomes a culturally appropriate framework by its very definition as Indigenous knowledge holders are the researchers posing the question, directing and implementing the applied action and evaluating the outcome in a way that is meaningful to the knowledge system to which they are learned and honours its instruments of observation and analysis. Through the Elders' research they concurrently generated solutions to the challenges they faced in managing country and in transferring their knowledge so they demonstrated how to record and research their knowledge, ensuring that it was passed onto their younger generations and demonstrated how to heal their country applying their fire knowledge. The methodology described here outlines the Elders' attempt to demonstrate new ways of undertaking contemporary research and management practice that readily incorporates a rich body of ancient knowledge and facilitates new solutions for re-positioning perspectives of fire and indeed land and water management on Cape York Peninsula and more broadly.

The methodology of the Elders' research is ceremony (Wilson, 2008), it is their methodology to address culturally identified concerns and implement grassroots Indigenous led community driven research practice embedded in the interconnected elements of traditional knowledge, its cultural practice, country and people. The Kuku Thaypan Elders' Indigenous research methodology is embedded in their wisdom and the rules that govern their culture and are reflected in the principles identified in Chapter 4 on how the research with them was to be undertaken.

Describing aspects of the rules, principles, and techniques that apply to fire as not distinct from its actual practice (Langton, 1999) has been critical in carrying out this research because it is a system of knowledge that in time could potentially be lost unless it is learnt and practiced, it is also a system of knowledge that demands learning on country. It is important to understand that there is no step-by-step recipe to understand traditional cultural fire knowledge. TCFK is naturally adaptive, particularly in contemporary contexts where the Elders were dealing with modified landscapes and as such, have adapted their fire management treatment for that area in order for it to re-set the system, differing fire management for a period of time for it to be healthy again, with the intent to get it where it needs to be in order to burn it the ‘right’ way and put ‘the good fire’ back on county. However, these adaptations were based on knowledge of how their fire treatments would generate the response that the country needed in order for it to be healthy again, for native species to outcompete weeds for example, or the burning off by hand of excessive leaf litter. Many native Australian plant species shed their leaves as a part of their life cycles, particularly Eucalypt and Bloodwood species. However, excessive leaf litter can also result when the canopy is scorched by fires that are too hot. Although leaves provide cover for soil to compensate for loss of canopy, this can result in the smothering of native grass regeneration. An intense fire that damages the canopy causes excessive leaf drop and when this occurs the management intervention of the Elders was to burn the excessive leaf litter so as to prevent it from smothering the regenerating grasses. Not all the leaf litter was burnt. See plate 7.4 that has excessive leaf litter that has resulted from fires that were too intense for that system. The image shows burning off of the excessive leaf litter by hand in sandridge country at the National Indigenous fire workshop 2017 on Balangawarra country where this knowledge was shared.

Understanding the Kuku Thaypan knowledge system and how this applies to fire cannot entirely be picked up and learnt from a book. What follows is a description of components of the Elders’ knowledge system categorised through defining the knowledge triangle and the knowledge map.

Plate 7.4 Burning by hand excessive leaf litter at the National Indigenous fire workshop 2017 on Balangawarra country

Source: Field records 2017 Image credit Robyn May Cape York NRM

The knowledge triangle

Steffensen describes the knowledge triangle in 2016 below.

"The knowledge triangle basically is just another formula really of many that are just like many other formulas that create life or create just being and process. You also have other numbers of elements like 5 and 8 and 3 and also 1, but three in this case is the number for the knowledge triangle which is really is the basis for life and three connected is what makes us up and what keeps us going and what allows us to get from a to b so that is for us to be alive its oxygen, food and water and for fire its air, heat and fuel and so on you know you get those elements and also those elements of what we do is also a living thing. So it's sort of based on those same three principles of knowing what it is, knowing what it does and knowing how to do it. So that is like a process and the process is our doing and our responsibilities and our actions which is also a necessity for life. So that is within the knowledge triangle knowing what it is specifically for example is knowing a plant and knowing what it does might be that plants leaves might be good for a sore stomach or something like that or throat and then

the process of knowing how to do it and then that process is the final process to committing an action of knowledge that is of benefit and sustainable and when you look at that on a larger scale that's also can be seen on a large scale in terms of a whole mass of people and in terms of where we are today with society and a lot of the places with research methodologies and current understanding of environment and understanding of process and action is usually distorted and its distorted by government policies or bureaucracies or simply the loss of knowledge, so the loss of knowledge can also stall that process and put people in the situation of only having two sides of the triangle like knowing what it is and knowing what it does but they are not sure how to apply it or how it works or how to do it and that's a fundamental problem within the application of knowledge (Field Notes: 24 June 2016 3:50 pm).

Simply, the knowledge triangle is the formula for understanding the elements of the knowledge map, it is the key to the system of knowledge. Steffensen first explained the knowledge triangle to me as the key to unlocking the application of TCFK in 2007 when we were discussing the Venn diagram explaining the key components of the methodology of the TKRP as presented in chapter nine.

The Knowledge Map

The knowledge map is about understanding how all the different elements of the Elders' Traditional cultural knowledge system are connected. Steffensen describes the knowledge map below and its importance in attempting to depict the complexity and value of the Traditional knowledge.

"Western Management Systems don't understand the value of Traditional Knowledge in a contemporary sense. This information - the integrated nature of all things to say something is not connected is on the wrong track from the start. Western management systems don't seem to want to recognise this information they can't accept it, they reject it. They have to understand it to move forward. It's a kind of social awkwardness not knowing this knowledge map – not understanding how it is all connected. Not knowing the links to develop projects on the ground, they need to understand; there needs to be programs for white fellas to see – they are presently ignorant lacking in

understanding, in a purity of understanding of the interlinking of everything across all fields. They are a long way from the pure understanding to develop they need programs. If you don't understand how fire and water relate you're sacked. It should be required for your role that people understand. It's not linear, if you're not connected you're not part of it. You have to be part of it to keep the cogs spinning. Each spot on that knowledge map is a cog – each spins the other – Mother Nature designed it that way. It is the blueprint, the DNA, we start from there we go back to there. It is important to show that knowledge map it is the same across for all of us it is the key it holds our role our identity. When you know this you are grounded, connected, closest to being spirit white light. This is why the knowledge map is so important to me to show what Traditional Knowledge has taught – the knowledge map." Steffensen 2010

***Mor atung* - Fire rise up**

In order to understand the significance of *Mor* (fire) to the *Awu Alaya* speaking Elders, it is necessary to recognise that every square inch of country is embedded with cultural meaning, that there exists interconnectivity between all things; and that all things are animate and sentient. Understanding how to manage this country using fire requires connection, presence, and learning on country; it is not something that can easily be interpreted and extrapolated in static text, maps or planning documents. Fire is not a process that operates in isolation from its surroundings. It necessarily follows then that other elements of the knowledge system need to be known, practiced and understood in order to manage fire sustainably in the landscape.

Diagram 7.1 identifies the connected and inter-related elements of the knowledge map as drawn by Steffensen in 2010 and their relationship to the knowledge triangle. These elements were identified as being important in the *Awu Alaya* Elders' traditional ecological knowledge system. How they are interconnected with the knowledge triangle are conceptualised in diagram 7.1 drawn by Steffensen, in 2010 and diagram 7.2 is from a hand drawing done by myself in 2010, then drawn digitally in Diagram 7.3. Neither of us were together when we drew these diagrams and had not seen each other's diagrams until they were done. We had previously had many discussions about the knowledge triangle and the knowledge map. However, these drawings were done in response to a discussion Steffensen and I had regarding the TKRP diagram (see Chapter 11) in 2009. It was here we discussed the knowledge map in detail and following this discussion we both drew the conceptualised diagrams at Figure 7.1, 7.2 and 7.5. Victor drew the knowledge triangle at figure 7.5 and provided to me both of these diagrams. These diagrams also formed the basis for the design of the Importance of Campfires – Firesticks Poster, see Chapter 3, developed co-generatively to communicate the mentorship of the methodology of the research projects to NSW and the beginning of formation of the Firesticks program (Gothe, 2016) .

Figure 7.4 shows a Venn diagram that illustrates inter-related elements of the knowledge map as part of a collaboration with University of Technology Sydney design student project in 2010.[50] This was developed through interactive meetings with myself and sharing of the triangle and map at Figure 7.1, 7.2 and 7.3. Each of these conceptualisations inform the basis for the continued development of the *Awu Alaya* database that houses data of the Elders documented through their TKRP and KTFMRP. Information recorded with the Elders through their TKRP as they relate to fire and recorded by their KTFMRP are categorised according to the knowledge map components its elements, place and the knowledge triangle in the database. See Table 7.1 for the Knowledge map components and elements.

[50] The design visual was initially developed during a collaborative project with UTS final year design students (2010) and updated with Ben Lister (2018).

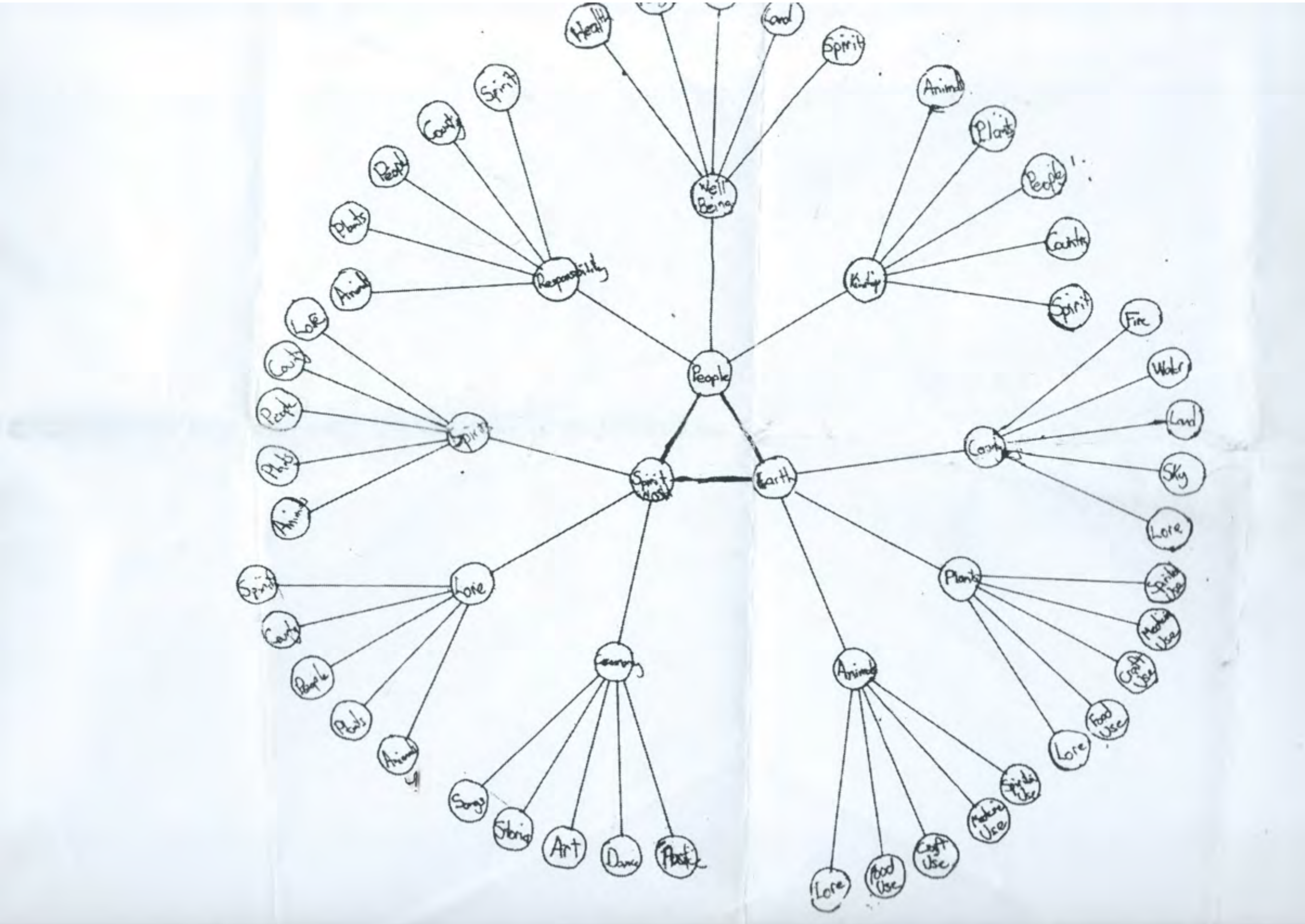


Figure 7.1 Drawing of knowledge map by Victor Steffensen

Source: Field records 2010

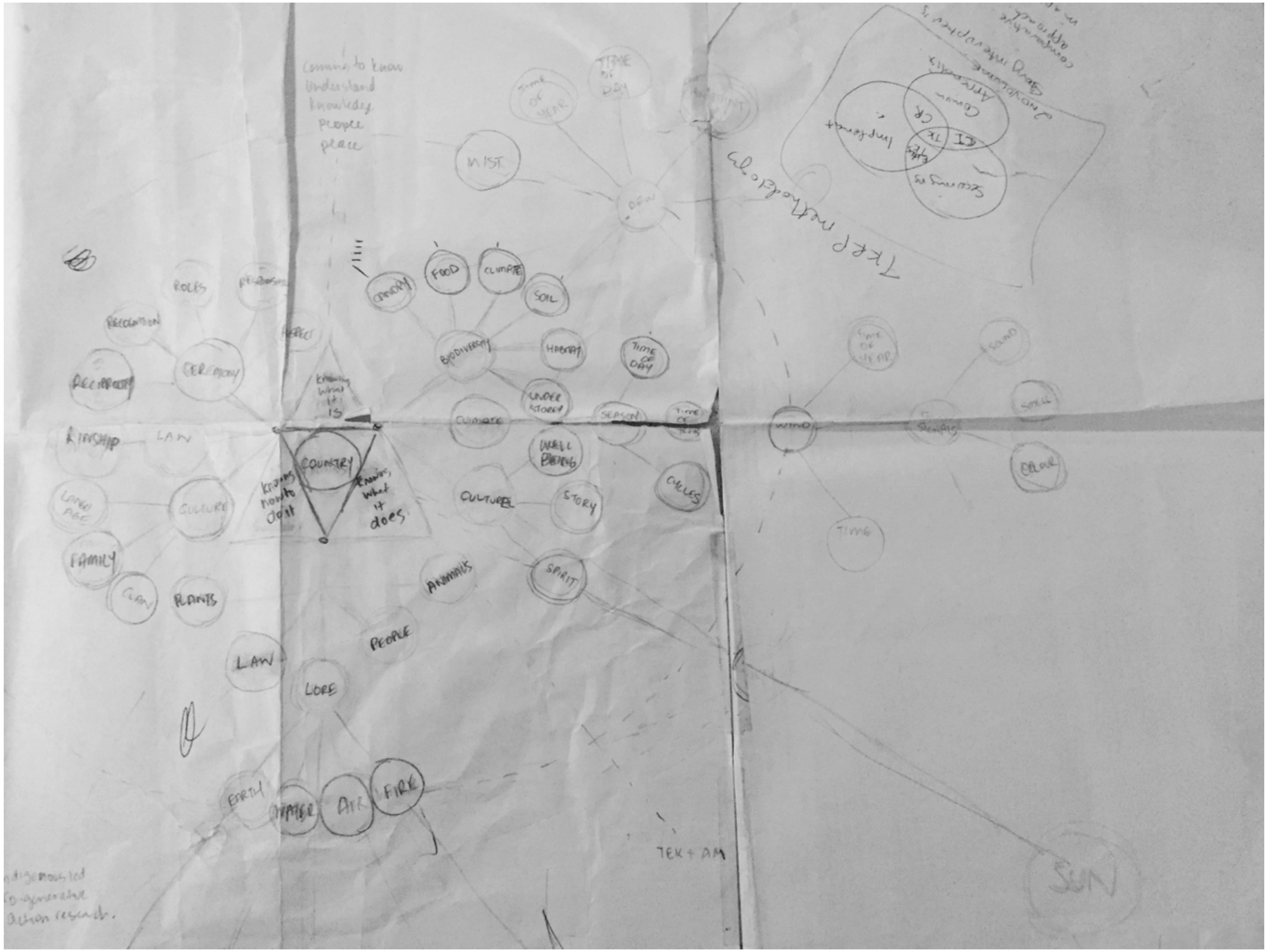


Figure 7.2 Drawing of knowledge triangle and knowledge map by Peta Standley

Source: Field records 2010

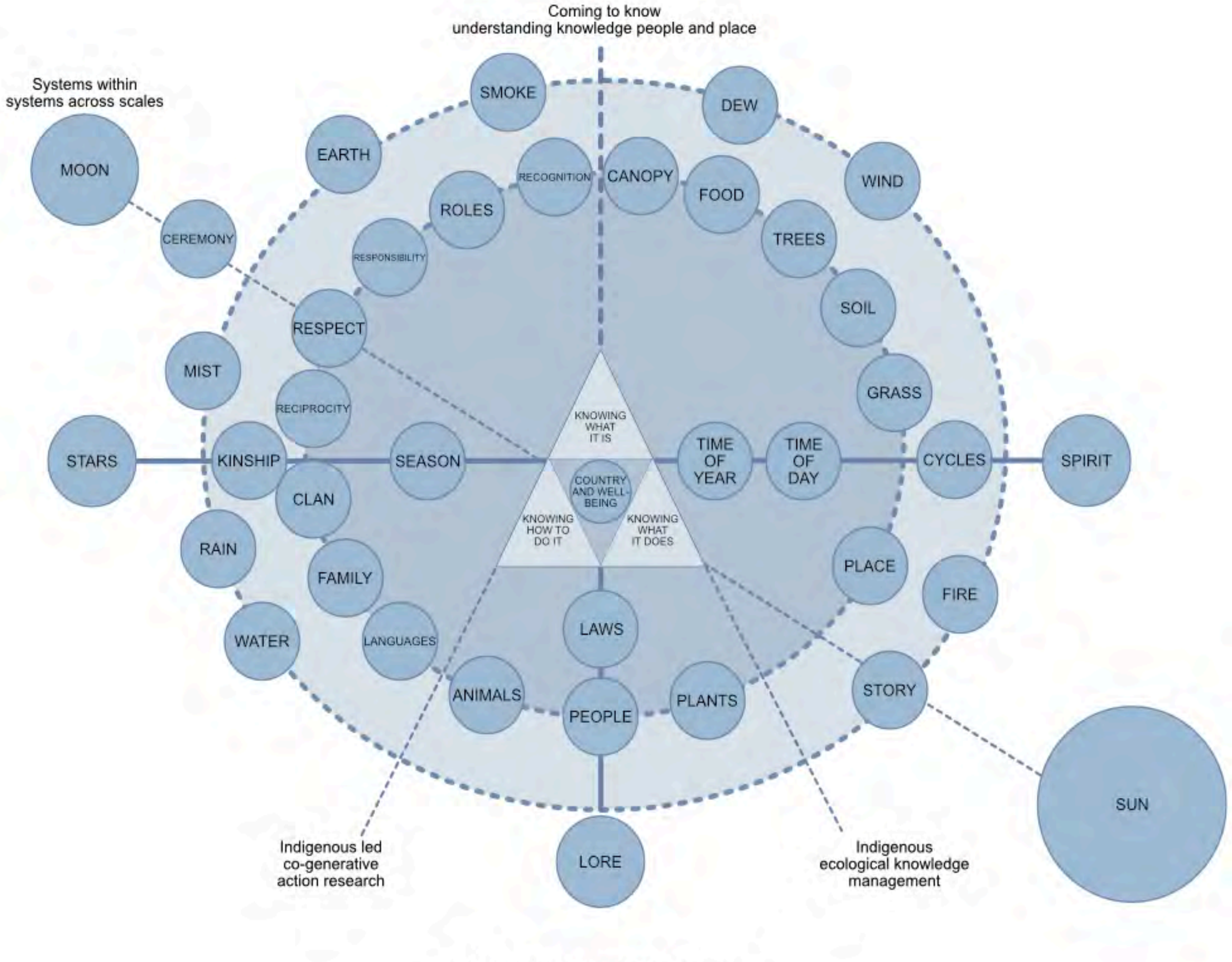


Figure 7.3 Knowledge map and relationship to knowledge triangle re-produced from hand drawing by Peta Standley

Source: Field records 2010

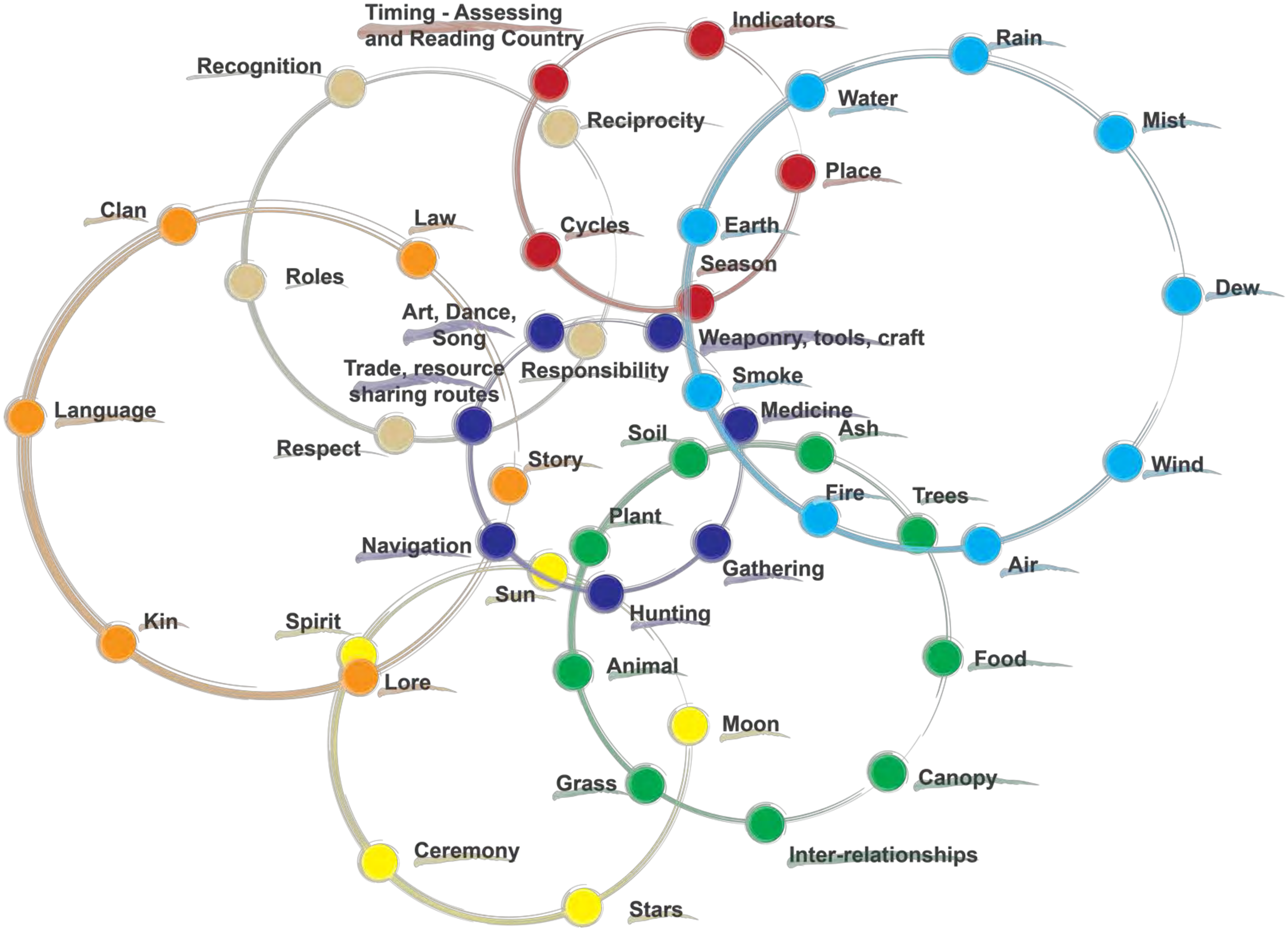


Figure 7.4 Knowledge map elements of the Elders Fire Knowledge that are connected to each other and the knowledge triangle. The design visual was initially developed during a collaborative project with UTS final year design students (2011) and updated with Ben Lister (2018).

Source: Field records 2011

Table 7.1 Knowledge Map Components and Elements

Knowledge Map Elements	Knowledge Map Components						
	Wisdom	**Governance**	**Custom**	**Phenomena**	**Features**	**Signs**	**Protocol**
	Sun	Lore	Medicine	Water	Grass	Indicators	Respect
	Moon	Story	Navigation	Dew	Canopy	Place	Responsibility
	Stars	Kin	Gathering	Mist	Food	Cycles	Reciprocity
	Ceremony	Law	Weaponry, tools, craft	Rain	Trees	Season	Recognition
	Spirit	Clan	Hunting	Smoke	Soil	Timing - Assessing and Reading country	Roles
		Language	Art, Dance and Song	Wind	Ash		
			Trade	Earth	Plants		
				Air	Animals		
				Fire	Inter-relationships		

The *Awu Alaya* database houses data from early research by Steffensen and the Elders TKRP and later the data Elders recorded through their Kuku Thaypan Fire Management Research Project and Importance of Campfires (this thesis). It contains over 2000 data records that are categorised into 7 components and 46 elements of the knowledge map; connected to the knowledge triangle and importantly to place. This knowledge of the Elders belongs to their direct descendants and has been shared with them through the many on-country visits they experienced with their Elders. The data in the database has been designed, categorised, and maintained through the efforts of Steffensen and the TKRP, this co-generative research project and supportive collaborators such as UTS and Ben Lister[51], for on-going access into

[51] Ben Lister was an employee with Mulong from 2011 to 2014 taking up a role as IT support at Cape York NRM firstly as a consultant in 2014 and then as an employee in 2016 and has continued to support the ongoing development of IT requirements of the Elders Indigenous-led research and ongoing legacy of the Indigenous fire workshops

the future by younger clan members. The data are off-line, with the capacity to be an on-line storage system for the data has been developed. Once approved by the descendants of the Elders this data-base can also be made accessible on-line if they desire and can be password protected. The database houses descriptions of the elements of the Elders' knowledge system, field data, GIS data, images and transcriptions of stories and knowledge shared by the Elders in the field.

In order to fully enable the application of the Elders' traditional cultural fire knowledge in contemporary contexts the key is knowing each of the sides of the knowledge triangle that unlock how to read country in order to understand how to implement this knowledge. The heart of the knowledge triangle is embodied by two slightly larger triangles that identify further knowledge and skill required to read country and apply traditional ecological fire knowledge. The knowledge triangle as described and drawn by Steffensen is shown in figure 7.5 and 7.6.

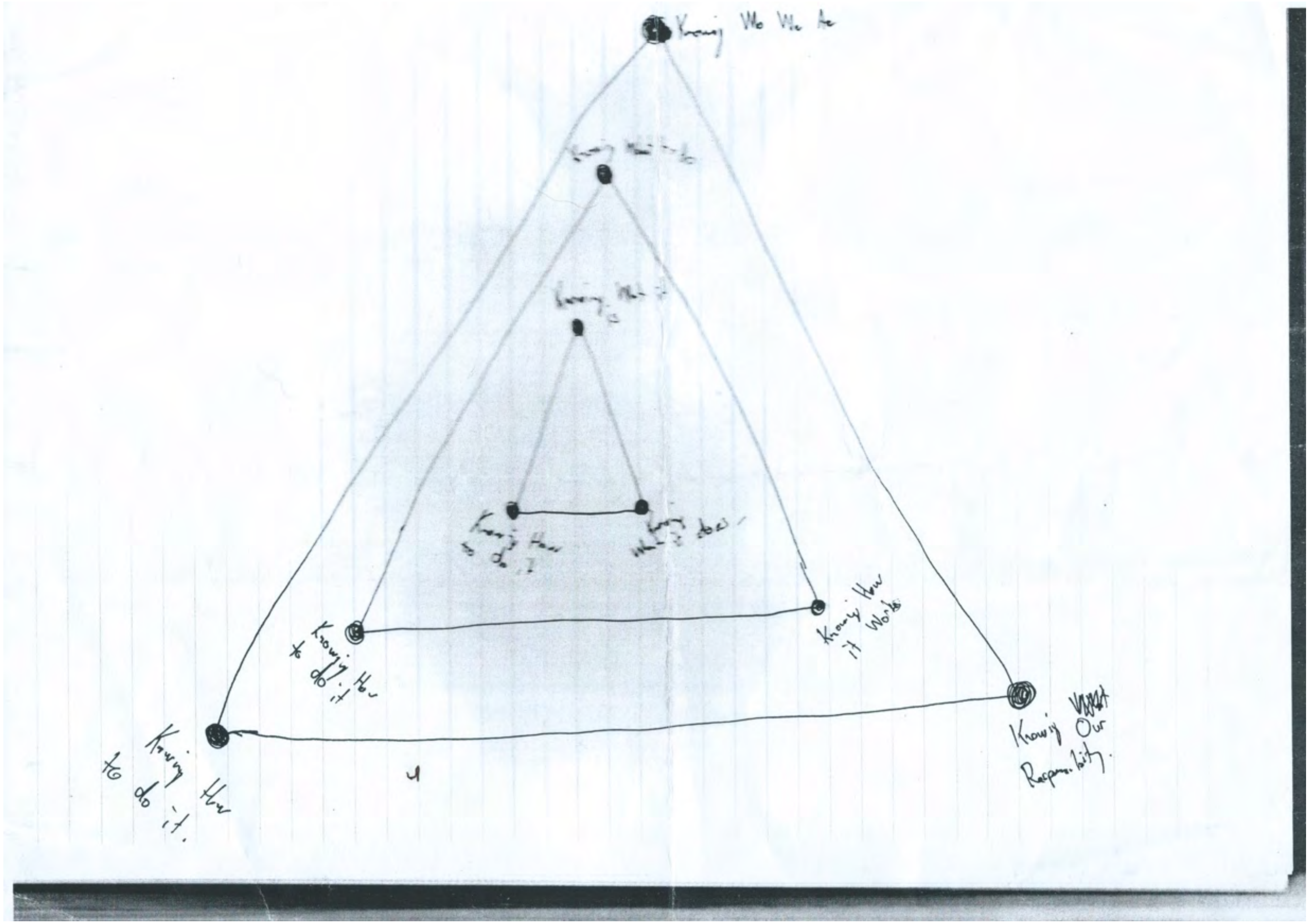


Figure 7.5 A hand drawn representation of the knowledge triangle

Source: (Steffensen, 2008a)

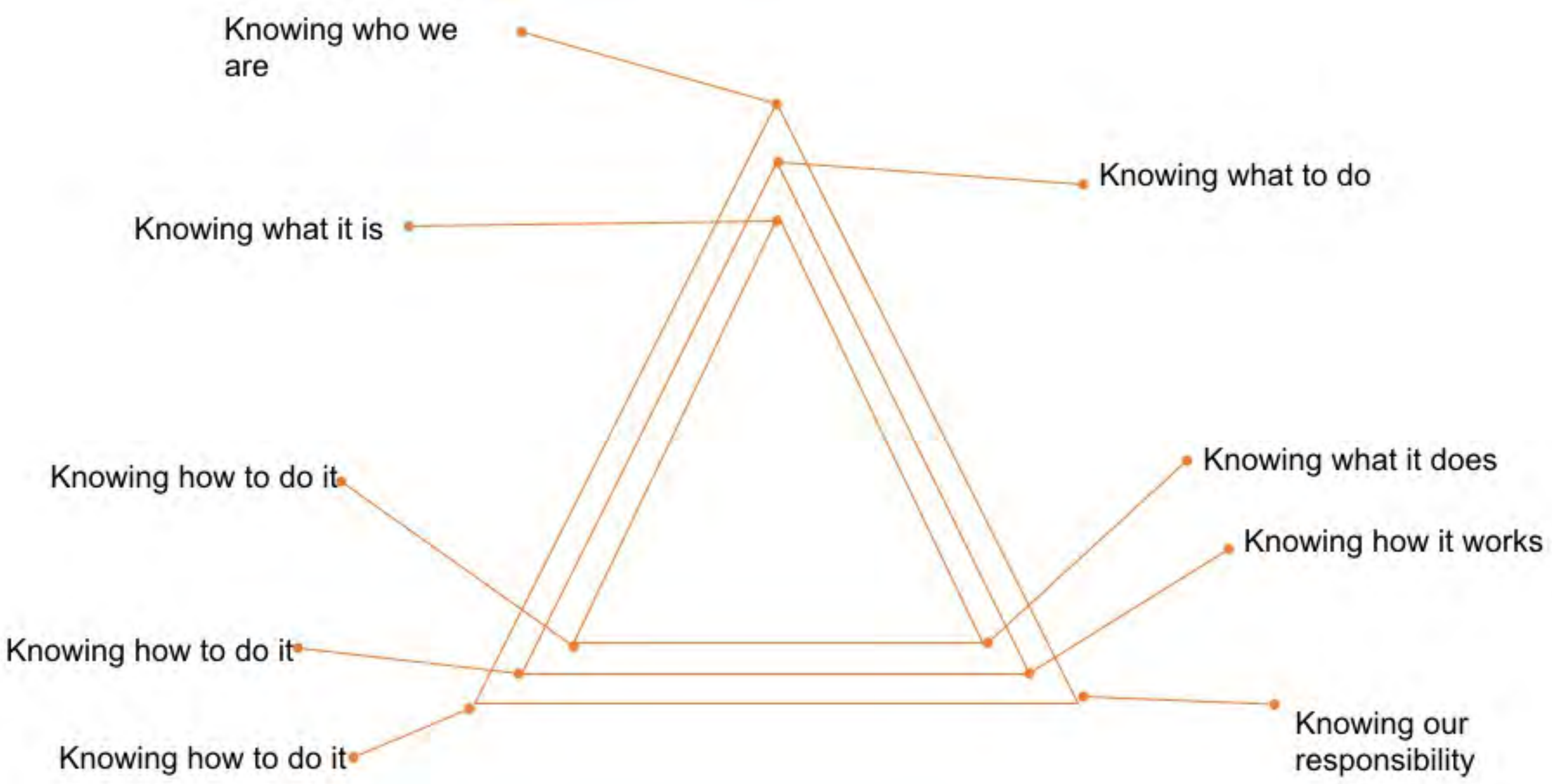


Figure 7.6 A diagrammatic representation of the knowledge triangle

Source: (Steffensen, 2008a)

As has been highlighted, it is impossible to reflect the depth of the Elders' fire knowledge using western constructs and representations. The best that this representation can do is reflect on the multitude of components, elements and indicators that are considered within the Elders' knowledge system when implementing fire management on country. This research dissertation is a western construct and therefore must necessarily demonstrate its capacity to define, categorise and analyse the Elders lived application of their knowledge system. Through this very process it lacks the capacity to adequately represent the experience of being on-country with the Elders and knowledge holders learning from them first-hand how to read country and ensure that the *"right fire"* management is applied to enable that system to function productively.

There is an intimacy that exists between the old people and country and this relationship is deeply respected. When this connection can be made it changes the way that people behave and how they acknowledge and show their respect to each other and country. The Elders' knowledge system contains systems within systems across scales as highlighted in diagram 7.3 and this is impossible to represent in a two-dimensional diagrammatic and written experience, even an interactive database, although useful for digital storage, remembrance and study of this knowledge although help to ensure the survival of this knowledge, it is strengthened when learnt from, shared and practiced on country.

A description of some of the understanding of each of the elements of the knowledge map is possible through researching with the Elders' TKRP and KTFMRP and data that have been categorised by this dissertation to connections with the knowledge triangle. This serves to provide a way to categorise and sort data gathered through the many years of the research project and describes elements that need to be known in order to apply "the right" cultural fire on country, however it does not provide the learner with all the knowledge and skill necessary to apply fire on country in the right way. The main elements of the Elders' Indigenous knowledge system as they apply to fire and their connections to the knowledge triangle as highlighted are best learnt on country as the knowledge is held in the country.

What follows is a description of some of the key elements of the Elder's knowledge system that may assist "others" to better understand the lived and practiced knowledge of the Elders and recognise the contribution that cultural fire management and Indigenous led cultural practice of fire on country provides to solution generation of the wicked problem of fire management in Australia. Table 7.2 below identifies how the elements of the knowledge map are connected to the knowledge triangle.

Table 7.2 Components of the knowledge map and connection to knowledge triangle

Source: Data 2016

Knowledge Map Components of cultural fire	Connection to knowledge triangle	
Wisdom	Knowing what it does/Knowing how it works/Knowing our responsibility	Understanding the three sides to TK to know how to use it as the baseline for applying adaptive management
Governance	Knowing what it is/Knowing what to do/Knowing who we are	
Custom	Knowing what it is/Knowing what to do/Knowing who we are	
Cultural Fire	The Knowledge map and interconnected elements accessed through the Knowledge Triangle	
Phenomena	Knowing who we are/Knowing our responsibility/Knowing how to do it	
Features	Knowing what it is/Knowing what it does/Knowing how to do it	
Signs	Knowing what it does/Knowing how it works/Knowing our responsibility	
Protocol	Knowing what it is/Knowing what to do/Knowing who we are	

The Knowledge Triangle and the interconnected elements of the knowledge map

Described below are the three sides of the heart of the knowledge triangle; knowing what it is, knowing what to do and knowing who we are. Knowing what it does, knowing how it works and knowing our responsibility that enable the knowledge, skills and ability to know how to do it, are described along with the interconnected elements of the knowledge map, as highlighted in table 7.2. Where ICFK from Traditional Owners other than the Elders is cited throughout the text it is appropriately acknowledged.

Knowing what it is – Knowing what to do knowing who we are

Knowledge of what "it"[52] is; this is about understanding what each of the elements of the knowledge map are, how they function and their inter-relationships to each other and the knowledge triangle. Knowing what it is and how it influences life on Earth. It is understanding what the universe does and knowing how to use the elements within it; knowing how to do it, applying this to understanding of seasons and changes in the environment, navigation, medicine, hunting, everyday living and health. It is about the respect and reverence to the dreaming and the ancestors through ceremony and how it benefits the spirit. It is about knowledge of lore, country, kinship, ceremony and the practice of culture, "knowing who we are, knowing our responsibilities and knowing how to do it." It is being an Indigenous Australian, the genetic connection to memory, the practice of culture and importantly it is about connection to place and knowing country, learning to listen to and read the country. It is about "knowing our responsibilities" and our connections to each other to ensure understanding and practice of culture, connection to and respect for country, and responsibility to know and look after country and each other.

[52] "it" refers to each of the elements of the knowledge map

Knowing what it does – knowing how it works knowing our responsibility

Knowing what it does is about knowing through practice how the elements of the system interact with each other. What is the role of each of the elements, how do they work and what are their relationships to each other and with people. Importantly how do they respond when humans, animals, weather and climate interact with them. "Knowing what it does" requires knowing through practice what the roles of each of the elements within the system are, what do they do, how they interact with each other, what are their uses and qualities, what do they provide to each other, what are their roles and inter-relationships to each other and with people. It is about learning how the elements and the systems work and experiencing and practicing how they work so that you know what it is, you know what it does, and you know how to do it.

'Knowing how to do it'

Knowing how to do it outlines what needs to be done in order to care for the knowledge system and for each other and understanding what our roles are in doing this. It identifies how we value, recognise and respect knowledge and skill, what are the protocols, rights, responsibilities and interconnections. It is about asking does our management and/or research practice and behaviour in place and with others enable the maintenance of culture, country and relationships. It is about "Knowing what to do" to ensure that this is done with recognition, respect and reciprocity. Knowing what to do is defined within the researcher practitioner model in Chapter 4. You need to know how to do it, in order to implement traditional cultural fire on country to achieve the desired management outcome that the country type requires.

Coming to know and understand fire requires guidance by Elders and fire knowledge holders through various stages of cultural learning on country. Learning the knowledge through a written or even a visual medium without learning that process on country means that components of the embedded nature of that knowledge in place and people can be misunderstood and importantly misapplied. It is not something that can be experienced once and then "picked up" so that people can "run away with the concept." This is the Elders' knowledge of country and fire, and it should be respected and acknowledged as their knowledge. It was shared with me through the undertaking of their TKRP and KTFMRP and has been documented and communicated in applying the principles outlined in "The Importance of Campfires" researcher practitioner model as discussed in Chapter 4. It has also been shared with many Indigenous peoples across Australia and Internationally practically on-country through training workshops and this work has helped these communities lay the foundations for furthering their own Indigenous led community fire projects.

This chapter has described the Elders' research methodology of re-instating their cultural fire knowledge on their country in Cape York Peninsula, the knowledge triangle as described by co-researcher Steffensen as key to unlocking the application of traditional knowledge on country and outlined the Elders' knowledge map components and elements. Chapter 8 will describe each of the elements of the Elders' cultural fire knowledge system and their relationship to fire.

Chapter 8 The Elders KTFMRP Knowledge Map Elements

Chapter 7 outlined the Elders' Kuku Thaypan Fire Management Research Project (KTFMRP) methodology and identified the components and elements of the Elders' knowledge map. This chapter will describe each of the knowledge map elements and how they relate to the knowledge triangle and cultural management of fire. Getting to know country, knowing what it is, knowing what it does, knowing how to do it; knowing place, reading indicators, understanding the seasons and cycles enables you to learn how to assess and read country and implement traditional cultural fire knowledge. The different elements of the knowledge map are outlined in Figure 8.1. Each one of the elements of the connected components of the knowledge map are discussed as they relate to the three sides of the knowledge triangle. The Knowledge Triangle is presented and each of the sides inter-connecting at the vertices discussed. See Figure 8.2 The Knowledge Triangle as drawn by Steffensen in 2010.

The knowledge map elements

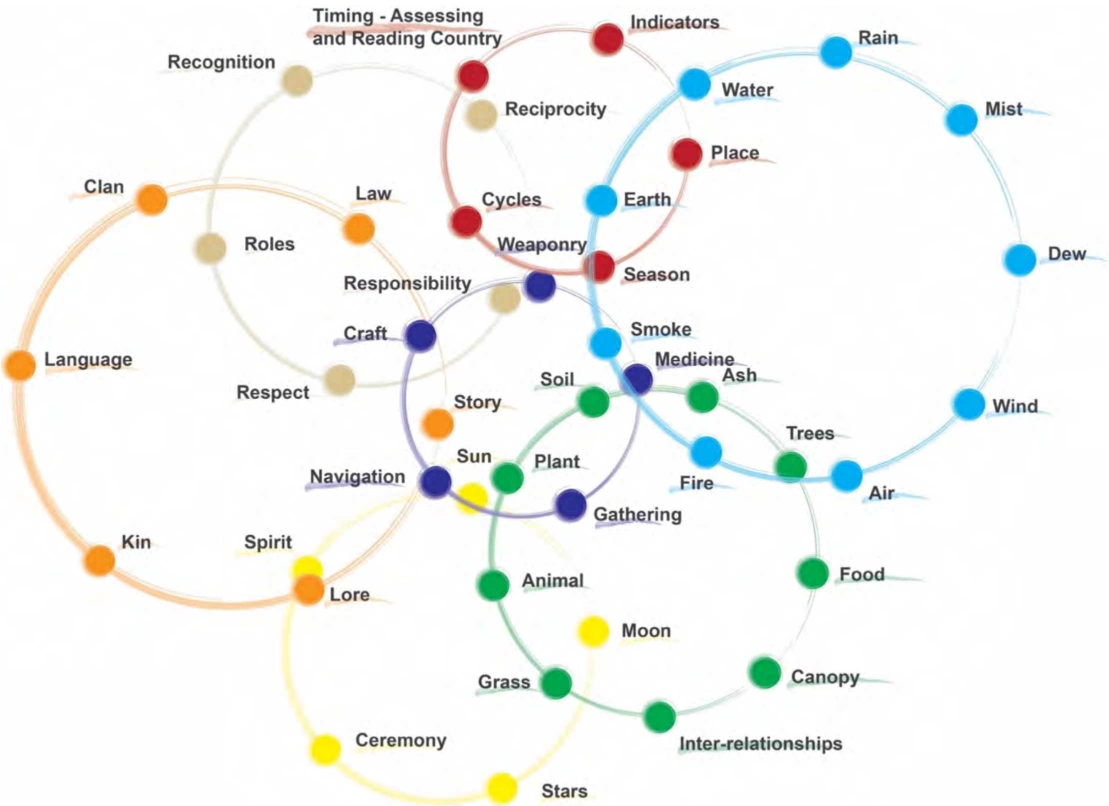


Figure 8.1 Knowledge map elements of the Elders Cultural Fire Knowledge that are connected to the knowledge triangle[53].

Source: Field records 2011

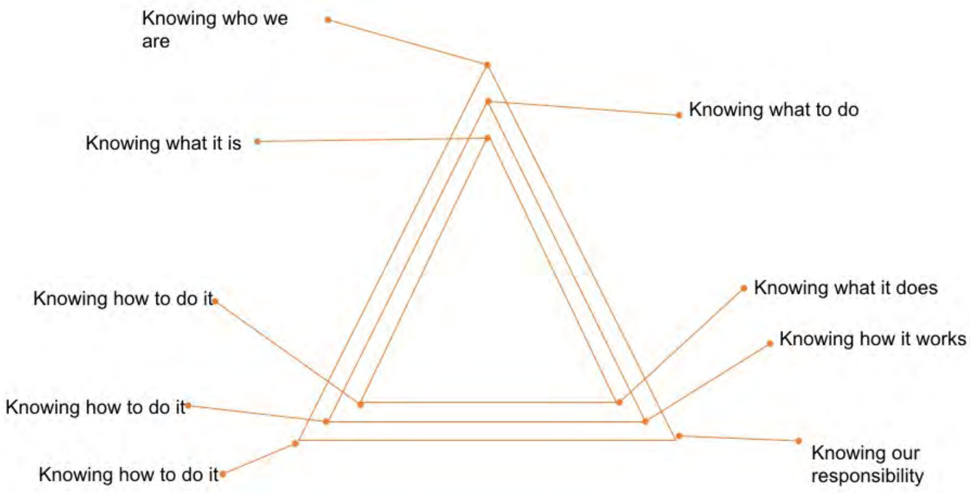


Figure 8.2 A diagramatic representation of the knowledge triangle

Source: field data hand drawing Victor Steffensen 2010

Knowing what it does, knowing how it works knowing our responsibility

In order to understand the Elders' TCFK you need to acknowledge the relationship they have with fire and how this relationship came to be. There is a strong acknowledgment of the Universe and understanding of how Earth systems work but also a deep connection to an infinite phenomenology. The Elders' nature of being understood how each of the elements works, what it does and how they interact with each other along with a cultural obligation to maintain this knowledge in the present realm and the responsibility this carries. Table 8.1 shows the elements that will be discussed in this section and their relationship to the knowledge triangle.

Table 8.1 Wisdom elements of the knowledge map and connection to the Kuku Thaypan knowledge triangle

Source: Data analysis 2016

Knowledge Map Components of cultural fire	Knowledge Map elements	Connection to knowledge triangle
Wisdom	**Sun**	Knowing what it does/Knowing how it works/Knowing our responsibility
	Moon	
	Stars	
	Ceremony	
	Spirit	

-

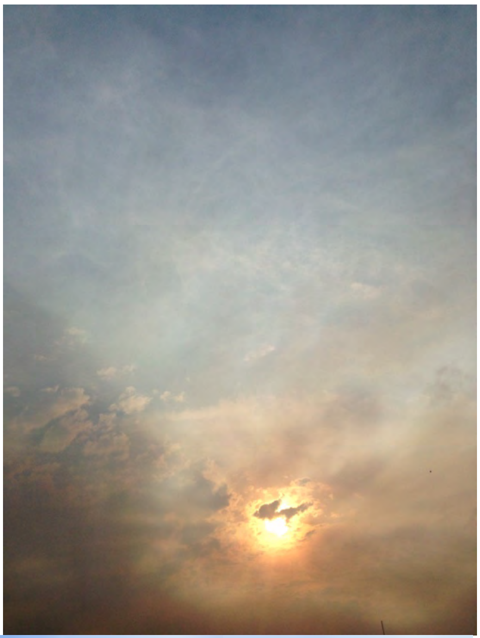
The Sun and the Moon

The Sun is *"the largest fire of all"* (Steffensen, 2010) and *"that's my universe that's Indigenous people's universe all over the world, not only Indigenous people, non-Indigenous people too... our sun is the core"* (Claudie, 2015). Without the sun, life on Earth would not exist and its significance is connected to the gift and use of fire. The Importance of the Moon is reflected in old lady Bairds statement *"I watch the stars, I watch the Moon"* (Steffensen, 2006), it's importance reflected in *"Gidja"* the Moon story she shared with me at Roaring Meg falls, a women's place in Yalanji country, South East Cape York. *'Ngoog arang utung'* look the moon rises, is a statement I heard from Dr George on many a night we camped by the light of the moon, waiting for the dew to come and go so we could start the days winter burns. The sun determines our seasons together with the moon and combined with the Earth's rotation our weather, seasons and cycles. The sun lifts the dew, provided by the moon cycles and this tells us when to get ready for burning on any given day, during the winter months. Plates 8.1– 8.4 show the presence of the Sun and Moon throughout the research project and how they interact with the moisture, light, temperature, fuel, fire and smoke indicate characteristics of fire timing and behaviour.

