COS10025 Technology in an Indigenous Context Project unit

School of Science, Computing, and Engineering Technologies

Seminar Week 7: Indigenous STEM Knowledge Continues

Shannon Kilmartin-Lynch

Acknowledgement of Country

We respectfully acknowledge the Wurundjeri People of the Kulin Nation, who are the Traditional Owners of the land on which Swinburne's Australian campuses are located in Melbourne's east and outer-east, and pay our respect to their Elders past, present and emerging.

We are honoured to recognise our connection to Wurundjeri Country, history, culture, and spirituality through these locations, and strive to ensure that we operate in a manner that respects and honours the Elders and Ancestors of these lands.

We also respectfully acknowledge Swinburne's Aboriginal and Torres Strait Islander staff, students, alumni, partners and visitors.

We also acknowledge and respect the Traditional Owners of lands across Australia, their Elders, Ancestors, cultures, and heritage, and recognise the continuing sovereignties of all Aboriginal and Torres Strait Islander Nations.

Indigenous STEM Knowledge

Recap Week 5

Indigenous Knowledges

We must remember, that Indigenous knowledges are specific to individual mobs, Indigenous groups across Australia are diverse, and have very different cultures, languages and customs. So too, are their health knowledges – particularly those around certain plants and animals which are specific to place.

However, the constant amongst all Indigenous mobs, is the holistic nature of Indigenous health and the inclusion of the "metaphysical, holistic, oral/symbolic, relational and intergenerational" (Levac et al. 2018)

Indigenous health is much broader than western models of health – as it includes interpersonal relationships, emotions, as well as physical and spiritual.

Even Indigenous understandings of learning and intelligence are intrinsically linked to nature and land, and the duality of the lived experiences of mob, plants and animals.

Western Knowledges

Western notions of intelligence differ strongly from Indigenous understandings – they ignore spirituality and connection, instead focusing on objectivity and "scientific"* rational.

The western model is much more anthropocentric, positioning humans at the top of the hierarchy of worldly order, and not plants, animals or the land.

However, Levac et al. (2018) states:

> "there are schools of Western philosophical thought that lend themselves more to Indigenous ways of knowing, such as feminist and narrative theories that privilege storytelling"

Fire Farming

Indigenous communities used fire across Australia.

The burning, while reducing risk of uncontrollable fires, also created expansive grasslands, ensured good soils and reproduction of plants which encouraged kangaroos and other animals to come to the regenerated sections, where they could easily be hunted for food.

Selecting what areas to burn, when, with what method and how often, was part of place-specific Indigenous knowledges of the land.

After invasion, fire farming became less used – as the Europeans feared fire.

This meant that thick scrub and tall grasses grew in previously controlled and carefully managed areas, increasing the prevalence of bushfires.

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Indigenous ways of knowing and health

Holistic health

Traditional healing and medicine

Caring for Country as necessary for holistic wellbeing

Sorry business

Men's and Women's business (gender specific Lore, custom and roles)

Health being a communal state, rather than individual

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What is Indigenous Knowledge

Indigenous knowledges also referred to traditional knowledge incorporates the know-how, practices, skills and innovations. It can be found in a wide variety of contexts, such as agricultural, scientific, technical, ecological and medicinal fields. As well as biodiversity-related knowledge.

It is intertwined within cultural and social practices and the vast Indigenous languages

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Relevance to science and innovation

Associate Professor Rowena Ball outlines examples of Indigenous scientific and engineering heritage, including the system of stone fish traps of the Ngunnhu people on the Barwon at Brewarrina; aquaculture and eel farming by the Gunditjmara people of south-western Victoria; and the work of eminent Indigenous scientist and inventor David Unaipon, 'who extensively documented the scientific abilities and achievements of Indigenous peoples over Australia'.

The 2013 report, *Indigenous engagement with science: Towards deeper understandings*, noted that there are 'significant opportunities for government and industry to engage with Indigenous people in a way that will maximise the potential for increased productivity across a wide range of scientific activity.'

