

Resource Guide

Science

The information and resources contained in this guide provide a platform for teachers and educators to consider how to effectively embed important ideas around reconciliation, and Aboriginal and Torres Strait Islander histories, cultures and contributions, within the specific subject/learning area of [Science](#). Please note that this guide is neither prescriptive nor exhaustive, and that teaching staff are encouraged to consult with their local Aboriginal and Torres Strait Islander community, and [critically evaluate resources](#), in engaging with the material contained in the guide.

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Please be aware this guide may contain references to names and works of Aboriginal and Torres Strait Islander people that are now deceased. External links may also include names and images of those who are now deceased.

Background and Introduction to Aboriginal and Torres Strait Islander Science

“Indigenous Australia has some of the world’s earliest scientists and inventors, who have witnessed major astronomical and catastrophic events like tsunamis, meteorites, floods, and entire ice ages, and fortunately have survived to tell the story. Long before the Greeks were studying the stars Indigenous Australians were developing highly sophisticated sciences...”¹
– Luke Briscoe, Aboriginal Scientist

It is important to appreciate that, while this guide focuses as much on Aboriginal and Torres scientific conventions and collaborations since colonisation, science has been an integral part of Aboriginal and Torres Strait Islander cultures for thousands of years, and continues to play an integral part in cultural life to this day. It is also important to acknowledge that, from Aboriginal and Torres Strait Islander perspectives, there is an intricate and inextricable interconnection between the physical, chemical and biological sciences and the *social* sciences more widely, particularly because of the deep and timeless relationship between Country and Aboriginal and Torres Strait Islander identities, languages, cultures and spiritualities. Indeed, in the words of Palawa woman and Aboriginal science educator, Angie Abdilla, “within an Indigenous paradigm, Indigenous Sciences are not segregated but part of all aspects of our culture and lore.”² For this reason, you may wish to consider the content in this subject guide in the context of some of the content organised within other—Civics and Citizenship, Economics and Business, Geography, Health and Physical Education, History, Languages, Mathematics, and Technologies—subject guides.

For generations, Aboriginal and Torres Strait Islander sciences have incorporated, but not been limited to, sophisticated knowledges and practices pertaining to seasons and meteorology; astrology and astronomy; bush food, medicine and healing; natural resource management; and the physics and chemistries behind the design, production or use of tools, instruments and inventions. Unfortunately, Aboriginal and Torres Strait Islander science traditions suffered significantly under oppressive colonial government policies that both directly and indirectly separated Aboriginal and Torres Strait Islander children from their cultures and communities. Colonial prejudices too often propagated a myth that Aboriginal and Torres Strait Islander sciences were “primitive” or “less than”, rather than acknowledging the important roles that these sciences can and do play in sustaining Australia’s ecosystem and economy alike.

Nevertheless, Aboriginal and Torres Strait Islander peoples and scientific knowledges/practices have also shown incredible resilience and adaptability over time. They are increasingly recognised and respected as being integral to contemporary conversations and collaborations around some of the biggest scientific questions of today, such as food security and climate change. In engaging with some of the resources referenced throughout the remainder of this guide, remember to consider their great relevance to the future of science education, and to reconciliation in education more broadly.

¹ Reference: Briscoe, L. (2016) *Indigenous science is at the core of social, economic and political change*, SBS/NITV, <<http://www.sbs.com.au/nitv/article/2016/08/12/indigenous-science-core-social-economic-and-political-change>>

² Ibid

Timeline of Key Dates in the Contemporary History of Aboriginal and Torres Strait Islander Science

This timeline chronologically lists some of the key dates in the more recent history of Aboriginal and Torres Strait Islander science and/or in regard to the relationship between science and reconciliation more generally.

- **60,000+ years ago:**

- Aboriginal and Torres Strait Islander communities across Australia have maintained longstanding conventions, conceptualisations and connections pertaining to Science for tens of thousands of years. For example, [The Brewarrina fish traps](#) demonstrate a strong scientific knowledge and understanding of tidal patterns and are approximately 40,000 years old, making them one of the oldest manmade structures on earth. As a further example of significance, the [Wurdi Youang stone arrangement](#) maps out the movements of the sun and is more than 11,000 years old (pre-dating Stonehenge and even the Great Pyramids of Giza).

- **1909:**

- By 1909, Aboriginal scientist/inventor, [David Unaipon](#), had developed and patented a modified handpiece for shearing. Between this year, and 1944, he made patent applications for nine other inventions, including a centrifugal motor, a multi-radial wheel and a mechanical propulsion device, building his reputation as “Australia’s Leonardo da Vinci”.

