Department of
Education

GOVERNMENT OF
WESTERN AUSTRALIA

Ngaparrtji Ngaparrtji
Two-way

Two-way Science Initiative

Ngaparrtji Ngaparrtji

Two-way

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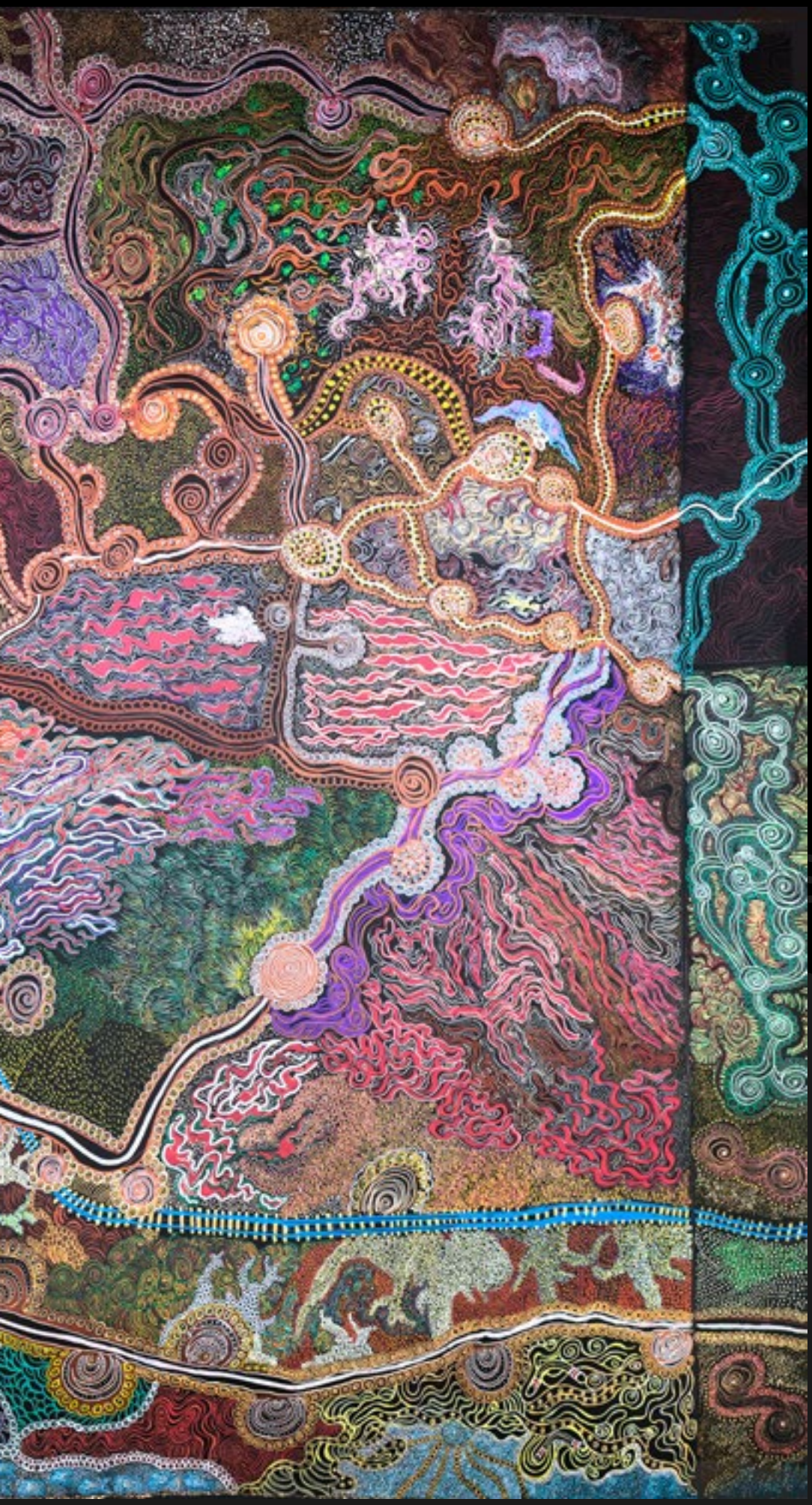
WARNING: Aboriginal and Torres Strait Islander readers are advised that this publication contains many images and names of Aboriginal and Torres Strait Islander people, who may have passed away since this publication was compiled.

Contents

The artwork remains the intellectual property of Daisy Tjuparntarri Ward. Its use is restricted to the Two-way Science Initiative.



Desert Education Story

Daisy Tjuparntarri Ward
(2022)

Desert Education Story

Daisy Tjuparntarri Ward
(2002)

I created this artwork over two intense weeks when I was thinking about teachers coming to desert schools for the first time. Do they think they are going to the middle of nowhere? I'm showing them that desert communities are not as remote as they might think. There are language, culture and sacred connections that join us all from Fremantle and the offshore islands, through the Goldfields, into the Pilbara, down to the Great Australian Bight and well into South Australia and the Northern Territory.

When I began my western schooling there was only one school in the desert. At Warburton we were taught in English. Now there are 8 schools on the Ngaanyatjarra Lands and we teach children in English and wangka yuti, their own languages, Ngaanyatjarra, Pintupi and Pitjantjatjara. We know that our senior people have knowledge that is really important to our students. What others call 'science', we call 'life'.

Look closely, you will see ocean, river, salt lakes, sand dunes, mining drill holes, plains of spinifex. At the bottom, see the extinct animals found beneath the Nullabor and the schools of fish, yes, fish go to school too! Find the first desert road built for atomic testing, the road between Giles Weather Station and Warburton that connected us to central Australia in the 1950s.

In my artwork there are layers upon layers of serious meanings. They are for people with more culture learning. The longer staff stay with us and the more they learn to relax and trust Yarnangu teachers and community members, the more they will learn these connections.

Welcome to desert education.

Daisy Tjuparntarri Ward

I was born in the spring of 1959 at Murrku, Western Australia. This is near Gill Pinnacle, part of the Schwerin Mural Crescent, close to the Giles Weather Station and the Northern Territory border. My mother was a Ngaanyatjarra speaker, my father a Mantjiltjarra speaker. I identify as a Ngaanyatjarra speaking woman of the Nungarrayi/Tjarraru social category.

My family lived in the way desert people have always lived. My father had four wives. His name was Mulyamaru (black nose). This is the same name as his wild dingo, a big black one, a good hunter. My father didn't know white men. He wasn't brought up in the Western way. My mother's name was Ngamirriya. She had many children. I am the youngest. I went to school at Warburton where I realised my father's language was different and so I learned Ngaanyatjarra as well as English. I have four children, several grandchildren and one great grandchild.

I work as Senior Cultural and Community Liaison for the Ngaanyatjarra Lands Schools and travel widely educating many in Australia and internationally in the strength of two-way learning. I am strong in my culture and my culture is strong in me.

Daisy Tjuparntarri Ward.

Note: From 1982 Daisy has worked continuously with the Departmentof Education apart from three years co-founding the Domestic Violence unit in the Ngaanyatjarra Pitjantjatjara Yankunytjatjara (NPY) Women's Council.

In 2019, a portrait of Daisy in traditional women's body paint, won the People's Choice Award as part of the Archibald Portrait Prize. In March 2020 Daisy won the Director General of Education's Women of Achievement Award for her work in cross-cultural education, her ability to educate and communicate about the two 'worlds' Yarnangu people operate in and her advocacy for remote Aboriginal students.

Daisy Tjuparntarri Ward
Photo by Jason Thomas

Acknowledgement of Country, culture and community

The Two-way Science Initiative acknowledges the Traditional Owners with whom we are collaborating and their vibrant living cultures and knowledge systems. We pay our respects to Elders past and present and thank all community members who are providing the leadership to ensure meaningful and effective engagement with Two-way Science schools.

The word Aboriginal is taken to mean Aboriginal, Aboriginal and Torres Strait Islander, and Indigenous.

Acknowledgements

The Two-way Science Initiative acknowledges the enormous contribution of school staff and communities. Their ideas, creativity, enthusiasm, flexibility, hard work and willingness to take risks has driven the development of the content in this publication and the future direction of culturally responsive education practice across the state. We are humbled and honoured by the leadership of Elders, communities and school staff who have incorporated this work into their existing practice and made it their own. We also recognise the efforts taken by schools and communities to develop networks that learn together and share this work with others.

Invaluable and indispensable cultural direction, leadership and guidance during the development and establishment of the Initiative was provided by, among many others, Daisy Tjuparntarri Ward, Lizzie Ellis, Lena Long, Rita Cutter, Noel Nannup and Caroline Long.

Initial consultation during the development of the project took place with members of the Indigenous Desert Alliance (Ebony Humble, Sam Murray), Ngurrura Rangers (Chantelle Murray), Ngaanyatjarra Lands School (Sandy Robertson) and the Kimberley Land Council (Zack Wundke).

The approach outlined in this book was initially developed during the Science Pathways for Indigenous Communities program, one element of the Commonwealth Scientific and Industrial Research Organisation (CSIRO) Indigenous STEM Education project. From 2016 to 2020 Science Pathways for Indigenous Communities program staff worked with selected remote Western Desert schools and communities in Western Australia and the Northern Territory to co-design and develop Two-way Science education resources and professional learning. The Department of Education Western Australia (the Department) has an agreement with the CSIRO to use and adapt the education resources and professional learning material as part of the Two-way Science Initiative.

Ngaparrtji Ngaparrtji Two-way

This book is titled ‘Ngaparrtji Ngaparrtji Two-way’. Ngaparrtji Ngaparrtji is a phrase used by several Western Desert Aboriginal languages that loosely translates as ‘I give you something, you give me something’. It is a complex cultural concept of reciprocity and exchange. Ngaparrtji Ngaparrtji is used here to elaborate on the term ‘two-way’ which underpins the Two-way Science Initiative and the principles that inform its development and implementation. It speaks to the obligation of education systems to ensure Aboriginal knowledges are included alongside other knowledges in the curriculum. It also speaks of the obligation of schools to value and respect the gift of this knowledge and ensure that Aboriginal people are acknowledged for their participation in the development of local culturally responsive teaching and learning programs. It refers to the complex interplay between Aboriginal scientific understandings of Country and culture, and Western scientific knowledge. The use of Ngaparrtji Ngaparrtji here acknowledges the contribution of Western Desert Aboriginal communities to the co-design and development of the concepts, frameworks and approachs that underpin the work in this book.

Ngaparrtji Ngaparrtji is spelt here using the Ngaanyatjarra orthography. The Two-way Science Initiative thanks Daisy Tjuparntarri Ward for her permission to use this word in the title of this book.

Aboriginal people are the first scientists, the first engineers and the first educators. This work is grounded in the critical importance of ensuring more than 60,000 years of wisdom and knowledge of Aboriginal people has its rightful place in our education systems.

Two-way Science is built on the skills, knowledge and effort over many years of Aboriginal Elders, communities and schools who have worked tirelessly to ensure that Aboriginal languages and cultures are represented in Australian education systems. Two-way Science supports schools to engage deeply and sincerely with the educational opportunities presented by the people, language, culture and Country of the local Aboriginal community.

Noongar Elder Vivienne Hansen teaches a student from Makybe Rise Primary School about bush medicine. Photo Department of Education Western Australia.

Principles for engagement with Aboriginal communities

These principles guided the development and implementation of the Two-way Science Initiative. The principles are consistent with, and framed by, culturally responsive approaches defined in the Aboriginal Cultural Standards Framework. They can be used by Two-way Science schools to plan, reflect on and review their practice when engaging with Aboriginal communities. Schools should use these as a starting point. Review and development should take place through collaboration and design with the local Aboriginal community.

Reciprocity

The efforts of Aboriginal communities must be recognised. That can be through remuneration, advocacy and support for local initiatives.

Co-design

Two-way Science strategies, procedures, schedules, monitoring and evaluation, professional learning and education resources must be developed through co-design with Aboriginal people and communities.

Listen to Country

Time must be spent on Country, listening to Country and learning from Country.

Local place-based solutions

Aboriginal cultures, languages and communities are different from one another and require local place-based programs to support the learning needs of students. Culturally responsive approaches to place and space must include traditional owners and build on the strength of diversity of Aboriginal cultural identities of students and families connected to the school.

Value and respect what people are already doing

Aboriginal communities and schools have a long history of developing innovations in education delivery. These innovations and the people that developed them should be respected and supported to action them within the scope of the project.

Cultural safety

The project systems and structures must enable the participation of Aboriginal people in ways that make people feel welcome and safe, and recognise that this will be different in different contexts and for every individual. This includes, for example, the way engagement and consultation takes place, where and how workshops are held, knowledge sharing protocols and the impact of colonisation on language and cultures.

Aboriginal intellectual and cultural property

Aboriginal intellectual and cultural property is owned by the authors and traditional owners of that property. Consent and permission must be obtained whenever intellectual and cultural property is used by anyone for any purpose.

