

Ngalak koora koora djinang* (Looking back together): a Nyoongar and scientific collaborative history of ancient Nyoongar *boodja

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***Abstract:** The Synergies of Meaning Research Project, based at Kurongkurl Katitjin, Edith Cowan University, constructs a working relationship between traditional Aboriginal knowledge and Western natural and social scientific knowledge. The aim is to find ways of going forward together. One recently completed focus, Nyoongar Boodja, required the development of a collaborated timeline of the formation of Nyoongar land. Cooperative inquiry and research of narrative methods were used. Eleven eras are identified, with the focus of the first eight being land from (1) The Nyetting (The cold, dark time = Permian ice ages 350 million years ago) to (8) Wardanaak boodja (The Holocene flood, 7000 years ago). Astonishing resonances between the knowledge sets were discovered. This coincidence of Nyoongar-inherited lore with Western scientific discoveries about the evolution of Nyoongar boodja highlights the value of walking together, cross-culturally, seeking synergies of meaning.*

Introduction

A convergence of accounts of natural phenomena, such as glaciations, meteorites and sea level rises, in Aboriginal culture and Western science is

very recent (e.g. Nunn and Reid 2015). There are a number of contributing factors; first, a thorough understanding of natural phenomena has only emerged in Western science in the past century

— for example, the theory of plate tectonics was accepted by the scientific community as recently as 1965 (Blacket et al. 1965). Second, Aboriginal people have perhaps only recently been able to trust that sacred cultural material such as creation stories will be respected. There was also a problem in that Western science understood that memories of people and events were no longer accurate after 500–800 years because they became buried in the embellishments of narrators (Nunn and Reid 2015). Nyoongar people of the west coast of Western Australia, for example, were laughed at when they spoke of a time when people used to walk out beyond what is now Rottnest Island (Stasiuk 2015). Aboriginal accounts of sea level rises associated with the Holocene warming were found to be accurate despite being 7000 years old (Nunn and Reid 2015).

The existing global literature on the topic is limited; convergence of accounts is explored for cosmogenic mega tsunami (Bryant et al. 2007), meteoric events (Hamacher 2011) and astronomy (Hamacher and Norris 2011). These convergent explorations come up with certain propositions on our general topic. Available evidence is insufficient in certain areas. We sought to fill key gaps in knowledge and test the hypothesis that there may be accounts of major events in the origin of country, due to the incisive natural history observations of first peoples, and the rigour in hypothesis testing emerging from the application of Western science to parallel curiosity about geomorphological and biological evolution.

The project described in this paper aimed to highlight the richness of Nyoongar knowledge about *boodja* (country) and compare insights from collaborative discussions in a documentary film (*Synergies: walking together — belonging to Country* 2015) between a senior Nyoongar Elder (Nannup) and a prominent Western scientist (Hopper). These discussions are amplified by a wider reading of the literature, and a new system of eras in the history of *boodja* is derived, giving equal prominence to concordant Nyoongar and Western science knowledge system narratives. This paper describes the eras and explores the interface between the two knowledge sets. The expression of convergent accounts enables the fullness of Aboriginal culture to be more

accessible to all people, and is an innovative direction in communicating science.

Primary outputs of this collaboration include a documentary film (funded by Lotterywest), *Djena koorliny danjoo boodjar-ang (Synergies: walking together — belonging to Country* 2015). The film involved a walk along the Swan River from its source at Walyunga to its entrance at Fremantle. In it Noel Nannup and Stephen Hopper discuss Nyoongar and Western science perspectives on the significance of the *boodja* they traverse, prompted by questions compiled by Glen Stasiuk and Francesca Robertson. This narrative was then researched and assembled as this paper by Robertson, in consultation with the other co-authors, identifying concordant eras of major events in the history of Nyoongar *boodja*. We cite relevant published literature and indicate sources of evidence derived from Nyoongar oral history. Key references are Nannup (2006a, 2006b, 2006c) for a Nyoongar perspective and Hopper et al. (1996) for a Western science review.

Methodology

In 2013 staff of Kurongkurl Katitjin, Centre for Indigenous Australian Education and Research at Edith Cowan University, embarked on a project to seek synergies of meaning in the meeting place between traditional Nyoongar wisdom and Western social and natural sciences. This *koodjal jinnung* (looking both ways) exploratory research approach was first developed by Pincher Nyurmiyarri in 1976 as a way of developing the primary and secondary educational setting to re-establish learning/teaching relationships between old and young and heal rifts in the transmission of traditional knowledge through the interference of schools (Ober and Bat 2007:70).

Staff at the Batchelor Institute of Indigenous Tertiary Education (2007:4) developed the concept and defined it in 2007 as a philosophy of education that ‘brings together Indigenous Australian traditions of knowledge and Western academic disciplinary positions and cultural context, and embraces values of respect, tolerance and diversity’. In this project the philosophy of both ways, and particularly the first principle of both ways being a shared learning journey (Ober and Bat 2008), is applied in a research setting. The project

was conducted with ethics approval from Edith Cowan University (document no. 11054).