- **1974:**

- The archeological [discovery of ‘Mungo Man’ \(and ‘Mungo Lady’ in 1968\) fossils near Lake Mungo, NSW](#), provided scientifically backed evidence that doubled the known length of Aboriginal history in Australia.

- **1980:**

- The [Centre for Appropriate Technology \(CAT\)](#) was established, growing to become a peak national Indigenous science and technology organisation.

- **1989:**

- The [Worldwide Indigenous Science Network](#) was founded, which Aboriginal and Torres Strait Islander scientists from Australia have since been a part of (see Luke Briscoe’s reflections on a 2016 collaboration [here](#), for example).

- **1995:**

- Image of Aboriginal inventor, [David Unaipon](#), was first printed on the Australian \$50 note.

- **2004:**

- The [National Indigenous Science Education Program \(NISEP\)](#) was established, when scientists from Macquarie University began collaborating with Elders from the Yaegl and Bundjalung communities of northern NSW on bush medicine projects.

- **2012:**
 - The Australian Government Department of Industry, Innovation and Science released its [Indigenous Engagement with Science: Towards Deeper Understandings](#) report, prepared by the Expert Working Group on Indigenous Engagement with Science to acknowledge the significant contributions that Aboriginal and Torres Strait Islander peoples have already made to the development of science in Australia, and the urgency to communicate the continued importance of engaging Aboriginal and Torres Strait Islander peoples in science to the scientific and broader Australian community.
 - Bill Gammage publishes book [The Biggest Estate on Earth](#) dispels the myth that pre-settlement Australia was an 'untamed wilderness' revealing the complex, country-wide systems of land management used by Aboriginal people.

- **2014:**
 - CSIRO launches its [Indigenous STEM Education Project](#), recognising the important contributions that Aboriginal and Torres Strait Islander peoples can make to the future of the science, technology, engineering and maths industries in Australia.

- **2016:**
 - A [world-first genomic study](#) confirms that contemporary Aboriginal and Torres Strait Islander peoples are the descendants of the first people to inhabit Australia.
 - [INDIGI LAB](#) was founded with a vision to create a future where Aboriginal and Torres Strait Islander Australians are leading in science, technology and digital innovation. It also launched Australia's first Aboriginal and Torres Strait Islander Science and Technology magazine, [STREAMS IQ](#).
 - The CSIRO launched its inaugural [Indigenous STEM Awards](#).
 - Bruce Pascoe's [Dark Emu wins the NSW Premier's Literary Awards](#) – the book challenges the perception of pre-colonial Aboriginal people as 'hunter-gatherers', and provides compelling evidence from the diaries of early explorers that suggests that systems of agriculture, food production and land management have been blatantly understated in modern retellings of early Aboriginal history.

Recently Released Aboriginal and Torres Strait Islander Science Resources

Organised below are a number of examples of recently produced or published Aboriginal and Torres Strait Islander science-related resources that can meaningfully contribute to contemporary classroom learning, and to the range of biological, chemical and physical fields of science in Australia as a whole.

Aboriginal and Torres Strait Islander Seasonal Calendar Resources

The list below includes a number of examples of Aboriginal and Torres Strait Islander seasonal calendars. The traditional ecological and meteorological knowledges captured in these calendars have become well esteemed within 'Western' science for what they can teach wider society about environmental management and sustainability, and about understanding and approaching contemporary science issues such as climate change.

- [Banbai calendar](#) (NSW)
- [D'harawal calendar](#) (NSW)
- [Gariwerd calendar](#) (VIC)
- [Gulumoerrgin \(Larrakia\) seasons calendar](#) (NT)
- [Jawoyn calendar](#) (NT)
- [Kunwinjku seasons calendar](#) (NT)
- [MalakMalak and Matngala plant knowledge calendar](#) (NT)
- [Maung calendar](#) (NT)
- [Gooniyandi seasons calendar](#) (WA)
- [Miriwoong Seasonal Calendar](#) (WA/NT)
- [Ngadju seasons calendar](#) (WA)
- [Ngan'gi seasons calendar](#) (NT)
- [Ngurrungurrudjba \(Yellow Water\) seasons calendar](#) (NT)
- [Nyoongar calendar](#) (WA)
- [Tiwi calendar](#) (NT)
- [Walabunnba calendar](#) (NT)
- [Walmajarri seasons calendar](#) (WA)
- [Wardaman calendar](#) (NT)
- [Yanyuwa calendar](#) (NT)
- [Yawuru Seasons](#) (WA)

A number of these individual seasonal calendars are hosted together on the Bureau of Meteorology's [Indigenous Weather Knowledge](#) page, and on the CSIRO's [Indigenous seasons calendars](#) page. You may also consider researching published curriculum resources around Aboriginal and Torres Strait Islander seasonal calendars, such as ABC Education's [Indigenous seasons across northern Australia](#) resources, Queensland Curriculum and Assessment Authority's [Torres Strait Islander Seasonal Calendar](#) resources, or the Catholic Education Office of Western Australia's [Growing Enriched Cultural Knowledge in Schools \(GECKOS\) Seasons lesson plans](#).

