

WA'S PARKS, WILDLIFE AND CONSERVATION MAGAZINE

LANDSCOPE

Volume 36 Number 4 Winter 2021 \$7.95

WARMING SANDS

Flatbacks and rising
temperatures

Mega geology

WA's giant landforms

Adventure trails

Firing up Dwellingup

Rocking Karijini

Exploring ancient
formations

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Department of Biodiversity,
Conservation and Attractions



ON THE COVER

Front cover A female flatback turtle returns to the same shores where she hatched—Eighty Mile Beach near Broome.
Photo – Tom Le Lievre

Back cover Courageous flatback turtle hatchlings make their way to the ocean.
Photo – Andrea Whiting

Science has been critically important in identifying and valuing our conservation assets so that we know and appreciate the diversity we have, and it continues to be important in identifying appropriate management strategies to facilitate persistence in the face of current and future pressures.

Early understanding and documentation of the unique flora of the State was enhanced by the fastidious work of botanist Dr William Blackall, and his illustrated key to identify Western Australian wildflowers produced with the collaboration of Professor Brian Grieve continues to be a foundational text for students of plant science and keen enthusiasts (see 'William Edward Blackall: Doctor and Botanist' on page 24).

DBCA scientists continue to work collaboratively with our colleagues in academia and welcome the opportunity to work with aspiring young scientists as they undertake their PhD studies (see 'The secret life of grasswrens' on page 28 and 'The heat is on: flatbacks and a changing climate' on page 40).

Science is fundamental to effectively managing our parks and reserves. The challenges in biodiversity conservation are becoming more complex and thus our management responses are more complex and require significant input from multidisciplinary science and integrated biodiversity knowledge (see 'Top marks for Kings Parks' on page 46).

Our scientific endeavours continue to provide the evidence base for effective conservation and management of our biodiversity, enable appreciation and enjoyment of WA's natural places, and inform decision-making for environmental sustainability and economic development. I hope the articles in this issue encourage you to think about the wealth of knowledge science provides us as you are out and about enjoying WA's biodiversity this winter.

Dr Margaret Byrne, Executive Director, Biodiversity and Conservation Science
Department of Biodiversity, Conservation and Attractions



Contributing

Aline Gibson Vega is an ecologist with a passion for conservation. She has assisted with and worked on projects with small macropods and mammals, which led to her gaining an interest in birds. Currently, her PhD project explores the population genetics, breeding and behavioural ecology of the western grasswren. She took on the project because she was eager to work on something with tangible conservation applications and outcomes. Aline also assists the Department of Biodiversity, Conservation and Attractions on the *Return to 1616 Dirk Hartog Island National Park Ecological Restoration Project*.



Michael Freeman is a geologist with a wealth of experience, from gold and phosphate rock to coal and heavy mineral sands, and to applying geology to land-use planning. He once spent a period as a forensic geologist, however from a personal interest viewpoint his love is sharing his knowledge of geology in the land around us for all to appreciate the world we live upon. Michael plans to focus on this by contributing more to the growing field of geotourism, particularly after his impending retirement from his professional career.



Malindi Gammon is a PhD student at the University of Western Australia where her research explores how a changing climate will impact flatback sea turtles. Malindi moved to Perth in 2018 from New Zealand where her passion for conservation was sparked by her masters research on the impacts of a changing climate on deep sea corals, before joining the Fisheries Department of the New Zealand Ministry for Primary Industries as a graduate.



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This page Mount Augustus.

Photo – David Bettini



Department of Biodiversity, Conservation and Attractions

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**Snap
shot**



READER'S PIC

Rainbow bee-eater (*Merops ornatus*)

Photo and words by Jacqui McGhie

"I have been trying to get a photo of the rainbow bee-eater for quite a while up in the Kimberley but they were always too quick for me, darting about chasing their insects, but I found out they nest right here in Perth! I took this at Lake Gwelup in the Perth suburb of Karrinyup, a known breeding area for rainbow bee-eaters."

Have you got a fantastic nature photograph you would like to see published in **LANDSCOPE**? Send it, along with a 100-word description of the species or how and where you took the shot, to landscape@dbca.wa.gov.au.



Penguin pergolas

The little penguins of Penguin Island are in real estate heaven after 22 new nesting boxes were specially built for them, as well as receiving new and upgraded lids to existing boxes.

The construction of the nesting boxes was a joint initiative between DBCA's Parks and Wildlife Service and the Rotary Club of Palm Beach.

To date, a total of 43 nesting boxes have been built, 30 sunshades have been made and fitted, 11 new lids purchased for old boxes, and 22 lids of old boxes painted.

Palm Beach Rotary Club also played a big part in building artificial hollows for black cockatoos. You can watch the short video on both nesting box projects on the club's Facebook page.



Discover more about the nesting box project

Scan this QR code or visit the Palm Beach Rotary Club's Facebook page



'Reflections' mural at Wellington Dam

The colossal mural on the Wellington Dam wall is thought to likely be the largest of its type in the world. It has been inspired by local stories and photographs and, unsurprisingly, it is already proving to be a major tourist drawcard.