Co-authorship

Projects for Aboriginal people must be developed by, or with, Aboriginal people. Co-authorship must be acknowledged where Aboriginal people have had an input into the development of projects as well as any written or audio visual material.

Commitment and sustainability

Support and grow Aboriginal-led initiatives to produce long term sustainable outcomes for schools and communities.

Work at the pace of Aboriginal communities

Aboriginal people must be given the opportunity to build projects according to local cultural protocols and practices with the full input of communities and Elders who have diverse commitments and geographic locations.

Take time to build relationships and trust

Newcomers to communities must take the time to listen and build relationships and trust during project development.

Define success

An Aboriginal community's indicators of success must be included alongside Department or school goals. Different communities will have different visions of success.

Coolbinia Primary School students learning to make glue from balka grass tree under guidance of Noongar Elder Neville Collard.
Photo Department of Education Western Australia.

The Two-way Science Initiative

Two-way Science is an approach to teaching and learning that connects the Western Australian Curriculum: Science to Aboriginal knowledges.

The Two-way Science Initiative supports schools to build partnerships with local Aboriginal communities to develop integrated culturally responsive learning programs that connect the Western Australian Curriculum: Science to Aboriginal knowledges.

Culturally responsive teaching privileges the first cultures of this country and builds on the social and cultural capital of students so that school and learning is more meaningful and rewarding. Culturally responsive teaching creates the conditions for Aboriginal students to succeed as Aboriginal people.

Building the cultural responsiveness of staff and schools is essential to creating culturally safe and engaging learning environments for Aboriginal and Torres Strait Islander students and for promoting reconciliation.

Two-way Science provides an opportunity for all students to learn about science from the world's oldest continuing cultures.

The Two-way Science Initiative aims to:

- build respect for Aboriginal histories, cultures, people, knowledges and experiences amongst school staff and students
- strengthen Aboriginal student wellbeing, engagement and achievement.

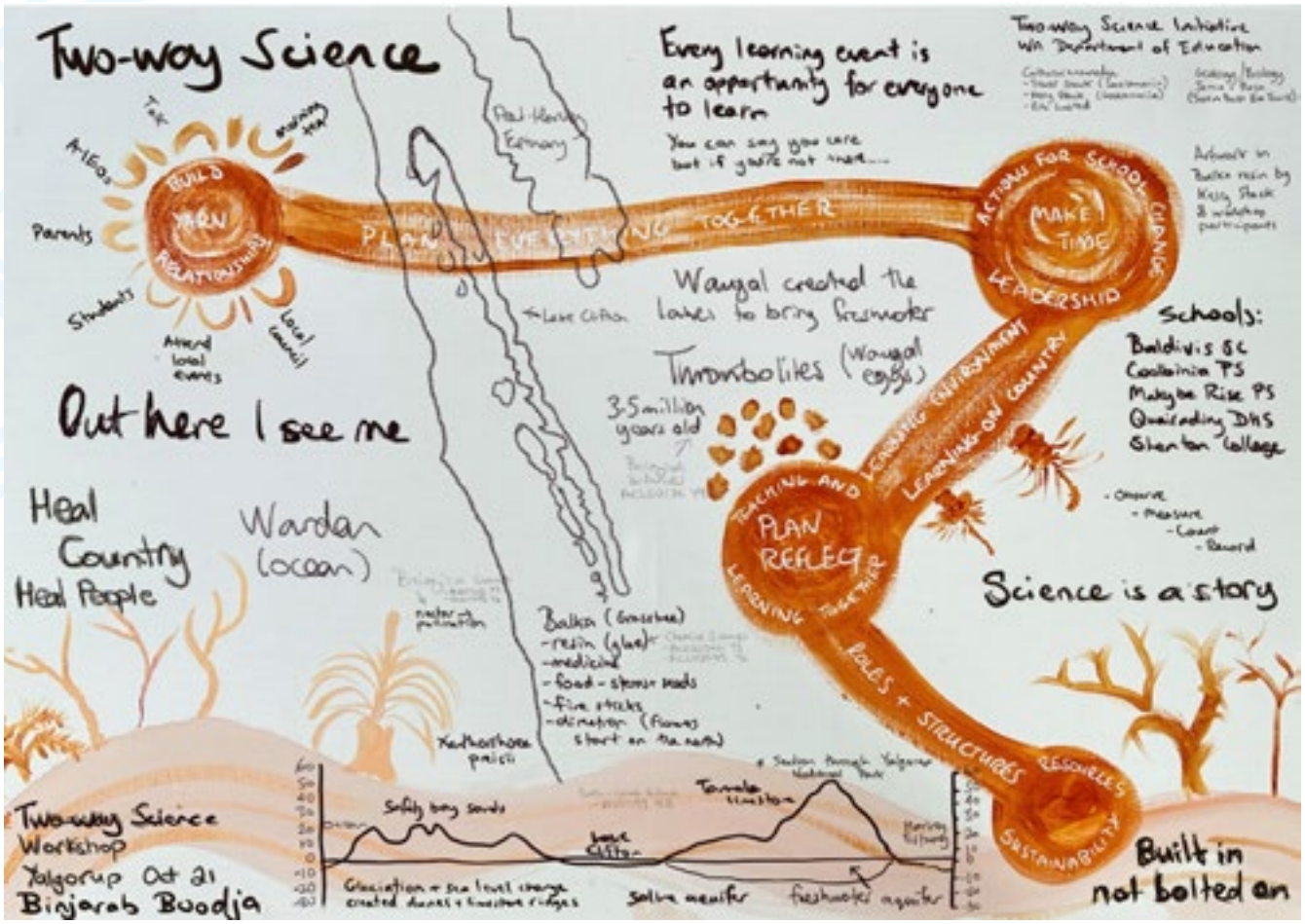
The foundation of a Two-way Science learning program is cultural and ecological knowledge taught by local Aboriginal people to students on Country and in the classroom.

Twenty-one schools from diverse locations and contexts across Western Australia have been engaged in the Two-way Science Initiative. These schools participated in a program of professional learning co-designed by the Department in partnership with local and regional Aboriginal organisations. Small teams from each school (teachers, Aboriginal and Islander Education Officers, school leaders and Aboriginal community members) engaged in an ongoing action-learning process through professional learning workshops and online webinars. Two-way Science schools document practice in order to share learning with other schools and communities.

Elder Daisy Tjuparrntari Ward and Tjiwarl Ranger Coordinator Talbot Muir lead a Two-way Science workshop. Photo by David Broun.

‘The kids are learning who they are. When they find out who they are, they’re going to be stronger people. If they have success out here, then they’re going to have success in the classroom. It’s a flow-on: out bush, into the classroom, we can do it.’

Fifi Harris, Principal Consultant Two-way Science, Aboriginal language educator (ACARA 2019)



A record of learning from a Two-way Science workshop held at Baldivis Secondary College and on Country at Yalgorup, Western Australia in 2021. Noongar cultural knowledge of Trevor Stack and Kerry Stack.

Wendy Bilgin and Scott Brown undertake a seagrass monitoring activity during a Two-way Science workshop near Broome.
Photo By David Broun.

Overview of a Two-way Science approach to teaching and learning

Two-way Science is a way of teaching and learning that supports schools and the local Aboriginal community to build integrated two-way learning programs that connect Aboriginal knowledge and the science curriculum.

Two-way Science privileges local Aboriginal knowledge, empowerment and leadership but asks all staff to work and learn together.

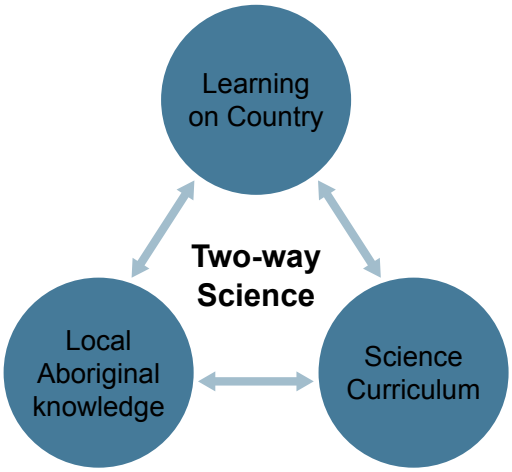
A Two-way Science program contains three essential elements:

- Aboriginal knowledge of the local community
- Learning on Country led by local Aboriginal experts
- The science curriculum

The foundation of a Two-way Science learning program is the cultural and ecological knowledge of the local Aboriginal community.

Learning on Country is led by Aboriginal experts who teach students Aboriginal cultural knowledge of, for example, plants, animals, seasons, tools, landforms, ecology, important sites and stories that connect people and place.

Learning on Country and local Aboriginal knowledge is connected to the science curriculum and related science activities.



In this photo Wangkatja and Tjupan knowledge holder Fifi Harris is leading Learning on Country with students and community.

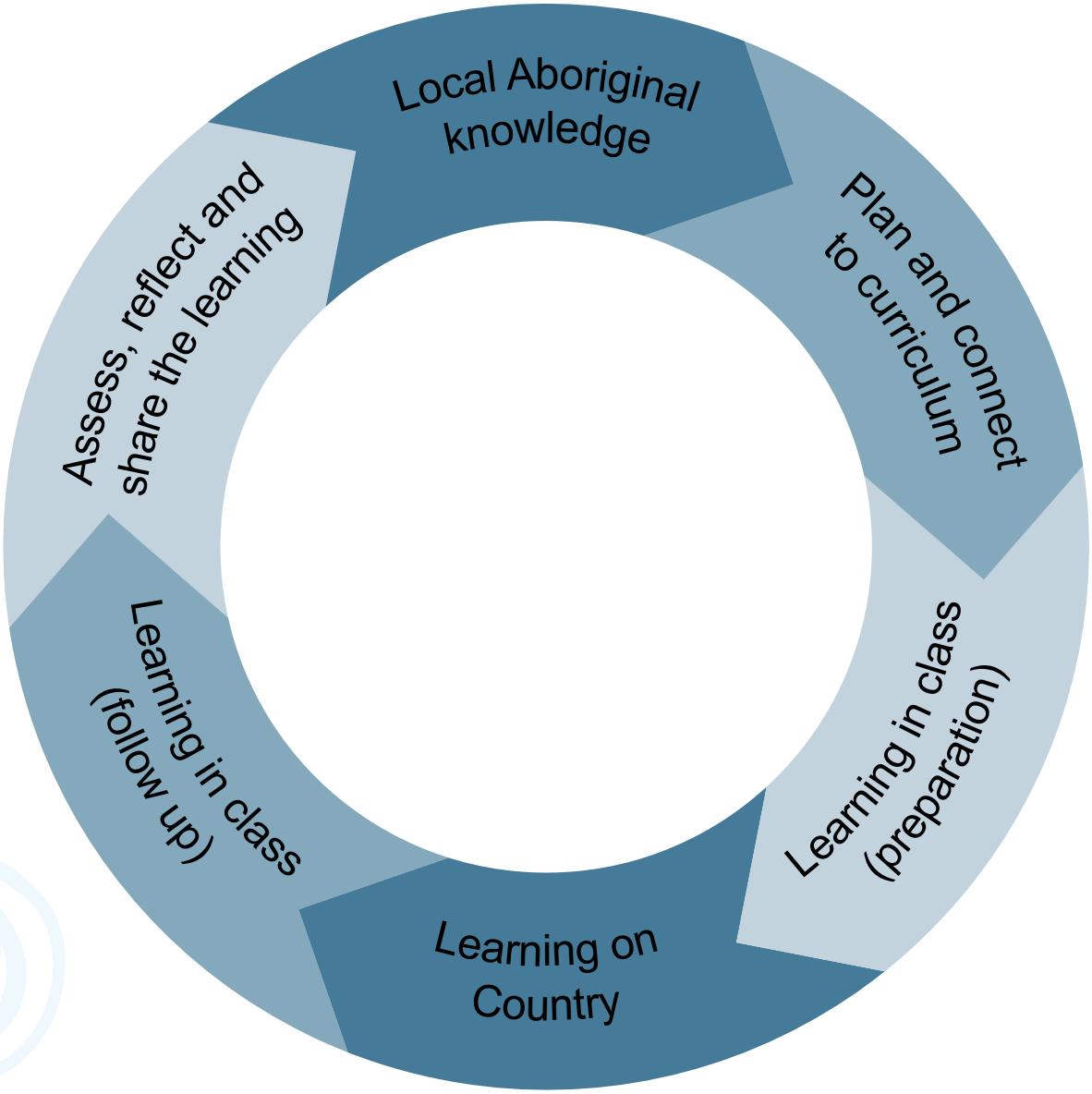
Fifi is sharing local Wangkatja and Tjupan knowledge of Yurrarn - honeydew produced by a small insect called a lerp that provides food for people and animals. The honeydew dries to form a protective casing for the lerp.

When heated, the orange casing becomes soft. It can then be used as kirti glue because it hardens as it cools.

This can be connected to a range of science curriculum outcomes such as Chemical Sciences Year 3:

'A change of state between solid and liquid can be caused by adding or removing heat'.

