Indigenous Science Network Bulletin

August 2021 (Volume 22, Number 3) **ISSN 1449-2091**

Coordinator: Mark Linkson **Contact:** IndigenousSciNet@yahoo.com

Promoting First Nations' science, teaching & education

Cindy and Lianna are part of a unique on-country education program for Aboriginal students living in Arnhemland in the Northern Territory of Australia. Learning on Country students complete the Certificate II in Land Management and graduate Year 12 with an employment pathway leading to work with local Indigenous Rangers (who are employed across the NT to care for country). It's a way of utilising traditional knowledge with the students on country by bringing it back into the Western school system. (*Image ABC News: Emma Masters, 9 July 2021*)

national science week 2021

national science week

The Indigenous Science Experience

We're going online again in 2021 with free workshops and seminars!
Sessions will be announced soon so keep an eye out.
Event will run across 16 - 22 August, 2021.

FROM THE COORDINATOR

In this edition of the bulletin, we present another collection of items related to First Nations peoples and their science for an audience of teachers, scientists and interested community members from across the globe. We are based in Australia and consequently have a majority of Australian items, although there is not necessarily a strong correlation. It has been suggested (by one of our international First Nations Co-Editors) that Australian media reflects the strong interest and engagement that this nation has with First Nations issues and affairs, as compared to other countries around the world. As an organisation aware of its limitations, we have attempted to broaden our net through appointing Regional Correspondents (and thanks to those of you who agreed to assist – we look forward to your contributions).

In this issue we have again highlighted the work of an Indigenous science student. Tahnee Brown of Katherine in the Northern Territory of Australia has submitted her research into the use of plants as medicine. She has called upon the wisdom of her ancestors and used that in researching and presenting a biology report. Fascinating work and we thank her teacher and network member Genevieve Firmer for negotiating this for us. Link.

Recently a book was released (Farmers or Hunter Gatherers?) that critiques the ground-breaking findings of Uncle Bruce Pascoe in his book Dark Emu. A series of articles have consequently been published which explore and enlarge upon the opposing claims made. Absolutely fascinating reading for anyone who cares about Indigenous Australian knowledge and how the retelling of history unavoidably reflects the interests and bias of the writers. Link.

One of our First Nations co-editors Assistant Professor Michael-Shawn Fletcher's important work in measuring the effects of cultural burning over thousands of years is highlighted in this story. Over in New Zealand, that perennial bugbear of Western empiricists claiming that there is only one true fact-based way of doing science (or maths etc) has sadly erupted again. Check out the series of responses which quickly followed the offending article here. Finally, please see our surprising Editorial by Assistant Professor Michelle Hogue, who has (against the odds) improved her science pedagogy due to the restrictions of the Covid pandemic!

Original artwork for the Indigenous Science Network from Tiwi designs by Jennifer Coombs, Melville Island, NT, AUSTRALIA

This week in Australia it is National Science Week and there are science activities occurring all across the nation. It is significant for us that Indigenous Knowledge has been included as one of the themes.

And please forward this bulletin to any friends / colleagues who may appreciate or benefit from our work.

Mark Linkson, Coordinator ISN, Cairns Queensland AUSTRALIA

First Nations' Advisory Board (Co-Editors)

Professor Elizabeth McKinley, University of Melbourne, AUSTRALIA (Chair of the Board)
A. Professor Michelle M. Hogue, University of Lethbridge, CANADA
A. Professor Michael-Shawn Fletcher, University of Melbourne
Dr. Femi S. Otulaja, University of Witwatersrand, SOUTH AFRICA
A. Professor Frances C. Koya-Vaka'uta, University of the South Pacific, FIJI
Joe Sambono, ACARA, Brisbane, AUSTRALIA
Carly Jia, AITSL, Melbourne
Jesse King, Stronger Smarter Institute, Brisbane

We acknowledge and pay respect to the past, present and future Traditional Custodians and Elders of the Aboriginal and Torres Strait Islander peoples of Australia and all First Nations peoples across the world. We celebrate and promote the continuation of their cultural, spiritual and educational practices.

Aims of the Indigenous Science Network

Originating from a meeting in 1998 of science educators and Indigenous community members in Darwin, Australia. We agreed that there should be a central place for Indigenous knowledge in any science curriculum. We have grown to cater for scientists, educators and Indigenous community members from across the world:

- To promote First Nations science, teaching and education
- To support all educators who would like to improve their knowledge and understanding of Indigenous science and how to access and use it in their teaching
- To involve Indigenous scientists, educators and community members who support the inclusion of Indigenous knowledge in teaching science and are open to dialogue and sharing about their own experiences.

Regional Correspondents (Note: we still require a volunteer for the Pacific region)

AFRICA

Femi OTULAJA, University of Witwatersrand, SOUTH AFRICA
Keith LANGERHOVEN, University of the Western Cape, SOUTH AFRICA
Sina Joshua FAKOYEDE, Federal University Oye-Ekiti, NIGERIA

ASIA

Prem PHYAK, Chinese University of Hong Kong, CHINA
Indra Mani RAI, Tribhuvan University, NEPAL

THE AMERICAS

Coimbra SIRICA, Burness Global, USA
Wanda BAUTISTA, Burness Global, USA
Claudia LIEVANO, Burness Global, USA
Andrew DAVIS, Fundacion PRISMA, EL SALVADOR
Lucas TOLENTINO, Global Alliance of Territorial Communities, BRAZIL
Michel LAFORGE, Global Alliance of Territorial Communities, ECUADOR

EUROPE

Michael Reiss, UCL Institute of Education, London UK

ISN Facebook page and Twitter account

The Facebook page now has around 1050 followers and the Twitter account has 1143 followers (as at 15 August 2021). Most of these people are not official members of the network (not having supplied an email address) but some do contact us via those sites to be enrolled. It means we can improve and widen our reach by posting to those media.

Items posted on Facebook focus on Indigenous science, environmental, welfare and equity issues. More pointedly, the Twitter account covers many Indigenous issues, much more than just science and has contributions from First Nations peoples of all settler countries. If you are not yet a Tweeter, I would encourage looking into it. The Coordinator of this Network, Mark Linkson, has been running both these media but would be happy to share the load with other members if you are keen. The logos above contain hyperlinks to our live and continuing everyday media presence. However, the Bulletin is our most important and significant work, although some of the issues and stories that first crop up on social media do translate to future stories in the Bulletin. Significantly for our visibility, on Twitter we have been followed by the **UN Biodiversity** account (with over 92k followers) and they have tagged us in some recent tweets.

Michelle Hogue (PhD) *is an Associate Professor & Coordinator of the Indigenous Student Success Cohort (ISSC) at the University of Lethbridge in Alberta, Canada. She has helped ensure the success of many students at university, particularly in science-related programs. Of Métis heritage, her locally, nationally, and internationally recognized teaching and research focuses on building bridges between Indigenous and Western ways of knowing and learning. In her work she uses culturally relevant and innovative methodological approaches such as narrative and the arts, hand on learning by doing first and land-based education that blends required curricular and institutional demands with methodological teaching practices that attend to Indigenous Ways of Knowing and Learning. Her research explores best practices in Canada, Australia, and New Zealand to develop an inclusive, culturally responsive teaching practice and curricula through the philosophy of Bridging Cultures: Two-Eyed Seeing for Both Ways Knowing to enable Indigenous engagement, retention, and academic success broadly, as well as specifically, in the sciences and mathematics.*

Reflections on Indigenous STEM Education in a Pandemic

Engaging Indigenous learners

My Scholarship of Teaching and Learning (SoTL) is focused on building Indigenous academic capacity in all areas but passionately in the sciences and mathematics. As a specialist in curriculum development focused on bridging cultures through Two-Eyed Seeing for Both Ways Knowing (TES-BWK), I have found that in order to engage and retain Indigenous learners in the sciences and mathematics in particular, the methodological approach has to be culturally relevant and attend to Indigenous Ways of Knowing and Learning (IWKL). My experience has led me to redesign the first-year Indigenous Student Success Cohort (ISSC) program, of which I am the Coordinator at the University of Lethbridge (Alberta, Canada), and also to redesign my chemistry course to attend to IWKL; to be hands-on "learning by doing first". My methodological approach of *practice first before theory* and *bridging with Indigenous knowledge* has been very successful in engaging and retaining Indigenous students. Most who take my chemistry course pass (and with good grades) and many go on into STEM-related fields such as environmental science, nursing, science education, and medicine. This approach has gained recognition at the local, national, and international levels as a methodological approach that engages and retains Indigenous learners academically and in STEM.

Remote Indigenous learning issues

This was great until the monkey wrench of March 2019 - the global COVID-19 Pandemic. When it hit, schools and universities in Canada like in most parts of the world, closed and went online, significantly disrupting the lives of students, educators, and researchers alike. With the sudden shift to online learning platforms, the limitations were great and there were unequal impacts, with those from marginalized groups such as the Indigenous population being most negatively impacted. Educators at all levels scrambled to finish out the academic year in a less than adequate online fix with the hope that all would return to normal by the start of the next academic year. However, it soon became clear that what we hoped to be a short-term challenge was to persist for another entire academic year, with educators and administrators being forced to reinvent education. The greatest challenges were in the sciences.

Many universities, mine included, created laboratory kits for students in the sciences so they could do the laboratory component of the course at home with the theory classes being taught either asynchronously or synchronously online. With this came the assumption the students have the foundation, context, support, space, and access to all the tools necessary to carry out the activities or experiments at home. For most non-Indigenous mainstream students this was the case. However, many Indigenous students are from rural or remote communities where the infrastructure and equipment needed to support online learning is inadequate or underperforms and their connectivity frequently fails. Additionally, Indigenous students, more-often-than-not, live in very crowded multi-generational households, with little space in which to work, which adds an additional layer of safety concerns. So, carrying out science experiments at home wasn't a practical option, and for some in remote communities, such as up north, getting science kits to them, particularly in the winter, was just not feasible. So how to teach science, chemistry in particular, was a challenge. My great concern was how to not further augment the educational STEM gap that already exists by inequitable remote learning. So, I began to explore other methodological approaches.

Land-based learning

Although there is much diversity between Indigenous peoples, a deep and abiding connection to the land is common, so land-based science seemed a viable option particularly for Indigenous students in community. Land as curriculum makes sense and nationally as well as around the world, land-based education has been gaining recognition for building the social-emotional skills and technical competencies Indigenous youth need in this 21st Century. For Indigenous learners in particular, land-based learning aligns and bridges their worldview and IWKL with Western systems. What better way to attend to pandemic health protocols and to socially distance than to be on the land? In a scoping review, I found Indigenous teachers were creating amazing assignments around traditional practices and land use such as:

- identifying and harvesting sacred plants
- traditional hunting and gathering practices
- traditional land use and
- cultural stories

to name just a few and then creating bridges to the curriculum they were to learn. Many teachers created assignments so that families could work together on a project in their own social bubble. As a result, culturally relevant project-based learning became the focus that engaged Indigenous students and their families. It inspired me to take my hands-on-learning-by-doing approach to chemistry in a different direction – a combination of kitchen chemistry and land-based science, both which turned out to be more successful than I anticipated (fodder for a more extensive article)!

Positive effects of the pandemic

So, while challenging, the pandemic forced a much-needed change to science curriculum development to make it relevant to both Indigenous and non-Indigenous learners alike. It unexpectedly opened this door much wider and provided the opportunity to redesign curriculum in a different way as educators scrambled with teaching science in safe ways. It enabled educators to move away from the traditional Euro-western classroom and teaching and learning practice and explore more traditional Indigenous ways of learning with the land as the textbook. As we move forward post COVID-19, we have the unexpected opportunity to keep this door open; to re-design curriculum in a different way, a way that moves from the traditional Euro-western textbook way of learning to traditional Indigenous ways of learning. The pandemic has forced that needed change in science curriculum development – to make it relevant – to both Indigenous and non-Indigenous learners so that they re-engage in the sciences. It is up to us to build on the opportunity presented inadvertently by COVID and get the momentum in STEM going. The land is a textbook and language common to both Indigenous and non-Indigenous learners. Post pandemic, and in our current global environmental crisis, it is a critically important way to bridge cultures.

***E'kosi,* Kind Regards, Michelle M. Hogue**

Important outcomes from the inaugural meeting of the ISN First Nations Advisory Board

(Mark Linkson, Coordinator ISN, 15 August 2021)

After having reconstituted the Indigenous Science Network in August last year, I invited a group of First Nations scientists and academics to volunteer as Co-Editors. On Friday 16 July (which was Thursday 15 July in the USA and Canada) we finally met in cyberspace to discuss our progress and agree on just exactly what it is this network hopes to achieve. With Professor Liz McKinley acting as our interim Chair (now confirmed in the position – congrats Liz), we agreed on the following:

- The aims of the network (as listed at the front of this bulletin) **Confirmed**

The Bulletin:
- appears to cover more than just Indigenous science but also such areas as culturally appropriate pedagogies, issues surrounding cultural awareness for non-Indigenous educators etc. This approach was seen as valuable since effective science learning for Indigenous students will always require teachers who appreciate the complexities inherent in the teaching and learning of an Indigenous science pedagogy within wider dominant western (often post-colonial) education systems. **Confirmed**
- is unwieldy and needs a contents page and differentiation of the Australian Vs World items. **Done**

Twitter account and Facebook page:
- definitely covers more than Indigenous science but has exposed a great many more potential members to the network and is also a source of stories for the bulletin so will continue. **Confirmed**

Complete minutes of the meeting will be emailed around to network members separately. To become a member, simply email your interest to the Coordinator Mark Linkson at IndigenousSciNet@yahoo.com

INDIGENOUS SCIENCE NETWORK: BULLETIN ITEMS

Items are listed under five headings being **News and Views; Resources; Papers; Indigenous Astronomy** and **Conferences / Seminars**. A new feature this issue is that we have further categorised some of these sections with sub-headers of **Australia** or **The World**, to make finding your areas of interest easier. (See the Contents List below). Weblinks for most items are contained as hyper-linked addresses or as hotspots within illustrations. Some items will not have links. All links were active at the time of publication (15 August 2021).

ACKNOWLEDGMENTS: This issue contains contributions from and reference to the following network members: Mike Michie, Gregory Smith, Bruna Irene Grimberg, Coimbra Sirica, Michelle Hogue, Liz McKinley, Genevieve Firmer and Jesse King. Apologies if I have missed anyone. Many thanks and to all members, your future submissions are most welcome.

Aboriginal and Torres Strait Islander people should be aware that this bulletin may contain images and names of deceased persons.

ONLINE HOME FOR THE BULLETINS

All ISN bulletins since 1998 have been stored on Inaugural ISN Convenor Mike Michies' personal website and can be downloaded from there:

http://members.ozemail.com.au/~mmichie/network.html.

Eventually we will need to find a more permanent home. Member suggestions regarding this are welcome.

CONTENTS

Image taken from: https://www.canterbury.ac.nz/study/subjects/science-maori-and-indigenous-knowledge/

"Māori don't need Western science to endorse or authenticate our knowledge systems, which are centuries old - but to dismiss it without understanding...really suggests quite an astonishing lack of awareness and rigour."

Read the article here.

Water Corporation and MADALAH collaborate on new Indigenous STEM scholarship

(National Indigenous Times: 24 April 2021)

MADALAH staff and mentors celebrated the launch of the Water Corporation MADALAH Scholarship Program at a function held at the Water Corporation in Perth on Monday 19th April 2021. MADALAH is a not-for-profit organisation that offers Secondary and Tertiary education scholarships for Indigenous students from remote and regional communities to West Australia's leading boarding schools and Australian universities.

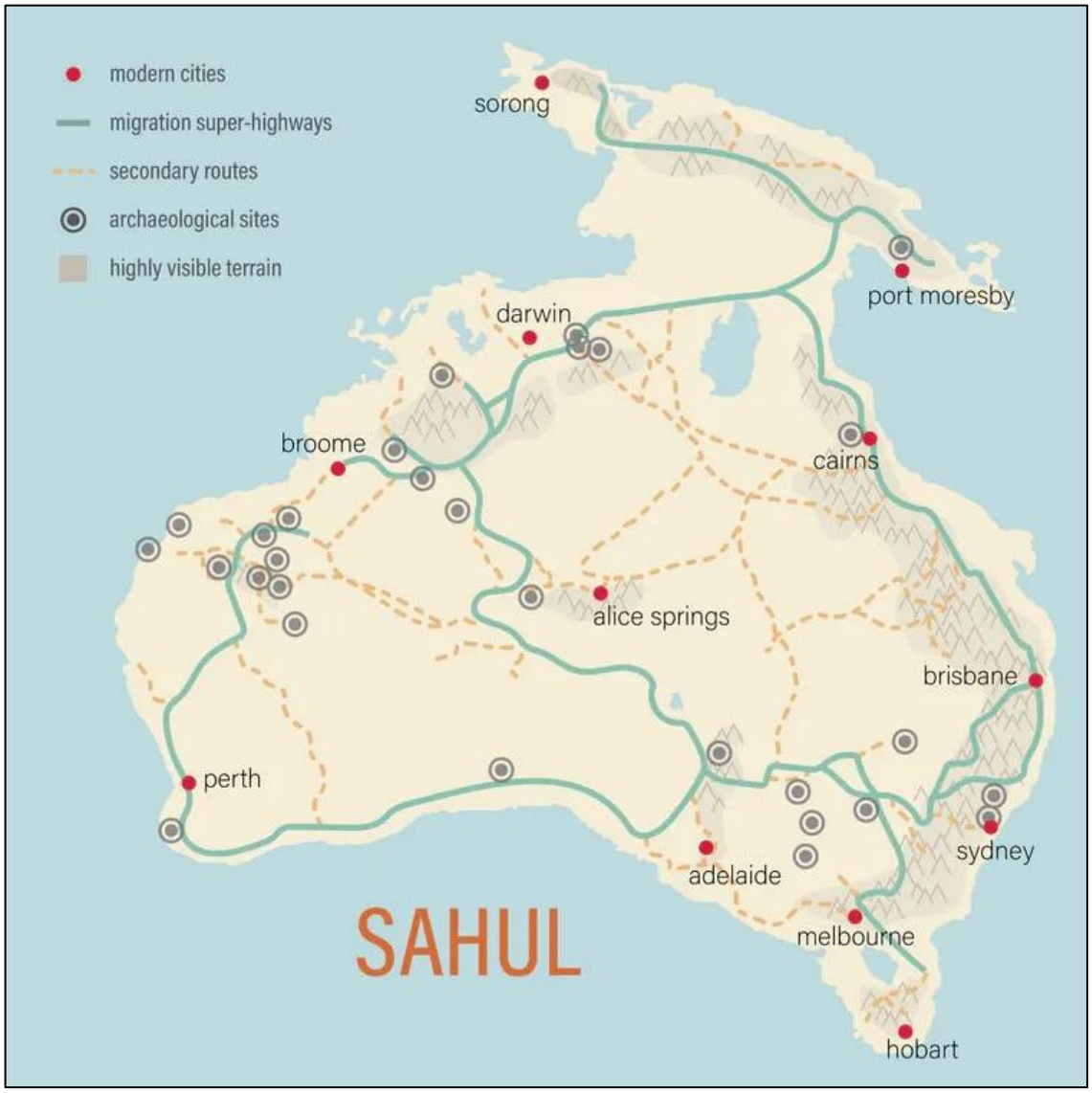
The new scholarship will support Indigenous students interested in STEM subjects and the water industry. Photo supplied.

The scholarship was created to support Indigenous students with a keen interest in STEM learning and the water industry and will cover education costs for Years 11 and 12, plus three years of tertiary study. Scholarship recipients Emmet Hodder Ryan, Talicia Griffin, Skye Carr and Samuel Tucker were all selected due to their interest in engineering, accounting and plumbing. The Hon. Dave Kelly thinks this is a fabulous program and feels education is vitally important. He believes the students now have the benefit of their culture, their knowledge and their Elders. "Thank you MADALAH for the work you have done putting this program together," he said.

Researchers demystify the secrets of ancient Aboriginal migration across Australia ***(Dana Morse, ABC News: 30 April 2021)***

A few years ago, archeao-astronomers discovered there was a link between Indigenous constellations and rural highways across parts of Australia (How ancient Aboriginal star maps have shaped Australia's highway network). Now a group of archaeologists, anthropologists, ecologists, geneticists, climatologists, geomorphologists and hydrologists have come up with an even more amazing claim: they believe that routes taken by the first settlers to Australia 60,000 years ago correspond with 19th century stock routes and Aboriginal trade lines!

Sixty thousand years ago, when rhino-sized wombats, giant echidnas and carnivorous kangaroos roamed the country, Aboriginal Australians were just making their way onto the shores. Australia's first people are thought to have arrived when the continent was a much bigger place, with lower sea levels connecting Papua New Guinea and Tasmania to what we now know as modern Australia, forming the mega-continent of Sahul. New research from the Australian Research Council Centre of Excellence for Australian Biodiversity and Heritage shows the paths that were likely trodden by the ancient Aboriginal people as they moved across the continent from the Kimberley to Tasmania.



"The super-highways that came out of some of the models actually seem to match up a lot of the old stock routes and the Aboriginal trade lines that we know from, say, the 19th century." "A lot of the European explorers — those that were smart enough to talk to the local people about which way to go and how to survive, I imagine that those would have passed down for a long time."

Using a plant to catch a fish? This is learning on country *(Emma Masters, ABC News: 9 July 2021)*

Indigenous students graduate high school by learning on country - It's a special trick handed down over generations — how to catch fish using the power of plants. On the sands of a creek bed on the edge of west Arnhem Land's stone country, Aboriginal elder Laura Rungguwanga is showing a group of local students the traditional fishing method and explains how to use the plants to force the fish to float to the surface.

Elder Laura Rungguwanga harvests fish from the creeks on her country using a unique method.
(ABC News: Emma Masters)

Her bush class is part of the Learning on Country program, which takes students through adapted vocational certificates in conservation and land management and includes going bush to learn. It's a way of utilising traditional knowledge with the students on country by bringing it back into that Western school system. Learning on Country began as a series of activities run by Indigenous ranger groups to better engage students in the Northern Territory's schools. It has since developed into a fully-fledged program that has been incorporated into the high school curriculum. Last year, the program had expanded to 15 communities around the Top End, with more than 700 middle and senior students enrolled.

Storm and splendour in the Top End *(Dr Brooke Ah Shay, Medical Republic: 12 July 221)*

The story linked below relates to the experiences of a doctor working in a remote Aboriginal community in the Northern Territry of Australia. Offered here for the insights which readers of this bulletin may appreciate.