Stars Ceremony Spirit

In the Elders' TCFK the stars are a part of our connection to spirit, the regards to and connection of spirit conducted through ceremony. Ceremony combines all the elements of culture. It is reflected in bora, initiation, art, dance, song and story places. Ceremony is the practice of the remembrance of lore and how this relates to how we interact with each living and *"non-living*[54]*"* thing. Plate 8.5 shows paintings of ancestral spirits at Mushroom Rock, one of the extensive rock art painting areas in the *Quinkan* Reserve.

[54] As previously highlighted, everything is sentient in the ICK of the Elders



[*]Plate 8.1 *Ngoog* The Moon Source: field records 1 April 2007

Plate 8.2 Sun through smoke from late season fires Source: field records Bamaga 6 November 2014

Plate 8.3 The sun through the trees as Steffensen delivers the Indigenous burning workshop at the 2017 National Indigenous fire workshop. Source: field records 03/07/2017 photo credit Robyn May Cape York NRM

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[*] Clockwise from top left

Plate 8.4 Sun through the trees on Victorian knowledge exchange with Cape York Traditional owners 2013

Plate 8.5 Ancestral spirits at Mushroom Rock

Source: Field records 24-29th July 2006

Knowing what it is knowing what it does knowing who we are

The Elders, TCFK is embedded in lore, story, relationship to country, kin, clan and language. They know what it is to hold traditional cultural fire knowledge, it is their knowledge. They know how best to apply this knowledge, they know what to do, how to implement their cultural fire knowledge on country. This capacity is deeply connected to knowing who they are and their connection to country and each other. Table 8.2 shows the elements that will be discussed in this section and their relationship to the knowledge triangle.

Table 8.2 Governance elements of the knowledge map and connection to knowledge triangle

Source: Data analysis 2016

Knowledge Map Components of cultural fire	**Knowledge Map elements**	**Connection to knowledge triangle**
Governance	**Lore**	Knowing what it is/Knowing what to do/Knowing who we are
	Story	
	Kin	
	Law	
	Clan	
	Language	

Lore

This is absolute, handed down through art, ceremony, song, dance, ritual, and embedded in country. Plate 8.6 showing the practice and remembrance of lore and culture at the Laura Dance Festival, which is held bi-annually on a traditional dance ground. This translates into management laws for how we interact with each other and with country. The knowledge is embedded in the lore and the lore in country, the lore is to be respected. In the words of Stanley Kalkayorta in the film “Water we Know” *“it never changes, white man’s law it’s changing all the time”* (Steffensen, 2006). Country is your heart, your kin, your blood, your birth place or your home through marriage, you are responsible for the safe keeping of this place and yourself and family within it. In parts of Australia, your connection and responsibility is through your fathers’ bloodline and you can have connection to it through your mother’s bloodline which can be given, chosen by an individual or transferred as outlined in this thesis introduction. In other parts of Australia, it is matrilineal.

Plate 8.6 The practice and remembrance of lore and culture Laura Dance Festival 2015

Source: Field records June 2015

"Today fire is seen as a destructive force with most Australians fear. This fear disconnects society from the land and its people. Fire is a powerful element. Fire illuminate's life and provides culture with ceremony, medicine, food, warmth and above all a lore that the land taught the people. We must respect this as an inherited responsibility to be passed on in our changing World. The challenge today is to keep this respect alive, not only in terms of looking after the land but to heal the differences between people and their relationship to country in (Gothe, 2016). This text was developed at a workshop at UTS in Sydney in February 2011 funded by Perpetual Trust and attended by over 60 Indigenous and non-Indigenous fire managers from across NSW, attendees are listed on the Importance of Campfires Firesticks Poster, see Chapter 3.

Story

Abiotic and biotic features contain stories of particular species or phenomena such as fire, fauna, flora and resources to name a few. Lagoons along the Morehead River drainage and specifically two places in the area of *Ngo Coom/Ngokumina* (Saxby lagoon) in Kuku Thaypan country are home to *Pa pieta pai* (Mermaid) a traditional story (Field notes 2005) that extends all the way to the border with Lama Lama country at Hahn River crossing and begins at the southern end at the top of *Kating* Morehead River junction with Mary's creek. Girls are not allowed to eat mussels from two places located near *Ngo Coom* and the *Kating* Morehead River specifically as to do so may harm the health of their babies. *Agnrawal Nyenarda* is one of these places and the Northern end beginning of the *Pa pieta pai story*. Barramundi *Nye dalku* small past 50 cm *Nye wayaeng* (big old) may be caught and eaten there, but may not be eaten at *Gno Coom* when women are pregnant. It was understood that the water at these two places was clean and would never dry up as the spirits of the mermaid maintained it. Today the water is not clear and you cannot see the bottom, which once you could. Therefore, there has been a decline in the interconnected cultural, spiritual and environmental values of that water. The water at the Hahn River crossing and the end of the *Pa pieta pai* story and a boundary with Lama Lama is brackish with mullet swimming upstream to the crossing. Women are also not allowed to fish at *Llung* Polly Lake as *Llung* is home to a white crocodile.

The Dreaming story (*Alpa kerwandha*) explains how saltwater turtle travelled up to the junction of Hahn, Sandy and Jungle creeks, made a nest then turned around and travelled back and marks where the saltwater once stopped and the freshwater begun recording landscape feature changes adding to the knowledge base within western science of the length of time humans have occupied Australia and the persistence of their knowledge of country. Other stories link water bodies, animals and plants to each other, their behaviours and how they interact with each other. Physical markers of these stories can still be seen at some places today and are present in the characteristics of fauna. Other stories link one clan estate to another as a story beginning at one place may have its end on another. Due to contemporary threats and pressures recorded across the study sites, including inappropriate fire regimes some of these physical markers are becoming increasingly difficult to locate, with some unable to be found on country visits. For example, during a visit to *Llung* Polly Lake in July 2007, a cultural story marker peg belonging to Emu and Big brown eel *Nyeguul* was not able to be located, this marker was known to exist here prior in 1996 as it was recorded by the Elders on a visit to the area in compiling the Lakefield Land Claim. The Taipan *Oxyuranus scutellatus* story place was unable to be located, due to years of stagnant grass growth, high fuel loads and inability to navigate country as unable to burn to assist in finding markers and it is also on Leasehold land. There are many more markers and places the Elders described that could not be accessed.

Story is important; it is how important events and places are remembered and communicated through oral transfer, through song, art and dance. Story also communicates the rules about how you and other elements in the system behave in differing parts of the landscape and it is important that this is remembered and obeyed or you may “get sick” or worse damage the spirit of the story place affecting the species and features that are held within it or in other places in the landscape, as is reflected in Dr George’s *Undun* Mist story explained later. Story places hold memory of places of birth and death and other phenomena and represent a map of the landscape and how species and systems interact within it. Story places often protect species of significance and management laws in those places ensure sustainable management of the species that are present or that utilise other resources present in that country. Stories also connect people to each other and place. Plate 8.7 shows Dr George in 2015 sharing stories with students from Cooktown State High School on a Conservation and Land Management CALM camp. He is telling these stories while present on one of the boundaries of his country that adjoins Lama Lama.

Plate 8.7 Dr George sharing stories with Cooktown High School CALM Conservation and Land Management camp on Kuku Thaypan Estate at the boundary with Lama Lama

Source: field records 10 February 2015

Kinship

This is your patrilineal and matrilineal connection to each other, your family groups, your clans, your main language, across clans, language and Nation Estates and to place; and all that it contains. Your kinship connection determines how you interact with country; if you can speak for it or listen for it and your obligations to country and each other, if you can directly communicate or if you cannot; and if you cannot, how you interact with others to ensure that your "poison[55]" relations well-being is cared for.

Law

In the Elders' TCFK, law applies to management of self, your relationship with your kin and places and what you can and cannot do, when you act the wrong way in a story place you break the lore and when you break the lore there are a number of phenomenological and physical consequences. For example, mussels were once larger and in high number across the entire wetland complex and the story place and source point (place in the landscape where a particular species is abundant and act as supply for the surrounding landscape) for mussels are at the Mermaid dreaming places discussed above. Mussel are periodically washed downstream during the wet. Due to the high level of pressures being experienced at these sites, mussels are no longer in abundant numbers. Eels were also present across the entire system while today they are rarely, if ever, seen. Bird numbers and diversity was higher across the entire system, species of note include: *Nhye areeba* Emus, *Nhye Wann* Magpie Geese, *Nhye Pulkin* Pelicans, *Nhye geaba* Brolgas, *Nhye chiilpa* Jabirus, *Nhye rou* Pacific Black Duck, *Nhye road* Snake neck darter, *Nhye ratamol* Pheasant and *Nhye woongara* Burdekin ducks. At some of the wetlands it was possible to see the bottom the water was so clear when the Elders were young. Some of the lagoons were kept free from *Nhye enara* saltwater crocodiles, like *Gno Coom* (Saxby) as they were actively netted out of places where people had regular camps for safety and

[55] Poison relations mean that there can be no direct interaction between the parties that are poison to each other. However, you are also obliged to care for that person, ask after them and ensure that others are looking after them. You may ask for things from them and take things from them but only through a third party.

maintenance of faunal population densities of fish, birds and wallabies. The water was clean and had an abundance of food; at *Agnrawal* there once were large populations of turtles here that would have benefited from the supply of hollow logs.

It has taken less than a seventy-year management timeframe for these changes to occur with Old Man Musgrave commenting in 2004 when he saw *Llung* Polly Lake that he had never seen it so dirty in his lifetime of traveling through country and Dr George was unable to locate the known Emu *Nhye areeba* story marker here on a visit in 2007. Emu are significant cultural species that are protected in Kuku Thaypan country, you are not allowed to eat them, although there is knowledge of how to hunt them. Hot fires occurring during their nesting period can have a negative effect on their abundance. This story starts all the way up on Glen garland station. *Llung* although now inside *Rinyirru* National Park up until the end of 2011 *Llung* was managed inside the adjoining pastoral lease with an unfenced boundary between the park and *Tenacull* Maryvalley station.

Clan

Your clan are your direct descendants with rights to speak for specific areas of country within Estates, these are your closest family groups through blood, marriage or connection. Through the kinship system; your totems are also part of your clan identity. Plate 8.8 shows members of the Kuku Thaypan clans with visitors on *Tenacul*l Maryvalley station at the Indigenous fire workshop 2015. Culture is how the lore is remembered through the practice of language, art, ceremony, song, dance, ritual, birth and burial, the practice of knowledge on country. Plate 8.9 shows Dr George marking Ash Standley with his mark using the Kuku Thaypan ochre colour at the Laura River 200x.

Plate 8.8 The 2015 Indigenous fire workshop on Kuku Thaypan country

Source: Field records 2015 Image credit Kerry Trapnell

Plate 8.9 Ash Standley being marked with Dr Tommy George's mark in the ochre colour belonging to Awu Alaya

Source: field records 201X

Language

Language connects you to country and kin and was spoken by the Elders when explaining knowledge and their use of it increased with time spent on country. Language classifies elements within the systems, such as different sexes of species, such as for female and male macropods, and differing age and size classes such as for Barramundi, see Table 8.3. Language described as an element also provides the ability to filter a language dictionary from the database for use. Language holds knowledge that helps to immediately identify what something is and what its characteristics are. For example, *chi* is a prefix for all edible fruit, *ku* for all trees, edible meats *nye*. There are 183 language entries in the *Awu Alaya* database, with more to be transcribed.

Table 8.3 Example of language classifications for animals of various sexes and age

Animal common name	Animal language name	Animal scientific name
Grey Kangaroo (Male)	*konbalong*	*Macropus antilopinus*
Grey Kangaroo (female)	*chuwurrung*	*Macropus antilopinus*
Red Kangaroo (Male)	*nye alarrambi*	*Macropus rufus*
Red Kangaroo (Female)	*arrkwodham*	*Macropus rufus*
Wallaroo (Male)	*arrawi*	*Macropus robustus robustus*
Wallaroo (female)	*wawli*	*Macropus robustus robustus*
Bandicoot (Male)	*arrmbakalam*	*Isoodon macrourus*
Bandicoot (Female)	*mun*	*Isoodon macrourus*
Barramundi large (>50cm)	*Nhye wayaeng*	*Lates calcarifer*
Barramundi small (<50cm)	*Nhye dulka*	*Lates calcarifer*

Knowing what it is, Knowing what to do, Knowing who we are

In the Elders' TCFK system you need to know what things are and know what to do with them, how to process them, store them, combine them for them to be used. You also need to know how to do this in the right way so as not to impact the resource, such as the harvesting of yams or tubers for example. This cultural knowledge that Indigenous Australians hold is intimately connected to who they are. It is shared but also unique to each group, there are similarities in language for some things for example or perhaps a shared use of practice. However, I have also been fortunate enough to be present at the 2009

Indigenous fire workshop at Bizant when during the indicators and monitoring session, Indigenous knowledge holders from across Cape York and Far North Queensland shared their knowledge on uses of plants and trees. It was astounding how long we stood around key species and listened as the groups spoke of their uses for different parts, or the same parts, or different processing or for use in different ways. Table 8.4 shows the elements that will be discussed in this section and their relationship to the knowledge triangle.

Table 8.4 Custom elements of the knowledge map and connection to knowledge triangle

Source: Data analysis 2016

Knowledge Map Components of cultural fire	Knowledge Map elements	Connection to knowledge triangle
Custom	Medicine	Knowing what it is/Knowing what to do/Knowing who we are
	Navigation	
	Gathering	
	Weaponry, tools and crafts	
	Art , Dance and Song	
	Trade and resource sharing routes	

Medicine

In the Elders' TCFK the care for and protection of medicine plants and animals was significant. Poor fire management impacts on the production species used for medicinal purposes. Medicine is used in both the physical treatment of ailments and the phenomenological treatment of patients. It can be good medicine or bad and its use is treated very seriously, sometimes having unexpected ramifications if not used correctly including disturbance of one's spirit or death. A favourite yarn of

Dr Musgrave's that he enjoyed telling was how people came to seek out 'medicine to catch a man or a woman' and how often they returned asking how to make it stop. He also used to receive a large number of artefacts or rocks that were returned by travellers who had taken them from places that they should not. Medicine is still used in Cape York to this day for many aspects of everyday life. Medicine can be self-administered once taught how to by a knowledge holder but was sought from experienced people who were recognised as doctors of medicine. There are 13 species and 27 records referring to medicine in the Awu Laya database.

On one field trip I had been walking in my thongs over burnt ground and the sole of my foot had been pierced by a stick. Some wood is poison and after a few days on country it had started to get infected and was beginning to make a red streak up my ankle. We did not really have any decent first aid supplies, so on direction from Dr George, Steffensen went in search for medicine for my foot. It was a combination of roots and boiled water with a stripped sheet for a bandage. Overnight the infection had gone. Now this could have been a combination of just boiled water some would say, however without seeing the gash in my foot and just how infected it had become to be able to walk around with no problem the next day was enough belief from me that the medicinal plants played a key role in reducing the infection and inflammation.

Navigation

There is a navigation marker on *Tenacull* that points to *Gno Coom,* one on route to *Ndolgin* from Rocky crossing that points to *Ndolgin* and one that points to *Agnrawal.* There is also one that points to *Llung.* These were recorded through time travelling on country. They were not pointed out to me, I came to ask through observation of them, almost as if I did not notice them, they could not tell me the way or what was at the source of where they were pointing. Magnetic termite nests were used to place marker sticks pointing in direction for water bodies/land marks *termite ant builds up over top holds it in place* (field records 05/06/07). Trees were often bent to indicate locations in the landscape, this practice has been witnessed throughout Cape York and the Wet Tropics. Plate 8.10 to 8.12 below highlight navigational markers. These markers have the potential to be seriously impacted by fires that are too frequent and too hot and could be destroyed over time as contemporary land managers are largely unware of their existence.

When walking through the forest it is also common practice to bend grass and saplings as you are walking so that you can navigate and others can locate you. Unless of course you were wishing not to be located in which case you would not do this. In this instance, fires were also lit inside termite mounds at night so that others could not see your fire if you were not to be travelling on country. Termite mounds were also used to make earth ovens.

Navigation through the landscape by the Elders was one of the amazing things to witness. They could name places throughout their Estate and describe them in detail. They used features in the landscape to navigate by and make tracks intertwining between trees where no track appeared to exist.

Plate 8.10 Navigational marker that points to 18 Mile on route to Ndolgin

Source: field records 2017

Plate 8.11 Navigational marker that points to Ndolgin

Source: field records 2007

Plate 8.12 Victor Steffensen explaining the use of navigational markers at the 2011 Fire Workshop on Kuku Thaypan country

Source: field records 2011 Image credit Oliver Costello

Gathering

On field trips we were always gathering; gathering knowledge; gathering food, gathering wood, gathering items for craft, medicine or ceremonial purposes. The capacity to gather and share cultural knowledge with younger clan members is impacted when fire is not used correctly across the landscape resulting in changes in fire frequency, intensity and timing that can drastically alter ecosystems in one event. The gathering of food, medicine, weaponry and craft resources was witnessed on many occasions on country. The importance of not wasting resources was reiterated time and again: from the burying of fish remains from the banks of where they were consumed, to the use and re-use of paperbark and return of it to where it was cut to name a few.

Weaponry and Crafts

In the Elders' TCFK system, weaponry and crafts are intimately tied to fire. Materials used in the creation of weapons require sap and resin and fire is used to stimulate the production of both in species that are utilised for this purpose. Seeds used for decorative purposes impacted by fires that are too hot as species do not produce abundantly. Games were also made that increased capacities to be better hunters such as the throwing of the bushman's clothes peg, *Grevillia glauca* seed that not only has a delicious edible kernel but can be attached to a throwing stick and be sent hurtling off into the distance for a long way. This technique although a game for young children is a method used to hunt birds on the wing.

Art, Dance and Song

The extensive and internationally acclaimed rock art and little-known petroglyphs in the region are some of the oldest in the World. Indigenous people have made their home in the Laura River valley since the dreaming. Custodians of this 'Quinkan' country are based in Laura as well as throughout Cape York and further. The country is so named after the spirits, or 'Quinkans', that inhabit the sandstone bluffs containing one of the world's largest and most significant rock art regions, dated to at least 15 000 years old (Trezise, 1993). Of those that are known about only some are available for public viewing. The local Indigenous people believe that some of the galleries are dated even older than this and the area is considered a highly significant meeting place throughout time. In the wet season, they would camp under rock shelters on the high ground. This is where their rock art can be found (Trezise, 1969).

The paintings also document post and pre-contact with the first European explorers and settlers who came to the region. However, the entire area is rich with evidence of occupation and the stories of interaction between early settlers and traditional owners. For example, the area behind the Laura township is littered with numerous types of scar trees from different groups showing to those who hold knowledge of how to read the embedded signs in country, where members from various surrounding language groups come together due to the changes inflicted upon them through contact and colonisation.

However, art was also present in the intricate rope and jewellery making as witnessed within the Roth collection at the Sydney Museum and the Thompson collection in Melbourne. These pieces were stunning and used in adornment and ceremony. The Elders possessed knowledge of how to make these pieces and where the materials were sourced from.

Trade and resource sharing

Trade and resource sharing and utilisation routes are still known to this day and held in songlines and in country. The jewellery discussed above is one example where shell materials were sourced from an adjoining *Lama Lama* group. Trade was essential and when resources where abundant and in season people would travel a long way to gather them for use and for trade. The concept of trade and resource sharing routes is discussed further in Chapter 1. Resource sharing had laws about how it was harvested, managed and distributed as highlighted in Chapter 4 in relation to Sugarbag.

Knowing who we are, Knowing our responsibility, Knowing how to do it

Knowing who we are is the deep connection that exists in the Elders' TCFK to cultural practice, to country and to their kin and their kin to each other and the responsibility that being a knowledge holder brings. Knowing how to do it is about being able to read and interpret phenomena in relation to implementation of fire on country. Phenomena exist in country, both physical and spiritual and knowledge of these and how they influence fire behaviour and each other are critical to enabling cultural fire management. Without this knowledge it is impossible to implement appropriate fire management. Table 8.5 shows the elements that will be discussed in this section and their relationship to the knowledge triangle.

Table 8.5 Phenomena elements of the knowledge map and connection to knowledge triangle

Source: Data analysis 2016

Knowledge Map Components of cultural fire	Knowledge Map elements	Connection to knowledge triangle
Phenomena	**Water**	Knowing who we are/Knowing our responsibility/Knowing how to do it
	Dew	
	Mist	
	Rain	
	Smoke	
	Wind	
	Earth	
	Air	
	Fire	

Water[56]

Water is essential in savannah environments and springs and wetlands are story places with the use of the water governed by the lore, outlining subsequent management for these places. There are places you cannot disturb, cannot fish, cannot swim, cannot throw rocks or sticks, cannot toilet near, cannot wash in. Water is vital for survival of all species and ways of finding and storing water were used by Indigenous Australians. Indigenous cultural knowledge of the Elders explains how to extract water from *Melaluca viridiflora* when required. It is slightly salty but will provide hydration while travelling if you really need it, you just don't drink too much of it (field data 2007). Water trees were created by the Ngadju people in the Great Western Woodlands in South West WA (O'Connor, Prober, Corporation, Environment, & Sciences, 2010). Similar to navigational markers trees were shaped over time to hold water. These water trees are very sacred and are protected from fire. Similarly, in Kuku

[56] See also description of lagoons and their values in each vegetation community

Thaypan TCFK water trees on certain watercourses and important to manage appropriately with fire to protect the quality of the water.

Dew

Dew provides essential moisture during the winter months, it is an important traditional ecological knowledge indicator for early dry season burning. The moisture supplied by heavy dews provides conditions necessary for re-generation of species post-fire and ensures that cool fires burn out overnight. This knowledge of the use of heavy dews in fire management is also identified in (*Pormpuraaw Cultural Uses for Plants*, 2016) *"particularly in the first few months of the season to aid regeneration"* identified as part of the cold dry season. Heavy dews particularly in the transition between the warmer to cooler winter months of the season aids in regeneration. Plate 8.13 shows dew and light winter rain *Ngo oilten* on and spider web and grass at *Chuulungun Ngachi* (July 2010). Plate 8.14 shows morning dew on the leaves of Cooktown Ironwood *Ku morteal* Steve Irwin reserve *Taepithiggi* country July 2016.

Plate 8.13 shows dew and light winter rain Ngo oilten on a spider web and grass on Chuulangun in July 2010

Source: Field records 2010

Plate 8.14 shows morning dew on the leaves of Ku morteal Cooktown Ironwood Erythrophleum chlorostachys. Steve Irwin reserve Tapethiggi country July 2016

Source: Field records 2016

The dew on the grass should let you know

It's time to start burning to help your home

Planets designed it can't be wrong

We have this dawning morning song

Peta Standley

Source Field records August 2011

Mist

The presence of mist *"Undun arung"* (mist rise up) at *Gno Coom* (Plate 8.15) indicates disturbance of a story place nearby 6/06/07 6:50 am. Dr George also explained the location of mist story place through recalling the birth place of *"Peter Costello be born over there (mist story place) Old Jack Morehead father, waterhole behind, climb island two swamps little one top, big one down. They people been camping on the sand old Bunji Jack Morehead working for Billy Costello that's how he got his name."*

Plate 8.15 Mist rises up at Saxby *Undun arang* at *Gno Coom* (Big Water)
Source: Field records 2007

Dr George also shared a story for *Llung* Polly Lake, although it was told at *Gno Coom* Saxby, as it starts from *Gno Coom* Saxby. "*Nyesteyung - Storm bird had a fight over fish with (grey Crane) mytumai (?)Nyesteyung wouldn't give him any fish Storm bird made a big rain sing corroboree make flood come wash away his fish. Red leg (Jabiru) and Curlew been having a fight over fish, red leg say,* *no go get your own fish, so curlew bin throw mud at him in his eyes he can't see, walk around up and down come from top down sing corroboree to himself I can't see. When you hunt him, you bang big white stick on the ground throw mud up at him, spear him, he can't look up for your shadow. Emu too when you hunt from behind.*

Black ibis white ibis fighting came that white ibis baby black like glossy one he my baby he looks like me - no no - so black ibis got a coal stick burnt him on the bum - he nrarkin (no good) one – Broken Rope is Pa Romi – this is another place. *The language name chiyen (pygmy goose)/chigaru (Reed grass)* was also shared 31/07/07 field notes.

This is how knowledge was generally shared interwoven stories connecting landscape features and behaviour of animals and plants with place. Impossible to interpret with just one experience.

Mist is important in providing moisture during the winter months and in higher altitude areas where mist is cloud vapor, this also provides important moisture prior to and following fire events.

Rain

There are many types of rain. The rain that falls in *Awu Alaya* country in the lead up to the Monsoon season arrives with thunderstorms that contain lightening. This rainfall can be highly variable across the landscape, down-pours may be short lived and contain varying levels of rainfall, sometimes a lot can fall in a very short time, sometimes very little. These storms are intermittent and can contain no rain at all, just thunder and lightning. Steadily as the Monsoon rainfall increases burning country decreases, however the use of fire continues. This rainfall is critical in feeding aquatic systems and re-charging aquifers, providing cooler water to the Great Barrier Reef and the Gulf of Carpentaria in Cape York. Rainfall begins to decrease and dry, clear days and nights begin.

Winter rain *Ngo oilten* is important as it provides moisture as the months begin to dry, however when there is too much rain during the winter months, western management considers that the window of burning gets even smaller. However, there is still ample opportunity to implement burns when the season is like this, in the Elders TCFK timing and methods are adapted.

Squally winter rain enables an increase in moisture prior to and following burning enabling quick regeneration of grasses. Burning during the winter months increases the chances of showers by increasing greenhouse gases into the atmosphere, feeding clouds present at this time of year and light rain can also occur as a result. The light knock em down rain generally occur early leading up to the coolest winter months but can extend into the year or may not arrive until late, depending on the wet season. This rain knocks down the grass seed heads providing moisture for re-generation as many native grass species contain hydroscopic awns that fall from the seed head and drill into the grass when wet. Plate 8.16 shows *Heteropogan contortis* Black spear grass beginning to un-screw as a result of moisture provided from knock-em-down rains. This rain also provides an increase in rainbows.

Plate 8.16 Knock em down rain present on *Heteropogan contortis* black spear grass 12 June 2015.

Source: Field records 2015

Smoke

Smoke is a very important element in the Kuku Thaypan Traditional Cultural Fire Knowledge system. It is important culturally and spiritually being used for ceremonial purposes to cleanse people and places in warming people to country or to cleanse houses and places where loved ones have passed away. Plate 8.17 shows Orale McGuire being welcomed to country at the 2014 Indigenous fire workshop on *Tapetheggi* country. The colour of smoke indicates how hot a fire is (intensity), tells you how dry the vegetation is that is burning (how cured fuels are). Thick white smoke indicates there is still moisture in the fuel load. Smoke can also tell you what direction the fire is travelling, the wind direction and how fast a fire is moving. For example, dark brown and dark grey black smoke is a sign of hot fire with bark and canopy burning, and also when the understorey has high fuel loads and well cured vegetation. These kinds of fires release larger amounts of greenhouse gases and carbon into the atmosphere altering weather patterns and impacting ecosystem function. Smoke is also used to communicate with different wood and leaves creating different coloured smoke that convey different meaning, being able to be seen from a distance these would indicate particular ceremonies or events (Doug Bresolin *Yidinji* man pers com March 2007).

Plate 8.17 Orale McGuire from Western Australia being welcomed to Tapetheggi country at the Indigenous fire workshop 2014

Source: field records 2014

The colour of the smoke tells you how a fire should behave according to how that system should be burnt. For example, when implementing burns in Messmate country (*Ku akulumbah* Messmate/Stringybark *E. tetradonta*, Yellow jacket and *Ku kulnm* Ironbark on sandridges a floating light white smoke is desired and reflects the right temperature burn for this culturally significant vegetation community. Smoke is important in germination of some flora species and lets fauna know there is a fire nearby. Smoke from certain vegetation is used to stop rain and this is a special kind of smoke (Steffensen, field data 2007). Plate 8.18 below highlights the light white smoke that *"is the healing smoke"* (Steffensen 2012). Note in the image below flame heights are low and visible and darker grey in the left of the image showing greater combustion. This in *Ndolgin* (Pelican Lake) and was the first time that the Elder Dr Musgrave had burnt this system since he was 15 years old and mustering on this country. Plate 8.19 shows burning against the wind, note the flames travelling into unburnt areas and the direction the smoke is blowing.

Plate 8.18 Ndolgin (Pelican Lake) reference site, image taken from the Western side looking towards the Eastern side showing the first burn implemented by Elder Dr Musgrave in May 2005

Source: Field records May 2005

Plate 8.19 Fire in open woodland adjoining Ndolgin Pelican Lake May 2005, note the flames in the bottom left of the image burning back against the wind and into the unburnt area

Source: Field records May 2005

Plate 8.20 is a *Melaleuca viridiflora* broadleaf tea-tree community that was burnt in June 2005 following the Boxwood community burns that were implemented earlier in May and provided a natural break. Note the number of saplings in the image indicating that this system has been burnt at the wrong time in the past. The smoke in this image is still light and white, despite grass being almost completely cured. Plate 8.21 shows a light white smoke through a *M.Viridiflora* Tea tree community that is not yet ready to be burnt but is adjacent to an boxwood open woodland system that was ready to be burnt.

Plate 8.20 ***Melaleuca viridiflora*** **broadleaf tea-tree community showing light white smoke from cultural burn**

Source: Field records June 2005

Plate 8.21 A light white smoke is seen through a *M.Viridiflora* Tea tree community from a cultural burn

Source: Field records April 2005

Plate 8.22 Smoke from a cultural burn implemented in an open Boxwood community

Source: Field records 6 June 2007

Plate 8.22 shows a 6th June Boxwood community burn in 2007 looking from Rocky crossing. This smoke from an open boxwood community is slightly browner, however is still light. Plate 8.23 shows patches of grass burning within grass communities that are still green, along an old creek line of a tributary of the Morehead river that is often braided with multiple channels. Plate 8.24 shows an open tea tree *M.Viridiflora* woodland with Quinine *Petalostigma banksia* showing how light and white the smoke is even in this community where the grassy understory of *Eriachne sp* is well cured. The fire is cool due to the number and spread of ignition points and the weather conditions, note the overcast sky. The time of day a fire is lit is adapted when a system is more cured that would be desired. What these images also show is the different curing of the vegetation across and within different country types which determines timing for burning across the landscape creating natural breaks.

Plate 8.23 A light white smoke from a cultural burn grass fire within a grass system that is still green

Source: Field records 6 June 2017

Plate 8.24 Open *M.Viridiflora* Tea tree community woodland showing light white smoke from cultural burn

Source: Field records 6 June 2017

Wind

Understanding the wind is important in burning as knowing how it will interact with fire and how that will then interact with the vegetation is critically important in undertaking a cultural burn to ensure the fire behaves as required. The wind is used to gently move fires through systems such as open boxwood communities when they are still green, so there is adequate moisture in both plant materials and in the soil. Plate 8.25 shows the use of the south easterly winds to push the fire through an open gum community burn in 2005 the wind is required to push the fire through the system to burn off dead materials when there is still adequate moisture for system recovery. However, predominately in TCFK of the Elders, burning was conducted against the wind. This requires knowledge of the direction the wind is coming from, if this changes regularly depending on where you are in the landscape, the extent of the vegetation community that is being burnt, surrounding vegetation communities and other natural features present, such as waterbodies.

Plate 8.25 Single ignition point typical of those used in cultural burns at the edge of an open gum also showing burning with the wind in this community at this time

Source: Field records 2005

Most cultural fires implemented in the Elders' TCFK use single ignition points, see plates 8.26 – 8.30. Single ignition points generate elliptical burns, which are naturally cooler than a linear fire. Single ignition points also enable the fire to be assessed when it is implemented. When a single ignition point is used there is a smaller fire front as the fire burns back on itself, reducing the height of the flames and the intensity of the front of the fire. When multiple points are used, they are separated apart so that they burn into areas that are already burnt (see plates 8.31 to 8.34). The wind is also used in such a way that the fire burns back on itself or, if you wish, the fire to travel quickly through the system. This method is also used to burn remaining parts of a system, following burns that have previously been implemented internally within systems as the system has cured. The system may then be lit around the edges of its extent, with the burn moving in from the edge of the system, so that it burns back into the areas that are already broken up from previous burns implemented prior. This intimacy with hand burning ensures a diversity of age class fires and the protection of important resources, such as yams. Plate 8.35 shows a cool fire that has burnt the dead grass around the yams, enabling them room to spread.

Plate 8.26 Single ignition point typical of those used in cultural burns

Source: Field records 2016 Image credit Cape York NRM

Plate 8.27 Single ignition point typical of those used in cultural burns in a Messmate grassland

Source: Field records 2017

Plate 8.28 Single ignition point typical of those used in cultural burns at the edge of a mixed tree community at the start of an open boxwood community

Source: Field records 2005

Plate 8.29 Single ignition point typical of those used in cultural burns in an open boxwood community late afternoon

Source: Field records 2017

Plate 8.30 Single ignition point typical of those used in cultural burns in an open boxwood community

Source: Field records 2005

Plate 8.31 Multiple ignition point typical of those used in cultural burns elliptical fires spread apart that burn into each other and go out

Source: Field records 2006

Plate 8.32 Multiple ignition point typical of those used in cultural burns elliptical fires spread apart that burn into each other and go out slowing the fire front

Source: Field records 2007

Plate 8.33 Multiple ignition points Maryvalley Tenacull station 2015 Indigenous fire workshop night fire

Source: Field records 2015 Image credit Michelle Hines NSW LLS

Plate 8.34 Multiple ignition points Maryvalley Tenacull station 2015 Indigenous fire workshop night fire

Source: Field records 2015 Image credit Michelle Hines NSW LLS

Plate 8.35 Single ignition point typical of those used in cultural burns showing areas left unburnt and yams protected from fire

Source: Field records 2017

Linear fire fronts are avoided as fires implemented in this way increase the speed and/or intensity of the fire. An elliptical pattern emerges from single ignition point and if lit against the wind will burn back on itself, slowing the rate of spread of the fire and reducing the intensity of the fire. If a hotter fire is required then a kerosene tree bark torch was used to enable spreading of the fire through the system. A bark torch may also be used to carry fire as you spread ignition points apart. Plate 8.36 shows Steffensen cutting tea-tree bark *mulkee*l on *Tenacull* station 04th June 2008. Plates 8.31 to 8.34 all shows single ignition points spread apart that demonstrate the typical elliptical pattern used in the Elders' ICFK. In the Elders' TCFK the wind is used to manage the speed and intensity of the fire. Where you place your ignition point in relation to the wind determines how the fire will behave. In the Elders' TCFK burning against the wind, so the fire front has only fuel to consume against the direction the wind is coming from, so the fire burns back on itself, moves slowly and is less intense. When you burn with the wind the wind pushes the fire from behind into the fuel and it will move quickly through the system. During field visits sometimes burning with the wind would be used if a system was a little to green and would then be too dry on our next trip out on country. Another reason to burn with the wind was if a system was highly modified and the treatment required the fire to have some intensity to carry through the system or not too heat up the soil. For example, you may alter your timing of burning for a system if it has historically been badly impacted by fires that are too frequent and/or too intense, so you may wish the fire to move more quickly through that system to aid recovery. This also depends on the soil colour and type of system being treated.

Plate 8.36 Steffensen cutting tea-tree bark mulkeel on Tenacull 2007

Source: Field records June 2007

Earth

Earth as an element of the Elders' TCFK represents all the vegetation complexes and their associated soils, geology and hydrology and the management laws that apply to them. In Kuku Thaypan TCFK significant vegetation communities and places are outlined in Chapter 8 that describes the Elders fire management knowledge as it relates to nine different country types, indicators, timing, conditions and place. This knowledge is the knowledge shared by the *Awu Alaya* Elders and is also described using western scientific terms. When it was possible to relate a country type to regional ecosystem descriptions cross referencing has occurred see (Sattler & Williams, 1999) and Queensland Regional Ecosystem descriptions (Queensland Herbarium, 2018). Nine different country types, their description and traditional cultural fire management are outlined in Chapter 9.

Air

Air is related to the system and how vegetation transpires and interacts with our atmosphere, weather and climate and how this system is impacted upon when vegetation burns. For example, high intensity fires consume large amounts of fallen and dead timber that provide essential habitat and often impact living limbs as it reaches the canopy. Hot fire scorches the canopy causing excessive leaf drop that in turn impacts on the way in which vegetation can take up nutrients and transpire following a fire event. When trees lose their leaves, it reduces their capacity to photosynthesise and therefore take in carbon dioxide, produce oxygen, grow re-produce and produce productively. While fallen leaves act to protect the soil following a fire event from erosion and increased temperatures as a result of a reduction in canopy cover, if not removed through a cool fire in following years can overtime act to impede grass regeneration. If the majority of ground and mid story vegetation within a system is consumed during a fire event it reduces the capacity of the system to uptake nitrogen available as a result of the fire, thereby increasing the likelihood that this will end up in aquatic systems.

Knowing what it is/Knowing what it does/Knowing how to do it

This is the heart of the knowledge triangle for traditional cultural fire management.

Table 8.6 shows the elements that will be discussed in this section and their relationship to the knowledge triangle.

Table 8.6 Feature elements of the knowledge map and connection to knowledge triangle

Source: Data analysis 2016

Knowledge Map Components of cultural fire	Knowledge Map elements	Connection to knowledge triangle
Features	**Grass**	Knowing what it is/Knowing what it does/Knowing how to do it
	Canopy	
	Food	
	Trees	
	Soil	
	Ash	
	Plant	
	Animal	
	Inter-relationships	

Grass

Grasses are identified collectively as "*Kwern*" There are names for individual species such as giant spear grass *Kwern umbayal* (*Heteropogan triticeus*), see plate 8.37 and wild rice *Che giuill* (*Oryza* species), see plate 8.38. Giant spear grass is not only an indicator of when it is time to get ready to burn in Cape York, following the wet season it's root base is a vital source of nutritious moisture at this time and leading into the dry. When this begins to fall you know it is time to get ready and thetiming is different from South to North East to West. Cockatoo or sugarbag grass *Kwern Yulan* was used in medicines and its root base was used as a mop in the collection of sugarbag or native honey.

Plate 8.37 Kwern umbayal Heteropogon triticieus Giant spear grass. An important indicator for getting ready to burn in Cape York. In the Awu Laya language his name is Kwern umbayal

Source: Field records 2007

Plate 8.38 *Che giuill* (*Oryza* species) wild rice is an important food source in Kuku Thaypan country York

Source: Field records 2007 and 2015

In the Elders traditional cultural fire knowledge, the timing of curing of grasses within systems was important in generating multiple age class fires that created and maintained a diverse mosaic of understory grasses. This burning targeted systems within systems across multiple timescales.

The Importance of the story in the understorey

Depending on the system signs of new grass penetrating through old leaf litter is an indicator of a fire that has been too hot. A hot fire that reaches the canopy increases leaf and branch fall changing system micro-climates. Fires that are too hot also cause die-back on tree extremities,

leaves coppicing close to branches and the trunk of the tree. Intense fire event burns all the dead wood on the ground and makes more wood fall. When native grass is still present there is a possibility of recovery under the right type of fire regime. Excessive brindle fern, acacia, tea-tree and other non-native woody weeds that generally do not occur in such abundance in that system is also an indicator that an area has not been burnt the right way. Orchids, lilies, forbs, legumes and tubers should be present in healthy woodland communities along with native grasses.

Canopy

The canopy is sacred in Kuku Thaypan lore, traditionally if you burnt the canopy you would have been severely punished as to do so destroys flowers and leaves and the impacts the health of all species that rely on them for food and habitat. Burning the canopy also alters the amount of light that is able to penetrate through to the ground and alters soil temperatures and microbial activity. When large amounts of bark and canopy are destroyed it changes the colour of the smoke and darker smoke is able to be seen entering the atmosphere shifting weather patterns and influencing climate. Plate 8.39 to 8.41 below shows fallen flowers following a fire event, small branches also have been burnt and fallen from the canopy and immature flower buds with caps separated that will now not reach maturity, impacting on this important food resource for a myriad of species. Plate 8.42 shows the impacts of fires that are too hot on the canopy. Note scorch heights on the trunks of these *E. Moluccana x platyphylla* and *Corymbia sp*., that are way too tall, they can be seen all the way up into the heighest branches, the leaves are all growing close to the branches and trunks of the trees and the understorey although containing native grass species, such as kugarl *heteropogan contortis,* there is also *themeda quadrivalvis,* grader grass and *senna obtusifolia* sicklepod present that has turned country "upside down" as a result of this hot fire event. Plate 8.43 shows the impacts of a fire that was too hot on the canopy in an Ironbark community on stoney country.

Plate 8.39 fallen flowers following a fire event, small branches also have been burnt and fallen from the canopy

Source: field records 2007

Plate 8.40 fallen flowers following a fire event from scorched canopy

Source: field records 2007

Plate 8.41 Immature flower buds with caps separated that will now not reach maturity, impacting on this important food resource for a myriad of species

Source: field records 2007

Plate 8.42 shows the impacts of fires that are too hot on the canopy in a bloodwood and gum community

Source: Field records 2016

Plate 8.43 shows the impacts of fires that are too hot on the canopy in an Ironbark community

Source: Field records 2014

Food

The careful use of fire is like "watering the garden" the fire trickles through the landscape burning slowly (Field records 2008). This means that animals have the opportunity to move out of the way of the fire into areas that are left unburnt within the system and in nearby habitats ensuring food and habitat resources are available for all species. For example, not every tea tree community would be burnt at the same time. Fire was also used to direct animals such as wallabies to areas where it was easier to hunt them. The old people knew where the animals travelled every day, could track them and use fire to contain them on areas where they could more easily be caught or speared. Shrubs and food for animals and people are both propagated and impacted by fire. If fires are too frequent and too hot, they can impact the flowering and fruiting of species and impede growth reducing the abundance of flowers, fruit and seeds available for use, for food for fauna and people and for regeneration. Trees and shrubs that provided valuable nutrition were actively managed, including through propagation and direct seeding intervention.

Trees

Every tree is a considered to possess spirit, every tree is a person. Trees have connections to people. There are birth trees, burial trees, scar trees for food, climbing trees, water trees, use trees for weaponry, ceremony and craft, carved trees, navigation trees, food trees for people and animals, habitat trees for people and animals. Therefore, their careful management through fire, including protection from fire was taken very seriously. Den and nest trees were cleaned away from, sugarbag (native honey bee) nests were known and burnt away from. *"I have seen trees being destroyed not only through fire but through colonisation taken trees that we use for ourselves as well but we try to do the best that we can to make sure those trees that we share in a relationship of carbon monoxide and the environment as well that we share a very strong relationship"* (Henderson, 2015). Table 8.7 is an extract of trees from the Awu Laya database and some of their uses recorded by the Kuku Thaypan Elders. Trees tell the story of the country type you are in, the soils drive the parent trees and the parent trees tell you what should be in that country type and are one of the key elements considered in when, why and how to burn.

Table 8.7 Plants and their uses as recorded by the Kuku Thaypan elders

Plant Common Name	**Plant language Name**	**Plant Western Scientific Name**	**Plant type and part**	**Seasonal Status**	**Uses**	**Description**
Box Wood Tree	*Ku Rloonga/Ku ronga*	*Eucalyptus leptophleba*	Tree, wood	Boxwood flats one of the earlier systems to burn following the wet season in KT fire management	The Boxwood Tree has a popular use for the Kuku-Thaypan People that sustains their day-to day living on country. It is one of the best woods to burn as it produces good coals	The Boxwood Tree commonly found in most parts of the country and grows into a large hardwood tree. The trees are usually located in their own forests in black soil areas of country which creates a diverse country type. The bark is of a grey colour and is quite flaky. The leaves of the tree are eucalyptus and are long and thin with a hardy light green colour. The tree grows very high at around 15 to 20 meters.
Bloodwood Tree	*Ku Anarmagetta /ku arramagel*	*Corymbia sp.*	Tree, sap, wood	Flowers during Wet season	The Bloodwood tree has an inter-relationship with two species of animal in the area, which was used to read stages of certain animal lifestyles. The tree is also used for a medical purpose. The tree has a unusual food source to the people as well. This is a close up of the gum displayed only in the June - July months of the year, and is an	This is one type of Bloodwood that is found all over the landscape except for in the river bed areas. Unlike other species, this Bloodwood tree has a very flaky bark and is red and grey in colour. It is common to see black marks on the bark, which is a result of passing bushfires. The sucker grows into a large tree and is commonly known to seep its distinct red sap in large portions throughout its life time. This bloodwood tree has a very poor wood quality and are commonly found dead or pretty much hollowed out by termites. Large numbers of suckers always shoot up after the wet season.

					indicator that the possums in the area are fat.	The Elder explains how the leaf was used to tell if the possums in the area were fat or not. In Thaypan language, they called possum *Neh Looun*. The Old Man grabs a young leaf that can be picked from their lighter green and plastic type appearance. The leaf was then broken off the tree and pulled apart. If the gum appears between the broken leaf then the possums were to be fat at that time. If there were no signs of gum present, then the possums were not fat. This gum is expected to be visible from the leaf in the June - July months of the year.
Cocky Apple Tree	*Ku Njora/chuada*	*Planchonea Careya*	Tree, fruit	Flowers during Wet season and at night	*Ku Njora* is a useful tool for hunting river animals used by the Kuku-Thaypan People. The root of the plant is utilised. The plant also contains a range of medicinal qualities that is used for different purposes.	*Ku Njora* is commonly found all over the country side in the Cape York region. The cocky apple is usually known as a small shrub like plant but also grows into a medium sized hardy tree. The plant is mostly identified by its broad green leaves that also gains a reddish yellow tint at certain times of the year. The flower is also unique to the apple family in the Cape York Tree world, with a pretty white flower with hairy type petals flowering at night.
Soap Tree	*Ku Nga-randa*	*Alphitonia Obtusifolia*	Tree, leaves		The soapy tree has personal uses known by the Kuku-Thaypan people that produce luxuries to the living of	*Ku Nga-randa* is found all over the country and is quite common all over the Cape York region. The plant is most identified by its slightly hairy green and yellow leaves with a whitish colour

					their traditional bush lifestyles.	under the leaf. The tree does not grow very large and has a thin whitish grey trunk. The soapy tree also produces a small black fruit.
Sore Belly Tree	*NULL*	*NULL*	Tree, leaves, root		The sore belly tree has a medicinal purpose to the Kuku-Thaypan People and also is linked to the behaviour of two known species of animals. Note: Goanna and kangaroo story.	This plant is located in most parts of Cape York, most commonly in the Sandridge and escarpment areas. It is identified by its small shrub like appearance with a purple stem and rows of small long button type leaves. The plant has a white flower which is produced a short time after the wet season. The plant does not grow very high at all, no higher than knee height, and is commonly found in clusters.
Golden Wattle	*Ku Toada*	*Acacia sp.*	Tree, flowers	Flowers June - August	The Golden Wattle has special inter-relationship values to the Kuku-Thaypan people.	The Golden Wattle is found in most parts of Kuku-Thaypan country, and is grows into quite a large shrubby tree at around 6-8 meters in height. The tree has a very attractive yellow flower that usually appears around the June - August months of the year. Like the typical wattle tree, it has a very hardy timber and has long slender hardy leaves.
Wattle Tree	*Ku Nbae*	*Acacia Rothii*	Tree, flowers		Ku Nbae has special craft uses and medical uses for tribal combat purposes to the Kuku-Thaypan People.	This type of wattle is found in most parts of the country and is most common in the sandridge areas. The tree is commonly found in large numbers like forests. The tree grows to about 6 meters in height and is a very hardwood tree. The tree is best identified by its hardy bark appearance and also by the seeds

						and leaves. The seeds of this tree grow into a pod like shape. The leaves are wide and long with sharp ends and has a hardy appearance.
Bushmans Clothes Peg \ Beef Wood Tree	*Ku Andeal*	*Grevillea glauca*	Tree, nut, seed		Ku Andeal is a useful tree for the Kuku-Thaypan People and has a few at that. The tree is used for food and cooking purposes, it is used for medical uses, it is also used for hunting uses and learning techniques. The tree also has a couple of witchcraft uses for certain members of the clan.	This Grevillea species has a few different names known locally around the area. It is known as the Beefwood tree, the Walnut tree, and commonly known as the bushman's cloths peg from its useful nut shape for doing just that. The tree is very hardy and is located all over the country. The nut produced from the tree has a small flaky seed inside that travels in the wind for its regermination process. The bark of the tree is very dark and rough and normally grows to be a average size tree at about 5 - 6m. The leaves are also of a hardy look, with a long spear head shape. The tree seems to have nuts on through most of the year and tends to drop on the ground when at age.
Cotton Tree	*NULL*	*Cochlospermum gillivraei*	Tree, inner branches	Flowers June-October	The bark of the tree was used to make string	This tree grows in sand ridges and rocky areas. It has a spectacular habitat and a bright yellow flower. When the fruits are forming and maturing the tree losses most of its leaves.
Stringy Bark Tree	*Ku Aldkalemba/ alkalemba*	*Eucalyptus Tetrodonta*	Tree, Outer Bark		Ku Aldkalemba was widely used by the Kuku Thaypan people and is an important tree. The tree has food and	Ku Aldkalemba is a large tree that grows about 8 meters in height and is commonly found in large forests in most areas. The bark of the tree is light grey in colour. The leaves are of the common

					food preparation uses and is also has laws that apply to the usage. The tree was spiritually used by the clan and had craft uses that were vital to the survival of seasons. The tree also provided luxuries to the people as well.	eucalypt appearance with the long hardy green look. The tree is commonly found hollow in some areas from termites. The tree is best identified by the bark appearance and the thin red stems where the leaves join.
Marble Tree	*Ku Mapuul*	*Canarium Australianum*	Tree, Bark			
Sand Paper Fig	*Ku Munjala*		Tree inner branches, Leaf		The sandpaper fig is a useful tree to the traditional people. It is used for food and medical purposes and for craft work too. The tree also has a spiritual use to assist the people with living on country.	The sandpaper fig grows in most parts of the country and is best identified by its rough sandpaper like leaves. The tree also has a very milky sap which also seeps out of the leaf stems. The tree grows fairly large and bears small fruits in many numbers throughout the year. The sandpaper fig can be found all by themselves and are not common in large forests.
Matchwood Tree (Turpentine tree)	*Ku Poondu*	*Erythroxylum ellipticum*	Tree, wood, Fruit	Bears little red fruit around the wet time of the year	The Matchwood tree was used for important survival and comfort needs for the people at certain times of the year. The tree was also a food source and used for craft work. It grows into a fair-sized tree and bears little red fruit	The Matchwood tree is located all over and will tend to be spread out and not so much in groups. The tree is hardy and has a good timber quality that has no grain. The bark of the tree is of a light greyish colour with a flakey type surface. The leaves are round oval shaped and turn yellow in the more stressed times of the year. It grows into a

					around the wet times of the year.	fair-sized tree and bears little red fruit around the wet times of the year.
Ironwood tree Cooktown Ironwood	*Ku Morteall*	*Erythrophleum chlorostachys*	Tree, leaf	Looses leaves in the winter dry	The leaves are used in warming/smoking ceremony across Cape York that welcomes people to country so that ancestors know that the person is welcomed by the mob. This ceremony can also be used to connect personal objects to country in order to be successful at the use of the object e.g. for fishing. Spiritual 2. The leaves are used in smoking ceremony for cleansing places and objects of spirits when someone passes away so that the area can be visited or the object used by others.	Cooktown Ironwood is found all across Northern Australia it is classified as growing in mixed tree country as it can occur in a wide range of environments. The tree has a number of uses and is culturally significant. It is known by Europeans to have a hard timber and was used as fence posts due to its termite resistance. It is brevi-deciduous losing its leaves in dry winters
Dead tree	*Ku ta*		Tree		Spiritual 1. Used to mark graves placed upside down with roots exposed Cultural 1. All trees are valued even in death as trees hold scars when dead such as for	

					implements or for harvesting of sugarbag	
Milky Pine/Cape Milkwood	*Ku njarl*	*Alstonia actinophylla*	Tree, Flowers, Bark, leaf (toxic)	When flower blooms crabs are fat	Medicine it is poison. The timber was used for carving as it is very soft the timber is used for ceremony poles and also to make dugout canoes (particularly in Aurukun). When the flower blooms crabs are fat	Milky Pines are a unique tree are easily distinguishable by their architecture, milky sap and corky bark. They mainly occur in Mixed Tree County and open woodlands and are often seen as isolated trees
Nonda Plum	*Ku gaan*	*Parinari nonda*	Tree, Fruit (edible)	Fruits anytime but is plentiful around cooler months	Food source	Major food source sometimes stored to ripen

Soil

Soils are an important driver of fire management in the Kuku Thaypan Indigenous knowledge system. Soil characteristics vary considerably across Cape York as they are mobile through the system and influence the types of vegetation communities that occur on them. As soils start to change so does vegetation. Soil is not the only factor that determines vegetation type but is an important consideration in TCFK. The colour of the soil is important in influencing the type of fire that a system should carry, for example in *E. Tetradonta* and *M. Viridiflora* communities with sandy soil, fires should move quickly across the sand so as not to hold heat in the soil. Black soil areas absorb heat quickly and also retain heat so fires should be lit under cool conditions in these areas.