Internationally-renowned Australian artist Guido van Helten created the 8000-square-metre mega-mural, which was officially unveiled by WA Premier Hon Mark McGowan MLA on 19 February 2021.

The mural is titled 'Reflections'. It demonstrates how the waterways are culturally significant to all people, locals and visitors, both in the past and present, and symbolises the future of the Collie River region as a place of natural beauty, recreation and solidarity.

The painting of the wall has been a monumental task, with people abseiling to clean the wall, building a specially designed scaffolding platform to paint it, and the design drawn and mapped onto a grid to help the artist translate his design from concept to a scaled mega mural.



Right Wellington Dam mural.

Photo – Stuart Harrison/DBCA

Above left Penguin nesting boxes.

Photo – Rick Dawson

Frog foraging with *Nearer to Nature*

As the rain begins and the creeks and wetlands start to fill this winter, many native frog species start to emerge. You may not realise just how many frogs there are living in your local area.

During the July school holidays, DBCA's *Nearer to Nature* program runs family 'Frog Forages' at different wetlands and swamps around Perth. On these night-time walks, participants learn the signs to spot frogs, discover how important frogs are to the environment, explore the array of species and understand how to identify them using their unique calls.

Keep a lookout on the *Nearer to Nature* Facebook page (@nearer-tonatureWA) to see when a 'Frog Forage' is happening near you.



Guest column

Dr Alan Briggs

President, Geoparks WA



Geoparks are defined by UNESCO as single, unified geographical areas where sites and landscapes of international geological significance are managed

with a holistic concept of protection, education, and sustainable development. Hence, geoparks are much more than just the protection of sites of geological heritage.

National parks are government reserves, traditionally focused on conserving flora and fauna, whereas geoparks are more about the earth, landscapes, and geology. Interestingly, national parks may be included within geopark boundaries.

Geoparks WA is a not-for-profit organisation comprised of members keen to promote and support the establishment of geoparks in WA. Its members are active across Australia through a range of other organisations including the Geological Society of Australia.

Geoparks are managed from the ground up by local communities, a requirement for geoparks. Local management brings about local ownership. Geoparks focus on geology, the flora and fauna evolving from that geology and then human interaction with these elements. There are unique and exciting stories to be told, especially about 65,000 years of Aboriginal custodianship of ancient lands and then early explorer and settler development leading to contemporary land use today.

Geotourism is a relatively new form of tourism and is attracting international attention. Geoparks have evolved from the original concept of protecting geosites. However, protection of geoheritage is still promoted through conservation and education, which is a central theme in establishing geoparks. With one of the oldest land platforms in the world forming the Yilgarn Craton, there is significant geological heritage to be shared.

Already several local government authorities have shown interest in establishing geoparks, including the Murchison Region, Wheatbelt, Margaret River and the cities of Joondalup and Wanneroo.

Geoparks WA has become a vehicle for promoting and supporting geoparks in WA. It is an exciting journey. Watch this space.



Above Noongar presenter Ash Penfold leads students in a dance workshop.
Photo – Ellen Davies/DBCA

Primary school students flocked to Kaarta Koomba (Kings Park) this year for a series of mini festivals to celebrate Aboriginal culture and learn about the six Noongar seasons.

Noongar Boodja Six Seasons is an exciting educational program delivered by the Kings Park Education and Learning team and proudly supported by Fugro.

During the seasonally-themed festivals, students learn about Noongar country—the land, plants, animals and people, and traditional ways of living on and caring for country. Local Noongar presenters lead cultural activities traditionally associated with each season, such as plants used for food and medicine, hunting, language, art, dance, and traditional games.

Find out more at bgpa.wa.gov.au/kings-park/events/kings-park-education/programs/noongar-boodja

New adaptive mountain bike in the Perth Hills

After months of fundraising, not-for-profit adaptive mountain bike and hiking organisation Break the Boundary were able to purchase a full suspension all-terrain adaptive mountain bike, Lasher Sport.

The Lasher Sport is specifically designed for off-road adventures with a patented front fork shock design that provides a smooth ride even in the most demanding terrain.

The handcycle was purchased by Break the Boundary with help from generous community fundraisers and donors, with shipping sponsored by disability equipment provider Push Mobility, based in Victoria.

"We talk about social, mental and physical well-being to promote our charity but honestly... this is far better!" a Break the Boundary spokesperson said.

Right Lasher Sport adaptive handcycle.

Photo – Break the Boundary





Yawuru Conservation Estate

From turquoise waters and sandy beaches, across pindan plains to biodiverse mudflats and mangroves, you can explore the rich cultural and environmental values on offer across the Yawuru Conservation Estate. Surrounding the picturesque town of Broome, there is truly something for everyone.

In Australia's tropical Kimberley region, on Yawuru country, lies a unique and diverse set of jointly managed parks, the Yawuru Conservation Estate. The area boasts dynamic lightning storms and warm tropical rains in Man-gala (the wet season, November to February), and picture-perfect days through Barrgana (the dry season, June to August).