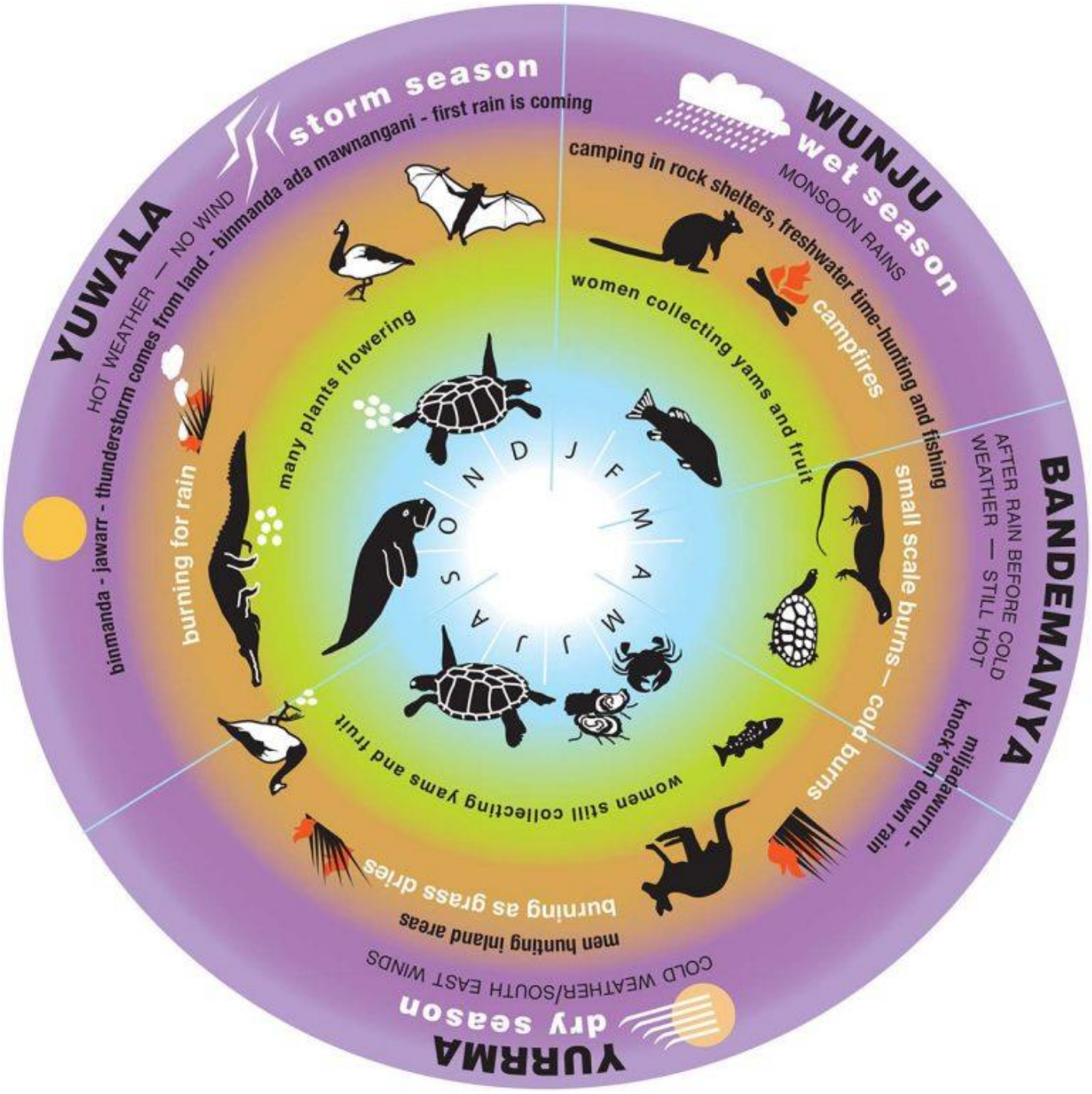
Working in Arnhem Land means having the privilege to bear witness every day to the world's oldest continuous culture, passed down over 60,000 years. To listen to language – remarkably, Maningrida is believed to be one of the most linguistically diverse places in the world per capita – and to hear stories. The stories are the best part. Hearing what patients caught while out fishing or hunting over the weekend, or how one of the traditional healers has been helping them recently, or learning about their family history, or simply what their favourite movies are.

Ancient Australian Aboriginal memory tool superior to 'memory palace' learning *(Monash University: 21 May 2021)*

Australian scientists have compared an ancient Greek technique of memorizing data to an even older technique from Aboriginal culture, using students in a rural medical school. The study found that students using a technique called memory palace in which students memorized facts by placinthem into a memory blueprint of the childhood home, allowing them to revisit certain rooms to recapture that data. Another group of students were taught a technique developed by Australian Aboriginal people over more than 50,000 years of living in a custodial relationship with the Australian land. The students who used the Aboriginal method of remembering had a significantly improved retention of facts compared to the control and the "memory palace" group.

Wunambal Gaambera Seasonal Calendar from the northwest Kimberley in Western Australia *(Bureau of Metrology: 6 July 2021)*

This NAIDOC Week, we are excited to launch the Wunambal Gaambera Seasonal Calendar from the northwest Kimberley, in Western Australia, on our Indigenous Weather Knowledge website. There are four major seasons as part of the seasonal cycle for Wunambal Gaambera Country — Wunju (wet season), Bandemanya (early dry season), Yurrma (cold season), Yuwala (build-up) Currently we are in Yurrma — the Dry season. This is the season of cold weather and southeast winds.



How can local plants in the Jawoyn region be used to prevent bacterial infections?

Scientific Report Prepared in 2019 for Year 11 Biology: Deconstruct and Design Task
Tahnee Brown: Submission supported by teacher, Genevieve Firmer

Author profile
My name is Tahnee Brown, and I am an Aboriginal woman from Katherine which is in the Jawoyn Region. My family is originally from New South Wales, but my grandfather moved to the Top End for work when he was younger.

Background to the report
The topic of my assignment was to see the antibacterial properties of traditional Indigenous medicinal therapies. I chose to base the assignment on investigating this topic to better my understanding of the ways in which Indigenous people relieved sicknesses before having the ability to access western medicines. In order to gather this information, a variety of different approaches were used. Books and websites were used to gather the information regarding the plants located in the Katherine region with medicinal properties. To gather the steps of preparation of the plants, a traditional owner was interviewed. Ozzie Daylight, interviewed, is the traditional owner of Elsey Station. This is located about fifteen kilometres out of Mataranka. I know Ozzie through Dad; Dad has been friends with many of the traditional owners in this area for many years. He explained the ways in which the plants were prepared and used and depending on the type of sickness, which plants are to be used. With this information the plants were prepared the way that the Indigenous peoples of the Northern Territory prepared them in the past. These steps of preparation are still used today by many Indigenous peoples, but is more commonly associated with medicine preparation in the past.

At the start of the project, I was working with another student, whose family is from Millingimbi, and this made talking about the topic interesting as some of the ideas and practices conflicted. Before the preparation of these plants, a plan was made which came over the conflicts and therefore, a viable experiment was agreed upon. In saying this, the project was quite enjoyable as it was a bit different to other classroom projects. Learning antibacterial properties of generalised plants is one step to better understand Indigenous cultures. I believe that other projects that investigate not only Indigenous cultures but many cultures should be completed in schools due to the fact that Australia is a multicultural continent.

I am interested in learning how medicines and other substances effect the brain and body. This includes the produce of diagnosing and treating patients. I am interested in what could be used as a better alternative to western medicines. In the future I plan to continue studying the effects that different medicines have on the body and how we can use first nations practices into the recognised medical fields.

Photo: Entrance to Kakadu via Manyallaluk, taken in 2019. From the left: Tahnee Brown, Genevieve Firmer. Manyallaluk is a small community situated roughly one hundred kilometres out of Katherine. My Dad has been going camping there before I was born, and I have been there since I was a little.

Teaching Notes by Genevieve Firmer

For this task, students were given free choice to design and conduct a scientific investigation related to our topic of microorganisms. The best thing about being a teacher is working with great students, particularly when they bring fresh, creative and innovative ideas about solving complex problems into the classroom.

When the idea about investigating something to do with local Indigenous knowledge came up in discussions, Tahnee enthusiastically took on the challenge. She consulted a book we had in the classroom about medicinal plants in the region and started a conversation with Ozzie Daylight, a traditional owner of the nearby Elsey Station, whom she has known through her family connections for many years. Tahnee brought all this information together to design the scientific investigation presented below about the anti-bacterial properties of a selection of local plants.

Infectious diseases are increasingly becoming a burden on society and the exploration of natural products for new potential drug molecules is more important than ever. Tahnee's project is a beautiful example of how students with diverse backgrounds can help to unlock information about natural products which may hold the key for scientific breakthroughs. Tahnee has used the strength of her family connections to navigate the process of community engagement in a way that is responsive to traditional owners and community.

This work is also a demonstration of how secondary students can use the existing frameworks for year 11-12 scientific investigation assessments to utilise contemporary scientific practices in the investigation of Indigenous knowledges. These skills are critical for progress to be made in the genuine engagement of First Nations peoples in scientific research, and projects like this allow students to see themselves and their strengths reflected in the curriculum.

This piece has been presented exactly as it was submitted it for a year 11 biology assignment as an authentic example of the work that students can achieve in a school environment. Permission has been granted by Tahnee and her family to share this work. Small sections of information have been withheld to protect the traditional knowledge shared with the student in confidence.

I would like to thank Ozzie for his willingness to work with Tahnee on this project and thank Tahnee and her family for agreeing to share this work publicly. Thanks also to Jesse King for the support in readying this piece for submission.

I would like to acknowledge the Jawoyn, Dagoman, Wardaman and Miali people, the traditional owners and custodians of the land on which this work was conducted, and where the authors lived at the time this project was completed.

To read the complete report, please go to the back of the bulletin. Link

ISN members are encouraged to submit items exploring any aspects of Indigenous science teaching or education. As the Bulletin is not an official journal or organ of any recognised institution, we are not required to enforce any formatting, editing or reviewing regimes. We do have an Advisory Board made up of eight First Nations Co-Editors who view all items before publication. If you are doing something valuable in Indigenous science, teaching or education, please consider telling your story here!

Medicine Bath ***(Georgina Gellett, I am Aboriginal, Public Facebook Group: 4 August 2021)***

My daughter and my niece having a bush medicine bath. Native bush medicine called in language *Butjuri'nganing* we crush or rip the leaves and boil it till the water changes colour to almost like the same colour as black tea then pour into bath tub and rub and massage your body. This traditional medicine is known to heal skin, bone and muscles and also has been scientifically approved.

This was taken at the Garma healing place during Garma festival after a long day of healing all our clients now it's time to heal ourselves.

So proud to be Yolngu and blessed to have a beautiful culture.

Aboriginal Intellectual Property Rights on Medicinal Plants with Henrietta Marrie - 3CR Earth Matters *(Cory Green, Radio 3CR, 30 January 2017)*

Henrietta Marrie, a Gimuy Walubarra Yidinji woman from Yarrabah in Queensland, has undertaken research in Australia and abroad on issues relating to traditional knowledge, access to genetic resources and benefit-sharing, protection of traditional knowledge as intellectual property, and the conservation and management of biological diversity. This is an interview recorded for Radio 3CR and hosted by Cory Green.

(Image: Cairns Post)

Linking modern science with Indigenous knowledge to care for the land *(Robyn Williams, The Science Show, ABC Radio, 5 June 2021)*

Professor of biodiversity Stephen Hopper says the world is struggling to care for biodiversity. The trend is down. In Australia, the damage has occurred in the last two hundred years, since European settlement. But Indigenous people lived in harmony with the land and its biodiversity for tens of thousands of years. Stephen Hopper is working closely with Indigenous people of Albany in Western Australia, the Noonga people, exchanging knowledge and ideas.

(Image: Albany Bugle)

TV news uses local Aboriginal names for Australian cities during weather reports *(4 July 2021)*

Bravo

@10NewsFirst

for the #NaidocWeek weather forecast

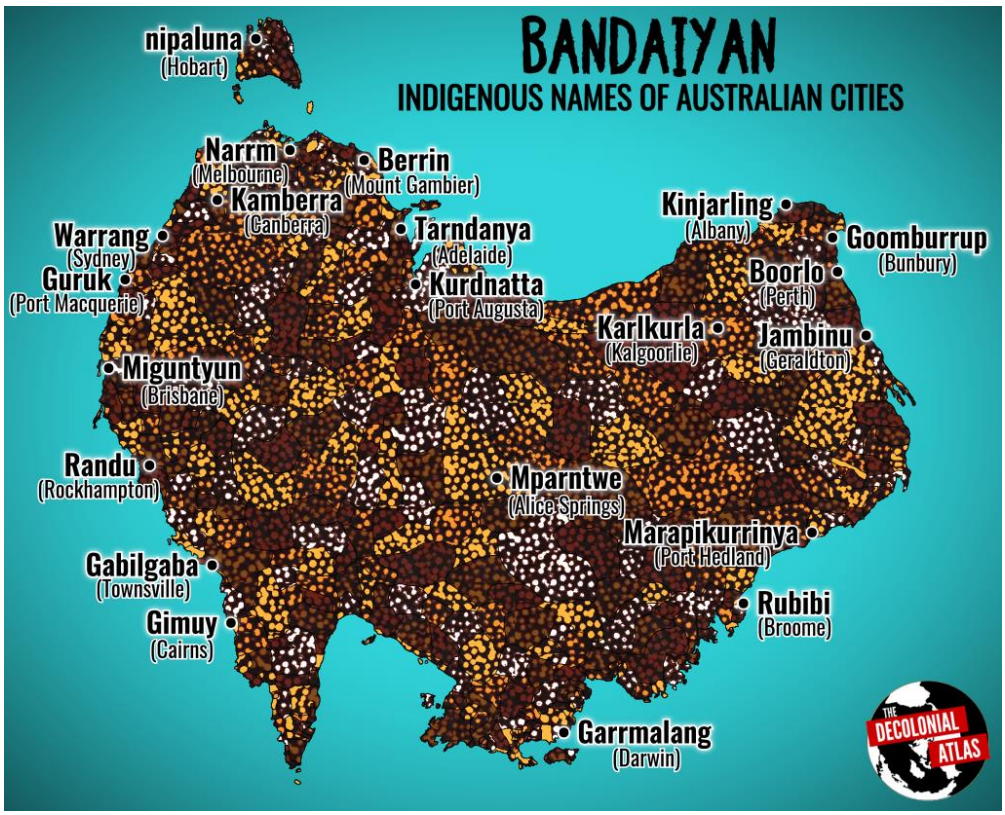
👏👏#NAIDOCWeek2021

Kudos to Channel 10 for celebrating NAIDOC Week by using Aboriginal language names on their weather maps.

Bandaiyan: Indigenous Names of Australian Cities *(The Decolonial Atlas: 23 January 2021)*

The meanings of the *Ngarinyin* word *bandaiyan* include 'landmass, nature, people in relationship.' According to the late Ngarinyin elder David Mowaljarlai, *Bandaiyan* refers to the whole of Australia. We use this term and all the other Indigenous names on this map in recognition that this continent is home to hundreds of peoples with their own languages who formed deep-rooted relationships with the land long before colonizers came and declared it Australia.

Shown on the map are the traditional territories of about 500 Indigenous groups, based on research from the 1996 Encyclopaedia of Aboriginal Australia, commonly called the "Horton map," with a stylistic nod to Papunya Tula dot painting and the Western Desert Art Movement. The map's South-up orientation shows a distinctly non-European perspective of the land down under.



Growing number of Aboriginal communities setting up independent schools to teach 'both ways' *(Emma Masters, ABC News: 4 July 2021)*

The students from the independent Nawarddeken Academy receive full-time education in a new style "two-way" curriculum that blends their culture and language with Western numeracy and literacy. Having children learn and play on their traditional lands had been a long-time dream of Aboriginal elders and rangers living and working at the outstation called Kabulwarnamyo, which has a population of just over 50. The curriculum has delivered attendance rates that hover between 80 and 95 per cent, as well as increased student engagement, and boosted the number of students who complete their allocated work.

Indigenous seasonal calendars are the backbone of the "two-way" curriculum. *(ABC News: Emma Masters)*

Study finds cultural inclusion key for remote Aboriginal students *(E-news, Charles Darwin University, 5 May 2021)*

A Charles Darwin University study has sought to examine the policy reasons why Aboriginal students in remote Northern Territory schools are underperforming under a western education model and framework. The study has revealed that the current education model is not setting up Northern Territory remote Aboriginal students for success, but instead is keeping them marginalised and significantly academically behind other Australian students. “Examples like Gunbalanya show that the institution of education is more likely to succeed when Aboriginal peoples are centrally positioned in the leadership, governance, and voices of education concerning children and community development,” Dr Fry said. He found that students who are connected to their Indigenous identity at school to be more positive and engaged at school and attendance and performance outcomes were higher. “If we want Aboriginal students to thrive in remote schools, the voices of Aboriginal people must be built in and integrated within the school and be a place where children can listen to the stories and languages of their people,” Dr Fry said.

Celebrating our first Teachers of STEM (ToSI) graduates *(Stronger Smarter Institute: 22 Jan 2021)*

It is estimated that seventy-five percent of the fastest growing occupations now require Science, Technology, Engineering and Mathematics (STEM) skills and knowledge (as reported by the Office of the Chief Scientist 2014). As noted in the report, students engaging with STEM education will develop in-demand skills that are relevant and highly valuable to an increasingly wide range of occupations. Workplaces of the future will be adaptive and nimble, and employees will need to be reflective of this. It is imperative that Aboriginal and Torres Strait Islander students are an integral part of this future.

Funded by the National Indigenous Australians Agency, the Stronger Smarter Institute developed the Teachers of STEM Initiative (ToSI) as an innovative response to support Indigenous women to succeed in obtaining a STEM teaching qualification. As part of the Institute's SSiSTEMIK Pathways, ToSI also provides professional development programs available to all educators seeking to improve the STEM educational experience of Aboriginal and/or Torres Strait Islander students.

Lisa Capewell, a teacher at Meekatharra School of the Air is one of the first graduates from the program, completing her Graduate Certificate in STEM at the Queensland University of Technology. Lisa says that completing her study has boosted her confidence in sharing Indigenous culture through STEM and inspired her to do further inquiry and project-based STEM with students on campus. "I have shared my experience with the staff at work, and we have implemented a yarning circle when on camps," Capewell says. "I feel more confident in planning and sharing Indigenous knowledge with the students and recognising Indigenous people as the first scientists, astronomers, and engineers."

Flori King-Smith also completed the Graduate Certificate in STEM at the Queensland University of Technology. Working as a Diamond Spirit Mentor Teacher at Bremer State High School in Queensland, King-Smith believes the ToSI program validated "how important it is to get into STEM in order to preserve Aboriginal culture". She felt the program provided social and wellbeing assistance in a culturally safe way and noted that "…a program that is run by Indigenous women [which helps] Indigenous women to gain a qualification, you couldn't ask for the most appropriate way to help me grow." She says that staying connected to other women in the ToSI program helped her to stay motivated and persist through the challenges.

South East Queensland's eucalypt toolbox rediscovered via historic records of regional Indigenous knowledge *(University of Queensland, 1 June 2021)*

South East Queensland's eucalypt trees can provide everything from medicines to tools, traps and building materials, according to rediscovered records of regional Indigenous knowledge. The University of Queensland's Associate Professor Rod Fensham has cross-referenced species data with the records of *Gairabau*, a *Dungidau* man, and German explorer Ludwig Leichhardt, who travelled with Aboriginal people through the region in the mid-nineteenth century. Dr. Fensham has verified his findings with contemporary Indigenous community members, and said he was blown away by the versatility of eucalypts in the south east corner.

Darwin's Aboriginal rangers are on a mission to protect the far eastern curlew *(Peter Lacey, ABC News: 10 July 2021)*

The far eastern curlew is not to be confused with its noisy and shorter-beaked cousin, the bush stone curlew. *(Supplied: Dan Weller)*

Along the shores of Darwin Harbour, Larrakia Indigenous rangers are monitoring and recording data on the far eastern curlew, a critically endangered bird that flies thousands of kilometres from north-east Asia to Australia's shores each winter. For senior ranger Gabrial Millar, 22, working to protect and care for her clan's traditional country is "more than just a job. It's central to my identity," she said. "Being a new mother, it's important to me to keep Larrakia country healthy and thriving because I can hand that down to my son and the next generation."

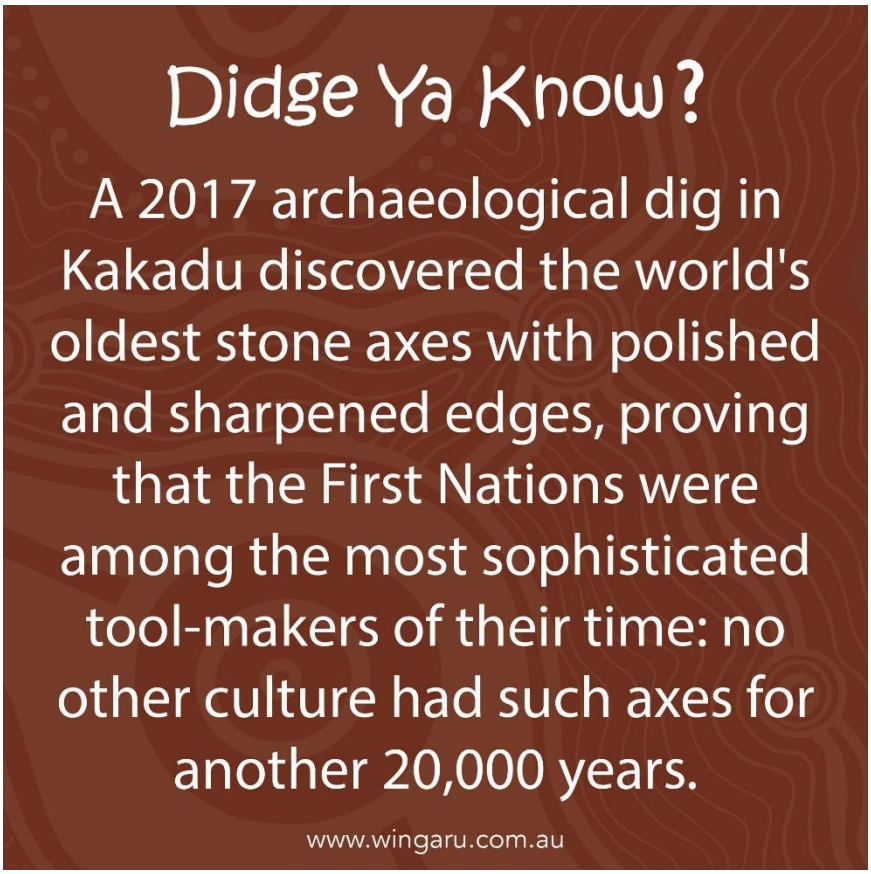
University of Tasmania's new subject aims to 'indigenise' teaching *(Alexandra Alvaro, ABC News: 31 May 2021)*

"That importance of being out here and feeling listening and seeing and smelling and talking and sharing — you don't necessarily get that in a classroom, or in a western education system," *Indigenous Lifeworlds: Story, History, Country* is an Australian first, and part of the university's attempt to 'Indigenise' it's curriculum. "Indigenising is bringing Indigenous leadership, Indigenous scholarship and Indigenous knowledges into the academy," said Professor Walter. In the past, students only learned about Aboriginal people and their experiences through a western lens. "It's been little bits, the bits that are seen as cute — dancing and food — of culture, rather than the hard parts of it, and it's always been interpreted through non-indigenous eyes," Professor Walter said.