The Two-way Science teaching and learning cycle



The Two-way Science teaching and learning cycle is a framework for schools and communities to plan and implement an integrated Two-way Science program.

The teaching and learning cycle maximises the educational benefits of Aboriginal knowledge and Learning on Country by developing integrated activities before and after in the classroom. The benefits of Learning on Country are spread throughout the learning program to improve student learning outcomes in science and other learning areas.

The cycle starts with the knowledge of the local Aboriginal community. The community decides the cultural learning goals of a Two-way Science program.

Schools develop partnerships and plan with the local Aboriginal community to build a curriculum-linked Two-way Science learning program based on the cultural learning goals of the community.

School and community partnerships

School and community partnerships look different in different places.

Some Two-way Science programs are led by Aboriginal staff at the school who provide cultural education or are given time to connect teachers with local community experts.

Other schools engage with an Aboriginal organisation such as an Indigenous Ranger program, or local language and culture organisation who has mutual goals of cultural knowledge transfer.

Some schools engage a local Indigenous tourism or cultural education company to deliver a set of workshops throughout the year.

In some cases, students' families volunteer time to take students on Country. Students may have cultural knowledge and can be supported to lead the learning of school staff and students.

Two-way learning partnerships

Two-way partnerships between Aboriginal and non-Aboriginal people, such as teachers and Aboriginal and Islander Education Officers (AIEOs), are critical to the success of a Two-way Science program.

AIEOs play a key role in building partnerships with the community and supporting teachers to connect local Aboriginal knowledge to the learning program.

Teachers and AIEOs need to really listen to each other and take time to understand what is being communicated. An understanding of the language and conventions of Aboriginal English is often required by non-Aboriginal people to facilitate effective communication.

Schools should allocate time for planning and learning for teachers and AIEOs to build skills, knowledge and ways of working together.

AIEOs need to give teachers time to grow and develop knowledge and understanding of the local culture and community.

Teacher Alana Summerhayes from Baldivis Secondary College and Noongar Elder Mort Hansen at a Two-way Science workshop in Baldivis. Photo by Stella Gray Broun.

Noongar Elder Neville Collard conducts a science lesson with students from Coolbinia Primary School.
Photo Department of Education Western Australia.

Working two-way: examples of practice from Two-way Science schools

The activities presented in this book feature Aboriginal cultural knowledge shared with schools by the local community during the development of Two-way Science teaching and learning programs. A cultural learning goal defined by the local Aboriginal community is connected to 'Learning on Country' and 'learning in class' activities across a range of year levels.

Curriculum connections

The content descriptions in each activity are primarily from the Science Understanding strand of the Western Australian Curriculum: Science. In some cases, the other science curriculum strands Science Inquiry Skills and Science as a Human Endeavour have been omitted for brevity.

Two-way Science promotes an integrated project-based learning approach. Many of the activities could also be used to deliver content from other learning areas such as Humanities and Social Sciences, Mathematics, English, The Arts, Digital Technologies and Aboriginal Languages.

Two of the three cross-curriculum priorities in the Western Australian Curriculum; Aboriginal and Torres Strait Islander histories and cultures; and Sustainability; have direct links to Two-way Science as do the General Capabilities specifically intercultural understanding, ethical understanding and personal and social capability.

Aboriginal Languages

This book contains a range of languages including traditional Aboriginal languages, Kriol, Aboriginal English and Standard Australian English.

Aboriginal English, the language through which learning occurs in many Aboriginal contexts, is an essential part of Aboriginal consciousness.

A Two-way Science approach supports the teaching of Aboriginal languages as a primary vehicle for cultural knowledge transfer, to strengthen Aboriginal student wellbeing and identity, and to build staff and student respect for Aboriginal histories, cultures, people, knowledges and experiences.

Traditional Aboriginal language translations in the text are indicated by different colour font.

Indigenous cultural and intellectual property

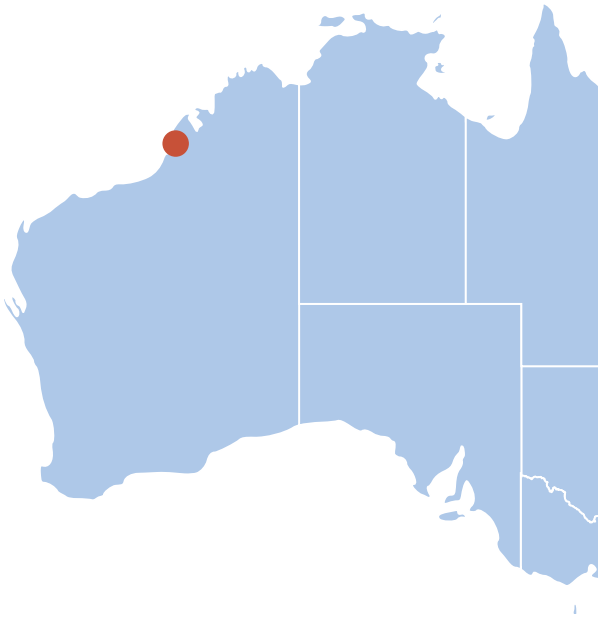
Any Aboriginal knowledge shared with a school and the Department in this publication, or as part of a Two-way Science education program, remains the Indigenous cultural and intellectual property of the knowledge holder and their culture or language group.

Two-way Science is a place-based program that looks different in every school and community.

Yagarrmurungunjina jijawiliwili warli Wirlburugun

We are all looking for shell meat in Wirlburu season

Yawuru knowledge shared by Bart Pigram
Broome Senior High School
Prepared by Bart Pigram and Joelene Pearson



Shellfish are an important seasonal food for Yawuru people. This is evident in the large shell middens found in and around Broome, including Roebuck Bay, that have been formed from thousands of years of Yawuru shellfish harvesting.

Shellfish are harvested during Wirlburu and Laja seasons when they are lidabarri fat.

The main types of shellfish collected are bunyman hairy mussel, liyi small pearl shell, jirrinygiliny blood cockle, bin-ga bailer shell, birrga birrga pipi, janga rock oyster, nibarda mangrove oyster, ramba mud whelk, wirndibin razor shell and wanggaja mud crab.

Activity: intertidal zone location of marine life with Yawuru names. Photo by David Broun.

Yawuru cultural learning goal

Students learn to locate and harvest shellfish during Wirlburu and Laja seasons.

Learning activities

Learning on Country

Students work with a Yawuru expert to access rocky, reef and mud areas at low tide to locate, identify, photograph and classify key shellfish species and their habitat. They collect a variety of species that can be cooked on coals.

Students learn:

- Yawuru names of shellfish
- edible and non-edible food
- correct size for harvesting
- intertidal zones and habitats (mud, sand or rock).

Learning in Class

- Label photographs or drawings of shellfish using Yawuru language.
- Use a satellite image of the location to place labelled photos of the shellfish in their habitats in intertidal zones.
- Create a food web that identifies shellfish in a marine ecosystem.
- Investigate how ocean acidity can affect shellfish by, for example, placing a sample of a shell in a weak acid solution such as vinegar.

Bunyman Hairy mussel (cooked). Photo by David Broun.

Nibarda Mangrove Oyster. Photo by Bart Pigram.

Curriculum connections

Biological Sciences

- Pre-primary Living things have basic needs, including food and water
- Year 1 Living things have a variety of external features
- Year 1 Living things live in different places where their needs are met
- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things
- Year 4 Living things depend on each other and the environment to survive
- Year 6 The growth and survival of living things are affected by physical conditions of their environment
- Year 7 Classification helps organise the diverse group of organisms
- Year 7 Interactions between organisms can be described in terms of food chains and food webs; human activity can affect these interactions
- Year 9 Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems

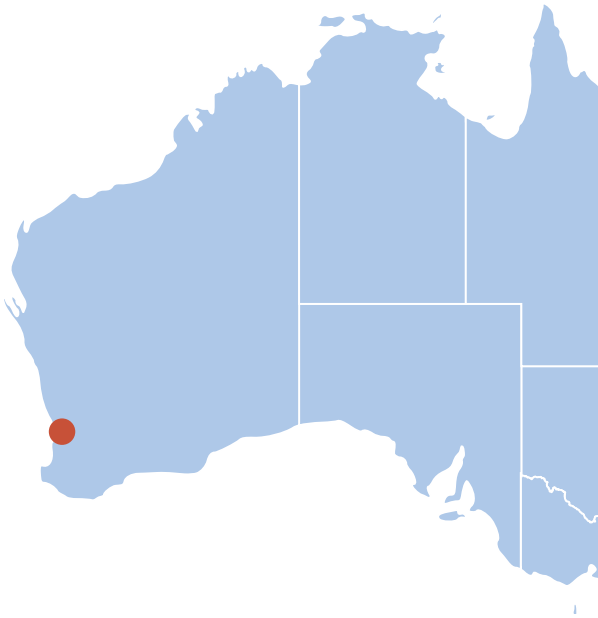
Chemical Sciences

- Year 8 Chemical change involves substances reacting to form new substances

Wilyawa

Red-eyed wattle

Ballardong Noongar knowledge shared by Vivienne Hansen
Baldivis Secondary College
Prepared by Alana Summerhayes, Imi Kealley, Madison O'Neill, Ella Passhier, Sophie Rennie, Rita Lusted and David Broun



Wilyawa red-eyed wattle leaves are used by Noongar people to clean hands. The leaves are rubbed together with water to produce a lather similar to that produced by soap.

At a Two-way Science workshop at Baldivis Children's Forest, Year 12 Chemistry students from Baldivis Secondary College worked with school staff and Noongar expert Vivienne Hansen to develop a science investigation to explore the chemical qualities of wilyawa red-eyed wattle.

Photo by Stella Gray Broun.

Noongar cultural learning goal

Students learn to identify wilyawa red-eyed wattle. They pick the leaves, rub them together and create a soapy lather to clean hands.

Learning activities

Learning in class (preparation)

Students are introduced to the principles of Indigenous Cultural and Intellectual Property and put them into practice when working with Aboriginal people and knowledges in scientific research. They watch the video and read the text from Our knowledge, Our way [1]. They develop a research agreement for using and sharing knowledge with the Aboriginal expert before jointly undertaking the investigation together into the chemical properties of plants.

Learning on Country

A Noongar expert shows students the wilyawa red-eyed wattle. They learn where it grows, the season it is ready and how to harvest the leaves sustainably. They rub the leaves with water to produce a lather and take some samples for the science investigation in class.

Learning in class (follow up)

Students undertake a science investigation to compare the cleaning action of wilyawa *Acacia cyclops* to soap.

Student use traditional methods to create a foaming wash. Students test soap and wilyawa against a fixed amount of solid fat to determine change in mass of the fat.

Students return the results of the investigation to the knowledge holders to determine how the results of the research can be used.

Further investigations could explore the antimicrobial/ antifungal properties of the plant and if this translates to antimicrobial protection against bacterial growth (Human Biology).

Students from Makybe Rise Primary School learn to use wilyawa red-eyed wattle to create a soapy lather with Noongar expert Vivienne Hansen. Photo by Stella Gray Broun.

Teacher Alana Summerhayes reviews a brainstorm around curriculum opportunities developed during the Two-way Science workshop at Baldivis Children's Forest. Photo by Stella Gray Broun.

Curriculum connections

Yr 12 ATAR Chemistry – Organic Chemistry

Science understanding

- The base hydrolysis (saponification) of fats (triglycerides) produces glycerol and the salt of a long chain fatty acid (soap)
- The structure of soaps contains a non-polar hydrocarbon chain and a carboxylate group; the structure of the anionic detergents derived from dodecylbenzene contains a non-polar hydrocarbon chain and a sulfonate group
- The cleaning action of soaps and detergents can be explained in terms of their non-polar hydrocarbon chain and charged group; the properties of soaps and detergents in hard water can be explained in terms of the solubilities of their calcium salts

Science as a Human Endeavour

- Scientific knowledge can be used to design alternative chemical synthesis pathways, taking into account sustainability, local resources, economics, and environmental impacts (green chemistry)

Science Inquiry Skills

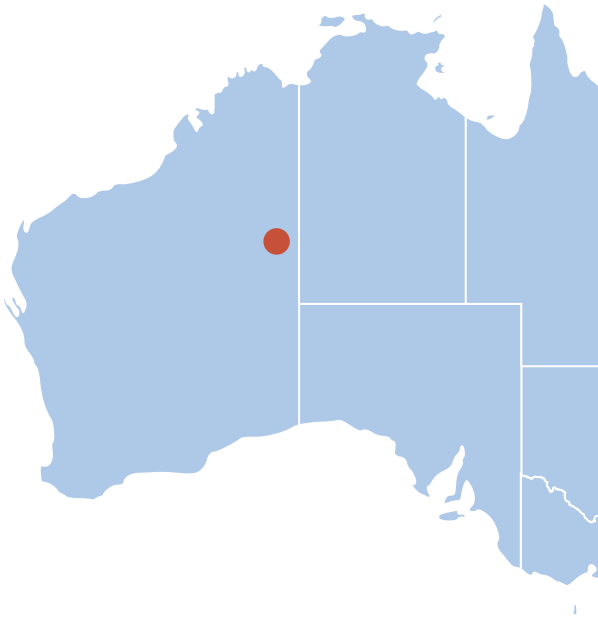
- Use science inquiry skills to design, conduct, evaluate and communicate investigations into reactions to identify organic compounds, including analysis of secondary data derived from chemical analysis
- Evaluate, with reference to empirical evidence, claims about organic synthesis and chemical design, and justify evaluations
- Communicate, predict and explain chemical phenomena using qualitative and quantitative representations in appropriate modes and genres

(1.) Woodward, E., Hill, R. Harkness, P. and R. Archer (Eds) 2020 Our Knowledge Our Way in caring for country: Indigenous-led approaches to strengthening and sharing our knowledge for land and sea management. Best Practice Guidelines from Australian experiences. NAILSMA and CSIRO.