Koodjal jinnung, as expressed here, is essentially a cross-cultural collaboration involving two fundamentally different approaches — Western science underpinned by Cartesian philosophy, which is about seeing objects, and traditional Nyoongar knowledge, which is about signs, story and relationships.

The methodology relied on a new and synergistic combination of existing research methodologies and techniques, all from the qualitative arena, and included co-operative inquiry and research of narrative. This approach is typically found in the humanities in disciplines such as education, psychology, social work and anthropology. Heron (1996) described the fundamentals of co-operative inquiry as research conducted in collaboration with, rather than on, people. The purpose of such research is to understand, make sense of the world and create new ways of looking at things. This can be taken a step further into action research to develop ways of changing existing practices. This typically uses a praxis intervention method, which follows a four-step process of planning, action, observing and reflecting (McNiff 2013). Co-operative inquiry is usually used to develop shared ontology and epistemology in social services (Heron 1996). In this project co-operative enquiry and action research techniques are used to establish the principle of collaboration and of persistent reflexivity between the knowledge sets. Research of narrative is concerned with the exploration of narratives as representational constructions. For this discourse, and within Nyoongar culture, narrative is the main means and source of creating or transforming meaning (Cihodariu 2012).

Story, for Nyoongar people, is the most significant transmitter of cultural knowledge. Other methods of cultural transmission, such as rock art, would have been rendered inaccessible during the sea level rises between 20,000 and 7000 years ago (Brooke et al. 2014). Nyoongar creation stories are not about the creation of the world: they are about the creation of Nyoongar land. The three stories foundational to this project are part of a collection passed down through the Nannup family. The oral tradition of these stories makes it difficult to verify veracity in accordance with

modern referencing techniques, although similar stories from independent oral traditions offer one form of verification. Noel Nannup explains, ‘These stories were told to me by Uncle Thomas in 1956, Uncle Thomas was never taken away, he lived in a Traditional way’ (Nannup and Hopper 2015:3).

The stories *The carers of everything* (Nannup 2006a), *The coming of the colours* (Nannup 2006b) and *When the sea levels rose* (Nannup 2006c) were recorded by Noel Nannup in 2006 for the Swan Catchment Council: transcripts were made of the recordings and used for the project. A shorter narrative was published in *Moondang-ak kaaradjiny* (Nannup Karda 2006).

Other traditional stories are also used. These are either recent recordings of traditional oral stories by Nyoongar people (Buller Murphy 2012; Nannup Karda 2006; Walley 2004) or those first written down by Europeans in the early days of European settlement (Bates 2004).

In order to establish a point of sustainable contact between the knowledge sets, the scientific explanation of the formation of Nyoongar land was written as a plain English narrative to make it compatible with the Nyoongar creation narrative. This required a detailed search of the local climate history, geology, archaeology, anthropology and European history. The material was then sifted, summarised and aligned until a single thread emerged.

The science narrative was not constructed to establish some sort of evidentiary truth against which the Nyoongar creation stories could be compared. Archaeological and environmental data are usually called ‘evidence’ because they have undergone certain scientific peer review. Such evidence is used to construct models of, for example, human dispersion or climate change. These models are constantly refined according to new evidence. Thus archaeological and environmental theories always make progressive approximations, rather than establish ‘the truth’. Therefore, on reflection, scientific narratives contain speculation and interpretation, elements shared with mythology.

The timeline was not pre-constructed; it emerged as a necessity to codify the amassing data. One of the first issues the researchers faced in the conceptualisation of a timeline was

differing cultural understandings of the concept of time. From a Western cultural perspective, time is linear and measurable. In theory, therefore, time has a beginning (the big bang) and will presumably one day whimper its conclusion. Within those end points, time is measured in days, years, centuries and so on. Each discourse measures its own eras; hence in Western science there is climatic time, geological time and evolutionary time, so there are eons, azoics and olithics.

In Nyoongar culture, the past is always present. This does not mean the passage of time is without reference. The greater meaning is that the spiritual significance of the past is omnipresent. There is no corresponding word in Nyoongar for the abstract word 'time'. Rather than being measured, the passing of time is experienced in traditional Nyoongar life by the passage of the sun and the moon, the tides and the six seasons. A linear concept of time, however, is present in Nyoongar culture. Unlike traditional European stories that open with a ubiquitous 'once upon a time', most traditional Nyoongar stories have an opening line that locates the story in a particular time such as the Nyetting, or the flood, or before there were clans, or in our time. This referencing of an event-related time with additional in-story indicators such as descriptions of real geophysical events, climate and patterns of human organisation in various contexts helped to map the complexity of Nyoongar life through ancient times.

Initially, there were two points of comparison; the Nyetting, which bore an uncanny resemblance to the Permian Ice Age, and the flood stories, which relate to the meltwater pulses that marked the warming of the Holocene. Eventually what became 11 eras were grouped in three phases — the Koondaarn, the Dreaming or spiritual eras when the land was formed, which is aligned with the rifting apart of continental slabs of Gondwana; the Koora Koora eras when spiritual ancestors became real and walked the land, developing their knowledge (these eras resonate with the presence of Aboriginal people in ancient times and their survival through the last Glacial Maximum); and, finally, *Wardaanaak boodj uer moomboorli*, when Nyoongars proved their lore through climate change and encroachment by other people. This is connected with the thermal maximum and beyond into modern times.