Covering approximately 100,000 hectares of land and waters on Yawuru country, the Yawuru Conservation Estate

comprises four jointly managed parks. These parks share cultural, environmental and recreational values and are managed holistically across the landscape.

LIVING CULTURAL LANDSCAPE

For thousands of years Yawuru people have lived along the foreshore of Roebuck Bay, across the pindan plains and along the fringes of the Great Sandy Desert. Yawuru people have continued their strong connection to country for generations and champion the protection and future of conservation areas in and around Broome.

The Yawuru Conservation Estate parks were created following the Yawuru Native Title Determination in 2006 and subsequent

Indigenous Land Use Agreements in 2010. The parks provide for the longheld aspirations of Yawuru people to continue looking after their lands and waters sustainably for future generations. These aspirations are shared by the Department of Biodiversity, Conservation and Attractions' Parks and Wildlife Service and the Shire of Broome. The parks also sit within the Yawuru Indigenous Protected Area.

WET YOUR FEET

The Yawuru Nagulagun / Roebuck Bay Marine Park contains some of the most productive tropical intertidal flats in the world, making it very important for Yawuru fishing, hunting and gathering seafood.

Above Bird life on the shores of Yawuru Nagulagun / Roebuck Bay.
Photo – Tourism WA



JOINT MANAGEMENT

The Yawuru Conservation Estate is made up of four different parks, managed holistically and collaboratively across three organisations. The parks are:

Guniyan Binba Conservation Park

The intertidal area of north Cable Beach and Willie Creek, jointly vested with Yawuru, the Shire of Broome and DBCA.

Yawuru Birragun Conservation Park

The lands adjacent to Willie Creek and Roebuck Bay, jointly vested with Yawuru and DBCA.

Yawuru Minyirr Buru Conservation Park

The lands within the Broome townsite including Minyirr Park jointly vested with Yawuru and the Shire of Broome.

Yawuru Nagulagun/ Roebuck Bay

Marine Park The intertidal and subtidal areas of Roebuck Bay jointly vested with Yawuru and DBCA.

Top left Painting representing Yawuru country and displayed on park signage.
Image courtesy Yawuru artist Martha Lee

Top Throwing netting in the shallows.
Photo – DBCA

Above left Snubfin dolphins.
Photo – Alex Brown

It also offers a wealth of recreation opportunities for visitors and locals alike.

Visitors can watch the sunrise over the bay while migratory and resident shorebirds feed on invertebrates in the mudflats, observe dugong feeding trails along the exposed seagrass meadows and walk in the footprints of dinosaurs.

Fishing is a popular pastime in Yawuru Nagulagun, with a variety of sea country to access, including mangrove-lined creeks and more open water. While recreating along Yawuru Nagulagun, we remind people the Kimberley is crocodile country and you may encounter estuarine crocodiles (*Crocodylus porosus*), particularly in the creek systems. Crocodiles are common, they move around, and they can be deadly so always be 'CROCWISE'.

SUNSET VIEWS

A popular activity in Yawuru Minyirr Buru Conservation Park is exploring the walk trails through the Monsoonal Vine Thickets, a Threatened Ecological Community, and across from Cable Beach. The Minyirr Trail extends approximately

four kilometres from the Broome Surf Club south to Minyirr Park Base Camp. This trail winds through yaminyari, or gubinge, trees (*Terminalia ferdinandiana*) that produce a small, green fruit high in vitamin C, past min min (*Crotalaria cunninghamii*) with delicate birdflowers that can also be sucked for the nectar.

Along the Minyirr Trail are seven Nagula (saltwater) trails that traverse over the dunes to access Cable Beach. Each trail is named after an animal found in the area, including Wandanyjirr (sea snake), Yari (humpback whale) and Gurlibil (turtle). The Birndany (stingray) Trail takes you to a viewing platform perfect for watching the sunset over the iconic Cable Beach.

Even in Barrgana, the coolest season in Broome, it is important to wear sturdy shoes and bring water when walking through the parks.

SIX SEASONS

Yawuru country is rich in biodiversity and Yawuru people have a deep understanding of the flora, fauna, landscape, seasons and cycles that make