What will be cover today?

- Astronomy from the Indigenous context
- Use of nanofibers from spinifex and other resin trees
- Traditional use of Kakadu plum and how it is being utilised today (case study)

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Astronomy & Narrative Science

Narrative Science

Storytelling is the way we transmit knowledges and educate our communities.

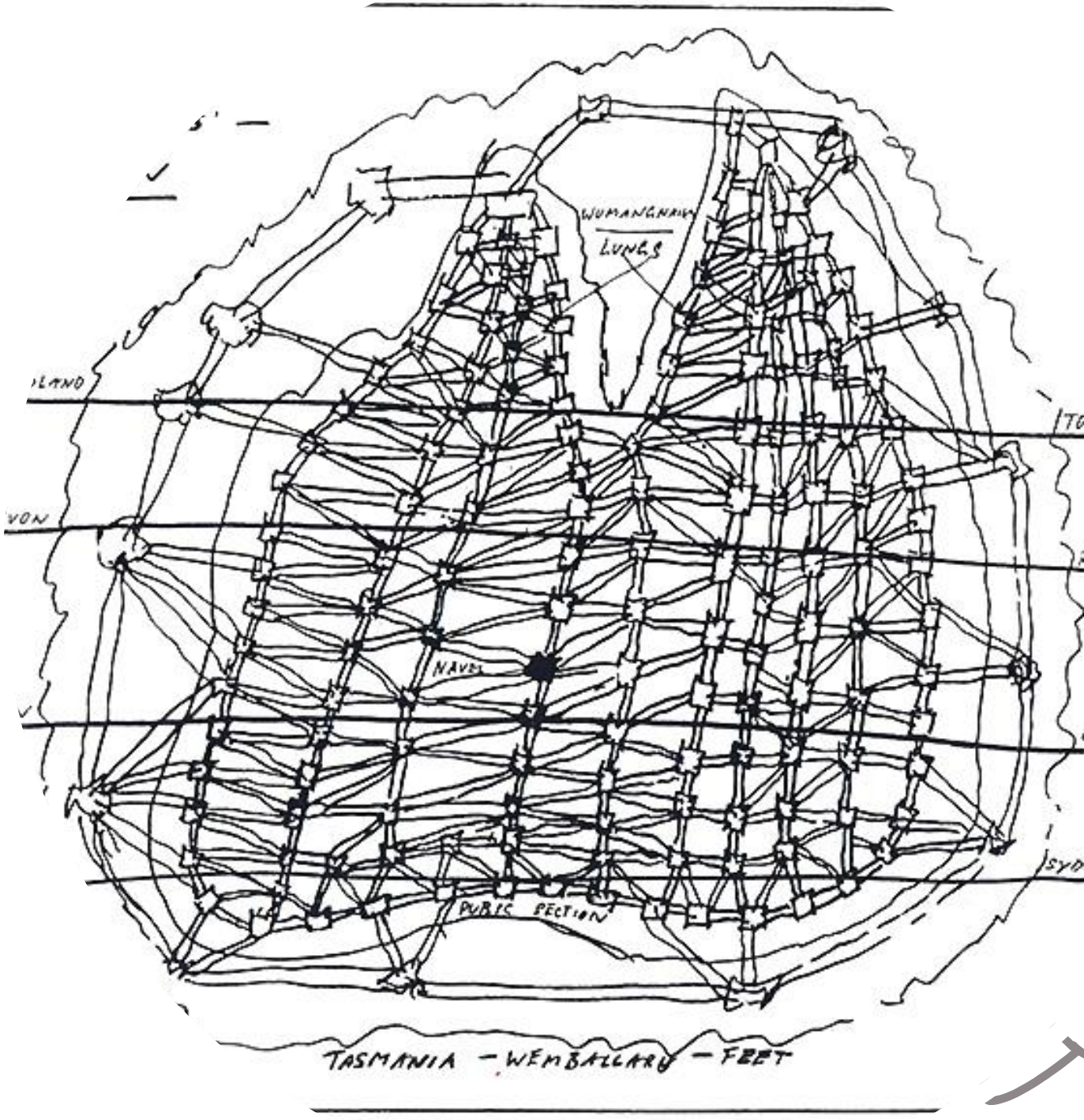
Story serves many purposes, and within our stories there are life lessons and rules for living, as well as detailed understanding of our countries, waterways, landscapes and seascapes and the world above us.