Aboriginal and Torres Strait Islander Astrology/Astronomy Resources

- ABC— [Behind the News: Aboriginal Astronomy](#)
- ABC News— [The world's oldest observatory? How Aboriginal astronomy provides clues to ancient life](#)
- ABC Radio National/Away!— [Aboriginal Astronomy and Star Maps](#)
- ABC Science— [Australia's first astronomers](#)
- ABC Science— [Beginners Guide to the Night Sky](#) (and corresponding ABC Education [Beginners Guide to the Night Sky](#) resource)
- ABC Education— [Star stories of the Dreaming](#)
- Australian Indigenous Astronomy— [Aboriginal and Torres Strait Islander Astronomy](#)
- Australian Institute of Aboriginal and Torres Strait Islander Studies— [Subject guide – Indigenous Australian astronomy](#)
- Catholic Education Western Australia— [Growing Enriched Cultural Knowledge in Our Schools: Astronomy](#)
- CSIRO— [Australian Aboriginal Astronomy](#)
- CSIRO/Norris, Ray P.— [Australian Aboriginal Astronomy in the International Year of Astronomy](#)
- Queensland Studies Authority— [Torres Strait Islander zugubal \(constellations\)](#)
- National Indigenous Times— [Everything is written twice – on the ground and in the sky](#)
- National Museum of Australia— [Songlines: Tracking the Seven Sisters](#) (including [digital interactive](#) that explores two different parts of the Seven Sisters songlines: the significant rock art site of Walinynga (Cave Hill), and the dynamic collaborative artwork project that created the tjanpi Seven Sisters Are Flying)
- SBS— [How ancient Aboriginal star maps have shaped Australia's highway network](#)
- SBS— [The Life Code](#)
- SBS— [Stories in the sky: Indigenous Astronomy](#)
- SBS/NITV – [Stars that vary in brightness shine in the oral traditions of Aboriginal Australians](#)

Aboriginal and Torres Strait Islander Bush Food/Medicine and Health Science Resources

- ABC— [Behind the News: Bush Food](#)
- ABC— [Behind the News: Bush Tucker](#)
- ABC— [Indigenous communities meeting demand for bush medicine](#)
- ABC Education— [Recognising the potential of native vegetables](#)
- ABC Education— [Tasty bush tucker](#)
- AIATSIS— [Subject guide – Indigenous Australian use of plants for food and medicine](#)
- ANU— [Living Knowledge Project: Bush Foods and Medicines](#)
- Murrumbidgee Catchment Management Authority— [Wiradjuri Plant Use in the Murrumbidgee Catchment](#)
- SBS— [Science of Footy: Encoding ancient knowledge through footy](#)
- SBS/NITV— [Mayi Jilbamun \(Food Journey\)](#)
- SNAICC— [Nutrition \(Bush Tucker\) Game](#)
- SNAICC— [Cooking with Bush Foods](#)
- TCC Natural Resource Management Trainees & Russell Butler— [Mundy Creek Aboriginal Bush Tucker Poster](#)

For more resources and information, you may also wish to consult the Health and Physical Education resource guide on the Narragunnawali platform.

Aboriginal and Torres Strait Islander Natural Resource Knowledge/Management

- ABC Education— [Aboriginal fire knowledge cuts greenhouse gas](#)
- ABC Education— [First Australians were also the first farmers](#)
- ABC Education— [Outback icon spectacular from space](#)
- ABC Education— [River kids](#)
- ABC Education— [Sticky grass from the past](#)
- ABC Education— [Science and ancient fire knowledge](#)
- ABC Education— [The many uses of indigenous plants](#)
- Australian National Botanic Gardens Education Services— [Aboriginal Plant Use and Technology](#)
- ANU— Living Knowledge Project: [Seeing environmental changes](#)
- Cool Australia— [Unit: Cool Burning – Primary](#)
- Cool Australia— [Unit: Cool Burning - Secondary](#)
- Murrumbidgee Catchment Management Authority— [Wiradjuri Plant Use in the Murrumbidgee Catchment](#)
- National Museum of Australia— [On Country](#)
- Reconciliation Australia— [Who We Are: Country/Place](#)
- Firesticks Alliance Indigenous Corporation— [Right Country – Right Fire: Podcast Series](#)
- SBS— [‘Our country needs to burn more’: Indigenous fire manager](#)