Nyaalytjinyaalytjiya nyuma palyalpayi?

How do we make nyuma?

Pintupi knowledge shared by John T West and Loretta Nungurrayi
Kiwirrkurra Campus of the Ngaanyatjarra Lands School
Prepared by John T West, Loretta Nungurrayi, Jason Van Poelgeest, Vania Van Poelgeest, Timothy O'Farrell and Nina Horeb



Yanangu Pintupingku mangarri palya palyalpayi yiiya tjutangka. Wangunu pakalpayi yiiya tjutangara nyarrapalulanguru. Tjana wangunu paltjilpayi. Palunyatjanu wangunu pulitjarralu rungkalpayi an kutjalpayi nyuma palyaltjaku. Nyuma warungka kampapayi. Ngaatjanya nganampa mangarri palya.

Pintupi people have prepared healthy food for many years. Wangunu woollybutt grass grows all through the year. We collect, clean and grind the wangunu seeds to cook nyuma bread in the fire. This is good food for us.

Mangarri traditional plant food sources have been an important part of life for many years. Yanangu use wangunu the seeds from the woollybutt grass to make nyuma bread. The plant grows after rain and is readily available for a long time. It is a woman's job to prepare the nyuma bread. They de-husk the seeds by rubbing and burning with waru fire, and yarrarapunganyi winnow them in the walpa wind. The cleaned seeds are then mixed with kapi water and rungkani ground using puli traditional grinding stones. This mixture is cooked in the ngamurru ashes of the fire until it is hard on the outside. The nyuma bread is shared and ngalkuni eaten.This is a healthy and nutritious food that has been a staple of Yanangu diet.

Tjiwa and tjungari are the names of the grinding stones used to make different kinds of mangarri plant food. Tjiwa is the lower grinding stone or flat rock surface and tjungari is the upper grinding stone.

Tjiwa and tjungari used to grind wangunu woollybutt seed. Photo by Nina Horeb.

Pintupi cultural learning goal

Students learn to identify and find the wangunu woollybutt grass plant. They learn the Pintupi name for it and hear stories of how it has been used by their families for a long time. Students practise collecting and preparing the seeds for cooking. They learn how to use the puli grinding stones and how to cook the nyuma bread mixture in the waru fire.

Learning activities

Learning in class (preparation)

Organise a Learning on Country field trip to these places, guided by local Elders and Rangers. Before going on Country, facilitate a class brainstorm about different plant food sources of local Aboriginal people. Identify the wangunu woollybutt grass and the places where it grows.

Nyuma cooking in a carefully prepared waru fire.
Photo by Nina Horeb.

Learning on Country

Students work with a Pintupi expert to identify and locate wangunu woollybutt grass. Keep a sample of the plant to press and preserve for an information sheet. They collect the seeds. Students learn to prepare the seeds by rubbing them, burning them in fire and winnowing them in the wind. Students learn how to grind the seeds mixed with water and cook it in the ashes of the fire. Students can enjoy tasting the nyuma bread and compare it to other foods they have eaten.

Learning in class (follow up)

Students complete a recount of the experience. They sequence the process of gathering, preparing and cooking the seeds. Students use the pressed plant sample to create an information sheet about the plant.

Students write a procedure to show the process of making nyuma bread from wangunu woollybut grass. Photo by Nina Horeb.

Curriculum connections

Biological Sciences

- Pre-primary: Living things have basic needs, including food and water
- Year 1 Living things have a variety of external features
- Year 4 Living things depend on each other and the environment to survive
- Year 6 The growth and survival of living things are affected by physical conditions of their environment
- Year 7 Classification helps organise the diverse group of organisms

Chemical Sciences

- Year 1 Everyday materials can be physically changed in a variety of ways
- Year 3 A change of state between solid and liquid can be caused by adding or removing heat
- Year 5 Solids, liquids and gases have different observable properties and behave in different ways

Earth and Space Sciences

- Year 2 Earth's resources are used in a variety of ways

Wanytja-purinytju waru palyara?

How do we create fire?

Yarnangu knowledge shared by Erin Nelson
Translated by Erin Nelson and Kirsty Nelson with support from Elizabeth Ellis
Wanarn Campus of the Ngaanyatjarra Lands School
Prepared by Mayne Henderson

Yarnangu pirniya mukurringkupayi waruku, mungangka nyakulatjaku, warungkalatju tjuma watjalpayi purulatju mirrka warungka paara ngalkupayi.

Yarnangu people need fire, we need it for seeing in the night, we use it for telling stories, we need it for our food.

Waru fire is an important part of life. It allows Yarnangu people to cook mirrka food, create tools and care for the land by burning off for hunting and new plant growth.

Waru fire is easy to create these days but it wasn't as easy in the past. There were 3 main ways to obtain fire:

1. Create a friction fire using a stick, tjanpi spinifex grass and kuna rabbit scat. Any dry herbivore scat will work as long as it contains grass fibres. The grass allows sparks to catch alight more easily.
2. Find a place where lightning has struck. This method is more difficult as it relies on the weather.
3. Carry a tjangi firestick from another fire, or trade fire with someone else who is carrying a fire stick. A tjangi firestick is made by taking a lit sturdy branch from an existing fire and carrying it to another place. The tjangi firestick is often given to a reliable person as it is an important job to keep the fire alight. If it goes out, it is a difficult task to light it again. The person carrying a tjangi firestick must make sure they don't start any fires as they travel. This could be caused by embers flying off or accidentally touching the stick to the ground.

A student using a tjangi firestick to light a fire. Photo by Andrea Mahiepala.

Yarnangu cultural learning goal

Students learn traditional ways of making fire. They learn the different uses of fire for warmth, cooking and making tools; as well as safety and responsibilities around fire.

Learning activities

Learning in class (preparation)

A Yarnangu expert discusses with students how fire is created now and how it was made and maintained in the past.

Learning on Country

A Yarnangu expert shows students, for example, how to use fire to cook food, burn designs on artefacts and use fire to keep warm.

Students learn to create a fire using friction or by carrying a tjangi firestick back to their camp.

Friction method

In pairs students take turns at twisting the stick to light the kuna scat and tjanpi spinifex grass.

Students lighting their tjangi firesticks after carefully selecting them.
Photo by Andrea Mahiepala.

A student blowing on the tjangi firestick to keep it burning.
Photo by Andrea Mahiepala.

Tjangi fire stick method

A Yarnangu expert explains how to carry fire with a tjangi firestick and the responsibility of the fire carrier to keep the stick alight and travel safely.

Students prepare waru wood and tjanpi spinifex grass for lighting a fire at camp. Students find purnu sticks/branches which they think will smoulder the longest to carry waru fire back to camp. The teacher lights a fire, and the students light their tjangi firesticks. Once they are ready students walk back to camp, caring for their tjangi firesticks and watching for falling embers.

Once they get back to camp, students light a fire with the tjangi firestick and the waru wood and tjanpi spinifex grass they prepared earlier.

Learning in class (follow up)

Students reflect on the activity and conduct science investigations at an age-appropriate level.
This could include:

- Investigating the best materials to create a fire on Country.
- Investigating how energy is transferred from one object to another using the different methods of lighting a fire.
- Investigating the different forms and transformation of energy in the different methods of lighting a fire.
- Creating a procedure to show the stages of fire making using the different methods.
- Reflecting on the responsibility of making and carrying a tjangi firestick.

Curriculum connections

Physical sciences

- Year 3 Heat can be produced in many ways and can move from one object to another.
- Year 8 Energy appears in different forms, including movement, heat, and potential energy, and energy transformations cause change within systems.

Waranygu bayalgu, buuju uburu

Finding bush foods and medicine

Yamaji and Wajarri knowledge shared by Tash Ryan, Donna Ronan, Derek Councillor and Elvie Dann

Beachlands Primary School

Prepared by Jason Plant and Tash Ryan

Yamaji and Wajarri people have developed and refined their knowledge and skills in sourcing food in a sustainable manner over tens of thousands of years.

They know the best time of year to pick fruits such as warlgu quandong, gulyu bush potato, gagurla bush pear and gamburarra wild gooseberry/bush tomato.

They hunt animals on barna country including marlu kangaroo, yalibirri emu, gunduwa echidna, wadbi fish and bardura bush turkey.

Yamaji and Wajarri experts can identify hundreds of plants and animals, knowing which are edible and which are poisonous. They use every part of the plant or animal for eating, medicine and other purposes. Yamaji and Wajarri people collect resources responsibly to ensure there is enough for the next season.

Significant locations:

- Greenough walk trail
- Chapman River walk trail
- Warlgu Trail (Alice Nannup trail)
- Bushland Walk Trail and Lookout, Mullewa

Bush foods in the basket:

- Salt bush is edible and some chefs use it in cooking.
- Sea grapes are tiny little grapes, high in vitamins.
- Warlgu quandong is edible when made into jam and the seed used as an ointment.
- Pig face produces a peppery fruit.

Bush medicines in the basket:

- Beach spinifex is mixed with salt water and used for sore eyes.
- Native lemon grass is used for essences.
- Sandalwood is used for fragrances.

Coolaman gathering tool used for collecting food or sometimes water.
Photo by Jason Plant.

Yamatji and Wajarri cultural learning goal

Students learn to identify bush foods and bush medicines. They learn about plants that grow at different times of the year and where to look for them. They learn how to collect, make and use bush medicine and foods.

Learning activities

Learning in class (preparation)

Invite a guest speaker to talk about how Yamaji and Wajarri people use natural resources from the land.

Learning on Country

Students go on a bushwalk with a local Elder to identify different types of bush tucker and bush medicine. They investigate traditional cooking methods and ways to make bush medicine.

Learning in class (follow up)

- Students work with a local Elder to prepare bush medicine or food.
- Students design, build and grow a bush tucker garden in class using the food and medicine plants identified by the local Elder.
- Students create an animation depicting the life cycle of a local plant or animal.
- Students build the landscape/environment of a chosen local plant or animal.

Plant and animal foods gathered in seasons. Photo by Jason Plant.

Students Learning on Country. Photo by Jason Plant.

Curriculum connections

Biological Sciences

- Pre-primary Living things have basic needs, including food and water
- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things
- Year 4 Living things have life cycles
- Year 4 Living things depend on each other and the environment to survive
- Year 6 The growth and survival of living things are affected by physical conditions of their environment

Earth and Space Sciences

- Year 2 Earth's resources are used in a variety of ways

Ngapa

Water

Karajarri knowledge shared by Jess Bangu, Maureen Yanawana, Lynette Wildridge and Angelina Nanudie

La Grange Remote Community School

Prepared by Michelle Buss and Mark Taylor

La Grange Remote Community School worked with Karajarri Rangers and Aboriginal and Islander Education Officers to develop and conduct a lesson about fresh water sources around the local coastline.

Karajarri find ngapa water in many places including lirri soaks and purrulpurrul ngapa bubbling water near the jurarr ocean. The jurarr ocean tides can cover and uncover purrulpurrul ngapa bubbling water.

Jurarr sea/ocean covers the purrulpurrul ngapa bubbling water during high tide. Photos by Rommel Ledesma.

Purrulpurrul ngapa bubbling water during high tide. Photos by Mark Taylor.

Karajarri cultural learning goal

Students visit different bodies of ngapa water on Country in different seasons to observe the plant and animal life around each source. Students yarn with rangers and Elders in the community to learn how community members have used these ngapa water sources for food and cultural practices over the years, and how they can be looked after.

Learning activities

Learning in class (preparation)

- Students use their knowledge of Karajarri seasons to predict which animals and plants might be observed on Country.
- Students learn how to complete a pH test. They are introduced to new vocabulary including neutral, acidic, alkaline and variable to support their understanding of the activity. Students test natural and household liquids and record their data on a graph to compare their results.

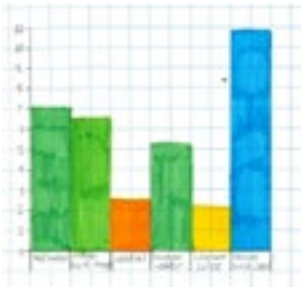
Learning on Country

- At the water hole Elders teach the different language words for the things students can see. Students learn about the way Karajarri have used waterholes in the past. Rangers teach the students how to look after waterholes.
- Students record the radius of the waterhole using a trundle wheel. This task links to measurement and geometry lessons as part of mathematics. They collect water samples to take back to class.