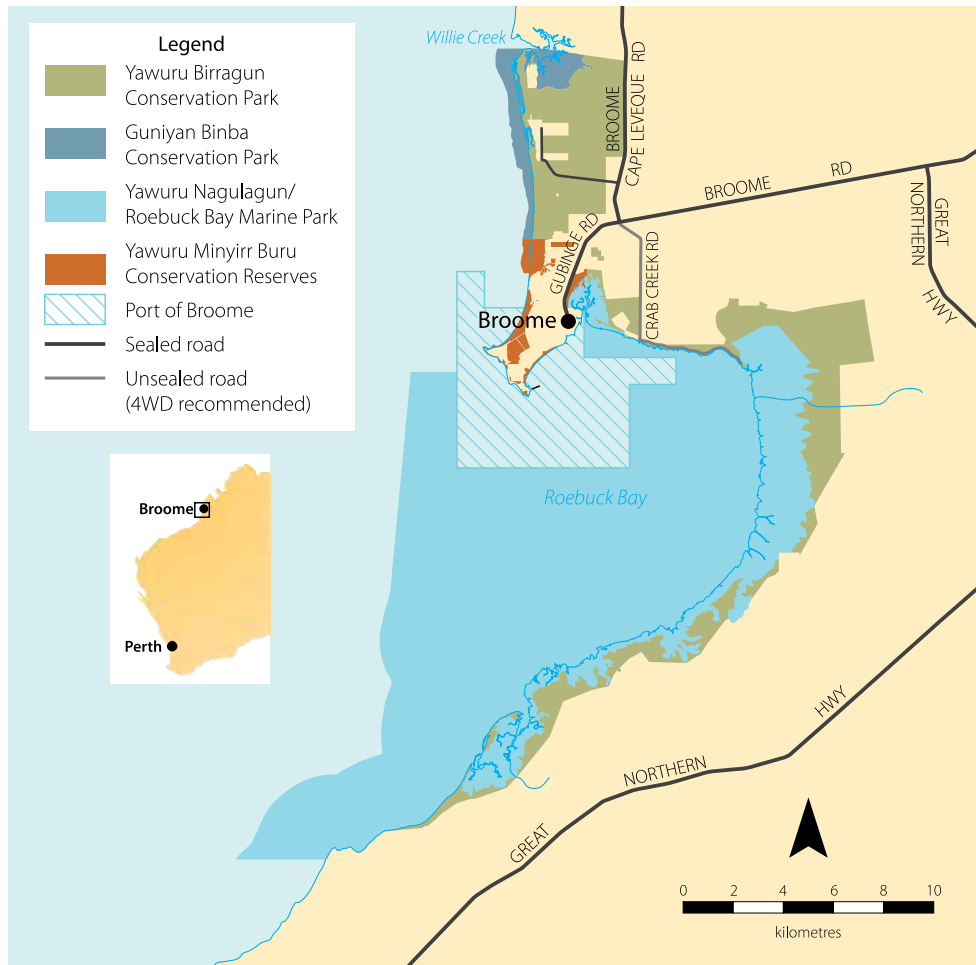


Discover more about
Yawuru Conservation
Estate

Scan this QR code or
visit Parks and Wildlife
Service's 'LANDSCOPE'
playlist on YouTube.



Parks for people Yawuru Conservation Estate



up their country. As you explore the variety of landscapes on Yawuru country you will notice different plants and animals at different times of year. Yawuru people recognise six seasons, with each season providing different weather patterns, bush food, medicine and resources.

As the days chill in the southern parts of Australia, there is a shift in the north. From June to August, the Yawuru Conservation Estate experiences the season of Barrgana. Barrgana is typified by strong, dry south-easterly winds, average daytime temperatures around 30 degrees Celsius with night-time temperatures cooling to about 15 degrees Celsius. This season typically brings low humidity, bright blue skies, clear nights and is the most popular time for visitors.

During Barrgana you can observe yari, also known as humpback whales (*Megaptera novaengliae*) migrating north, past Cable Beach, to breeding grounds around the Lalang-gaddam marine parks.

The Walga-walga (*bluenose salmon*) is fat and a sought-out species for fishing. The vibrant jigily tree, also known as the jigal tree, (*Bauhinia cunninghamii*) is flowering and producing a sweet nectar and the badar-badar (*Mallotus nesophilus*) is fruiting with edible berries.

CITIZEN SCIENCE

Many of the key species that occur across the Yawuru parks have research and monitoring programs underway. Several of these offer opportunities for the public to participate, including the Broome Community Seagrass Monitoring Program, Cable Beach Community Turtle Monitoring Program and shorebird monitoring with the Broome Bird Observatory to name a few. Members of the public are encouraged to report sightings of snubfin dolphins through the Marine Fauna Sightings app and there is a 'fin book' available to help identify individual snubfin dolphins in the area.

Top View from the Birndany viewing platform in Yawuru Minyirr Buru.

Above Yawuru ranger monitoring shorebirds. Photos – DBCA

Do it yourself

Where is it? Surrounding Broome, the Yawuru Conservation Estate extends to the north, east, west and south of the town.

Total area: Approximately 100,000 hectares.

Recreational activities: Walking, sightseeing, photography, nature observation and bird watching, fishing, boating.

Nearest Parks and Wildlife Service office
Broome
111 Herbert St
Broome, WA, 6725
(08) 9195 5500



COMMUNITY-BASED CONTROL OF INVASIVE SPECIES

It isn't a secret that invasive species can wreak havoc on native ecology and agricultural productivity.

But if you have ever questioned how human behaviour plays a part in pests, *Community-based Control of Invasive Species* might be your next read.