Aboriginal and Torres Strait Islander Australians view the sky as mirroring the earth.

Our stories are more than beautiful tales they are narrative science and knowledge and rules for living.

Navigation & Astronomy

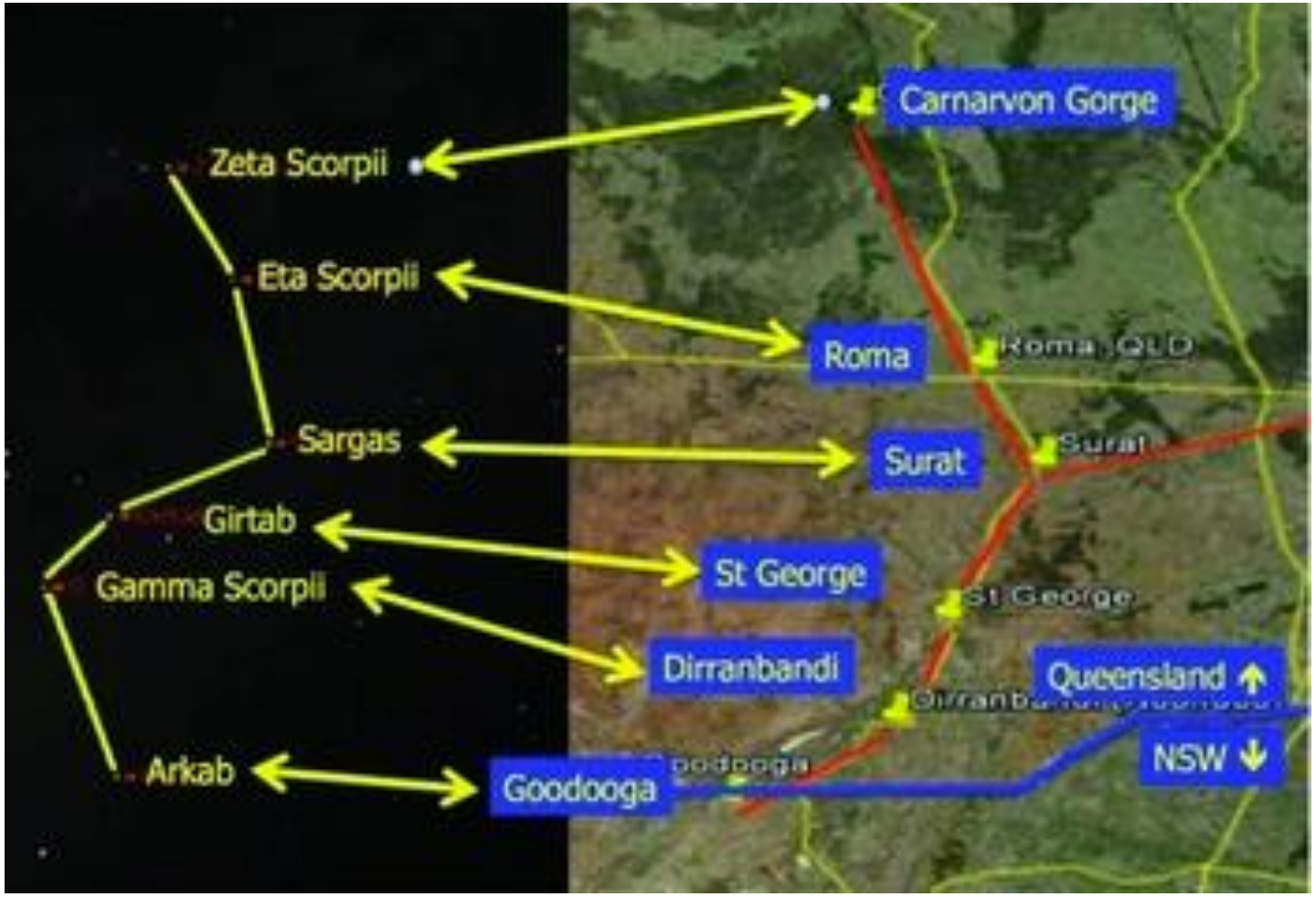
Songlines & Dreaming Tracks



"Songlines are epic creation songs passed to present generations by a line of singers continuous since the dreamtime. These songs, or