Learning in class (follow up)

- Students get into four groups representing four of the language groups in Bidyadanga. They are given a list of the key words the Elders had discussed in Standard Australian English and a language word dictionary. Using their own knowledge and checking with the language dictionaries they race to put the correct language words for Standard Australian English words on the board.
- Students compare the pH levels of fresh water from the water holes, tap water, sugar water and lemon juice.
- Students are introduced to the water cycle including changes of state of water, including ocean currents and weather cycles across the world. They complete diagrams of the water cycle and tides.
- Students investigate the impacts of climate change, damming and desalination on water in Bidyadanga and across the world.

Students collect water samples and record observations; kari salt water; ngapa fresh water; limpa or karimarta salty. Photos by La Grange Remote Community School.



Integrated Two-way Science planning at La Grange Remote Community School leads to outcomes across learning areas.

Curriculum connections

Earth and Space Sciences

- Year 7 Some of Earth's resources are renewable but others are non-renewable
- Year 7 Water is an important resource that cycles through the environment

Science inquiry skills

- Year 7 Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge

Science as a Human Endeavour

- Year 7 Science knowledge can develop through collaboration across the disciplines of science and the contributions of people from a range of cultures

Wankatja Language and Two-way Science

Tanya Tucker, Wangkatja Language and Two-way Science specialist teacher
East Kalgoorlie Primary School

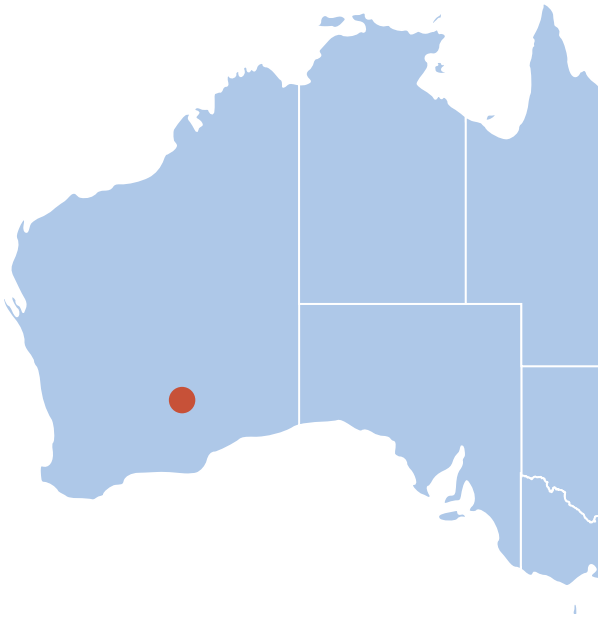
I connect Two-way Science with the Wangkatja language education program. This term the language theme was animals. Each week we learnt about a different animal.

I like to create a hook at the beginning of a new topic. I put the dried skin and spines of a tjilkamarta echidna in a box and let the students shake it and talk about what it might be. Then we touched the tjilkamarta echidna spines and shared what we knew. We used Wangkatja language to describe the tjilkamarta echidna.

I played a short video about the tjilkamarta echidna and we had a class discussion.

We had an incursion with Aboriginal Rangers in week 3, then in week 5 we had a Learning on Country excursion with the rangers to Credo Station about 100 km from Kalgoorlie.

Students researched a local animal of their choice and created a project poster and presentation to the class.



Tjilkamarta
Echidna

Nyaapa tjilkamartalu mayi ngalkulanyi?

What food is the echidna eating?

Wantjangka tjilkamartaku ngurra?

Where is the echidna's home?

Tjilkamarta ngaralanyi tupunta.

The echidna is standing on the sandhill.

Students investigate the dried pelt of a tjilkamarta echidna. Photo Department of Education Western Australia.

Warru

Black footed rock wallaby

Anangu knowledge shared by Marianne Fraser, Aaron Fraser, Lois Fraser, Mary Fraser and Hazel Fraser

Kenmore Park Anangu School (Yunyarinyi community)

Prepared by Marianne Fraser and Emily Gilbert

Iriti, warru tjuta mulapa nyinapai apu ngura winkingka. Kutjupa tjaraya iluntanaki ngayangka munu tuukngku. Palulanguru nganana kuliningi atunymankutji kitjangku malaku winkiringkutjaku.

Nganana tjunguringkupai Ranger tjutangka munula tjarara iyalpai ngura kutjupa kutjupakutu. Tjitji tjuta Ranger tjutangka tjungu nintiringkupai waru atunmankutjikitja.

Long ago there was many warru black footed rock wallabies around. Then when the groups of cats and foxes were introduced, lots were killed. We need to ensure there is an abundance of warru black footed rock wallabies living around, we need to protect them. We have worked with rangers before, and we are working with them now, to learn how they protect warru and how we can help.

The warru black footed rock wallaby, is a significant animal to Yunyarinyi (Kenmore Park). In the past it lived all over rocky hills in central Australia. They have become critically endangered however Yunyarinyi country is one of the places where warru black footed rock wallabies still live. Seeing these populations decrease highlights the importance of caring for these animals and encouraging learning about how we can help the populations to grow.

Kenmore Park Anangu School (Yunyarinyi) has previously been involved with the land management rangers in efforts to translocate wallabies to other areas of the Anangu Pitjantjatjara Yankunytjatjara (APY) lands in South Australia and to Monarto zoo near Adelaide. We revived this relationship with the rangers and engaged with them so the students could learn how to increase the warru black footed rock wallabies population.

Dennis and Dakota are filling out trapping data sheets after checking a trap. Photo by Emily Gilbert.

Students climbing to check warru black footed rock wallabies traps with rangers. Photo by Wilbur Klein.

Kenmore Park cultural learning goal

Students learn from Rangers how feral animals impact warru black footed rock wallabies and how to increase warru black footed rock wallabies population.

Learning activities

Learning on Country

Students camped out with rangers to closely learn and observe how people are using their traditional and modern knowledge to help this species. They participated in a trapping day where they took measurements of warru black footed rock wallabies heads, feet and tails, performed health checks, and helped to release a number of warru black footed rock wallabies. Later, they helped to translocate some captured warru black footed rock wallabies to another part of the APY lands.

Learning in class

The data gathered was collated in a table and the older students used excel to graph the results. Younger students were focused on learning about the habitat of the warru black footed rock wallaby. Other activities included:

- habitat diagrams with/without labels
- diet flipbooks describing warru black footed rock wallabies diet
- poster outlining how people apply science to solve problems
- site mapping
- food chain role play activity
- data presentation including graphs and tables using technology
- art activities.

All learning in class is connected to the cultural and science learning that happens on Country to contextualise the learning for students and deepen knowledge of the focus area.

Students mapping locations of warru black footed rock wallabies. Photo by Emily Gilbert.

Students and rangers carrying a warru black footed rock wallabies in preparation to translocate it to a new location. Photo by Wilbur Klein.

Curriculum connections

Biology

- Pre-primary Living things have basic needs, including food and water
- Year 1 Living things have a variety of external features
- Year 1 Living things live in different places where their needs are met
- Year 2 Living things grow, change and have offspring similar to themselves
- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things
- Year 4 Living things have life cycles
- Year 4 Living things depend on each other and the environment to survive
- Year 5 Living things have structural features and adaptations that help them to survive in their environment
- Year 6 The growth and survival of living things are affected by physical conditions of their environment
- Year 7 Interactions between organisms, can be described in terms of food chains and food webs; human activity can affect these interactions
- Year 9 Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems

Science Inquiry Skills (all year levels)

Djidi-djidi

Willie wagtail

Noongar knowledge shared by Rita Lusted, Kerry Stack, Trevor Stack, Jason Phillips and Vivienne Hansen

Makybe Rise Primary School

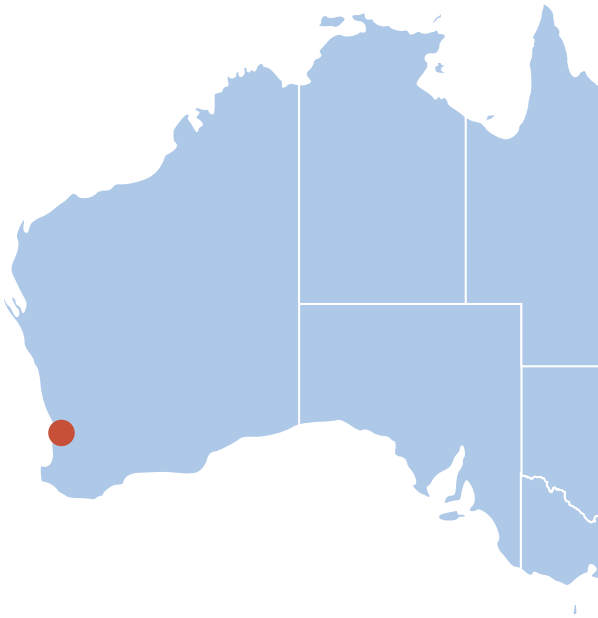
Prepared by Hillary-Jane Thompson

The djidi-djidi willie wagtail is a small fearless djerap bird, that isn't scared to chase away bigger djerap birds when protecting moort family or mereny food.

'Djidi-djidi willie wagtail is known as a mischief maker and when I was little my pop would tell me that djidi-djidi willie wagtail wants me to follow him, but I'm not to follow him as he will lead me away to trouble. As an adult I still sit and watch djidi-djidi willie wagtail flitter around and wonder what mischief they are creating today.' Rita Lusted.

Students observed a djidi-djidi willie wagtail building its nest in a tree in the school grounds. They observed the laying of eggs and the hatching and growth of the chicks.

As a follow up activity, Jason Phillips, a family member of a student, visited the classroom to share his expertise on native animal life cycles and how this knowledge is used to collect eggs for food and art. He shared his artwork depicting the karda goanna laying its eggs in an ant nest and wayitj emu eggs that he had carved and painted.



Students observing a djidi-djidi willie wagtail nest.
Photo by Hillary-Jane Thompson.

Jordyn Phillips with 'Pa' Jason Phillips who is showing the class his decorated wayitj emu egg. Photo by Hillary-Jane Thompson.

Noongar cultural learning goal

Students learn the cultural story of the djidi-djidi willie wagtail from a Noongar expert. They learn to identify birds, bird nests, nesting behaviour and life cycles of djert birds in the season of Djilba or Kambarang. Students learn about the importance of birds and eggs as food for Noongar people.

Learning activities

Learning on Country

Students learn about the plants and animals in the school grounds from a local Aboriginal expert. They look carefully for bird nests in trees in the seasons of Djilba and Kambarang.

Students learn how to find and locate different bird nests. They learn about the materials birds use to make nests, where the materials come from in the environment and how the bird creates the nest.

Students make daily observations of the nest, the bird's behaviour and the life cycle of the bird. Students drawings showing the different stages of the bird's life.

Learning in class (follow up)

Students write about the importance of different birds, nests and eggs for Aboriginal people.

They use their knowledge of nests and materials to create their own nest.

Student Amelia Reed with a nest made using found materials.
Photo by Hillary-Jane Thompson.

Students observing a djid-djidi willie wagtail nest.
Photo by Hillary-Jane Thompson.

Curriculum connections

Chemical Sciences

- Pre-primary Objects are made of materials that have observable properties
- Year 1 Everyday materials can be physically changed in a variety of ways
- Year 2 Different materials can be combined for a particular purpose

Biological Sciences

- Pre-primary Living things have basic needs, including food and water
- Year 1 Living things live in different places where their needs are met
- Year 2 Living things grow, change and have offspring similar to themselves

Science Inquiry Skills Pre-primary to Year 2

A Two-way Science exploration of emu eggs, guided by Pa

The mum shared with the class teacher, “look, Pa lives in the country a couple of hours out of Perth and hunts for emu eggs. They collect the emu eggs and then Pa actually carves them and Nan removes the yolks and does traditional cooking”. So, the Mum said, “if I can get them to come up here to Perth perhaps we can do some cooking and some egg carving demonstrations?”

It took a lot for her to get them to come, and in the end just Pa came because as you can imagine, it can be really daunting to come up to a school with a whole class of kids. But Pa came in and he was a natural! The kids loved him! Their levels of engagement were through the roof! He shared the process of hunting, carving and painting the eggs.

He brought along the emu eggs, and the kids were able to touch them, feel them, he showed them how he carved the eggs and he also was a painter and brought along a couple of pieces of artwork that the kids were looking at. They asked hundreds of questions!

You know when kids are learning because they ask more questions. They wanted to know about his artwork. There was a picture of a goanna and a big anthill. The question one child asked was “are those ants?” and he said “yes and that’s an anthill and the goanna’s there because it has dug a hole and laid the eggs inside the anthill and when the eggs hatch the babies will have lots of ants to eat and then they come out of the nest.”