Nyoongar people

Nyoongar people are the Aboriginal inhabitants of the south-west corner of the State of Western Australia. Nyoongar *boodja* was not significantly encroached by Europeans until the 1830s, and some Nyoongar people continued living a traditional life until the 1900s. Although wounded by successive waves of destructive government policy, and still affected by the legacy of the Stolen Generations (De Maio et al. 2005; Haebich and Delroy 1999), Nyoongar traditional knowledge has remained largely intact. There is no one definitive Nyoongar language but 14 distinct dialects. The language used in this paper is that used mostly by the Whadjuk Nyoongar (Bindon and Chadwick 1992) people, centred on Perth. Within quotations original spellings are used. Hence, one word may have several spellings in the document.

Era 1 The Nyetting (The cold, dark time)

When Nannup (2006a) tells the story of *The carers of everything* he describes the Nyetting as 'The freezing cold, near darkness time, long, long ago when there was nothing on the earth, it was flat and featureless' (Nannup 2006a:1). The spiritual ancestors of all living things had gathered to talk about who would become the carers of everything. As they talked they saw the Waakarl, the huge rainbow serpent, open a space between the crushing sky and the earth: 'Mountains rose and valleys fell as the serpent pushed the earth out of the way, then it was forced under the earth and emerged again creating rivers and lakes' (Nannup 2006a:1). Many of the spiritual ancestors followed the trail left by the Waakarl and selected the places they would one day flourish.

The key elements of the story are recorded extensively elsewhere. For example, in summaries of Nyoongar culture presented by the South West Aboriginal Land and Sea Council (SWALSC 2016), the *Nyitting* or Dreaming means 'cold', 'cold time' or 'ancestral times'. Noongar people know it as the Creation time. It is the time before time when spirits rose from the earth and descended from the sky to create the landforms and all living things. *Nyitting* stories laid down the lore for social and moral order and established cultural patterns and customs (SWALSC 2016).

The Waakarl is a feature of many Aboriginal creation stories:

...there was a high degree of consistency in relation to the most widespread beliefs (the need to appease spirits, wirrnitjs, the creation snake story, wagyys, wudatji, mabarn). This says something about the unity of people across the claim area and their adherence to traditional ways. (Wilcox as quoted in Host and Own 2009:xxi)

Hopper et al. (1996) indicated that 300 million years ago Nyoongar *boodja* was subjected to freezing cold, to darkness and to a sky so heavy it crushed the ancient tree ferns. It was the beginning of the Permian; the major landmasses were clustered into a single continent called Pangea, which straddled the equator and extended to the poles (Morrison and Morrison 1990). Today's Australia was part of the southern half of Pangea, which would become the great southern continent of Gondwana. Being at the southern polar tip, Nyoongar *boodja* was in darkness for much of the year and was crushed beneath three to five kilometres of ice.

Referred to in the Nyoongar narrative as the rhythm of the earth, the Waakarl is an embodiment of energy generated by persistent friction between ice and land. The weight and eroding effects of the ice sheet formed the flatlands of the Wheatbelt region and scoured out the basins at Coolcalalaya and Merlinleigh that would later fill with coal (Kininmonth and Baafi 2009). The surge and retreat of the ice sheet sculpted some of the boulder ridges that remain today as part of the iconic landscape of Nyoongar *boodja*.

Dodson et al. (2002) described climates of extreme heat and cold and widespread deserts elsewhere in Gondwana. This intensely challenging environment led to new ways of reproduction. Flora adapted by evolving seeds with protective covers and fauna evolved the egg. Thus, gymnosperms proliferated and the first modern trees — conifers, ginkgoes and cycads — appeared. Early amniotes (marine invertebrates) diversified into the ancestors of mammals, turtles, crocodiles, dinosaurs, reptiles and birds. Western scientific discourse describes evolutionary ancestors of modern flora and fauna that would eventually find their niches in the trail of retreating ice. The

Nyoongar narrative describes these evolutionary ancestors as spirits of future plants and animals that would eventually find a home in the tracks left by the ice.

Era 2 Jindalee (Spirit Woman)

In a summary of the story *The carers of everything* (Nannup 2006a), the ice had gone, the trees had taken root on the earth and the spirit ancestors of animals were finding homes in the new landscape. It was still uncertain who would become the carers of everything. Spirit Man and Spirit Woman, Jindalee, were still there looking out, they saw beautiful little lights. Spirit Man and Jindalee were curious and soon discovered the lights were in the eyes of Spirit Children. Jindalee was entranced and followed the Spirit Children onto the land. Jindalee turned south, collecting the children and putting them in her hair. When she reached what is now Bunbury she turned back and made a trail that reached north to what is now Geraldton. She turned east, then realised she was doing wrong collecting children as ornaments because the children would become the carers of everything. She wandered about in distress, trembling and weeping with the Spirit Children falling from her hair. Those still trapped cried out, and spirit birds helped to set them free by building platforms to hold up the sky. Jindalee put her foot on the pile of stones and they tumbled and rolled like a wave down through the South West. The stone beneath her foot suddenly sprung up like a trampoline and Jindalee was flung in the sky. Her hair spread out and became the Milky Way and the remaining Spirit Children became stars (Nannup 2006a:1, 2).