song-cycles, have various names according to which language group they belong to, and tell the story of the creation of the land, provide maps for the country, and hand down law as decreed by the creation heroes of the dreamtime. Some songlines describe a path crossing the entire Australian continent."

(Wositsky & Harney 1999, p.301)

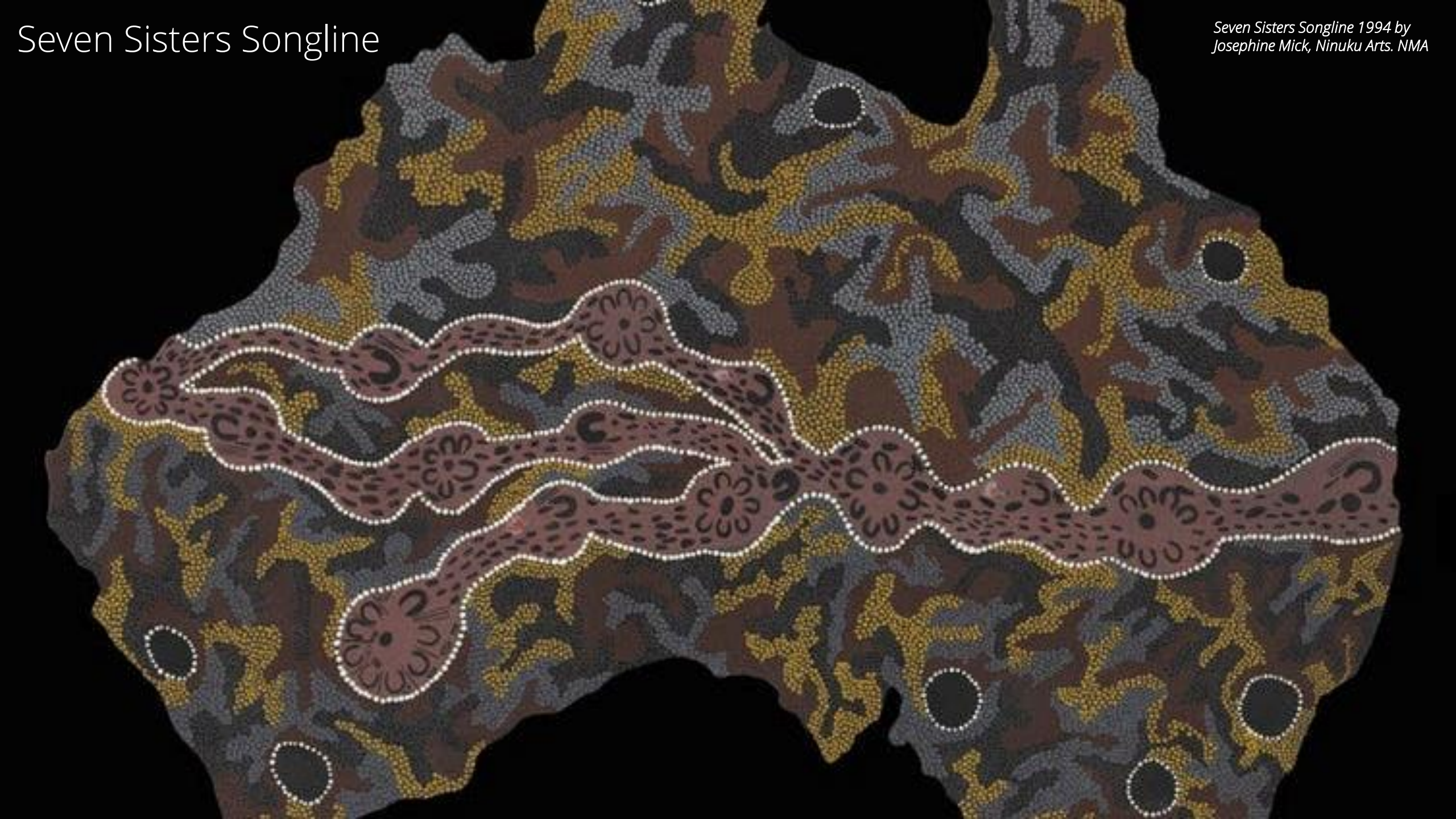
Euahlayi Songline: between QLD and NSW.