Through his sharing of the lifecycle, the teacher linked the information to the life cycle the class had completed on the djidi-djidi willie wagtail, this reinforced the student learning and allowed the students to build on to what they had already learned.

What you get out of those sorts of experiences are more ideas for more learning. He also brought an ostrich egg so the kids could do a compare and contrast of the weight and the texture of each of those eggs and then he generously left us with one of his carved eggs, the ostrich egg, and one of his artworks for the children to enjoy.

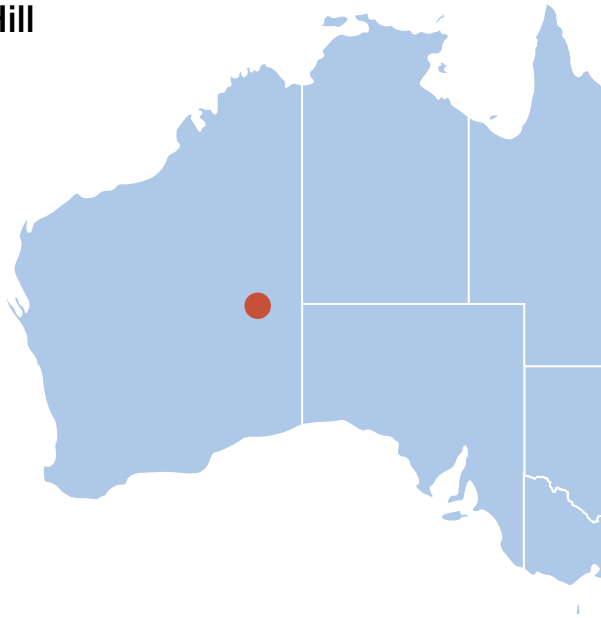
Makybe Rise Primary School staff member
(Two-way Science Initiative ‘Proof of Concept’ Evaluation Social Compass 2022)

Jordyn Phillips with a waitj emu and ostrich egg in front of Pa's artwork. Photo by Hillary-Jane Thompson

Ngaapirinypa-ya kirti palyalpayi

This is how they make resin glue out of spinifex

Yarnangu knowledge shared by Merna Green and local Rangers
Translation by Lizzie Ellis
Warburton Campus of the Ngaanyatjarra Lands School
Prepared by Merna Green, Jodi Doyle and Taylah Hill



Yarnangulu-ya tjanpingurulu kirti palyalpayi.

Tjanpi-latju yurrara, palunyalu kirti tjanpingka ngarantjanya langalpayi, palunyalu-latju langara tjanpi tjunkuntjanya waru likarrangka purrkaralu nyuyulpayi.

Nyuyunnyangka yururriku, puru warrirrinyangka tangkarriku. Tangka ngaanya-latju watjara Kirti.

Yarnangu people make kirti resin glue out of tjanpi spinifex. We collect the tjanpi spinifex, beat the kirti resin particles from it and heat it slowly using burning mulga bark. The kirti resin particles melt together and form a hardened glue.

Kirti resin from tjanpi spinifex is used by Yarnangu to make an adhesive. It is malleable while warm and cools to be very hard. Kirti is used as a glue for tools and weapons.

Kirti resin glue can be made during any time, as long as the tjanpi spinifex is old enough. Yarnangu know when tjanpi spinifex is old when it forms a ring with dry tufts in the middle. The green tjanpi spinifex is collected while the dry tufts are left alone.

Tjanpi spinifex was traditionally harvested by kicking in the surrounding earth with your feet to loosen it and then pulling it out from the ground. It would then be laid out and beaten with a large stick so the smaller pieces break off.

The smaller pieces of broken off tjanpi spinifex get separated and then sieved through cloth so only the resin particles remain.

The sieved kirti resin then gets ground into a powder. The process of grinding and heating has changed throughout the years with some opting to use a frying pan instead of a wirra wooden bowl. A piece of burning mulga bark is held over the top of it, heating the resin slowly.

The kirti resin particles are gently prodded with a stick as they change states of matter. Once complete and the kirti resin is cool enough, use your hands to mould it into the form you want or into a ball to use later. The kirti resin will eventually harden into place.

Kirti resin processed from a type of spinifex. Photo by Taylah Hill.

The old tjanpi spinifex forms a ring with dry tufts in the middle. Photo by Taylah Hill.

Yarnangu cultural learning goal

Students learn to process kirti resin from tjanpi spinifex.

Learning activities

Learning in class (preparation)

- Students learn about the fauna and flora on purti bushland leading to a discussion on tjanpi spinifex and its uses.
- Students learn about the uses of kirti resin with Yarnangu experts.
- Yarnangu experts show students a range of tools that have been made using kirti resin.

Learning on Country

Yarnangu experts teach the students how to harvest tjanpi spinifex and make kirti resin on Country. They show them how it is done now and explain how it was done in the early days using traditional tools such as wirra wooden bowl.

Students learn:

- when and how to collect tjanpi spinifex
- the process for creating kirti resin
- how to heat the kirti resin using the mulga bark safely
- practical uses for kirti resin during the early days and now.

Learning in class (follow up)

- Students create a spoken or written procedure showing how to process kirti resin from tjanpi spinifex.
- Investigate the properties of the resin glue by testing it with different materials and weights.
- Investigate how the tjanpi spinifex changes state into a malleable substance once heated and a solid once cooled.
- Experiment with the kirti resin. What happens if it is not heated enough? What happens if it is heated too quickly?

Nowadays, shovels and tarps are used during the process of collecting the kirti resin particles from the tjanpi spinifex. Photo by Taylah Hill.

Traditionally the broken off tjanpi spinifex would be shaken in a wirra wooden bowl. Here, Elders are using cloth. Photo by Taylah Hill.

Curriculum connections

Chemical Sciences

- Pre-primary Objects are made of materials that have observable properties
- Year 1 Everyday materials can be physically changed in a variety of ways
- Year 2 Different materials can be combined for a particular purpose
- Year 3 A change of state between solid and liquid can be caused by adding or removing heat
- Year 4 Natural and processed materials have a range of physical properties that can influence their use
- Year 5 Solids, liquids and gases have different observable properties and behave in different ways
- Year 6 Changes to materials can be reversible or irreversible
- Year 8 Properties of the different states of matter can be explained in terms of the motion and arrangement of particles

Earth and Space Sciences

- Year 2 Earth's resources are used in a variety of ways

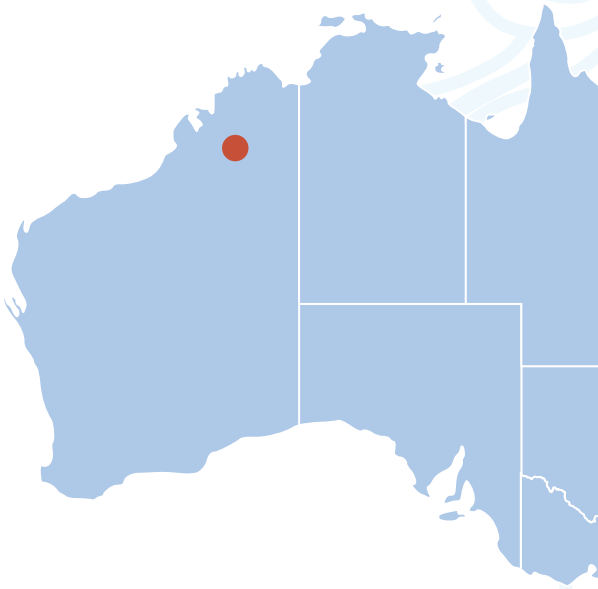
Physical Sciences

- Year 3 Heat can be produced in many ways and can move from one object to another

Majala, Malaa, Gooroo

Freshwater Mangrove

Walmajarri knowledge shared by Marmingee Hand
Gooniyandi knowledge shared by Brenda Carter
Bunuba knowledge shared by Amarillo Oscar
Fitzroy Valley District High School, Bunuba Country
Prepared by David Broun and Marmingee Hand



At Fitzroy Valley District High School we teach three languages – Bunuba, Gooniyandi and Walmajarri – because this reflects the cultural backgrounds of most of our students.

The freshwater mangrove is an important plant for Bunuba, Gooniyandi and Walmajarri people. Walmajarri call it majala, Bunuba call it malaa and Gooniyandi call it gooroo. It has powerful anaesthetic properties. It can be used as medicine to stop a toothache and as fish poison to stun fish in a waterhole. To make the fish poison you crush the leaves and stems and put it into a waterhole. The stunned fish float to the surface. You can collect enough stunned fish for a feed and leave the rest to revive and swim away for next time.

Majala malaa gooroo freshwater mangrove in Danngu.
Photo by David Broun.

Majala malaa gooroo freshwater mangrove flower.
Photo by David Broun.

Bunuba, Gooniyandi and Walmajarri cultural learning goal

Students learn to use majala malaa gooroo freshwater mangrove for fish poison. They learn to identify and locate the plant and how to prepare it.

Learning activities

Learning in class (preparation)

Ask a local Aboriginal expert who knows about majala malaa gooroo freshwater mangrove to visit the class. Ask students how people catch fish now and in the old days. The local expert shares knowledge of majala malaa gooroo freshwater mangrove with the class.

Learning on Country

Arrange a field trip with the local expert to a place where majala malaa gooroo freshwater mangrove grows.

Ask everyone to explore the area. The local Aboriginal expert shares knowledge of the plants. Students can share their own knowledge with each other and the teachers. Take a sample from each of the plants that grow in the area.

Lay the samples out together and classify the different plants into, for example, medicine, tools and food according to the local Aboriginal classification system.

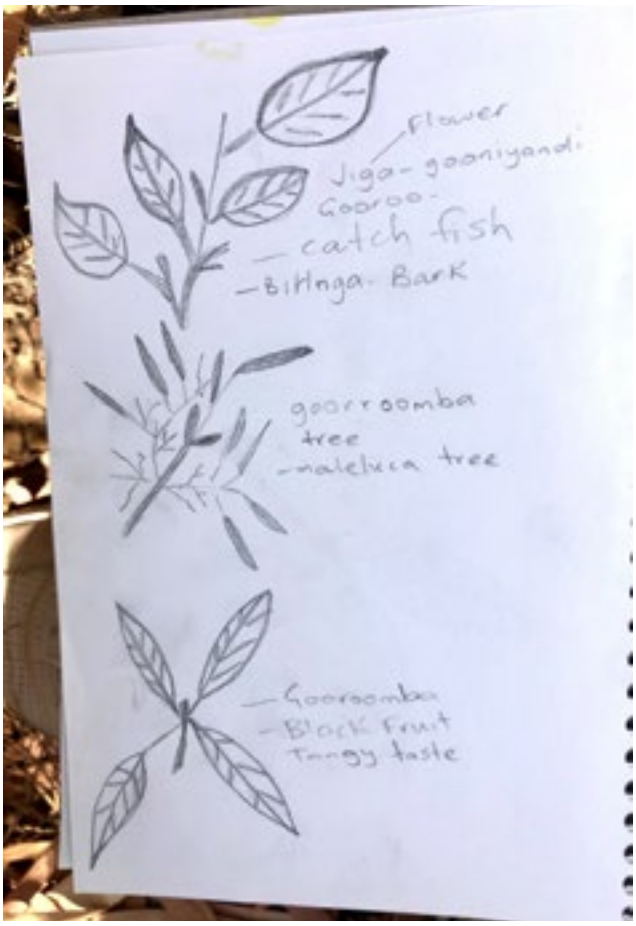
Students record information about the plants in their Two-way Science journal using labelled scientific drawings.

Experts show students how to prepare Majala malaa gooroo freshwater mangrove as a fish poison.

Catch some baitfish with a throw net. Test the majala malaa gooroo freshwater mangrove in buckets with the baitfish. One bucket with majala malaa gooroo freshwater mangrove in solution with river water and the other with clean river water. Observe what happens. Return the fish to the water after the experiment.

Learning in class (follow up)

Students write a science investigation report about the majala malaa gooroo freshwater mangrove investigation.



Botanical drawings. Photo by David Broun.

Plant samples collected at Danngu. Photo by David Broun.

Preparing the fish poison. Photo by David Broun.

Curriculum connections

Biological Sciences

- Year 7 Classification helps organise the diverse group of organisms

Chemical Sciences

- Year 7 Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques

Science inquiry Skills

Tjurlpu/ tjirta pirni

Birds

Wangkatja knowledge shared by Tanya Tucker, Amanda Sambo, Tahle Blizzard and Shauna Blizzard

Mount Margaret Remote Community School

Prepared by Colleen Smit, Tahlee Blizzard, Shauna Blizzard and Diane Fraser

There are many different species of tjurlpu/ tjirta pirni birds found in and around the Mount Margaret community. We watch the tjurlpu/ tjirta pirni birds to see when they are making marnngu pirni nests, laying ngampu pirni eggs and preparing for their young to arrive. This behaviour tells us that there is a change of seasons.

Piil-piil Magpie-lark mud marnngu nest. Photo by David Broun.