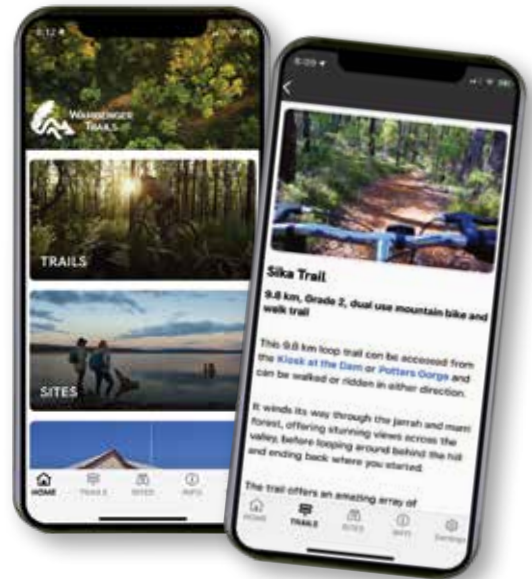
This in-depth scientific book is based on five years of research by leading scholars and will be best enjoyed by engaged scientists with knowledge of the topic.

Using case studies, the authors help readers to understand the underlying science of key behaviour management methods and how these can be used to encourage people to voluntarily become involved in managing such species.

With loads of detail and real-life examples, this CSIRO-published book will be a valuable resource for professionals who work in natural resource management and want to up-skill.

You might even learn a few tips on how to actively engage private citizens, how good communication can motivate groups, and how governing bodies can best offer support to reach a common goal.

Community-Based Control of Invasive Species is available to purchase at publish.csiro.au.



COLLIE WAMBENGER TRAILS

Collie is fast becoming a popular destination in WA's south-west, particularly for those who love the outdoors.

And while the town's reputation as a tourism hub is quickly growing, there are still many places and activities that are yet to be discovered by travellers.

That's where the *Collie Wambenger Trails* app comes in handy. Why? Because it's like having the whole town in the palm of your hand (read: smartphone).

The app is simple, but it's cleverly divided into different subcategories so users can design a trip to suit individual interests.

Of course, there's a big focus on the many different mountain bike trails throughout Wellington National Park and beyond.

But, if you aren't an outdoor adventurer, head to the app's attractions directory and you'll find more options like local art galleries, museums and other attractions.

Even if you're only stopping in at Collie for a day trip, this is a good one to download.

It will cut down on your web searching time to find fun things to do and also give you details you need like maps and directions, opening hours and costings for what Collie has to offer.

Collie Wambenger Trails is available to download on the App Store and Google Play.



MY PEST GUIDE REPORTER

It's been proven time and time again that a little bit of citizen science can go a long way.

The *MyPestGuide Reporter* app is harnessing that power and encouraging people to get curious about the world around them.

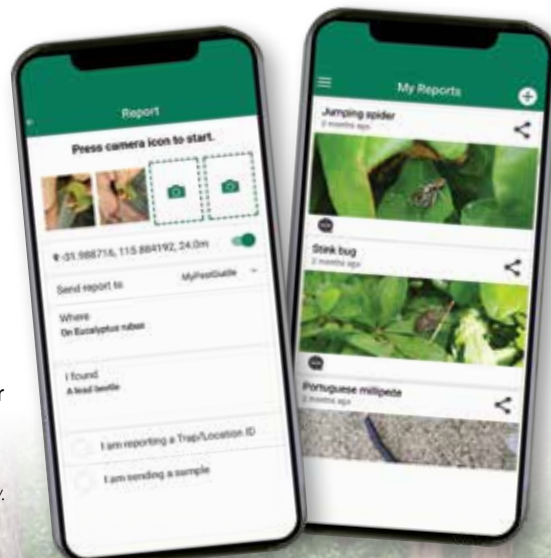
Managed by the Department of Primary Industries and Regional Development, users are encouraged to snap and upload photos of any odd pests spotted in the local community—whether bug, plant or something unknown.

Get uploading and you'll quickly discover a community of like-minded people who have come across similar pests to the ones you have found.

In my humble opinion, this app is great for two reasons: it can help to solve an individual's pest problem, and it provides valuable monitoring data that can potentially have a major impact on the biosecurity of our State.

I love the concept, it's simple, user-friendly and an excellent educational tool. So, if a mystery insect has been hanging about your garden, it'll be worth an upload.

MyPestGuide Reporter is available to download on the App Store and Google Play.





Trails firing up Dwellingup

In 1961, a bushfire swept through Dwellingup destroying houses and nearby timber settlements. Today, trail tourism is heating up in the area once again, transforming and reshaping the town.

by Rod Annear



Dwellingup was once known as a timber and fruit growing town approximately 100 kilometres south-east of Perth. The area's relatively high rainfall, deep Murray River valley and fertile soils gave rise to tall jarrah and marri forests, which fed timber mills in and around town, driving employment and the economy.

The nearby Lane Poole Reserve, named after WA's first Conservator of Forests, Charles Lane Poole, has long been a playground for locals and attracted visitors to camp, swim, fish, walk, paddle and ride in the reserve. The areas' proximity to Perth, natural beauty and physical features also drew schools, bringing students to Dwellingup for outdoor education camps.

Lane Poole Reserve's new mountain bike trail network is now complete and riders have signalled their approval by arriving in droves.

"The trails are super busy," Department of Biodiversity, Conservation and Attractions (DBCA) project manager Sarah Campbell said.