“The Dreaming Track in the sky! Planets making the pathway! Travelling routes, a pathway you could call it, like a highway! Travelling pathway joins to all different areas, to base place, to camping place, to ceremony place, where the trade routes come in; all this sort of things. The Dreaming Track in the sky, the planets come straight across... walking trail becomes a pad, then becomes a wagon road, two wheel tracks, then become a highway”

(DS in Norris 2014).

Seven Sisters Songline



Seven Sisters Songline 1994 by Josephine Mick, Ninuku Arts. NMA

Seven Sisters – Pleiades

Within Australia, the dreaming stories of the Seven Sisters are among the most common astronomy story told.

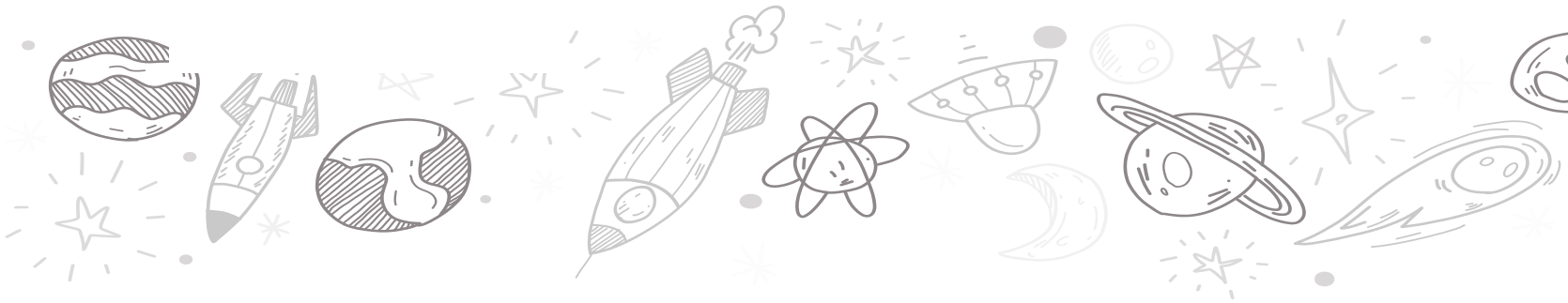
Star navigation & moon shadow travel

Songlines were used **for long haul navigations**:

"Not just songline trail, walking trail, trade routes. You sing a song, then you follow your song, in that track you go along singing the song, like a blazed mark"
(Norris & Harney 2014).

When no songline existed, or for much shorter travel, mob would use **the moon and stars** alone for patterns and directions.

In summary



Indigenous stories are never just stories – but are complex knowledges, bound in culture and lore, which speak to the interconnection of the earth, the sky, plants, animals and waterways.

Slowly, modern Western science is looking to our peoples and our ancient knowledges and realising that Aboriginal and Torres Strait Islander Australians have had these knowledges well before the West, and that we might have knowledges of the sky and earth, that they do not yet possess.