Aboriginal and Torres Strait Islander Tools, Instruments and Inventions

- Australian Geographic— [Aboriginal inventions: 10 enduring innovations](#)
- Australian Museum— [Explore Indigenous Australian Objects](#) (including examples of tools, containers, fishing gear, toys etc.).
- Department for Education and Child Development South Australia— [Aboriginal Cultural Studies: Science and Technology](#) (see the science-aligned resources around shelters, string, toys, containers, sports equipment, for example)
- My Place for Teachers— [Australia in the 1770s: Science and Technology](#) (see the ‘Fishing,’ ‘Weapons’ and ‘Canoe Making’ tabs, for example).

See the Technologies—Design & Technologies and Digital Technologies resource guide on the Narragunnawali platform for more information. Note that there can be culturally distinct protocols around who can teach/learn about, use, or even touch some of the kinds of tools or instruments featured in the resources above, so it is important to consult with your local Aboriginal and Torres Strait Islander community before engaging with these resources.

Aboriginal and Torres Strait Islander Science Media Articles

Listed below are examples of media articles that have been released in recent years, and that

feature Aboriginal and Torres Strait Islander science-related issues, events and achievements.

- ABC— [Indigenous knowledge and western science unite to save the reef](#)
- ABC— [Students discover scientific principles are as old as Aboriginal culture itself](#)
- ABC— [Wide Bay Indigenous student recognised by CSIRO for excelling in STEM](#)
- Australian Geographic— [Mapping Aboriginal knowledge of the bush](#)
- BBC— [Aboriginal legends reveal ancient secrets to science](#)
- CSIRO— [Five ways Indigenous science explains the world](#)
- SBS/NITV— [How Indigenous science can save humanity from itself](#)
- SBS/NITV— [Indigenous science is at the core of social, economic and political change](#)
- SBS/NITV— [Science Week: NITV talk to Indigenous scientists about their work and inspiration](#)
- SBS/NITV— [Winners of the 2016 Indigenous STEM Awards announced](#)
- Sydney Morning Herald— [Aboriginal scientific achievements recognised at last](#)
- The Conversation— [Aboriginal people – how to misunderstand their science](#)

Aboriginal and Torres Strait Islander Scientists

Aboriginal and Torres Strait Islander people who have played, and/or continue to play, a key role in the field of Science in Australia may not always be explicitly recognised, or referred to, through the title of 'scientist'. However, in many ways, all Aboriginal and Torres Strait Islander people could be considered scientists given their deep connections to, knowledges of, and/or caring contributions to Country and the natural sciences that intersect with the natural landscape. For this reason, as an example starting place, you may consider researching and learning about the contributions of Aboriginal and Torres Strait Islander ranger groups. The Australian Government's map of [Indigenous Protected Areas and Commonwealth Funded Indigenous Ranger Groups](#) pinpoints a number of Aboriginal and Torres Strait Islander ranger groups active as at February 2020. As well as using the internet to look up the specific webpages of the individual ranger groups mapped, you may be able to find out more about these, and other, ranger groups through your local Aboriginal and Torres Strait Islander Land Council.

Furthermore, should you wish to provide opportunities for students and children to explore and acknowledge specific Aboriginal and Torres Strait Islander individuals who have made important contributions to the subject/learning area of Science, some examples include:

- [Angie Abdilla](#)
- [Bradley Moggridge](#)
- [Cass Hunter](#)
- [Chris Matthews](#)
- [David Unaipon](#)
- [Djarra Delaney](#)
- [Faye McMillan](#)
- [Gerry Turpin](#)
- [Jason Barrow](#)
- [Jen Campbell](#)
- [Joe Sambono](#)
- [Karlie Noon](#)
- [Luke Briscoe](#)
- [Mibu Fischer](#)
- [Misty Jenkins](#)
- [Mitch Gibbs](#)
- [Renee Cawthorne](#)
- [Rowena Ball](#)
- [Shane Ingrey](#)
- [Simone Reynolds](#)
- [Tuguy Esgin](#)
- [Willy Stevens](#)

Aboriginal and Torres Strait Islander Science Groups/Organisations/Programs

Listed below are examples of Aboriginal and Torres Strait Islander science-related groups, organisations and programs. Note that some of these groups, organisations and programs may not be exclusively Aboriginal and Torres Strait Islander owned or governed, but are nevertheless meaningfully dedicated to supporting Aboriginal and Torres Strait Islander science and scientists. Note that, given the relationship between science and the wider STEM field, some of the listed institutions and programs may also relate to the Technologies and Mathematics subject areas³. Furthermore, other subject areas such as Health and Physical Education and Geography also have strong relationships with Aboriginal and Torres Strait Islander sciences, for which reason you may consider consulting the lists of organisations contained in those resource guides too.