Celebrating Indigenous cultures through STEM and virtual reality ***(Nick Pattison, Tulliallan Primary School, Teacher Magazine: 17 Nov 2020)***

At Tulliallan Primary School in Melbourne, teachers and students have been working with local Indigenous groups to create an immersive Acknowledgement of Country. In today's reader submission, STEM teacher Nick Pattison shares the story from different perspectives.

As STEM teachers, we felt it was important to show how a STEM mindset with project-based learning (PBL) can be used to make the community a better place. We designed our primary STEM program in the belief that kindness and empathy are key to any meaningful project, and we wanted to show how this approach can be applied to an authentic problem. We are ecstatic with the outcome of this project because we were able to apply technology in a relevant way. We have been able to build a better relationship with Wurundjeri, as well as provide our students with the opportunity to better understand and connect with the people and elements of our local land.



Righting the wrongs: teachers must fight ignorance of Aboriginal history with education and break the cycle *(Shelley Ware for IndigenousX, The Guardian: 17 June 2021)*

Children at a Sydney black deaths in custody rally earlier this year. Education is the key to breaking a cycle of ignorance about Australia's Aboriginal history. *Photograph: Mick Tsikas/AAP*

As an Aboriginal teacher and education consultant, I am often met with the same statements from teachers about why they are not embedding Aboriginal and Torres Strait Islander history and culture into their everyday curriculum. Many cling to statements like, "I don't want to offend" and "I don't know where to start" like a security blanket. In all honesty, we are asking a generation of teachers who were effectively denied an education of their own country's true history to teach the next generation.

I've been an educator for 25 years. Whenever I visit a school and I start talking to students, teachers often become very nervous and start answering my questions for them. Then they will come up to me at the end and say "we have done this, I have no idea why they didn't know". I ask them how they taught it, and nine times out of 10 they will say, "I read a book for Reconciliation or Naidoc week". I then explain that it's about embedding this knowledge into the curriculum, not doing special dates only. It's so important.

Canberra school using yarning circles to teach reconciliation, promote deeper communication *(Holly Tregenza, ABC News: 8 June 2021)*

For thousands of years, yarning circles have been used by Aboriginal and Torres Strait Islander people to resolve conflicts, negotiate trade routes and welcome outsiders to a territory. Now, a primary school in Canberra's north-west, is using them to teach a new generation about reconciliation. "It provides a communication, that is deeper from the heart, and this is something that we have had for tens of thousands of years," Wurundjeri woman Virginia Marshall said. And Dr Marshall said the practice was much more than "a gas bag over the fence." "It ensures that trust exists," she said.

The primary school uses the yarning circle as an outdoor classroom where children are taught about the land they learn on and the Elders who care for it. "It's about empowering all our students, but especially our First Nations students, who are so excited that their culture is being valued," cultural integrity coordinator Tikarra Looke said. "Then they get to be the teachers, their families get to be the teachers – that's reconciliation for me."

(Image ABC News: Holly Tregenza)

Australia's first Aboriginal fire management course *(Taylah Fellows, scone.com.au, 17 June 2021)*

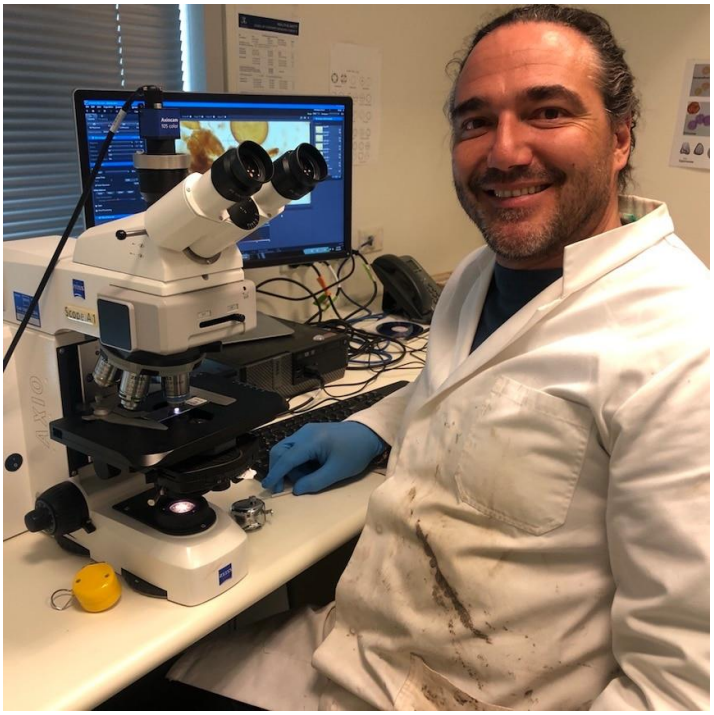
HUNTER Local Land Services (LLS) has launched a Cultural Burn training program that teaches Traditional fire management practices and techniques to Aboriginal land management students. The pilot course is the first tertiary qualified Cultural Burn course in Australia, offering training in both Aboriginal Fire Knowledge Practices and Western Science. There are currently 30 students enrolled who will learn how to apply the correct fire knowledge to specific types of vegetation to reduce weed infestations, improve the health and function of native vegetation communities, protect native animal habitats, reduce the risks of wildfires and promote resilient landscapes. Cultural burns will be held on different types of land tenures in the Hunter, from Travelling Stock Reserves to privately held properties including Box-Gum Grassy Woodlands, open grassy woodlands and high elevated areas such as Mount Sugar Loaf, with monitoring plans used to capture data prior to and after each burn.

Aboriginal Land Management students on Biraban LALC Country near Morisset for a recent Cultural Burn. *Photo supplied by Hunter LLS.*

Hunter Local Land Services Aboriginal Community Officer Toby Whaleboat said the course could not have been developed or proceed without the support of local Elders and community, who are allowing the students to work on Country. "We are so grateful to be working with Traditional owners, our community and Local Aboriginal Councils in the Hunter and Manning Great Lakes, as well as our training partners to deliver this unique course," Mr Whaleboat said.

Scientist investigating Australia's past says Indigenous cultural burning key to controlling bushfires ***(Tim Lee, Landline: 26 June 2021)***

We are pleased to see that the work of one of our ISN First Nations Co-Editors (Michael-Shawn Fletcher) has been recognised as vitally important to the future health of the Australian natural environment.



Dr Fletcher examines earth samples at the University of Melbourne. *(ABC Landline: Tim Lee)*

Associate Professor in earth sciences and Wiradjuri man Michael Shawn Fletcher is a geographer who studies high-resolution images of fossils, organic material and charcoal trapped in sedimentary layers often deep in the earth. "[It is important] to unpack the history of landscape change from Aboriginal management through to the modern day, not only for how we manage this country but understanding how it operates," Dr Fletcher said. This is really, really fundamental information." Varieties of pollen reveal what plants were once present. Charcoal tells the story of fire regimes. Geochemical changes indicate the frequency of floods. "The biggest change that we see most uniformly in the last 10,000 years on this continent is the invasion by the British and a removal of cultural burning from landscapes," Dr Fletcher said. His work may be providing the most compelling data yet about the crucial role of fire in Australia's ecology.

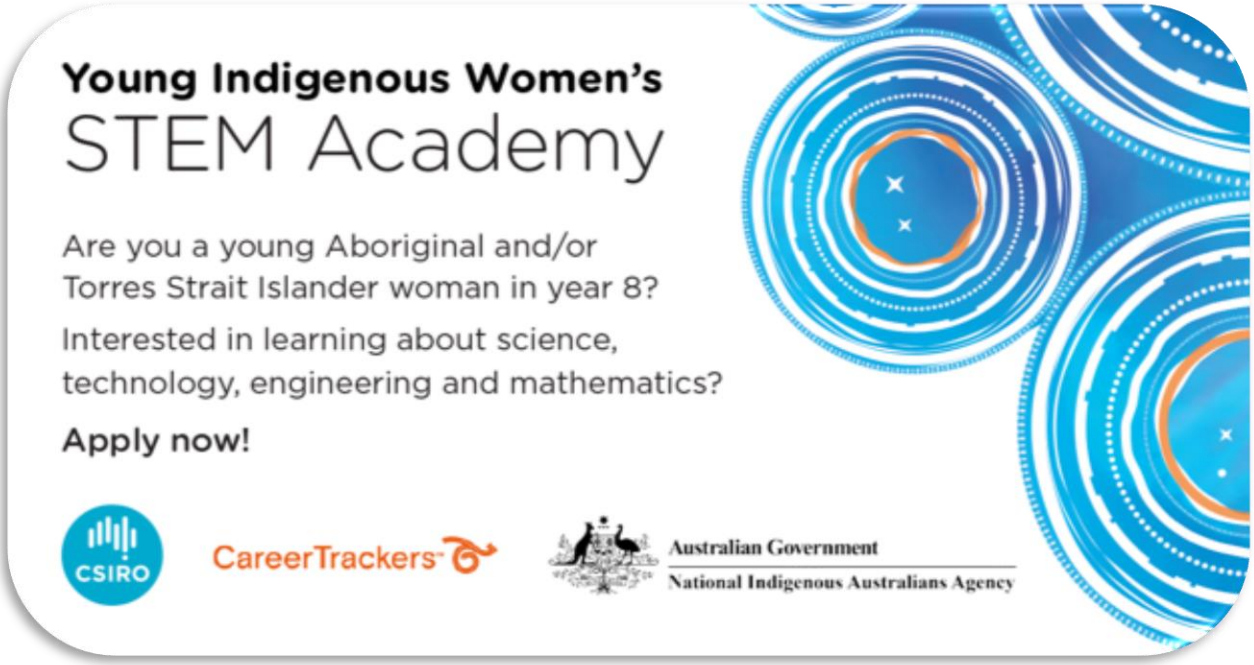
This groundbreaking work has some sizeable support, including from prominent Indigenous leader and academic Marcia Langton, who is also a geographer and anthropologist. Professor Langton has been a long-time advocate of restoring Indigenous people's burning practices across the continent. She believes that if we are to avoid catastrophic wildfires such as the Black Saturday and Black Summer events, we need radical changes to fire prevention and management. "Take a commonsense view, adapting to the Aboriginal way of managing country, using science and coming to grips with this Australian landscape and its ecologies, and not importing European ideas here which frankly have been disastrous for the country," she said.

Professor Langton has advocated for more than three decades for wider use of Indigenous fire regimes in land management. *(ABC Landline: Tim Lee)*

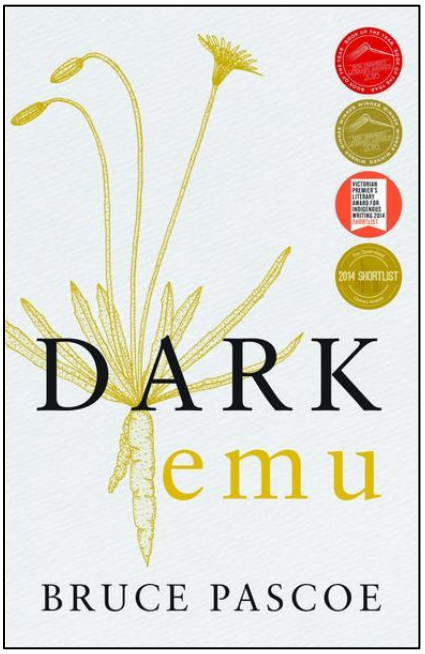
New sculpture unites traditional knowledge and modern science in Western Australia's south ***(Tom Edwards, ABC Great Southern: 30 May 2021)***

A first of its kind sculpture that unites traditional knowledge with modern science has been unveiled in Western Australia's Great Southern region.The 3.5 metre high 'evolutionary tree' is a collaboration between Indigenous and non-Indigenous artists and conservation groups. Menang elder Carol Petterson - one of the driving figures behind the project - said the artwork was a fitting tribute to her people's deep connection to the land. The sculpture seeks to represent the stories of significant plants and wildlife from the area, juxtaposed with the deep time history of the region.

The Genestream sculpture was a collaboration between Indigenous and non-Indigenous artists as well as conservation groups in the Great Southern. *(ABC Great Southern: Tom Edwards)*

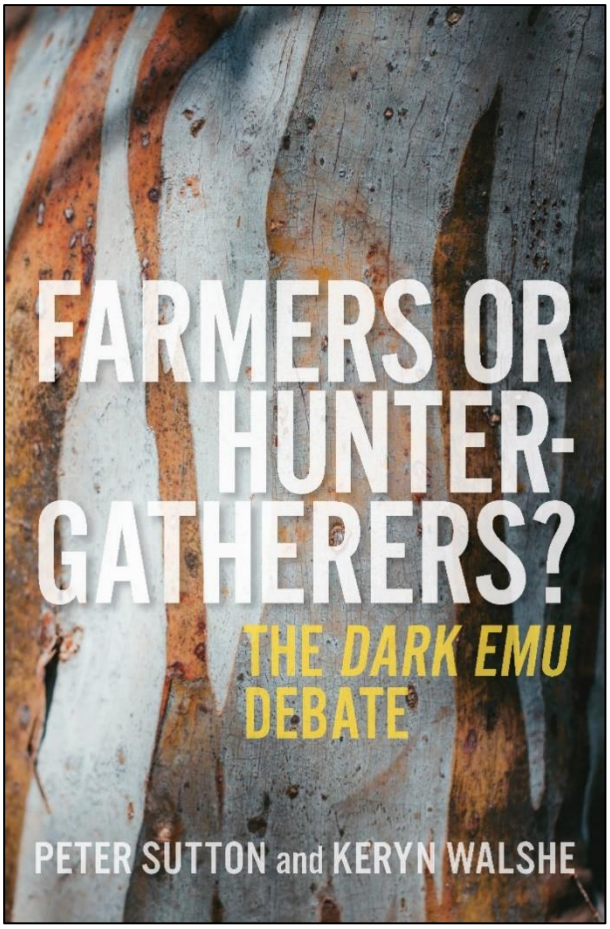


The Dark Emu debate *(Mark Linkson, Coordinator ISN: 15 August 2021)*



Recently a book was released that re-examines the ground-breaking findings of Uncle Bruce Pascoe, who wrote Dark Emu to demonstrate that Indigenous Australians were much more than just hunter-gatherers, but had permanent settlements and farmed large areas of the land. "Farmers or Hunter Gatherers?" by archaeologists Peter Sutton and Kerryn Walshe, goes back to the colonial sources that Pascoe used and argues that he was selective in what he chose to highlight, while ignoring passages that would not support his thesis. It is undeniable that Dark Emu has had a massive impact on the thinking of many Australians as regards the pre-colonial history of Indigenous Australia. It is also undeniable that every author brings something of themselves and their biases when writing and researching. Thus, we can only do as Pascoe himself has done – welcome the debate and hope that it advances understandings on all sides. Below is a selection of items related to this topic. Please note that Uncle Bruce himself has not yet responded to any of the points made about his research and claims.

Farmers or Hunter-gatherers? The Dark Emu Debate *(Peter Sutton & Keryn Walshe: Melbourne University Press, 16 June 2021)*



Australians' understanding of Aboriginal society prior to the British invasion from 1788 has been transformed since the publication of Bruce Pascoe's Dark Emu in 2014. It argued that classical Aboriginal society was more sophisticated than Australians had been led to believe because it resembled more closely the farming communities of Europe. In Farmers or Hunter-gatherers? Peter Sutton and Keryn Walshe ask why Australians have been so receptive to the notion that farming represents an advance from hunting and gathering.

Drawing on the knowledge of Aboriginal elders, previously not included within this discussion, and decades of anthropological scholarship, Sutton and Walshe provide extensive evidence to support their argument that classical Aboriginal society was a hunter-gatherer society and as sophisticated as the traditional European farming methods. Farmers or Hunter-gatherers? asks Australians to develop a deeper understanding and appreciation of Aboriginal society and culture.

Book review: Farmers or Hunter-gatherers? The Dark Emu Debate rigorously critiques Bruce Pascoe's argument *(Christine Nicholls, The Conversation: 14 June 2021)*

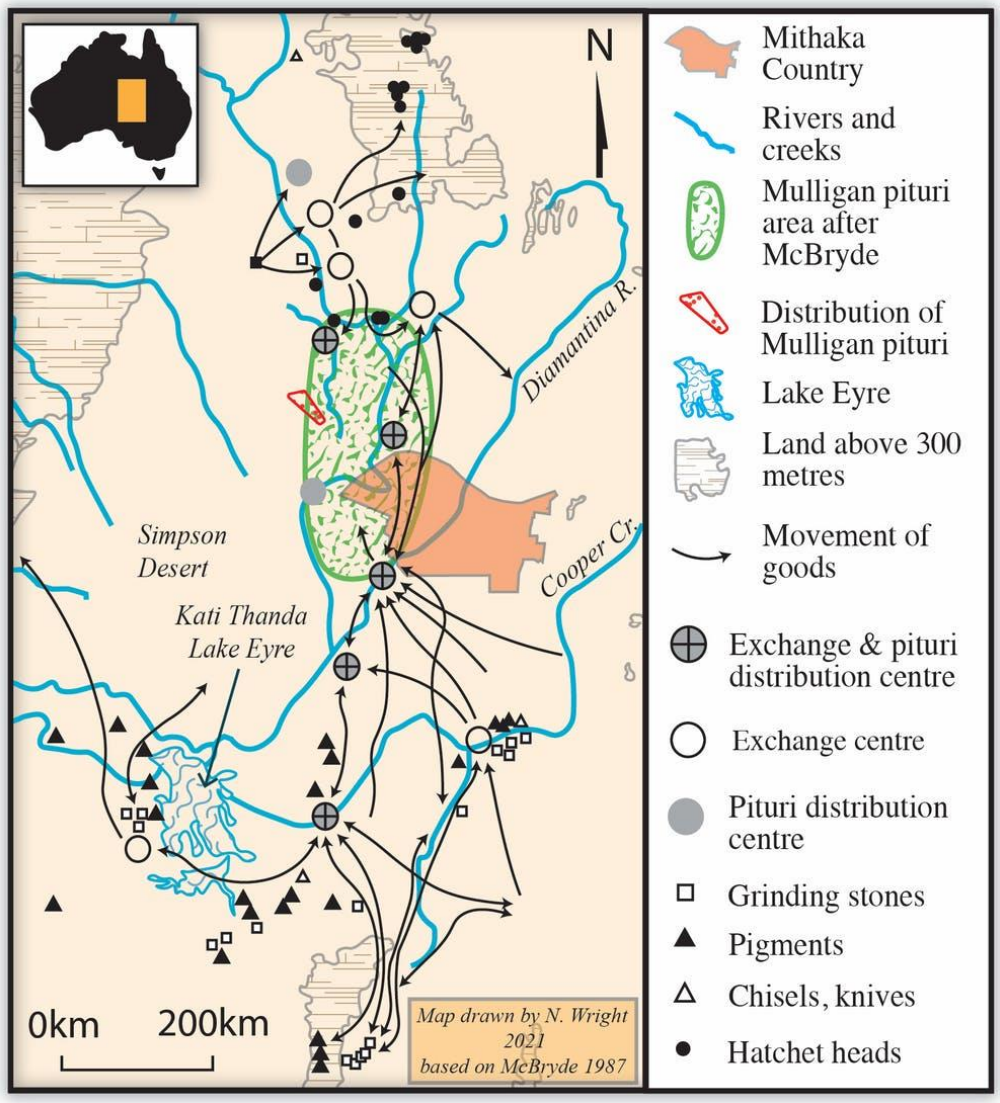
First published in 2014, Pascoe's Dark Emu has spawned numerous derivatives. Pascoe contends that in pre-contact times, Australian Aboriginal people weren't "mere" hunter-gatherers, but agriculturalists. Descriptors like "simple" or "mere" are anathema to people like me who've lived long-term with hunter-gatherers. For many Australians, Pascoe's book is a "must-read", speaking truth to power. For such readers, Dark Emu seems a breakthrough text. Not so, in Sutton and Walshe's estimation. Nor mine. While some have described Dark Emu as fabrication, Sutton and Walshe are more measured. They methodically show that in Dark Emu, Pascoe has removed significant passages from publications that contradict his major objectives. This boosts his contention that all along Aboriginal people were farmers and/or aquaculturalists. Why not simply celebrate the long-term achievements of hunter-gatherers? Hunter-gatherers worked in concert with the natural world, not against it as most humans do today, resulting in insoluble difficulties such as overcrowding, pandemics and toxic agricultural and aquacultural practices. Survival depends on this. For eons, it ensured the continuity and the continuing existence of Australia's hunter-gatherer people and their culture. Farmers or Hunter Gatherers? The Dark Emu Debate needs to be read carefully, keeping an open mind. The book's focus is on both material and spiritual economies and their misrepresentation.

The people in this photo are throwing pebbles and dust - not scattering or threshing seeds. It's a maintenance ceremony for nutgrass ('yelka'), to ensure spiritual reproduction.

Ralph Piddington, 'Totemic system of the Karadjeri tribe', Oceania 4, 1932, pp. 376–93, Plate II.