Nyii nyii zebra finch nest mud marnngu nest. Photo by David Broun.

Kaarnka crow marnngu nest with found materials.
Photo by David Broun.

Walawurru wedge-tailed eagle marnngu nest.
Photo by David Broun.

Wangkatja cultural learning goal

Students learn to identify different tjurlpu/ tjirta pirni bird species from the area e.g. karlaya emu, warlawurru eagle, kaarnka crow, piyarrka pink and grey galah, nganamarra mallee fowl and nganurti bush turkey. They learn about the different materials birds use to make marnngu pirni nests, and the different locations that birds make their marnngu pirni nests including: warta pirni trees and parna ground near certain warta pirni plants. Students observe the interaction between different species of tjurlpu/ tjirta pirni birds.

Learning Activities

Learning on Country

Local Aboriginal experts teach students to identify birds, their habitats and behaviours. They share knowledge of the materials that birds use to make nests.

Students photograph the information for use later in class.

Jordynn collecting materials to make a nest.
Photo by Tahlee Blizzard.

Learning in class (follow up)

- Draw and learn the Wangkatja language names for birds and their nest materials.
- Create a charcoal drawing using the outline of a bird filled with texture ‘rubbings’ from various materials and surfaces that they use to make their nests.
- Create a digital collage based on the materials birds use to make their nests.
- Research various birds and their nests then follow the ‘Design, make and appraise’ process to make a bird nest.
- Write an information report based on a specific bird.

Students with bird nest projects. Photos by Tahlee Blizzard.

Curriculum connections

Chemical Sciences

- Pre-primary Objects are made of materials that have observable properties
- Year 1 Everyday materials can be physically changed in a variety of ways
- Year 2 Different materials can be combined for a particular purpose

Biological Sciences

- Pre-primary Living things have basic needs, including food and water
- Year 1 Living things live in different places where their needs are met
- Year 2 Living things grow, change and have offspring similar to themselves

Nyingarn

Echidna

Ballardong Noongar knowledge shared by Phillip ‘Pinky’ Winmar, Annette Bennell, Margaret Collard and Joy Collard

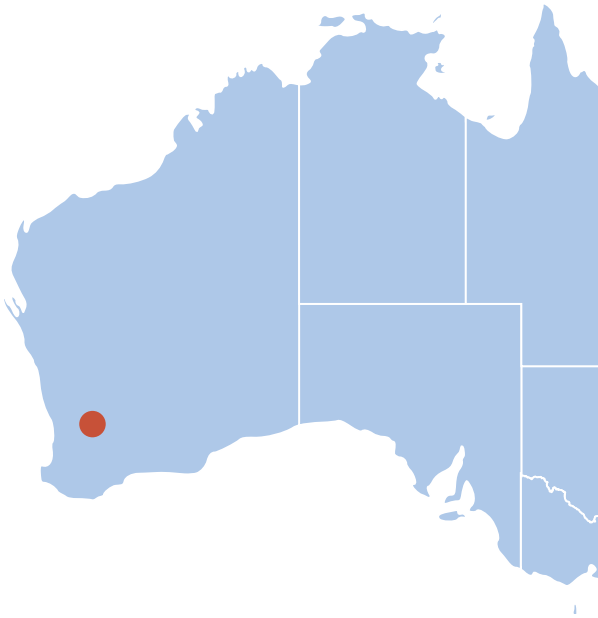
Quairading District High School

Prepared by Jaime Garrett and Kelsie Squiers

Nookaminnie Rock is a granite outcrop which is a significant cultural learning site for local Aboriginal people. The key animal species found on Boodja Country around the granite outcrop are yongka kangaroos, nyingarn echidnas, noorn snakes and various djert birds. They live amongst the mungart jam trees, eucalypts, kwerl sheoaks and boorak grasstrees that surround the boya rock.

Quairading township is named after the Noongar word Kwira meaning home of the small red kangaroo who live on the reserve.

There are many resources available at Nookaminnie Rock for both people and animals. It is a great place to make karla mia camp and hunt for mereny food. Nyingarn echidnas, yongka kangaroos and djert birds live on and around the boya rock as water is plentiful and they can shelter amongst the malark bush. One favourite delicacy for Ballardong Noongar people is the nyingarn echidna. There are signs everywhere on boodja country that nyingarn echidna are around and they are easy to track.



Nyingarn echidna in a burrow. Photo by Jaime Garrett.

Looking for snout holes. Photo by Karla Wyatt.

Ballardong Noongar cultural learning goal

Students learn to find animals on boodja country by looking for the tracks, scratchings, scats and nests of nyingarn echidnas. They discover the different habitats of nyingarn echidnas and the types of boorn trees and logs that noorook nests are found. They observe the features of the nyingarn echidna and their young. They also learn how the nyingarn echidna is prepared as food.

Learning activities

Learning on Country

Arrange a Learning on Country field trip with a local Ballardong expert to marlak native bushland where nyingarn echidnas live.

The local Ballardong expert works with students to identify the evidence in the marlak bush that nyingarn echidnas live in that area. This can include tracks, scratchings, landforms, wirt termites, nesting sites and goona scats. They discuss the features of a nyingarn echidna and how these features relate to the tracking marks.

Students can draw or photograph the evidence of nyingarn echidnas shown to them by the local Aboriginal expert for use in class.

A student work sample showing a food web that illustrates the feeding relationships between the nyingarn echidna and its habitat. Photo by Jaime Garrett.

Learning in class (follow up)

Back in the classroom, alongside the Aboriginal expert, students follow up the cultural learning at an age-appropriate level. This could include:

- food chains and food webs that connect the nyingarn echidna to the country
- 'Talk 4 Writing' narratives about nyingarn echidna or informational texts
- 'Ecograms' to demonstrate the connection between living organisms and the abiotic components of an environment
- the 'life cycle' of a nyingarn echidna
- procedural writing of how to capture and prepare a nyingarn echidna for food
- using local language to label a diagram of the features of a nyingarn echidnas and puggles (babies).

Looking at a nyingarn echidna up close. Photo by Stacey Harris.

Curriculum connections

Biological Sciences

- Pre-primary Living things have basic needs, including food and water
- Year 1 Living things have a variety of external features. Living things live in different places where their needs are met
- Year 2 Living things grow, change and have offspring similar to themselves
- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things
- Year 4 Living things depend on each other and the environment to survive
- Year 5 Living things have structural features and adaptations that help them to survive in their environment
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment
- Year 7 Interactions between organisms, can be described in terms of food chains and food webs
- Year 9 Ecosystems consist of communities of interdependent organisms and abiotic components of the environment

Maku

Witchetty grubs

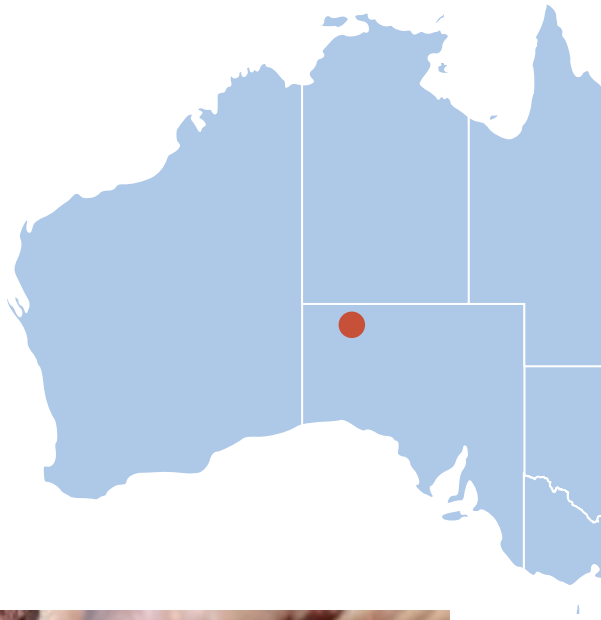
Anangu knowledge shared by Joanne Roberts (Pitjantjatjara language)
Fregon Anangu School
Prepared by Nicole Chataway and Gladys Roberts

Punu ilykuwara tjuta Fregon-ta – West Bore la itingka. Anangungku nintingku Ilkuwara nyakula kulipai munu maku ngurilpai.

Maku rawa ngarapai year winki panya maku ngurira nyakupai piltalpa makungku punu Ilkuwarangka ala kulupa palyara unngu tjarpara Iwiringka unngu ngura palyara ngaripai. Munu unngu ngalkura palkaringkupai.

Munu maku pulkaringkula punu-nguru tara pakara pinta-pintaringkula ankupai.

Tjitji tjuta mukuringkupai maku tjarawa mantintjikitja. Kulunypa tjutaku nyakula nintiringkupai.



There are lots of places to find maku witchetty grubs around Kaltjiti Fregon especially near West Bore – there are many maku ilykuwara trees. Anangu know what the right maku ilykuwara tree looks like and exactly where to find it.

Maku witchetty grubs is good all year round, it is always there. When you go looking for maku, you will see little holes on the maku ilykuwara tree. That is how the small ones get in. Then they travel down to the roots to eat until they are big enough to come back up.

The ilykuwara tree has many punu tjuta roots underneath. Maku witchetty grubs must be eating and eating. They grow bigger from eating the roots and work their way up to the surface of the dirt to become moths. When they are in the punu tjuta roots they are pink, yellow and white in colour. Pink are small ones, yellow are a little bit bigger and white are best to eat. They eventually turn into a big moth with long wings.

The kids love digging for maku witchetty grubs, they watch and learn from a young age. When kids get a little bit older then they can start digging for themselves, it is too hard for the smaller kids.

Maku witchetty grub. Photo by Gladys Roberts, Fregon (Kaltjiti).

Anangu cultural learning goal

Students learn to find the maku witchetty grubs tree. Students learn to find the shells at the base of the maku witchetty grubs tree to know that there is more maku witchetty grubs nearby or in the roots of that tree. Students learn to identify the long crack on the ground that shows there is a maku witchetty grubs. Students begin noticing the special roots in the hole. They learn which maku witchetty grubs are big enough to eat.

Learning activities

Learning on Country

Arrange a field trip with a local Anangu expert to a location with many maku witchetty grub trees – such as West Bore if you are near Fregon (Kaltjiti). The expert works with students to identify trees in which they should search for maku witchetty grubs. The Anangu expert works with students to dig for, and find, maku witchetty grubs in the tree and analyse them. How big are they? Are they ready to eat? Will there be any more maku witchetty grubs in this same tree?

Bring a data sheet for students to record data on Country. Record weather data as a group.

Students trace and measure the maku witchetty grubs they find and photograph them for use in class.

Learning in class (follow up)

Students follow up the cultural learning at an age-appropriate level.

This could include:

- Investigate the variety of external features maku witchetty grubs and other living things possess.
- Explore the different characteristics of life cycles of maku witchetty grubs such as egg, caterpillar and moth.
- Make and record observations of maku witchetty grubs as they develop through their life cycle.
- Investigate how Anangu understand and use the life cycles of maku witchetty grubs and other species.

Photo by Gladys Roberts, Fregon (Kaltjiti).

Student learning activity. Photo by Gladys Roberts, Fregon (Kaltjiti).

Curriculum connections

Biological Sciences

- Pre-primary Living things have basic needs, including food and water
- Year 1 Living things live in different places where their needs are met
- Year 2 Living things grow, change and have offspring similar to themselves
- Year 3 Living things can be grouped on the basis of observable features and can be distinguished from non-living things
- Year 4 Living things have life cycles
- Year 4 Living things depend on each other and the environment to survive
- Year 5 Living things have structural features and adaptations that help them to survive in their environment

Noongar six seasons

Noongar knowledge shared by Neville Collard, Belinda Cox, Melissa Spillman and Alton Walley

Coolbinia Primary School

Prepared by Sara Stewart, Sally Walsh and Elaine Lewis

Wadjak Noongar people recognise six seasons – Birak, Boonaroo, Djeran, Mookaroo, Djilba and Kambarang. These seasons are indicated by changes in local weather, plants, animals and the sky.

Wadjak Noongar experts know what grows where and what time of the year it is available for harvest. Noongar people hunt and gather food according to the seasons, they know which animal and plant resources are plentiful at different times. They are guided to move to different areas by signs in nature. For example, Mookaroo (June to July) is the coldest and wettest time in the southwest of Western Australia and it was when people moved inland away from the coast and hunted animals such as the yongka kangaroo.

Yongka kangaroo not only provide meat but also booka animal skin cloaks. Nothing was wasted. Even the bones and sinews were used in the manufacturing of bookas cloaks and for affixing barbs to hunting tools such as spears.

At this time miya-miya shelters were repaired and updated to make sure they were waterproofed and facing in the right direction for the wintery months. All these lessons about Country are passed down from one generation to another.

Coolbinia Primary School has an area of natural bushland next to the school which is used for Two-way Science and Learning on Country.

Noongar six seasons calendar, Coolbinia Primary School. Photo by David Broun.

Mangart firewood banksia.
Uses: a sweet cordial can be made from the nectar.
(Djeran season, April to May). Photo by David Broun.