Nanofibres and spinifex resin

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Case study: Spinifex

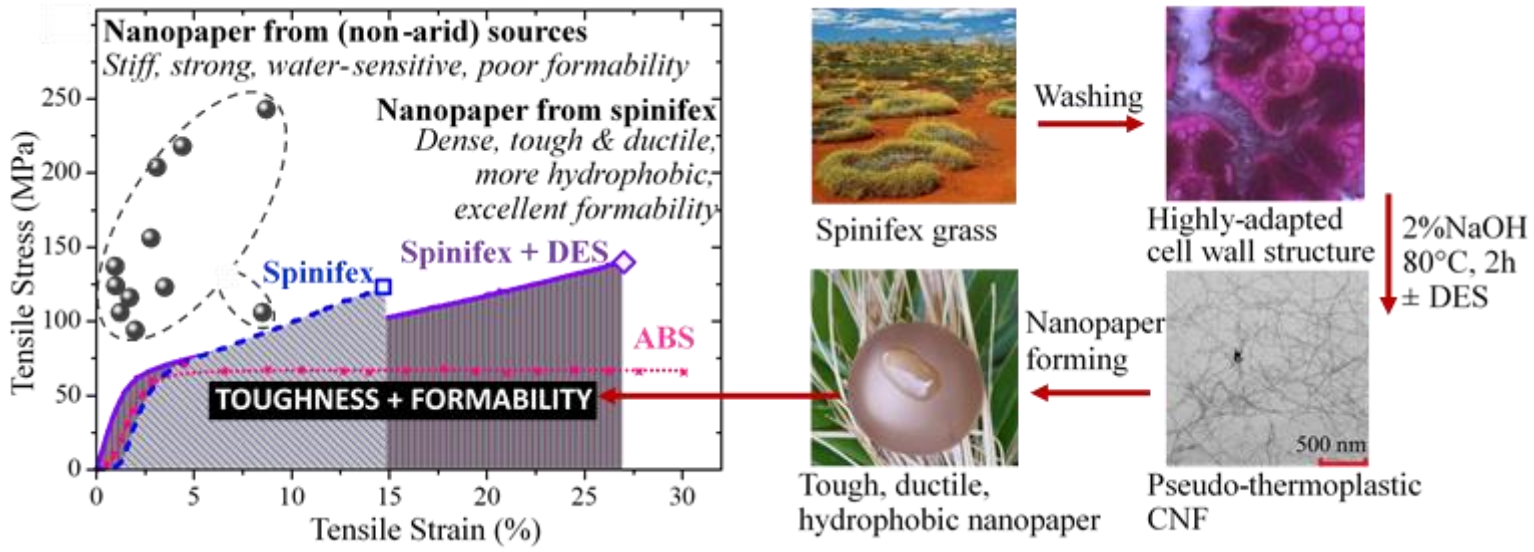
Scientists at the University of Queensland worked with the local Injalanj Didanu community in central Australia to identify and harvest specific spinifex species to extract nanofibers and resin. The project team will combine indigenous knowledge of Spinifex and its resin applications, manufacture, structure, and properties with controlled laboratory refining, modification, and testing to develop resins and fibres into renewable materials. We evaluated the possibility of developing as Principal investigator Professor Martin says the finding is unique stating:

The nanofibres that we can extract are long, thin and stretchy – only a few nanometres wide but thousands of nanometres in length…As a materiascientistsist, this is exactly what we look for when we want to reinforce flexible materials…

The technology is expected to be of great interest to applied materials science industries, including the multi-billion dollar condom market, and in carbon fibre and composites manufacturing (used for example, in aircraft, high-end cars and bikes).

This project has the potential to significantly improve prospects for employment and economic development for Indigenous people. Harvesting and initial processing of the spinifex will be undertaken in the community, with local rangers managing the environment where the spinifex grows. Colin Saltmere, Managing Director of the Dugalunji Aboriginal Corporation, said 'It's about providing jobs to our people and reclaiming some integrity'.