How our new archaeological research investigates Dark Emu's idea of Aboriginal 'agriculture' and villages *(Michael Westaway & Joshua Gorringe, The Conversation: 18 June 2021)*

Bruce Pascoe's Dark Emu is in the news again, with the publication of a new book critiquing Pascoe's arguments. Dark Emu builds on an earlier, less known work by archaeologist Rupert Gerritsen, who argued a number of regions across Australia should be considered centres of Aboriginal agriculture. Historians Billy Griffiths and Lynette Russell, and now anthropologist Peter Sutton and archaeologist Keryn Walshe, have argued Pascoe has fallen into a trap of privileging the language of agriculture above hunter-gatherer socioeconomic systems. Were First Australians farmers or hunter-gatherers? Contemporary archaeological research suggests it's not such a simple dichotomy. Understanding the Mithaka food production system may well tell us whether such terms are a good fit for defining socio-economic networks in Aboriginal Australia. For one of us (Michael), the ideas generated through Gerritsen's research and Pascoe's popularised account have inspired and stimulated a different way of thinking about Aboriginal food production systems, and how we might investigate an archaeological record for Aboriginal village settlements. And for the other (Josh), Dark Emu provides a different account of the Aboriginal past, written by an Aboriginal person outside of the academy, which challenges us to think differently about how we might define Aboriginal people. Josh believes it is up to archaeologists now to test Pascoe's hypothesis.



The location of *Mithaka* country within the trade network of pituri. Pituri leaves (some of which are from the Mulligan River region) are a narcotic and highly valued. This map shows the direction of trade and market centres and also the location of other important items of exchange.

Illustration by Nathan Wright

'Media never question the ethnicity of any other Australian': Minister responds to Dark Emu controversy ***(Frank Chung, News Ltd: 22 June 2021)***

Indigenous Australians Minister Ken Wyatt has broken his silence on the Dark Emu controversy, a week after fresh questions were raised about the accuracy of the influential Aboriginal history book. A number of experts now say Bruce Pascoe's 2014 bestseller – which claimed that Indigenous Australians prior to colonisation were not just hunter-gatherers but engaged in agriculture, irrigation and construction – has been all but "demolished" by a scholarly rebuttal by two respected academics, anthropologist Peter Sutton and archaeologist Keryn Walshe. Mr Wyatt noted that Pascoe was an "author of fiction, nonfiction and children's literature, including the book Dark Emu which re-examines colonial accounts of Aboriginal people and presents evidence of pre-colonial agricultural and engineering sophistication from various sources as cited". "I welcome more people taking the time to read Dark Emu and consulting Mr Pascoe's references to verify or disprove his assertions as we do with various academic studies or research," he said.

The Great Divide *(Bill Gammage, Inside Story: 21 July 2021)*

The debate about Dark Emu is trapped in a centuries-old European worldview says Bill Gammage, author of "The Biggest Estate on Earth", one of the chief sources quoted by Bruce Pascoe in his seminal work on Australia's Aboriginal pre-history.

Our European ancestors locked us in a madhouse. To explain why their society was technologically more complex than others, they came up with what I call the Great Divide — the separation of the world's peoples into farmers or hunter-gatherers. Anchored by their crops, farmers stayed put; hunter-gatherers didn't. So the Divide is also a division between sedentism and mobility.

Who are Pascoe's critics talking to? They are alarmed by what the public is being led to think, by what might be taught in schools, by how much good research is overlooked. Their remedy is to talk to each other.

The gap can be bridged. History is the most open of disciplines, the readiest to ignore jargon and theory, though some historians use too much of both.

How far does Farmers or Hunter-Gatherers bridge the gap? Dark Emu is a history and a polemic**.**

I approach both "Dark Emu" and "Farmers or Hunter-Gatherers" cautiously. Pascoe and I are both dissatisfied by the Great Divide but disagree on some fundamentals. He thinks people were farmers in 1788. I don't — I think some farmed but none depended on it. He thinks people have been here 120,000 years or more; the earliest possible date I know of is 65,000 years.

An Aboriginal settlement depicted in Francois Péron's account of Nicolas-Thomas Baudin's 1800–04 expedition, *Voyage de Découvertes aux Terres Australes (1807–16).*

The Government of Canada supports Dene Nation initiative to help conserve boreal caribou *(Environment and Climate Change Canada: 15 July 2021)*

YELLOWKNIFE, NT, July 15, 2021 /CNW/ - The Government of Canada is committed to partnering with Indigenous peoples to protect ecosystems, species, and cultures for a healthier environment. Indigenous Knowledge is a valuable source of environmental information that plays an instrumental role in shaping scientific activities and policies. This initiative will further Dene Nation work with leaders, Elders, youth, other land users, and knowledge holders to braid Dene Traditional Knowledge together with Western science on the ecology and conservation of boreal caribou across the Northwest Territories. This work will inform models of landscape change, as well as ongoing and future boreal caribou range planning in the Northwest Territories.

Māori connections to Antarctica may go as far back as 7th century *(Manaaki Whenua - Landcare Research: 7 June 2021)*

Over the last 200 years, Antarctic narratives have been of those carried out by predominantly European male explorers. However, a research project led by Manaaki Whenua—Landcare Research and Te Rūnanga o Ngāi Tahu researchers looked into the connection of Māori with Antarctica to better document and understand the contributions and perspectives of under-represented groups who are missing from current narratives. In the project, researchers scanned literature and integrated this with oral histories to provide a compiled record of Māori presence in, and perspectives of, Antarctic narratives and exploration. Māori (and Polynesian) journeys to the deep south have been occurring for a long time, perhaps as far back as the seventh century, and this work highlights the tradition of Māori Antarctic exploration and contribution to New Zealand's work in the Ross Sea continues into the future.

New Zealand's Māori may have been first humans to set eyes on Antarctica, study finds

(Saphora Smith, NBC News: 12 June 2021)

New Zealand's Māori explorers could have been the first humans to set eyes on the frozen continent as far back as the 7th century, a new study suggests, even though for the past 200 years, tales of discovering Antarctica have centered on Russian, European and American expeditions. Polynesian stories of historic voyages include the expeditions of Hui Te Rangiora and his crew on the vessel Te Ivi o Atea into Antarctic waters, likely in the 7th century, according to the study published this month in the Journal of the Royal Society of New Zealand. In some of these stories, Hui Te Rangiora and his crew traveled far south and in so doing were likely the first people to set eyes on Antarctic waters and perhaps even the continent, according to the authors of the report.

Glaciers in Half Moon Bay, Antarctica, pictured in 2018. *Alexandre Meneghini / Reuters file*

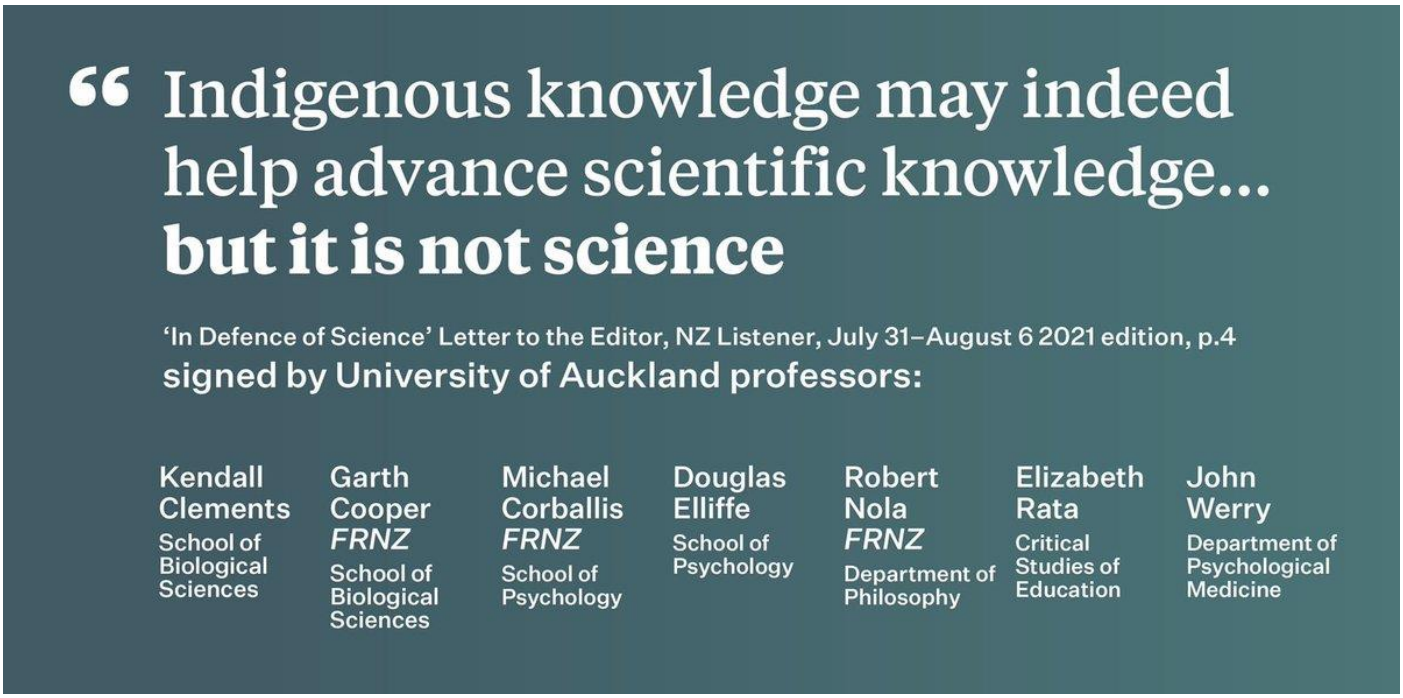
ISN members are encouraged to submit items exploring any aspects of Indigenous science teaching or education. As the Bulletin is not an official journal or organ of any recognised institution, we are not required to enforce any formatting, editing or reviewing regimes. We do have an Advisory Board made up of eight First Nations Co-Editors who view all items before publication. If you are doing something valuable in Indigenous science, teaching or education, please consider telling your story here!

The Empire Strikes Back in New Zealand – a story of privilege and retribution over who can claim to do "real science". Performed in three acts:

Act 1.

Seven pakeha academics discount Maori science *(The Listener, July 31 – August 6, 2021)*

Unfortunately, we have been unable to secure the text in question (sitting behind a paywall) but images of it can be found online. However, it is quoted extensively in the rebuttal articles following.



Act 2.

Joint statement from President and Chair of Academy Executive Committee *(Royal Society Te Apārangi: 27 July 2021)*

Royal Society Te Apārangi supports, fosters and recognises research within many knowledge systems. The Society is deeply proud of the rich variety of outstanding work being undertaken across Aotearoa at present. In the past year alone, this includes Distinguished Professor Brian Boyd's literary scholarship (winner of the 2020 Rutherford Medal), the work of Te Pūnaha Matatini on COVID-19 modelling by 2020 Te Puiaki Pūtaiao Matua a Te Pirimia Prime Minister's Science Prize Winner (led by Professor Shaun Hendy), and the knowledge sharing of Matariki by Professor Rangi Matamua.

The Society supports all New Zealanders to explore, discover and share knowledge. The recent suggestion by a group of University of Auckland academics that mātauranga Māori is not a valid truth is utterly rejected by Royal Society Te Apārangi. The Society strongly upholds the value of mātauranga Māori and rejects the narrow and outmoded definition of science outlined in The Listener – Letter to the Editor.

It deeply regrets the harm such a misguided view can cause.

Dr Brent Clothier
President

Professor Charlotte Macdonald
Chair of Academy Executive Committee

Scientists rubbish Auckland University professors' letter claiming Māori knowledge is not science ***(Dubby Henry, New Zealand Herald: 28 July 2021)***

A public letter from a group of prominent academics at the University of Auckland that claims Māori knowledge "is not science" has been rubbished by other scientists. The letter, signed by seven professors, was published in the Listener magazine in response to proposed changes to the Māori school curriculum. Those changes are meant to put *mātauranga Māori* (Māori knowledge) on a par with other types of knowledge, particularly Western knowledge. But the academics - drawn from biological sciences, psychology, philosophy and education - claimed that while indigenous knowledge contributes to our understanding of the world, "it falls far short of what we can define as science". "Better to ensure that everyone participates in the world's scientific enterprises. Indigenous knowledge may indeed help advance scientific knowledge in some ways, but it is not science."

University of Auckland vice-chancellor Dawn Freshwater told staff the letter did not represent the university's views. "The University has deep respect for *mātauranga Māori* as a distinctive and valuable knowledge system. We believe that *mātauranga Māori* and Western empirical science are not at odds and do not need to compete. They are complementary and have much to learn from each other."

Dr Daniel Hikuroa (*Ngāti Maniapoto*, Waikato-Tainui), a geologist and senior lecturer in Māori studies at Auckland University, said science was both "a method for generating knowledge, and all knowledge generated using that method". Some indigenous knowledge - though not all - had been generated using the scientific method so it was clearly science, Hikuroa said. He pointed to the Māramataka - the Māori lunar calendar - and how it is applied as science.

Ecologist Dr Tara McAllister (pictured left) rejected the 'inaccurate assertion that my tīpuna did not do science'. "As Rangi Mataamua says we did not navigate to Aotearoa on myths and legends. We did not live successfully in balance with the environment without science. Māori were the first scientists in Aotearoa."

Victoria University of Wellington sociology professor Joanna Kidman (Ngāti Maniapoto, Ngāti Raukawa) said it was "really disturbing that Western science is being pitted against indigenous knowledge". "It's not productive, it doesn't advance scientific debate," she said. "Māori don't need Western science to endorse or authenticate our knowledge systems, which are centuries old - but to dismiss it without understanding...really suggests quite an astonishing lack of awareness and rigour."

Act 3.

University of Auckland professor relinquishes role after claiming mātauranga Māori is 'not science' *(Mina Kerr-Lazenby, Stuff NZ: 29 July 2021)*

A University of Auckland professor has resigned from one of his roles following a backlash to a letter he signed publicly dismissing mātauranga Māori. Professor of Psychology Douglas Elliffe has stepped down from his role as acting dean of the faculty, a University of Auckland spokeswoman confirmed on Wednesday. Elliffe was one of seven professors from the University of Auckland to sign the letter, which was published last week in The Listener.

Epilogue.

Let's choose our words more carefully when discussing mātauranga Māori and science *(Emily Parke and Dan C H Hikuroa, The Conversation, 2 August 2021)*

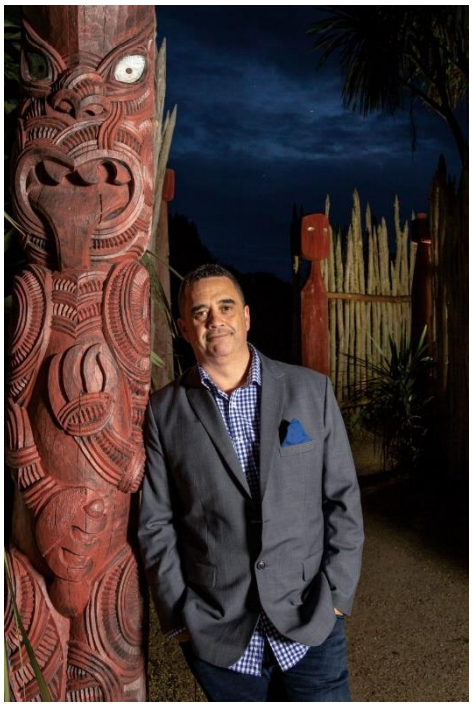
Responding to the recent controversy over mātauranga Māori and the letter he co-authored titled "In defence of science", Emeritus Professor Michael Corballis said: "We don't know any Māori who knows what mātauranga is." This immediately made us wonder: what would happen if we asked a group of scientists what science is?

Ambiguous statements are poor starting points for careful, constructive debates. We see people talking past each other in discussions of mātauranga and science. These discussions could benefit from more careful articulation of the concepts at stake. We'll start with science. We see understandings of science — methodological, epistemic, status-based, universal and specific — often run together in the recent debate about mātauranga and science. And that's not even an exhaustive list of ways to address the question "what is science?".

"Māori have always been scientists. You don't navigate that expansive ocean on myths and legends. You don't come here and apply a very detailed and regionally specific division of time, thrive and sync yourself into the natural rhythms of the environment here without having science. Science is the cornerstone of those undertakings"

"But because science is wrapped up in our cultural beliefs, even in our spirituality, in the way we view our science, I think western practitioners of science have difficulties understanding the depth and richness of Indigenous Peoples knowledge base."

Professor Rangi Mātāmua



Protagonists explore their differences on mātauranga Māori following the recent controversy *(The Hui, 2 August 2021)*

Sick of reading articles? Watch an old white man explore his views and misunderstandings about Maori science, followed by some real experts who actually know what they are talking about! So many wonderful observations in this video, firstly of the troglodytic ability of some academics to continually ignore the strength, power and truth of Indigenous knowledge. So impervious to seeing through another lens! Secondly, the generally polite and generous approaches that Maori take when confronted AGAIN by the distortions and dismissals of (white) people with power and privilege:

> *"typical of the slow violence that happens to Maori academics"*
> *"science doesn't exist within a vacuum, it's part of a broader system which used violence to colonise and dispossess Maori "*
> *"race underpins this whole argument"*

Critical analysis or institutionalised racism?

Tonight on The Hui, host Mihingarangi Forbes sits down with Emeritus Professor Michael Corballis, whose recent letter to The Listener claiming mātauranga Māori isn't a science has sparked controversy among academia. Then, experts Tina Ngata from the Institute of Environmental Science and Research, astronomer Dr Rangi Mātāmua, and indigenous environmental sociologist Melanie Shadbolt are live in the studio to discuss the value and application of mātauranga to science.

Western SARE Competitive Grants, Sabbatical Research and Education, 2022 Call for Proposals ***(Irene Grimberg, Western SARE: 1 June 2021)***

Western SARE (Sustainable Agriculture Research & Education) Sabbatical Grants provide an opportunity for faculty around the world to partner with farmers, ranchers, agricultural professionals, and researchers of the Western U.S. region for conducting research, education, and extension activities. Projects focused on unexplored topics in underserved communities and understudied geographic locations are of special interest. **Open – Deadline November 18, 2021**

I am Irene Grimberg, the Deputy regional Coordinator of Western Sustainable Agriculture Research and Education (SARE). We are a USDA supported agency to develop grant programs for the advancement of sustainable agriculture in the Western U.S. and the protectorate states of the Pacific (Federated States of Micronesia, Marshall Islands, Marianas Islands, and American Samoa). We offer grant programs for farmers and ranchers, researchers, agricultural professionals, and graduate students. We are invested in reaching diverse communities that are representative of our large region, including Indigenous people. For more information about Western SARE please visit our website.

There is a grant program that I think could be of interest to the readership of the Indigenous Science Network, the Sabbatical program. In Sabbatical, an expert researcher from anywhere in the world partners with a researcher and producer from the Western USA to work on an applied issue of sustainable agriculture. If you are interested in having an article that describes with more detail such grant program, please let us know.

Mathematics Doesn't Get a Pass on Racial Justice Reform *(Jason To: 14 July 2021)*

Although this article focuses on the promotion of culturally relevant maths and the consequent backlash from conservative commentators in Ontario, readers of this Bulletin should find useful the many observations made as clear parallels exist with the teaching and promotion of Indigenous science.

Once upon a time, the Ontario (Canada) Grade 9 mathematics curriculum stated the following:

> An equitable mathematics curriculum recognizes that mathematics can be subjective. Mathematics is often positioned as an objective and pure discipline. However, the content and the context in which it is taught, the mathematicians who are celebrated, and the importance that is placed upon mathematics by society are subjective. Mathematics has been used to normalize racism and marginalization of non-Eurocentric mathematical knowledges, and a decolonial, anti-racist approach to mathematics education makes visible its historical roots and social constructions. The Ontario Grade 9 mathematics curriculum emphasizes the need to recognize and challenge systems of power and privilege, both inside and outside the classroom, in order to eliminate systemic barriers and to serve students belonging to groups that have been historically disadvantaged and underserved in mathematics education.

And then all the right-wing conservative commentators made loud their unease. The above passage, along with many others related to better understanding the history and meaning of maths in a colonised country, were, unfortunately, quickly deleted from the proposed new Ontario curriculum. Author Jason To explains why these changes were unnecessary and counter-productive. Jason is a high school mathematics teacher who's taught primarily in the northwest corner of Toronto. His current role challenges academic streaming from K-12, paying particular attention to inclusive and culturally responsive mathematics instruction.

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Take care when seeking Indigenous knowledge *(Krystal Tsosie and Mark Linkson, Twitter, August 2021)*

Firstly, there was a tweet by a non-Indigenous academic seeking Indigenous knowledge from anyone willing to share. It attracted a response from Krystal Tsosie, @kstsosie Indigenous (Diné/Navajo) geneticist-ethicist, Vanderbilt University and Co-Founder of @NativeBio (Indigenous #genomics and #data sovereignty to decolonize #health and #research). Her response was queried by Mark Linkson, the non-Indigenous Coordinator of the ISN who was seeking better understanding of the issues involved.

Tweeter unknown

Dear colleagues: I teach a course, Decolonizing Global Health, at Duke University. I am interested in consulting your syllabus for ideas to use in my class, particularly on data/research ethics and decolonizing research methodologies. Would you share your syllabus or resource list with me? Many thanks in advance for considering this request.

Krystal

The knowledge and information provided during the IndigiData workshop represents the collective contributions of over a dozen Indigenous perspectives from colleagues and communities. It would be extractive and colonial for me to give out without their consent.

Krystal

It's the start of a new semester. Seems like a good time to gently remind non-Indigenous instructors with "decolonizing" courses that asking to access Indigenous knowledges for your syllabus is a sadly ironic show of academic colonialism.

Mark

re a tweet from this morning, I am confused Krystal, how do whitefellas decolonize curriculum without making reference to the wonder and power of Indigenous knowledge? Is it the asking that is the problem? Not the referring? Is it that we are in this space? Asking in solidarity. Cheers Mark

Krystal

Definitely how they ask is part of the problem. I've encountered too many academics with a "gimme" approach to wanting to access Indigenous knowledges and tech without first building good relations

Reciprocity is also key to maintaining good relations, too. Sharing Indigenous knowledges with non-Indigenous persons in the case of decolonizing syllabi definitely benefits those individuals, but it may not be commensurate with the risk of sharing that Indigenous wisdom to begin with

Some Indigenous knowledges are sacred and are not meant to be shared with outsiders or outside set times or places. Therefore it would be disrespectful to be expected to be automatically granted access

Mark

thanks Krystal - I was aware of these nuances and deal with them when assembling the Indigenous Science Network bulletin. Hence why we have 8 First Nations co-editors. Still I am thick sometimes and need to be reminded that sensitivity to my position and how I relate and write about Indigenous science needs constant renewal.