Ash

Ash is important in savanna landscapes as it provides macro and micro nutrients to depauperate soils. The ash remaining from fires implemented by the Elders was minimal, what was generated generally stayed close to the ground surface layer and fires were preceded or followed by rainfall that either penetrated the soil surface prior to burns or was light enough to sprinkle ash into the soil, followed by heavy dews after burns. Macropods come to roll in and wash in the ash as it assists them with skin disorders and parasites.

Birds of prey circle above fires and as a result of the low intensity and speed of the fire animals are able to escape. The birds of prey feed off grasshoppers flying up out of the grass, small mammals and reptiles fleeing, they dive into the ash and pick up lizards that are exposed. Cattle too are attracted to the ash and come in and lick it once the flames have passed. Ash comes after fire and generates new growth.

Plants

Knowing what a plant is and what is does is vital for survival, for food, medicine, art, craft, weapon making. This, however, is not enough you also need to know how it works and what to do in order to incorporate this knowledge into everyday living and understand what part of the plant to use for what purposes and knowing what to do in order to process plants accordingly. Knowing what a plant is and what it does in relation to the application of fire is essential in order to ensure the survival and availability of important resources. Plants were not only considered in terms of their use value for humans their management also considered the needs of species that were known to feed from and them.

Animals

Animals were respected not only for the use they provided to humans but for also for their role in the system. Language and clan groups are associated with particular totem animals and individuals within Indigenous families are given language names by Elders sometime following birth. These language names may contain total animals and can reflect the characteristics that the Elder sees in the person or that the Elder foresees will develop, or documents elements or indicators that are occurring at the time of the birth or the naming.

Not just lightning and people start fires, plate 8.45 below shows a Brown Falcon hunting on the fire front taken Maryvalley *Tenacull* Indigenous Fire Workshop 2015. The image was taken by Mark Saddler a Wiradjuri Man who attended the workshop. The story of this bird is told at the fire workshops. The old people talked about this bird being the fire bird “He picks up a burning stick from the fire, fly's away and drops it to make his own fire for hunting (Dr George field records 2007).” Prof. Bruce Rigsby 2005 identified this characteristic as belonging to whistling kites, his notes also mention “sparrow hawks” or falcons. This research project confirmed in the field that this behavior is characteristic of brown falcons (field data 2007). This knowledge has been known by Indigenous people for a long time and has been expressed in their paintings and in prior publications. More recently this behaviour has been ‘confirmed’ by a western science study published in the Journal of Ethnobiology (Bonta et al., 2017). Other knowledge holders have expressed concern at publishing findings of this behaviour due to the risk that it poses to the increased killing of these species due to their use of fire for hunting purposes. Headlines such as *‘In Australia arsonists may have wings’* (Elbein, 2018) would not allay concerns.

Plate 8.45 Brown falcon on fire front. Light white smoke from a cool burn in Messmate/Stringybark (*Eucalyptus tetradonta*) on sand ridge country. Maryvalley *Tenacull* station.

Source: 2015 field records Indigenous fire workshop. Image credit Mark Saddler

In Kuku Thaypan law possums were not killed in front of other possums they were taken away so that their kin could not hear their passing. This also acted to ensure that there was on going trust between humans and possums. The Elders’ traditional cultural knowledge of fire ensured that bloodwood species were burnt to produce new shoots for possums at important times of year in their breeding cycles, the result not only that possums were fat but populations were sufficiently healthy to breed productively.

Elder Dr Musgrave Snr 2003. "They use that leaf, young sucker. You know what that for, this one here. They look possum. Possum, Neh Looun, Neh Looun. You see the young one here look, here, now I'm gonna break em now look. I try look see any possum see if any fat. Have a look now, oh yeah look, he fat now that minya (meat). That thing he tell ya, you go out around for possum, that possum really fat now look. See. Out of that Bloodwood tree. Bloodwood tell you the fat that possum. You go out and find a minya you kill him they all fat. You think oh yeah, thats a leaf tell me cause he fat, see how fat him." Source: Field records TKRP 2002 & re-told May 2005.

Inter-relationships

Fire Management and Relationship Laws - *Water*

Just as fire is a sacred element, water too is sacred and essential to life; it is the blood of country. River flows are highly valued for animating wetlands and floodplains in savannah systems water literally brings to life important places, stories and living creatures (plants, fish, other animals), plants, trees and people. Kuku Thaypan country contains wetlands and lagoons that are listed as Nationally important in the Directory of Important Wetlands and form the majority of the Lakefield aggregation. The area contains soils that have the potential for high erosion and sedimentation that are saline and naturally experience times of high inundation (Sattler & Williams, 1999).

"It is time for western management to step aside for a while and let us apply our knowledge and law for country. We know it works, we can see that it works. If the water is clean, if we can drink it without getting sick, if we can catch fish easy. Simple things. We don't need science to prove this to us but if scientists want to do it, then we ask them to back what we already know. We want to prove this the other way round, by demonstration and case studies. If they would just listen, we have a way. It's like the Great Barrier Reef Marine Park zoning but on land and along rivers. Same thing. Aboriginal people have law for uses of country. This provides a management system that all mobs have, but say there is a place where you can't fish, each group might have a different reason why you can't fish. We know the water holes far inland are the womb for everything else. Looking after water quality and the

reef must start there. The Great Barrier Reef Park just too slow. We want to go ahead now. We have law for many places and everyone can follow that same law for country." (Steffensen 2007)

"If the water is clean, if we can drink it without getting sick, if we can catch fish easy," scientists might be able to test turbidity with secchi discs or more advanced equipment: regarding drinking, test for flagellates, E. coli, heavy metals; catch fish easy, a number of catch per unit effort surveys etc. But Traditional owners ask the question, *"why?" "we can see for ourselves." "Look at the dead cow in the water, look, the feathers on that geese, dirty, something not right."* The Traditional Owners do not want to quantify change; they have lived it and know it is occurring at an alarming rate, they are of the view that this too wastes time. They want to simply fence the water hole off to keep pigs and cattle out or take other ameliorating actions. If scientists want to come along and confirm that this worked through measurement instruments belonging to their own knowledge system, well and good. Deferring to the expertise of learned Elders in any realm must have a place in a reality that is short of funds and time (Standley & Roberts, 2007). How these areas are managed are important and Dr George communicated that some areas such as springs should not be dug out and so impacts should be managed in areas surrounding springs, allowing them opportunity to repair over time. This is because often springs are story places (Field data 2005).

Water and fire are inter-connected like all elements of the Kuku Thaypan Traditional Cultural Knowledge system. Water is precious and the land needs the water, it is the blood of the land, everything needs the water to grow, and water is connected to the Moon. Inter-relationships don't just exist between the fire and water, they exist between all living and non-living things.

The incredibly diverse lagoon and aquatic systems in the *Kating* Morehead River drainage are important places of cultural, spiritual and environmental diversity, they are refugia areas during the dry and seed to the surrounding landscape come the wet. They are significant migratory bird pathways and are connected to the surrounding landscape and must be protected from disturbance from hot fire and intense grazing during the early dry and late dry seasons as they are subject to soil erosion. These lagoons and wetlands act as important breeding grounds and filtration systems that feed the Great Barrier Reef through Princess Charlotte Bay. They act as natural sediment traps in protecting the Great Barrier Reef, however due to contemporary impacts they are filling up and will eventually cease to provide this ecosystem service.

Every square inch of Australia is embedded with cultural meaning. Indigenous peoples have managed water bodies and riparian areas for millennia and "do not draw a distinction between the land and waters that flow over, rest upon or flow beneath it" (Lingiari Foundation 2002:p6 in Jackson et al 2005) as highlighted by Cape York Chairman and Olkoloo Elder Michael Ross in the TKRP documentary 'The Water we know' "the land is no good without the water" (Steffensen, 2006). Further, water as an element like land is often referred to by Indigenous peoples as containing a life force (Yu 2000; Jackson 2004b in Jackson et al 2005) and a part of the dreaming "stories (that) created the landscape" Michael Ross in (Steffensen, 2006). *"Water for Aboriginal people is crucial for survival, identity, language and law,"* Brad Moggridge Hydrologist and Murri from Kamilaroi Nation (15th Feb 2007 in BBC article).

In the *Awu Alaya* Elders' Traditional Cultural Knowledge system lagoons and wetlands are a vital part of the overall network of the river system all the way to the ocean. These areas have traditional laws concerning their use and management that act to maintain cultural ecological diversity. These laws are relevant to contemporary management concerns that are affecting these areas such as; impacts from cattle and pigs that occur throughout the year. Cattle and pigs in these areas need to be controlled and an appropriate fire regime implemented to improve water quality.

These areas should be bunt early in the dry season as close as possible after water begins to recede from the wet season. This protects water quality for the aquatic and terrestrial species that rely on these environments *"if you leave this too late in the year there will be no grass and all the soil will wash into the water"* (Field records 22/05/2007). Plate 8.46 shows grass remaining at the edge of lagoon at Rocky crossing after implementation of a traditional cultural fire in June 2017 on Kuku Thaypan country in the research project area of interest.

Plate 8.46 Grass remaining at edge of lagoon at Rocky Crossing following traditional cultural burn conducted on the 1st June 2017.

Source: field records 2017

These significant aquatic places in Kuku Thaypan country are connected through diverse vegetation communities and landscape features.

Knowing what it does, Knowing how it works, Knowing our responsibility

In the Elders' TCFK system knowing what it does is critical. This refers to knowing what each element, species, landscape features and phenomena do, what services do they provide. Understanding how each of these elements, species, landscape features and phenomena function and then understanding Indigenous peoples' responsibility to care for and look after country and each other. Table 8.8 shows the elements that will be discussed in this section and their relationship to the knowledge triangle.

Table 8.8 Signs elements of the knowledge map and connection to knowledge triangle

Source: Data analysis 2016

Knowledge Map Components of cultural fire	Knowledge Map elements	Connection to knowledge triangle
Signs	Indicators	Knowing what it does/Knowing how it works/Knowing our responsibility
	Place	
	Cycles	
	Season	
	Timing Assessing and Reading country	

Indicators and place

The Elders' TCFK of indicators and place are presented in Chapter 6 and 9.

Cycles

Understanding the cycles within and of the systems and seasons and the changes to these over long geological and climactic time periods, knowing that these are embedded in cultural practice and held within country enables this knowledge to be included in management decisions, including the application of fire.

Seasons

Seasons are a part of understanding the cycles, seasons shift forward and back over months influencing the phenology (flowering and fruiting) of different species and the resultant species assemblages that rely on these resources influencing breeding success and mortality. Knowing where you are in the moon and seasonal cycle will influence hunting success and the amount and kind of food resources available that can be sustainably harvested. Where country is at in any given time of its seasonal cycles dictates when and how burns take place. The time of day is also an essential consideration, fires lit early in the morning on a hot day will travel a long way if conditions are right and they are implemented in vegetation communities without sufficient moisture to slow fires down. Fire lit too early in the day will not carry far enough if lit in a vegetation community that still has heavy dew or it still green with heavy due. A fire will carry in areas that are considered by western fire management to be too green, but the wind is required to enable the fire to travel through the cured off parts of vegetation within the system.

Timing

In the Elders' fire knowledge system in the winter months fires begin to be implemented as dew lifts and continue throughout the day in vegetation communities that are cured adjacent to areas that are still too wet to burn, this is across ecosystem structure from micro to macro scale, using the timing and degree of curing within and between vegetation to manage fire. This timing is adjusted according to the current state of the system. For example, if an area has reached a degree of curing that may increase the intensity of fire due to it not having experienced a fire earlier then it may be burnt later in the day when conditions begin to cool so that the fire is lower in intensity and will go out over-night. Some days the window for implementing fire is smaller than others as the conditions may see the wind, temperature or rainfall increase or decrease limiting the ability for the fire to travel or causing it to travel too fast or too slow in particular vegetation types. For example, sandstone country burns should move relatively quickly through the system under cool conditions so require sufficient wind, as sandier soils heat up quickly, the soil temperature will otherwise continue to increase if the fire moves too slowly, affecting the ability of the vegetation to take up moisture and nutrients following the fire.

The time of year that fires are implemented shifts slightly from season to season, across years and is adjusted according to the presence or absence of seasonal indicators read in country, not from a calendar. Burning is implemented according to the conditions in any given year, on any given day. As such, timing is intricately connected to weather. This is why being on country is essential so that burns can be implemented on-ground according to the cues in the landscape. *"At the moment, it is unbalanced in terms of that you are putting too much CO2 in the atmosphere when you get wildfires, wrong time of burning and things like that whereas if you have it all in sync in terms of timing you know with different seasons based upon Indigenous burning…then it is balanced and at the moment it is unbalanced"* (Claudie, 2015).

Given considerations of the impacts of climate change on weather variability, this is even more important as the conditions and indicators are likely to shift. Indigenous people in Cape York are already noticing these changes as highlighted in Cape York NRM recent "Your Climate" film series as part of engagement in development of the living Cape York NRM plan, see http://climate.capeyorknrm.com.au/weather-stories/films. *"The devastation we see from wildfires is thousands of kilometres being burned ...uncontrolled burning. My travels all over Cape York in the last twelve months there has been bad fi e management. With Climate change and we as Indigenous owners we need to adapt a traditional burning method and it has to be done from a traditional management point of view and done correctly"* (Tayley, 2015).

Assessing and Reading country

Assessing and reading country requires you to be on country and become familiar with country, to learn about how it works, what species do, to observe behaviour and function of the system. Skills of observation can be learnt. However, it is understanding what the signs mean in relation to each other that develops capacity for skilled traditional cultural fire management. Women and men observe and know of different things in country and therefore assess and read country and its relationship with fire through other ways of knowing. What can be seen in country depends on your focus. I will use the *'The Sugarbag project – threats to native stingless bees and their potential as an indicator for biodiversity health'* to highlight the different ways that the Elders and researchers tend to assess and read county.

In the Sugarbag project what we were mapping and monitoring were different to answer the question that was sought *"are native stingless bees a potential indicator for biodiversity health?"* Indigenous and non-Indigenous knowledge systems have different ways of recording, naming, validating, evaluating, monitoring and communicating information. The sugarbag or stingless-bee project was created to assist in demonstrating these differences and show how the two knowledge systems can work together to provide solution to issues of shared concern or common interest. Firstly, the way in which the Elder Dr George and the research scientists set up methods differed. Dr George observed the nests and scars, the differences in the nests, if the nests were active, the abundance of flower in the landscape and their location in the landscape as a key for understanding how many bees there were on country. *They all like it close to water"* Dr George field records 2007. The research scientists netted bees on flowers and at nests to record their presence and timed collection along transects at flowering food species to determine abundance. The finding for establishing future transects was that they *"Transects should cross-cut important environmental gradients rather than run parallel to them e.g., from billabong edge into woodland, rather than parallel to a billabong"* (Report 2009). The project found differences in nomenclature "naming systems" for native bees, see table 8.9 below.

The first collection of bees that were sent to the Museum were not *Tetragonula sp*., those understood to be 'sugarbag' bees by western science. Their identifications are: *Homalictus dampieri* and *Hylaeus*. However, these bees are understood to be sugarbag bees by Traditional owners and are recognized as different from other types of sugarbag bee. Comments on the divergence from a western trained scientist *"It is interesting to observe where Western Science and Aboriginal Culture diverge on nomenclature. We taxonomists have a "strict" definition for "sugarbag bees" which are those bees belong to the genera Trigona*[57] *and Austroplebeia whereas sugarbag can mean other things to other people."* Sugarbag is an English word, potentially some stingless bees carry this common name

[57] *Trigona sp.* have now been renamed *tetragonula sp.*

because traditionally the soaked mop was carried inside a small bag on the waist and/or the nests are bag shaped.

Table 8.9 Differences in nomenclature for native stingless bees

Source Field data 2008

Sugarbag TCK	Stingless Bees WK
Sugarbag as understood in the Elders TK system refers to the interconnected bee, honey, nest, tree, grass, flowers and country	Sugarbag as a name in WS taxonomic system refers to "stingless bees" belonging to the genera *Tetragonula* and *Austroplebeia*
Other species of bees were identified by the Elders and knowledge holders as Sugarbag bees during the project but these were not recognised by Western Science as "sugarbag" bees i.e those that make substantial amount of honey	

The first field trip specimens were collected from flowers not at the nest none of these species were "stingless bees." They were identified by Traditional Owners as sugarbag bees. The second field trip "stingless bees" were collected at the nest and from flowers by the CDU research team. Table 8.10 outlines the species collected on each field trip.

Table 8.10 Species of native bees collected on each field trip

Source: Field trip Report 2009[58]

Field Trip One collections	**Field Trip Two Collections**
3 females Halictidae: *Homalictus dampieri*	B2 Tetragonula hockingsi
3 females Colletidae: *Hylaeus sp.*	B3 Trigona clypearis, Tetragonula hockingsi and Euryglossula sp.
1 female Apidae: *Ceratina sp.*	B4 *Tetragonula hockingsi*

[58] Assoc. Prof. Mike Lawes and Dr Hylton Adie- Charles Darwin University

	B5	*Tetragonula hockingsi*
	B6	*Tetragonula hockingsi*
	B7	*Tetragonula hockingsi*
	B8	*Tetragonula hockingsi*
	B9	*Ceratina sp.*
	B10	*Tetragonula hockingsi*
	B11	*Tetragonula hockingsi*
	B12	*Tetragonula hockingsi*

Dr Georges traditional cultural knowledge of nests and scar characteristics resulting from harvesting and those that were naturally occurring was extensive. Native bee honey was traditionally harvested to protect the nest so as to minimise disturbance and allow repair. This is evident in active hives being found in old scars. Traditional cultural harvest methods included the repair of the entry point into the nest with wax and *kwern* (grass). Dr George explains that you*"put it underneath.stop the honey .they would build hive over. you shut him kwern enyarl apun. Aerei boyl.. he shut up his nest. The eye is still up there, he stop there …If the axe mark is big and a lot taken bees will go nest somewhere else." Dr George field data 2010.* Careful entry was made just below the nest entrance and a mop made from softened sugarbag grass was fastened to the end of stick *"kwern enyarl apun"* it was then inserted into the entry cut and the honey was soaked out on the mop. More scars were made over time going down rather than up the tree. There is often more than one harvest scar going down the tree with the oldest scar at the top. Plates 8.47 and 8.48 show an example of this type of scar and hive formation.

Harvesting Scars made by Stone Tommyhawk

Arrlonomen or stone tommyhawk scars tend to be more rounded in the center and then wider to the surface of the tree, this indicates wedging the timber rather than just a straight cut through the wood.

This is more likely to be a stone axe as it starts wide and finishes small and rounded. Note in plate 8.47 in the first photo *‘you can see disrupted grain, where the wood was pried out leaving a rough surface with lots of loose timber grain...you can see it clear at the top of the cut...this is also from wedging the loosened bits of timber out with a not so sharp tool. Most stone axe holes have a smaller entrance cause the aim is to just make a hole to get in. Steel axe scars cannot make small holes like this, cause the blade can't cut in this fashion…other details for stone axe are the strike lines’* (Steffensen field data 2010).

Plate 8.47 example of entry made by stone tommyhawk

Plate 8.48 an example of stone tommyhawk multiple entry points going down the tree one in fork and one further down trunk

Source: Field data 2007

Plates 8.49 and 8.50 Example of multiple entry points down the tree. This tree displays both stone tommyhawk and steel horseshoe axe marks

Source: Field data 2007

Harvesting Scars made by Horseshoe Axe

During the gold rush to the region there was an increase in horses and a subsequent increase in horseshoes. These were utilised by the local Indigenous people, they were sharpened and fashioned into an axe and used to harvest Sugarbag. Plate 8.49 and 8.50 shows examples of a scar made by a small sharp axe that has made a deep cut into the wood at the bottom and a smaller harvest scar made by a stone tommyhawk.

Harvesting Scars made by Steel Axe

The entry hole is long and even from the surface to the inside, because it takes the shape of the steel axe head, and sharp edge which is why there is no battering of the edges like the stone axe ones.

Dormant hives were recorded in old large scars during the study. The Cooktown Ironwood tree in plate 8.51 shows two steel axe scars and a scar made by Stone Tommy hawk. This hive was no longer occupied. As recorded by Dr Tommy George often large harvest scars result in the abandoning of the hive. Scars are also made naturally, *"its a bloodwood tree nest. The scar is not man made. It is where a branch fell off, then the nest was made after cause its hollow inside."* Plate 8.53 shows a nest in this type of scar.


Plate 8.51 and Plate 8.52 Show two scars made by Steel axe. Plate 8.52 also shows a scar made my Stone tommy hawk further up the tree to the top left

Source: Field data 2008

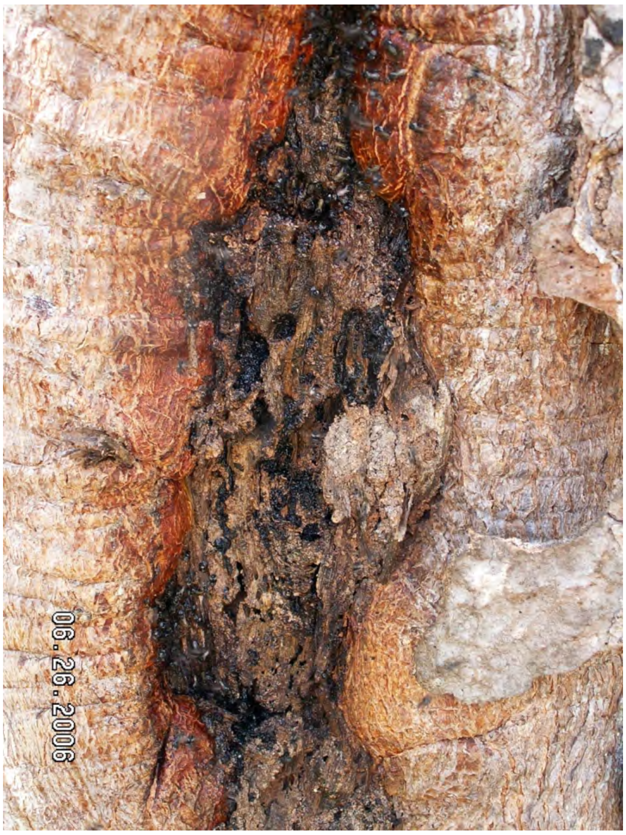

Plate 8.53 Natural hollow showing active hive

Source: field data 2006

Burning of the canopy, a result of poor fire management practices results in a loss of flowers and food resources at critical times. Plates 8.54 to 8.55 highlight how flower – *Ku enyarl* production can be impacted by fires that are too intense or at the wrong time in the wrong place. Plate 8.56 showing a healthy canopy with flowers during July. Table 8.11 outlines tree species that are important for Sugarbag and *Awu Alaya* language names for these species.

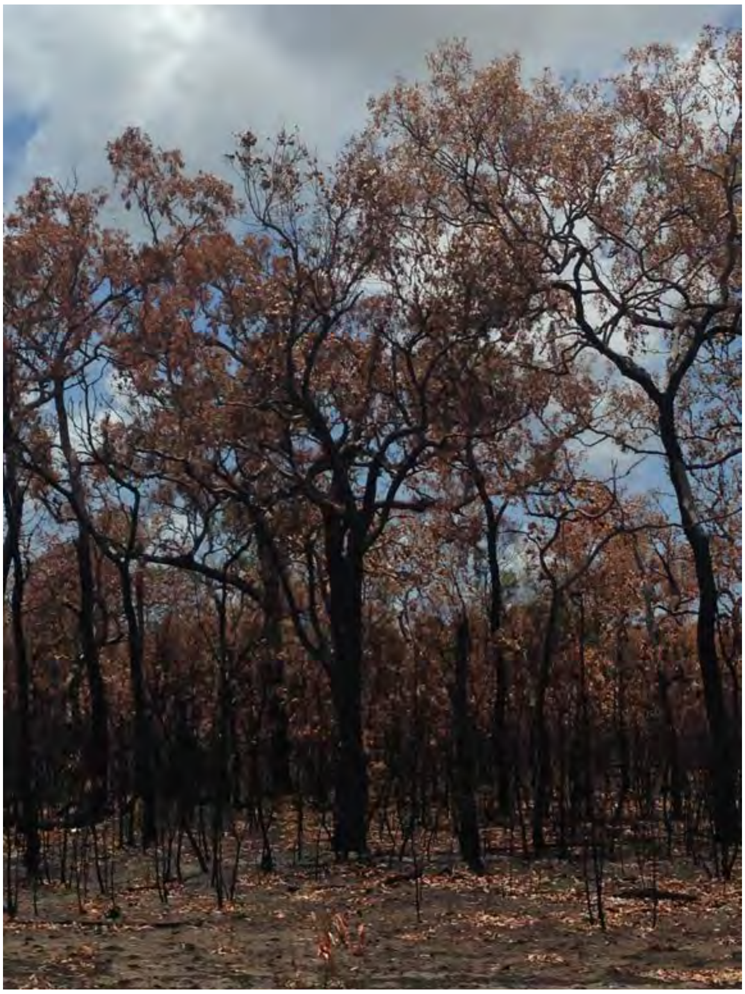

Plate 8.54 A fire that is too intense and has impacted the health of the canopy

Source: Field records

Plate 8.55 Immature flower buds on burnt ground damaged from canopy scorch resulting from an early season fire

Source: Field data

Plate 8.56 A healthier flowering canopy

Source: field data 2007

Table 8.11 Types of trees important for native Sugarbag bee's

Source: Field data 2009

Language name	Common name	Scientific name
Ku Andeal	Walnut Tree/Bushman's clothes peg	*Grevillea glauca*
Ku garl	Gum Tree	*Eucalyptus sp.*
Ku taeru Ku toada Ku Nbae	Wattle trees	*Acacia sp.*
Ku Morteall	Cooktown Ironwood	*Erythrophleum chlorostachys*
Ku Anarmagetta *ku arramagel*	Bloodwood	*Corymbia sp.*
Ku Aldkalemba	Stringybark Messmate	*Eucalyptus tetrodonta*
Ku ta	Dead tree	
Ku kulnm	Iron bark	*E. culleni*

The TCK of Dr George in relation to Sugarbag did not just extend to their biology, behaviour, nest characteristics, distribution, production and harvest of honey but also its inter-relationship to the elements of the knowledge map. Table 8.12 highlights the differences between Dr George's traditional cultural knowledge of 'sugarbag' and western science knowledge of *tetragonula sp.* Table 8.13 outlines Dr George's traditional cultural knowledge of sugarbag as they relate to each of the knowledge map elements from medicine to roles. This also demonstrates how the knowledge map elements enable the documentation of cultural values and their inter-relationships. For example, the Elders' ICFK system recognises that flower production is essential for native bee survival, native bees are responsible for pollination and are an important food resource for insectivorous birds.

Table 8.12 Differences between the Kuku Thaypan Elders TCK of sugarbag and western science knowledge

Source: field data analysis 2009

<table>
<tr><td>Sugarbag

Nye Aerei

algah: any sugarbag bee</td><td colspan="6">Sugarbag is an English word. Sugarbag in WS taxonomic system refers to “stingless bees” belonging to the genera Trigona and Austroplebeia.

It is possible that stingless bees carry this common name because traditionally the soaked mop was carried inside a small bag on the waist and/or the nest is bag shaped. In the Elders IKS it refers to the interconnected bee, honey, nest, tree, grass, flowers and country.</td></tr>
<tr><td>TCK Types of Bees</td><td>TCK Nest characteristics</td><td>Field notes</td><td>Western science knowledge</td><td>TCK Behaviour</td><td>TCK Size</td><td>Australian Distribution TCK and WS knowledge</td></tr>
<tr><td>Aerei wumba
English Bee</td><td>Large nest on branches</td><td></td><td></td><td></td><td>Bigger than Aerei kun</td><td>Recorded by TCK in project study area, Morehead River, Rinyirru CYPAL, Cape York Peninsula

Present on country for at least 75 years</td></tr>
</table>

Aerei nyenjo	Ground, crevices, logs, tree, ant bed	Nesting behaviour recorded by WS for *Tetragonula clypearis* and *Tretragonula sapiens* is similar to that described by Dr George for this species "little one lives in the ground, ant bed, nest in tree too…rock anywhere. On a log." However, the Elders description of this species lacks the description of common entrance tunnel for both these species as recorded by WS. The size description of this species by Elder Dr George as "the little one" indicates its *Tetragonula clypearis* however this was not able to	*Tretragonula clypearis* - the brood cells are roughly arranged in diagonal rows. Most nests have an external entrance tunnel. Often nesting inside walls or building cavities. Except for the body size difference (T. sapiens larger) there is no easily recognised character to separate *T. sapiens* and *T. clypearis.*	Nests anywhere They all like to nest close to water. Smaller sugarbag honey, **little to no honey**, flies a long way	Little one Smaller than *Aerei kunbul*	Recorded by TCK and WS and collected in project study area, Morehead River, Rinyirru CYPAL, Cape York Peninsula.

		be confirmed in the field.				
Aerei kunbul	Short nose entrance to the nest Nest is real black you can see it a long way from the nest	*Tetragonula hoskingsi* (confirmed collection and identification in the field)	In *T. hockingsi*, the brood cells form small irregular horizontal combs. Normally there is no external entrance tunnel.	They all like to nest close to water **Most honey**	Biggest one	Recorded by WS and IEK and collected in project study area, Morehead River, *Rinyirru* CYPAL, Cape York Peninsula
Aerei rombul	Funnel sticking out, long nose entrance to the nest with flowers on the entrance to the nest	*Tetragonula sapiens* based on size description and entrance tunnel both recorded by WS and TK. However nesting behaviour recorded by WS "It is found on Cape		He is "everywhere" Maryvalley station **Sweetest honey**		Recorded by IEK in project study area, Morehead River, Rinyirru CYPAL, Cape York Peninsula. Known to occur in Eastern Cape York (WS)

		York, QLD, often nesting inside walls or building cavities”more reflective of Dr George’s description for *Aerei nyenjo.*				

The results from the report from CDU scientists noted '*based on current search efforts at Saxby (Gno Coom) Stingless Bees (SB) are thin on the ground. Hive density is at best 0.4 hives per ha and probably more like 0.04 hives per ha.'* Did this confirm Dr George's hypothesis that sugarbag was not as abundant as it once was? In order to examine that in more detail the Elders' methodology of mapping and monitoring the density of active hives vs non-active hives and the number of harvest scars per tree across their country would also be replicable and determine density. So what else did we find out from the study.

- the efficacy of using a relatively uncommon (or at least low abundance or hard to find) species as an indicator species.
- Using an uncommon species results in a relatively insensitive measure of whatever environmental factor one is trying to indicate.
- Scorch heights on trees as indicated in the field to CDU staff may represent an easier indicator to measure
- Ongoing monitoring of sugarbag sites and fire history would enable validation of the bees as potential useful indicators and is important from a cultural and ecological perspective.
- IF fire management that benefits bee requirements was implemented then an increase in their density would be expected to be able to be detected over time as the health of country returns.
- An increase in Traditional Cultural Knowledge has been shared and communicated with Indigenous and non-Indigenous fire and bee practitioners on and off country.
- The development of two methodologies and methods for mapping and monitoring sugarbag and stingless bees on country.
- An assessment of the value of stingless bees as an indicator of savanna woodland biodiversity health.

- A cross cultural exchange of knowledge on country led by Indigenous knowledge holders demonstrating Indigenous led participatory action research.
- Determination of the taxonomic status of all bee species collected
- Development of a methodology to map and monitor ICK of “sugarbag" should include mapping of fire management behaviour at site.
- Clear differences in the way country is assessed, read, monitored and mapped

The way in which country is read and assessed in the Elders’ TCFK differs from western ecological ways of examining and determining healthy country. Rather, TCFK delivers multiple outcomes to contemporary fire concerns including ecological diversity as outlined in Chapter three. The knowledge map elements provide a way to document TCFK as highlighted in Table 8.13 below that outlines the knowledge map elements, their relationship to the knowledge triangle and to Sugarbag.

Table 8.13 The Elders knowledge map elements, connection to knowledge triangle and their relationship to Sugarbag

ICFK Element	Connection to knowledge triangle	Relationship to sugarbag
Medicine	Knowing what it is/ Knowing what to do/ Knowing who we are	Honey is an important medicine
Navigation		Sugarbag rock is a landscape feature known by Kuku Thaypan people
Gathering		Harvest of honey
Weaponry, tools, craft		Use of wax in weaponry
Hunting and craft		Use of wax in craft
Art Dance and Song		Sugarbag its creation, use and lore are communicated through art, dance and song

Trade and resource sharing routes		Sugarbag was managed and distributed according to strict governance
Fire		The importance of fire management that maintains native bees and their hives
Water		Knowing that native stingless bees prefer to nest near water/moisture
Dew		The importance of dew in providing moisture during the winter months to aid in regeneration
Mist		Mist is connected to appropriate management practices that ensure adequate moisture
Rain		Cool fires in the winter months stimulate localised showers
Smoke		The effect that smoke has on bee activity
Wind		The need for the wind to push fire through early dry season burns when areas are still moist
Earth	Knowing who we are/	Knowledge of bee species nesting behaviours
Air	Knowing our responsibility/ Knowing how to do it	Cooler temperatures bring an increase in due and available moisture
Grass		The use of grass in harvesting and maintenance of nest
Canopy		The importance of the canopy in maintenance of food resources for bees and production of honey
Food		The importance of honey for all species not just as a food resource for people
Trees		Interaction of fire timing with tree species present
Soil	Knowing what it is/	Different ecosystems occur on different soil colour changes composition of species present
	Knowing what it does/ Knowing how to do it	The importance of ash in renewal of grass species used in harvest of honey

Ash		
Plant		Understanding the relationship of the bee with flowering plant species
Animal		Recognition of different species of bees and their nesting behaviour
Inter-relationships		Sugarbag, people & fire
Indicators		Knowing when honey is ready for harvest
Place		Reading the indicators in place, landscape features and habitat of sugarbag
Cycles		Understanding how phenology shifts with climate and influence honey production
Season	Knowing what it does/	Knowing what seasons species are flowering and fruiting
Timing Assessing and Reading country	Knowing how it works/ Knowing our responsibility	Ensuring that fire management did not impact flower production
Respect		Respect for the resource
Responsibility		Responsibilities of all aspects of maintenance of the supply of honey
Reciprocity		Laws around the sharing of honey
Recognition	Knowing what it is/	Recognition of Elders in need of honey
Roles	Knowing what to do/ Knowing who we are	Responsibilities for looking trees with active hives, harvesting and distributing honey

Knowing what it is, Knowing what to do, Knowing who we are

In the Elders' TCFK system knowing what it is; respect, responsibility, reciprocity to country and kin, recognition of whose knowledge it is and the roles that each of us play in enabling cultural fire management to be implemented on country are understood. Description of these elements are discussed in chapter three but are presented in Table 8.14 and described in Table 8.15 below.

Table 8.14 shows the elements that will be discussed in this section and their relationship to the knowledge triangle

Knowledge Map Components of cultural fire	**Knowledge Map elements**	**Connection to knowledge triangle**
Protocol	**Respect**	Knowing what it is/Knowing what to do/Knowing who we are
	Responsibility	
	Reciprocity	
	Recognition	
	Roles	

Table 8.15 The Elders knowledge map elements and their discussion

Knowledge Map Components of cultural fire	Knowledge Map elements	Connection to knowledge triangle
	Respect	Respect requires acknowledgement of an "other's" way of being. Respect interpreted through the lens of the Elders is knowing that there is a difference between respect that is given and respect that is earnt. Their knowledge system also shows respect to country, an example being the calling out to ancestors in language when entering a sacred area and the use of human smell to welcome strangers so that spirits of the ancestors who are present in country will not bother them. I never ceased to be amazed by the incredible tenacity of the Elders to deflect disrespect and continue with their way of being. Often disrespect was met with silence or a simple "oh yeah" and a nod. The layers of respect in the Elders' knowledge system also pertain to knowledge of and your relationships in the kinship system.
	Responsibility	It was not the desire of the Elders to have their knowledge recognised, but their deep feelings about their obligations to care for the country that weighed upon them and influenced the need to bring western scientific approaches to fire management and research alongside their Indigenous knowledge system. Cultural responsibility to look after country is not negotiable in the Elders' knowledge system. This responsibility is akin to looking after people, just as culture and nature are, people and country are analogous, therefore impacts to country are believed to impact the spirit and health of people (field notes 2003).
	Reciprocity	Reciprocity is inherent in the Elders' knowledge system and somehow in contemporary concepts almost intangible. Very few social transactions contain altruistic behaviour. However, the knowledge system of the Elders through

Protocol		enlivens respect through the giving back not only to humans but to plants, animals and country as its health is part of their identity.
	Recognition	Respect is about recognition of who’s knowledge it is and who’s country, it is about acknowledging when people carry out their role with pride. It is about recognition of knowledge transfer and decisions of Elders to transfer that knowledge and preside on consensus. It is about recognition of country as teacher and familiarity with it and with each other. It is about recognition for the value of the knowledge of young people and what they contribute to the future.
	Roles	TCFK is defined by the responsibility that you carry with regards to knowledge, your bloodlines and your practice of knowledge. Not everyone has the same role or the same knowledge, however each role is valued. This is not dissimilar to the chain of command on a fire front and the roles that individuals play in understanding and containing the spread of the fire. In the application of fire on the landscape you need to know who is lighting where and how this will influence the overall behaviour of the fire in relation to variables listed in chapters 6 and 9.

This chapter has described each of the elements of the Elders' TCFK map, and highlighted how they relate to the knowledge triangle and cultural management of fire. The element of fire is connected to all of the elements that have been highlighted in this chapter. Chapter 9will outline the Elders' documented cultural fire management for nine different country types that occur across Kuku Thaypan country, some of the Elders' indicators for reading country and their fire management prescriptions, values and threats. Western science descriptions and ways of knowing country are also described so that western scientists may recognise aspects of connectivity to their own ways of understanding the World and acknowledge the complexity of the Elders' 'fire management plan'.

Chapter 9: Application of the Kuku Thaypan Traditional Cultural Fire Knowledge on nine types of Country

Chapter 8 presented the knowledge triangle as described by Steffensen and the Elders' fire knowledge components and elements as demonstrated by them through their Kuku Thaypan Fire Management Research Project (KTFMRP) and documented by the Importance of Campfires. The description of aspects of the elements of the Elders' Traditional Cultural Fire Knowledge (TCFK) system highlights the complexity of interconnected cultural considerations related to implementing fire on country.

This chapter describes, some of the Elders' indicators for reading country and their fire management prescriptions, values and threats by examining nine different country types that occur across Kuku Thaypan country. These country type descriptions are the *Earth* element of the Elders' knowledge map. The Elders' TCFK map *Indicators* element is also discussed here. Western science descriptions and ways of knowing country are also described so that western scientists may recognise aspects of connectivity to their own ways of understanding the World and acknowledge the complexity of the Elders' 'fire management plan.'

The information is not exhaustive but demonstrates the diverse, in depth knowledge that the Elders possessed of their country and how to manage it with fire. It is also important to remember that what is outlined is a summary as it relates to western management frameworks. As highlighted previously, in the Elders' TCFK the timing and method are adapted across seasons. Further adaptations occur when dealing with modified systems, such as those that have had hot fires and have a sparse canopy and understories, are dominant with one grass, or missing vital mid-storey shrubs, or invaded with woody weed species including native species that are acting as invasive species, the Elders would modify the way in which fire would be implemented such as burning with or against the wind, the time of day or season may be modified depending on the current state of system and the desired outcome, as this would then influence how fast the fire moves through the system and the intensity of the fire.

Awu Alaya speaking Elders' traditional cultural _Mor_ (fire) knowledge (TCFK)

"Cultural Burning according to the conditions"

In the Kuku Thaypan Elders' traditional cultural fire knowledge system, timing for burn recommendations are read via accessing all of the elements of the knowledge map and the prescribed formula for applying this knowledge; the knowledge triangle. Indicators and listening to the environment is connected to the ability to read country across seasonal changes inter-annually and between years. Climate shifts affecting weather patterns are indicators themselves but are also intimately connected to other indicators held in country, influencing timing for burning. Other indicators such as flowering, fruiting phenology and faunal movements, vegetation communities curing times and timing of curing within systems, along with fire histories (read in the country) and the condition of country (presence of weeds and feral animals), cultural customary practice (such as the passing of kin), warfare, and access to country all influence decision making on the timing for burns in different country types and the type of fire that is used. This complexity and flexibility to respond to queues in country, weather and climate is also reflected in Kuku Yalanji Elder "Old man" Fischers[59] quote in 1996 *"Nganjinanga calendar yamba kari. Yamba nganjin Bamangka juku nyajil-nyajil. Yinya juku binalbajaku nganjin bama jara yala" – "We don't have a calendar. Bama story goes by the tree. The tree knows better than we do"* in Hill (2004).

Like other areas on Cape York Peninsula, the main fire season commences straight after the wet season, as soon as the country is ready to burn, although this timing varies across Cape York. The Kuku Thaypan country in Princess Charlotte Bay, Normanby Basin country is still very green at this

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[59] now sadly passed over

time of year and would be considered by western fire managers as being “too wet” to burn. As highlighted earlier, the wind at this time of year helps push the fire through the system. At this time of year strong South East winds occur on the East Coast of Cape York. Even though the country is predominately green, areas will begin to dry out and be ready for burning once the seed has set. Burning begins anywhere between April and July, depending on the strength (and length) of the wet season and the capacity of land managers to implement fires at the local scale and continues through August, September, breaks around October and resumes once the storm season rain returns. Kuku Thaypan knowledge for timing for initiating ecosystem burns following the monsoon rains is altered according to seasonal conditions and the capacity to implement fires according to TCFK practice. TCFK timing of implementation of burns depends on for example, the soils, the parent trees, the mix of tree species present, their phenology (flower development and timing), *nyekeel* bark shedding, elevation, geology, curing of *kwern* grasses, drainage and climactic conditions including the presence of *Ngo oilten* (winter rain), faunal presence, absence and movements, and resources required such as resin, gum.

The Elders’ TCFK promotes burning where scorch heights are kept low, and in some instances, leaving no evidence of scorch marks on the bark of trees. Fires that scorch and burn the tree canopy are to be avoided. Canopy burns are prohibited under Kuku Thaypan traditional lore, and burns in woody areas are conducted with awareness of the biological requirements of the flora and fauna that inhabit these areas. For example, in Boxwood communities’ possum breeding season and tree flowering times are considered before burning.

As highlighted above, traditional cultural fire knowledge demonstrated through the Elders’ research project defines that different country types (ecosystems) are burnt at different times throughout the year. This detailed knowledge of when to light a fire responds to ecological and seasonal indicators present in the natural environment. As country begins to dry out as rainfall decreases and the South-East winds begin to increase, days are marked by clearer blue skies and hotter temperatures, insect life. Notably native *Arear* sugarbag *Tetragonula* sp. and *Nye yelia* butterfly species begin to increase in number and activity. At this time of year as temperature and the SE winds increase the large open box woodland plains begin to dry out. Rainfall is still present but has been replaced by light, patchy intermittent knock-em-down rain. Tall Spear grass *Kwern umbayal Heteropogan triticius* seed stalks begin to fall down and native grass seed begins to be knocked off the plants ready for fire, smoke and germination. The geology, land form, soil and parent trees as well as numerous other considerations as outlined in the knowledge map elements described in Chapters 7 and 8 define timing for burning.

Burning all year round was intimately connected to the curing of vegetation across all vegetation strata, burn history, weather and climactic conditions. This prevented unmanaged fires that can cause substantial loss of habitat and food resources impacting on native flora and fauna. Cool earlier season fires move slowly through the landscape, leaving areas unburnt, that may later in the season be burnt, helping to create a heterogeneous landscape or varying age class fires in space and time, capable of sustaining greater diversity.

Awu Alaya speaking people burned for a variety of reasons, implementing fire across the landscape throughout time and space, careful layers of age-class fires, varying in intensity, micro to macro scales, *"tendering the land."* Steffensen field data Kings Plains Fire Workshop 2012. There occurred a natural break around October, the driest month of the year and the start of the build-up to the Monsoon wet season, when lightning strikes increase in frequency, when the air is drying, when the deciduous species lose their leaves, when Eucalypt species begin their preparation for transition to the wet and shed bark, when important totem bird species are busy on their nests ensuring shelter for the onset of the Wet. The increase in bark and leaf litter at this time of year intensifies fuel loads and the potential for fire to travel fast and hot across the landscape even if it has been burnt prior earlier in the year.