- [Aboriginals and Torres Strait Islanders in Marine Science \(ATSIMS\)](#)
- [Centre for Appropriate Technology Limited \(CAT\)](#)
- CSIRO [Indigenous STEM Education Project](#)
- [Old Ways, New](#)
- [INDIGI LAB](#)
- [National Indigenous Science Education Program \(NISEP\)](#)

³ See the Science resource guide and the Technologies resource guide for lists of institutions and organisations that include those more specifically tied to either of these three subject areas.

Aboriginal and Torres Strait Islander Science Celebrations/Events

Listed below are examples of Aboriginal and Torres Strait Islander science-related events and celebrations, past and present.

- CSIRO [Aboriginal and Torres Strait Islander Student STEM Achievement Awards](#)
- CSIRO [Indigenous STEM Awards](#)
- (Former) Deadly Awards— [Scientist or Science Project of the Year Award](#)
- National Indigenous Science Education Program [Indigenous Science Experience](#)
- National Youth Science Forum— [Indigenous Program](#)
- [National Science Week](#) (and the number of Aboriginal and Torres Strait Islander science events and experiences often run during this week such as the annual [Indigenous Science Experience in Redfern](#))

Other Online Guides/Reference Materials

- Australian National University (2008) *Living Knowledge: Indigenous knowledge in science education*, <http://livingknowledge.anu.edu.au/>
- Department of Education Western Australia (2016) *Aboriginal Education: Working in partnership empowers all to make a significant difference – Science*, <http://www.det.wa.edu.au/aboriginaleducation/apac/detcms/aboriginal-education/apac/lesson-plans/science.en?cat-id=9192344>
- Department of Industry, Innovation and Science (2012) *Indigenous Engagement with Science: Towards deeper understandings*, https://www.industry.gov.au/sites/default/files/2018-10/inspiring_australia-indigenous_engagement_with_science-towards_deeper_understandings_2013.pdf
- McKinley, E. (2016) *STEM and Indigenous Students*, http://research.acer.edu.au/cgi/viewcontent.cgi?article=1290&context=research_conference
- More Aboriginal and Torres Strait Islander Teachers Initiative (2012) *Embedding Indigenous perspectives into Science to support the implementation of the Australian Curriculum*, <http://matsiti.edu.au/indigenous-perspectives-science/>
- New South Wales Department of Education and Training (2008) *Science in Context: Schools working with Aboriginal Communities*, <http://livingknowledge.anu.edu.au/html/educators/sic/index.htm>
- Queensland Studies Authority (2013) *Aboriginal and Torres Strait Islander histories and cultures resources: Science*, https://www.qcaa.qld.edu.au/downloads/aust_curric/ac_ccp_atsi_cultures_science.pdf
- Tasmanian Government (2018) *The Orb: Living Cultures*, <https://www.theorb.tas.gov.au/living-cultures>

Reflective Questions for Science Staff and Students

- How have Aboriginal and Torres Strait Islander cultures and histories influenced Australian biological, chemical and physical sciences, and what active role do these cultures and histories play today?
- Choose to research an Aboriginal or Torres Strait Islander scientist. What is the importance of his or her contributions to science on either a local or (inter)national scale?
- What is the relationship between Aboriginal and Torres Strait Islander science and the wider STEM field? What is the relationship between Aboriginal and Torres Strait Islander physical, chemical and biological sciences, and *social* sciences more widely? Why is it important to appreciate the relationship between Aboriginal and Torres Strait Islander science, and other subject/learning areas?
- How can engaging with the knowledges passed down from some of the world's earliest scientists help to address some of the biggest scientific questions or challenges of today?
- What are some of the similarities and differences between Aboriginal and Torres Strait Islander and 'Western' scientific knowledges, approaches or conventions? How can these knowledges, approaches and conventions work together in important and positively impactful ways?
- Where possible, organise an excursion to a public Aboriginal and Torres Strait Islander science organisation, event or exhibition. What learnings and messages did you take away from your excursion? Were there any collaborations occurring between this Aboriginal and Torres Strait Islander organisation and non-Indigenous organisations, and/or can you think of any potential positive avenues for collaboration?
- How might your school or early learning service contribute to the celebration of Aboriginal and Torres Strait Islander science, and scientists?
- (How) Can embedding Aboriginal and Torres Strait Islander cultures and histories into the study and practice of Science help to foster reconciliation?