Ryan

Settler scholars, we *must* grapple with this. Indigenous communities owe us nothing. As we share what has been shared with us, we must model humility, respect and ethical engagement for our settler students & acknowledge it's only a partial picture. Also hire Indigenous faculty.

Inuit Cartography *(The Decolonial Atlas, 12 April 2016)*

Before the ISN Coordinator (Mark Linkson) studied to become a teacher, he was a geological cartographer working for the Department of Mines and Energy in South Australia. Hence, although this article is five years old, we are including it in this bulletin because he loves maps AND as testament to the idea that Indigenous peoples were our first scientists (and in this case, cartographers!) It is a wonderful example of a simple but clever Indigenous technology with links to maths, science and art.

In Kalaallit Nunaat (Greenland), the Inuit people are known for carving portable maps out of driftwood to be used while navigating coastal waters. These pieces, which are small enough to be carried in a mitten, represent coastlines in a continuous line, up one side of the wood and down the other. The maps are compact, buoyant, and can be read in the dark.

These three wooden maps above show the journey from Sermiligaaq to Kangertittivatsiaq, on Greenland's East Coast. The map to the right shows the islands along the coast, while the map in the middle shows the mainland and is read from one side of the block around to the other. The map to the left shows the peninsula between the Sermiligaaq and Kangertivartikajik fjords.

The Decolonial Atlas is an online growing collection of maps which, in some way, help us to challenge our relationships with the land, people, and state. It's based on the premise that cartography is not as objective as we're made to believe. The orientation of a map, its projection, the presence of political borders, which features are included or excluded, and the language used to label a map are all subject to the map-maker's bias – whether deliberate or not. Because decolonization is a process of unlearning and rediscovering, we're especially committed to Indigenous language revitalization through toponymy – the use of place names.

First Nations want a bigger say in how wildfires are managed in Canada *(Wendy Stueck, The Globe and Mail Online, 2 August 2021)*

Currently, provinces and territories can call on each other for firefighting help or tap international networks. In July, for example, crews from Mexico and Australia were scheduled to arrive in B.C. As of July 31, about 3,230 firefighters and other personnel were fighting fires in B.C., including 301 from out of province. First Nations are often on the wildfire front lines and are pushing for a bigger say in how they are managed. “We hear from the communities that we work with all the time that they would much rather have a proactive role in managing the risks,” said Brenden Mercer, forestry management liaison with the B.C.-based First Nations’ Emergency Services Society.

Brady Highway assists on a prescribed fire within the Waskesiu community in Saskatchewan in 2013. BRADY HIGHWAY /HANDOUT

‘It could feed the world’: amaranth, a health trend 8,000 years old that survived colonization *(Cecilia Nowell, The Guardian, 6 August 2021)*

Indigenous women in North and Central America are coming together to share ancestral knowledge of amaranth, a plant booming in popularity as a health food. Just over 10 years ago, a small group of Indigenous Guatemalan farmers visited Beata Tsosie-Peña’s stucco home in northern New Mexico. In the arid heat, the visitors, mostly Maya Achì women from the forested Guatemalan town of Rabinal, showed Tsosie-Peña how to plant the offering they had brought with them: amaranth seeds.

An elderly woman cuts an amaranth crop, in Uttarakhand, India. The plant is indigenous to North and Central America but also grown in China, India, Southeast Asia, West Africa and the Caribbean. *Photograph: Hitendra Sinkar/Alamy Stock Photo*

They are now six-foot-tall perennials with flowering red plumes and chard-like leaves. But during that first visit in 2009, the plants were just pinhead-size seeds. Tsosie-Peña and her guests spent the day planting, winnowing, cooking and eating them – toasting the seeds in a skillet to be served over milk or mixed into honey – and talking about their shared histories: how colonization had separated them from their traditional foods and how they were reclaiming their relationship with the land.

How Indigenous memories can help save species from extinction *(Karen Pinchin, Vox: 24 June 2021)*

From Canada to the Amazon, scientists are trying to build on Native knowledge before it's too late. From his home in remote coastal British Columbia, Ernest Mason, a 77-year-old elder and hereditary chief of the Kitasoo/Xai'xais Nation, remembers. He remembers a childhood fishing trip with his father, when they packed sleeping bags but caught so many halibut they were home before dark. He remembers setting traps for pink Dungeness crab and floating hemlock branches to collect edible herring eggs. He also remembers watching the first two times the herring stocks collapsed, and then, fearing a third collapse, telling the Canadian government that he and the other chiefs were banning commercial fishermen from their traditional territorial waters. "I said, 'We'll do what it takes to protect what we have,'" Mason told Vox. "This is one of the ways our grandfathers taught us, how to look after things. That's one of the chores now." For coastal Indigenous communities like Mason's, these ancestral lessons can be the difference between plenty and poverty.

Hereditary Chief Ernest Mason, 77, pilots a boat during the annual Kitasoo/Xia'xias herring spawn harvest along British Columbia's Central Coast. *Courtesy of Jack Plant*

Mason is one of the province's few elders who was not forced into Canada's residential schools, which stripped Indigenous children of their languages, oral histories, and cultures. This is one reason Mason, who often wears a baseball cap over his silver hair, remembers so much. Around the world, the memories of elders like Mason are playing a powerful role in understanding and helping to preserve marine species. A growing group of researchers, some of them from within Indigenous communities, is translating the qualitative stories of fishermen into quantitative data, in a process that often requires sensitive negotiations and uncomfortable conversations between Indigenous leaders and Western institutions. Their recollections can help fill historical and geographical gaps that have eluded scientists until now.

REPRESENTATION MATTERS

RESOURCES - AUSTRALIA

Australian Indigenous watercraft *(The Australian National Maritime Museum)*

The Australian National Maritime Museum is Australia's national centre for maritime collections, exhibitions, research and archaeology. The museum presents a changing program of stimulating exhibitions and events to share Australia's maritime history and connect the stories, objects, people and places that are part of our country's narrative. Below are links to two sections of their website that explore Australian Indigenous watercraft:

RAFTS

Aboriginal rafts have always co-existed alongside Aboriginal bark canoes, and a raft structure may be the type that originally brought people to Australia more than 50,000 years ago. They may then have been the first type of craft used to exploit waterways as people settled around the country.

The Kimberley region is renowned for its rugged terrain and harsh environment, and the waterways mirror this with their strong tides, whirlpools and rips creating difficult passages, alongside areas of calm water in the many bays. The arrangement of pegs tying the rafts together creates a strong structure that is quite capable in these conditions. *(Posted on 16 Dec 2016 by David Payne)*

Kalwa.Image: Andrew Frolows / ANMM Collection 00001700.

CANOES

Sharing the waterways across the top of the mainland coast are a number of different types of sewn bark canoes. The museum's three sewn bark canoes represent two distinct types. Two are Yolngu *gumung derrka* – these are freshwater swamp and river craft. The other is *a Yunyuwa na-riyarrku* – it is a coastal saltwater craft. They show many of the features common to sewn bark canoes. The bow and stern are sewn or stitched together (giving rise to the descriptive name), the sides have gunwale branches, and different types of ties, beams and frames are used to give support across the hull. *(Posted on 15 Dec 2016 by David Payne)*

Gumung derrka. Image: Gallery Gabrielle Pizzi / ANMM Collection 00026018.

Bribie Island Aboriginal Stories: Fish traps *(Moreton Bay Region Libraries)*

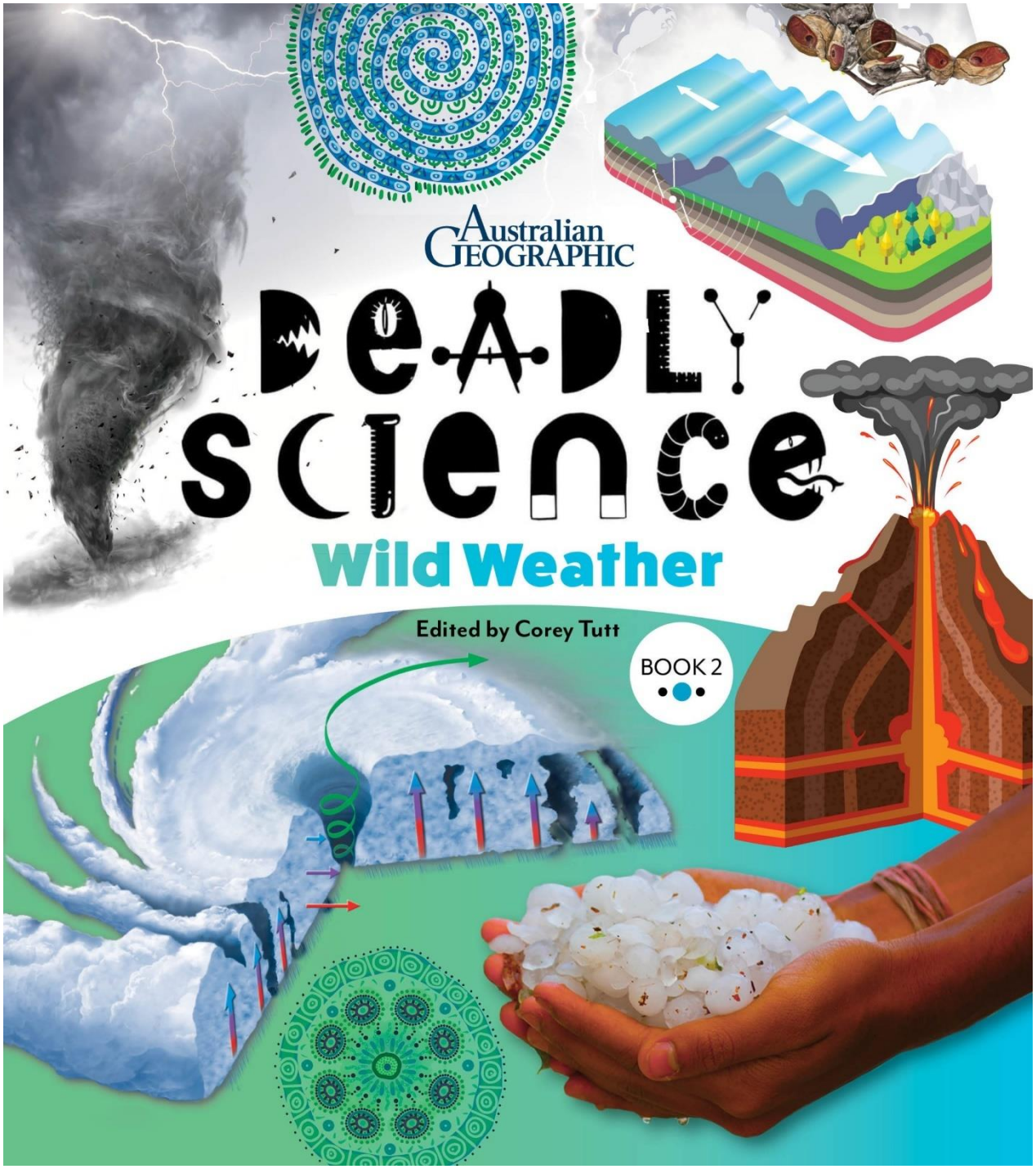
Did you know there were Aboriginal fish traps on Bribie Island? Find out more in this short film highlighting language and our natural environment.

This is one of Moreton Bay Region Libraries' new collection of short films promoting the importance of language in culture. Local Aboriginal Language Short Films are available online and are on show in Moreton Bay Region Libraries.

More information: https://www.moretonbay.qld.gov.au/libraries/Discover/Welcoming-Places

Deadly Science: Wild Weather ***(Corey Tutt, Australian Geographic, 2021)***

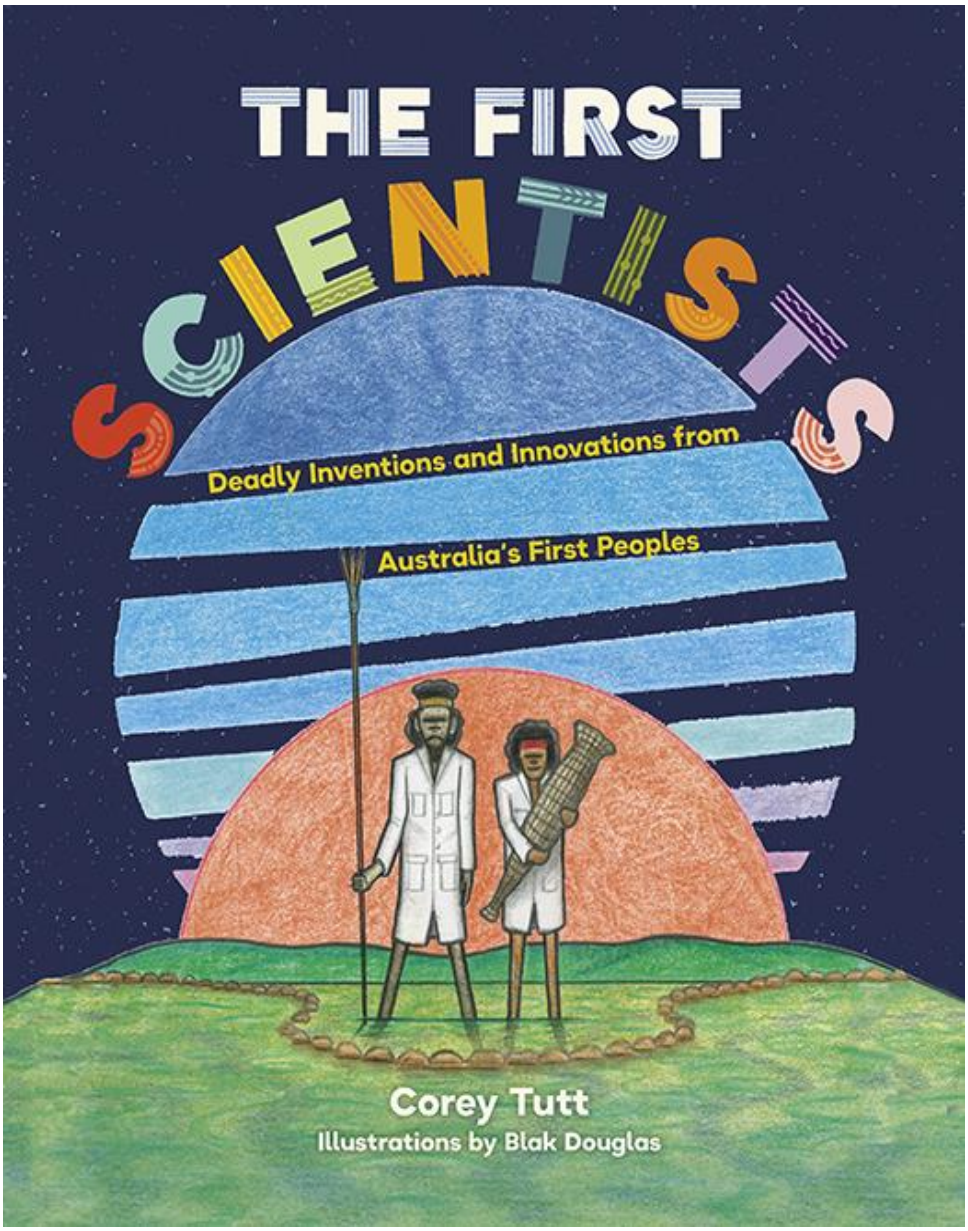
Extreme weather events, from bushfires to floods, and sudden geological changes, from earthquakes to tsunamis, have an enormous impact on our planet. In this book, students investigate different examples of extreme weather, focusing on examples from around Australia, and learn how these events affect living and non-living aspects of the environment. Students will investigate the past, learning how Indigenous Australians have recorded and documented geological events, and also look to the future, focusing on how science is giving us better understanding of weather patterns and events, and new tools for managing natural disasters.



The First Scientists - Deadly Inventions and Innovations from Australia's First Peoples

(Corey Tutt, Hardie Grant Publishing: 2021)

The First Scientists is the highly anticipated, illustrated science book from Corey Tutt of Deadly Science. With kids aged 7 to 12 years in mind, this book will nourish readers' love of science and develop their respect for Indigenous knowledge at the same time. Have you ever wondered what the stars can tell us? Did you know the seasons can be predicted just by looking at subtle changes in nature? Maybe you have wondered about the origins of glue or if forensic science is possible without a crime scene investigation. Australia's First peoples have the longest continuing culture on Earth and their innovation will amaze you as you leaf through the pages of this book, learning fascinating facts and discovering the answers to life's questions.



Corey Tutt is a Kamilaroi man from Nowra on the New South Wales south coast. As a kid, he dreamed of becoming a zookeeper and in high school he developed a love of STEM subjects. But unlike the arts and sport, he found there was little encouragement for Aboriginal people to pursue careers in STEM.

In 2018, while working as a research assistant for the University of Sydney, Corey founded Deadly Science, a not-for-profit organisation that aims to provide science books and telescopes to remote schools in Australia, and connects young Indigenous people with mentors to encourage their participation in STEM subjects.

Launch of Indigenous Science Community of Practice *(Australian Council of Deans of Science, 22 March 2021)*

Indigenous Science is an area of growing interest for scientific and cultural understanding, and as a mechanism for empowering Australia's diverse first nations peoples. This interest was evident at the 2020 Australian Conference on Science and Mathematics Education (ACSME). Faculties of science are increasingly introducing new units of study in this area, and also reviewing their science offerings to integrate Indigenous perspectives into their existing courses. The Australian Council of Deans of Science (ACDS) funded a project to collate, curate and share resources and good practice to give tertiary science educators a starting resource in their quest to incorporate Indigenous knowledges, pedagogies, and perspectives in their teaching. You can see the website here.

ACDS Indigenous Science resources

As noted in the previous article, the ACDS has created an online resource for those people wishing to improve their knowledge of Indigenous science. Importantly for this readership, they have a specific teacher resource section. To their credit, they have introduced the resources with a lengthy reminder not to use them out of context or without any Indigenous community input:

After centuries with little positive attention, the recognition and interest are very welcome for most. However, great care needs to be taken to ensure educational resources are made and shared in consultation with experts in a culturally respectful manner. Central to this is that perspectives and pedagogies of Australia's first peoples should be respected. All non-Indigenous educators working in this space should actively seek out robust cultural competency training, read and watch material generated by experts with cultural relevance, and work at building relationships with local groups. Almost all universities have an Indigenous Engagement office and it is important to seek out the relevant representatives so they can also guide your work. It is also important to keep in mind the following quote. By adding content alone, we risk adding nothing if the content is abstracted from the Indigenous perspective and the complex, interdisciplinary nature of Indigenous knowledges.

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Indigenous Education resources

Dr Lakshmi Sharma is an Australian high school teacher and has created a website focussing on Indigenous education. She has a section of her website devoted to science, and has sub-topics for the following strands of the science curriculum which contain links to useful Indigenous websites and resources:

Biology	*Chemistry*
Physics	*Space*
Earth Science	*STEM*

I am a secondary school teacher & passionate about Indigenous Education. I believe that by educating students in Indigenous Perspectives, we can eliminate the cultural bias & appreciate the amazing contribution to society by the First Nations People. This website blossomed from my Bastow Create Project, after interviewing both teachers and students it was evident there was a desperate need for teachers to have Indigenous resources available in one place and to provide a mapped-out curriculum with the relevant Indigenous links. As a result, I have made and personally fund this website in my own time, for all to use for free. I only ask that you acknowledge myself (for any non-classroom use) and the DET & VCAA, (for any reference to the Victorian Curriculum), who I would like to thank for permitting me use. I hope you enjoy the site and incorporate the resources into your teachings.

INDIGENUITY – Indigenous scientists interviewed *(Krystal De Napoli, 3RRR Melbourne: from 24 May 2021)*

Indigenuity is a new pop-up show on Triple R hosted by Aboriginal astrophysicist Krystal De Napoli, Mondays from midday to 1pm. The show is a weekly conversation with Indigenous knowledge holders, showcasing all forms of Indigenous ingenuity. Here is a link to the podcasts:

https://twitter.com/IndigenuityAU/status/1397790070577405953

The Diversity Council Australia & Jumbunna has developed:

10 Truths to centre Indigenous Australians' voices to create workplace inclusion

1. Commit to unearthing and acting on workplace truths – however uncomfortable this may be
2. Ensure any Aboriginal and Torres Strait Islander-related work is Indigenous-led and informed
3. Develop organisational principles to make it clear how Indigenous community engagement and employment should work in practice
4. Focus on workplace readiness (cultural safety) rather than worker readiness
5. Recognise identity strain and educate non-Indigenous staff about how to interact with their Indigenous colleagues in ways that reduce this
6. Recognise and remunerate cultural load as part of an employee's workload
7. Consult with Indigenous staff on how to minimise cultural load while maintaining organisational activity
8. Focus on sustainable careers and career development, rather than just short-term appointments
9. Take action to address workplace racism
10. Look to high-impact initiatives – those that research shows are linked to better wellbeing and retention for Indigenous staff

Traditional production of spinifex resin by Indigenous Australians ***(Soveriegn Union Facebook page: accessed 15 August 2021)***

Spinifex Resin - Applied science of the world's oldest continuing culture. View the video presentation by clicking on the hyperlinked image right.

RESOURCES – THE WORLD

Fresh Banana Leaves – Healing Indigenous Landscapes Through Indigenous Science ***(Jessica Hernandez, Penguin Random House: To be published on 18 January 2022)***

An Indigenous environmental scientist breaks down why western conservationism isn't working–and offers Indigenous models informed by case studies, personal stories, and family histories that centre the voices of Latin American women and land protectors. Despite the undeniable fact that Indigenous communities are among the most affected by climate devastation, Indigenous science is nowhere to be found in mainstream environmental policy or discourse. And while holistic land, water, and forest management practices born from millennia of Indigenous knowledge systems have much to teach all of us, Indigenous science has long been ignored, otherized, or perceived as "soft"–the product of a systematic, centuries-long campaign of racism, colonialism, extractive capitalism, and delegitimization. mathematics, freeing us from the cultural confines of the white male priesthood that has been the dominant paradigm, we may begin to see exciting new research opportunities at the interface. **https://www.jessicabhernandez.com/**

The Inspiring Story of the Polynesians of Taumako

"Our Vaka" is the first part of a two-part documentary called "We, the Voyagers: Lata's Children." In this film, Polynesian voyagers of Taumako, Solomon Islands, share their history, motivations, and skills through story-telling, canoe building and wayfinding. Using only the designs, materials and methods of Lata, the Polynesian culture-hero who built the first voyaging canoe and navigated across the Pacific, the voyagers recall their ancestors, who made the greatest of human migrations.