Pre-colonisation, the land was prepared by people, the mosaics were implemented, the fuel loads reduced, shed bark reduced, areas burnt away from for protection such as wetlands, springs, rivers, den trees and sugarbag (native honey bee hives). In the words of the last remaining fluent speaker of the *Awu Alaya* language Dr George when I asked how his parents were burning on country in the old times, *"That's a long story."* It is indeed a long story, embedded in creation and lore, what has come to be interpreted as the "Dreaming" the creation of the universe and the ancestral beings' gift of fire. It is a story of great responsibility, knowledge and skill, of remembrance, practice and maintenance of the lore that informs the management laws for its implementation on the landscape for both men and women. The time and dedication could be described as akin to that required for scholarly study, however the motivations and connections differ. The result of this *"long story"* was a heterogeneous landscape able to support a diverse array of species, inherited by contemporary Australians upon colonisation. There were varying age classes of recently fired and regenerating areas that existed when people were living on country. These multiple scales of fire were far less intense than the fires that have affected the Elder's country since European colonization with increasing impacts in Cape York from the early 1900's.

In Kuku Thaypan fire management, fires are predominantly low in intensity, except for some firing regimes of some systems, there is little charcoal created. Ash particles resulting from the types of fires the *Awu Alaya* speaking people created disperse in a number of ways, macropods and birds come to roll in it and lick it, birds forage among it for seed, ants gather the seed for storing and take particles down into the soil, light rain generated from the right smoke, enables capacity for it to go back into the soil. When people were living on country the varying age classes of fire regimes within and between ecosystems, careful management ensuring moisture is available for regeneration leaving little interval between when fires were implemented and cover returned.

Indicators

As mentioned previously, here were numerous indicators that the Elders were reading in their environment and in country, read across and within systems and across and within seasons. Timing of burns modified according to the outcome desired, the seasonal pattern and the weather on the day. Kuku Thaypan Elders' Traditional cultural burning indicators demonstrate knowledge of a wide range of cues across the seasons that need to be read and the shifting but interconnected nature of these indicators to determine when fire begins for that country.

Reading country is not only about reading the indicators it is also about being able to learn from the country what has happened with fire, some of the ways to interpret country and the type of fire that is then required to heal country are also discussed in the threats and management discussion of each country type classification. Table 9.1 describes some of the Elders' TCFK indicators of country that can tell you when an area is in poor health and good health. These indicators are signs that previous fire management has resulted in positive or negative consequences for ecosystem function. Table 9.2 describes some of the indicators that are read in country for different country types across the year and how they relate to timing for burning in the Elders' TCFK. Nine of these different country types known by the Elders; their fire management prescriptions, values and threats are then further described in detail.

Table 9.1: Kuku Thaypan Elders' Traditional Cultural fire Knowledge Indicators that Country is in Good or Poor Health

TCFK Indicators of poor health from fires that are too intense and too frequent	**TCFK Indicator of healthy country from the 'right' type of fire**
Scorch height high on trunk	Low scorch height on trunk
Food resources and nesting habitat low	Food resources flowers and fruits developed and mature trees with nesting hollows
Canopy scorch percentage high	Healthy green canopy capable of reproduction
Too much leaf litter and heavy fallen timber debris on ground	Fine and course woody debris present but reduction in large amounts of leaf litter not smothering understorey
Presence of woody weeds (exotic and native)	Absence of woody weeds (exotic and native)
Bare branches and canopy	Decrease in large debris
Coppicing re-growth of shoots close to trunk and branches	Healthy canopy of multiple leaves, leaf stems and twigs
Change in habitat *structures "upside down country"* Succession is out of sync invasion of understorey in response to loss of canopy	Standing mature trees varying age classes of species present – recruitment of canopy species present
Changes in species presence and absence	Species known to occur in this system present
High levels of bare ground, no grass, flowers, orchids, yams, lilies, legumes	Increase in grass cover and diversity of species found in system present
Fallen mature dead trees often with hollows, standing dead timber, no smaller outer branches and branchlets	Branches have right structural form/s for the species
Shrub layers of native species in systems where they are supposed to occur stunted and limited flowers and fruit	Shrub layer mature at full growth and abundant flowers and fruit
View and access obstructed by weeds (exotic and/or native woody weeds), upside down county, fallen timber, increase in obligate seeders, excess leaf litter, fine and course woody debris on the ground and in the mid-storey	Clearer view through system, a healthy canopy with strong structural form, grass and other species diversity in understorey

Table 9.2 Kuku Thaypan Elders' Traditional burning indicators, highlights indicators across the seasons that need to be read and the shifting but interconnected nature of these indicators to determine when fire begins for that country type Source: KTFMRP records 2003 – 2017 compiled in 2017

Approx month	Season	Burn timing	Country Type	Indicators
Nov - Feb	Summer	Wet season burns	Ironbark country	Increase in lightning strikes
			Stoney country	
			Wattle Lancewood country	Increase in Intermittent storms
			Storm burns plains	Adequate soil moisture depth 15-20 cm (at least a ft (300 mm of rainfall)
			Debil Debil country (poison wattle)	Increase in rainfall
			Wetlands and Rivers swell through the wet season	Monsoon rainfall
Jan - April		Lead up to burn season. Can be wet or dry depending on season	Wetlands and Rivers swell through the wet season Wetlands begin drying out	Increase in Clear Blue Sky's
				Rainbows
	Autumn			Increase in *Arear algah Trigonia sp*. Any Sugarbag (*Nye Arear*) bee
				Flowers on *Gravellia*, *Calitrix*, large leaf wattles
				Increase in *Nye yeliya* – Butterflies
				Ku taeru *Ku enyarl* Wattle Flower begin flowering
				Kwern yulan Sugarbag grass Cockatoo grass *Alloteropsis semialata* finished flowering and fruiting
May - September		Burns can begin depending on season. Can still be wet	Wetlands begin drying out Curing *Kwern* (grasses) *Ku arronga* Boxwood community. Boxwood systems begin to be ready to burn	*Nye Koil* Longneck Freshwater Turtle Fat
	Winter			Fat Goanna
				Ku agawl Gum have new growth
				Healthy Possums
				Black spear grass seeding
				Light showers
				Rainbows
				Strong wind gusts
		"All systems are burnt through this time and start to slow down in spring. Systems burnt earlier in the season are green by spring. All systems are burnt from boxwood through to mix tree and all the rest in between." (VS 2017) Timing for systems is adjusted through the months according to indicators read in country, seasonal weather conditions, vegetation on different land forms, trees soils and current state of system (repairing contemporary fire histories/the condition of vegetation is read in country).		Mornings start to get cooler
				Nights get longer
				South East Winds increase
			Curing *Kwern* (grasses) *Ku arronga* Boxwood community. Boxwood systems begin to be ready to burn Begin burning to protect lagoon edges	Light to heavy squally showers Knock em down *Nyo oilten* rain begins
				Kwern umbayal (Giant Spear Grass) *Heteropogan triticeus* begins to fall over
				Che giuill Wild rice *Oryza sp.*is ready
				Cooler nights temperature decreasing, Heavy Dews present. Ring around the moon
				Ku Anarmagetta/Ku argnamageel Bloodwood flowering
				Emu is nesting
			Ku agawl Gum tree	*Kwern Eriachne sp* setting seed
			Open Plains	*Ku akalmba* Messmate flowering
			Ku Anarmagetta Bloodwood sandridge	*Kwern Themeda* sp setting seed

			***Ku akalmba* Messmate Stringybark sandridge**	**Burn to protect art sites**
			Bloodwood *Ku Anarmagetta*	***Ku agawl* Gum flowering, Yam fnished growth, lillies and orchids growing**
			Open Plains	***Ku agawl* Eucalypts begin to shed bark**
			Tea-tree	**Last of light to heavy squally showers SE Knock em down rain**
			Mixed tree	
			Rainforest edges, vine scrub and *callitris sp*	**Temperatures begin to increase**
	Spring		**Coastal woodlands on plains**	**Increase in leaf drop by Eucalypt sp.**
			Coastal grassy plains	**Burns slow-down in Spring depending on rainfall levels**
Sept - October		**No burning in October Hot and dry start of build up to the wet season**		**Air is dry and hot temperatures are high and vegetation moisture is low. Large amounts of leaft litter**

Descriptions of Country and their fire management in the Elders' TCFK

Outlined below are nine country types that are known in the Kuku Thaypan traditional cultural fire knowledge TCFK. These country type descriptions are the *Earth* element of the Elders' knowledge map. Not all the country types the Elders identified are described. A description of the dominant vegetation communities that occur within and adjacent to Kuku Thaypan country by western science are also highlighted.

As highlighted in Chapter 6 Broad Vegetation Groups (BVG's) mapped by (Neldner & Clarkson, 1995) in the project area of interest in the Kuku Thaypan estate are:

1. Closed Forest
2. Eucalypt Forest
3. *Eucalypt* Woodland
4. Grassland
5. Heath[60]
6. Mangroves
7. Melaleuca Woodland
8. Seasonally inundated

Nine different country types known by the Elders and knowledge holders; their fire management prescriptions, values and threats are described here. These country types are:

1. **Messmate Stringybark Country -** *Ku akalmba Eucalyptus tetradonta* Messmate Stringybark Country on Sandstone and Sand ridge (sub *Ku kulnm* Ironbark on Sand Ridge

[60] Heath and Mangroves occur in the boundary with *Lama Lama* at *Nraada/Ndolpin* at Low Lake

2. ***Mixed-tree country*** - *Ku argnamagal* Bloodwood, *Ku morteal* Cooktown Ironwood, *Ku andeal* Bushmans clothes peg, mixed trees on higher elevation light sandy soils

3. ***Debil Debil country*** on Stoney soil

4. ***Boxwood Country*** - *Ku ronga* on floodplains and river terraces light brown soil

5. ***Kwern Country*-** open grassy plains

6. **Lagoons and Swamps**

7. **Kugarl Gum Tree country -** *Ku garl* Gum and *Ku argnamagal* Bloodwood and shrub species present on wetlands, rivers and plains

8. **Tea-tree country** on sandy soils three different Tea tree *Melaleuca sp.* in broad leaf Tea tree *Melaleuca viridiflora* communities on floodplains, inundated areas and drainage depressions

9. **Wattle country** – Wattle/Lancewood country, *Ku nbae* Red inside wattle, *Ku toeadoo* yellow-flowered wattle on lower elevation ridges, red soil reddish sandy soils

The mix and structure of vegetation, elevation, soils and moisture, weather and climate drive fire management prescriptions in The Elders' traditional cultural fire knowledge system.

Each of these vegetation and landscape features communicate the type of fire they require. Learning how to listen and read the country enables the ability to create not only many differing age class fires but a heterogeneous landscape capable of supporting the diversity inherited by contemporary Australia, generated by land and waters that were well managed by Indigenous Australians for tens of thousands of years

1. **Messmate Stringybark Country -** *Ku akalmba Eucalyptus tetradonta* Messmate Stringybark Country on Sandstone and Sand ridge

Significant sandstone escarpments, gorges and plateaus occur throughout the Laura and Normanby Basins in Cape York Peninsula, and are found along the length of the Great Dividing Range. They are unique ancient landforms that often contain significant Indigenous art galleries and flora and fauna that are only found here. They are either Land Zone 5, 9 or 10 in the Queensland Bioregional ecosystem mapping system depending on whether they are formed of fine grain or course grain sedimentary rock or adjacent to Quaternary loamy sandy plateaus. They contain a diverse array of vegetation communities and plants, including vegetated springs, soak swampy wetlands. These areas have shallow sandy soils on sandstone to moderately deep soils at the base of escarpments on plateaus and hills (Queensland Herbarium, 2018). These areas occur predominantly outside the study area of interest where fire management was able to be implemented during the years of the research project, however the entire basin is surrounded by and contains landforms derived from these spectacular and Internationally important places that contain significant rock art.

Geology and soil

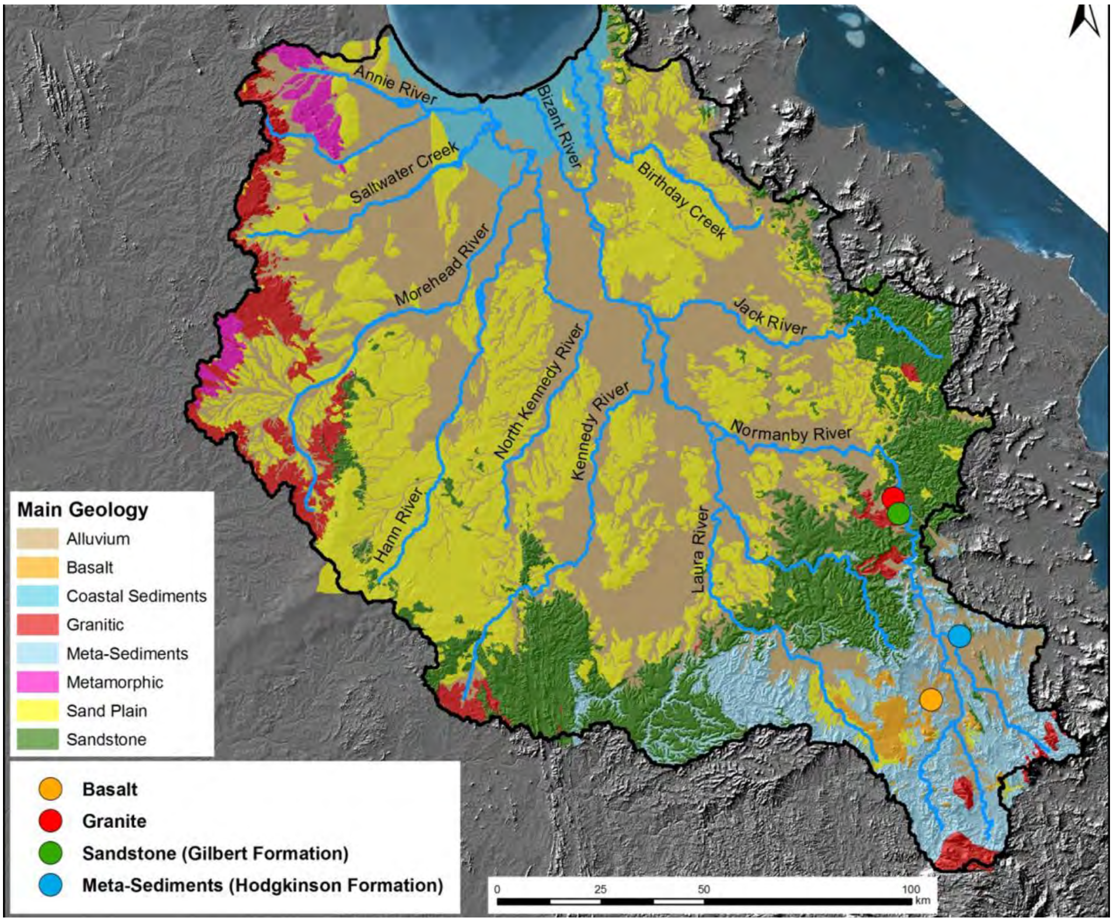
The geology differs for Stringybark country types, sometimes it is sandstone, sometimes it is bauxite and sometimes it granite. However, Messmate *E.tetrodonta* and/or also Stringybark *E. Phonecia* and other unique Eucalypt species grow across these areas but shift in presence and dominance, the most abundant woodland being *E. tetrodonta*.

Woodland of *Eucalyptus tetrodonta* (Darwin stringybark) and/or *Ku argnamageel* (bloodwood) *Corymbia clarksoniana* (Clarkson's bloodwood) *+/- Erythrophleum chlorostachys* (Cooktown ironwood) are documented as having very sparse to sparse sub-canopy and shrub layers can contain a range of species. In the Elders’ knowledge system they once had a thicker understorey and higher mid storey. It is as a result of the wrong kind of fire over subsequent years that has caused them to become sparser in recent years. There are a range of communities contributing to this regional ecosystem. These systems occur extensively on low rises and erosional plains both east and west of the Great Dividing Range in southern and eastern Cape York Peninsula and extensively throughout the study area (Queensland Herbarium, 2018).

In some areas of Cape York Peninsula, the canopy of this system is extremely high and in the south eastern and lower areas in the landscape where it is also found it is not as high. Elevation and available groundwater drive the height of the canopy. Sand ridge country in the south has a lower canopy than sand ridge country in the North but soils are derived of similar parent material with fine light-coloured sandy soil sometimes white. Towards the North on the Weipa plateau on bauxite, stringybark forms an extremely tall canopy, bauxite pebbles cap the soil in places and where soils have been weathered are sandy red. *E. Phonecia* woodlands on sandstone have reddish sandy soils. Stringybark *E. tetrodonta* grow in single stand forests where it can be the dominant tree in the canopy layer as soils slightly change Bloodwood *Corymbia sp.* begin to appear in the system. When I travelled on country with Dr George Musgrave in May 2005, he explained to me that the Elders recognised two different messmate species, one has a smoother bark than the other.

These vegetation communities are found when travelling down the lagoon complex adjacent from the top of the Morehead River *Kating* catchment to *Gno Coom* through Artemis station. They are also found on the foothills undulating down from the escarpments and on the Sand ridge to the West of 18 Mile lagoon *Agnrawal*. These areas surround and feed into Princess Charlotte Bay and form an arc shape from Melsonby station in the South East through around to Laura continuing through to the Morehead River to the North, scattered throughout the

Normanby Basin to Marina Plains. Map 9.1 shows the terrestrial digital elevation and main geology for the Normanby basin, within which the research project area of interest in situated.



Map 9.1 Main Geology of the Normanby Basin
Source: (Brooks et al., 2013)

The research study area of interest is along one of the main northern river systems of the Normanby Basin, the Morehead River or *Kating* that feeds into Princess Charlotte Bay and the Great Barrier Reef. Unique Eucalypt and bloodwood species are found in the vegetation communities of this country and their presence and dominance influence timing for burning. These systems also had diverse mid-storey and ground layer providing resources to fauna and people. Dominant vegetation communities as described by Regional ecosystems as described by (Queensland Government 2017) that collectively contain Messmate country are:

Regional Ecosystem 3.10.6

- Woodland to low woodland (and sometimes low open forest) of Corymbia stockeri subsp. Stockeri (gum-topped bloodwood) +/- Eucalyptus tetrodonta (Darwin stringybark) +/- E. cullenii (Cullen's ironbark). Sparse sub-canopy and shrub layers are often present. Sandstone rocks are common on the surface, occurring on sandstone plateaus and hills.

Regional Ecosystem 3.10.7 See Plate 9.1

- Eucalyptus phoenicea (scarlet gum) dominates the sparse canopy with Corymbia stockeri subsp. Stockeri (gum-topped bloodwood), E. portuensis (broad-leaved stringybark) or C. nesophila (Melville Island Bloodwood) frequently present in the canopy. A very sparse sub-canopy tree layer is usually present. The very sparse to sparse shrub layer consists of canopy species, Acacia spp., or Xanthorrhoea johnsonii (grass tree). The very sparse ground layer is dominated by Aristida spp., Schizachyrium spp., and Thaumastochloa spp., occurringon the wetter areas of sandstone ranges.

Regional Ecosystem 3.10.7b see Plate 9.2

- *Eucalyptus phoenicea* (scarlet gum) dominates the sparse canopy. Scattered *E. tetrodonta* (Darwin stringybark), *Corymbia clarksoniana* (Clarkson's bloodwood), C. stockeri subsp. Stockeri (gum-topped bloodwood) and *Erythrophleum chlorostachys* (Cooktown ironwood) trees are frequently present in the canopy. A very sparse sub-canopy tree layer is usually present with *Grevillea glauca* (bushman's clothes pegs) and *Melaleuca nervosa* (woodland paperbark) can be prominent in this layer. The very sparse shrub layer consists of a variety of species. The sparse ground layer is dominated by the grasses, *Aristida spp., Schizachyrium spp*., and *Thaumastochloa spp*., occurring on sandy plains and ridges on sandstone. This is an 'of concern' regional ecosystem.

Regional Ecosystem 3.5.2 see Plate 9.3

- Tall Eucalypt woodland on sand that includes Ku akulumbah Messmate E. tetradonta, Ku asteemul Yellow jacket and Ku kulnm Ironbark on the ridgelines +/- grass trees, grading to E. tetrodonta and Corymbia sp. Bloodwood. The understory of this community contains significant food and medicine resources and is usually sparse grasses, Heteropogon triticeus (giant speargrass). Schizachyrium spp. (fire grass), Alloteropsis semialata (cockatoo grass), Heteropogon triticeus (giant speargrass), Aristida sp (three-awned spear grass).

Plate 9.1 Regional Ecosystem 3.10.7b *E. Phonecia* dominated woodland showing signs of recent hot fires and wind impacts from Cyclone Ida recorded at the National Indigenous fire workshop

Source: field records 2017

Plate 9.2 Regional ecosystem 3.10.7 National Indigenous fire workshop 2017 light white smoke being implemented in Messmate country to improve condition of understorey and canopy

Source: field records 2017 image credit Robyn May Cape York NRM

Plate 9.3 Regional ecosystem 3.5.2 Tall Messmate Forest on the Weipa Plateau Steve Irwin Reserve 2015

Source Field records 2015

These four different regional ecosystems all contain dominant or co-dominant parent trees of *E. tetradonta* or Messmate/stringybark. In the Elders' TCFK these systems dominated by *Eucalyptus tetrodonta* are understood commonly as Stringybark or Messmate country and in the *Awu Alaya* language *Ku alkalemba*. These systems would all have slightly different timing although having the same parent tree and differing geology and sols depending on where they occur in the landscape. They are described here to show how easy it could be for non-knowledge holders to learn to read only one indicator; the parent tree and implement a burn based only on this knowledge alone.

Further, there are also unique systems and significant cultural features that occur within Messmate/Stringybark country such as springs, wetlands, rock art and endemic species that are often unrecorded and therefore not adequately represented in the protected estate or simply unprotected. The careful fire management of the vegetation surrounding these areas is critical for the protection of cultural and natural values both in the Woodland community and the unique fire sensitive flora of the spring community. Plate 9.4 shows a unique ecosystem, Barney springs that occurs within *E. tetrodonta* woodlands Steve Irwin Reserve. If the surrounding *E. tetradonta* woodland is not managed with fire appropriately then the springs are at risk of being damaged by Wildfire. These springs are also highly culturally significant.

Plate 9.4 Unique ecosystem, Barney springs within *E. tetrodonta* woodlands Steve Irwin Reserve

Source: Field records 2014

Management

In the Elders' TCFK these areas should be burnt very cool with a floating light white smoke trickling through the landscape. It is naturally cool in this country as the trees are very large and should have a healthy canopy cover, light fine sandy soils are typically found here. The openness of the canopy varies depending on where messmate country occurs in the landscape. The canopy in this vegetation community is important to as it provides significant food resources and habitat for animals and shade for the species and soil underneath. If it is burnt too hot it takes many years for important food and medicine resources to recover.

When stringybark on sandstone and sandridge community is burnt hot it becomes sparse underneath and native grass species decline, tubers and roots of important medicine and food resources also decrease. The shrub layer becomes stunted and don't flower and fruit as prolifically as they remain small not growing to their true size. Plate 9.5 and 9.6 show the impacts of a hot fire on a *E. tetrondonta* Messmate community. Note the height of the fire scars, mature dead trees and large amounts of leaf litter on the system floor, resulting from canopy scorch which causes leaf drop, note the skelton of the canopy in both images. A healthy canopy functions to protect soils from excessive heat and light. In the absence of the canopy, the shrub layer increases as trees coppice and send up tubers from their roots in response to hot fire and smothers regenerating grass species, shifting the way fire travels in the understorey.

Plate 9.7 shows a night burn in the same vegetation community type of Steve Irwin Reserve and the resultant effects the following morning in plate 9.8. Note the height of the scorch marks on the trunks of the trees is very low, areas are left unburnt and there is little to no canopy scorch. An older fire scar can be seen in the fire scorch back on the back of the largest

Messmate in this image. This scorch mark is from an earlier fire as can be seen in the flaking, patchiness of the remaining scorch mark.

Plate 9.9 shows the same ecosystem on Maryvalley station, however you can see in the image the different soil colours and the role that termites play, not only in hollowing out the inside of the trees but in protecting the outer bark during fire events. In this image, you can also see old fire scars reaching up into the canopy in trees in the background, thickening of non-grass vegetation in the understorey and the well cured grass layer.

Image 9.10 shows a cultural burn that was implemented in 2015 at the Indigenous fire workshop on *Tenacull* Maryvalley Station with visitor Robert Redford Snr. from Mimal Rangers in the Northern Territory and John Jarrard from Victoria Orange Aboriginal Land Council. People can be seen walking with the fire and into areas that are burnt as the fire subsides. Despite being cured the fire flame height is still kept low with little scorch marks evident on the trees and those that are present are low.

Plate 9.5 Regional ecosystem 3.5.2 Tall Messmate Forest on the Weipa Plateau Bertiehaugh station

Source: Field records 2015. September 2013 Weipa Plateau

Plate 9.6 Regional ecosystem 3.5.2 Tall Messmate Forest on the Weipa Plateau Bertiehaugh station

Source: Field records 2015

Plate 9.7 Cultural night burn in Regional ecosystem 3.5.2 Tall Messmate Forest on the Weipa Plateau Steve Irwin Reserve

Source: field records 2014

Plate 9.8 Cultural burn in Regional ecosystem 3.5.2 Tall Messmate Forest on the Weipa Plateau Steve Irwin Reserve

Source: field records 2014 image credit Lyndal Scobell Cape York NRM

Plate 9.9 Regional ecosystem 3.5.2 Messmate on sandridge *E. tetrodonta* woodland on *Tenacull* Maryvalley station

Source: field records Indigenous fire workshop 2015

Plate 9.10 Robert Redford Snr. Mimal Rangers and John Jarrard Orange Aboriginal Land council during a Messmate burn on Maryvalley station at the 2015 Indigenous fire workshop

Source: field records 2015 image credit Michelle Hines LLS NSW

These areas require careful management with fire as they contain species that are fire sensitive and can be damaged by fire that is too hot. These areas are naturally cool due to the elevation and the trees are very large with healthy canopy cover. The plateaus are deeply incised and contain numerous dissected catchments that ensure adequate moisture.

Hot fires further weather and erode soft rock and remove nutrients in sandy soils and impede drainage by impacting the ability of soil to absorb water. Springs are also considered highly culturally significant and are often story places. They are to be protected from hot fire which increases sedimentation. Rock art areas should be burnt away from to be protected. These areas contain top soil comprised predominantly of sand with little clay content. Sandy soils with higher clay content are found deeper in the soil profile. The sandy soil holds the heat from fire so it is desirable that the fire moves relatively quickly through the system with low flame height, and recent rainfall is present so soil moisture is high prior to fires being implemented and is likely to occur in areas following to aid in recovery.

Values

These areas are culturally significant as they contain many important medicine, craft, weaponry and food resources including fruits, seeds, yams, dyes, roots, tubers, glues, resins to name a few. Sandstone areas contain significant rock art galleries that document the history of the landscape, flora and fauna and the spiritual practices, beliefs and experiences of Indigenous ancestors throughout time. Emu and other significant totem species forage, shelter and nest in sandridge areas. Species of significance include gliders, quolls, rodents, wallaroos and rock wallabies, micro-bats and flying foxes, diverse spiders and insect species, reptiles such as Knob tailed Geckoes, Nephurus asper; Northern Death Adder, Red belly black snakes, taipan snakes to name a few. Some plant species are restricted to areas within sandstone rock formations in Cape York Peninsula such as *E. phoenicea* see plate 9.11 to 9.13 and *Homoranthus tropicus* see plate 9.14 and 9.15 which is a near threatened shrub (NCA QLD 1992). These species occur outside of the research project study AOI, other trees and plants are more widespread across Sandstone and sandridge country such as *E. tetradonta, Calytrix exstipulata* see Plate 9.16 or Turkey bush and *Grewia Retusifolia* Turkey Fruit or commonly known as Dogs Balls, see Plate 9.17.

Plate 9.11 E. Phonecia seed capsules in hand of traditional owner

Source: field records 2011

Plate 9.12 *E. Phonecia* bark

Source: www.anbg.gov.au last accessed 2017

Plate 9.13 ***E. Phonecia*** **flowers**

Source: www.anbg.gov.au last accessed 2017

Plate 9.14 Habit of ***Homoranthus tropicus***

Source: www.northqueenslandplants.com last accessed 2017

Plate 9.15 flowers of Homoranthus tropicus

Source: www.northqueenslandplants.com last accessed 2017

Plate 9.16 Calytrix exstipulata

Source: Field records 2015

Plate 9.17 Grewia Retusifolia Fruit

Source: image credit John Elliot

https://www.flickr.com/photos/john_elliott_townsville/7654854418

This sandridge country is culturally significant as *Nye reeal* Emu make their nest here, see plate 9.18 and forage for important food resources, fires that are too hot at the wrong time of year can destroy their nests and the abundance of available fruit. This vegetation community also provides habitat to arboreal mammals, small mammals, reptiles and bird species. This vegetation community provides special medicines, food resources, fruits and yams. Sugarbag like to nest in Messmate country near water and are affected by fires that are too hot.

Plate 9.18 Emu *Nye reel* on Artemis station

Source: field records July 2005

The tall messmate was cut and traditionally used for canoe making in western Cape York and is naturally hollowed by termites providing good habitat for turtles when placed in lagoons by people, acting as natural traps. *"Ku Aldkalemba was widely used by the Kuku Thaypan people and is an important tree. The tree has food and food preparation uses and is also has laws that apply to the usage. The tree was spiritually used by the clan and had craft uses that were vital to the survival of seasons. The tree also provided luxuries to the people as well"* (Awu Laya database 2003). A craft use was explained by Elder Dr George Musgrave to Steffensen in 2003, *"You know what they gonna make this one out of, they, they make em. I show you now we make it ya, build a house with it. Old People have a look, you know how he look, see in there. That mean to take the bark off now ready to make a house, humpy. You see hard, you cannot get him. You only get certain time after wet, out of this. Make a humpy, and you can* *make canoe out of him and you see old bush tucker man, he make out of this tree, he cannot get any other tree. Get this one Messmate, I call em Ku Aldkalemba. Make it for Karoll, for Karoll make like a dish, make Karoll. Out of this."*

Bloodwood trees were utilised for sap and cut with a stone tommy hawk to gain the useful sticky substance. Elder George Musgrave Snr recorded by Victor Steffensen in 2003 explains, *"This thing here (sap), he come out little bit, you know with big lump. And jelly, you see red stuff coming out. The gum what they call a gum, red gum. Coming out of the tree, because the tree very hot, and froth coming out and turn into red, make it out of gum tree, gum out of that tree, from Bloodwood tree. And you can see the red one. But what old people use em, if you no gum they use that thing, mix em up the grass tree gum, mix em up. Turn it hard. You can tie the spear, or you can plug the, ah the, Mess Mate Bark (Stringy Bark bowl) anything leak like that, you can put that plug that on. Shut the hole up."*

Threats

These areas often experience hot fires late in the season from October to December burning by wildfire or are burnt via aerial incendiary early in the season often resulting in fires that are high in intensity, affecting vegetation composition and structure and increasing the sparseness of the understorey and destroying important food, craft and medicinal resources. These types of fires can destroy the canopy and shrub layer, increasing coppicing at ground layer, increasing temperatures to the soil and impact the seed bank. Turning country *"upside down"* (Steffensen, 2016b). This in turn affects how fires can and should be implemented to restore the system to its functions prior to experiencing fires that are too hot. Rock art faces a number of threats including damage from wildfires (Sefton, 2011; Tratebas, Cerveny, & Dorn, 2004). See Plate 9.19 for rock art in Balangawarra Sandstone country that has been damaged by fire. The Elders' knowledge ensures these areas are protected by burning away from them earlier in the season. The trees in this country contain bark that naturally protect themselves from fire. For example, although the outer bark of *E. Phoenicia* is able to be stripped, although sharp if rubbed the wrong way and the bark is flammable but when it is on the tree it is formed with grooves that lightly funnel the fire and protect the inner bark and heartwood by combusting slowly, however once alight from hot fires it smoulders for a long period of time. When this trees timber is burning it smoulders to a fine ash, rather than coals like Messmate.

Plate 9.19 Rock art image of macropod damaged by fire and water on Balanggawarra country

Source: Field data 2011 taken with permission

On the Bauxite Plateau in Weipa threats to E.tetradonta on sandy soil derived from bauxite include Bauxite mining, which is strip mined and processed into aluminum. Leblanc et al. (2015) highlighted "*the existence of a flow pathway from the bauxite land surface to the sandy aquifer that feed the springs through discontinuities in the ferricrete layer*" p.1. As such when this land surface layer of bauxite is removed, restoration of the system is impossible with filtration impacted in perpetuity.

These country types contain considerable food, medicine and craft resources that are both promoted and destroyed by fire. The careful use of the right fire for this country is important to ensure the availability of these resources across space and time. Plate 9.20 shows the impacts to the understorey in a Messmate community that has experienced a wildfire in the recent years. Notice the fire scorch marks have been rubbed from the bark slightly and there is a thickening of *Acacia sp* and a reduction of grass in response to this wildfire event.

Plate 9.20 showing signs of fires that have been too hot in Messmate community note fire scorch heights and thickening of *Acacia spp.* in understorey

Source: field records 2014

Timing

These areas should be burnt very cool with a floating light white smoke. It is naturally cool in this country as the trees are very large and the woodland is relatively closed with a healthy canopy cover that provides shade. They are burnt later in the year in July when knock-em-down rain provides adequate soil moisture but are targeted by western management for early burning as they are perceived to dry out earlier as they are higher in the landscape. When these vegetation communities experience hot fire for long periods they often have a sparse understorey with recovering shrub species. Fires should be implemented when there is sufficient soil moisture during the knock-em- down rain when Bloodwood species begin flowering. These vegetation communities are ready later than boxwood and gum but before tea-tree, in late July early August depending on the mix of tree species present, the geographical location and the season.

Weather

These areas should be burnt when the weather is cool and as the afternoon heat is waning. Late June, July through to August is generally when this system is ready to burn depending on the level of recent winter rain, its condition and location in the landscape. If the area is still receiving winter rains than the sun is needed from the middle of the day and a good wind, burning against the wind to keep the fire cool. If affected by fire there will be little grass to carry a fire and these areas may need to be burnt with the wind rather than against the wind, so that the fire will travel quicker through the existing shrub and grass layer, so as not to increase shrub and understory trees coppicing. This however should still be under cool conditions as the midday heat is waning but the wind is still present. It is burnt in the cooler parts of the day towards the afternoon when the nights are still cool but the winter equinox has passed. These areas are naturally moist as when these systems are healthy, they have a healthy canopy cover. They are also higher in the landscape thereby also receiving moisture from cloud. These areas have naturally sandy soils with low clay content and low moisture holding capacity. Lower down in the soil profile higher clay content soils are present. Rainfall seeps through soils and feeds into aquifers and rivers, filtering through the sandstone derived soils and bauxite.

2. ***Mixed-tree country*** *- Ku argnamagal* Bloodwood, *Ku morteal* Cooktown Ironwood, *Ku andeal* Bushmans clothes peg, mixed trees on higher elevation light sandy soils

Mixed Tree country contains parent trees of *Ku argnamageel* Bloodwood *Corymbia sp*., *Ku morteal Erythrophleum chloroystachys* Cooktown ironwood, with a mid-storey of *Ku chuada (Njora)* Cocky apple *Planchonia careya, Ku andeal Grevillia glauca* Bushmans clothes pegs and cabbage palm and it is found on slightly elevated light sandy soil. It has a diverse understory of *brachychiton* and yams. *Aristida sp*. Three awned spear grass and *Eriachne sp* dominate the grass layer when it is burnt too hot and *Alloteropsis semialata (*cockatoo grass), *Heteropogon triticeus* (giant speargrass) are present but decrease when fires are too hot. See Plate 9.20 and 9.21 TCFK management burns being implemented in Mixed tree country in 2005 and 2017 at Gno Coom.

Plate 9.20. Dr Old Man Musgrave Snr. monitoring his country during a protection burn being implement in mixed tree country at Gno Coom (Saxby Lagoon)

Source: field records 2005

Plate 9.21 Old man Musgrave Junior implementing and monitoring a burn on his country during a protection burn in mixed tree country at Gno Coom in 2017.

Source: field records 2017

Management

This vegetation community surrounding *Gno Coom* was often burnt at a slightly different time of year than it would normally be ready, to protect the outstation shed and to act as a break between boxwood fires and Artemis station. This system generally would be burnt later in the year being one of the last systems to burn in the Elders' TCFK. See Plate 9.22

Plate 9.22 Camp protection burn in mixed tree country at Gno Coom in 2017

Source: field records 2017

Values

The country contains bloodwoods *corymbia sp*, *brachychiton*, yams, messmate, and cooktown ironwood, *grevillia glauca* and cabbage palm. All of which have uses in in arts, crafts, weaponry, food, hunting and ceremony. The understory grass species include *Eriachne sp*., Aristida sp, and *Alloteropsis semialata* cockatoo grass or sugarbag grass. It once contained common brushtail possum species, quolls, macropods and native honey bees.

Threats

This country is easily invaded by weeds such as *Sida sp*, *Hyptis*, Wynn Cassia *Chamaecrista rotundifolia* and if burnt at the wrong time the grasses become sparser, increasing weed presence. When these woody weeds dominate it changes the way fire behave. If hot fires travel through this country it destroys vital nesting and food resources for fauna and subsequently people. See Plate 9.23 for example of a fire that is too hot in a mixed tree community not implemented by the Elders' KTFMRP but occurring in the research project AOI and Kuku Thaypan country.

Plate 9.23 An example of a burn that is too hot burn in a mixed tree community – note fire scar height

Source: field records 2007

Timing

This vegetation community is burnt later in the season, it is one of the last systems to burn. "In the winter seasons, mixed tree is one of the late winter burns, among the last before spring in September."

Weather

This community generally has a healthy grassy understory and smaller tree layer. Fires should be lit when the morning dew has lifted and begin to target grasses as they are begin curing throughout the season. Light rain will come from burning this community and winter dew provides moisture to ensure that fires go out over-night in areas where the fire travels due to curing and age of understory grasses.

Gno Coom (Saxvy Lagoon)

This vegetation community is representative of the vegetation surrounding Gno Coom or Saxby Lagoon, see Plate 9.24. Gno Coom is a significant cultural site on Kuku Thaypan country. It is a story place, and the language name translates to Big Water. The water here is permanent. It has very high spiritual value and is a cultural use area. It is a good fishing and hunting ground, and represents half of the area where fishing is permissible from the bank by Traditional law across Kuku Thaypan country. Law applies to who can fish, and who in relation to others, what type and size fish can be taken and where fish can be eaten and where and how carcass can be disposed apply to this and other water places. This lagoon is important as it once contained high faunal numbers as outlined in the monitoring indicators recorded with the Elders below for *Gno Coom.* There is high evidence of people utilising this country through cultural practice. There are scar trees, sugar bag scars and nests and grinding stones adjacent to the lagoon. This lagoon is facing high impacts as it was once a naturally deep lagoon. It has high cattle impacts, high pig impacts, high unsolicited fishing. It has increased siltation – impacting water depth and clarity. The aspiration of the Elders was to fence the boundary to decrease pressures from cattle and re-implement appropriate fire regime to protect water quality and aid in floral and faunal recovery. The Elders wanted to upgrade the area to an outstation management facility to enable greater management capacity across entire Morehead *Kating* River complex and re-introduce traditional cultural management.

The Elders recorded the following indicators that would highlight an improvement in the condition of *Gno Coom* for monitoring the return of healthy country as follows:

1. Visitation, appropriate use and management by younger clan members engagement and participation in their Elders' management aspirations.
2. Size increase in Barramundi present due to decrease in fishing impacts
3. Return of mussel numbers and size
4. Removal of crocodiles
5. Control of cattle and pig access to reduce mud and return of sand over time, less trampling and muddying of edge of lagoon
6. Water quality improved clearer and more drinkable
7. More confidence in safe swimming
8. Water level higher during the dry and halt in bank erosion level
9. Grinding stones clean and free from siltation
10. Balance in number of claw-fish present more in overflow areas due to natural siltation levels
11. Lagoon depth maintained – no increase in visible erosion of bank
12. Increase in grass cover due to re-implementation of appropriate fire regime and decrease in weeds
13. Evidence of fish carcass waster decreases and evidence of unsolicited camping (toileting near waterway) and fishing decreases
14. Increase in number and diversity of bird species, including an increase in flocks of Magpie Geese during migration and throughout the year
15. Presence of and an increase in sugar bag (native honeybees trigonia sp.)

16. Increase in number of Agile wallaby

17. Decrease in presence and sign of cattle and pigs

18. Presence of Eels

19. Reduction in presence of heavy mist at inappropriate times of year

Plate 9.24 ***Gno Coom*** **Saxby Lagoon on sunset**

Source: Field Records June 2018

4. ***Debil Debil country on Stoney soil***

Debil Debil country is like mixed tree country but has a lower canopy and is thicker country with harder lumpy soil. It has impeded drainage and contains fire sensitive species, it is also burnt later in the season, grass recovers poorly in this country if it is burnt the wrong way. Devil country is sandy country but has a very lumpy floor. *"Not very common this country, which is why there isn't much of it"* Steffensen (2017*)."* This country contains a mixture of trees *Ku andeal* Bushmans clothes peg *Grevillea glauca*, Kurrajong *Brachychiton sp.*, Cocky Apple *Planchonia careya*, *Corymbia sp*., Kugarl (gum) Eucalypt sp., Acacia sp. Fine leaf paperbark *Melaleuca sp*. Ku arnagel Mixed Bloodwood Corymbia sp., Ku morteal Erythrophleum chloroystachys Cooktown ironwood. See Plate 9.25 – 9.27.

Plates 9.25 – 9.27 *Ku Anarmagetta/ku arramagel* Mixed Bloodwood *Corymbia sp*., *Ku Morteall Erythrophleum chloroystachys* Cooktown ironwood, *Ku Andea,l Grevillia glauca* Bushmans clothes peg with *Kugarl* Gum *Eucalyptus sp*. found in Devil Devil country

Management

This country recovers very slowly from fire and if burnt too hot will not recover a grassy understorey for a long time.

Values

Debil Debil country contains medicinal and spiritual plants.

Threats

Because this country has harder ground if it is burnt at the wrong time it takes a long time to recover.

Timing

"This country can trick you with timing because it has bloodwoods in it so you think ah its bloodwood country but it isn't it is much stonier and shorter than bloodwood country" Steffensen (2017) Field data.

Weather

This country burns later than other systems, when they have recovered and the surrounding country is green. There should have been recent rainfall before lighting.

4. *Boxwood Country - Ku ronga* on floodplains and river terraces light brown soil

Riverine floodplains and terraces with grassy understorey and parent trees of *Ku ronga* Molloy Red box *E. leptophleba* +/- *C.clarksoniana.* See Plate 9.28 of Dr George assessing a traditional cultural burn implemented by his KTFMRP in Boxwood country.

Plate 9.28 *Ku ronga* Molloy red box (*Eucalyptus leptophleba*) woodland grow in areas on the floodplains of the Hann and Morehead rivers and are representative of Boxwood Sites 1-4. Dr Tommy George monitoring a *Kuronga* boxwood burn. Grassy understory consists of *Eriachne sp.* and when managed well with fire sees a return of *Themeda augens.*

Source: field records 2007

Management

Boxwood Flats are a significant ecosystem in Awu Laya Country. Boxwood trees are called Kuronga*.* in language. Boxwood flats are open eucalypt woodland dominated by *Eucalyptus leptophleba* having a grassy understorey of mostly perennial tussock species. The understorey has a diverse array of grasses, notably *Themeda sp.* (when in a healthy condition) and *Eriachne stipacea* on open plains. All grasses present have different curing times. Mosaic burning throughout this ecosystem aims to maintain this diversity. Kuku Thaypan burning law prescribed that these expansive areas are burnt very early in the year between April and May but may be as late as July, depending on seasonality and ecosystem condition.

Burning at these times protects surrounding ecosystems from late season wildfire by preventing this system from acting as a large potential ignition source. The grass in this system is still mostly green early in the dry season, this ensures that the fire will travel slow and cool. Green grass makes a loud crackling/ popping sound when burning. Fires within this system at this time will burn out when they encounter areas with impeded drainage or topography as a result of increased moisture and also overnight as the mornings are cool and still have a dew. Burning these systems early ensures that the opportunity for large intense fires later in the season are minimised. Such late season fires will travel hot, fast and higher into the canopy, destroying nesting hollows, flowers, seeds, fruits and pods. Burning of the bark and canopy increases greenhouse gases and carbon emissions. Bark and canopy burning increases risk of spread of fire to surrounding ecosystems. As noted previously, culturally it is against the law to burn the canopy; certain people only burnt it at very special times for special reasons. Burning the canopy causes leaf drop and respiration capacity is reduced. Vital food resources and habitat are also destroyed. It is important to be able to burn this country by hand as country within country (dry areas) can be targeted to maintain diversity and results in heterogeneity of grassy understories, important for granivorous bird species.

This type of tending ensures adequate habitat is maintained for ground and tree dwelling small to medium weight range mammals. Aerial incendiary burning does not allow for the reading of country and even burns implemented this way early in the year can cause destructive results, similar to those resulting from wildfire later in the season. Boxwood country burns are implemented before breeding seasons of possums and also before the flowering time of the boxwood. This is more reason to get the burning regime right, as wrong burning will interfere with the life cycles that depend on the boxwood communities.

The implemented TCFK of the Elders results in a diversity of age class fires with differences in frequency even within one system. The intervals between fires varied depending on the health of the system. Timing not just seasonality, but including time of day and time since last burn, time of species curing are all very important considerations in creating the “right fire” for each ecosystem type. Sometimes this means progressive burning within one habitat type across space and time. For example, in Boxwood *Kuwronga* communities grass species are targeted at different times depending on curing. Some species cure earlier than others. These species are targeted for early burns and the heat that is generated from these fires helps to cure adjoining species. A follow-up fire is then implemented in the same general area to create a mosaic of fire with differing age classes and burning conditions. I have also seen this system then burnt later from the outside back in on itself and extinguishing. These fires in quick succession are not implemented in all years. This approach is taken when country is “unwell” but once the composition of the ground cover has stabilised longer fire intervals can occur. The resulting mix of species has potential for supporting a greater diversity of fauna. Fire treatment varies depending on the type of ecosystem and where it occurs in the landscape. For example, the same broad vegetation type may be burnt differently depending whether it is on a river flat or flood plain, the soil, the mix of species present, the current health of the ecosystem, the time of year, the purpose of burning, climactic variables and the time of day.

Values

These areas are important hunting and hence feeding areas for large marsupials, areas burnt traditionally to attract game such as *Nyeh rabi* male and *Nyeh myra* female agile wallabies and *Nyeh kombalon* grey and red kangaroo *Nyeh lardenbie*. See Plate 9.29 of a female agile wallaby *Nyeh myra* enjoying grass regrowth resulting from an early season burn. Boxwood communities provide habitat to a range of fauna. *Kuwronga* Boxwood produce nesting hollows for a range of animals such as the common brush tail possum, reptiles and various bird species. It is important to protect developing boxwood flowers through cool burns in the early dry season as they are an important food resource for possums, numerous insects, insectivorous and

insectivorous bat and bird species. This timber burns hot and makes good coals for fire and cooking. Boxwood tree flowering is an important indicator for timing of burns for other vegetation systems. The smoked seed on the ground of the understory perennial species provides a valuable food resource for foraging bird and insects. Plate 9.30 shows Black Cockatoos coming in to land on a recently burnt site. Low intensity burns protect grasshoppers, stick insect and mantis species important for soil nutrient cycling through their

predation of grass species in savanna systems. The majority are able to fly off the grass canopy before burning. Those unfortunate enough to be too slow provide a food resource for brolgas, those flying off are also a feast opportunity for birds of prey. See Plate 9.31 of Brolgas foraging on a recent burn. Boxwood communities are also recognised as some of the most productive country for cattle during the dry season. Today they suffer from impacts resulting from over stocking such as weed infestation and reduction of native grass diversity and cover.

Plate 9.29 A female agile wallaby *Nyeh myra* enjoying grass regrowth resulting from an early season burn

Source: Field data 2007

Plate 9.30 Black cockatoos landing on recently burnt site 17/09/2008

Source: Field data 2008 Image credit Victor Steffensen

Plate 9.31 06/06/2007 Brolga foraging after a recent burn. A variety of burn times and mosaics are important for this species

Source: Field data June 2007

Threats

These systems historically had a healthy, thick, tussock grass understorey interspaced with forbs, flowers, legumes and orchids that have been threatened in recent years through cattle pressure and high intensity wildfires late in the dry and early storm seasons. Today when they are burnt early in the dry season, they are subject to intensive grazing pressure from cattle if areas are not able to be protected from stock. Although a significant proportion of Boxwood flats in Kuku Thaypan country are within *Rinyirru* (Lakefield) National park they have historically been subject to grazing pressure since the early 1900's. After significant efforts of the Elders in 2008 a western boundary fence was established. However, the misalignment of parts of this fence-line and the remoteness of that part of Kuku Thaypan country means that grazing pressure is still an issue for Boxwood management. Traditional fire regimes or water management cannot be effective and provide full benefits to the natural resources if cattle are roaming free to devour the regrowth and destroy fauna habitat, leaving areas of bare ground for longer periods prior to the onset of the wet season.