The science narrative of the Triassic and Jurassic periods, 250 million to 130 million years ago, was equally dramatic. Morrison and Morrison (1990) described a massive extinction event towards the end of the Permian from which it took the biosphere some ten million years to recover. Gondwana began to break up; Greater India rifted westwards away from Western Australia, elevating the Stirling Range and a seaway with massive volcanism on either side, evident today in the basalts exposed at Bunbury and further south at Black Point south-east of Augusta (Hopper et al. 1996). The Darling Fault Scarp formed the eastern edge of a rift valley and to the west lay

what became known as the Perth Basin, which, during the Jurassic Period, gradually filled with sediment deposited by rivers (Hopper et al. 1996).

Just as geologists can read this dramatic history of the land by what remains today, so the drama of Jindalee remains in the landscape. The great gathering of spirits was at Kaarta Garup, which continues to be the major meeting place for all Nyoongar people. There they discussed the lore, celebrated weddings, mourned the dead, danced and partied. It is still used for all those reasons in its current guise as Kings Park. Before her exile in the sky, Jindalee left her footprint at Djenalup (Blackwall Reach in Perth Water); a strand of her hair snapped off and fell to Earth creating the lakes at Joondalup. Where Jindalee realised she was doing wrong, she trembled and this went into the ground, creating the South West Seismic Zone, which produces swarms of trembles and delivered the Meckering earthquake in 1968 (Featherstone et al. 2004). Where Jindalee roamed over the land in great distress weeping, there are now chains of small salt lakes. She was cast off the earth at Kartagitj (head first like a spear), now known as Wave Rock.

Era 3 *Waaliny walkern* (The coming of the colours)

The Nyoongar *boodja* creation story continues in *The coming of the colours* (Nannup 2006b). When Spirit Woman was exiled in the sky she grieved and sought to atone. She created a fire and from that created a rainbow but she could not get beyond the clouds to deliver her gift to Nyoongar *boodja*:

There Jindalee was, balancing this beautiful gift in her hands, looking at the situation that seemed hopeless, there was no way that she could get this gift down to everything on the land beneath the clouds...her situation was hopeless...she began to cry. The tears rolled down her cheeks and as they did the colours reflecting from the sun were trapped inside each of those teardrops...The colours, still trapped in each of the teardrops fell on the plants, the birds, the animals, the trees, all becoming real. (Nannup 2006b:3)

In the construction of the science narrative the team considered that this story resembles events

during the Cretaceous and Tertiary periods, 130 million to 2.6 million years ago (Anand and Paine 2002). Then Australia was slowly moving northwards out of the recurrent darkness of the Antarctic Circle into the warmth and the light. The release of water in a much warmer atmosphere led to greater evaporation, monsoons and rain systems. Soon there were associated phenomena of sunsets and rainbows. Nyoongar *boodja* became warmer, the days were shorter, there were conifers on the hillsides, and ferns and tree ferns in the valleys (Morrison and Morrison 1990). Ammonites evolved; one group evolved as reptiles and birds and another evolved into primitive mammals (Hopper et al. 1996).

By 140 million years ago the global climate was warm, today's western coast of Australia was underwater, and there was an inland sea in Central Australia. Up to half of Australia was repeatedly flooded. Nyoongar *boodja* received more of the steady rainfall that gently fed the earth rather than the mighty downpours that destroyed and eroded. This aided in the evolution of trees and plants known for their colours (the angiosperms), and flowers soon bloomed in the forests and swamps (Dodson et al. 2002). At around 65 million years ago a meteor crashed into Earth, ending the age of dinosaurs. The biosphere recovered and mammals and birds with colourful skins and feathers diversified, taking up the ecological spaces vacated by the dinosaurs (Hopper et al. 1996). Mammals that were once nocturnal became active during the day and developed the capacity to see colour (Jacobs 2009). By 50 million years ago Australia had moved close to its current position. The sun rose and set in the same places as it does today and the same constellations of stars greeted the night sky as they do today.

Era 4 *Kalykool* (Always)

The coming of the colours (Nannup 2006b) story continues, preparing the human spirit for reality:

Jindalee built a kaal (fire) and gave the Spirit Children their instructions, some returned to Earth. As they gathered knowledge came to them about how they were to be as people with totems and marriage lore...When they reached the place the Spirit Woman had taken them from they lay down to sleep because

they were very tired. They dreamed of the six seasons so that when they woke they knew how to live, moving across the country in accordance with the benefits of the seasons. The people knew they had become the carers of everything and that they were real. (Nannup 2006b:3)

Thus the human spirit ancestors became real, having all the qualities and vulnerabilities of modern humans. It was not a separation from the spirit world but a continuation of the cycle of birth, life, death and Spirit.