"We the Voyagers" began in 1996 when Paramount Chief Kaveia, an experienced navigator, began training new generations to plant gardens, feed workers, make rope from plants, weave and sew sails, protect the island's trees, adze parts for voyaging canoes, and lash them together. After years of filming, Lata's children are ready to share their story, and the lessons Lata has taught them, with the world.

To watch a 15 minute documentary for free, use this link and scroll down to **Below is our 1999 Short video: The First Voyage**

STEM + CULTURE Chronicle

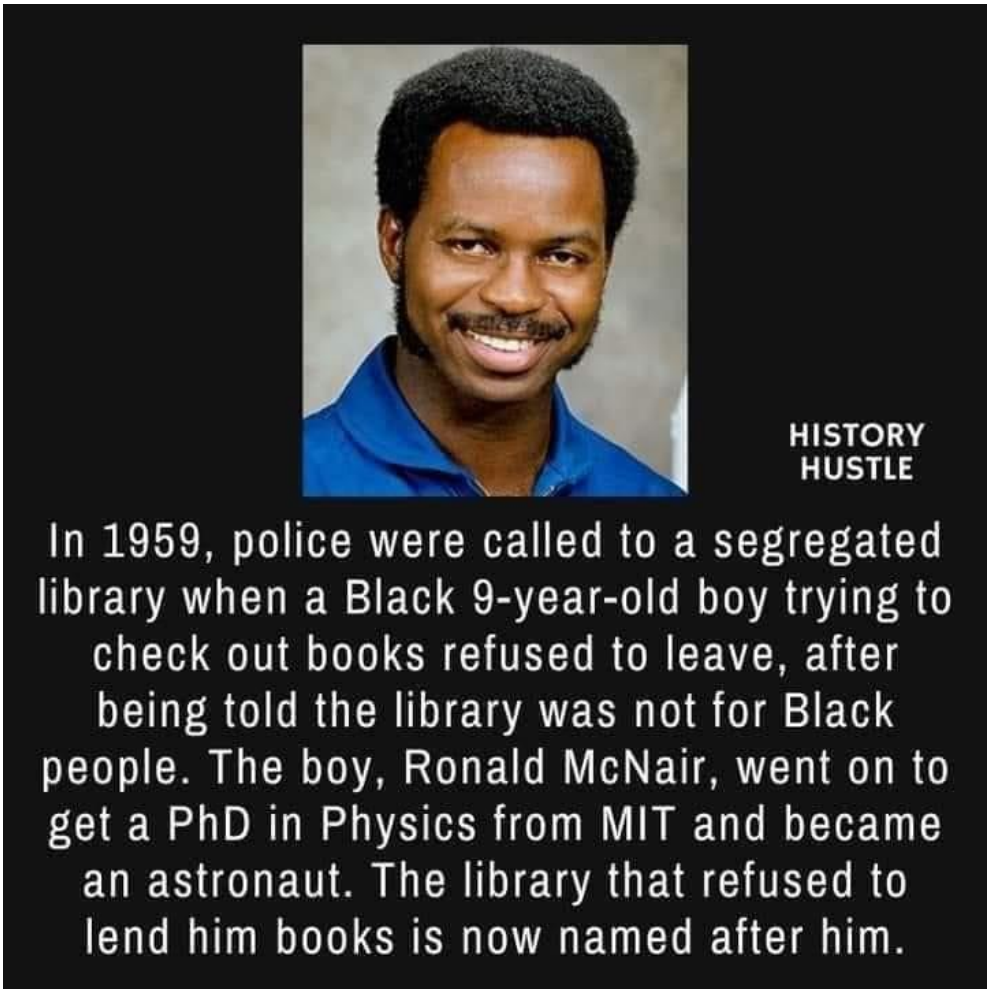
The STEM + Culture Chronicle is an online resource containing articles that look at all aspects of culture in STEM. Produced by SACNAS, an inclusive organization dedicated to fostering the success of Chicanos/Hispanics and Native Americans, from college students to professionals, in attaining advanced degrees, careers, and positions of leadership in STEM.

Indigenous people in STEM

A page on the STEM careers website listing [many black scientists](). A valuable resource when seeking inspirational stories for Indigenous students.

Nine-year-old Jarom Hauwai-Sauer is a self-taught coder who is using his tech skills for good! If you think a nine-year-old coder is impressive, wait 'til you hear that Jarom actually started coding and engineering when he was four! He says he's a self-taught coder and uses coding games like CodeCombat and Code Avengers to learn programming languages like Python, JavaScript and HTML.

Through Code Avengers, he's even built his very own apps, including a photo booth (complete with filters and emojis) and a beat-the-clock type game. He spends about three hours a day on his coding education. Jarom is also involved with Young Engineers – a program that's passionate about helping younger generations become highly skilled engineers and scientists by getting them into robotics.



Exploring Indigenous Science to Identify Contents and Contexts for Science Learning in Order to Promote Education for Sustainable Development *(Education Sciences, 10 March 2021)*

Indigenous science is comprised of the science-related knowledge and associated practices of indigenous cultures. Indigenous science provides rich contexts that can contribute to understanding the relationship of sociocultural life and environmental ethics in certain communities. It can also lead to better reflection upon Western modern views of science. Based on a qualitative analysis of indigenous science in the Baduy community (Indonesia), we describe how indigenous science can provide relevant contexts for students to learn scientific concepts, as well as help them to recognise the value of promoting sustainability.

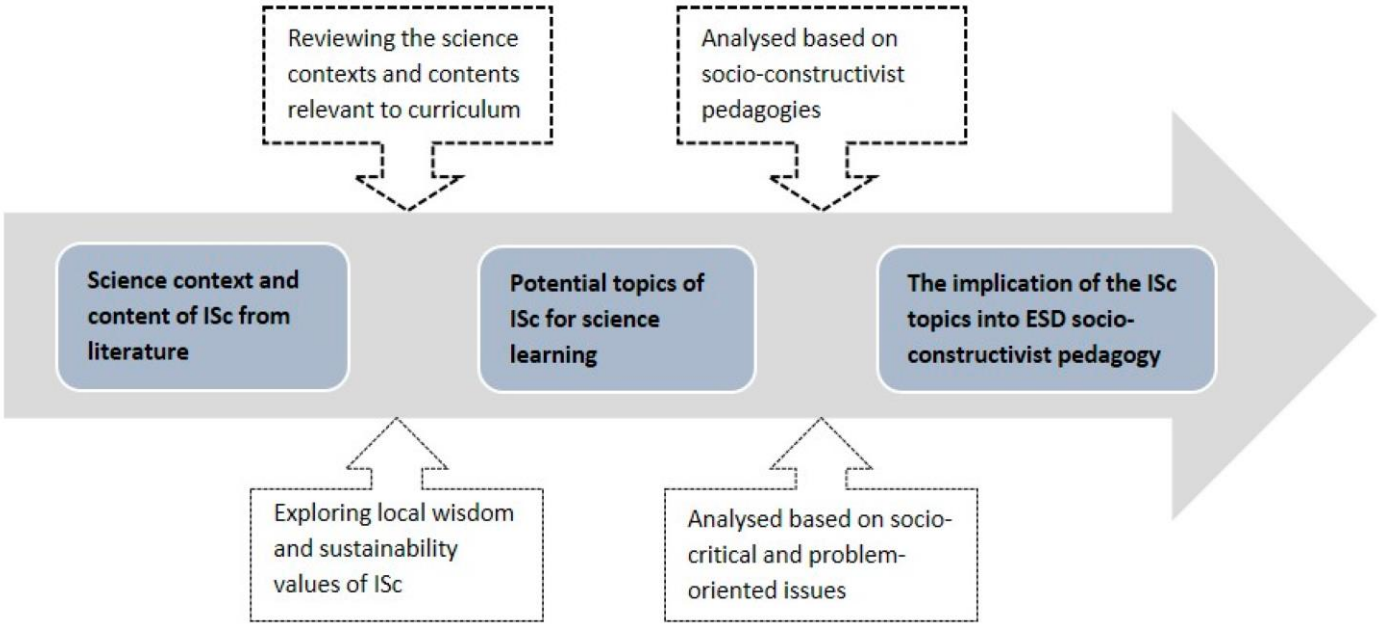


Figure 2: Analysis for incorporating Indigenous science (ISc) into socio-critical, problem-oriented issues.

We present potential topics encompassing the sociocultural context of Baduy science that can be associated with sustainability issues. Topics were identified from six themes (agriculture, medicine, natural dyes, household chemicals, renewable energy, and astronomy). Potential implications of these topics to science learning are also presented. We view contextualization of science teaching and learning by indigenous science as a promising source to enhance students' perception of the relevance of science learning. It can also promote education for sustainable development.

Zidny, R.; Solfarina, S.; Aisyah, R.S.S.; Eilks, I. Exploring Indigenous Science to Identify Contents and Contexts for Science Learning in Order to Promote Education for Sustainable Development. *Educ. Sci.* 2021, 11, 114. https://doi.org/10.3390/educsci11030114

"Trees Are Our Relatives": Local Perceptions on Forestry Resources and Implications for Climate Change Mitigation *(Education Sciences, 24 May 2021)*

The link between nature and society is vital for climate change mitigation and sustainable natural recourse management. Based on a case study of the indigenous people of Mbire in Zimbabwe, we argue that perceptions of indigenous people about forestry resources provide useful pointers toward framing climate mitigation interventions. This interest was necessitated by the growing call to address the suppression of forest-rich indigenous communities in climate change science. **Accordingly, the aim of the study was to understand how indigenous people can contribute to the abatement of climate change.**

The study engaged 32 purposively selected elderly participants in focus group discussions; these participants had long histories of staying in the villages studied and were figures whom the locals regarded as "experts" in giving credible inferences about their environment. The participants corroboratively perceived forests and trees as their own "relatives", who should not be harmed because of the support they continue to generously give to the people. Their construct of climate change relates to the gradual but continuing trivialization of cultural beliefs and abandonment of traditional practices, which they believe offend the spirits who have powers to influence the climate system. Although their attribution view on climate change is in contrast with that of mainstream climate scientists, we argue that their profound acknowledgement of climatic change, coupled with their scientific understanding of the intrinsic relationship between people's wellbeing and the environment, are key entry points to design sustainable climate mitigation programs at community scales. The sustainability of such programs should not ignore local belief systems and strategies that communities use in preserving their forests.

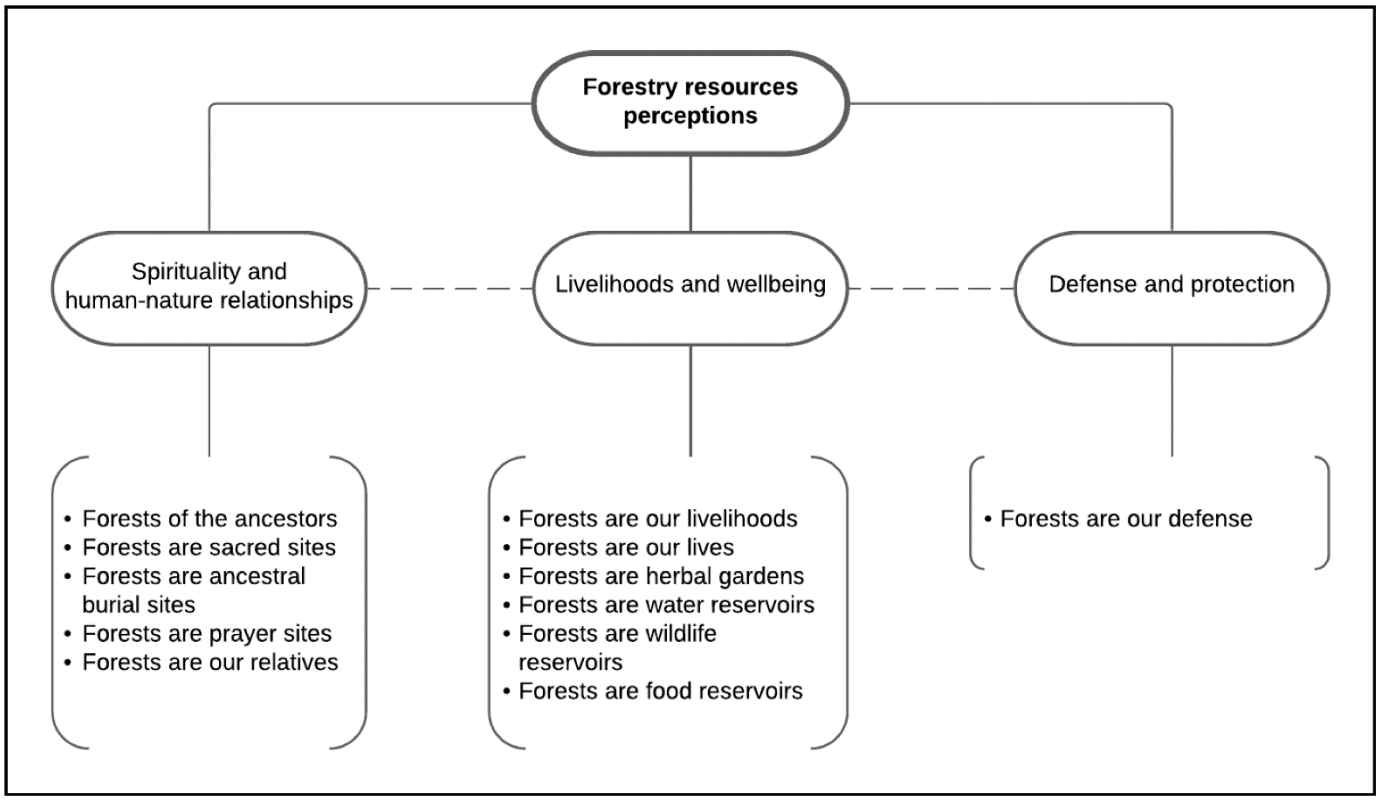


Figure 3: Local perceptions about forests in Mbire.

Chanza, N.; Musakwa, W. "Trees Are Our Relatives": Local Perceptions on Forestry Resources and Implications for Climate Change Mitigation. *Sustainability* 2021, 13, 5885. https://doi.org/10.3390/su13115885

Indigenous Science, Climate Change, and Indigenous Community Building: A Framework of Foundational Perspectives for Indigenous Community Resilience and Revitalization

(Gregory A. Cajete: 17 Nov 2020)

This essay presents an overview of foundational considerations and perceptions which collectively form a framework for thinking about Indigenous community building in relationship to the tasks of addressing the real challenges, social issues, and consequences of climate change. The ideas shared are based on a keynote address given by the author at the International Conference on Climate Change, Indigenous Resilience and Local Knowledge Systems: Cross-time and Cross-boundary Perspectives held at the National Taiwan University on 13–14 December 2019. The primary audience for this essay is Indigenous Peoples and allies of Indigenous Peoples who are actively involved in climate change studies, sustainable community building, and education. **As such, it presents the author's personal view of key orientations for shifting current paradigms by introducing an Indigenized conceptual framework of community building which can move Indigenous communities toward revitalization and renewal through strategically implementing culturally responsive Indigenous science education, engaging sustainable economics and sustainability studies.**

As an Indigenous scholar who has maintained an insider perspective and has worked extensively with community members around issues of culturally responsive science education, **the author challenges all concerned to take Indigenous science seriously as an ancient body of applied knowledge for sustaining communities and ensuring survival over time and through generations.** The author also challenges readers to initiate new thinking about how to use Indigenous science, community building, and education as a tool and a body of knowledge which may be integrated with appropriate forms of Western science in new and creative ways that serve to sustain and ensure survival rather than perpetuate unexamined Western business paradigms of community development.

Cajete, G.A. **Indigenous Science, Climate Change, and Indigenous Community Building: A Framework of Foundational Perspectives for Indigenous Community Resilience and Revitalization**. *Sustainability* 2020, 12, 9569. https://doi.org/10.3390/su12229569

The Wisdom of and Science behind Indigenous Cultural Practices *(Rose Borunda & Amy Murray, College of Education, California State University: 23 Jan 2019)*

Conquest and colonization have systematically disrupted the processes by which Indigenous communities of the Americas transmit cultural knowledge and practices from one generation to the next. Even today, the extended arm of conquest and colonization that sustain oppression and culturicide continue to inflict trauma upon Indigenous people. Yet, current scientific research now attests to how Indigenous cultural practices promote healing and well-being within physical as well as mental health domains. This examination addresses Indigenous cultural practices related to storytelling, music, and dance. In drawing from evidence-based research, the case is made for not only restoring these practices where they have been disrupted for Indigenous people but that they have value for all people. The authors recommend reintroducing their use as a means to promote physical, spiritual, and mental well-being while recognizing that these practices originated from and exist for Indigenous people

Borunda, R.; Murray, A. **The Wisdom of and Science behind Indigenous Cultural Practices.** *Genealogy* 2019, 3, 6. https://doi.org/10.3390/genealogy3010006

Principles of an Indigenous Community Based Science Program

(Hiria McRae, Victoria University of Wellington, New Zealand: 2018)

This paper describes a set of principles found within existing indigenous community-based science programs, identified as possible contributors to the success of indigenous students in science education. The examination of what makes these types of programs successful is an area of research that is yet to be thoroughly explored. These principles could support indigenous communities to develop, examine and enhance community-based science programs that could benefit all involved.

> *Sutherland and Dennick (2002) identified that a key concern for indigenous students and science education is how the science curriculum is developed with limited consideration or total disregard for indigenous knowledge: Science curriculum is assimilative in its own right because it gives the impression the Western view of nature is the only legitimate way of learning about the natural world, thereby reducing indigenous knowledge to inferior and non-scientific (p. 2). Aikenhead and Elliot (2010) agree that most school science programs in industrial countries are focused on acquiring Western or Eurocentric knowledge and skills. They further assert that school science teaches what it is to be a scientist or possess a science identity based on Western beliefs and values with minimal recognition of indigenous perspectives of our world.*

McRae, H., Principles of an Indigenous Community-Based Science Program, *International Journal of Innovation in Science and Mathematics Education*, 26(2), 44–56, 2018. Special Issue: Supporting Indigenous Student Engagement with STEM in Higher Education

Indigenizing Science and Reasserting Indigeneity in Research

(Krystal S. Tsosie, Vanderbilt University and Katrina G. Claw, University of Colorado: 9 June 2020)

Science, at its core, is knowledge systematically gained through repeated observations about the world around us. Indigenous people have always been scientists. As agronomists, Indigenous people of pre-Colombian Mexico domesticated maize over 9,000 years ago (Matsuoka et al. 2002). As astronomers, Polynesians studied constellations and movements of celestial bodies to become skilled sailors and navigators (Lewis 1972). In almost every scientific discipline throughout history, Indigenous people have contributed to our physical and biological understanding and have developed technologies that benefit all. Imagine then how science today could be advanced if we empowered Indigenous approaches to the level of Western science.

Krystal S. Tsosie and Katrina G. Claw "Indigenizing Science and Reasserting Indigeneity in Research," *Human Biology 91(3),* 137-140, (9 June 2020). https://doi.org/10.13110/humanbiology.91.3.02

https://digitalcommons.wayne.edu/cgi/viewcontent.cgi?article=1163&context=humbiol_preprints

A short scan of Māori journeys to Antarctica *(Wehi, P., Scott, N., Beckwith, J., et. al. 2021)*

The narratives of under-represented groups and their connection to Antarctica remain poorly documented and acknowledged in the research literature. This paper begins to fill this gap. Our exploration of Māori connections to Antarctica details first voyagers through to involvement in recent science projects, as well as representations of mātauranga in carving and weaving. This exploration begins to construct a richer and more inclusive picture of Antarctica's relationship with humanity. By detailing these historical and contemporary connections, we build a platform on which much wider conversations about New Zealand relationships with Antarctica can be furthered. More than this, however, we create space for other under-represented groups and peoples to articulate their narratives of connection to the southern land- and sea-scapes. In so doing, we provide significant first steps for uncovering the rich and varied ways in which Antarctica features in the lives and futures of indigenous and other under-represented communities.

Figure 1. A, Te Kaiwhakatere o te Raki, also known as the Navigator of the Heavens, looks skyward with Scott Base shown behind. B, The view of Te Kaiwhakatere o te Raki looking outward across the Ross Ice Shelf.

Priscilla M. Wehi, Nigel J. Scott, Jacinta Beckwith, Rata Pryor Rodgers, Tasman Gillies, Vincent Van Uitregt & Krushil Watene (2021) A short scan of Māori journeys to Antarctica, *Journal of the Royal Society of New Zealand*, DOI: 10.1080/03036758.2021.1917633

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Scientists' Warning to Humanity on Threats to Indigenous and Local Knowledge Systems

(Álvaro Fernández-Llamazares et.al., Journal of Ethnobiology, 5 July 2021)

The knowledge systems and practices of Indigenous Peoples and local communities play critical roles in safeguarding the biological and cultural diversity of our planet. Globalization, government policies, capitalism, colonialism, and other rapid social-ecological changes threaten the relationships between Indigenous Peoples and local communities and their environments, thereby challenging the continuity and dynamism of Indigenous and Local Knowledge (ILK). In this article, we contribute to the "World Scientists' Warning to Humanity," issued by the Alliance of World Scientists, by exploring opportunities for sustaining ILK systems on behalf of the future stewardship of our planet. Our warning raises the alarm about the pervasive and ubiquitous erosion of knowledge and practice and the social and ecological consequences of this erosion. While ILK systems can be adaptable and resilient, the foundations of these knowledge systems are compromised by ongoing suppression, misrepresentation, appropriation, assimilation, disconnection, and destruction of biocultural heritage.