"We knew there was a lot of unmet demand for quality trails, but even so, we have been surprised by how popular the new trails have been. Since the official opening in October 2020, there



have been more than 100,000 rides recorded on our trail counters," Sarah said.

Peter White has been running Dwellingup Adventures for nearly 30 years, leading visitors and school groups on outdoor adventures in the forests and rivers around Dwellingup. He sees a bright future for trails, the outdoors and for the area.

"Getting people outdoors has been a big part of my life. I have seen first-hand the impact outdoor experiences have on people's lives," Peter said.

"They often become fitter, healthier, more confident and you can see through time in nature they form a connection to that place. The focus on trails has lit a fire on a new era of trail tourism for Dwellingup, and it's burning bright.

"Over the years we have seen the focus change to outdoor pursuits and the area's natural environment is becoming as highly valued for tourism as it once was for timber. The Bibbulmun Track and Munda Biddi Trail both come right through town and this made trail tourists more visible."

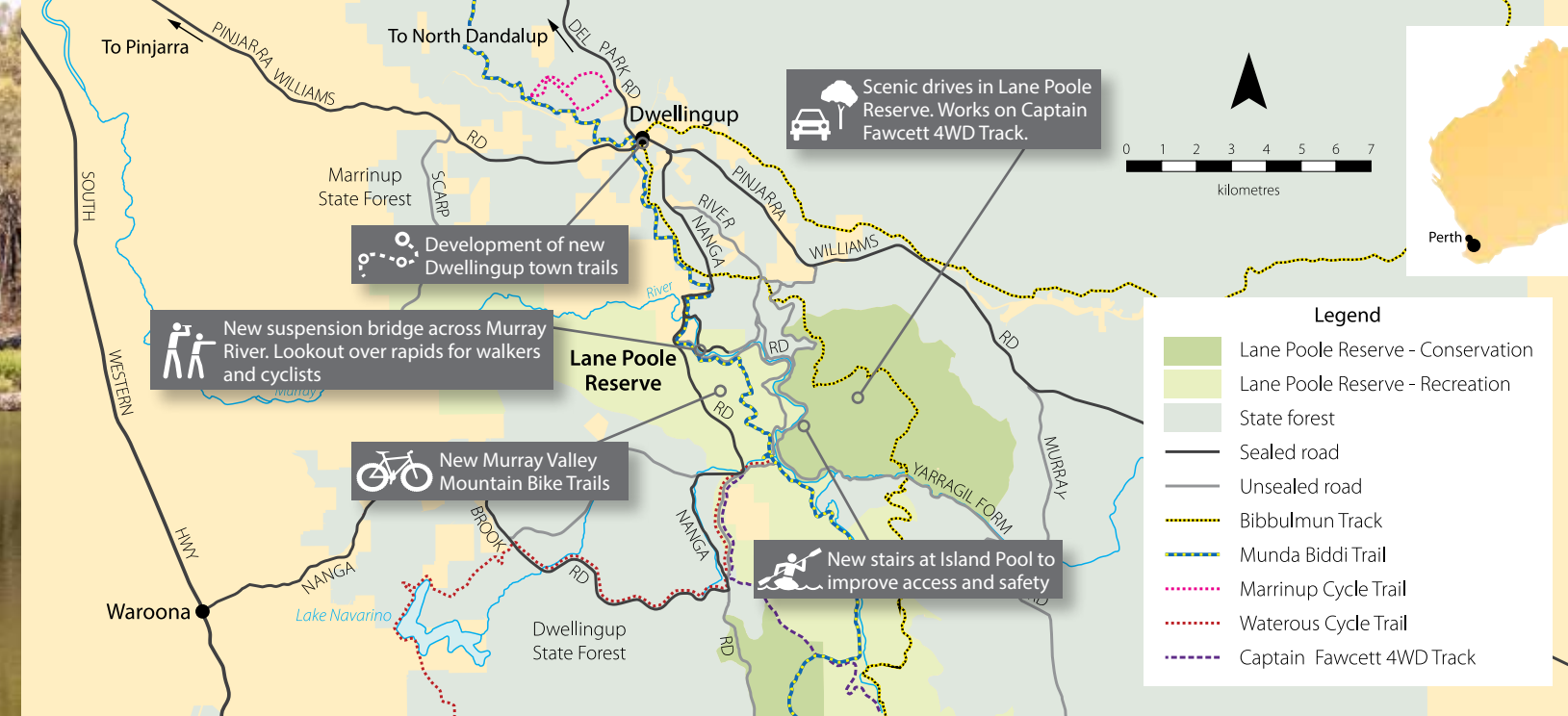


"Since the official opening in October 2020, there have been more than 100,000 rides recorded on our trail counter."

Previous page
Main Rider on the Murray Valley Mountain Bike Trails.