The current consensus among Australian archaeologists is that Aboriginal people arrived as modern humans following migration from Africa between 50,000 and 60,000 years ago (Hiscock 2008). One large arrival group of more than 1000 people, including several hundred women, made a sea crossing from the Indonesian land mass: 'Studies in Aboriginal genetics indicate that Australia was colonised by a single large and diverse population and has remained minimally affected by outside gene pools' (Hiscock 2008:97). Furthermore, there is no evidence to suggest that other human or closely related species evolved independently within the land-mass (Hiscock 2008).

At the time of Aboriginal migration Australia was bigger and a different shape to modern Australia. By 75,000 years ago glaciation had lowered sea levels and the Australian landmass, called Sahul, included New Guinea and was separated by sea from Sunda, the Indonesian land mass (O'Connell and Allen 2015). There was intense glacial activity in the highlands of Tasmania and New Guinea, with pockets of temperate rain-forest at lower altitudes. There were greater northern storms and winter rainfall, and, because it was approximately 4 °C colder than the present day, there was less evaporation. Inland there were grasslands with surface water and permanent lakes and river systems, including Lake Eyre and the Murray Basin (Monroe 2015).

It seems that there are no resonances between Nyoongar and Western knowledge sets in this era. Nyoongar people believe they have been here *kalykool* (forever) or, as the creation story suggests, for as long as here has existed. Modern archaeology claims Nyoongar people arrived here

approximately 50,000 years ago. Modern archaeology has no regard for concepts such as 'becoming real'. Its understanding is that *Homo sapiens* (modern humans) evolved from a mix of ancient hominid genes in Africa and migrated from there (Stringer and Andrews 1988).

Era 5 *Koondaarn boodja* (Lore of the land)

An ancient Nyoongar story, *Boranga boon-gorang* (The great shaking), from Bibulmun and Wardandi Country (around Margaret River), differs from other Nyoongar stories. In this story the formation of landscape is not attributed to the Waakarli; rather, the story relates events in sequence rather like an information bulletin: 'Long ago, before there were clans, a great shaking came through the land changing everything'; it goes on to describe 'Fierce winds full of smoke and dust', followed by:

a great stillness and quietness as if there was not enough air. Some people died. Later on, when a strong wind did come, people could breathe again and they felt better...But then more great shaking came, with loud thunder. Enormous waves rushed in from the sea to cover the land. When this wild water came, the people and animals had to go high up into the hills, so they didn't drown. The great water returned to the sea, many fish were left behind. The great shaking and mighty water had changed everything. The hills became plains. The most amazing thing was that the sun didn't set or rise where it had before the great shaking. Before it rose in the north and set in the south. Now it rises in the east and goes down in the west. (Buller Murphy 2012:67)

There are two important elements in this story: the use of the phrase 'before there were clans' and the description of a major geophysical event. 'Before there were clans' is perhaps what archaeology calls the dispersal phase, which occurred sometime between 50,000 and 35,000 years ago, when the group of 1000 people (or those made real) rapidly occupied the continent (Fisher et al. 2010). Archaeology dates the earliest human presence in Nyoongar *boodja* at 48,000 years ago in Devil's Lair in the South West (Turney et al. 2001). Other traces found in the Upper Swan are

38,000 years old (Pearce and Barbetti 1981). Then the climate was thought to have been mild and moist (Munyikwa 2005) — perfect conditions for growth in the human population. Larger populations require a different kind of organisation.

The dispersal phase was marked by rapid occupation of an area by bands of people consisting of ‘a few dozen individuals, many belonging to one or several extended families’ (Diamond 2012:14). Typically they were mobile and survived by scavenging, or became hunter-gatherers, moving in seasonally determined patterns. Once the expeditionary bands were successful and the population grew, they needed to restructure, typically into tribes: ‘Tribes consist of...dozens of families, often divided into kinship groups termed clans, which may exchange marriage partners with other clans’ (Diamond 2012:15).

Only sustained volcanic activity or a meteorite hitting Earth could produce the effects of blast, earthquake, tsunami and disruption of the Earth’s tilt described in the *Boranga boongorang* story. If ‘before there were clans’ is used as a dating technique to locate the story on the timeline and this story describes a volcano, it could be an unknown major eruption of the Heard Island volcano some 4000 kilometres west of Western Australia (LeMasurier et al. 1990). Alternatively, it could describe the eruption of the super volcano Toba, although this occurred between 69,000 and 77,000 years ago (Savino and Jones 2007). Or, it could be an unknown, much closer activity to the South West Seismic Zone. In whichever case, the change in direction of the sun rising and setting could be attributed to a change in landscape, which made the sun appear to rise and set in a different place.

If the geophysical activities were caused by a meteor, the only known sizeable meteor impact during the Pleistocene or the later Holocene occurred in what is now the Arizona desert about 50,000 years ago. The crater it left, now known as Meteor or Barringer Crater, is massive — approximately 1200 metres in diameter and 170 metres deep — and is surrounded by a rim that rises 45 metres above the surrounding plains (Masaitis 2006). Whatever the cause of the great shaking, *Boranga boongorang* is probably the oldest news report in the world.