Formation of nano paper



Amiralian, Nasim, Annamalai, Pratheep K., Memmott, Paul and Martin, Darren J. (2015) Isolation of cellulose nanofibrils from Triodia pungens via different mechanical methods. *Cellulose*, *22* 4: 2483-2498. doi:10.1007/s10570-015-0688-x

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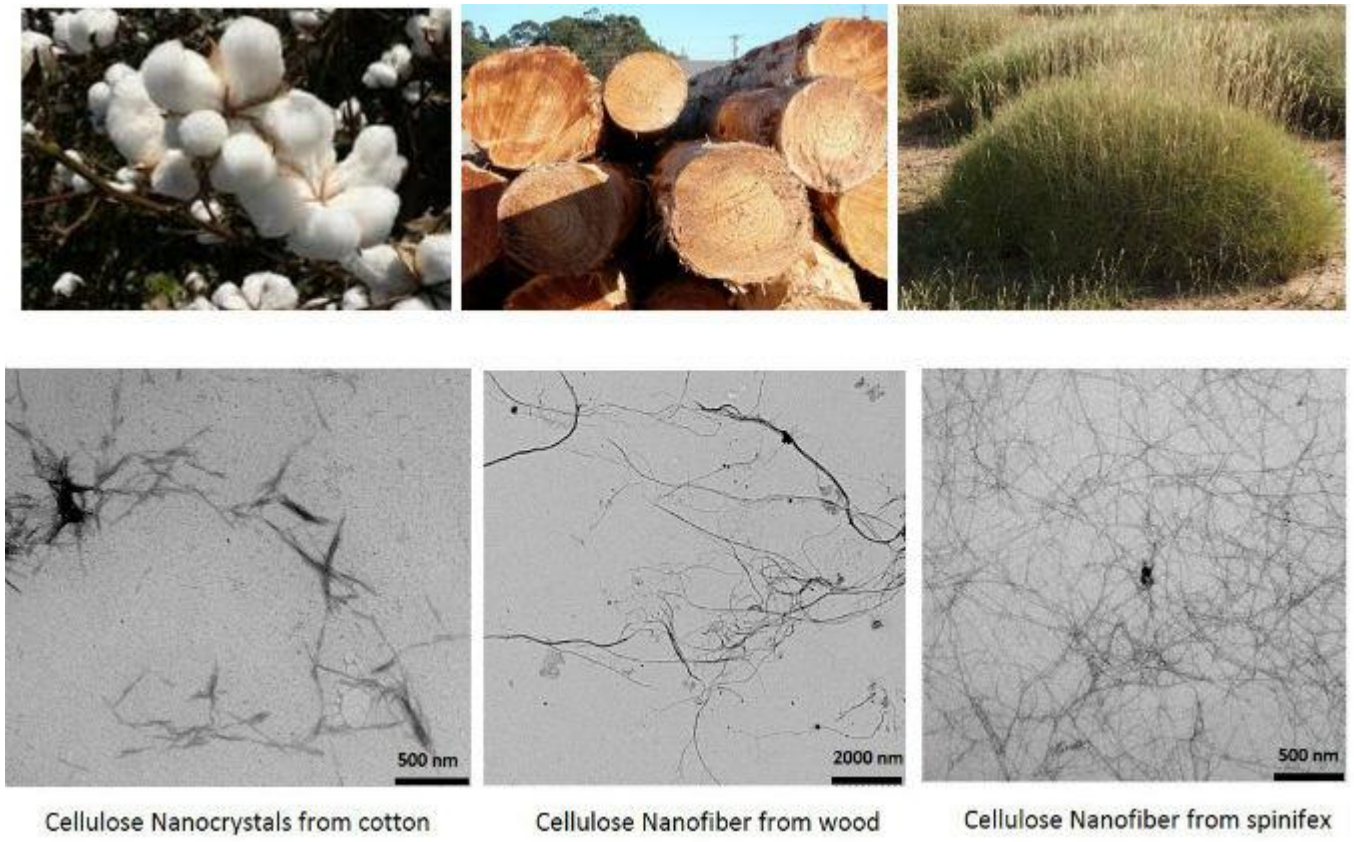
Producing nanofibres from spinifex

First, the grass is washed with hot water, dried and ground into a powder. Then, we isolate the nanofibres.