Timing

This system is ready for burning after the knock-em-down or first early dry season (winter) rain. This rain knocks down mature grass seeds at this time allowing predation by insects and birds and for germination in the soil fed by early season dews. Burns implemented shortly after, assist processes through the creation of nutrients for annual and perennial seeds. Removal of old grass enables perennial grasses to produce new growth, high in nutrients for wallabies and other predators such as cattle. Timing is dependent on constant reading of the land and weather patterns. For Boxwood, timing is when the grass is ready, then right time of day, considering fuel load and feral weed situation of the ecosystem, a healthy Boxwood system is burnt during the day from mid-morning to when the winds pick up, to the late afternoon. If Boxwood timing is missed slightly due to limitations of access then timing is adjusted to later in the day to ensure a cooler burn. *"Normally ready to burn in the afternoon at this time of year - less heat to make more grass"* Steffensen communicating with Dale Musgrave (8/01/2007) when implementing fire earlier in the day in a Boxwood community. See Plate 9.32 of a cool burn in the afternoon in an open boxwood community. As there is slight variability between the same systems some may be readier than others within a window of a few weeks. You know it is the right time when the fire is travelling slowly through the landscape burning against the wind, low under the canopy and you can *"hear the grass crackle"* Steffensen (8/01/07), *"it sounds like a massive bag of popcorn"* Ash Standley (2017).

Weather

This system is ready for burning after the knock-em-down or first early dry season (winter) rain *Nyooilten.* There are often a lot of rainbows around this time of year. This seasonal change is just one indicator for beginning of the burn season and timing for this system. The Bloodwood *Ku argnamageel* flower *ku enyarl* also signals that the Boxwood system is ready for burning. The light grey smoke created through a cool burn in this system early in the dry season has an important association with influencing rainfall patterns at this time of year. At this time of year there is also heavy dew important to ensure that fires will go out overnight and there is sufficient moisture for germination of grass seeds and perennial regrowth through heavy dew and light rain generated through smoke from fires at this time. Fires early in the dry season will make the sunset a light pink colour, see plate 9.33. The system cannot burn without wind, due to green grass and cool temperatures. At the early time of the year that Boxwood burns, the wind starts to blow at around mid---morning and is quite gusty. The system should not burn under TCFK without this wind.

Plate 9.32 A cool burn in an open boxwood community

Source: Field records 2007

Plate 9.33 A pink sunset from smoke in the atmosphere

Source: Field records 2007

5. *Kwern* Grasslands open plains

Eriachne sp. Aristida sp. Themeda augens. low closed tussock grasslands with a very sparse open canopy of Ku garl, E. tessellaris and M.viridiflora present. See Plate 9.34 and 9.35.

Plate 9.34. These open grassy plains are found along the Morehead River at Rocky lagoon and Rocky crossing.

Source: Field records 2017

Plate 9.35 light white smoke floating over an open grass plain

Field records 2017

Management

Fire in these systems moves quickly and can have a high flame height due to the density of the grassy layer. Fires are implemented generally later in the afternoon as the heat of the day is dropping. Single ignition points are implemented within the system against the adjoining vegetation communities that are still green, or have been burnt earlier in the season and then around the system so that it burns back in on itself extinguishing the fire and preventing it from travelling into adjacent wooded systems. If these areas are burnt too hot then the native *Themeda augens* begins to decrease and its growth becomes stunted causing *Eriachne sp.* to dominate, see Plate 9.36.

Plate 9.36 Eriachne species common on degraded open grassy plains

Source: field records 2007

Values

Open grassy plains are important for hunting, maintaining grass resources as food and habitat for a myriad of vertebrate and invertebrate species, importantly macropods, small mammals, birds, and reptiles. These areas contain a large number of invertebrate species, providing significant food resources. Grassy savannah systems provide food for termites, that are the dominant biomass and decomposer of savanna systems. Grasshoppers and other invertebrate species provide important food resources to birds of prey and small carnivorous marsupials. During a fire event, birds of prey flock to these areas to feast on the insects flying from the grass to escape the fire. A myriad of species of birds of prey can be witnesses flying on all trophic levels. These areas often contain large termite mounds, both magnetic and rounded made by two different species of termite that consume large quantities of grass. These are unique features of these ecosystems and provide a distinctive ecosystem service in Australian savannas, in the absence of large grazing herbivores found in other savanna systems across the World (Queensland Museum 2011). Termite mounds also hold spiritual significance and there is a story place towards Glengarland station where the mounds are found in abundance and are extremely tall. They were also used to hold navigational markers such as the one that points to Red Kangaroo Man and Wallaby woman story on Musgrave station.

Threats

These areas are subject to over-grazing and high fire frequency and intensity. In western fire management where cattle are also being grazed, they are not burnt until much later in the year, if at all as they are a source of food for cattle. If they are burned it is often with a storm burn late in the year, to reduce tree thickening and fuel load and produce green pick as the rains increase. More recently they are being burned earlier in the year as part of overall savanna burning project implementation as this prevents these systems acting as wicks for wildfire travelling later in the year. In the Elders' TCFK if these areas are burnt too hot when there is insufficient moisture for grass recovery then this will increase woody thickening as it reduces the capacity for the grasses to outcompete suckers and recruiting woody species.

Timing

In the Elders' TCFK system these areas are burnt around July, a significant degree of curing is required prior to fires being implemented, however they should not be completely cured. The time of day that the fire is implemented, maybe adjusted if these areas are not burnt in this condition and a night burn maybe used to cool the fire down and reduce the rate of spread and intensity. The cooler nights of winter provide significant dew and moisture to regeneration of grass species.

Weather

These areas are seasonally inundated for long period during the wet season and so retain significant soil moisture following the monsoon rains, however they can dry out very quickly once the SE winds begin to increase. If these areas are burnt when it is still slightly green then a fire will be lit a little earlier in the day to increase the speed and intensity at which the fire travels ensuring that the majority of cured, old and stagnant grass is removed. Fires are still patchy however, ensuring that there are still food and habitat opportunities available for species to recruit to during habitat recovery from fire.

6. **Lagoons and Swamps** (Water element)

Neldner and Clarkson (1995) mapped over 100 permanent riverine lagoons in the area. Ecological features of the vegetation of some of these lagoons include: *Ku argnamagal* Grey bloodwood (*Corymbia clarksoniana*) and/or *Ku garl* Moreton Bay ash (*C. tessellaris*) woodland is common around some of the wetlands and is representative of areas around *Ndolgin*/*Ndolnggan* (Pelican Lake) reference site, see Plate x.x *Ndolgin* (Pelican Lake) reference site, image taken from the West looking towards the Eastern side showing the first burn implemented by Elder Dr George Musgrave in May 2005 and x.x. *Ndolgin* (Pelican Lake) image taken from the East side where burns were implemented in June 2017 looking West.

In perennial swamps northern tea-tree (Melaleuca leucadendra) may dominate and swamp tea-tree (Melaleuca dealbata) and Freshwater Mangrove (Barringtonia actangulata) may be common, as is the case for areas of Ndolgin (Pelican) Lake, see Plate 5. Aquatic species such as ferny azolla (Azolla pinnata), Nelumbo nucifera, water lilies Nymphaea sp., Eleocharis sp. and Oryza spp. also occur. These wetlands may be occupied by floating plants such as Nymphoides spp. and Monochoria spp., bottom rooted species such as Ludwigia perennis and water lilies Nymphaea spp., emergent grasses (e.g. Oryza rufipogon) and sedges (e.g. Bulkurru, Eleocharis spp.) are also common. On the lake edges there are narrow bands of Eucalypt sp. along with northern tea-tree and/or swamp tea-tree (Melaleuca dealbata) woodland" (Neldner & Clarkson, 1995), see Plate 9.37 – 9.39 below.

Plate 9.37 Ndolgin (Pelican Lake) image taken from the East side looking West.

Source: Field records June 2017

Plate 9.38 Ndolgin Pelican Lake showing transition of aquatic species from edge

Source: field records 2005

Plate 9.39 Paperbark swamp on the North Western edge of Ndolgin

Source: Field records 2017

As early as 2002, the Elders via their TKRP traditional knowledge recording project communicated management aspirations for these significant cultural sites to which *"there are strict laws and customs"* Steffensen (2002/12/00) QPWS Presentation 1: field data). Each Lagoon has different lore stories and management laws that relate to them and their connectivity to each other. The Lore stories and their management aspirations were recorded by the Elders' TKRP and built on later through recording of their cultural water quality indicators that were documented through the Elders and compiled by this research dissertation. Each of the Lagoon systems in the study site are different and have different vegetation communities. For example, *Gno Coom* (Saxby Lagoon) is surrounded by Mixed Tree and Bloodwood communities while *Ndolgin* features Gum tree, Mixed tree and tea-tree communities. Rocky crossing has an anabranch and wetland complex that is surrounded by open tea-tree grassy plains with edges of boxwood community as illustrated in plate 9.40.

Plate 9.40 Rocky crossing wetland complex

Source: field records 2005

7. Ku awgarl Gum tree country

Ku garl E. teriticornis and *E. tesselaris* around lagoon systems, riverine woodland and open eucalypt grassy woodlands on plains. Water settles in these systems from the wet season and they have hard brown dark soil. Different types of gum tree communities are recognised in the Elders' traditional ecological fire knowledge, they are grouped according to where this system occurs in the landscape, for example on open plains, surrounding lagoons or on river banks. Plates 9.41 to 9.44 below show *Ku garl* Gum tree country on different land forms below.

Plate 9.41. *Ku garl E. tesselaris* eucalypt grassy woodlands on open plains

Source: field records 2007

Plate 9.42. Ku garl E. tesselaris eucalypt grassy woodlands on open plains

Source: field records 2007

Plate 9.43 Ku garl Gum tree on riparian areas

Source: field records 2007

Plate 9.44. *Ku garl* around lagoon systems. TKRP Director Steffensen teaching younger Kuku Thaypan clan members about Lagoon burning at Horseshoe Lagoon

Source: Field records 2007

Management

Gum tree country is burnt later than tea tree and mixed tree. If these areas have not been burnt for a number of years the fire that is required is hotter than it would normally be in managing these systems with fire. The darker the soil the greater the heat holding capacity, these soils have the tendency to stay hotter for a longer time, as they are seasonally inundated, they also contain more organic matter that can smoulder for longer than other soils. Where gum is present on darker soils it is burnt earlier.

Values

These systems on open plains provide food and shade for macropods and good habitat and cover for macropods small mammals, frogs, and reptiles. Riparian systems provide fresh water, shade and food resources and burning is conducted to ensure that these areas are kept open for access and water quality is protected.

Threats

Along riparian areas these communities can become infested with woody weeds. In areas that have not been burnt for a number of years, grass can grow high half way up the trees and loose fertility. This also increases the intensity of fires when long unburnt areas do experience a fire. Plate 9.45 shows a Gum community that has experienced a fire that is too hot. This community will take at least four years to recover, see Plate 7.42 in discussion of the importance of the canopy in Chapter 7 as this is the same community still recovering from this wildfire event two years later.

Plate 9.45 Gum tree community and bloodwood community showing a fire that is too hot

Source: field records 2014

Timing

This system is ready for burning when the *Ku akalmba* Messmate is flowering. By this time of the year the gum tree communities have flowered and produced fruit. Gum tree community is one of the first systems to burn, the darker the soil the earlier the burn, lighter soils are burnt later.

Weather

The last of the light squally showers and the SE knock em down rain is an indicator for this system, when *Eriachne sp* is setting seed and bark has shed.

Within the lagoon/water-based systems that contain significant *Ku garl* systems, *Ndolgin* Pelican Lake has a special focus. *Ndogin* or Pelican Lake is a permanent lagoon with high spiritual values – story place adjacent to Dog Story Dreaming – the tail of the story is here. It is a traditional hunting ground. A traditional prohibition on access applies to part of the area and fishing in a certain part of the Lake is also prohibited. In other areas fishing and eating of fish is not subject to restrictions. There is a Bora Ground located in the vicinity of *Ndolgin*. This lagoon is facing high impacts from feral cattle and pigs that have resulted in increased siltation impacting the current water depth. It is naturally of medium depth and is a very large lagoon. There are high levels of unsolicited fishing.

The Elders recorded the following indicators that would highlight an improvement in its condition for monitoring the return of healthy country as follows:

1. Visitation, appropriate use and management by younger clan members engagement and participation in their Elders' TKRP

2. No physical signs of camping

3. No signs of unsolicited fishing with boat (tire tracks/dragging etc)

4. Lilly's present with no visible signs of predation by cattle/disturbance from pigs

5. Water quality improved clearer and more drinkable

6. Control of cattle and pig access to reduce mud and return of sand over time –less trampling and muddying of edge of lagoon

7. No visible change to depth of lagoon during dry season climactic variability considered

9. Increase/no loss in number and diversity of bird species present

9. Increase/return of magpie geese and pelican numbers and increase in health (weight, feathers clean)

10. Return of mussel numbers and increase in size

11. Increase in grass cover due to re-implementation of appropriate fire regime –decrease in weeds

12. Return of eels

13. Reduction in numbers of cattle and pigs present and presence through sign

As a result of the Elders' fire research project *Ngolgin* Pelican Lake and Rocky crossing lagoons were burnt in the early dry season April – November progressively over a number of years from 2005 to 2018. *Gno Coom* has slightly different timing due to the vegetation surrounding it and the establishment of the small shed and later a toilet block. *Ndolgin* and *Gno Coom* both experienced other fires during the last ten years, that sometimes followed on the Elders' burns weeks after they left and others occurred much later in the hotter part of the year. When the Elders first burned it in 2005 at *Ndolgin* it had high fuel loads with grass heights well above 1 metre and large areas under the Eucalypt canopy were very overgrown and difficult to walk/drive through. Cattle should be kept off these areas with alternative water provided. Impacts from cattle and pigs throughout the year cannot result in the water quality required to maintain biodiversity. On all trips on country feral pigs and cattle were present on lagoon systems.

8. Tea-tree country

Tea-tree country is composed of mixed tall and low open Tea-tree *Melaleuca viridiflora* woodland flats, with open grassy plains, see Plate 9.46.

Plate 9.46 Open Plain within tea tree country

Source: field records 2017

Management

In the Kuku Thaypan fire management knowledge system although it is true for most communities that hot fires are not desired, some vegetation communities were burnt hot to produce a desired outcome but not all of them all of the time, and the surrounding landscape was also managed. For example, areas of Grass Trees *Xanthorrhoea sp.* were sometimes burnt hot to extract resin to work with gum.

Hot fires heat the soil to a level that destroy grass seed but often does not destroy lignotubers by which *Melaleuca viridiflora* (broad leaved tea tree) and other Cape York species such as *E. Phoenicea* grow, thereby increasing the likelihood of thickening. This is because in the Elders' TCFK if the grass species in these systems are targeted at the correct time they will outcompete regenerating tea-tree as cooler fires reduce stress to the tree, which re-sprout from lignotubers as a result of stress such as fire to the crown and trunk. Species such as these have fibrous papery bark that are in dense layers, once alight they smoulder inside, burning slowly holding heat, causing stress and increasing likelihood of re-sprouting from lingo-tubers following hot fires that damage the bark and canopy. These characteristics of *Melaleuca sp.* paperbark are why it provides an effective drip torch and as a wrap for food to keep it clean when cooking in the ground.

Plate 9.47 shows an earlier burn implemented by the research team in 2005 in an open boxwood community adjacent to a *Melaleuca viridflora* woodland. Notice also the difference in scorch mark heights on the last boxwood to the left of the image where this fire has stopped when it reached the still green *M. viridflora* woodland. This *M.viridiflora* woodland is now almost ready for burning. This plate also shows a scorch mark on the *M. viridiflora* in the foreground from a fire the year prior. Plate 9.48 shows the difference in curing in similiar vegetation communities that have a slightly different mix of species and soil moisture. This natural break in the differences in curing act to stop the spread of the fire and increase diversity of timed burns. Plate 9.49 shows a cultural fire implemented in a *M. viridiflora* community on an open plain. The use of elliptical fire patterns and the wind ensures that the fire moves quickly through the system reducing the intensity of the fire to shift the current grass species *Schizachyrium fragile* or fire grass which is a sign when it is the dominant grass species that the community has been burnt too hot in the past.

Plate 9.47 Melaleuca viridiflora woodland. Paperbark tea-tree (*Melaleuca viridiflora*) low open woodland at the edge of a boxwood burn.

Source: field records 2005

Plate 9.48 Paperbark tea-tree (*Melaleuca viridiflora*) low open woodland at the edge of another thicker woodland adjacent that is still not ready to be burnt and acts to stop the fire

Source: field records 2007

Plate 9.49 Paperbark tea-tree (Melaleuca viridiflora) low open woodland on a plain showing how an elliptical fire burns quickly through this community to increase likelihood of return of additional native grasses that should be found in this community

Source: field records 2007

Values

Tea tree country was valued as medicine, as a source of flowers for animals and for survival when required. These open areas were good for hunting. They are also nesting habitat to *Arrmorral* or Golden Shouldered Parrots. These areas are also important hunting grounds for wallaby species.

Threats

Hot fires are recommended by western fire management practice to control tea-tree (*Melaleuca viridiflora*), as this species is implicated in the decline of the fledging's success of Golden Shouldered Parrots *Arrmorral* (*Psephotus chrysopterygius*) by enabling increasing perching opportunities for butcher birds. As a result of the thickening of the tea-tree species, there are perches closer to the ant beds where the parrots nest, and fledgling parrots are preyed upon by the pied butcher birds. As a result of this country has been subject to hot fires late in the dry season. In the Elders' TCFK if burns are implemented in this system prior to the onset of enough soil moisture the grasses will take a long time to recover and be outcompeted by suckers and re-sprouting vegetation.

Plate 9.50 Broad leaf tea tree *Melaleuca viridiflora* on light sandy soil

Source: field data May 2017

Plate 9.50 shows an example of a fire that it too hot in tea tree country. Note the fire scorch heights resulting from a fire from the previous year. Note the recruiting younger tea-tree in the foreground in competition with the native grasses. Plate 9.51 shows the consequences of a fire in tea tree country that was likely from an incendiary burn, nonetheless it was too hot, note the level of dead mid recruiting species and the increase in suckering in the ground layer. Plate 9.52 shows this system the following year. Note the change in structure in just a twelve-month period. The descendants of the Elders implemented a cool fire in this system in 2018, following when this image was taken.

Plate 9.51 A tea tree community with grass trees that has experienced a recent hot fire

Source: Field data 2017

Plate 9.52 Tea Tree Country – change in structure of the system as a result of one hot fire event on Awu Laya country 2018

Source: Field Records 2018

Timing

The fire management recommended by western science to prevent thickening is storm burning. The Elders' fire management knowledge highlights that tea-tree country is "tea-tree country" and it should be burnt later in the year than other systems but it should not be constantly burnt hot and particularly when the surrounding landscape is not broken up from earlier burning in adjacent systems. Burning vegetation communities too hot increases bare ground the following season, as it favours an increase in woody vegetation through regeneration of tree species present through coppicing and re-sprouting re-generation that reduces shade at the canopy layer and increases cover at the ground layer, outcompeting grass recruitment, generating *"upside down country"* Steffensen (2016 Indigenous Fire Workshop, Wujul Wujul Cape York).

Weather

A common fire management practice promoted on Cape York Peninsula at the time was to light fires during the storm season. This was promoted as a way to maintain or restore open country and a conservation action for *Arrmorral* Golden Shouldered Parrots (*Psephotus chrysopterygius*). Prior to this research project and the sharing of the knowledge recorded by Dr George Musgrave, western science considered that storm burns should be implemented 2-3 days after the onset of the first inch or more rain of storm rain (Crowley, 1995; Garnett et al., 2006; Stanton, 1992) and that follow up moisture is important in the role of grass recovery and soil stabilisation (Stanton, 1992). The Elders' TCFK for storm burning is that it should occur on a hot day when there is sufficient depth of soil moisture from earlier storm rain. Without adequate moisture in the soil, fires at this time can spread further than intended and it can take longer for the native grasses to re-establish leaving areas susceptible to soil erosion. The level of moisture that can be taken into the soil rather than generate run-off into aquatic systems in a rainfall event is variable and dependent on a number of factors including;

previous soil moisture, the vegetation determining the amount of interception that occurs, the soil type as different soil types have different infiltration capacity and the intensity of the rainfall event. Higher intensity rainfall events, such as those experienced in early monsoon storms in Kuku Thaypan country, have larger raindrops that can clog the surface of the soil and reduce infiltration resulting in considerable run-off which is also affected by the slope and size of the catchment.

The Elders' Storm burning TCFK considers soil characteristics and moisture as critical indicators for timing of prescribed burns. Storm burning occurred under traditional practices but after it was already ensured that adjoining ecosystems enabled natural breaks to prevent fire spread. Areas within and surrounding the system would be green from earlier burns and the return of grasses from the winter rains and heavy dew. Timing for storm burning was also dependent on the right amount of soil moisture. The onset of the first storm rain is not the indicator for when to light a fire at this time of year. The rainfall needs to be significant enough to ensure adequate soil moisture to a depth of approx 10-15 cm, see Plate 9.53 below.

Plate 9.53 Dr George Musgrave demonstrating the depth that moisture needs to infiltrate from storm rain falls prior to implementing any burns

Source: Field records Steffensen November 2005

This knowledge was recorded on the 29th of November 2005 by Dr George Musgrave on his country. This was his last knowledge recording trip on country. As he is illustrating in the photo it is important to dig down and ensure that soil moisture is at least 10-15cm deep in order to support re-generation prior to lighting a fire to ensure that ground cover recovers quickly prior to the on-set of heavy monsoon rain. This type of storm burning protects the soil and enables nutrients generated from the fires to be readily taken up by regenerating vegetation.

9. Wattle country Lancewood (Acacia torulosa) country

Ku garl Gum *Eucalypt sp, Ku mbae* Red wattle, *Ku toeadoo* Golden Wattle *A. torulosa* Northern Lancewood are present in this system on reddish sandy soils on lower altitude ridges, often rocky or stony, nearby. These areas have sparser grass than other systems. Plate 9.54 is typical of this country type.

Plate 9.54 Wattle country

Source: field records 2005

Management

Lancewood country needs to be managed carefully to retain a balance of recruiting wattle species and grassy understorey.

Values

Wattle or acacia species have many uses in the Elders' TCFK. There are many different types of wattle species and they have different uses. The timing of their flowers also indicates different changes in the environment. The Lancewood and wattle roots provide a good source of fiber for witchetty grubs and a good food source for people. Wattle timber was used to make fighting sticks and other weapons. Red Wattle timber is toxic and if you get a splinter it will get infected really quickly. Wattle also has craft and spiritual uses and is an indicator for timing of when fish, turtle and goanna are fat. Plate x.x shows how the Lancewood base provides nutritious food for witchety grubs and the how to dig for them, see Plate 9.55.

Plate 9.55 shows how the Lancewood base provides nutritious food for witchetty grubs and how to dig for witchetty grubs

Source: field records 2007

Threats

If this country is burnt hot it will lose its grass understorey and thickening of Acacia sp. will occur.

Timing

This system is burnt late in the season and its timing is related to weather as has been demonstrated in the discussion for all country types. If it is burnt without consideration for this important element than the grass gets really sparse and this system is prone to a woody understorey.

Weather

The amount of rainfall influences the timing for this system. It is required that there is an increase in intermittent monsoonal storms before burns are implemented in this system, but not until after a least a foot of rain has fallen otherwise the grass will not recover well.

Conclusion

It is the fire management practices of the Indigenous people of this place that over millennia have shaped and maintained the values that the country holds. For the Indigenous people of Cape York Peninsula who maintain their cultural practice, every square inch is embedded with animism. This is their dreaming, their spirit; Indigenous people are this place and this place is them. Cape York's Traditional custodians are obliged to care for each of the responsibilities assigned to them through their kinship, their languages, their song-lines, their cultures, each inherited through lore, custom and place, each unique; everyone has a role, each a part of the whole.

From the Elders' point of view the best that an amalgam of Western science and TK can offer is a form of receptacle or vessel in which to attempt to hold the true meaning of "country" and to assist the Elders to translate to others what they do not yet "know" in how important the application of this knowledge is to maintaining what environmental scientists and resource managers understand as biodiversity. Moreover, how critically important the application of fire is to the maintenance of culture and country. Without this knowledge held by the old people being transferred and applied, what Elder Dr Musgrave feared may have come to pass, *"When all the old people die, country too will die."* This is because the Elders were concerned that the caretakers of country today, both Indigenous and non-Indigenous have not yet learnt and practiced enough on how to read county and carefully manage it with fire. The Elders' research methodology was their cultural obligation to care for their country and implement their cultural fire knowledge on country, to ensure that this was recorded and importantly passed onto their descendants and others willing to learn. In this way they could ensure that country would be looked after for generations to come. What the Elders taught was how to read country, and this important lesson continues to be taught today 'the knowledge is in the landscape. The Elders have not passed. The land is an Elder too.' Steffensen (2016 and 2018).

As highlighted earlier, the Elders and Steffensen had already begun the journey of recording the Elders' knowledge on country through their Traditional knowledge recording project (TKRP). It is this work that has led to teaching others how to read country elsewhere and sparked Indigenous led community fire projects across Australia. Until 2018, the fire workshops have remained contextual within Cape York and were held on the Elders' country three times. The purpose of moving to different areas and working with different groups was to support them to re-implement their cultural fire practices on country, maintain and revitalise their traditional cultural fire knowledge. Chapter 10 discusses the methodology of the TKRP which was a collaborative exercise in documenting with the Elders their traditional cultural knowledge and guided protocol for the co-generative research of the Elders' Kuku Thaypan Fire Management Research Project and informed the methodology of The Importance of Campfires.

Chapter 10 TKRP Traditional Knowledge Revival Pathways
Introduction

Indigenous research methodologies

The three different ways of knowing described in this research dissertation are: the Traditional Knowledge Revival Pathways (TKRP) project, the Kuku Thaypan Fire Management Research Project (KTFMRP) and the Importance of Campfires project (this dissertation). The TKRP and KTFMRP share a similar ontology and epistemology, and the Importance of Campfires has a different ontology and epistemology. Each share differing but firmly connected methodologies.

This chapter describes the methodology of the TKRP that developed over time through Steffensens' work with the Elders Dr Musgrave and Dr George, and subsequent mentorship with Indigenous communities across Australia and Internationally. This project is relevant because the ontology and epistemology that informed the TKRP, and the subsequent methodology and methods it applied, are the underlying organising rules and principles that enable a successful uniting of Indigenous and western knowledge. The TKRP also serves to develop the empowerment of Indigenous people in contemporary land management. The TKRP as its names suggests consists of multiple pathways for generating diverse ecological, social, and cultural enterprises that support Indigenous people and their partners.

The Traditional Knowledge Revival Pathways on Kuku Thaypan country

The Traditional Knowledge Revival Pathways TKRP grew from the methodology of the Kuku Thaypan Elders' own research on country to practically demonstrate and record their knowledge. The *Kuku Thaypan* Traditional Knowledge Recording project became named in 2001. However, it really began in 1991 when Steffensen began learning from the Elders and assisting them in their cultural management obligations, such as in getting a section of the Peninsula Development Road sealed near Split Rock Indigenous art galleries to protect them from dust. In 2001, Steffensenbegan to be recognised for recording the knowledge of the Elders and together they gained momentum in protection of significant cultural sites on Kuku Thaypan country and, importantly, within the then Lakefield National Park. The results of these efforts can still be seen today within the *Rinyirru* (Lakefield) CYPAL lands at Low Lake interpretation site. This work resulted in a newspaper article in 2003 in *The Australian* describing the Elders' and Victor's work (Plate 10.1). Documenting the Elders' knowledge system was far more extensive than just ethnobotany or cultural site protection, and the Traditional Knowledge Recording Projects that crossed multiple communities in Cape York and Far North Queensland began.

Quagmire: Aboriginal elder Mr Musgrave and Mr Steffenson at Saxby Lagoon

Picture: Graham Crouch

An elder reclaims his damaged land

Amanda Hodge

AS a 10-year-old station hand, George Musgrave led government men across his Cape York ancestral lands, pointing out the waterholes and good grazing spots that would serve generations of white graziers on Lakefield Station.

Standing on the ravaged fringe of Saxby Lagoon — an important story place for the Kuku Thaypan people — he can only shake his head at the 73-year-old legacy of that folly.

Twenty years after Lakefield Station was declared a national park, the banks of the lagoon are a deeply pockmarked quagmire from wild pigs and cattle. The ground is barren from overgrazing.

Even so, Mr Musgrave is delighted at its return to traditional ownership. After a 15-year struggle, the Kuku Thaypan elder is the first traditional owner in Queensland to have national park land handed back for an outstation and he can't wait to get started.

"See all the mud here? That's pigs, that's why we want to take back this place," he says. "They make a mess here, taking all our stories. We want to get all the pigs and all the cattle out of here. It used to be clean water here. Really clean. You could see to the bottom."

Mr Musgrave hopes to get troubled youth and old people back on country so they may reconnect with the land and its spirits.

But first he must save it.

As one of two remaining elders who hold the key to Thaypan cultural traditions and language, his encyclopedic knowledge of traditional laws and land management, medicines, tucker, magic and stories are now being recorded on an ever-expanding database.

The Kuku Thaypan have already struck an agreement with the Queensland Parks and Wildlife Service to declare the culturally and environmentally important Low Lakes wetlands within Lakefield a restricted access area.

Victor Steffenson, the architect of the traditional knowledge website, says Low Lakes is a perfect example of the synergies that exist between traditional land management and modern conservation agendas.

The Australian
19 November 2003
Page 5

Plate 10.1 Australian Newsletter Article featuring the work of the Elders' and Steffensen

Source: The Australian 19 November 2003, p.5

The TKRP created by Steffensen with the Elders' guidance was not just focussed on one aspect of the knowledge system, but the connectedness between the elements of the systems. Steffensen continued to support the Elders to practically demonstrate and record their traditional knowledge to secure it for future generations to come, while mentoring the project at the same time with other Indigenous communities. Since its origins, the Indigenous methodology applied by the TKRP has continued to develop through Indigenous-led mentorship and has spread throughout Australia (Milton, 2018; Mundy, 2015; SBS TV, 2016; Steffensen, 2008b) and Internationally as an appropriate way to unite Indigenous knowledge with contemporary environmental conservation and resource management. For further examples of Steffensen's work see the Vimeo channel for the *Living Knowledge Place* https://vimeo.com/user12381768 and www.livingknowledgeplace.com.au (last accessed 13th January, 2019).

Over the years, the TKRP project has evolved and the protocols, principles and elements of the methodology continue to inform services delivered by *Mulong*[61]—an Indigenous film, production and environmental management company of which Victor Steffensen is the founding Director.

Mulong provides services that are Indigenous owned and community based. Mulong offers training, consultancy, and networking services that support the recording and application of Traditional Knowledge. Mulong operates on requests from Indigenous groups, communities

[61] *Awu Laya* (Kuku Thaypan) word for spirit ghost associated with a story and song-line coming from the West

and other agencies to assist with the aspirations and outcomes from a diverse range of Indigenous, Community and Environmental stakeholders (Steffensen, 2016a). Importantly this work has also involved extending the learnings of the Elders' TKRP and their Kuku Thaypan Fire Management Research Project, and the continuing support of this co-generative research project "*The Importance of Campfires*" in demonstrating appropriate research with Indigenous people and their knowledge systems. As outlined, Steffensen has travelled extensively across Australia and internationally sharing the methodology, protocols and principles that formed the TKRP and empowering Indigenous communities to re-implement their traditional knowledge and fire management practices on country, bridging principles and teaching others how to read country and heal it with fire.

The TKRP recognised the need for conceiving frameworks for engagement that co-create opportunities for mutual respect, where different ways of knowing, being and doing interface. Hence, through professional networks, a non-Indigenous researcher was identified in 2003 to begin "The Importance of Campfires" dissertation, that is, this dissertation. This type of engagement over fire management research and practice was to allow co-learning from each other and generate new ways of doing science and natural resources management to demonstrate how both knowledge systems can benefit. The research project dissertation supported development of the TKRP specific to the fire research component and later, extension of the methodology through mentoring with NSW, Victorian and Tasmanian groups. For a list of TKRP processes supported in my role as co-researcher on the KTFMRP (see Appendix 10.1).

The priority of the TKRP was to fulfil the expressed wishes of Elders to transfer and record as much of their Traditional Knowledge (TK) as possible to the clan youth before it was lost, to secure, demonstrate, apply and communicate this knowledge to contemporary issues of community concern, see Figure 10.1. In order to do this the entire knowledge system needs to be practiced to look after country so that resources provided by country are present and the knowledge of them able to be shared.

The revival of TK also enables the building of sustainable pathways for community development. Multimedia and information technology were combined in a robust and culturally appropriate method for recording, transferring, transcribing and securing the knowledge through on-country implementation and active engagement in land and sea management. Multi-media products were and continue to be developed in partnership with communities by Mulong to reflect information able to be shared, to maximise its ongoing use by all communities, and to demonstrate the sharing of knowledge and its application to contemporary environmental issues that require improvement through Indigenous fire management. The recording of communities while being mentored, practicing and rebuilding knowledge, and the production of local films with the community speaking of their management concerns and the actions they are taking, re-enforces learning after the experience when not on country.

The TKRP methodology as described by this research collaboration in 2007 then contained elements of community informatics (CI) that enabled the bridging of the digital divide and promoted the effective use of information communication technologies (ICT) that empowered community voice through training in the use of information technologies on and off camera

(Gurstein, 2007). Unlike some projects applying the use of western ICT and design strategies to deal with issues of TK loss, (Verran, Christie, Anbins-King, van Weeren, & Yunupingu, 2006) and emancipation (O'Brien, Djusipov, & Wittlin, 2006), the TKRP originated from grassroots Indigenous-identified need and action and was driven by Indigenous people for Indigenous people. In addition, the communities it operated in drove ownership and control of their TKRP project, thereby avoiding some of the issues that occur when western "experts" and TK holders come together to undertake digital design projects, see (Christie & Verran, 2006). Further, the demonstration of the cultural practice forms part of the methodology and ensures that culture is not only recorded but continues to be maintained on country.

Multi- media products are developed to reflect information able to be shared to maximise its ongoing use by all communities. Mulong continues to apply this method in generating short films on community fire management practices and the annual Indigenous fire workshops. Further, this is done while demonstrating and applying TK on country, implementing action research to address issues of relevance to country and community. Mulong continues to use the creation of short films when working with communities to empower community voice and uses different edits of footage to serve different digital communication platforms for clients, Indigenous community project delivery partners, hosting and communicating on TKRP YouTube, Mulong and The Living Knowledge Place Vimeo account (Steffensen, 2017), social media accounts; the National Indigenous fire Alliance Facebook and Twitter, Steffensen et al, (2017) and importantly in educating young Indigenous and non-Indigenous people through The Living Knowledge Place web site (Steffensen, 2017).

The project methodology has evolved over time and is not static, but its roots enable the sustaining of culture as it is shared between communities through mentorship and kinship system, with Elders and guided younger clan members mentoring transfer. Both Indigenous and non-Indigenous trainers delivered IT skill transfer and have assisted in the development of communication pathways; however, non-Indigenous trainers and partners are guided by their Indigenous colleagues. In this way, skills are built from within communities through experience and inspire confidence in the capacity for social change, laying pathways for self-determination. The project has now spread to numerous Indigenous communities in Cape York, Queensland, New South Wales, Victoria, Tasmania, Northern Territory, Western Australia, New Zealand, the United States and Canada as a result of its grassroots methodology and has engaged and assisted thousands of people. A conceptual model of the process is provided in Diagram 10.1 below.

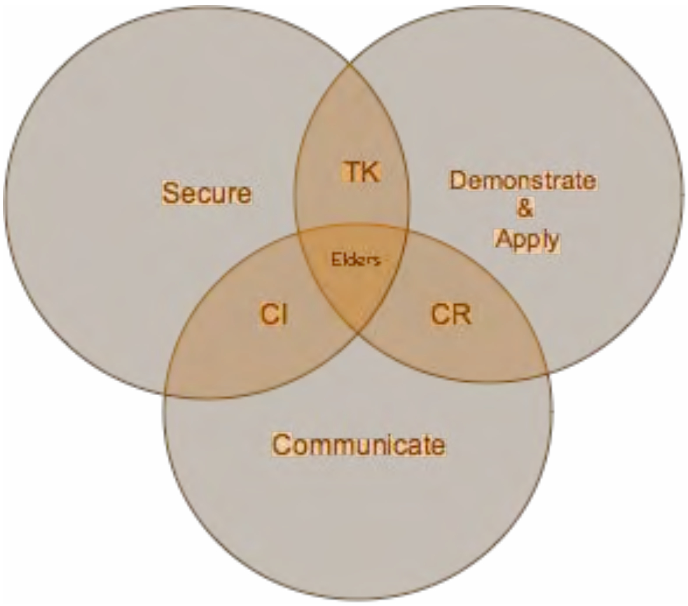


Figure 10.1 Conceptual diagram of interactive components of the TKRP methodology TK = Traditional Knowledge CI = Community Informatics CR= Co-generative Research

Source: Standley, Field data 2007

The TKRP methodology is based on:

- Ensuring the survival of cultural knowledge through enabling traditional transfer on country; and providing
- Opportunity to demonstrate and apply practices that have the ability to innovate contemporary management and community outcomes for the benefit of all generations to come.

The following priority areas are interlinked parts of the methodology used by the project as represented in Figure 10.2 each helping to strengthen outcomes of the other. The connected components of the methodology are descried below.

Demonstrate Traditional Knowledge

Elders are on country transferring TK to younger clan members, applying their inherent adaptive management knowledge, reading and responding to cues in country, thus securing and communicating with country and to kin. In doing so, they are able to demonstrate their knowledge within and between communities and provide elements of shared knowledge to interested external agencies. The methodology ensures that cultural practice is maintained as it physically demonstrates knowledge while it being shared and recorded, all of its connected elements and the steps in the processes that Indigenous ecological knowledge systems contain are shown; for example, the processing of nuts, seeds and fruits for use, the building of shelter, weapons, tools, traps and canoes, the creation of navigational markers, the creation of elaborate jewellery for decoration, the collection and processing of materials for basket making to name a few.

Secure Traditional Knowledge

Securing traditional knowledge is enabled because sharing, learning and practicing takes place on country. Being out on country with Elders and younger clan members using digital multi-media, scientific instruments, creative communication technologies is applying community informatics (CI); the training in the use of multi-media technologies, empowers communities in the use of these tools in securing, demonstrating and communicating their TK. This enables their voice to be heard by others on issues of concern to them and record the actions they are taking to heal and look after country. Critically though, this component of the methodology ensures that knowledge is secured as it occurs through the same cultural practice of transfer on country that has been since the Dreaming enabling the opportunity to connect and learn country.

Communicate Traditional Knowledge

Communication between country and people is enabled through the TKRP action research methodology. (CI) training in-field training methods of TKRP also enable communication with others in a variety of mediums. The (CR) co-generative action research case studies identified and designed by Elders and younger clan members are recorded while being implemented on country. Training is delivered within and between clan groups supported by western scientists and practitioners creating shared knowledge case studies – training others in TK based cultural practice and natural resource management. Communities are supported to develop communication products sharing elements of TK and issues of community concern using digital technologies.

Communicating and applying research protocols enable the contribution of Traditional Knowledge to contemporary research theory and practice through a culturally appropriate framework.

As highlighted, the TKRP methodology continues to be applied in the development and delivery of the National Indigenous fire workshops and Mulong video case studies of community mentorship of cultural practice. This includes fire projects that contribute old and new knowledge to fields of Indigenous research, environmental conservation, natural resource management, biodiversity conservation, climate change, fire ecology, participatory action research, communication design, co- generative action research, action learning, cultural environmental education, digital design, community informatics and health to name a few.

TKRP in-field training methods includes trainees, younger clan members of mentoring groups being recorded in front of the camera practicing the knowledge they had just learnt from the Elders and knowledge holders, while being guided by Elders and TKRP project mentors off camera – this process was often also filmed. Community trainees also learn how to record their Elders behind the camera and interview them appropriately. The footage was used to develop multi-media community specific training products (as in plate 10.2) so that new community participants are able to view the films and are able to view themselves demonstrating, communicating and applying their TK securing it for future generations. See Plate 10.2 below. Mentorship and knowledge exchange also occur off camera, plate 10.3 shows Victor Steffensen mentoring fire with Larry Banning (traditional owner) at the 2017 National Indigenous fire workshop on Balnggarrawarra Gaarraay traditional country.

Plate 10.2 Dr Tommy George demonstrates his knowledge on sugarbag to Lizzy Lakefield (Lama Lama traditional owner) being recorded by Djerami Callope and being guided off camera by Victor Steffensen

Source: field records 2009

Plate 10.3 Victor Steffensen mentors and shares fire knowledge with Larry Banning at the 2017 National Indigenous fire workshop

Source: Field data 2017 Image credit Robyn May

Through developing a defined grassroots methodology, applying traditional practice is of greatest interest from a Traditional Owner perspective, as the applications and outcomes are diverse and outcomes are inter-linked and practical to the needs of the community and environment. It is important that Indigenous peoples get the support to develop and recognise their methodologies of research and their application in order to fully engage with western research methods and gain more value and opportunity from the process.

The ongoing stages of constructing a multi-platform Indigenous ethno-biological database, for the preservation and application of traditional knowledge is continuing with the involvement of partnerships, involved descendants of the Elders and the support of this research dissertation. Multimedia and information technology were and still are combined in a robust and culturally appropriate method for recording, transferring, transcribing and securing the knowledge on country and in an interactive database.

The TKRP followed a system of methods that encompassed the cultural processes originating from the Elders sharing their knowledge on country. Adhering to cultural processes was necessary for the project's successful implementation. Choices made during the project's development were respectful of Indigenous cultural practices, their mores, and ways of teaching and learning. The project sough to respect and retain the integrity of knowledge transfer from Elders to youth by enabling on-country recording and demonstration of knowledge where country is able to speak to its people and its people to it. The following strategies were applied to assist in achieving the goal of TKRP:

- Supporting Elders' and community knowledge and skill holders to mentor to other interested clans
- Communicating internally and externally knowledge that can be shared
- Connecting schools to culture and community through engagement with Elders and Information technology
- Appling the inherent adaptive management knowledge of TK through Indigenous identified, designed and led action research activities
- Establishing culturally appropriate co-generative and co-operative research frameworks and agreements
- Establishing regional, State, National and International positions, strategies and recommendations based on common issues, concerns, findings and solutions
- Advancing the recording, storage, service and communication of TK through digital technology, the world-wide web and later social media.
- Facilitating meaningful cooperative management of Australian landscapes in the longer-term

- Demonstrating and promoting sustainable economic development and Indigenous enterprise opportunities that respect TK, people and enable management of the country

Traditional Knowledge Protocols

Traditional Knowledge protocols were communicated by Kuku Thaypan Elders and TKRP co- creator and described as they applied to research through their co-generative action research fire management project PhD "The Importance of Campfires, see Chapter 3." *"It's always been this way it's not new"* (Steffensen, 2008a). The Kuku Thaypan Elders, Dr George and the late old man Musgrave, through their Kuku Thaypan Fire Management Research Project (KTFMRP) secured, demonstrated, applied and communicated these protocols as applied in their original TKRP – Traditional Knowledge Recording Project. In their KTFMRP they undertook their fire research "on their own terms." In effect supporting their continued TKRP through their KTFMRP was the protocol for engagement with the Elders and their knowledge.

Research partnerships principles and protocols

TKRP supported communities in the development of Traditional knowledge and western land management research training and development case studies as a way for communities to interface with natural and cultural resource management organisations, government, agencies and institutions. Diagram 10.2 below developed through a workshop with the then TKRP staff team in 2008.

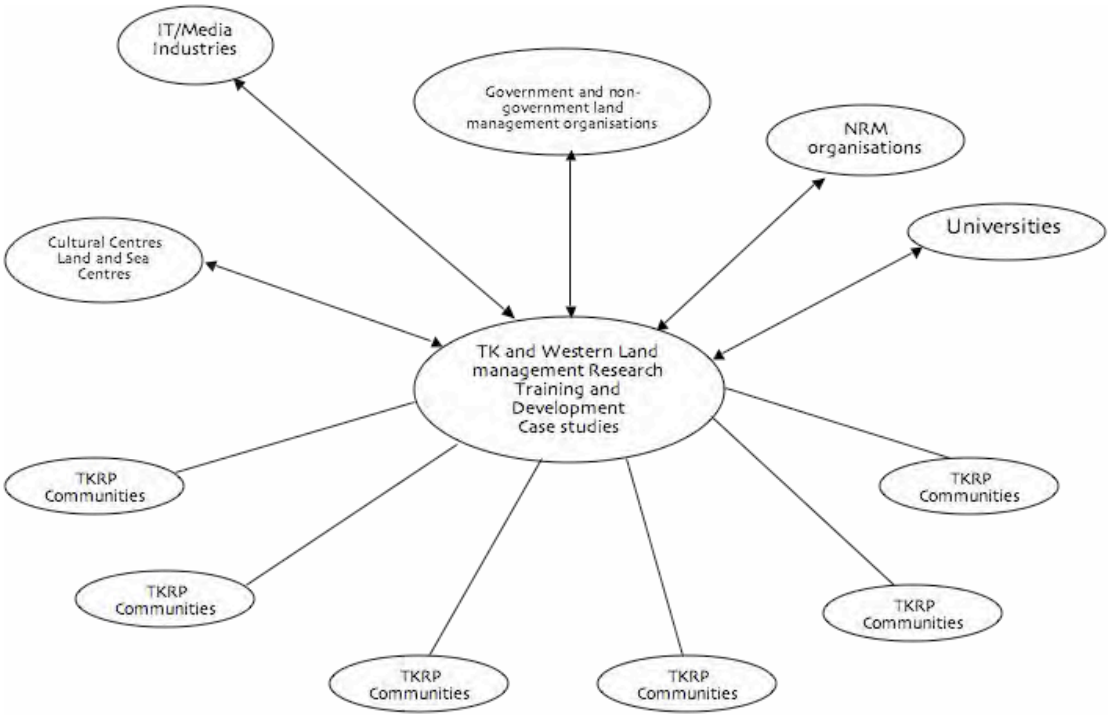


Figure 10.2 describes how TK and Western land management case studies were developed with Indigenous communities to support them in interfacing with government and institutional processes

Source: Field data 2008

Research and partnerships should recognise and respect peoples inherited Traditional Knowledge systems by supporting communities to demonstrate their Traditional Knowledge formula for doing it. *"You have to understand the three sides to Traditional Knowledge to know how to use it as the baseline for applying adaptive management"* (Steffensen, 2008a) see Figure 10.3.

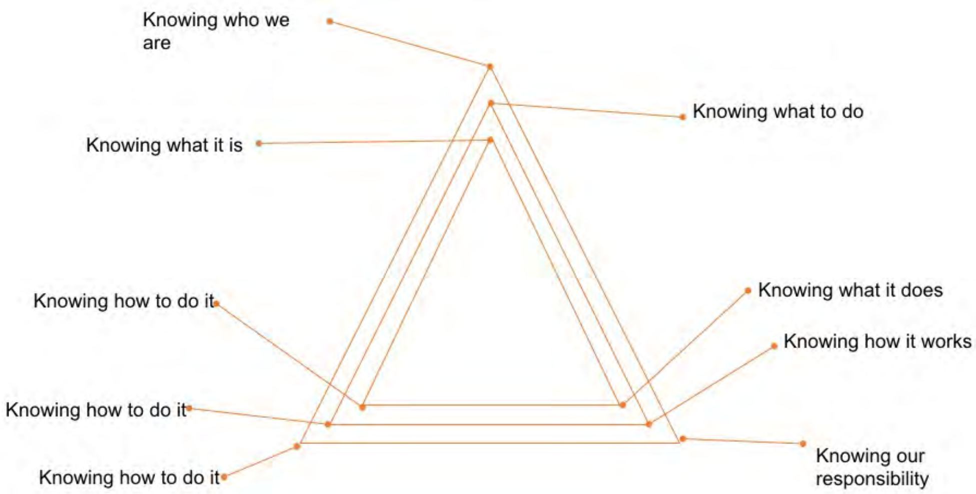


Figure 10.3 Traditional Knowledge Formula "The Knowledge Triangle"

Source: (Steffensen, 2008a)

Protocols are community specific and are enlivened through the building of relationships. In general, the following principles should apply to the development of partnership projects both in mentoring Indigenous communities and with non-Indigenous researchers, organisations and agencies, they should:

- Respect where shared knowledge has come from and acknowledge holders of that knowledge
- Access knowledge in a culturally appropriate way
- Support Indigenous-led and identified projects
- Address issues of community concern
- Co-generate solutions applying agreed laws of respect, recognition, responsibility, reciprocity, roles and risk
- Respect peoples cultural and institutional obligations, knowledge systems and ways of being and doing
- Understand different ways of undertaking projects and research

- Contribute to the identification of solutions to issues of wider contemporary concern

In this way, equitable partnerships are enabled, where Indigenous communities can identify and design Indigenous led projects, engage in participatory projects and inform collaborative approaches from their own point of view, retaining lore and laws relating to their knowledge system. Through this formula different ways of knowing, being, and doing are recognised and supported empowering communities to contribute solution to social, environmental and economic concern.