Era 6 *Nyoongar-abiny* (Becoming Nyoongar)

The coming of the colours continues with the formation of Nyoongar culture:

As they were thinking knowledge came to them about forming into the fourteen clans that became the Nyoongar nation. They thought about dividing all people into two groups (moiety) to establish the first law of relationship and marriage. Clouds rolled in and rain fell. The water gathered and ran filling all the trails the serpent had made. The people followed the course of the water until it reached the ocean. Tired they lay down and slept. When they slept they dreamed their language, language comes from the earth and when some one dies and is buried their language returns to the earth. Each person took on a totem, some took animals, some trees, some plants that way they could care for everything. (Nannup 2006b:4)

Fourteen clans remain, all speaking the Nyoongar language, each having its own dialect.

Many anthropologists understand a clan to be a social group that is descended from a common ancestor, consequently sharing a genetic identity (Kuper 1982). The formation of a clan system enables the tracing of lineage through the mother or the father. It is through a clan system that strategies can be implemented to keep the gene pool healthy, necessary in a population of relatives. A clan system, therefore, presupposes a population density needing complex organisation.

Nyoongar people traced blood descent through the mother, and at birth female Elders allocated each infant a place in one of two moieties (groups) — Manitch (white cockatoo) or Wardong (crow) — or one of the four subsidiary groups (SWALSC 2015). The moiety, among other functions, determines who one cannot marry. For example, people cannot marry within the same skin group. A second totem may have been attributed in recognition of local patrilineal descent, particularly in relation to the father’s land. This totem may have been an animal or plant species of the area. During childhood, when the personality of the child had developed, a third totem was given that reflected the child’s personality. The

totemic system was and remains profound: it is the fibre of being Nyoongar.

The totem system linked the skill sets of hunting and gathering with the complementary responsibilities of the genders. Women, as Elders, looked after marriage and family business; men, as Elders, looked after land and location business.

The shift from bands to clans and later to tribes makes intuitive sense; the behaviours supporting the growth and dispersal of a transitory population are not necessarily the same ones that would support a settled population. The new system was successful and enabled Nyoongar people to cope with the pressure of climate change. From approximately 35,000 years ago to about 22,000 years ago, the climate became colder and drier as the planet moved into another period of glaciation (Morrison and Morrison 1990).

The cooling and drying meant a significant change in flora. Sclerophyll communities consisted of grasslands with fire tolerant trees such as eucalypts. Acacia species, including mulga, became more prevalent (Hopper et al. 1996). This meant loss of habitat for many animals, including megafauna, which gradually became extinct. Some archaeologists have suggested ancient Aboriginal people contributed to the extinction of megafauna (Flannery 1995), but others say this was not the case: 'instead it was the more subtle and gradual dynamics of habitat transformation which created conditions that gave an advantage to some species and disadvantaged others' (Hiscock 2008:75; Stiner 2013). In essence, the change in climate and flora was so significant it was a case of adapt or die. Some animals adapted by changing their diets and managing on less food, in some cases becoming smaller, and were later identified as new species.

People, too, had to adapt. It can be speculated that firestick and other farming techniques were developed in response to the tougher conditions. Aboriginal people, like Australians today, had to come to terms with fire. A study of charcoal sediment indicated no distinct change in the frequency of biomass burning in Australia from approximately 50,000 years ago to today (Mooney et al. 2011:28). Either a system of controlled burning was established or nature was left to take its course. Traditional controlled burning was perhaps developed into fire stick farming in

colder, drier conditions and was so effective the practice continues today in some areas.

Firestick farming was a four-field cycle of burning off that ensured one local patch of land always had new grass and regenerating trees to attract kangaroos and other animals, which were sustainably farmed (Gammage 2011; Hallam 1975). The benefits are threefold: animal habitats are preserved, there is no catastrophic devastation in which seeds and soil are incinerated, and new growth in recently burned areas attracts animals needing to feed (Hallam 1975; Johnson 2006).

Era 7 *Kaarla mia* (Keeping the home fires burning)

The final Ice Age of the Pleistocene, known as the Last Glacial Maximum (LGM), occurred between 25,000 and 17,000 years ago. It was one of the most severe glaciations, with most of Europe and North America under glaciers. Nyoongar *boodja* was not covered in ice but it was cold and endured a 10,000-year drought, making life tough (Morrison and Morrison 1990).

A review of stories conducted for this project indicates two types of *Nyetting* stories; epic stories about the creation of Nyoongar *boodja* and stories about what seem to be real people struggling with *nyidiny* (cold). Later *Nyetting* stories concern life in tough conditions, articulating the rules of life in the clan and exploring the dilemmas this imposed. Before the LGM the prevention of catastrophic fire had been a survival tool; now the concern was keeping the fire going. In the story of *Kwenda, Djilidjili and Wata* (Bandicoot, Sparrowhawk and Pigeon) (Bates 2004) fire is the central issue.

If Nyoongars had no fire, they had to eat their meat raw and when the cold waters came 'they would long for the sun to shine down to dry the land and warm them':

Kwenda had fire but he kept it hidden under his tail, and would not share it. Djilidjili and Wata chased him until they reached... Kwenda's uncle. Kwenda threw the fire to his uncle but a spark fell onto Wata's beard and smouldered. Overjoyed they hurried home putting a lot of fire into the balga, the kwel (she-oak) and the mangatj (banksia) but only a little into the jarrah and marri. (Bates 1992:167–8)

This instructive story tells listeners which woods burn well and give good ash, and that some, such as banksia, could be made into firesticks and carried around for a long time so they would always have fire.