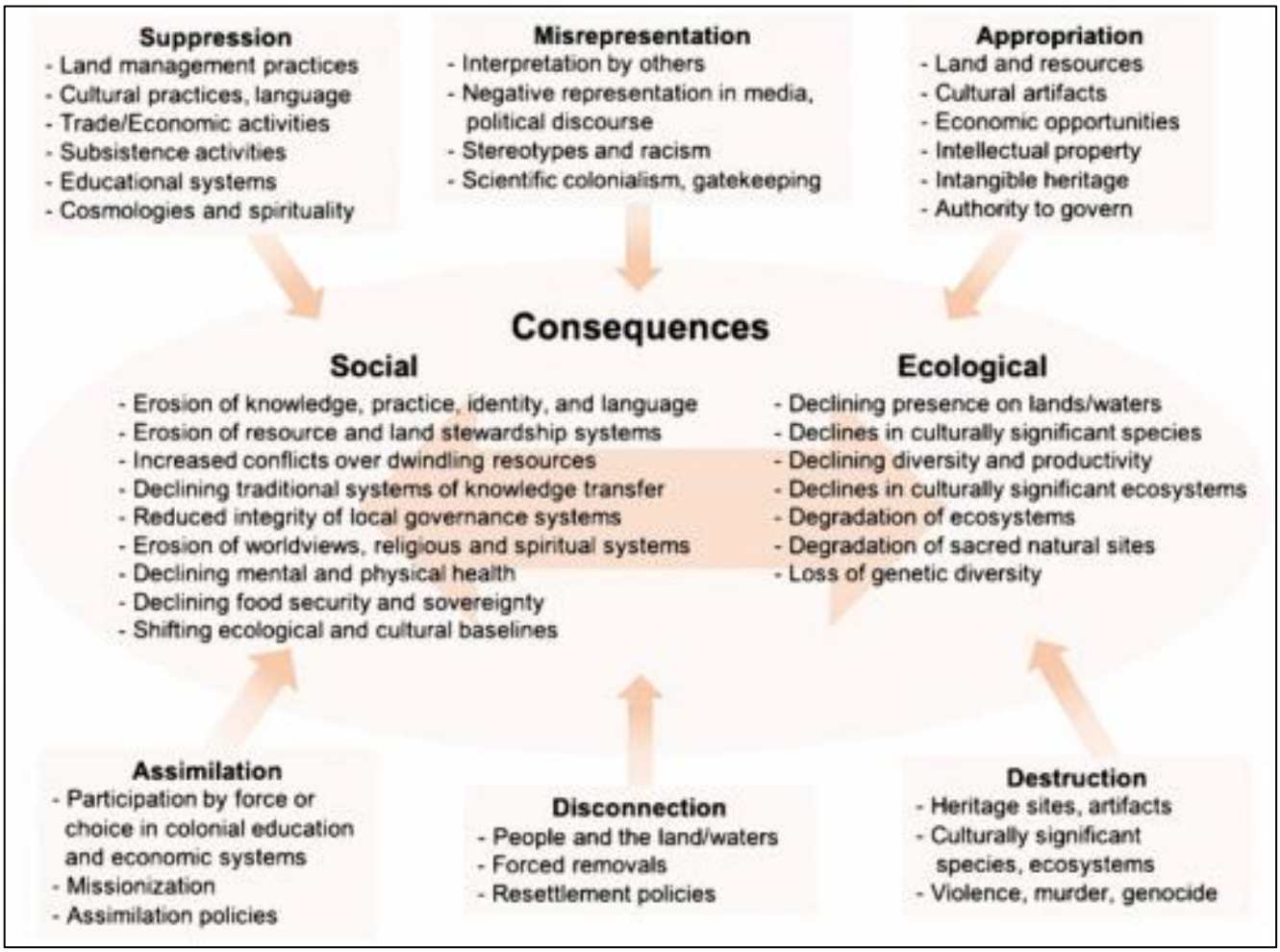


Figure 1.

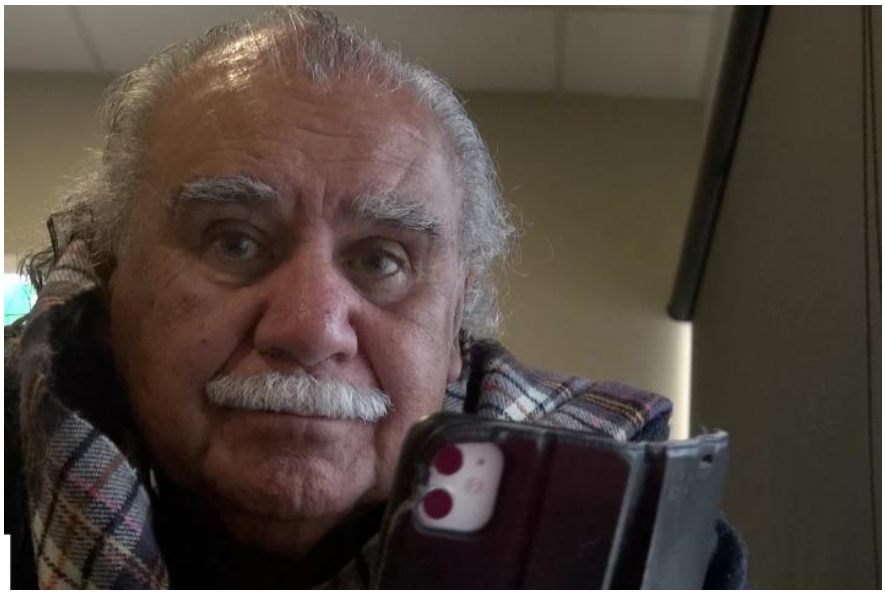
Some of the many threats to ILK systems and lifeways of Indigenous Peoples and local communities (outer boxes) and the interconnected consequences for social and ecological dimensions (central oval). Drivers of change can exert their influence quickly or over time in subtle and pernicious ways. Many of these linked threats and consequences are highlighted in this paper's case studies and 15 recommendations.

INDIGENOUS ASTRONOMY

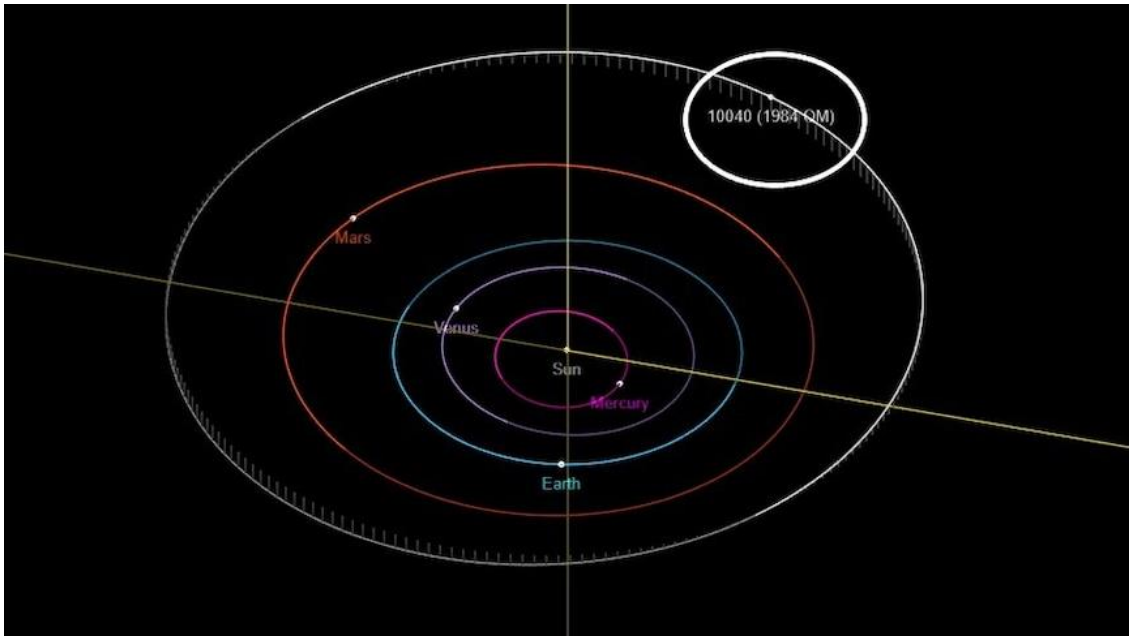
Asteroid named in honour of Ghillar Michael Anderson for the Aboriginal elder's contribution to astronomy *(Gary-Jon Lysaght, ABC Western Plains: 8 July 2021)*

An asteroid has been renamed Ghillar 10040. It has been named after Ghillar Michael Anderson in recognition of his contribution to astronomy. The International Astronomical Union is responsible for the naming and classification of celestial bodies.

Ghillar Michael Anderson has been interested in astronomy from a young age. "My nan and pop were always talking about the stars and they'd tell you all the different stories," he said. "On the day my youngest brother was born, we were laying out in the bush. "My nan was saying, 'If you look up there now, we're going to see that thing called Sputnik going through.'" Mr Anderson is a Euahlayi elder from Goodooga, in north-west New South Wales. Mr Anderson said the recognition was a great honour, and that Aboriginal people had a lot to contribute to the study of space. "It was a bit of a shock first, but proud to be one of the first First Nations people in the world to have an asteroid named after them," he said. "We have a lot to teach Australia and the rest of the world and people are just starting to realise that now.



Ghillar Michael Anderson has published several papers on Aboriginal astronomical knowledge. *(Supplied: Eleanor Gilbert)*

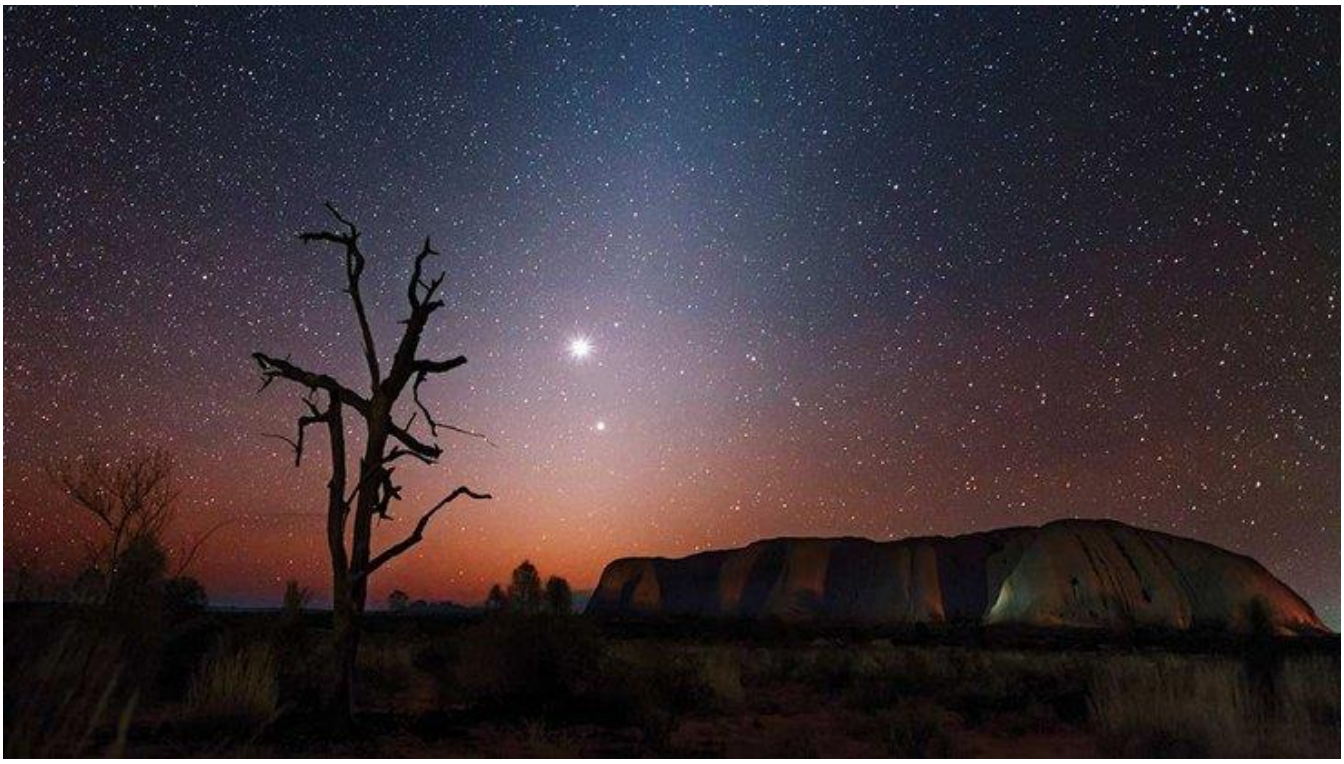


Asteroid 10040 Ghillar (circled) has been named after Aborginal elder Ghillar Michael Anderson.(Supplied: NASA)

Venus: First Peoples recognising the Morning and Evening Star *(Kirsten Banks and Duane Hamacher, COSMOS, June 2021)*

Venus is the brightest planet and third brightest object in the sky after the Sun and Moon. Of all the Aboriginal and Torres Strait Islander astronomical traditions involving the planets, Venus is the most prominent. The regular path of Venus (pictured over Uluru, trailed by Jupiter) has long been understood, and is celebrated in numerous ceremonies and stories.

The Yolŋgu people on Galiwin'ku (Elcho Island) in the Northern Territory conduct a sacred ceremony called Banimbirr when Venus rises in the morning sky after disappearing as an Evening Star eight days previously. This ceremony is planned well in advance and people travel from far and wide to attend as Venus ascends into the dawn sky, signalling the location of Burralku, the island of the dead in the east. Elders explain how they count the days to know when it will appear. Western astronomers refer to this cycle as the synodic period of Venus, which lasts for 584 days before repeating.



The regular path of Venus (seen here over Uluru, trailed by Jupiter in the early evening zodiacal dust light) has long been understood, and is celebrated in numerous ceremonies and stories. *Credit: Simon Stone / Alamy*

WEBSITES

To learn more and attend upcoming events, please follow us on social media and visit our website

- www.aboriginalastronomy.com.au
- www.facebook.com/AboriginalAstronomy
- twitter.com/aboriginalastro

The Indigenous Science Experience

National Science Week this year includes an Indigenous initiative. See below for details

What can Aboriginal astronomy tell us about the night sky? How is our native flora used as bush medicine? What can we learn about sustainable living from 60 000+ years of Indigenous culture? Find out the answers to these questions and more during the Indigenous Science Experience Online. The Indigenous Science Experience Online will consist of a series of workshops and webinars that will run through National Science Week. The sessions will showcase a wide range of Indigenous and Western STEM presented by Indigenous secondary students, Elders and community members and STEM outreach providers from various organisations.

Please go to: https://nisep.org.au/indigenous-science-experience/ to see the sessions that are currently open for registrations.

Try these other links for sessions related to Indigenous science:

https://www.scienceweek.net.au/event/the-benefits-of-taking-stem-classes-outdoors-free-webinar/

https://www.scienceweek.net.au/event/great-barrier-reef-science-celebration/

https://www.scienceweek.net.au/event/not-the-science-type-short-online-film-viewing/

https://www.scienceweek.net.au/event/indigenous-food-and-agriculture/

https://www.scienceweek.net.au/event/indigenous-science-experience-at-redfern/

https://www.scienceweek.net.au/event/birds-and-language-conference/

STEM 2021: On Demand *(NSW Govt., Google & Global NSW: 2021)*

A unique, online, on demand event bringing Australian educators and STEM professionals TED-style talks from world-renowned experts on creativity, innovation and STEM. STEM 2021 is a FREE, online event bringing together Australia's and the world's leading experts on innovation creativity and STEM. The on demand content includes keynote presentations, EdTalks, workshops, case studies, online forums, a virtual expo and a whole lot more! This event is ideal for teachers, students, parents, professionals, and STEM enthusiasts alike. Keynote Speaker Corey Tutt of Dealdy Science speaks about the importance of Indigenous science knowledge and his own journey in discovering his purpose as a promoter of science.

With a belief that education is freedom and science is hope, Corey's mission is to enhance the lives of young Aboriginal children by giving them access to the wonders of STEM. As a proud Kamilaroi man, he established Deadly Science which provides science resources and books to remote schools and communities across Australia. In this keynote presentation, Corey discusses the history of Indigenous Australians as the first scientists and the importance of encouraging young Aboriginal kids to discover the joy of STEM because the lessons of the past will be the answers for the future.

2021 Australian Conference on Science and Mathematics Education (ACSME)

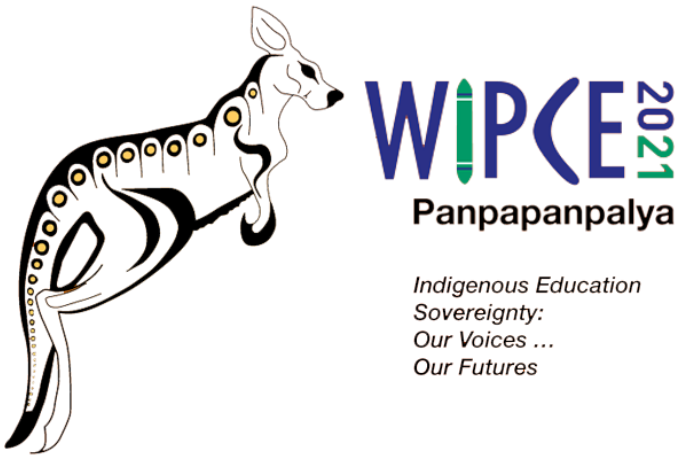
The conference theme will be *Sustainable transformation of science education*. The pandemic forced us to carefully think about what a science education could look like today in order to equip graduates for the ever-changing world. By necessity, faculties of science are engaged in large-scale experimentation with online delivery, in the process discovering what works well and what doesn't. As we emerge from this highly disruptive experience, how will we reshape science education in a way that it is sustainable and meaningful for a complex world facing numerous challenges? We promise it will be another memorable event to share good practice and discuss the latest developments relevant to the teaching and learning of science and mathematics.

ACSME 2021 will explore this theme through many lenses, and will address questions such as:

- What cannot be taught online effectively?
- What does real science and mathematics teaching with technology look like??
- What is the best blend of online and face-to-face teaching?
- How should we change our assessment practices?
- How do we make sure that no student is left behind in this transformation?
- How do we engage the secondary school teachers to be part of this journey?

WORLD INDIGENOUS PEOPLES' CONFERENCE ON EDUCATION

ADELAIDE, SOUTH AUSTRALIA, 26 – 30 SEPT 2022 (POSTPONED AGAIN DUE TO COVID)



Postponed from 2020 and 2021, WIPCE 2022 will feature an exciting Indigenous education program of keynote presentations, networking, interactive workshops and discussion forums with an associated rich and diverse cultural program. An estimated 370 million Indigenous peoples live in all continents of the earth and represent a significant part of the world's vast cultural and linguistic diversity and heritage.

Indigenous peoples possess unique knowledge systems, which are recognised as crucial for sustainable development. At the same time, social, economic and political marginalisation of Indigenous peoples is pervasive in all the regions across the world.

Indigenous peoples face fundamental challenges when attempting to reconcile their own forms of culturally transmitted learning with systems of formal education. Over the past 30 years, WIPCE has endeavoured to address this issue and has grown to become a major international event in the Indigenous education movement. The WIPCE conference draws Indigenous representatives from across the globe to share successes and strategies for culturally grounded education. The needs of young Indigenous educators and leaders will be a key feature of WIPCE 2021 youth forums. WIPCE attracts Indigenous education experts, practitioners, scholars, students and communities, with up to 5,000 delegates expected in 2021 – the largest and most diverse Indigenous education forum on earth.

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"The Sharing Cycle of Science Learning"
by Laurie Houseman Whitehawk, 2012

Watercolors made from
Nebraska plants

Indigenous Pedagogy Virtual Academy
presents

Indigenous Science
Professional Development Workshop
for Teachers, Instructors, and Administrators
of Indigenous Students

Thursday, 9 Sept 2021 at 3:30-5:00 pm CST Online

THE SHARING CYCLE OF SCIENCE LEARNING
Connecting Chemistry at Tribal Colleges to Tribal History, Language, and Culture

Mark Griep, PhD, University of Nebraska
Beverly DeVore-Wedding, PhD, Adams State University

Register here for this and many more workshops
https://noindiggames.wordpress.com/offerings-3/

Free to the first 250 registrants
This session is sponsored by Nebraska EPSCoR - NSF OIA-1557417

Conference of the European Science Education Research Association (ESERA 2021)

ESERA 2021

Fostering scientific citizenship in an uncertain world

30 Aug - 3 Sep 2021
Organised by
University of Minho, Braga, Portugal

The University of Minho (UMinho), in Braga, Portugal, is proud to organise the ESERA Conference 2021 to be held from 30 August to 3 September 2021. This 14th Conference of the European Science Education Research Association (ESERA 2021) will be held as an exclusively virtual conference due to the current Coronavirus situation and travel restrictions.

We expect this ESERA Conference 2021 will bring together the international science education research community where we will be able to share our research and to engage in discussion about the pressing issues in science education. “Fostering scientific citizenship in an uncertain world” is the theme of this 14th edition, which was selected having in mind the severe social and educational changes resulting from this recent public health problem.

We hope you will join us for an excellent virtual ESERA Conference!

Prof. Graça S. Carvalho, (UMinho)
The ESERA 2021 Conference President

2021 INTERNATIONAL CONFERENCE ON TECHNOLOGIES IN STEM 'LIVE'

ICTSTEM 2021 is moving forward with a physical event in 2021!

We’re pleased to announce that 2021 International Conference on Technologies in STEM (ICTSTEM 2021), organized by East Asia Research and supported by Australia’s Curtin University, will be live, in-person, in Singapore from December 14-15, 2021! Learn from the masters of STEM education at the premier conference for the global Educator community. The conference aims to further the application of technology education within STEM and specific learning areas. Within Technology education, students use design and/or computational thinking and technologies to generate and produce designed solutions both digital and physical for authentic problems. As such it applies to many areas of STEM.

We invite practitioners and researchers to network and share their experiences. Teachers, and heads of learning areas as well as teacher educators, researchers and HDR researchers from K to higher education are all encouraged to attend. A broad range of technology education topics, including significant developments as well as innovative uses of technology that promote learning, performance, and instruction, will be presented at ICTSTEM 2021.

Keynote Speakers:

Dr. Jeremy Pagram, Former Technologies Coordinator School of Education Edith Cowan University
Dr. P John Williams, Professor of Education and the Director of Graduate Research, School of Education, Curtin University

You’ll find this conference lively, informative and inspiring. We have set the last day of registration to be on the 15th Nov 2021, giving you ample time to decide. There are virtual options if travelling is difficult. Head over to our ICTSTEM 2021 website www.sldt.ear.com.sg to find out more. Go for it.

The Bulletin of the Indigenous Science Network is distributed four times a year via email directly to members. Membership is open to all. If interested in being a part of the Network, please contact the Coordinator via email at IndigenousSciNet@yahoo.com. Issues distributed in February, May, August and November each year.