The process of learning to know how to do it

Inherent adaptive management of TK and Indigenous led action research

TK, as described in Chapter 1, is recognised as inherently adaptive. In order to apply and acquire traditional knowledge, you need to be able to communicate with country and be on country practicing knowledge. Fire knowledge needs to be learnt and demonstrated on country; being able to intimately manage country with fire requires being able to apply the three sides of the knowledge triangle. In order to do this, you need to know country or get to know country and practice culture in order to listen, to learn how to read it, to reapply the right balance of management to it and look after it. In this way, you secure traditional knowledge as it is transferred through cultural practice with country, kin, and people applying methods of traditional transfer. I accompanied Steffensen on a visit to UTS in 2010. At that time Steffensen, outlined the following requirements when implementing cultural burn on country that benefit biodiversity '*This is best practice example of a burn for biodiversity and community benefits.'*

Planning and Negotiation spaces

- *Planning stages (identify, talk, share, people management) (Law – admin/bureaucratic)*
- *Inclusive – community, landholders, government, science, general public*

Observe (assess country)

- *Get to know country (protocol, cultural lore, cultural sites, indicators, learn to read country, plants and animals, right people) record country*
- *Get to know its people*

First burn

- *Assess country*
- *Implement fire management*
- *Record country*

Assess

- *Country*
- *Knowing what it does learn to read its indicators*
- *Record country*

Implement

- *Fire management prescriptions/plan*
- *Monitor*
- *Implemented management*

Access and Review, Repeat

Source: Field records Wednesday 11th of August, 2010. 10:13 am

Steffensen's earlier work with the Elders included the development of an interactive database that would house videos of the Elders in the field, their transcriptions and translations and would be categorised according to culturally connected elements as outlined in Figure 10.4 below such as ceremony, animals, plants, story places, and so on. Figure 10.5 shows a later iteration of a country type record within the database. The development of this version of the database was supported through a partnership with the University of Technology in Sydney (UTS) Communication and Design School that had also supported the development and delivery the TKRP training program see Plate 10.4 that shows the front page of the TKRP Training and Field Guide Manual and Plate 10.5 of a TKRP training workshop that was delivered on the Atherton Tablelands in 2008.

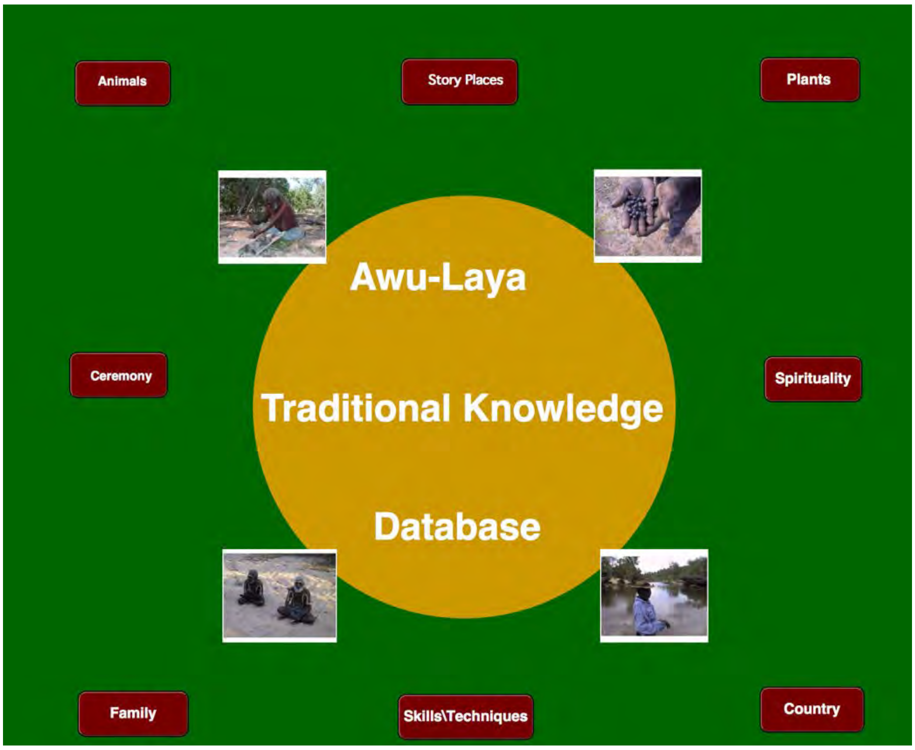


Figure 10.4 Awu Laya Traditional Knowledge Database

Source: Field data 2005

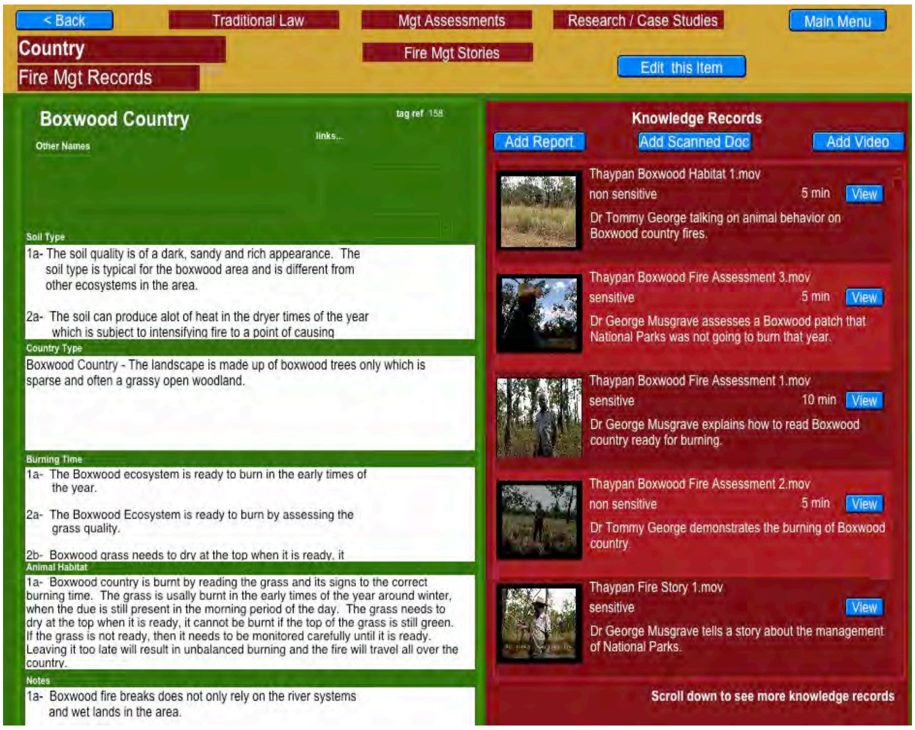


Figure 10.5 Awu Laya Traditional Knowledge Database Version 2.4 2008

Source Field data 2008

Traditional Knowledge Revival Pathways

Project Training and Field Guide Manual.

For Field and Studio Work.

Prepared for and on behalf of
Traditional Knowledge Revival Pathways.

June 2008

Plate 10.4 TKRP Training and Field Guide Manual

Source: Field data 2008

Plate 10.5 TKRP training Yungaburra, Atherton Tablelands 2007

Source: Field data 2007

The collaborative partnership with UTS has evolved throughout the years and support over this time has included the development of TKRP video documentaries, film, sound and editing training with Indigenous communities, and supporting the mentorship of the KTFMRP and the carrying of the *Mo Yeilea* Firestick to NSW Indigenous communities. Jacqueline Gothe, a Senior lecturer at the Design School, who supported the collaboration between TKRP and UTS also supported the development of communication products for the KTFMRP with assistance from the Importance of Campfires researcher working with final year design students to develop communication products for the Elders, KTFMRP and the

Importance of Campfires the results of these are presented in the Importance of Campfires methodology chapter 3.

Firesticks continues to be further developed and led in NSW and now more broadly by Oliver Costello who at the time of mentorship in 2008 was undertaking an Indigenous cadetship with Jumbunna at UTS. The communication design of Firesticks has continued to be supported by Professor Jacqueline Gothe. In 2017, through the continuing application of the mentorship method applied through the TKRP methodology, an *Indigenous Fire Alliance - Firesticks Alliance Indigenous corporation* (FAIC) spanning the length of the East Coast of Australia formed incorporated in 2018, supported by expressions for membership and continuing broader community support networks.

The work of Steffensen continues to inspire training and project strategies for community initiatives, to empower involved communities to lead and drive their own fire and broader cultural processes. The TKRP methodology informed the building of this network, and it is seen as a positive and constructive resource to preserve, protect, and promote traditional knowledge in a safe way, producing the on-going momentum of bridging sustainable Indigenous project and employment opportunities. By supporting this methodology, the survival of cultural knowledge is ensured through traditional transfer on country within and between communities – providing an Indigenous methodology to inspire communities to engage and develop themselves. It also provides the opportunity to demonstrate and apply traditional practices that have the ability to innovate and contribute to contemporary management solutions; demonstrating the values of traditional knowledge to the broader community.

The three methodologies applied together in the research practitioner model described in this dissertation, applied in co-generation enabled action to ensure the demonstration of the Elders' TCFK alongside the use of western science tools to outline a culturally appropriate model to do research and bring Indigenous knowledge of fire alongside contemporary fire management paradigms. This approach respected an ancient way to undertake and maintain cultural practice, where the right people have a voice to ensure that interactions with country and people are undertaken according to protocol, kinship and lore. Importantly this process has sparked action across the Nation with attendees at the National Indigenous fire workshops continuing to drive cultural fire practices in their own communities. The formation of the Firesticks Alliance Indigenous corporation in 2018 continues this action in working across borders to share experiences and develop an Indigenous designed and led national accreditation approach for the continued professional development of Indigenous cultural fire practitioners and researchers. In 2018 the National Indigenous fire workshop was formally mentored to NSW with the support of many partners and sponsors. A copy of the report of this work can be found at https://www.firesticks.org.au/national-indigenous-fire-workshop/.

Importantly this chapter demonstrates the Indigenous led methodology of the TKRP and its inherently adaptive processes in supporting communities to lead their cultural maintenance and revival, that includes their fire management knowledge in providing solution to contemporary issues of community concern. Like the Indigenous traditional cultural knowledge of the Elders, the methodology of the TKRP was not static. However, as highlighted in this chapter and Chapters 1 in the analysis of TEK and chapter 3 in the description of the Elders' knowledge map components; Indigenous traditional cultural knowledge, is grounded in lore, that never changes as it is held in the land. The wisdom in Indigenous traditional cultural knowledge systems is through its governance processes that ensure customs are practiced according to lore, including in the knowledge keeping and application of cultural fire. Further that phenomena and features of the land are read through signs and indicators held in the land and access to this knowledge is enabled through appropriate protocol.

Chapter 11 Discussion and conclusion

In 2004, when the Elders' Kuku Thaypan Fire Management Research Project (KTFMRP) began on Cape York Peninsula there was little opportunity for Traditional owners to demonstrate their knowledge in the land and sea management fields and the literature was relatively scarce (Scott, 2004). This produced a limited understanding of Traditional Cultural Fire Knowledge (TKFK) burning practices that was further exacerbated by limited or no involvement of Indigenous Traditional Owners who are fire knowledge holders. Therefore, Traditional Knowledge (TK) was absent from research studies and management interventions being implemented through joint management frameworks. Fire management is critical to biodiversity conservation and clearly linked to TCFK prescribed burning regimes and occupation of country. The Kuku Thaypan Elders, therefore, made substantial efforts to enact their fire research project to sustain their cultural obligation to care for country and community and to educate others of the benefits of their fire knowledge to contemporary fire management. This obligation was and remains their research methodology as discussed in Chapter 7.

Further, the Elders' research methodology not only demonstrated how to undertake cultural practice of their Indigenous fire knowledge but ensured the survival of cultural knowledge through the traditional transfer of knowledge to younger clan members on country. They can be seen practicing and implementing these cultural burns and practices in Plate 11.1 where Dwayne Lewis Musgrave and Griffin Dale Musgrave implement a cultural burn in tea-tree community in June 2007. Plate 11.2 shows Dwayne Lewis Musgrave working with Elenore Musgrave and teaching a very young Coraline George how to burn in 2007. Plate 11.3 shows the families camping on an open grassland adjacent to Rocky Crossing in 2017 implementing burns across their traditional Kuku Thaypan country, with fires burning in the grasslands and boxwood woodlands in the distance.

At the initiation of this thesis research, ecological studies in Cape York Peninsula that addressed Indigenous fire management provided limited discussion of the Indigenous use and removal of fire and associated vegetation change. TCFK and its practice were deciphered from limited anthropological accounts in historical records, early explorers and pastoralist's journals, and tended towards scientific methods formulated by the dominant cultural paradigm as provided (Stanton, 1992). This was not unique to Cape York, with studies by (Hallam, 1975) in South-West Australia using archaeological writings of explorers and settlers to provide insight into burning practices by "Aborigines"[62] at the time of colonisation. This information is important but does not replace the living knowledge of Indigenous people as highlighted in this thesis.

The Elders' Indigenous-led co-generative action research project provided opportunity for the Elders to speak for themselves and teach according to their cultural protocol. Numerous studies including a study by (Bowman, 1998; Ford, 1985) into fire ecology and Indigenous Australians calls for this type of research to be undertaken to address this significant gap in the literature. This research project provided an ever-narrowing window of opportunity to address this significant knowledge gap and to demonstrate and record living Indigenous cultural knowledge of the Elders related to their fire management practices and support demonstration of its application to contemporary environmental issues. This the Elders' KTFMRP chapter is a contribution of a significant body of Indigenous cultural fire knowledge to address this significant gap in the literature and support the mentorship and application of this knowledge between Indigenous communities, led by Indigenous people in

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[62] The primary author does not recognise this word as in contemporary interpretation it can be considered derogatory having connotations of 'not original,' which is in stark contrast to the explanations Indigenous Australians have communicated to me of their evolution here on this continent we now call Australia.

implementing fire management practice across Australia and in generating solution to contemporary fire management concerns.

Plate 11.1 Dwayne Lewis Musgrave and Griffin Dale Musgrave implement a cultural burn in tea-tree community in June 2007

Source: Field records 2007

Plate 11.2 shows Lewis Dwayne Musgrave working with Elenore Musgrave and teaching a very young Coraline George how to burn in 2007

Source: field records 2007

Plate 11.3 Camping on country in an open tea tree community at Rocky Crossing following the implementation of the days burns

Source: field records 2017

The management of fire in Australia is a complex issue (Dutta, Das, & Aryal, 2016) found that weekly bushfire frequency in Australia has increased 40 percent between 2008 and 2013. Not only has the frequency of bushfire increased but the intensity of bushfires has also increased, not just in the past four years, but since European colonisation of Australia as evidenced by Mooney et al (2015). Across savannas of Northern Australia, western scientific research highlights that grassland habitat is disappearing and associated thickening of grassy woodlands is occurring (Crowley & Garnett, 1998 ; Fensham R.J., 2002; Neldner, R.J., & Clarkson, 1997). Rolls (1999) identified the loss of Australian grasslands through the examination of historic literature. Studies in the Laura Basin, Cape York Peninsula, suggest that cattle grazing and reduced use of fire are factors leading to changes in vegetation composition and structure (Crowley & Garnett, 1998 ; Crowley, Garnett, & Shepard, 2004). Studies elsewhere in savanna systems report similar findings and suggest that long-term seasonal cycles of wet and drought affecting thickening and dieback of vegetation are also a contributing factor (Fensham, 1999; Lewis, 2002). Large-scale changes in ecosystems and increases in endangered species in areas that are not now occupied intensely by humans correlate with removing Indigenous inhabitants from the land and replacing their fine-scale mosaic management practices (Burbidge & McKenzie, 1989). Whitehead, Bowman, Preece, Fraser, and Cooke (2003) encourage wider application of 'Indigenous' prescriptions of fire management in contemporary fire management.

Carefully tended country with *multiple* scale burning practices implemented by people have been replaced with:

- limited burning exacerbating wildfire risk,
- inappropriate timing of burns,
- inappropriate implementation of burns,
- an increase in the frequency, intensity, severity and area of wildfires.

The associated impacts from these changes are:

- benefiting feral species such as cats (McGregor, Legge, Jones, & Johnson, 2014) and invasive grasses and woody weeds including natives that act in the same way,
- influencing faunal assemblages and species composition (Yates, Edwards, & Russell-Smith, 2008),
- changing soil properties,
- increasing erosion
- negatively impacting hydrological systems, and water quality (Smith et al., 2011; Townsend & Douglas, 2000)

- increasing greenhouses gases accelerating climate change.

Studies by Braithwaite (1991) and Yibarbuk et al. (2001) demonstrate that the removal of Indigenous burning practices of spatially localised and prescriptive regimes has caused a shift in the spatial extent of fires. In Northern Australia, the contemporary fire management regime that exists results in numerous, large, intense fires burning uncontrolled late in the season (Aug – December) with many areas burnt annually (Russell-Smith, 1997) as outlined in Chapter 4.

Studies conducted in Cape York Peninsula that examine the topic of fire, vegetation change and species decline allude to the removal of Traditional burning practices as a contributing factor (Crowley & Garnett, 1998 ; Crowley & Garnett, 2000; Stanton, 1991; Stanton, 1992). In the absence of this spatially and temporally localised and diverse burning, the frequency, intensity and extent of fires has changed so there are many large, destructive and uncontrolled fires burning late in the season (Stanton, 1992). These changes are implicated as major contributing factors to species decline (Burbidge & McKenzie, 1989; Crowley & Garnett, 1997; Crowley & Garnett, 1998 ; Crowley & Garnett, 2002 ; Crowley et al., 2004). Therefore, western science recognises the inherent natural variability between fires in different places and that the landscape is less able to sustain the biodiversity inherited upon colonisation. The impact of European occupation of the landscape has been to reduce fine scale heterogeneity to a homogenous landscape (Hill, 2003) or more simply to reduce diversity.

Anthropological research and historical analysis of the literature over the last 200 years have undoubtedly proven that each Traditional Owner group had its own knowledge of and uses for various components of the ecosystems which they occupied, including the application of fire (Armstrong, 1978; Penny, 1989; Stocker, 1981; Underwood, 1978). Most historical journals recount the use of fire by Indigenous Australians; in (Blainey, 1982) it is noted, *"When Captain Cook in the HMS Endeavour (1770) became the first European to see the Pacific coast of Australia he and his crew saw the Autumn fires burning in the bush on most days as they sailed northwards. On several days they saw large fires, on other days smaller fires - the smoke conspicuous against the blue hills even when the ship was far out to sea p.."*

More recently, historians such as (Gammage, 2012) are adding to the knowledge base of changes that have occurred to Australia's ecosystems as a result of contemporary firing regimes. Indigenous peoples of Australia literally lived on the land, observing and recording seasonal changes and undertaking management of a diverse array of resources for a variety of purposes, each action having shaped and influenced the vegetation assemblages and hence associated faunal population ecology, their connection deeper than the European concept of ownership (Bird, Bird, & Parker, 2005; Kohen, 1995; Lyons, 1989; Martin, 2003; Pascoe, 2014; Vigilante, 2004; Yibarbuk et al., 2001).

Research by (Crowley et al., 2004) revealed *"if grasslands are not burnt, then density of broad-leaved tea tree above the grass layer can increase two to seven fold over a 20 year period"* p.38. Findings within this work also reveal that the timing and frequency of burns required for maintaining grassland habitat and a necessary pattern for re-establishment is not well understood. It is also acknowledged amongst colleagues in the scientific community and organisations undertaking anthropological, ecological, land management, social science or training and education-based Natural Resource Management or conservation-based research that there is a significant lack of understanding of Indigenous land management practices including those associated with timing, extent, and intensity of burning regimes important to species and communities that have co-evolved through diverse and complex interactions with these regimes (Bowman, 1998; Stanton, 1991; Vale, 2002).

Mooney et al. (2011) released a paper on fire regimes in the late quaternary interpreted from the charcoal record and results were promoted in the media to inform the debate on Indigenous Australian burning practices. Williams, Mooney, Sisson, and Marlon (2015) examined archaeological radio-carbon data and a new synthesis of charcoal records to test for a relationship between people and fire over the past 20 000 years across Australia and concluded that the lack of significant change in the charcoal record over this period concludes that *"there were no long-lasting impacts to the environmental biota and macro-scale palaeo environmental records prior to European colonisation'* p.1. Their conclusion was that *"human control of fire by prehistoric people in Australia is not evident at broad landscape levels"* p.1. Following media on this published paper, I arranged for Steffensen and I to meet with Mooney in Sydney after this paper was published and we interviewed him, during this interview we asked him if levels of charcoal found in the record were influenced by the intensity of fires and that the fine ash created from the low intensity burns implemented prior to European colonisation would not result in a change in the charcoal record. In short, his response was it was possible.

Not only has the frequency of bushfire increased the intensity of bushfires has also increased not just in the past four years but since European colonisation of Australia as evidenced by (Williams et al., 2015). As discussed in the Elders' Chapters 7 and 8, not all timber on the ground is burnt by traditional burns and dead trees can be identified just as if they were living by the characteristics that the dead timber exhibits. Little charcoal is created from land management fires, however significant *kunari* charcoal is generated by burning of timber for daily use purposes; for example, drying of skins and food, warmth, for weaponary and craft production or when used in warfare.

Conclusion

Clearly western fire management systems do not hold all the answers to contemporary fire concerns, together with fragmented and restricted traditional cultural fire management practices. Plate 11.4 shows continuous areas of standing dead timber as a result of wildfires outside Melbourne. This is not a unique sight across Australian landscapes. These systems are in a negative state of succession, generating ongoing fire risk as country gets turned “upside down” Steffensen (2006). The impacts that wildfires have on people, infrastructure and the environment in Australia are significant, with the frequency and intensity of these fires increasing. Wildfires are increasing in frequency and intensity across Australia, including Cape York, more recently in Central and Southern Queensland in 2018 sparking a review (Queensland Government, 2018). However, at the time of finalisation of this dissertation in 2019 the results of which are not yet known with the review date closing on the 28th February, 2019. Fires of this size and intensity result in significant impacts to culture, livelihoods, life and property, the economy and ecosystem function.

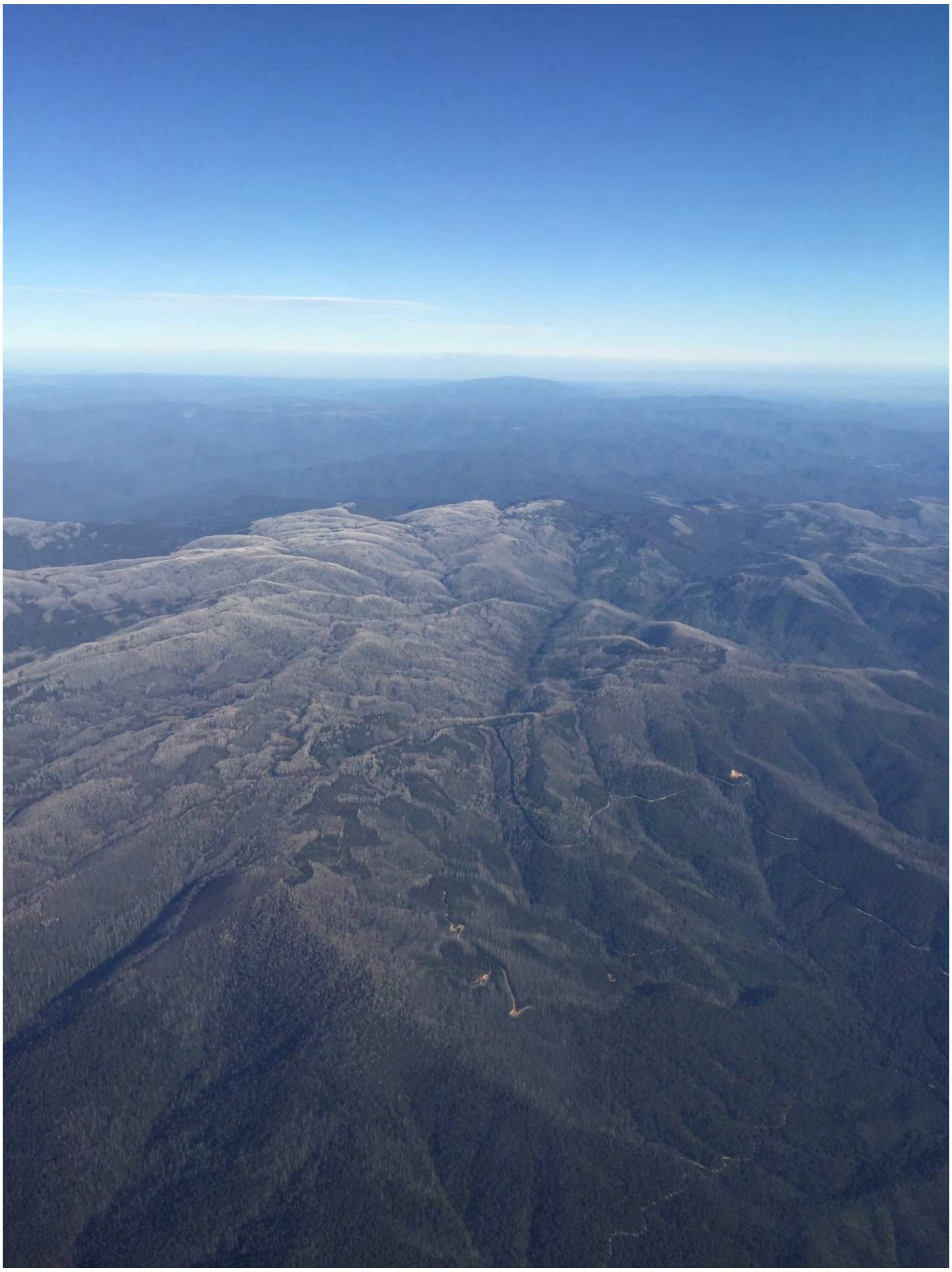


Plate 11.4 shows continuous areas of standing dead timber as a result of wildfires outside Melbourne

Source: Field records 2015

Fortunately, through the methodologies applied in this Indigenous led co-generative action research project the dissertation has addressed part of this gap in information by addressing the fire management practices of the *Awu Alaya* Elders Dr Musgrave, Dr George and *Tuguluk* descendant Steffensen in Kuku Thaypan Country in Cape York Peninsula. The work of the Elders and Steffensen continues to inspire communities across Australia and Internationally.

Through participant observation, field work and literature research over a number of years it was possible to gain an understanding of the extent and impacts of fire occurrences on Cape York Peninsula. This understanding was also informed by the data produced by western science (Chapter 5) and identifies how these fires impact ecosystem function in order to demonstrate understanding of the western science way of knowing about fire. However, the primary aim of the dissertation was to document the TCFK (Chapter 8 and 9) and associated methodology of the *Awu Alaya* Elders of Kuku Thaypan Country, Cape York Peninsula (Chapter 7). In order to achieve this, it was essential to first document an existing and developing methodology, the TKRP (Chapter 10). Working with the TKRP which was an Indigenous methodology, it was possible to describe a culturally appropriate research methodology for working with Indigenous peoples and their knowledge through “The Importance of Campfires” and outline the researcher practitioner model (Chapter 4) to assist other researches and agencies to consider the motivations, power relations and impacts of their research.

The dissertation importantly has been able to describe the Elders’ research methodology and translation of their TCFK knowledge into management considerations for implementing cultural fire practices in nine country types as described in Chapter98.

It is this collective co-generative body of work that has influenced the way in which Indigenous people and Indigenous knowledge is engaged with by western research and management organisations, particularly with regards to contemporary fire management. Not only has this partnership approach to research adhered to best practice principles for writing up Indigenous research as described by Indigenous lawyer (Janke, 2009), it has further defined the differences between research approaches and how these impact on benefits for Indigenous people as outlined in Chapter 3.

The research project was constantly challenged by limited resources, a lack of consistent support, a lack of understanding of the importance of how time critical the research projects were not only in initiating change, but in recording the Elders' fire knowledge while they were alive and enabling them to implement it on country. The research project has also been impaired by inappropriate engagement and a lack of understanding of those engaging on the risks of knowledge appropriation. Furthermore, Chapters 2 outlined the power relationships that exist in wildfire management in Australia and the legislative constraints that exist with regards to the practice of traditional cultural fire knowledge. How these impact capacity to act were discussed in Chapters 4 and 6.

Unfortunately, the research project as significant as it has been, has not yet been able to result in the realisation of an *Awu Alaya* Indigenous ranger program to support the full implementation of all of the Elders' aspirations for management their country into the future. Descendants still continue to work with Steffensen and Standley each year to enable burning to continue in Kuku Thaypan country in the research project AOI.

However, the documentation and transfer of the Elders' knowledge and the methodology developed by their TKRP and mentored across the Nation and Internationally by Steffensen has and continues to be a significant and meaningful contribution to the actualisation of Indigenous fire projects across Australia and abroad, to demonstrating the depth of knowledge inherent in Indigenous traditional cultural fire management practice, that too often has been over-simplified by western constructs. The three interconnected research projects provided a unique opportunity for Indigenous people to lead the implementation, documentation and transfer of their traditional cultural fire knowledge and interconnected fire management practice. Importantly, the research project also enabled the Elders and their families to manage their country, see the changes that this management generated and connect with their country, while contributing a significant body of knowledge to contemporary fire management and research, on their own terms.

As for all research activities, there are limitations. The major limitation from an academic point of view is the time necessary for undertaking research of this nature. Documenting Indigenous cultural knowledge cannot be rushed. As highlighted in Chapter 4, the sharing and documenting of Indigenous knowledge is an Indigenous domain and the principles outlined in the research practitioner model necessitate the research should enable Indigenous peoples as the holders of that knowledge the ability to demonstrate their science, knowledge and skill. The importance of relationships is critical in ensuring that information is shared appropriately and that knowledge is learnt on country and this requires *'plenty'* time on behalf of researchers and others wishing to learn and understand further traditional cultural fire management. True collaborative research efforts with Indigenous people require working together with Indigenous people to determine what, when and how they want to research not just fulfil priorities set by non-Indigenous research institutions and management frameworks.

Manypeople and agencies, both Indigenous and non-Indigenous, have directly benefited from the development of this co-generative research approach and the multiple pathways and partnerships that have been undertaken in achieving the shared vision of appropriate involvement of Indigenous people in contemporary fire management. Furthermore, this body of work has contributed to the valuing of Indigenous ecological knowledge of fire in providing important cultural solutions to the worsening wicked problem of fire management in Australia and Internationally, led by Indigenous people. Some of the types of activities that have been undertaken by the non-Indigenous researcher and the artefacts that they have helped co-generate to support the Elders and the TKRP include; presentations, posters, papers, development of web content, media articles, organisation and attendance at meetings, communications with QPWS, land managers and partners, field trips, data recording, events, promotion and logistics in delivery of Indigenous fire workshops, contribution to short films, posters, conference presentations, radio, digital and print media, development of monitoring methodology and methods using western scientific instruments to support the documentation of cultural fire management, support for mentorship between communities to name a few, some examples are listed in Appendix 10.1.

This research project dissertation has already significantly contributed to current understanding and practice in these areas and helped guide and support a growing network of Indigenous-led community fire projects across Australia since 2008; evidence of the results of this body of work are highlighted throughout the chapters and listed in annexures to this dissertation. This is where my efforts have been for the past 14 years in completing this dissertation, building and maintaining partnerships with Firesticks in NSW and SEQ, Indigenous groups in Victoria, Tasmania and the broader NRM work in which I have been involved in Cape York where I have applied the learnings of my research with the Kuku Thaypan Elders and the Traditional Knowledge Revival Pathways. I am currently the operations manager at Cape York NRM starting with them in 2011. I have continued to support the aspirations of Indigenous peoples involved in the emerging Indigenous fire network across Australia and Firesticks Alliance Indigenous Corporation that has resulted from the growing community of Indigenous cultural fire management practitioners across Australia, inspired by the work of the Elders. I am currently one of two non-Indigenous Associate Directors of Firesticks Alliance Indigenous Corporation.

The three methodologies and key results are described as a contribution to the body of knowledge on how the two knowledge sets of Indigenous and western knowledge of fire management can benefit people and country. This has occurred through active on-country demonstration of how Indigenous knowledge of fire and country can be have a role in contemporary environment and resource management. The KTFMRP is presented as a tool for enabling Indigenous cultural knowledge of fire and ecology to reshape the “wicked” problem space of contemporary fire management and research practice. It is described to highlight how Indigenous knowledge of fire and country can operate alongside contemporary research and fire management to benefit all Australians. The overall methodology for the research dissertation is participant observation as the research required that I document the Elders’ traditional cultural fire management research project, their KTFMRP. The dissertation describes three methodologies for understanding fire management in the landscape. The Elders’ methodology is embedded in country and although they have expressed this knowledge throughout their lives it was not until the development of their TKRP with the support of Steffensen that their knowledge became published in their voice through the use of videography and the digital technologies of the TKRP. Critically this enabled the practice of their knowledge on country and the sharing of it with younger clan members and later across Australia and Internationally. The Indigenous led research practitioner model and CAMPFIRES methodology support Indigenous people to demonstrate and document their cultural fire knowledge while also helping others; agencies, institutions, researchers and practitioners of fire to ‘see and act’ in the World differently.

We need to rely on Indigenous people who comprehend and live their systems and social structures of knowledge to inform what might be a good management practice to apply, when, where and by whom and when and where a joint research project is appropriate and on what terms. By doing so we are empowering Indigenous people in the application and practice of their cultural fire management knowledge across Australia and undertaking alongside science and management without hybridisation and homogenisation of their knowledge through integration in entirely western research and management domains. Future research priorities should support Indigenous people in the demonstration of their fire management knowledge and to document their practices in ways that are meaningful on mutual terms and results in benefits to too all parties. There are too few skilled fire management practitioners in this country. If we had more Indigenous fire managers skilled in both their cultural knowledge and western fire knowledge systems, over time we may need less fire fighters.

Future research needs identified include working across the East Coast of Australia supporting Indigenous communities involved in this Indigenous led community of practice centred on traditional cultural fire management to establish appropriate research and monitoring programs to document, demonstrate and communicate their fire management knowledge and practice. The development of an Indigenous led training and accreditation program based on Indigenous traditional cultural knowledge of fire along with Western fire management and fire-fighting training; applying the mentorship methodology established through this Indigenous led co-generative research project, subsequent fire workshops and its continuance through the establishment of the Firesticks Alliance Indigenous Corporation in support of the development of a network of experienced Indigenous traditional cultural fire practitioners is essential. As highlighted by this research dissertation and by (Fairbrother & Tyler, 2018)*"various communities of practice, may not have the capabilities and resources to address the divisive narratives that mark the social groups that comprise many localities, at least in ways that mitigate and allow adaptations to the prospect of wildfire events"* p. 203. As highlighted in Chapter 2 the management of fire and particularly wildfire events in the exercise of power by the State, agencies, Institutions and those with political and economic influence can be at the detriment of others. In order to solve the complex wicked problem of wildfire it is essential that localised communities in fire prone areas are enabled to contribute their knowledge and action to the solution. For example, despite the efforts of traditional owners to improve fire management on their country, direct descendants of the Kuku Thaypan Elders, and indeed all traditional owners on all CYPAL and some adjoining Aboriginal freehold lands in Cape York still have to gain approval for their fire management plans through western governance, policy and planning frameworks. As highlighted in Chapter 2 Indigenous led governance and approval processes for cultural fire that also address risk management as highlighted in the research practitioner model in Chapter 3 could complement and/or streamline existing planning and legislative requirements. There is currently no cultural fire management policy for any State governed lands in Queensland.

In the words of Andry Sculthorpe from the Tasmanian Aboriginal Centre and a current Indigenous director on Firesticks Alliance Indigenous Corporation, in the film of the 2016 Indigenous fire workshop, *Wujul Wujul* country *"We need to respect that aboriginal knowledge is primary knowledge on how fire operates in the country, so if we can have a situation where that knowledge is respected alongside western knowledge, in fact probably over western knowledge in implementation of fire regimes then there can be that trust put within the aboriginal community to undertake that knowledge and until that happens we will be in a situation where the current fire management practices in the country which aren't working will prevail and the management practices which have been working for thousands of years and are the only ones that we have that we know work will be left out in the cold, so until that is reversed we will have the ongoing problem we have*."

The Indigenous led co-generative research projects documented through this dissertation have generated momentous change in how Indigenous people and their cultural fire knowledge is recognised and implemented across Australia. This research dissertation contributes a body of work on how research can support Indigenous people in the demonstration and documentation of their TCFK. In answering the question of how Indigenous knowledge of fire can be known in contemporary fire management and conservation, this research dissertation demonstrates the value of Indigenous cultural fire knowledge alongside western science. Indigenous traditional cultural knowledge and practice of fire management are valuable in providing solution to the negative social, economic and environmental impacts of fire that we are facing Globally. Working alongside western fire management, ICFK implemented by Indigenous fire knowledge holders and practitioners and mentored by them can provide solution to contemporary fire management concerns. In the words of Dr George *"We all got to work together…everyone"* (Steffensen, 2006).

Appendix 4.1

Kuku Thaypan TEK Indicators Fire Monitoring Sheet

Site ID: T1TOB Veg identifier Site number TO or other burn	State: QLD Location: GPS datum code:	Coordinates: Latitude Longitude	Site way point number:
Survey number:	Date:	Time: Survey duration:	Recorder/s:

Methods of Recording ☐ TKnowledge recorded ☐ Video footage taken ☐ Way point ☐ Photographic image of entrance ☐ Photographic image of scar/s ☐ N/E/S/W Photographic images taken from centre of site and each corner 25m transect back into the site	**Country type:** ☐ Tea tree ☐ Mixed Tree ☐ Messmate ☐ Grassy Plain ☐ Gum ☐ Boxwood ☐ Ironwood ☐ Bloodwood ☐ Other please describe ________________	**Land form:** ☐ Sandstone ☐ Sand Ridge ☐ Flat/Plain ☐ Lagoon ☐ Wetland ☐ Creek ☐ River ☐ Other please describe ________________	**Soil Type:** ☐ Light ☐ Med ☐ Dark Moisture ☐ Dry ☐ Damp ☐ Moist Level ☐ **15 cm or** ___ **cm**	**Fire Management** **Source of burn** ☐ TO – Traditional Owner Burn ☐ BO –Burn Other (QPWS/Wildfire/Pastoralist) IF you are sure of the source then use QP/W/P) otherwise just leave as BO **Age of Burn** ☐ NB – New Burn ☐ OB – Old Burn if **Regrowth present** ☐ Yes ☐ No **Height of re-growth** ☐ **<5 cm** ☐ **5 – 10 cm**
Burn implemented ☐ Yes ☐ No **Ignition Point:** WAY: ____ **Fire scars Present** ☐ No ☐ Yes At centre of site in a 25 m radius count tree's the same width or bigger than a gauge (basal wedge/pencil) and scar heights if present to estimate tree density and average scar heights across site. Map these **Average Scar height** ☐ < 50 cm ☐ 50 cm – 1 m ☐ >1 m ☐ 1 – 5 m ☐ 5 – 10 m ☐ < 10 m ☐ Canopy	**Scorch height** 0 = leaves are mostly green with some evidence of drying from fire 1 = leaves are half brown but still green at top 2 = leaves are brown to top of the crown 3 = leaves are recovering from too hot fire by re-sprouting close to trunk/branches **Fuel Loads** Low = +/- low surface fuel, +/- low bark risk, low elevated fuel, high bare ground Moderate = +/- 2-3 cm of surface fuel, >50cm elevated	**Curing Index** 100 % = all grass in system dry with most seed set 75 % = most grass dry with some still yet to set seed 50 % = some grass in system dry with others yet to cure 25 % = grass in the system still green at the bottom 0 % = grass still too green to burn **When fire is being implemented** **Flame height** ☐ < 50 cm ☐ 50 cm to 1 m ☐ < 1 m ☐ 1 – 5 m ☐ 5 – 10 m **Colour of smoke** ☐ White	**Post new fire Scar height** ☐ < 50 cm ☐ 50 cm – 1 m ☐ >1 m ☐ 1 – 5 m ☐ 5 – 10 m ☐ < 10 m ☐ Canopy **Wind** ☐ 0 = no wind ☐ 1 = light breeze ☐ 2 = windy ☐ 3 = gusts ☐ 4 = strong wind **Direction** .... **Other burn notes:** Fire No: Time : am/pm	

1

Evidence of fire 0-3 ☐ 0 ☐ 1 ☐ 2 ☐ 3 0 = no visible impact to 3 = recent major impact affecting all of the site	fuel, +/- low-med bark risk, medium bare ground High = +/- 3cm + surface fuel, +/- high bark risk, 50cm - 1.5m elevated fuel Very high = +/- 5cm+ surface fuel, 2m+ elevated fuel, little to no visible bare ground	☐ Light grey ☐ Med grey to brown ☐ Dark grey to black **Rate of spread** ☐ Slow ☐ Med ☐ Fast	Temp: ℃ Wind Speed Max: Av: Relative Humidity: Dew Point: Altitude: m

Other notes:

Vegetation

SITE DESCRIPTOR						
General description						e.g. Kating Morehead River tall eucalypt riparian vegetation
CROWN Cover						
Tree 1						
Tree 2						
Tree 3						
Shrub 1						
Shrub 2						
Shrub 3						
	0 -5 m	5 – 10	15	20	25	
Tree one						Most abundant tree
	Species					Species of tree
	Species %					Percent of this species of all trees on site
	Median ht (m)					Median height of this species of tree
	Number of trees					Number of this species of tree on site
	% canopy cover					Percent of site covered by canopy of this species
Tree two						Second most abundant tree
	Species					
	Species %					
	Median ht (m)					
	Number of trees					
	% canopy cover					
Tree three						Third most abundant tree

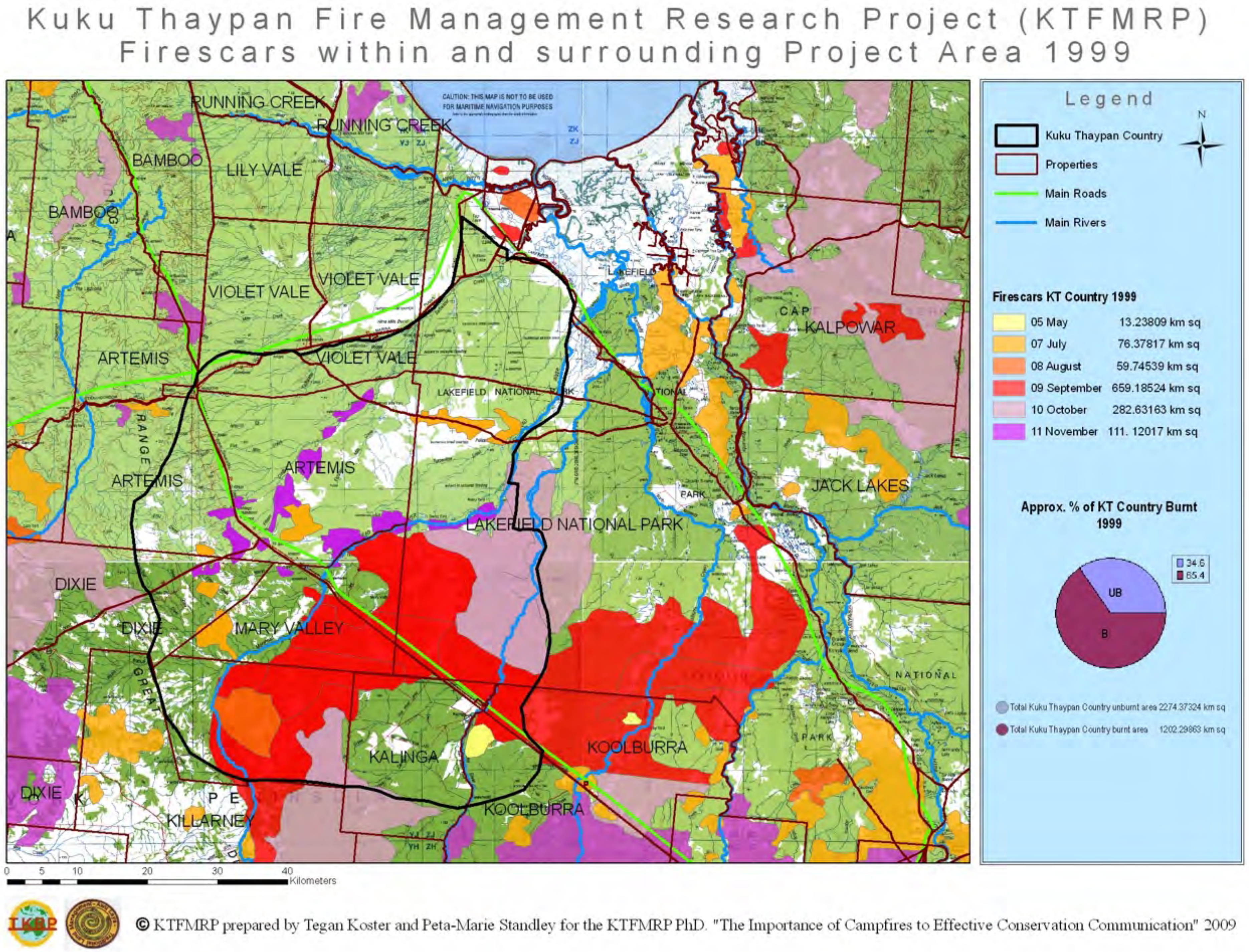
	Species %	
	Median ht (m)	
	Number of trees	
	% canopy cover	
Ground cover species three		As for trees
	Species	Third most abundant grass
	Species %	
	Median ht (m)	
	Number of trees	
	% canopy cover	
Ground cover % of 100		
Bare ground		Percent of bare ground covering site
Pebbles		Percent of pebbles covering site
Vegetation		Percent of vegetation covering site
Litter		Percent of leaf litter covering site
Rock slabs		Percent of rock slabs (large boulders) covering site
Soil Cracks 0-3		0 = none, 1 = few, 2 = several , 3 = many
Distance to nearest permanent water		<1km (1), 1-3 km (2), 3-5 km (3), > 5 km (4)
Moisture Present at site (Dew)		Y = yes N = No
Evidence of cattle 0-3 (stomping, scats, tracks)		0 = no visible impact to 3 major impact affecting all of site
Land zone		Land zone number Satler and Williams xxx
BVG number		Number given to vegetation type in xxx
Notes		
Fruit 0-3		0 = none, 1 = few on scattered plants, 2 = abundant on few plants or moderate on most, 3 = abundant on most plants

4

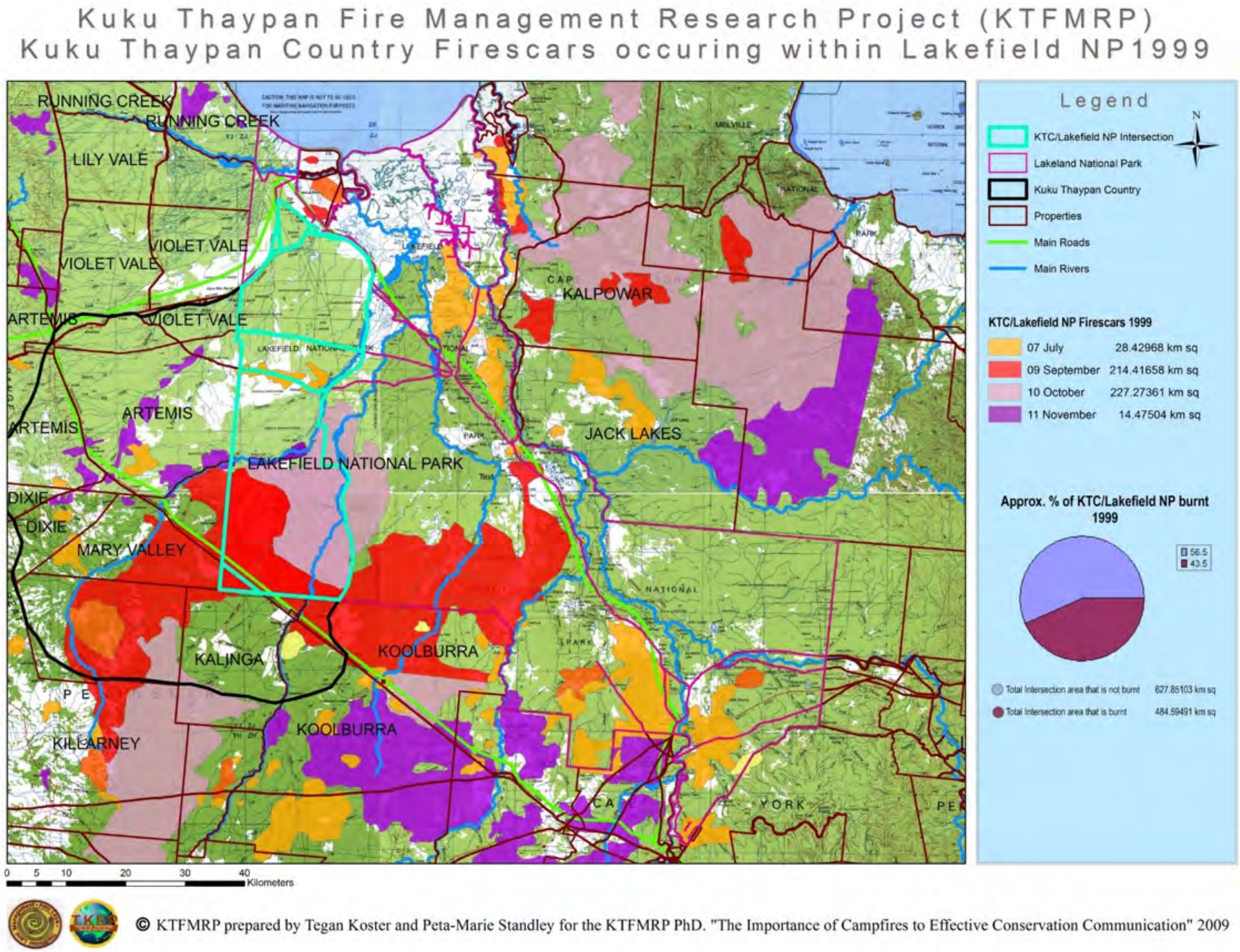
Figure 4.6 Sample KTFMRP field monitoring sheet