Above Riders taking a break on the nearby Murray River.
Photos – Tim Bardsley-Smith

Left Murray Valley Mountain Bike Trail Network.
Photo – Rod Annear



Dwellingup Trail and Visitor Centre

The Dwellingup Trail and Visitor Centre sits proudly in the middle of town, offering visitors the latest information on trail adventures and features interactive digital maps, virtual reality trail experiences, maps, guides, equipment and more. It also houses the Waypoints Café, where you can refresh and refill before/after hitting the trails, and an outdoor shop. Here you can hire or purchase outdoor equipment including bikes, water craft, camping gear and spares. The Centre sits between a bike pump track and skatepark and the Hotham Valley Railway, where steam trains take you on a trip through surrounding forest.

Top The Roost trailhead sign.

Above A trail with personality! Trail marker signage, Murray Valley.

Far right Dwellingup Trails and Visitor Centre. Photos – Rod Annear

Right Dwellingup Pump Track. Photo – Tim Bardsley-Smith



What is a trail town?

A 'trail town' is a population centre offering a large range of high-quality trails, trail-user-related services, facilities, trail-related businesses and supportive governance. In addition to meeting specific distances of sanctioned, signed and high-quality purpose-built single-track mountain bike or hiking trail towns will need to meet a range of essential criteria.

The Trails WA Trail Town Accreditation Program is a tailored, best practice accreditation system designed to help communities become world class trail tourism destinations.

Independent not-for-profit organisation Trails WA rolled out the trail town Accreditation program for aspiring trail towns in Western Australia. Dwellingup will be among the first towns to go through this accreditation process.



A greater focus on trails has seen Dwellingup adopt tag lines, 'Where Trails Meet' and 'Wild at Heart,' with the Shire of Murray and locals beginning to think about how Dwellingup could become a 'trail town'.

Steve Bennett has been working on trails and trail development in Western Australia for more than 15 years.

"Since 2012, towns across WA were assessed to see how well they measured up as possible trail towns and Dwellingup was one of the first places we looked at," Steve said.

"While the town has some great qualities, there were gaps in the number, variety and length of trails as well as information and services such as food, accommodation and transport."

John Cusack is an architect who made the tree change to Dwellingup in 2014 and saw the potential of Dwellingup becoming a trail town.

"It's a special place to live," John said.

"Nature is on your doorstep; the town has character and soul and the people who live here are motivated to see the

Dwellingup Adventure Trails

From all the planning and enthusiasm for trails in Dwellingup, the Dwellingup Adventure Trails project came to life. A joint Federal, State and Local Government project will see the following projects rolled out by 2022–23



**DWELLINGUP
ADVENTURE
TRAILS**

Mountain bike trails

- 32 kilometres of new, dedicated mountain bike trails in Murray Valley and near Dwellingup
- Eight kilometres of realigned Munda Biddi Trail linking Dwellingup to trails network

Canoe trails

- New stairs at Island Pool on Murray River to improve access and safety

Scenic drive trails

- Sealing of roads in Lane Poole Reserve

Dwaarlindjirraap Trail Centre

- Commercial 'pop-up' centre by private operator with kiosk, equipment hire and services complementing the Dwellingup Trails and Visitor Centre

Suspension bridge

- New suspension bridge across Murray River linking Baden Powell with Murray Valley mountain bike circuit
- Lookout over the rapids for walkers and cyclists



town prosper. Many people got involved to develop a community-led trail plan for the town. To see this becoming a reality is incredibly rewarding.”

The townspeople of Dwellingup are very supportive of developing the trail town, and the Shire of Murray has been at the forefront, leading the change and transformation.

Shire of Murray CEO Dean Unsworth has applied his infectious enthusiasm to the vision of Dwellingup becoming a trail town.

“We had a look at what others were doing around Australia and the world

and quickly realised we had the makings of a first-class trail destination here in Dwellingup,” Dean said.

“Council and community were on board with the idea to invest in new infrastructure to support visitors coming to town for trail adventures.”

From that enthusiasm and planning, the Dwellingup Trail and Visitor Centre

was born; a new facility to welcome visitors seeking trail adventures. Trail and visitor centre manager Susan Allan said the new facility has been a raging success.

“Since we opened in September 2020, visitation is up by 190 per cent and sales are up by 30 per cent. We couldn't be more pleased with how much visitors love the new centre,” Susan said.

Opposite page

Top far left Marrinup Falls, Dwellingup.

Photo – Josh Cowling/Shire of Murray

Top left Camping at Lane Poole Reserve.

Photo – Tourism WA

Above Murray River, Lane Poole Reserve.

Right Morning mist at the Murray Valley Mountain Bike Trails.

Photos – Josh Cowling/Shire of Murray



Rod Annear is the assistant director visitor services with DBCA's Parks and Wildlife Service and can be contacted at rod.annear@dbca.wa.gov.au or (08) 9219 8524.





MEGA GEOLOGY

Western Australia's giant landforms

Millions of years before Aboriginal peoples roamed the land of Western Australia, earth movements buckled and faulted rocks, causing them to rise and lower, creating giant landforms. Some of our favourite natural areas such as the Stirling Range and Karijini have an incredible geological history and significance.

by Professor Ross Dowling AM and Mike Freeman

Some 200 million years ago the supercontinent Pangaea broke into two land masses—Laurasia in the north and Gondwana in the south. Australia was part of the latter supercontinent, known geologically for being 'old, flat and red'. In the west, former mountain ranges have been eroded with the sediments creating large flat areas, or being washed into basins on the edge of the continent.