Other stories focus on the need for adherence to lore above all other considerations. Following the lore meant putting community before the individual despite the difficulties this entailed. In *Bindatan* (Buller Murphy 2012), a story about domestic violence, a clan's struggle was that protecting the beaten wife would break the lore of a wife promised. With great cleverness the women in the story find a way through and in the ensuing drama the perpetrator 'got what he deserved'. Parenting also was a hard road. In the story of *Kolguru and Jindabirrbirr* (Little Pigeon and Wagtail) (Bates 2004), a mother is speared because she let her young sons go away from the camp by themselves and they drowned. In the story of *Lengo and Mandabulabula* (Bates 2004) a father is punished for treating his son like a child after he had grown up.

Morrison and Morrison (1990) describe the period 30,000 to 20,000 years ago as a time when the world grew rapidly colder, dropping to 6–10°C below current temperatures. By 22,000 years ago the glaciers were at their thickest, with ice sheets covering most continents. Sea levels were at their lowest, dropping to approximately 150–400 metres below current levels. In those times Tasmania and Wadjemup (Rottnest Island) were part of mainland Australia. It was a very difficult time for all species all over the planet; many became extinct, including the last alternative surviving humanoid species, the Neanderthals. Lake Eyre became dry and remained so for 20,000 years; old water ecosystems disappeared and arid areas expanded. The south of Australia experienced virtual Antarctic conditions, and eastern Australia suffered massive dust storms (McTainsh 1996).

Archaeologists suggest that during the LGM population numbers fell by as much as 60 per cent after having stable sustained growth (Williams et al. 2013). People across Australia needed to adapt or face extinction. Adaptations included farming, varying diet and conserving water. There are indications that farming and aquaculture (Pascoe 2014) happened through this period, with grinding

stones from more than 30,000 years ago and fish traps thought to be 40,000 years old (Pascoe 2014:57). It is very likely Nyoongars harvested yams in the damp soils in the lakes regions and ground seeds in what is now the Wheatbelt. They also experimented in order to extend the range of available food. For example, they worked out how to extract toxins from zamia seeds. They also became very clever at conserving water. For example, on the coast they took *kappi wodern* (fresh water from the surface of the ocean (Macintyre 2004); inland, they used existing waterholes and probably created new waterholes, now known as gnamma holes.

Era 8 *Wardanaak boodja* (The flood)

In the story *When the sea levels rose* (Nannup 2006c) special roles are allocated to the spirits of *nginyarn* (echidna) and *kaarda* (goanna). They care for the Spirit Children and the spirits of those who have passed on who are buried in the land that is being flooded. They convince *mamang* (whale) and *kwilana* (dolphin) to bring spirits to rivers and beaches with freshwater springs and release the spirits so they can reach land. *Djenark* (sea gull) offered to fly out and sit on the ocean above where anyone had been buried, to connect with their spirit, then come back to land, bathe in fresh sweet water and release the spirit (Nannup 2006c). The notable element about this story is its proactive nature. *Nginyarn* and *kaarda* knew that the sea would rise and they prepared for it.

Rising sea levels are also the subject of local stories, such as *Walyalup Dreaming* (Walley 2004), in which the settling of the new coastline following inundation. Yondock, an ancestral crocodile, travelled down from the north, causing floods and disturbances, creating Wadjemup (Rottnest Island), Gnooroolmayup (Carnac Island) and Derbarl Nara (Cockburn Sound), and flooding the Derbarl Yerrigan (Swan River) with salt water. The Waakarl, guardian of freshwater, travelled down the Derbarl Yerrigan to see what was happening. Yondock and Waakarl fought, the Waakarl triumphed and Yondock's remains formed Meeandip (Garden Island). Dingoes watched from Cantonment Hill to make sure the spirit of the crocodile was not reunited with its tail (Walley 2004).

Morrison and Morrison (1990) describe the rising of sea levels following the end of the LGM. From 20,000 years ago the planet began to warm, and the sea level rose both gradually and in massive melt water pulses, causing great flooding. For example, between 14,600 and 13,000 years ago the sea level rose about 20 meters in less than 500 years (Fleming et al. 1998; Milne et al. 2005). The climate continued to warm and the sea level continued to rise until the thermal maximum (the warmest period in the past 125,000 years) was reached 8100 years ago. During this time other changes occurred: the Australian climate went from being cold and dry to warm and dry; Tasmania was cut off from the mainland about 10,000 years ago; 8100 years ago the Torres Strait formed, separating Australia from New Guinea; 7000 years ago Rottneest Island was separated from the mainland and the ridge that is now Garden Island was surrounded by water; and the estuarine conditions of Derby Yerrigan (Swan River system) moved upstream as the coastline advanced eastwards (Morrison and Morrison 1990).

The recent eras

The focus of the first eight eras is Nyoongar *boodja*; the focus of the remaining eras is family and community. Research on these eras is not complete. Era 9, *Nyoongar ngank baloonginy* (Rise of modern Nyoongar), concerns the climatically stable, warm period known as the Neolithic. Era 10, *Bwokaboort boodjar* (Stripping of land), commences in 1829 and concerns European settlement, and Era 11, *Ngalak benang kourliny* (Going forward together), commences in 1975 and concerns reconciliation.