Wadjak Noongar cultural learning goal

Students learn to use their senses to observe changes in the natural environment. They observe the weather, plants and wildlife that can be found at school, in the bush and in their community. They learn the vital significance of Country to Noongar people.

Learning activities

- Walk in the bush. Record sights, smells, sounds and bodily reactions. Continue to do this several times a term to observe, record and photograph the changes that can be seen in the bushland to add to the weather wall as the changes occur.
- Learn from a Noongar Elder about the uses of native plants for food and medicine.
- Create a weather word wall in Noongar and English.
- Compare the European and Noongar seasons to decide which is more appropriate. Noongar seasons are not based around the changing months. They are based on what is happening on Country.
- Students present a daily weather report using observations on Country.
- Plant native food and medicine plants in the class garden.
- Create a miya-miya shelter out of found materials and test it to see if it is waterproof.

Balka grass tree after fire.
Uses: fire making, resin glue, edible seeds.
(Djeran season, April to May) Photo by David Broun.

Testing a miya-miya shelter model to see if it is waterproof.
Photo by Elaine Lewis.

Noongar artist Melissa Spillman working with students to create 6 seasons murals. Photo by Elaine Lewis.

Curriculum connections

Earth and Space Sciences

- Pre-primary Daily and seasonal changes in our environment affect everyday life. Learning how Aboriginal and Torres Strait Islander Peoples' concepts of time and weather patterns explain how things happen in the world around them

Muupungana marnalurla jinawarntiwu, ngana ngunangana Lumpu Lumpu

Using tracking and motion sensor cameras to find out what lives at Lumpu Lumpu

Walmajarri knowledge shared by Hanson Pye, Wendy Bilgin, Latarney Bilgin, Jaylene Bilgin, Ronelius Kogolo, Clifford Campbell, and the Ngurrura Rangers Maya Surprise, Regina Thirkall, Raylene Lenmardi and Marika Rogers

Djugerari Remote Community School

Prepared by Hamish Etheridge, Scott Brown and Jarred Mellor

Lumpu Lumpu is living water. It is an underground spring in rocky hills on the edge of the desert. It is important cultural site for Walmajarri people. The Ngurrura Rangers and Walmajarri Elders worked with Djugerari school students to teach them to use tracking and motion sensor cameras to find out which animals live at Lumpu Lumpu. Motion sensor cameras are triggered by movement. They are left in remote locations to record data about animals that live in an area. The Ngurrura Rangers use motion sensor cameras for conservation and land management work on Walmajarri Country.

Some of the animals that live near Lumpu Lumpu include marlu kangaroo, pinkirrjarti bush turkey, karnanganyja emu, marrany dingo and kakaji goanna.

Lumpu Lumpu, jila living spring water. Photo by David Broun.

Ngurrura Ranger Raylene Lenmardi teaches students about motion sensor cameras. Photo by Cameron Hugh, Kimberly Land Council.

Walmajarri cultural learning goal

To learn about the animals and plants found at Lumpu Lumpu. To teach the students what our grandparents and great-grandparents taught us. How to track animals, and what we can use from the land around us including jila natural spring water.

Learning activities

Learning in class (preparation)

- Arrange for rangers to visit the classroom to explain how to use motion sensor cameras.
- Students predict the animal tracks and scats they might find at Lumpu Lumpu.
- Students learn the Walmajarri names of animals and how to identify their tracks and scats.

Learning on Country

- Students learn from Elders how to identify the tracks and scats of animals at Lumpu Lumpu. They photograph them for use in class.
- Students work with rangers to identify locations for the motion sensor cameras and set them up.
- Students return to Lumpu Lumpu at a later date to retrieve the cameras.

Learning in class (follow up)

- Analyse the data from the camera trap.
- Make a list of the animals recorded on the motion sensor cameras.
- Compare the results with student predictions.
- Sort the animals into native and feral animal categories.
- Choose an animal photographed by the motion sensor camera and write an information report including the impact of feral animals at Lumpu Lumpu.

Students drop counters into labelled cups to make predictions about the animals that live at Lumpu Lumpu. Photo by David Broun.

Ranger Regina Thirkall teaches students to install a motion sensor camera. Photo by Cameron Hugh, Kimberly Land Council.

Reviewing motion sensor camera images. Photo by Ngurrura Rangers.

Curriculum connections

Biological Sciences

- Pre-primary Living things have basic needs, including food and water
- Year 1 Living things live in different places where their needs are met
- Year 4 Living things depend on each other and the environment to survive
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment

Science Inquiry Skills (Year 3 to 4 example)

- Questioning and predicting- With guidance, identify questions in familiar contexts that can be investigated scientifically and make predictions based on prior knowledge
- Planning and conducting- With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment. Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately
- Processing and analysing data and information- Use a range of methods including tables and simple column graphs to represent data and to identify patterns and trends. Compare results with predictions, suggesting possible reasons for findings
- Evaluating- Reflect on investigations, including whether a test was fair or not
- Communicating- Represent and communicate observations, ideas and findings using formal and informal representations

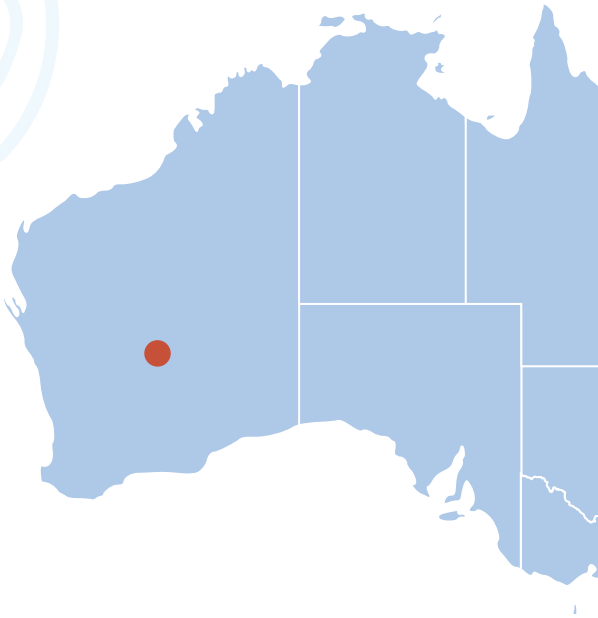
Yaalpanya ngalipa kapiku ngurrila?

How do we find water?

Wangkatja knowledge shared by Fifi Harris
Leonora District High School
Prepared by Fifi Harris and David Broun

Wangkatja pirnilu kapi ngurrila. Ngalipa tjirta pirniku, animal pirniku tjina, ka warta pirniku nyawa/nyaku, parntila ka kulila. Yuwa kapi palu nyangangka/ngaangka.

Wangkatja people search for water. We watch the birds, animals and their tracks, and plants. We look, smell and listen for water. Then we know, yes there is water here.



There are many ways for people to find kapi water on ngurra / parna country. Tjirta pirni birds, animals and warta pirni plants can tell us where kapi water can be found.

Tjirta pirni birds such as nyii-nyii zebra finch and the piyarrku / piyarrka pink and grey galah need kapi water to drink and indicate that kapi water is nearby.

Tjina pirni tracks and yiwarra pads from animals can lead people to watering places.

Some yitiya pirni reeds and yukuri pirni grasses need fresh kapi water close to the surface and can indicate where kapi water can be found.

Nyii-nyii pirni zebra finches. Photo by David Broun.

Karlayaku tjina emu tracks. Photo by Fifi Harris.

Wangkatja cultural learning goal

Students learn to find water on Country by observing animal behaviour, animal tracks, plants and landforms.

Learning activities

Learning on Country

Arrange a field trip with a local Wangkatja expert to a water source with water in it.

The expert works with students to identify ways that tjirta pirni birds, animals and warta pirni plants can indicate the presence of kapi water.

Students draw or photograph the evidence shown to them by the local Aboriginal expert for use later in class.

Learning in class

- Create a 'life around the waterhole' drawing or diagram showing the collected evidence of different animals that visit the waterhole (e.g. tracks, scats, bird calls, feathers, bones).
- Investigate habitat around the waterhole and indicate what different animals need to eat, shelter and breed.
- Create a food chain or food web that connects the animals and plants around the waterhole.
- Create an 'ecogram' to demonstrate the connection between living organisms and abiotic components of the environment.

Ngamara rockhole. Photo by David Broun.

Students create a model of a waterhole after Learning on Country. Photo by CSIRO.

Curriculum connections

Biological Sciences

- Pre-primary Living things have basic needs, including food and water
- Year 1 Living things live in different places where their needs are met
- Year 4 Living things depend on each other and the environment to survive
- Year 6 The growth and survival of living things are affected by the physical conditions of their environment
- Year 7 Interactions between organisms, can be described in terms of food chains and food webs
- Year 9 Ecosystems consist of communities of interdependent organisms and abiotic components of the environment

Pipitjarli

Bush carrot

Martu knowledge shared by Rita Cutter, Anthea Cutter, Valdera Morgan and Bernadette Morgan

Wiluna Remote Community School

Prepared by Scott Olsen and Rebekah Fisher

After yalta puru cold time, pipitjarli bush carrot (*Calandrinia schistorhiza*) begin to bare bright pink flowers around Wiluna. Pipitjarli bush carrot is a compact, prostrate plant that is supported by a finger sized edible tuber, which can be eaten kunka raw or munyjulypa / yurnmi cooked, which enhances its sweet flavour. Wiluna Martu Elders often share stories about when they used to dig pipitjarli bush carrot with their families during the mission times (1955 to 1975). During this Learning on Country experience, Wiluna Martu Elder Rita Cutter shared knowledge and stories about pipitjarli bush carrot with the students. Her teachings are recorded below.

Before we go digging these pipitjarli bush carrot, a big fire will be going first, that's what we do first, that was at the mission, yeah, so we can have the hot sand and when we finish getting them ahhh delicious!

When I was a little girl, I used to just help my mum dig it all out. Old people used to get a stick from the straight warta stick, sharpen it, we used to dig them. We can cook some, but the rest, dry them in the sun. That's what they used to do, dry them in the sun, leave them, come back and get them, cook them and oh! I couldn't wait.

Waru fire and day camp. Photo by Scott Olsen.

In the mission, where the church is, I used to go out with my parents, my mum, we used to dig all this and put it in the sun to dry. But I couldn't wait, I used to get stuck into it, cook it in the waru fire. Put it out in the sun to dry then we'll come back, later we'll come back.

A lot of them old people that are resting now, they used to go out in groups, take their children what is all grown up now, like me I suppose, and show us how to dig for pipitjarli bush carrot. There is pipitjarli bush carrot, that's his name and another name is tjanmurlmarta. Old people had a lot of names for this one.

Rita Cutter with her straight warta stick. Photo by Scott Olsen.

They need to know this, these kids, what I used to do long time ago, when I came in from my desert home. Putjiman, Milyiri is my ngurra home, that's where I was born, in the parna sand like this. Good one, that's why I know my ngurra, and my Putjiman ngurra, and my culture, and my history.

Martu cultural learning goal

Students learn to identify, collect and prepare pipitjarli bush carrot. Students learn to:

- Identify the specific plant as there are many that look similar
- Carefully excavate and collect pipitjarli bush carrot keeping the tuber intact
- Prepare pipitjarli bush carrot by removing the leaves and flowers before cooking it in hot parna sand.

Learning on Country

- Arrange a field trip with local experts to find, harvest and cook pipitjarli bush carrot. Take photos of the process to use back in class.

Learning in class (follow up)

- Recount and sequence the steps to identify, collect and prepare pipitjarli bush carrot.
- Sort and group different vegetables in relation to their similarities with the pipitjarli bush carrot.
- Explore how pipitjarli bush carrot can be physically changed when cooked in hot parna sand.
- Investigate how pipitjarli bush carrot responds to changes in temperature and the effect that it has on the texture and hydration of the tuber.
- Investigate the tools used to collect pipitjarli bush carrot in the old days and what is used now.
- Explore how rain and evaporation affect the soil and pipitjarli bush carrot collecting process.
- Discuss the process of cooking pipitjarli bush carrot and whether it is reversible or irreversible.

Anthea Cutter teaching a student how to cook pipitjarli bush carrot in the hot parna sand. Photo by Scott Olsen.

Sequencing activity. Photo by Scott Olsen.

Curriculum connections

Chemical Sciences

- Pre-primary Objects are made of materials that have observable properties
- Year 1 Everyday materials can be physically changed in a variety of ways
- Year 2 Different materials can be combined for a particular purpose
- Year 3 A change of state between solid and liquid can be caused by adding or removing heat
- Year 4: Natural and processed materials have a range of physical properties that can influence their use
- Year 5: Solids, liquids and gases have different observable properties and behave in different ways
- Year 6: Changes to materials can be reversible or irreversible

Painting by participating school staff and community to record learning during a Two-way Science workshop at Danggu near Fitzroy Crossing.

Painting by participating school staff and community to record learning during a Two-way Science workshop north of Leonora.