The grass powder is treated with a mild alkaline solution to loosen its structure before it is deconstructed using a high-pressure homogeniser, the same instrument used for homogenising milk.

These nanofibres, either in powder form or dispersed in water, are then mixed with other materials such as rubbers, latex or cardboards to improve their strength while retaining flexibility and stretchiness.



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Traditional use of spinifex

- Spinifex is a type of arid plant

- Grown in Australia for over 15 million years

- Traditionally used within the hafting process

- Some species produce a sticky resin, which Aboriginal people have used as an adhesive. But spinifex also has food, medicinal and architectural uses.

How spinifex can improve...

Cardboard and filters

Using spinifex nanofibre as a water filter significantly improves the removal of metal ions in water.

The hemicellulose on the surface of nanofibres works as absorption cage to trap metal ions.

Reinforcement of recycled cardboards with tough spinifex nanofibres improves its strength, which generally decreases in the recycling process.

Hemicellulose acts as an adhesive during the cardboard manufacturing process and imparts toughness and strength.

How spinifex can improve...

Elastomers and polymers

For stretchy, rubber-based products like gloves and condoms, the ideal material is strong and very flexible.

This combination will result in a glove or condom that is resistant to breakage

The common reinforcing agents used in rubbers to improve their mechanical properties are silica, carbon black, carbon nanotubes and graphene.

These can provide strength but, due to their rigidity, can also make the material too stiff or less stretchy.

A solution to this is using a soft and tough filler — such as spinifex nanofibres — to produce a thinner, tactile membrane.

In other rubber applications, such as seals, tyres and boots, similar technical requirements exist.

For all of these, toughness and abrasion resistance is key while still retaining the soft, elastic nature of rubber.

Adding just a small amount of spinifex nanofibres into different types of rubber results in a significant improvement in the strength of rubbers without reduction of their resilience and flexibility.

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How spinifex can improve...

Concrete

Spinifex nanofibre has shown to increase the strength of cement by at least 20 per cent. This means that we can reduce the amount of cement needed or we can make thinner structures.

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Case study: Kakadu Plum

The Kakadu plum is native to the top end of Northern Australia and is the richest known source of Vitamin C in the world, with multiple potential applications in the food, beauty and health industries.

The Gundjeihmi Aboriginal Corporation, representing the Mirarr people, says:

> *The Kakadu plum has been an important source of food and medicine for the Mirarr…It also features in oral histories and 'dreaming' stories.*

Local Indigenous people are now beginning to trial commercial plantations of the fruit, however there were concerns in the past that Indigenous communities had little or no recognition, control or benefit-sharing from the commercialisation of their knowledge.

Wendy Morgan, chair of the Gandangara Local Aboriginal Land Council, said:

> You'll have the big pharmaceutical companies coming out and talking to [Indigenous communities] and taking samples of their medicines. They might acknowledge where they got it from, but there is no money going back into that community they got the information from.

In a 2016 episode of Landline, Margo Northey, leader at the Wadeye Women's Centre noted:

> *This is knowledge that's been around for a long time, and it's great that it's being exploited to some extent, but recognition…is really important. There is no priority given to Indigenous people. Anyone, including big companies, can currently put in place patents on processing bush foods, making it difficult for Indigenous people to commercialise them.*

The program also notes that 'the Northern Land Council…represents traditional owners and is calling for a blanket moratorium on all patents over native foods and plants until a legal framework protecting Indigenous interests can be enforced.'

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30th August 2022