Discussion

As previously stated, this project is not an attempt to use science to verify Nyoongar spirituality. Neither are the authors suggesting Nyoongar creation stories are metaphorical versions of science. This project is merely a conjoint exploration that found similarities in the traditional Nyoongar and modern scientific descriptions of how Nyoongar *boodja* was formed. The project, indeed the notion of convergence, for some, raises a number of questions, particularly about the representation of Aboriginal narratives.

Within the few convergence works there is a reliance on European accounts of traditional Aboriginal stories concerning natural phenomena. Nunn and Reid (2015), for example, look to the records of early European settlers and past anthropologists for Aboriginal accounts of natural phenomena; Hamacher (2011) also looks to European accounts and includes words and phrases from Aboriginal languages. Nunn and Reid (2015) validate a collective Aboriginal memory of 7000 years by the use of stories concerning inundation, which they assume are associated with sea level rises during the Holocene warming. They claim the memory of inundation remained in culture because Australian Aboriginal society was comparatively isolated and therefore not subject to cultural intrusion, that Aboriginal people placed great importance on traditional knowledge and its transmission across generations, and that attachment to place might be amplified by referencing to landscape (Nunn and Reid 2015:1466). By then only using European accounts close to the time of settlement, are they tacitly assuming that cultural intrusion would henceforth dilute or corrupt Aboriginal accounts? Was the Aboriginal material recorded at European settlement 'an authentic residue of the past' and anything told today 'an entirely malleable construction in the present' (Olick 2008:159)?

This project predominantly uses material that was, until 2006, part of an oral tradition. The authenticity is inherent in the landscape, as Noel Nannup (Nannup and Hopper 2015:4) explains:

The creation stories are embedded in the names of places in the landscape of the song line. The Spirit Woman story, for example, would have been the feature of a song line from what is now Bunbury to Geraldton then east to Wave Rock. As the clan walked the song line so the story was told. As each Nyoongar grew in maturity and knowledge, layers of meaning within the songline were revealed. After the Europeans came, if your family continued to use language and to pass on all the information about places it would be hard to forget the creation stories. These concerns about whether a story is authentic if it wasn't written down by a white person are *nyndiyang* (white fella) concerns.

This does not mean the concerns should be ignored but they cannot be answered within the scope of this paper.

These *nyndiyang* concerns were reflected in responses to the film version of the timeline. Not one Nyoongar or other Aboriginal person questioned the validity of the creation story. Non-Aboriginal people typically asked how Nyoongar people developed a creation story that so closely resembled the current scientific account when they could not remember (for example, the Permian Ice Age). This rationalist question was responded to by the Nyoongars on the team using explanations derived from the stories. First, human spirit ancestors participated in the creation of *boodja*; when they became real they brought with them the memory of creation. The memory is constantly reiterated because the story is present in the land. The second explanation comes from *The coming of the colours* (Nannup 2006b). As part of the process of becoming real, people lay down on the earth to sleep. The land spoke to them as in a dream, giving them language and lore. Nannup (Nannup and Hopper 2015:58) went on to say, 'For Nyoongars, and others who listen, the Earth continues to speak. There are many examples of where Western society, apparently inadvertently, used land for the same reasons Nyoongars did: churches built on sacred sites, hospitals in places of healing and schools on sites previously used as training grounds.'

For Noel Nannup and Glen Stasiuk, these two explanations of how Nyoongar culture 'remembers' ancient land are not conflicting. They both work. If the conduit for culture, oral transmission through the generations, is broken, as it was in part during the Stolen Generations era, then the land will restore cultural memory when the generations can speak through each other again.

Conclusion

In this phase of the Synergies of Meaning Research Project, Nyoongar people and Western scientists together looked back through time. Although they looked through very different lenses and came up with very different ways of knowing about the land, there were many resonances between them. The major differences perhaps lay in how those knowledge sets were developed and how they are communicated.

There is a place for rigorous scientific study to be undertaken. Unfortunately, the intensity of the discourses often makes it unintelligible to those outside it. The presentation of such information in a way that can engage the non-specialist is rare. There is a place for traditional culture with its focus on story and on signs to convey knowledge about land and how to care for it. For Nyoongar people, many of whom have been disconnected from oral tradition, the placing of Nyoongar history in the timeline does not replace a song line but it does provide a historical map and a framework for memorialising social and climate patterns of the past.

The activity of constructing and presenting a conjoint timeline has been recognised by both the Nyoongar and scientific communities. Wayne Nannup of the South West Aboriginal Land and Sea Council said, 'This project represents a paradigm shift in the making of cultural relationships — a timely celebration, it takes reconciliation to a new level' (Wayne Nannup, pers. comm., 16 June 2015). Professor Peter Klinken, Chief Scientist of Western Australia, said, 'Such an innovative direction in communicating science — through the wisdom of Traditional knowledge — a wonderful achievement' (Peter Klinken, pers. comm., 14 July 2015).

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