Source: Field records 2007

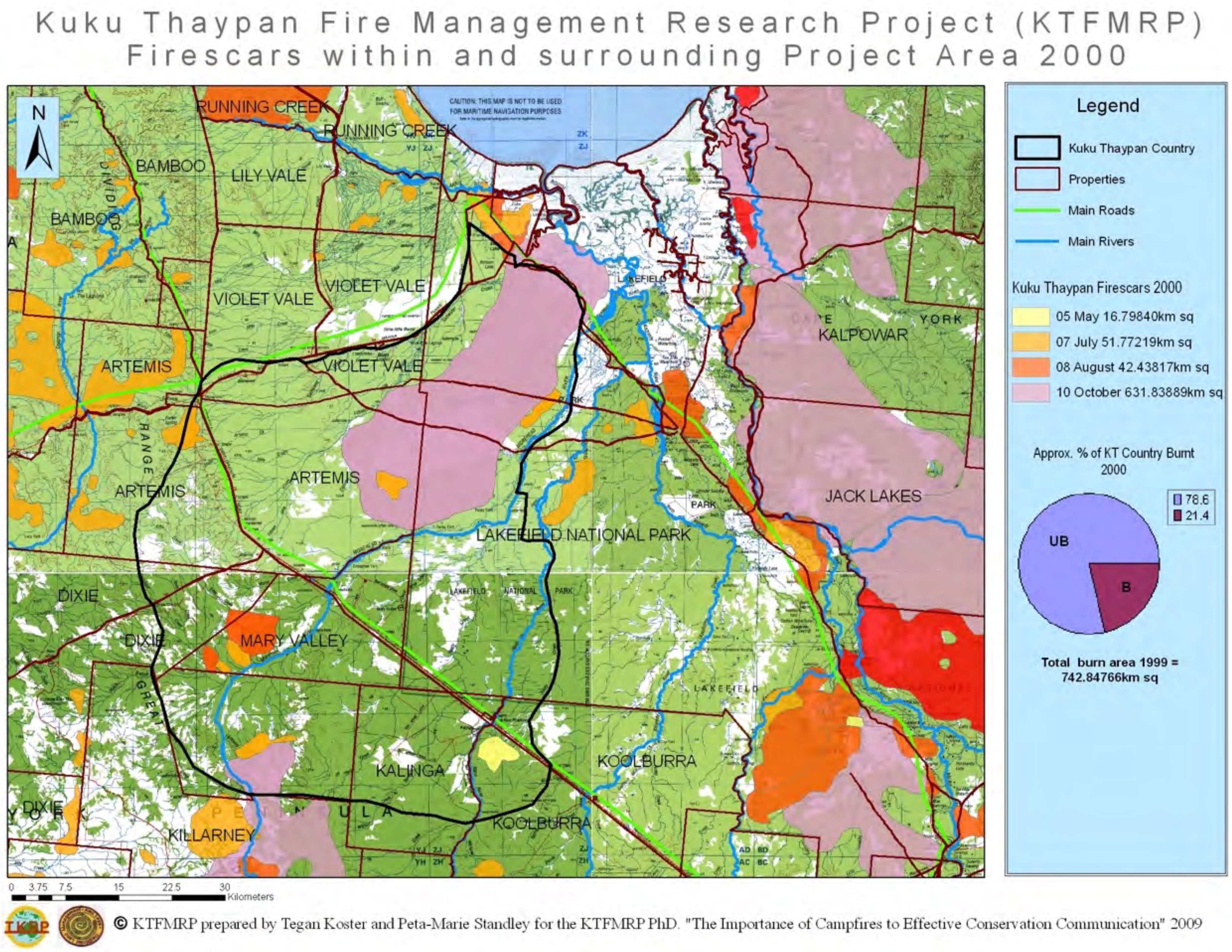
Appendix 6.1 Fire scar maps for Kuku Thaypan clan Estate and the KTFMRP and the Importance of Campfires Research project AOI 1999-2010



Map 6.7 Fire scars surrounding and within Kuku Thaypan country May-November 1999
Source: The Importance of Campfires GIS database 2009

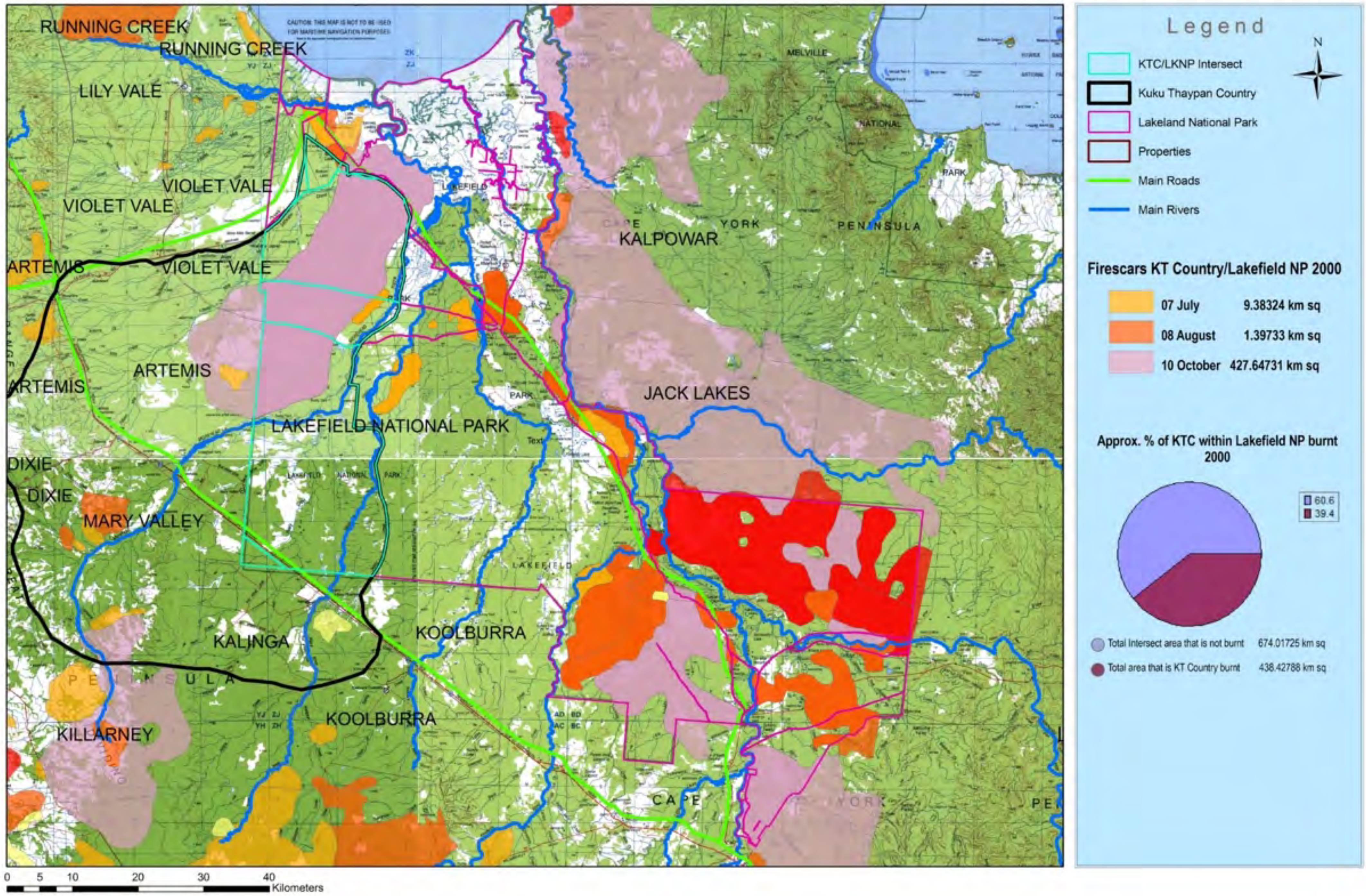


Map 6.8 A closer examination of the fire scars in 1999 study AOI
Source: The Importance of Campfires GIS database 2009

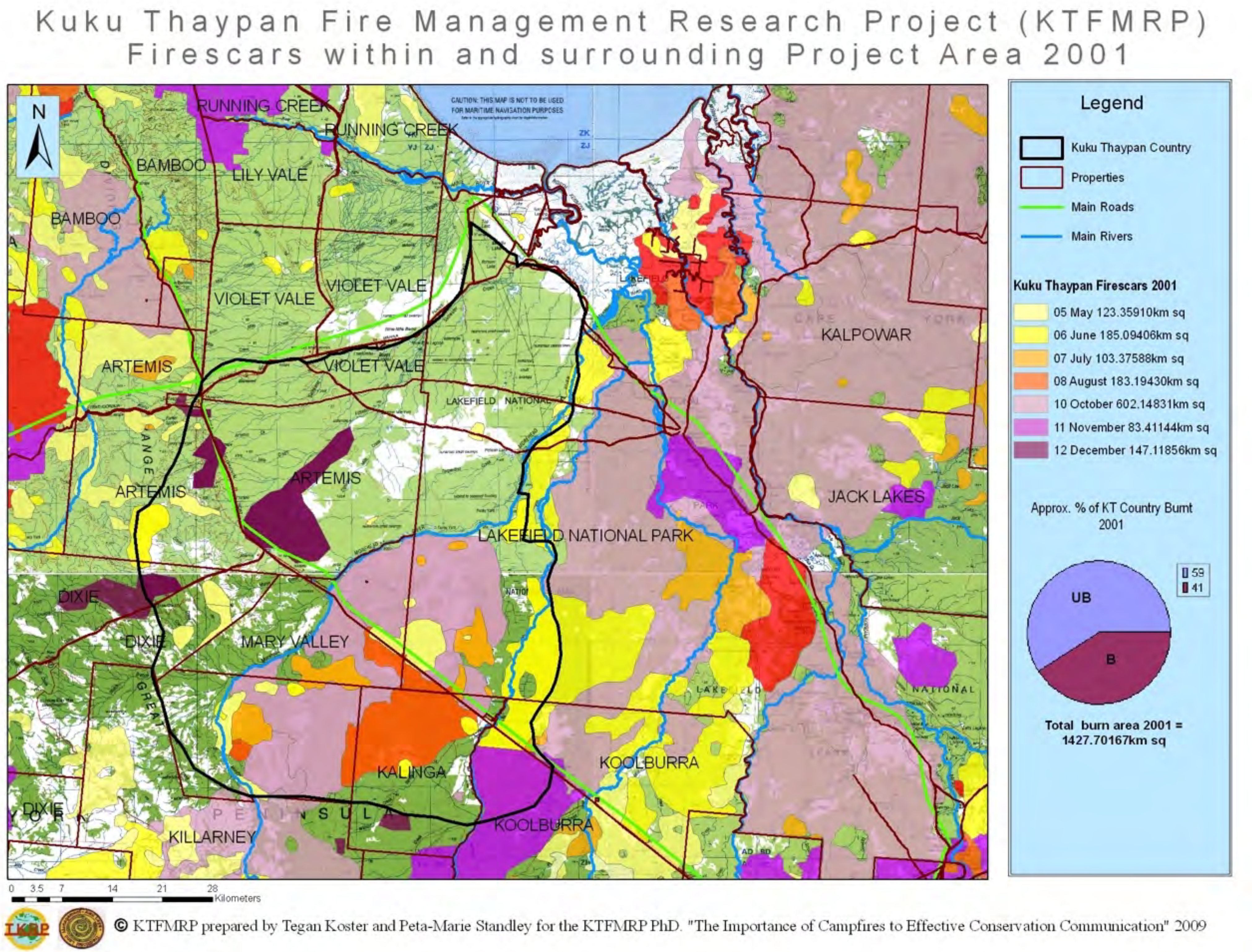


Map 6.9 Fire scars surrounding and within Kuku Thaypan country May – October 2000
Source: The Importance of Campfires GIS database 2009

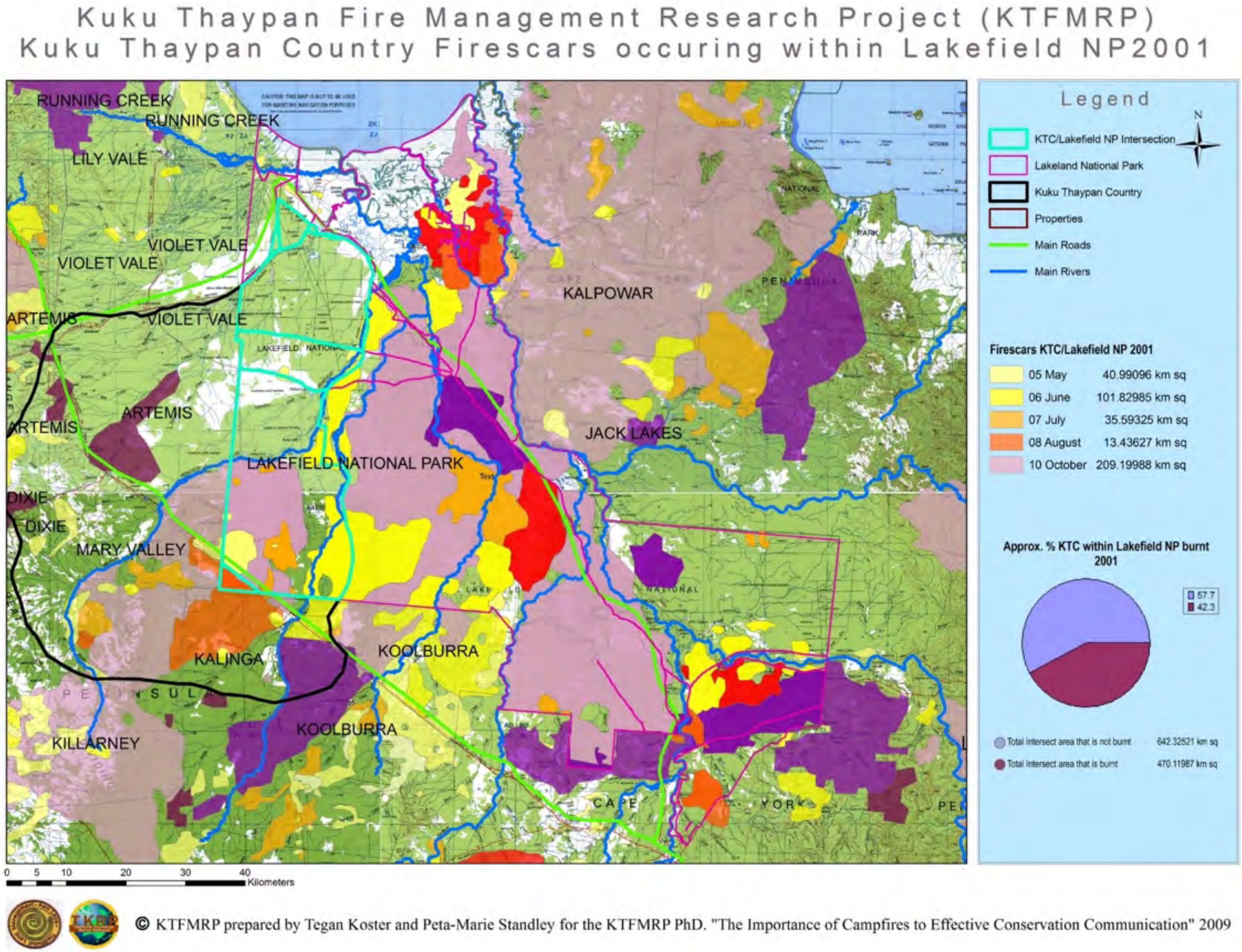
Kuku Thaypan Fire Management Research Project (KTFMRP)
Kuku Thaypan Country Firescars occuring within Lakefield NP2000



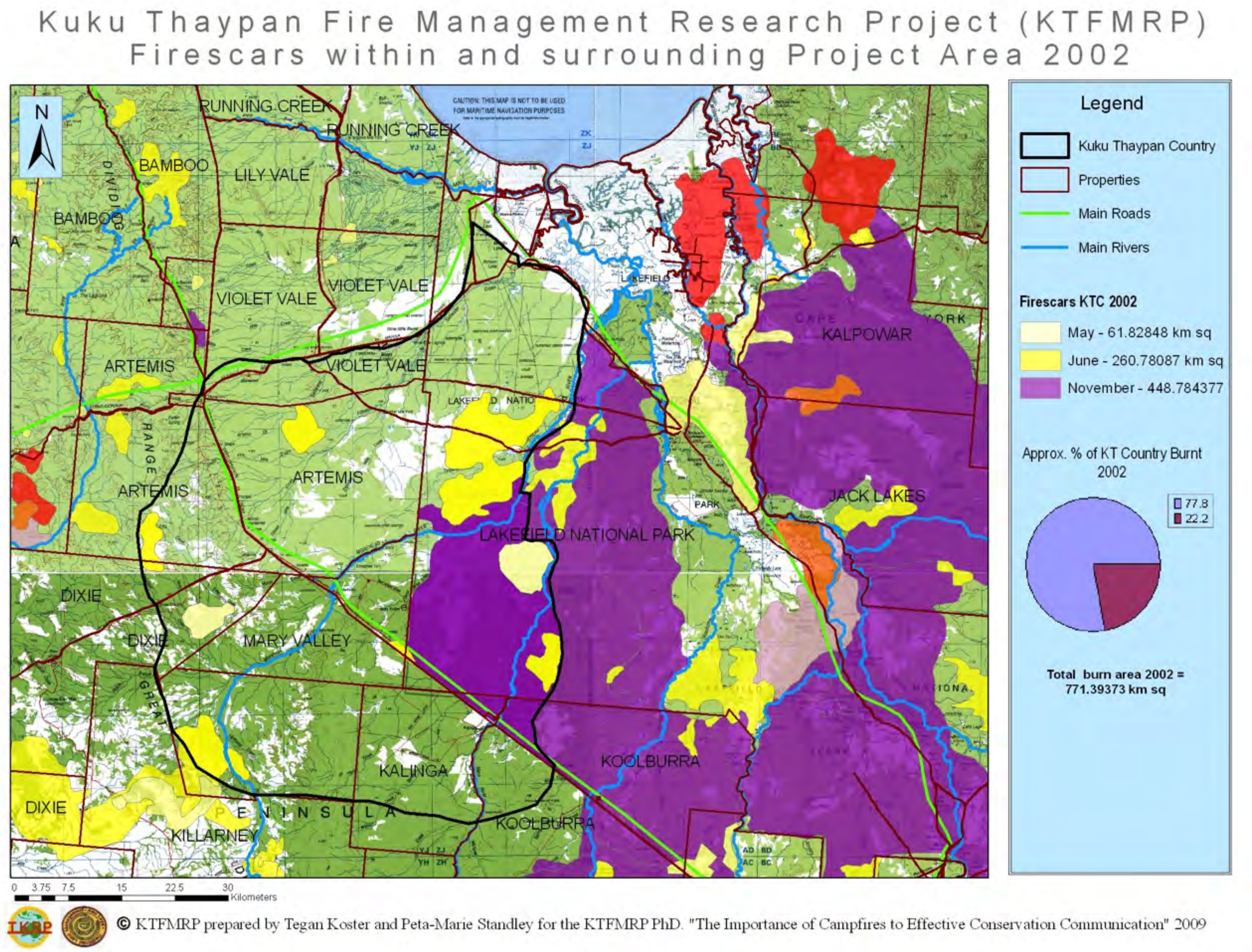
Map 6.10 A closer examination of the 2000 fire scars in the study AOI
Source: The Importance of Campfires GIS database 2009



Map 6.11 Fire scars surrounding and within Kuku Thaypan country April – December 2001
Source: The Importance of Campfires GIS database 2009

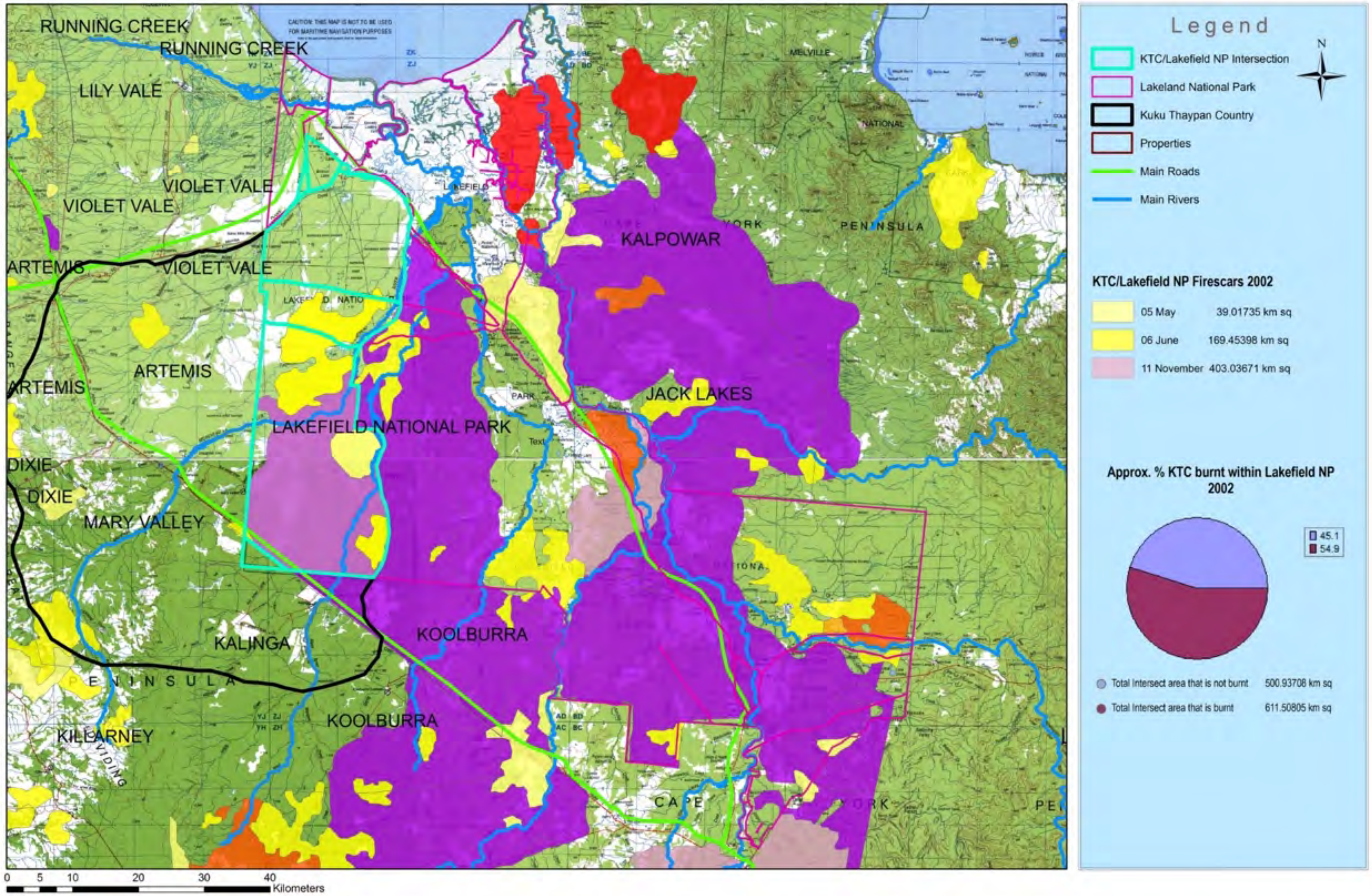


Map 6.12 A closer examination of the 2001 fire scars in the study AOI
Source: The Importance of Campfires GIS database 2009



Map 6.13 Fire scars surrounding and within Kuku Thaypan country April – December 2002
Source: Cape York Peninsula Development Corporation 2006

Kuku Thaypan Fire Management Research Project (KTFMRP)
Kuku Thaypan Country Firescars occuring within Lakefield NP2002



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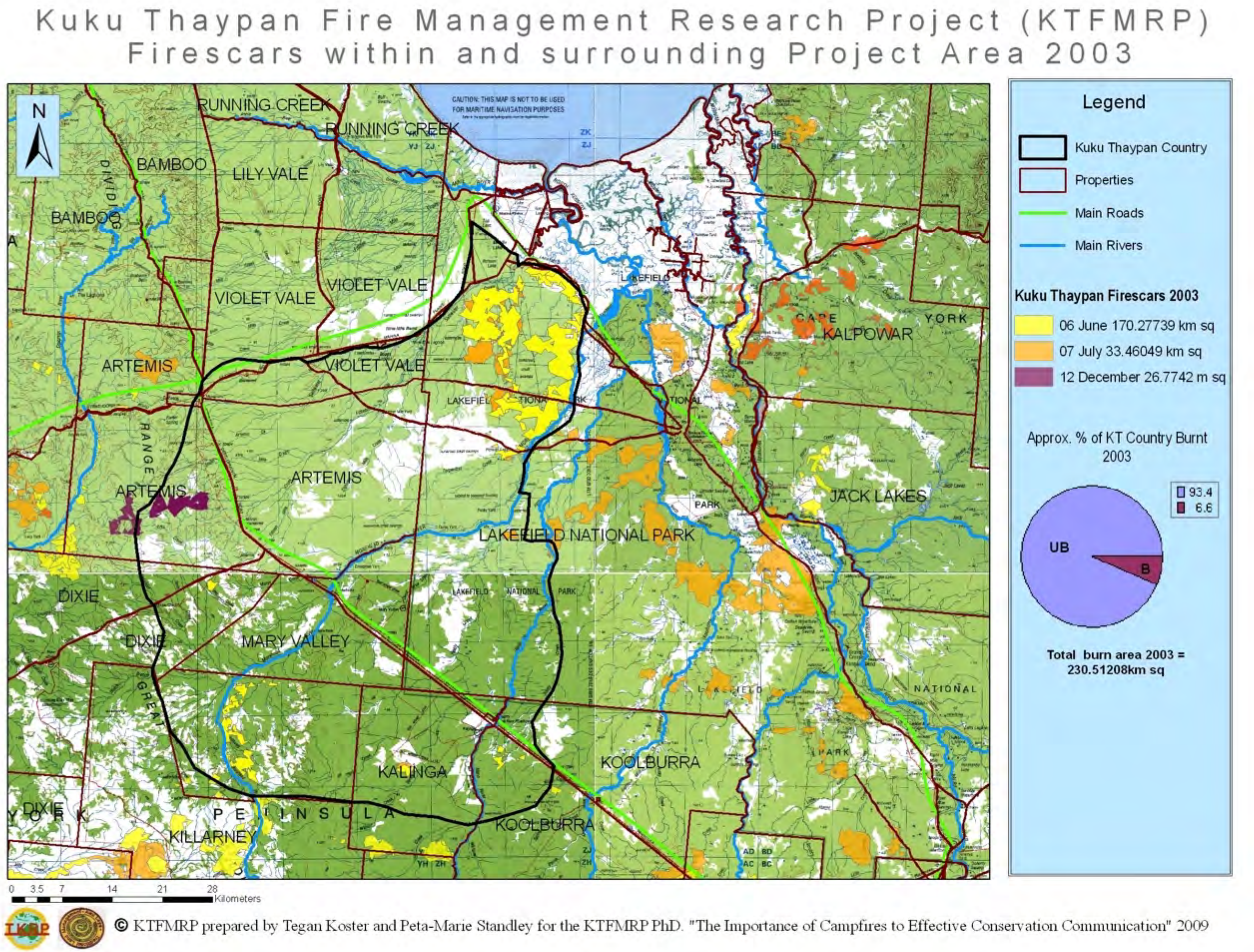
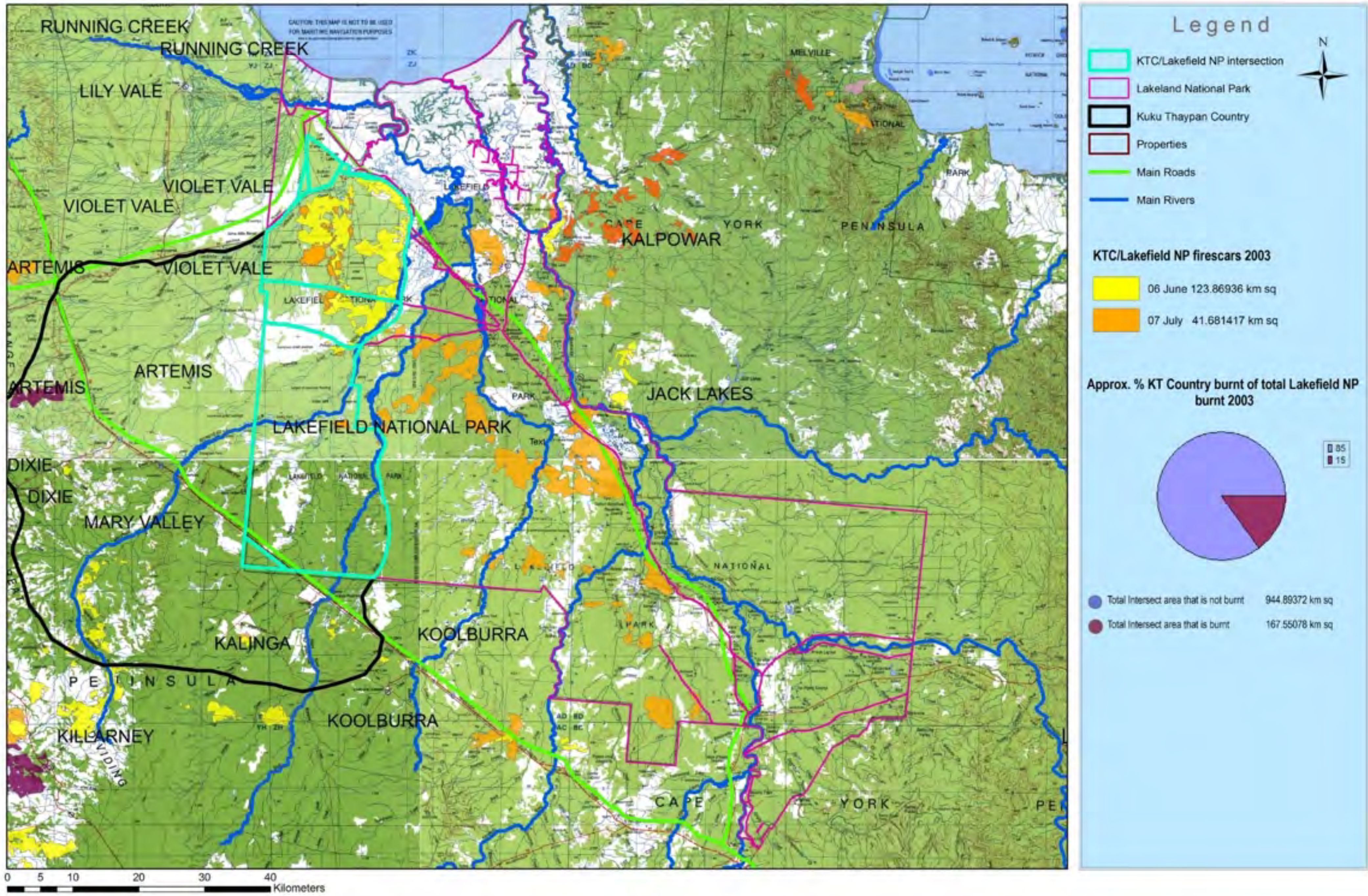
Map 6.14 A closer examination of the 2002 fire scars in the study AOI
Source: The Importance of Campfires GIS database 2009



Map 6.15 Fire scars surrounding and within Kuku Thaypan country June – December 2003
Source: Cape York Peninsula Development Corporation 2006

Kuku Thaypan Fire Management Research Project (KTFMRP)
Kuku Thaypan Country firescars occuring within Lakefield NP 2003



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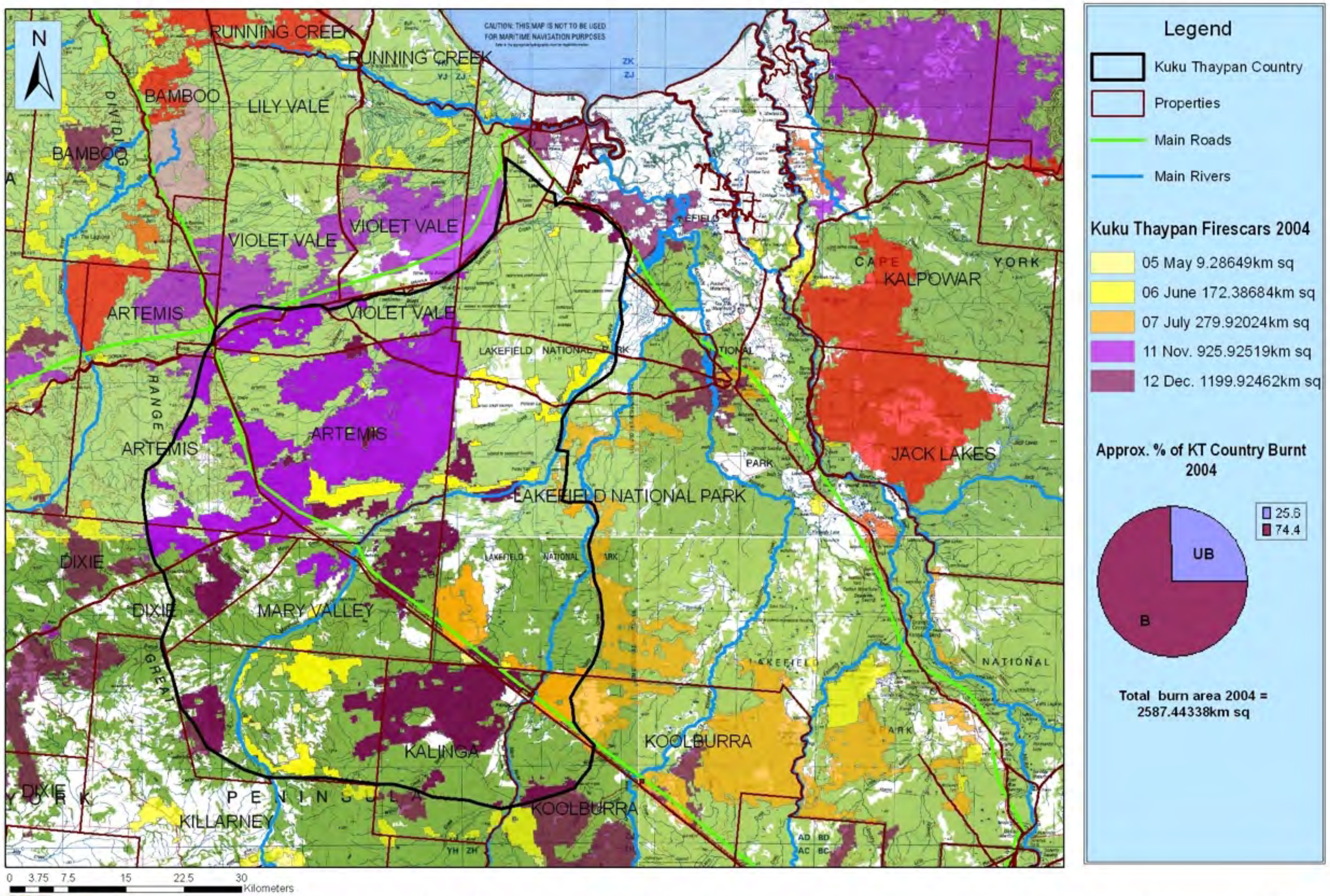
Map 6.16 A closer examination of the 2003 fire scars in the study AOI
Source: The Importance of Campfires GIS database 2009

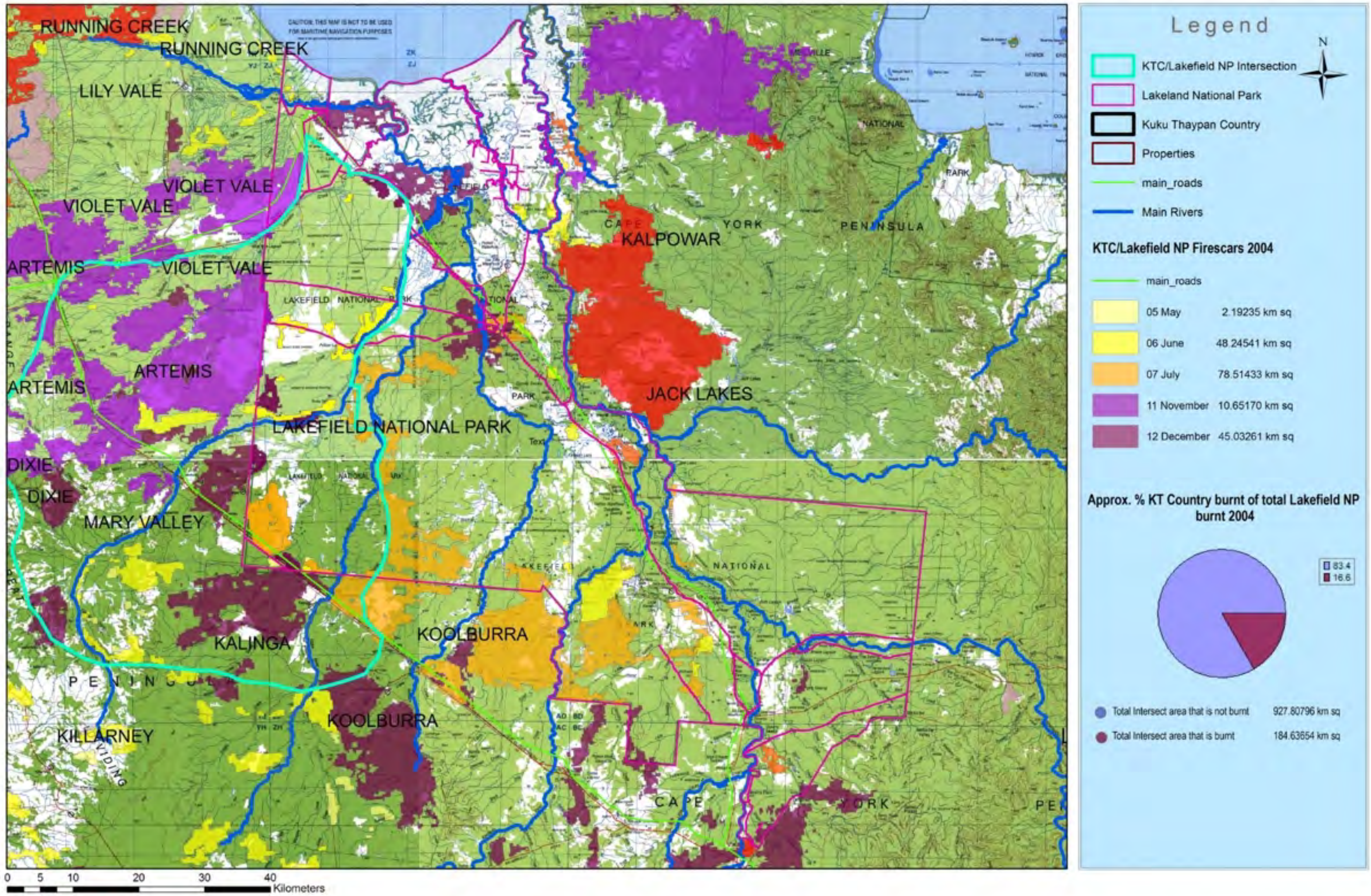
Kuku Thaypan Fire Management Research Project (KTFMRP)
Firescars within and surrounding Project Area 2004



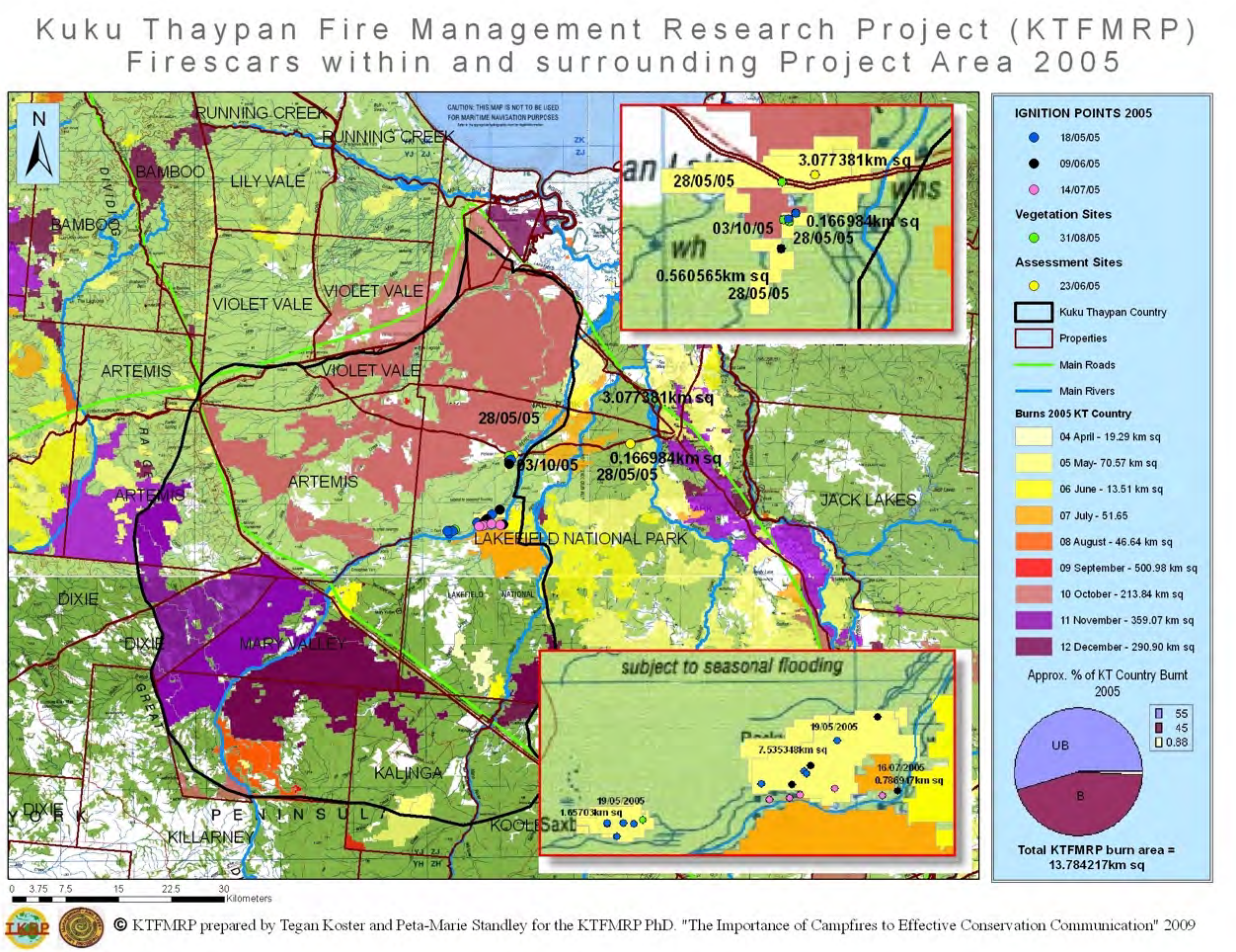
© KTFMRP prepared by Tegan Koster and Peta-Marie Standley for the KTFMRP PhD. "The Importance of Campfires to Effective Conservation Communication" 2009

Map 6.17 Fire scars surrounding and within Kuku Thaypan country April – December 2004
Source: Cape York Peninsula Development Corporation 2006

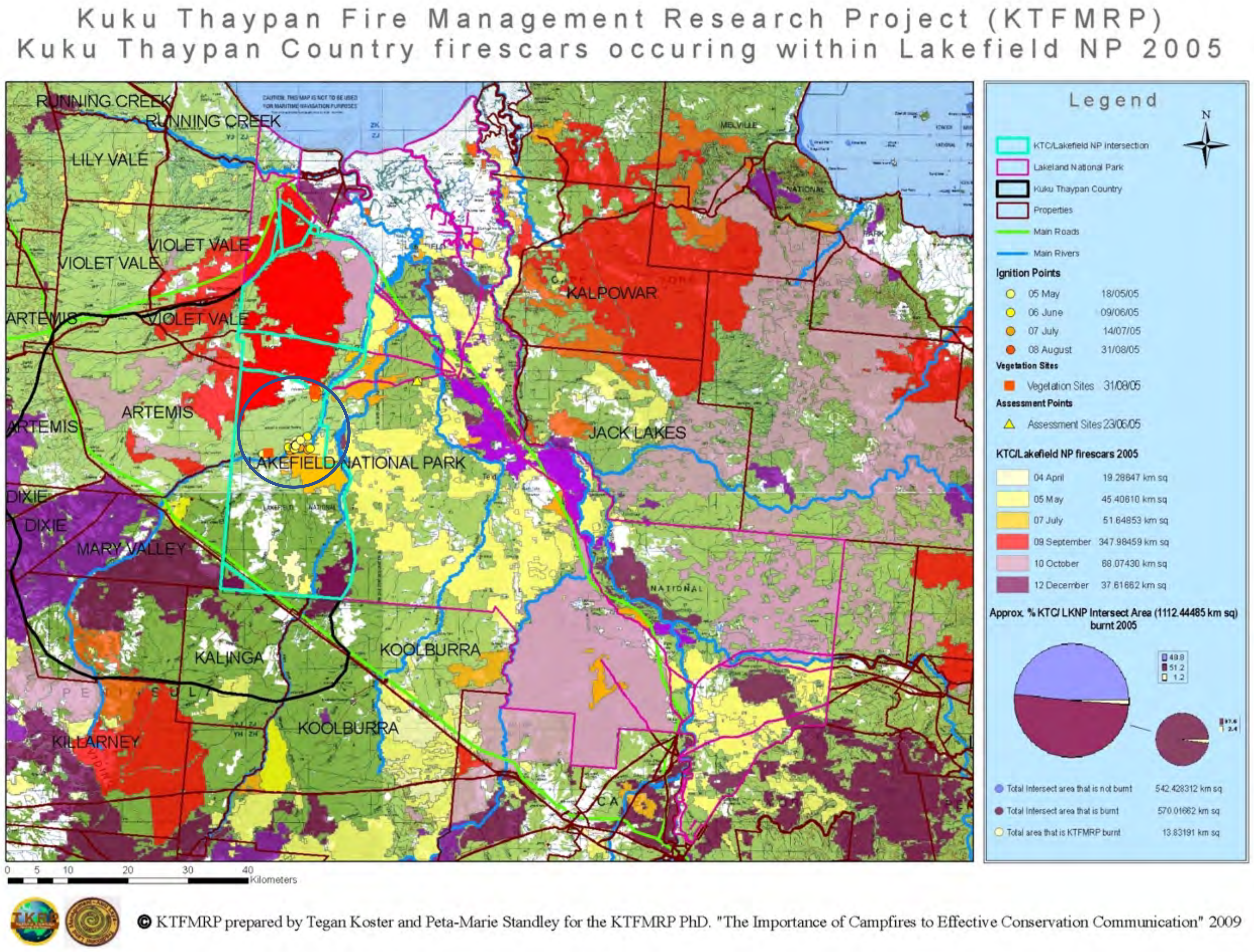
Kuku Thaypan Fire Management Research Project (KTFMRP)
Kuku Thaypan Country Firescars occuring within Lakefield NP2004