2021 SACNAS National Diversity in STEM (NDiSTEM) Digital Conference, October 25 – 29, 2021

SACNAS

Advancing Chicanos/Hispanics & Native Americans in Science

For the past 48 years, SACNAS has been deeply committed to building community, celebrating our unique identities, and providing access to opportunity for thousands of STEM college students and professionals across the country, a majority from historically excluded populations. One of the main ways we do this is by producing and hosting the National Diversity in STEM Conference.

Last year, our country faced an unprecedented global event with the COVID-19 pandemic. Throughout these difficult times for our community, SACNAS persisted, and together, we thrived. SACNAS hosted the organization's first-ever digital conference, which saw record-breaking participation with over 5,700+ attendees, 863 student research presentations, 346 exhibiting companies and 25 sponsoring partners to meet and recruit our SACNAS members. For these reasons we are excited to announce that the 2021 SACNAS National Diversity in STEM Conference will be a fully digital experience! If you had a great time at last year's conference, or didn't get a chance to attend, this year will be twice as incredible.

How can local plants in the Jawoyn region be used to prevent bacterial infections?

By Tahnee Brown

Introduction

Medicinal plants are plants that have healing properties or use beneficial pharmacological effects in a living organism. These types of plants have been used as traditional medicines in many cultures around the world. Therefore, the history of medicinal plants is just as long as the history of humans.

Figure 1 - Red Bush Apple

Medicinal plants have played an essential part as sources of drug lead compounds of Indigenous peoples in the Northern Territory lives, to decrease bacteria inflections in their community. The knowledge of the plant's application, location and structure was passed down through generations via song and dance. Indigenous peoples remembered the ideal season for selection and the correct method of preparation and indicators for use. This gained knowledge is vast and critical for survival.

Figure 2 - Gumbi Gumbi Bush

These medications where either applied internally or externally to relieve pain, promote healing, or cursing such elements that was common to them. For this reason, there does not appear to be any traditional medicines that can cure or decrease the bacterial infections for those diseases introduced by colonising races.

Indigenous people confine their use to plants within their respective areas and do not consider them as having therapeutic value outside this area. The same plant that grows in two tribal areas is often used in very different ways medicinally. Different parts of the plant are considered by one tribe to be more important than another or vary in preparation or use indication.

Aim

To determine which Jawoyn plants are optimal to decrease the rate of bacterial infections.

Hypothesis

If plant extracts are added to the bacteria by having both, bacteria and plant extract, on the same agar plate the growth rate of bacteria will decrease because plants have bacteria killing antibodies.

Variables

Independent Variable: Solution placed on agar plate.
Dependent Variable: Bacteria Growth
Uncontrolled Variable: Amount of Agar in Plates, how tight the dish is sealed, temperature in cupboard.
Controlled Variable:

Table 1 – Controlled Variables

Variable	Why it needs to be controlled	How will it be controlled
Amount of water	The same amount of water needs to be controlled because then the concentration of the plant is the same throughout all of the experiment.	50mL
Amount of Plant	The amount of plant needs to be kept the same so then the concentration of the plant to water is the same throughout the entire experiment.	1g
Size of container	The size of the container needs to be the same to have the same amount of bacteria on the agar place at the start of the experiment.	Petri Dish
Amount of nutrients	This has to be controlled so that each bacteria has the same living conditions.	The same nutrients and amount will be used
Temperature	The temperature that the bacteria are growing all the same, in case the bacteria grow faster or slower in different temperatures.	They are stored in the same area
Human Interaction with Agar Plates	If there is human interaction with the agar plates than the bacteria will start to grow, and the experiment will not be valid.	Do not breath or touch the agar plates

Safety

Table 2 – Safety

Hazard	Risk Level	Precautions
Broken Glass	Low	- Stir everything cautiously and gently - Immediately notify supervising adult
Split water	Low	- Place beakers away from the edge of the table - Clean up any spills immediately
Burn from Fire	Low	- Do not touch or play with fire - Pay attention when in use - Turn off when not in use
Risk of Bacterial Infection	Medium	- Do not incubate bacteria at body temperature - Don’t infect petri dish with human bacteria - Don’t close the plates entirely - Do not reopen plates

Materials

- 5x Bark and Leaf samples
- 5x 250mL Beakers
- 2x Bunsen burner
- Cotton Swabs approx. 10
- 2x Gauze Mat
- 2x Heat Mat
- 5x Mortar and Pestle
- 50mL Measuring Cylinder
- 12x Petri Dish
- 1x Permanent Marker
- Personal Protective Equipment (PPE)
- Scales
- Scissors
- Tape
- Timer
- Tongs
- 2x Tripod Stand
- Water approx. 500mL

Method

1. Collect five different leaf and bark samples and take photos of the different trees for evidence and classification.
2. Separate the samples. Using separate mortar and pestles crush up the plants as much as you can. (Figure. 2)
3. Place the crushed mixture into 250mL beakers, and using a permanent marker label the beaker with the plant used.
4. Prepare five beakers with the following:
    - 1g of crushed plant sample
    - 50mL of water
5. Prepare the control beaker with the following:
    - 50mL of water
6. Setup two Bunsen burners; Heat Mat, Tripod Stand, Gauze Mat, Bunsen Burner, Tongs and PPE. Boil the plant mixtures for five minutes each. (Figure. 3)
7. After all of the mixtures have been boiled, get a new 250mL beaker and fill will with 50mL of water.
8. Dampen a new cotton swab with the water from new beaker and collect bacteria from hands and bench.
9. Then contaminate the petri dish with the cotton swap by swiping side to side all the way down the dish. Turn the petri dish slightly and repeat this four times and after each trial.
10. Repeat steps 8 and 9 for all of the petri dishes.
11. For each of the plant samples, label two petri dishes with a permanent marker the plant used.
12. Using a new cotton swab spread the boiled mixture over the agar plates. A different cotton swab needs to be used with a different plant mixture.
13. Repeat step 11 for all of the agar plates.
14. Once the samples have been coated in the plant mixture tape the cover to the bottom of the petri dish. (Figure. 4)
15. Place all of the petri dishes upside down in a cupboard out of human interaction to grow.
16. Check and analyse the bacteria in five days.

Figure 3 - Crushing Up the Plants

Figure 4 - Boiling the Samples

Figure 5 – Completed Samples

Results

After the experiment the results support my hypothesis as there was less bacteria in the treated petri dishes compared to the controlled treatment method.

Table 3 – Difference Between Control and Treatment

	Control	Shiny Leaf	Bauhinia Bark	Bauhinia	Big leaf	Smelly
Number of Types	3	3	3	3	4	4
Description	Yellow	Fluffy White	Red	Fluffy White	Black Fluffy	Little Fluffy
	White	Yellow	White	Yellow	White	Fluffy Black
	Fluffy black	White	Yellow	White	Yellow	White
					Little Fluffy Dots	Yellow
Fluffy Black	4	0	0	0	0	1
Fluffy White	0	1	0	1	1	0
Little Fluffy	0	0	0	0	2	1
Red	0	0	15	0	0	0
White	20	234	57	23	36	30
Yellow	24	94	38	21	7	10

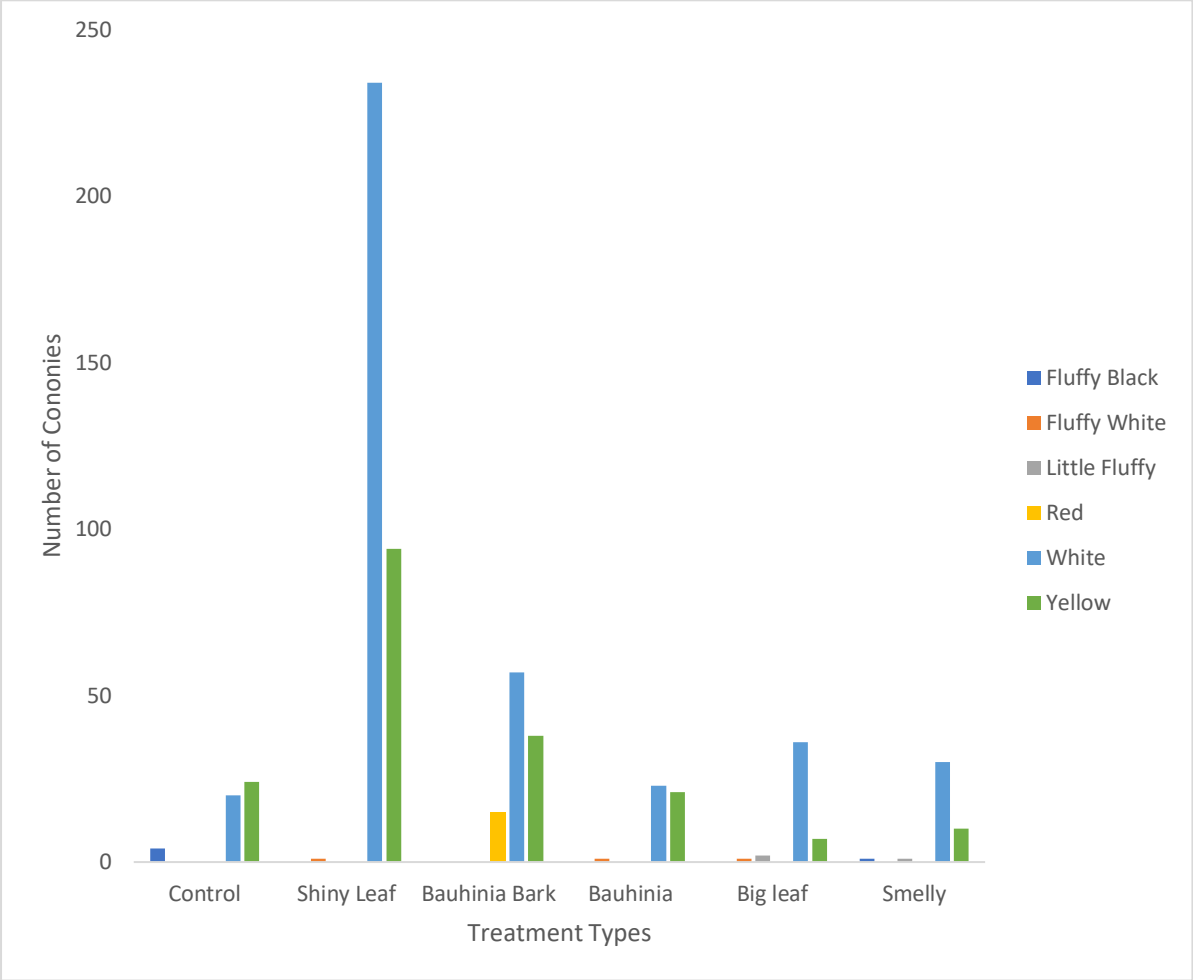

Figure 6 - Difference Between Control and Treatment

Discussion

These results support the hypothesis as there was less bacteria in some of the petri dishes compared to the control trials. The different plant samples decreased the growing rate of the bacteria collected from various surfaces for some of the trials. The control petri dishes had a total number of 48 colonies of bacteria with only three different types of colonies between the both of them. These colonies included; a fluffy black irregular shaped bacteria colony, 20 small to medium sized white colonies and 24 small to mild sized yellow bacterium colonies.

The shiny leaf did not grow a fluffy black bacteria colony like in the control petri dish but instead grew one fluffy white colony and the number of white and yellow bacteria colonies increased drastically, with 234 white bacteria colonies and 94 yellow colonies between the two petri dishes.

The treatment that worked the best for decreasing the number of colonies of bacteria is the Bauhinia leaves with three different bacteria colonies types; these were identified as yellow, white, and fluffy white bacteria colonies. There was, in total, one fluffy white bacteria colony, 23 white bacteria colonies, and 21 yellow bacteria colonies. This means that the bauhinia leaves may have antibacterial properties as they decreased the number of some of the bacteria colonies on the petri dishes. These results are backed up by the authors Gupta and Paarakh at The Oxford College of Pharmacy, as “it was found that aqueous extract has antibacterial activity”.

The bauhinia bark had a total of 110 bacteria colonies. These included 15 red colonies, 57 white colonies and 38 yellow bacterial colonies. The bauhinia was the only bark that was selected to use and the only product with red bacteria colonies on the agar plate. This shows that the bauhinia bark and the bauhinia leaves have different antibacterial properties.

Evaluation

Table 4 – Systematic and random Errors

Systematic Errors	Reasoning	Effect on Conclusions
The scales might not be precise	If the scales where not precise with weighing out the plants, there might only be 0.97g. The scale would have been accurate as it has the same weight in all of the beakers, but not precise.	This effects the conclusions by the trials may have slightly less/more antibacterial agents.
The measuring cylinders may not be precise	The measuring cylinder might not have been precise with measuring out the amount of water, there might only be 48mL instead of 50mL.	This effects the conclusions by the trials may have slightly less/more antibacterial agents.
Random Errors	Reasoning	Effect on Conclusions
Swabbing of the Agar Plate	The swabbing motion onto the agar plate was the same but the amount that actually got stuck to the agar plate might have been different.	This effects the conclusions by the trials may have slightly less/more agents compared to the other trials, this is limited by using the same swabbing technique.
Amount of Bacteria on Agar Plate	The amount of bacteria collected from the surfaces used might be different amounts in different places on the bench.	This effects the conclusions by the trials may have slightly less/more bacteria that could grow on the agar plates, to limit this the same swabbing pattern was used.
Amount of Treatment on Agar Plate	The amount of treatment that was carried on the cotton swab may have been different for all of the treatment trials.	This effects the conclusions by the trials may have slightly less/more treatment agents compared to the other trials. To limit this the same swabbing pattern was used.

Conclusion

The experiment that was undertaken supported my hypothesis that the plants will decrease the rate at which the bacteria will grow, as some of the trials have less bacteria grown compared to the control trials. The best plant for decreasing the rate of which the bacteria will grow in this experiment was the bauhinia leaves. This was made accurate by considering the variables and limited their impact on the experiment. There were still some errors including; systematic and random errors. Overall, the plants decreased the growth of the bacteria.

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Appendix A – Investigation Planning

What Affects the Growth of Bacteria?

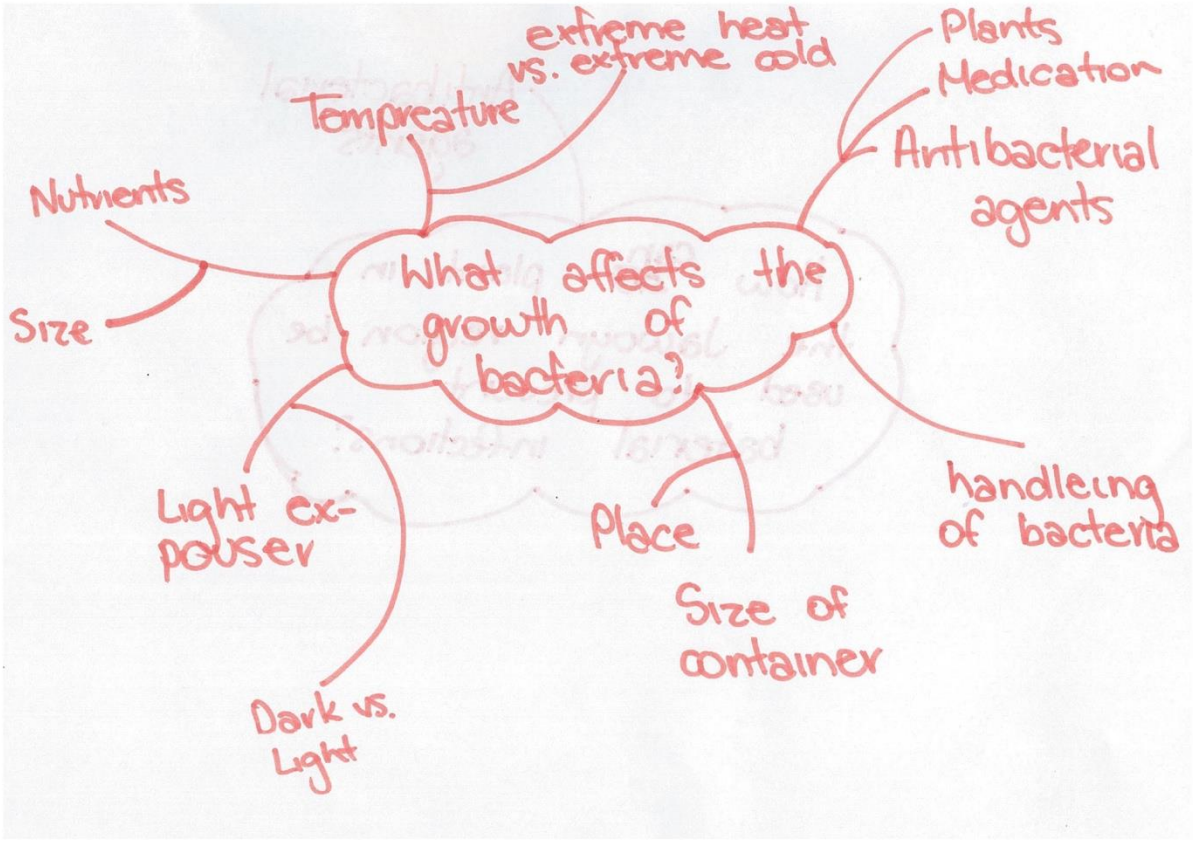


Figure 1 - What Affects the Growth of Bacteria?

Ways to measure the product

There are multiple ways to measure the outcome of the bacteria growth/death. This includes the size of bacterium, amount of bacterium, number of different types of bacterium, weight, and percentage of coverage. These measurements would be compared to the control petri dish rate of the bacterium. E.g. The percentage of coverage of bacteria on the control dish compared to the other petri dishes with the independent variables on it.

What was investigated?

I selected to investigate the antibacterial properties of different plants around the Jawoyn region. I have done this by boiling the plants and placing the extract on a petri dish with bacteria collected from hands and benches. To measure the outcome, I have chosen to compare the number of bacteria on the agar plate to the control.

Different Plants

Katherine Medicinal Plants

- *Acacia translucens* (p. 101)
- *Centipeda thespidioides* (p. 105)
- *Chenopodium cristatum* (p.106)
- *Cymbonotus lawsonianus* (p. 107)
- *Dianella ensifolua* (p. 108)

Jawoyn Medicinal Plants

- *Erythrophleum chlolstachys* (Ironwood) The [redacted] of ironwood is used as medicinal drug.
- *Gyrocarpus americanus* (Shitwood)

- *Eruatamia orientalis* (p. 109)
- *Erythrophleum chlorostachyum* (p. 109)
- *Euphorbia australis* (p. 111)
- *Gyrocarpus americanus* (p. 112 & 113)
- *Lavatera plebeia* (p. 114)
- *Mimulas gracilis* (p. 115 & 116)
- *Planchonia careya* (p. 117)
- *Swainsona pterostylis* (p. 120)

The [redacted] of Shitwood is used as a medicine.

- *Planchonia careya* (Cocky Apple) The [redacted] of the Cocky Apple are used to prevent bacterial infections.

(Details of some parts of the plants used have been hidden for cultural reasons)

Preparing the Plants

Ozzie Daylight – "You gotta get da plant, boil 'em up then use the water to wash on yourself and treat sickness"

To prepare you need to crush them up as best you can before you boil the plant in water. Using only the water to wash over body to treat sickness.

Variables

The Independent variable is the solution that is made and spread over the agar plate and the dependent variable is going to be the increase in bacteria. The reasoning for this is due to the fact that the dependent variable changes depending on the independent variable. The Bacteria's growth depends on the solution that is spread across the agar plate.

Independent Variable: Solution placed on agar plate.

Dependent Variable: Bacteria Growth

Uncontrolled Variable: Temperature in cupboard, how tight the dish is sealed.

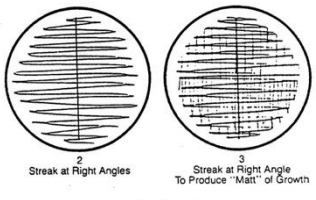
Controlled Variable:

Table 1 – Controlled Variables

Variable	Why it needs to be controlled	How will it be controlled
Amount of water	The same amount of water needs to be controlled because then the concentration of the plant is the same throughout all of the experiment.	50mL
Size of container	The size of the container needs to be kept the same so there is the same amount of surface area for all of the bacteria trials.	Petri Dish
Amount of nutrients	This has to be controlled so that each bacteria has the same living conditions.	The same nutrients and amount will be used

Method

Table 2 - Method

Steps	Justification
1. Collect five different leaf and bark samples and take photos of the different trees for evidence and classification. 2. Separate the samples. Using separate mortar and pestles crush up the plants as much as you can. 3. Place the crushed mixture into 250mL beakers, and using a permanent marker label the beaker with the plant used. 4. Prepare five beakers with the following: o 1g of crushed plant sample o 50mL of water 5. Prepare the control beaker with the following: o 50mL of water	The plants need to be boiled as this is how Indigenous peoples apply most of the medicinal plants found in the Jawoyn region.
6. Setup two Bunsen burners; Heat Mat, Tripod Stand, Gauze Mat, Bunsen Burner, Tongs and PPE. Boil the plant mixtures for five minutes each.	From the boiled mixture Indigenous peoples use the water to cure sickness and prevent bacterial infections.
7. After all of the mixtures have been boiled, get a new 250mL beaker and fill will with 50mL of water.	
8. Dampen a new cotton swab with the water from new beaker and collect bacteria from hands and bench. 9. Then contaminate the petri dish with the cotton swap by swiping side to side all the way down the dish. Turn the petri dish slightly and repeat this four times and after each trial. 10. Repeat steps 8 and 9 for all of the petri dishes.	Bacteria from benches and hands was used as humans interact with it on a daily basis. This means that it has many bacteria that could infect people.  2 Streak at Right Angles 3 Streak at Right Angle To Produce "Matt" of Growth *Figure 2 - How to Contaminate Petri Dish*
11. For each of the plant samples, label two petri dishes with a permanent marker the plant used.	
12. Using a new cotton swab spread the boiled mixture over the agar plates. A different cotton swab needs to be used with a different plant mixture. 13. Repeat step 11 for all of the agar plates.	Using different cotton swab is illuminate cross contamination of the plant samples.
14. Once the samples have been coated in the plant mixture tape the cover to the bottom of the petri dish. 15. Place all of the petri dishes upside down in a cupboard out of human interaction to grow.	

16. Check and analyse the bacteria in five days.	

Plants Used

Figure 3 - Big Leafed Tree

Figure 4 - Shiny Leafed Tree

Figure 5 - Smelly Leafed Tree

Figure 6 - Bauhinia Tree