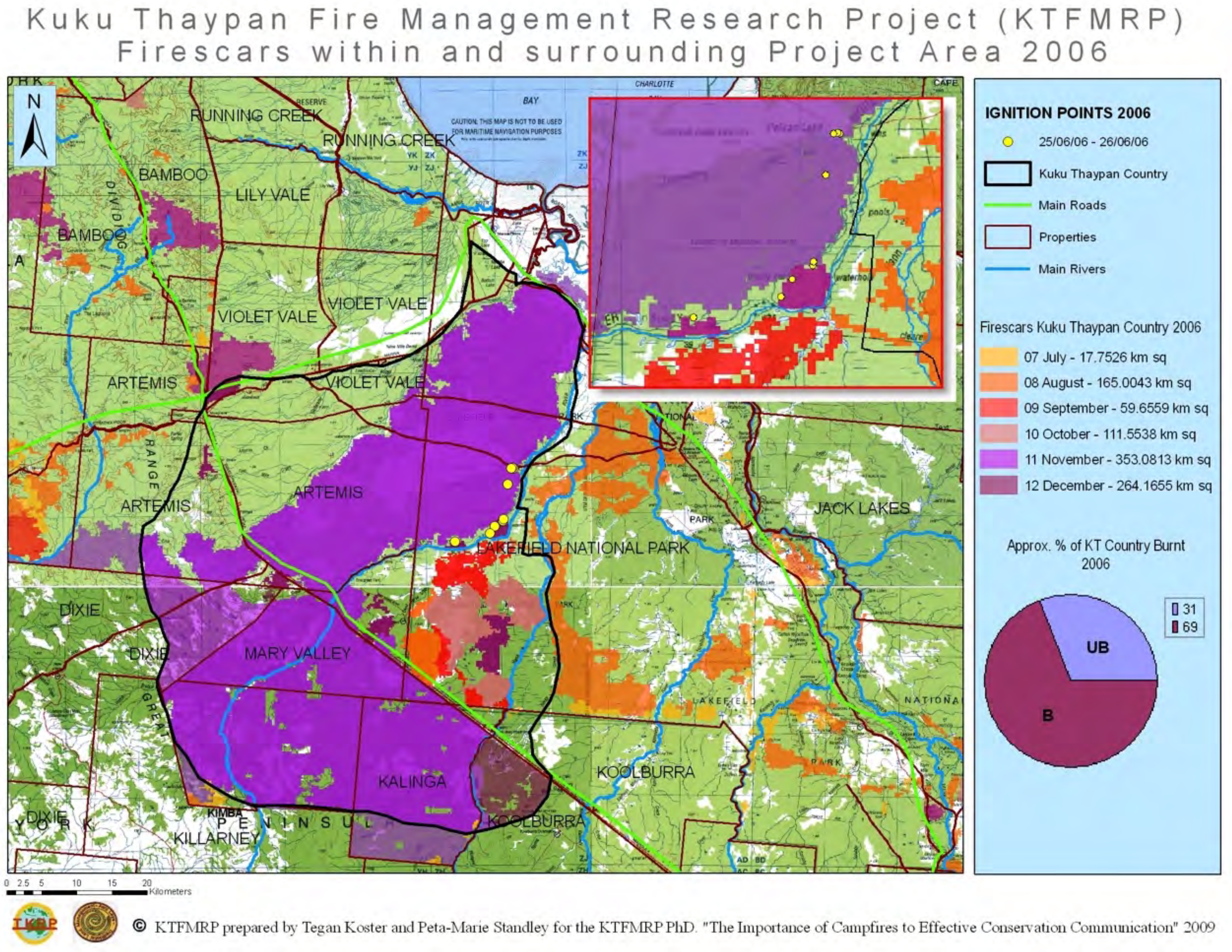
Map 6.18 A closer examination of the 2004 fire scars in study AOI
Source: The Importance of Campfires GIS database 2009



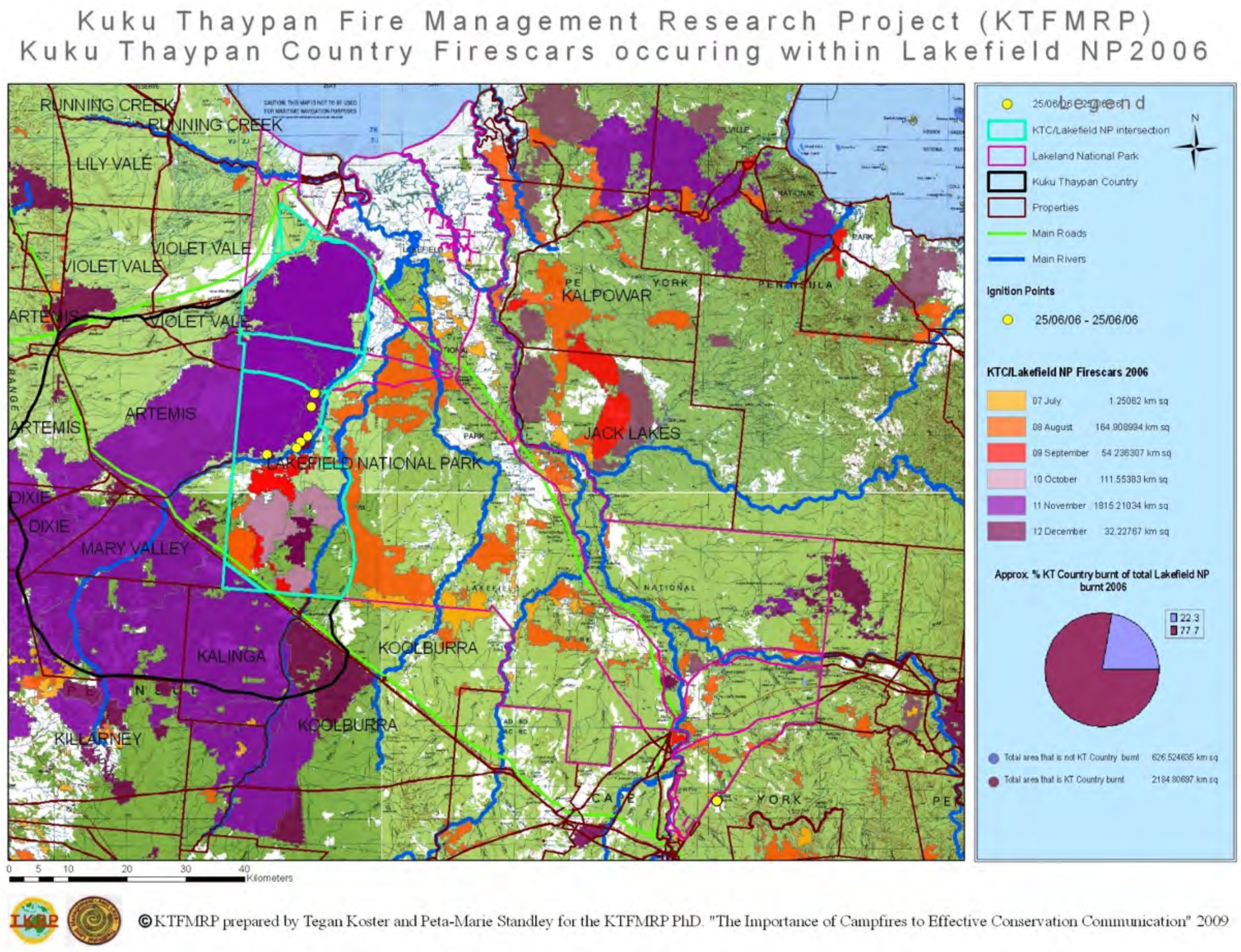
Map 6.20 Fire scars within and surrounding Kuku Thaypan Country April – November 2005
Source: Cape York Peninsula Development Corporation 2006



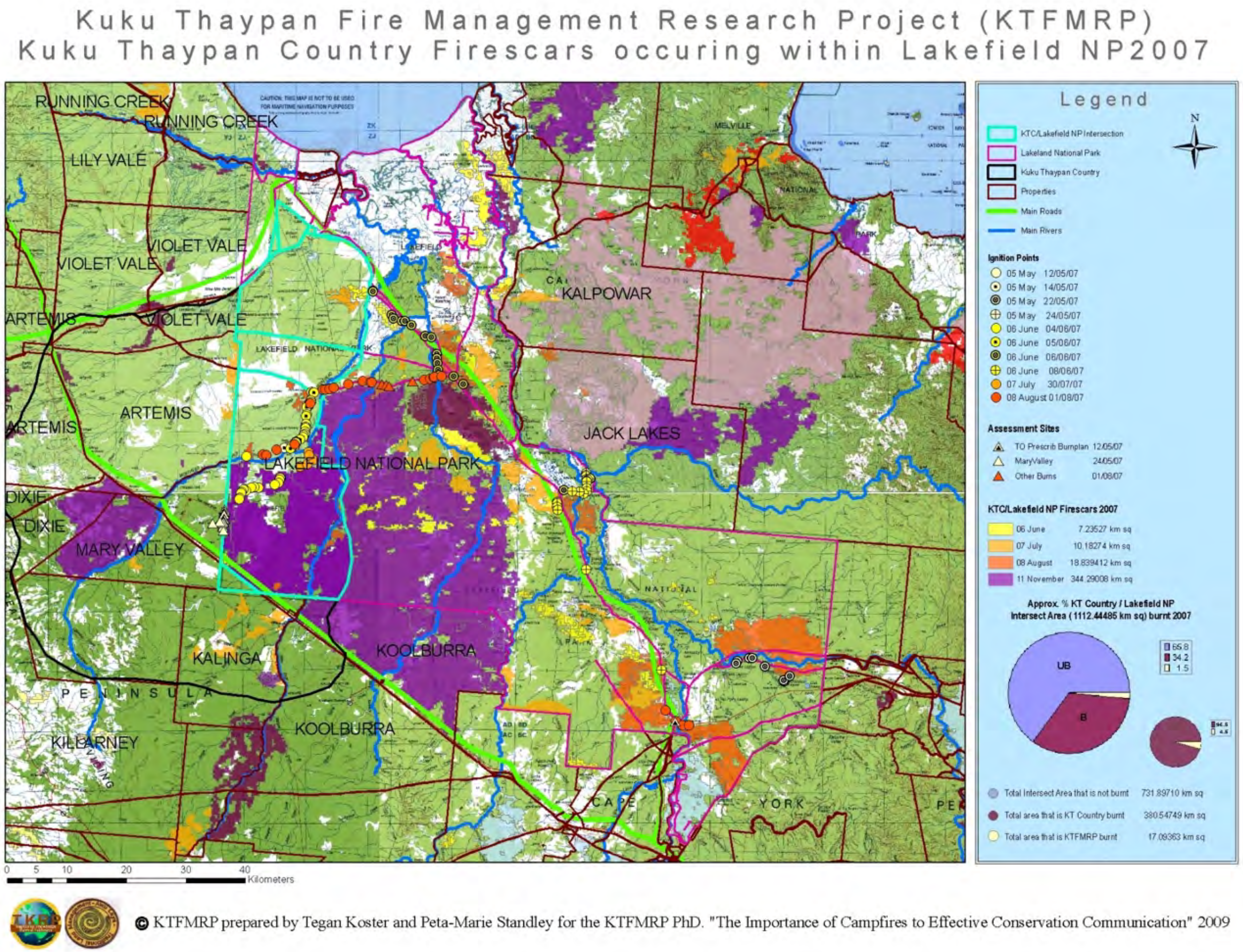
Map 6.21 A closer examination of the 2005 fire scars in the study AOI
Source: The Importance of Campfires GIS database 2009



Map 6.22 Fire scars surrounding and within Kuku Thaypan country April – August 2006, highlighting the Elders June burns were not detected.
Source: Cape York Peninsula Development Corporation 2006

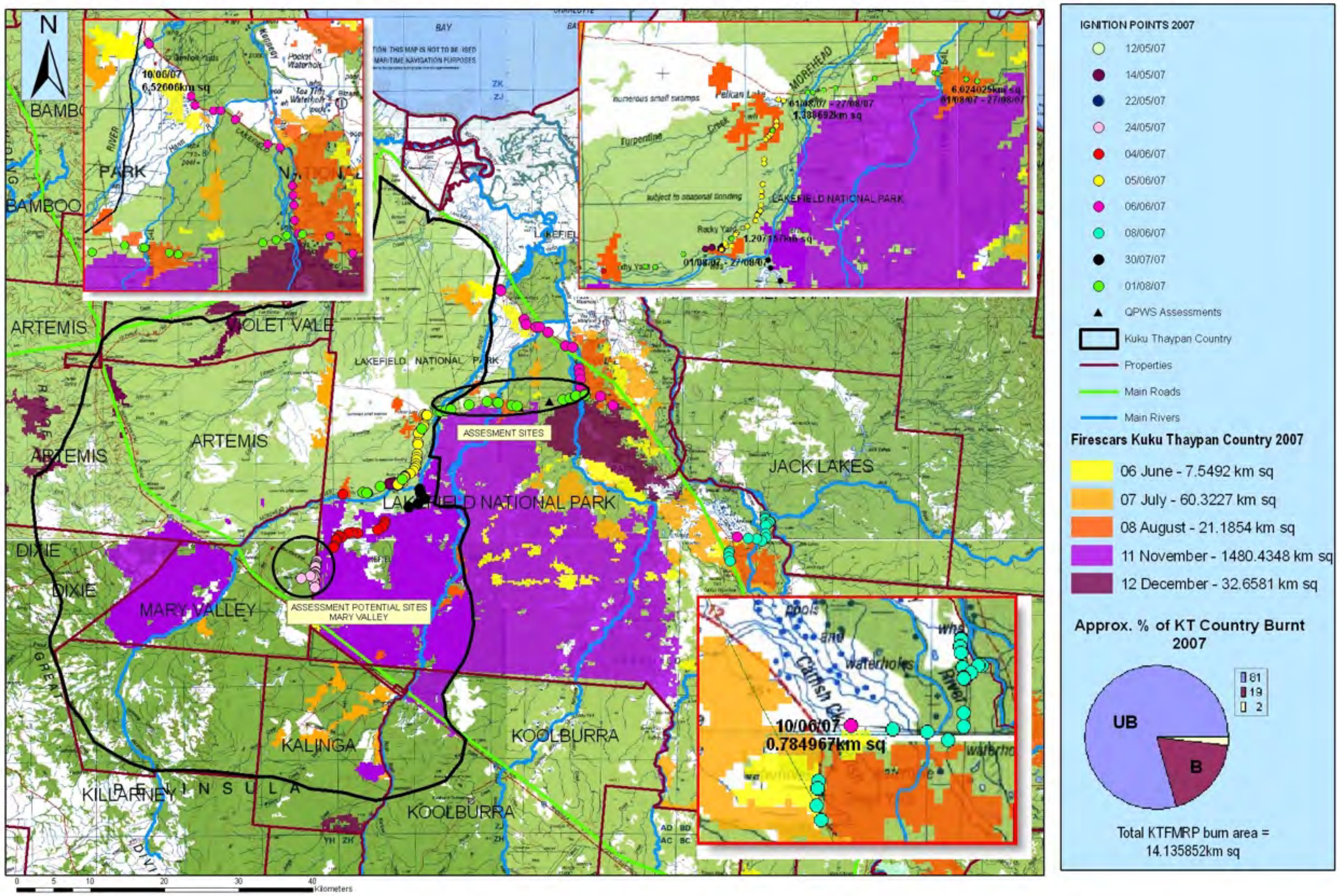


Map 6.23 Fire scars surrounding and within Kuku Thaypan country June –December 2006 highlighting burns conducted by research team in June 2006
Source: The Importance of Campfires GIS database 2009



Map 6.25 Fire scars surrounding and within Kuku Thaypan country 2007
Source: The Importance of Campfires GIS database 2009

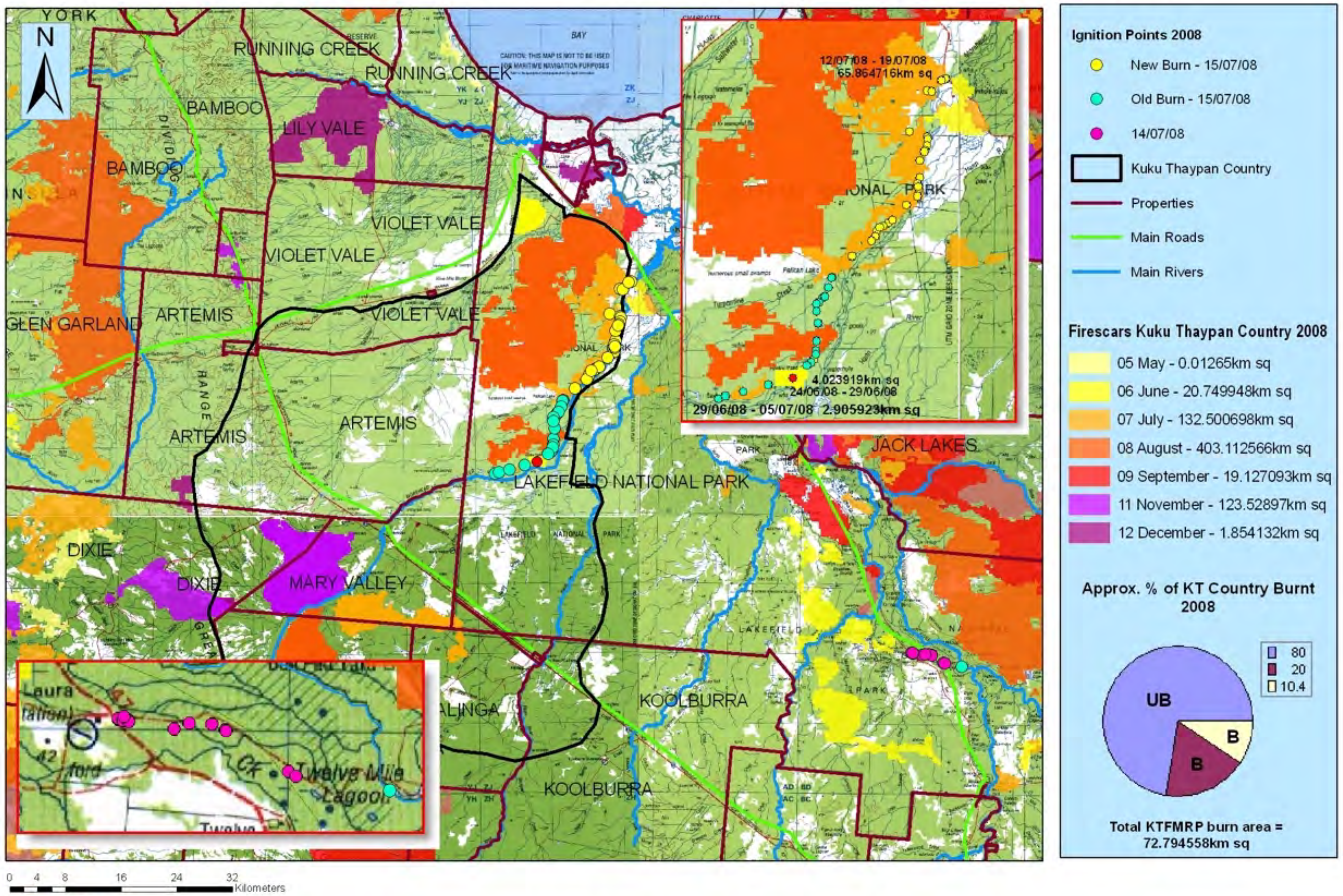
Kuku Thaypan Fire Management Research Project (KTFMRP)
Firescars within and surrounding Project Area 2007



© KTFMRP prepared by Tegan Koster and Peta-Marie Standley for the KTFMRP PhD. "The Importance of Campfires to Effective Conservation Communication" 2009

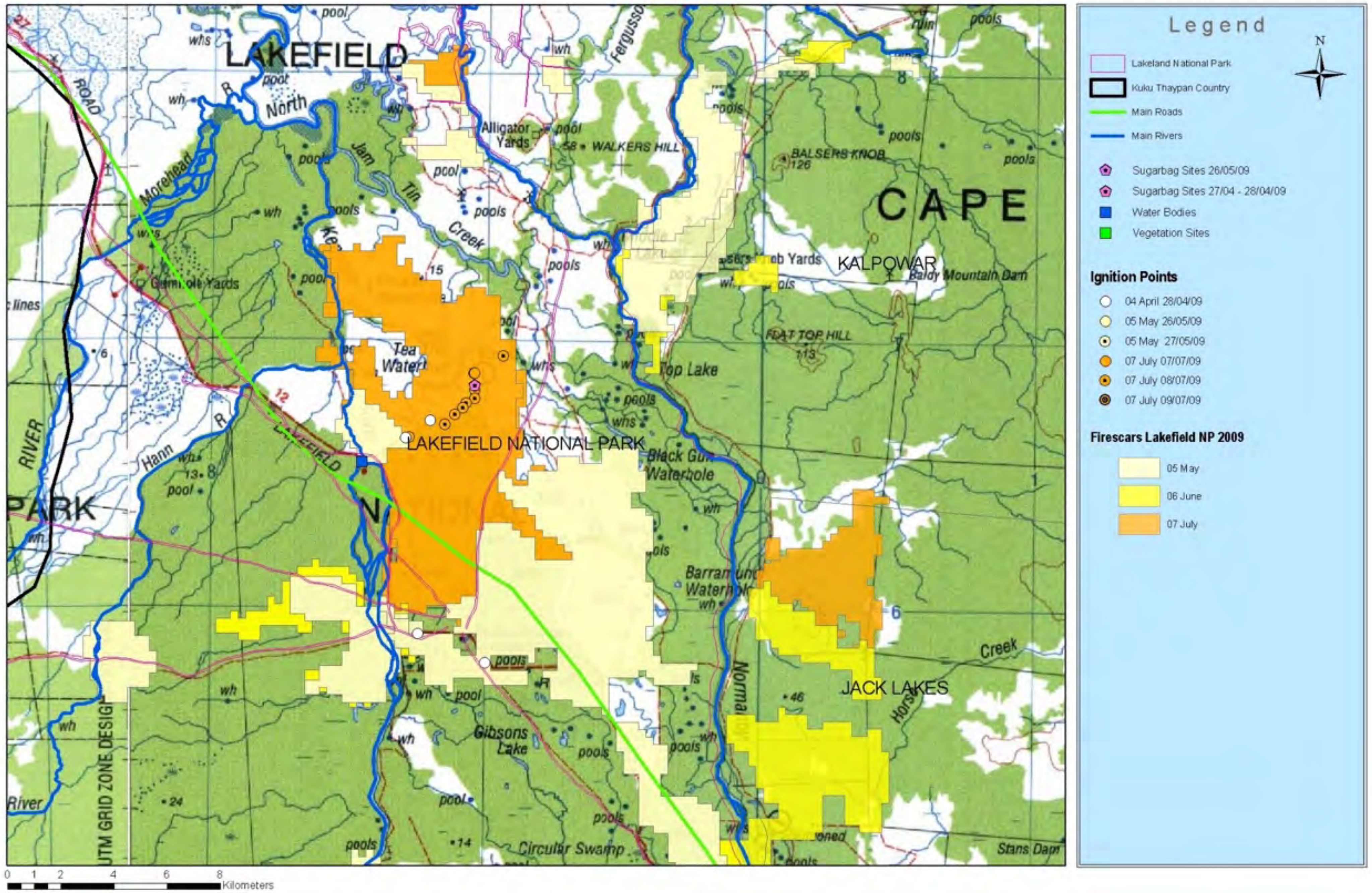
Map 6.26 Fire scars surrounding and within Kuku Thaypan country 2007
Source: The Importance of Campfires GIS database 2009

Kuku Thaypan Fire Management Research Project (KTFMRP)
Firescars within and surrounding Project Area 2008



© KTFMRP prepared by Tegan Koster and Peta-Marie Standley for the KTFMRP PhD. "The Importance of Campfires to Effective Conservation Communication" 2009

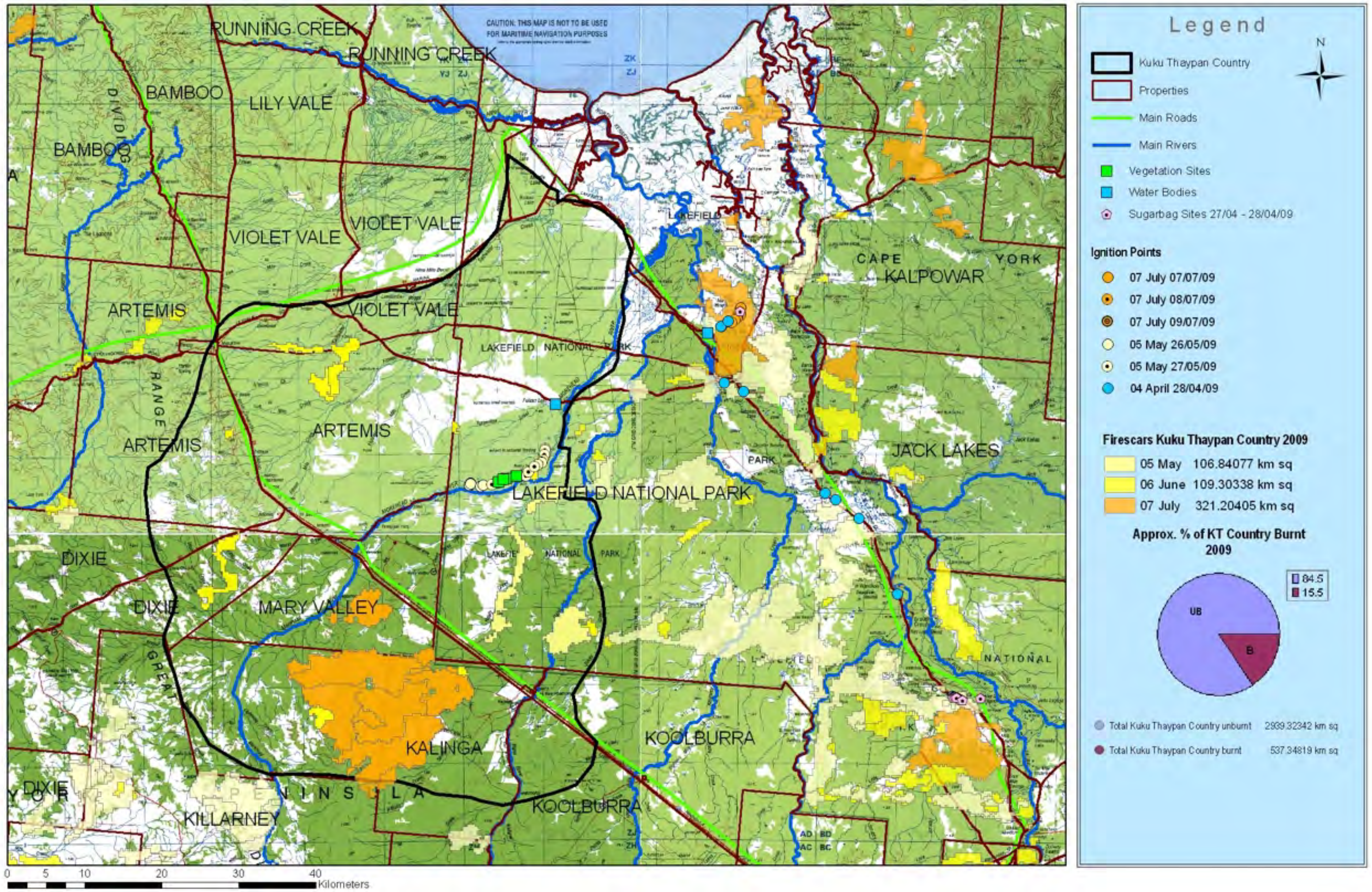
Kuku Thaypan Fire Management Research Project (KTFMRP)
2009 Waypoint Close View 1



© KTFMRP prepared by Tegan Koster and Peta-Marie Standley for the KTFMRP PhD. "The Importance of Campfires to Effective Conservation Communication" 2009

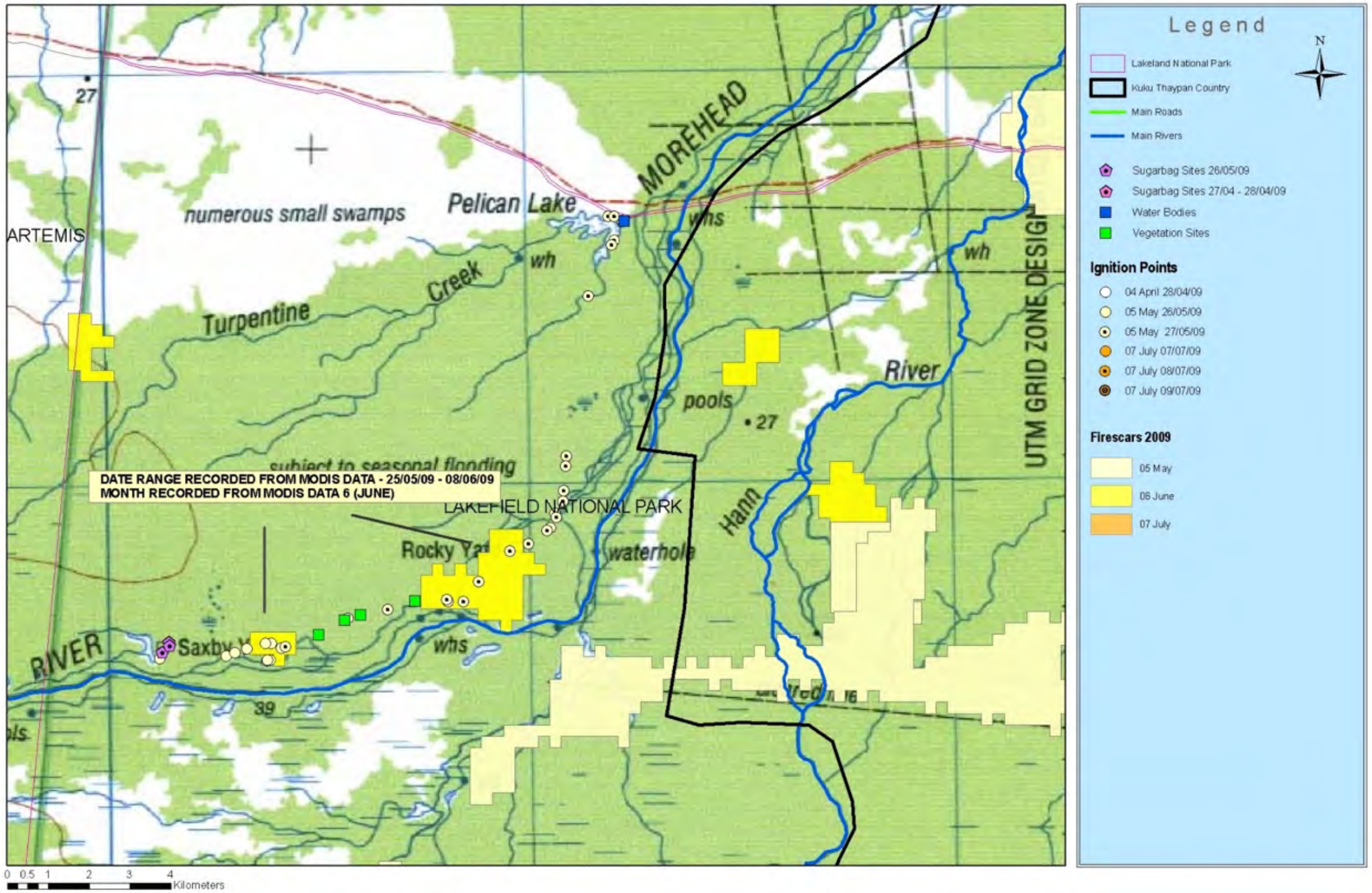
Map 6.27 Sugarbag sites recorded in 2009 and close up view of fire scar in July resulting from the first Indigenous fire workshop 2009
Source: The Importance of Campfires GIS database 2009

Kuku Thaypan Fire Management Research Project (KTFMRP)
Firescars within and surrounding Project Area 2009



Map 6.28 Project ignition points and fire scars 2009 in the study AOI
Source: The Importance of Campfires GIS database 2009

Kuku Thaypan Fire Management Research Project (KTFMRP)
2009 Waypoint Close View 2



Map 6.29 Zoom of project ignition points and fire scars 2009 in the study AOI Gno Coom (Saxby) and Rocky
Source: The Importance of Campfires GIS database 2009

Appendix 6.2

Table 6.2 Introduced flora and fauna recorded in the project area of interest and those that are identified as problem species in one or more locations in northern Australia and pose a potential risk in Kuku Thaypan country. Pests and potential pests on Kuku Thaypan Country

Group	Common Name	Scientific Name	Qld Status	National Status
Flowering Plants	American Rats Tail Grass	*Sporobolus jacquemontii*	Class 2	-
Flowering Plants	Awnless Barnyard Grass	*Echinochloa colona*	-	-
Flowering Plants	Butterfly Tree	*Bauhinia monandra*	-	-
Flowering Plants	Cinderella Weed	*Synedrella nodiflora*	-	-
Flowering Plants	Coffee Senna	*Senna occidentalis*	Class 2	-
Flowering Plants	Couch Grass	*Cynodon dactylon*	-	-
Flowering Plants	Flannel Weed	*Sida cordifolia*	-	-
Flowering Plants	Gamba Grass	*Andropogon gayanus*	-	-
Flowering Plants	Gambia Pea	*Crotalaria goreensis*	-	-
Flowering Plants	Grader Grass	*Themeda quadrivalvis*	-	-
Flowering Plants	Hyptis	*Hyptis suaveolens*	-	-
Flowering Plants	Indian Jujube	*Ziziphus mauritiana*	Class 2	-
Flowering Plants	Itchgrass	*Rottboellia cochinchinensis*	-	-
Flowering Plants	Lions Tail	*Leonotis nepetifolia*	-	-
Flowering Plants	Noogoora Burr	*Xanthium occidentale*	-	-
Flowering Plants	Olive Hymenachne	*Hymenachne amplexicaulis cv. Olive*	Class 2	-
Flowering Plants	Prickly Malvastrum	*Malvastrum Coromandelianum*	-	-
Flowering Plants	Purpletop Chloris	*Chloris inflata*	-	-
Flowering Plants	Roadside Leafbract	*Malachra fasciata var. lineariloba*	-	-
Flowering Plants	Rubber Vine	*Cryptostegia grandiflora*	Class 2	WONS
Flowering Plants	Sabi Grass	*Urochloa mosambicensis*	-	-
Flowering Plants	Sicklepod	*Senna obtusifolia*	Class 2	-
Flowering Plants	Slender Balloon Vine	*Cardiospermum Halicacabum*	-	-
Flowering Plants	Slender Balloon Vine	*Cardiospermum halicacabum var. halicacabum*	-	-
Flowering Plants	Spiny Sida	*Sida spinosa*	-	-
Flowering Plants	Stinking Passion Flower	*Passiflora foetida*	-	-
Flowering Plants	Townsville Stylo	*Stylosanthes humilis*	-	-
Flowering Plants	Woolly Morning Glory	*Argyreia nervosa*	-	-
Frogs	Cane Toad	*Rhinella marina*	-	KTP
Birds	Common Starling	*Sturnus vulgaris*	-	-
Birds	Nutmeg Mannikin	*Lonchura punctulata*	-	-
Birds	House Sparrow	*Passer domesticus*	-	-
Mammals	Agile Wallaby	*Macropus agilis*	-	-

Mammals	Dog	*Canis familiaris*	-	KTP
Mammals	Cat	*Felis catus*	Class 2	-
Mammals	Pig	*Sus scrofa*	Class 2	KTP
Mammals	European Cattle	*Bos taurus*	-	-

Status Codes:
1. National Status Codes: WONS, Weeds of National Significance
(Please call Exotic Plant Pest Hotline 1800 084 881 if you think you have seen this weed):
2. QLD Status Codes: Class 1, Uncommon in Queensland. Not to be introduced, kept, supplied or released. Must take reasonable efforts to eradicate:
Class 2, Established in Queensland. Not to be introduced, kept, supplied or released without permit. Must take reasonable efforts to eradicate:
Class 3, Established in Queensland. Not to be supplied without permit. Must be controlled in or near environmentally significant area

Source: Cape York Info net in (Standley et al., 2011)

Appendix 6

Table 6.3 Threatened species recorded in the vicinity of Kuku Thaypan country (1degree grid square)

Source: Perry, J in (Standley et al., 2011)

Group	Common Name	Scientific Name	Qld Status	National Status
Flowering Plants	Stemona	*Stemona angusta*	V	V
Flowering Plants	Cooktown Orchid	*Dendrobium bigibbum*	V	V
Flowering Plants	Orchid	*Dendrobium phalaenopsis*	V	V
Flowering Plants	Haresfoot Grass	*Ectrosia blakei*	V	V
Flowering Plants	Muellerargia	*Muellerargia timorensis*	E	-
Flowering Plants	Pigeon-pea	*Cajanus mareebensis*	E	E
Flowering Plants	Kurrajong	*Brachychiton vitifolius*	R	V
Flowering Plants	Jedda	*Jedda multicaulis*	V	V
Flowering Plants	Teucrium	*Teucrium ajugaceum*	E	-
Reptiles	Estuarine Crocodile	*Crocodylus porosus*	V	-
Fish	Bizant River Shark	*Glyphis glyphis*	-	CE
Birds	Red Goshawk	*Erythrotriorchis radiatus*	E	V
Birds	Buff-Breasted Button-Quail	*Turnix olivii*	V	E
Birds	Little Tern	*Sternula albifrons*	E	-
Birds	Golden-Shouldered Parrot	*Psephotus chrysopterygius*	E	E
Birds	Masked Owl (Northern Subspecies)	*Tyto novaehollandiae kimberli*	V	V
Birds	Gouldian Finch	*Erythrura gouldiae*	E	E
Birds	Crimson Finch	*Neochmia phaeton*	V	-
Mammals	Ghost Bat	*Macroderma gigas*	V	-
Mammals	Coastal Sheathtail Bat	*Taphozous australis*	V	-

1. National Status Codes (EPBC): CE, Critically Endangered: E, Endangered: V, Vulnerable: CD, Conservation Dependent.
2. QLD Status Codes (NCA): E, Endangered: NT, Near Threatened: R, Rare: V, Vulnerable.
Source: Cape York Info net in (Standley et al., 2011)

Appendix 6

Table 6.4 Unique historical records of faunal species of significance recorded on Kuku Thaypan country

Source: Perry, J in (Standley et al., 2011)

Common Name	**Scientific Name**
Large-footed Myotis	*Myotis macropus*
Grassland Melomys	*Melomys burtoni*
Northern Quoll	*Dasyurus hallucatus*
Yellow-footed Antechinus	*Antechinus flavipes*
Eastern Tube-nosed Bat	*Nyctimene robinsoni*
Northern Blossom-bat	*Macroglossus minimus*
Eastern Blossom-bat	*Syconycteris australis*
Eastern Horseshoe Bat	*Rhinolophus megaphyllus*
Common Bent-wing Bat	*Miniopterus schreibersii*
Fawn Leaf-nosed Bat	*Hipposideros cervinus*
Diadem Leaf-nosed Bat	*Hipposideros diadema*
Cape York Pipistrelle	*Pipistrellus adamsi*
Cape York Rat	*Rattus leucopus*
Spectacled Flying-fox	*Pteropus conspicillatus*
Black Flying-fox	*Pteropus alecto*
Little Red Flying-fox	*Pteropus scapulatus*
Common Spotted Cuscus	*Spilocuscus maculatus*
Common Brushtail Possum	*Trichosurus vulpecula*
Little Bent-wing Bat	*Miniopterus australis*
Hoary Wattled Bat	*Chalinolobus nigrogriseus*
Cape York Melomys	*Melomys capensis*
Spectacled Hare-wallaby	*Lagorchestes conspicillatus*
Giant White-tailed Rat	*Uromys caudimaculatus*
Southern Common Cuscus	*Phalanger mimicus*
Bare-backed Fruit-bat	*Dobsonia moluccense*
Water-rat	*Hydromys chrysogaster*
Striped Possum	*Dactylopsila trivirgata*
Short-beaked Echidna	*Tachyglossus aculeatus*
Agile Wallaby	*Macropus agilis*
Eastern Grey Kangaroo	*Macropus giganteus*
Sugar Glider	*Petaurus breviceps*
Greater Large-eared Horseshoe Bat	*Rhinolophus philippinensis*
Red-cheeked Dunnart	*Sminthopsis virginiae*
Red-legged Pademelon	*Thylogale stigmatica*
Dingo	*Canis lupus dingo*
Antilopine Wallaroo	*Macropus antilopinus*
Cinnamon Antechinus	*Antechinus leo*
Northern Brown Bandicoot	*Isoodon macrourus*
Black-footed Tree-rat	*Mesembriomys gouldii*
Beccari's Freetail Bat	*Mormopterus beccarii*
Swamp Wallaby	*Wallabia bicolor*
Cape York Rock-wallaby	*Petrogale coenensis*
Canefield Rat	*Rattus sordidus*
Delicate Mouse	*Pseudomys delicatulus*
Common Ringtail Possum	*Pseudocheirus peregrinus*
Common Wallaroo	*Macropus robustus*
Northern Broad-nosed Bat	*Scotorepens sanborni*

Black Rat	*Rattus rattus*
Dugong	*Dugong dugon*
Lesser Large-eared Horseshoe Bat	*Rhinolophus philippinensis*
Northern Nailtail Wallaby	*Onychogalea unguifera*
Ghost Bat	*Macroderma gigas*
Brush-tailed Phascogale	*Phascogale tapoatafa*
Godman's Rock-wallaby	*Petrogale godmani*
Southern Myotis	*Myotis macropus*
Bare-backed fruit bat	*Dobsonia moluccense*
Torresian tube-nosed bat	*Nyctimene cephalotes Pallas*
Water rat	*Hydromys chrysogaster*
Northern blossom bat	*Macroglossus minimus*
Eastern bent-wing bat	*Miniopterus schreibersii oceanensis*
Coastal sheathtail bat	*Taphozous australis*
Semon`s leaf-nosed bat	*Hipposideros semoni*
Whiptail wallaby	*Macropus parryi*
Fawn-footed melomys	*Melomys cervinipes*
Northern long-eared bat	*Nyctophilus arnhemensis*
Yellow-bellied sheathtail bat	*Saccolaimus flaviventris*
Common sheathtail bat	*Taphozous georgianus*
Long-nosed bandicoot	*Perameles nasuta*
Eastern cave bat	*Vespadelus troughtoni*
Northern freetail bat	*Mormopterus lumsdenae*
Eastern dusky leaf-nosed bat	*Hipposideros ater*
Golden-tipped bat	*Kerivoula papuensis*
Bare-rumped sheathtail bat	*Saccolaimus saccolaimus nudicluniatus*
Sulphur-Crested Cockatoo	*Cacatua galerita*
Red-Tailed Black-Cockatoo	*Calyptorhynchus banksii*
Inland broad-nosed bat	*Scotorepens balstoni*
Tube-nosed insectivorous bat	*Murina florium*

Appendix 10.1 Publications

Standley, P., Steffensen, V., George, T. (2011) Three Action Research Projects: (i) Traditional Knowledge Revival Pathways Fire Program, (ii) Kuku Thaypan Fire Management Research Project and (iii) The Importance of Campfires to Effective Conservation – Cape York Peninsula. EMR Project Summaries, Journal of Ecological Management and Restoration. http://site.emrprojectsummaries.org/2012/01/26/three-action-research-projects-itraditional-knowledge-revival-pathways-fire-program-iikuku-thaypan-fire-management-research-project-and-iiithe-importance-of-campfires-to-effective-conservation-2/

Statement of contribution: Lead Author

Standley, P., Steffensen, V., George, T. (2011) Threats to Native Bees (Sugarbag) Project – one of the pathways of the Traditional Knowledge Revival Pathways Kuku Thaypan Fire Management Program. EMR Project Summaries, Journal of Ecological Management and Restoration. http://site.emrprojectsummaries.org/2012/01/26/threats-to-native-bees-sugarbag-project-one-of-the-pathways-of-the-traditional-knowledge-revival-pathways-kuku-thaypan-fire-management-program/

See:

Statement of contribution: Lead Author

Hill, Rosemary, Turpin, Gerald, Canendo, Warren, Standley, Peta-Marie, Crayn, Darren, Warne, Sarah-Jane, Keith, Katrina, Addicott, Eda, and Zich, Frank (2011) *Indigenous-driven tropical ethnobotany.* Australasian Plant Conservation, 19 (4). pp. 24-25.

Statement of contribution: contributor

Standley, P.-M., Bidwell, N. J., George, T. S., Steffensen, V., & Gothe, J. (2009). Connecting communities and the environment through media: Doing, saying, and seeing along Traditional Knowledge Revival Pathways. *3C Media: Journal of Community, Citizen's and Third Sector Media and Communication*(5), 9-27.

Statement of contribution: Lead Author

Bidwell, N. J., Standley, P.-M., George, T., & Steffensen, V. (2008). *The landscape's apprentice: lessons for place-centred design from grounding documentary*. Paper presented at the Proceedings of the 7th ACM conference on Designing interactive systems.

Statement of contribution: Lead Author/significant contribution with supervisor taking alphabetical approach to publication.

Browning, D., Bidwell, N. J., Hardy, D., & Standley, P.-M. (2008). *Rural encounters: cultural translations through video*. Paper presented at the Proceedings of the 20th Australasian Conference on Computer-Human Interaction: Designing for Habitus and Habitat.

Statement of contribution: Minimal contribution case study summary and editorial overview

Conferences and presentations

Ecological Society of Australia (2011) *Ecology in a changing environment.* Hobart. Indigenous symposium presentation.

Standley, P. (2012) *Carrying and Communicating Fire: Building Relationships and frameworks for creating change,* Indigenous Knowledge Forum. Indigenous knowledge and biodiversity in India and Australia. University of Technology, Sydney.

Firesticks Symposium, University of Technology Sydney. 2011 Mentorship of TKRP and research project to NSW

Cape York and Victoria fire knowledge exchange 2011 and 2012 see

http://www.youtube.com/watch?v=3X_9nT7jfo4

http://mojowire.net.au/tag/peta-marie-standley/

Australia and NZ Ecological Society Conference Indigenous Symposium Presentation NZ 2011

National NRM Knowledge Conference Launceston. Conference presentation, interview on ABC radio and meeting with Elders and staff at Tasmania Aboriginal Centre. 2013

Fire Forum Orange NSW Central Tablelands and Lighting the Path burn workshop Girralang 2014

Indigenous Interactions with the Environment Forum Victoria

Successful grants and Reports

Standley, P., and Hill, R. (Eds.). 2011. Exploring the potential for Indigenous-driven tropical ethnobotany. *Report of the tropical Indigenous ethnobotany centre workshop on the cultural use of plants. Cairns, November 19th 2010.* CSIRO: Cairns.

Standley, P. 2005 *Support to Elders for Kuku Thaypan Fire Management Research Project*. TKRP – Traditional Knowledge Revival Pathways for Northern Australian Environmental Alliance.

Standley, P. 2006/2007 *Kuku Thaypan Fire Management Research Project*. TKRP - Traditional Knowledge Revival Pathways. Contribution of location data and facilitation of field trips for University of California Davis – NOAA funded "Improvement of Forecast Communication and Use between Indigenous and Governmental Groups in Australia: Managing Fire in Arid and Semi-Arid Lands under Conditions of Inter-annual Climate Variability" and linked Monash University PhD research project **"**Environmental variables and human factors influencing fire activity under inter-annual climate variability in northern Australia."

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Standley, P. 2010 Traditional Knowledge Revival Pathways. Caring For Our Country Open grants program. TKRP - Traditional Knowledge Revival Pathways. Department of Environment, Water, Heritage and the Arts.

Standley, P. 2010 Sugarbag Project TKRP Threats to Native Bees and their potential as an indicator species for Woodland Health. TKRP - Traditional Knowledge Revival Pathways. Department of Environment, Water, Heritage and the Arts, Biodiversity sub-program

2010 TKRP *KTFMRP Kuku Thaypan Fire Management Research Project Traditional Knowledge Fire Training, mentorship and exchange program*. TKRP - Traditional Knowledge Revival Pathways. Department of Environment, Water, Heritage and the Arts

Support for delivery of Green Army project working with Kuku Thaypan descendants 2016 - 2017

Workshops, documentaries and AV material

Contribution annually to the development of the workshops, the monitoring and indicators masterclass delivery and workshop documentation processes.

Cape York Indigenous Fire Workshops to National Indigenous fire workshop co-organiser and workshop mentor 2009 – current see links to all fire workshops films as listed in Table 3.2 in Chapter 3.

Mulong (2007) Fire and the Story. DVD and played on NITV contribution editing script

CD Awu Laya songlines Story translation. Cover Photo contribution.

Stories

Children's story book of the Campfires research project 2007. Revised 2017

Posters

TKRP KTFMRP The Importance of Campfires Firesticks NSW mentorship project

OCHRE a 4 x Connected Poster Series presenting NAFI data for years of the project using visual communication with Elders quotes and showcasing the research project

Web site content contributions

www.capeyorkfire.com.au

http://fire.capeyorknrm.com.au/

http://www.youtube.com/watch?v=JOaHCByWBhw&list=UU1cmtne0AndG1Sa3Ze7OTuA

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Media

Over 11 radio interviews and 16 web site references on the research methodologies, 12 newsletter articles, two brochures.

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