Delve deeper and we find the landscapes, landforms and rocks of Western Australia show remarkable diversity and significance. WA's national parks contain many different geological provinces as well as many of the State's giant landforms. Some examples are captured in the national parks of Mount Augustus, Karijini, Stirling Range and Cape Range.

MOUNT AUGUSTUS

**1109 kilometres from Perth,
474 kilometres from Carnarvon**

Mount Augustus (Burringurrah) is in an area between two large and old blocks of the Earth's crust, termed cratons, which form the nucleus of the continent. The southern Yilgarn Craton contains rare mineral grains up to 4400 million years old, the oldest parts of Earth, and were formed in a mere 100 million years—just after the solar system formed from the original solar nebula. The northern Pilbara Craton contains fossil stromatolites, the oldest proven forms of life on Earth dated at 3450 million years old. The Yilgarn Craton and the Pilbara Craton started colliding about 2200 million years ago and continued to collide until about 1800 million years ago. This produced a 250-kilometre-wide area called the Capricorn Orogen.

The Orogen was then affected by many periods of earth movements that folded, buckled and faulted the rocks, lowering and raising them—it was a zone of ongoing earth activity starting

at the time of the collision and finally ceasing around 900 million years ago.

After the collision, at about 1600 million years, rivers deposited sands and conglomerate eroded from the cratons. Later the ocean flooded the area and more sand was deposited with layers of mud and volcanic lavas. Uplift resulted in erosion of

much of these layers, but left a prominent mountain consisting mostly of the river-deposited sand named the Mount Augustus Sandstone. This is Mount Augustus, a prominent elongate inselberg (German for 'island mountain'), a peak rising to an altitude of 1105 metres, about 700 metres above the surrounding landscape.

Mount Augustus and the boy called Burringurrah

Mount Augustus and surrounds are the traditional lands of the Wajarri people. Burringurrah is the Wajarri name for Mount Augustus. In times of plenty, the Wajarri people would roam over a wide area of the Gascoyne. In times of drought, they would return to areas where water was available, such as the natural springs along the base of Mount Augustus. Aboriginal occupation is evident by engravings on rock walls at Mundee, Ooramboo and Beedoboondy visitor sites, and numerous stone tools discovered in these areas. Burringurrah continues to be a significant site for the Wajarri people.

According to the Wajarri Dreamtime story, Burringurrah was undergoing his initiation into manhood. The rigours of this process so distressed him that he ran away, thereby breaking Aboriginal law. Tribesmen pursued the boy, finally catching up with him and spearing him in the upper right leg as his punishment. Burringurrah fell to the ground; the spearhead broke from its shaft and protruded from his leg. The boy tried to crawl away but was hit with a mulgurrah (fighting stick). Burringurrah collapsed and died, lying on his belly with his left leg bent up beside his body. You can see his final resting pose when you approach Mount Augustus from the south. The geological fracture lines at the western end of the inselberg indicate the wounds inflicted by the mulgurrah. Look for the spear stump in his leg that today is called Edney's Lookout.

Previous page

Main Hamersley Range, Karijini National Park.

Above Mount Augustus (Burringurrah).

Photos – David Bettini

Right Moon setting over Burringurrah.

Photo – Janine Guenther





KARIJINI

**1250 kilometres from Perth,
650 kilometres from Exmouth**

Karijini National Park is located in the Hamersley Range area of the rugged sedimentary Hamersley Basin, which lies south of and covers part of the granite and greenstone-based Pilbara Craton. The range extends 300 kilometres east-west and comprises mostly horizontal layers of red, iron-rich rocks dissected by deep gorges affording spectacular rugged scenery in ancient geological formations.

The area has been relatively stable for two billion years and is important for its minerals, particularly iron ore. After 1960, large iron mines were developed at Mount Tom Price, Mount Newman, Paraburdoo, Pannawonica, and other sites. By the early 1990s, the range accounted for more than 90 per cent of Australia's iron ore production, which is nearly 40 per cent of the global demand for iron and steel.

In the national park, mountains and escarpments rise out of the valleys. The high plateau is dissected by breathtaking gorges, and stony, tree-lined watercourses wind their way over the dusty plain. Erosion has slowly carved this landscape. There are many beautiful gorges and sites to visit (see 'Rocking the patterns' on page 36) including Dales Gorge with Fortescue Falls, one of a number of permanent waterfalls in the park. It cascades more than 20 metres down a series of natural rock steps before finishing in a large, picturesque pool. Also within the national park is Mount Meharry; at 1249 metres

it is the highest mountain in Western Australia.

In an Aboriginal Dreamtime story, Barrimirndi was a Warlu, or giant sea serpent, who emerged from the sea at Coral Bay. He meandered his way across the land, forming waterways as he went. As the legend goes, Barrimirndi became angry with two boys who cooked and ate a parrot. Barrimirndi followed the scent of the singed feathers in search of the boys. Travelling underground, he wove his way up the river now known as the Fortescue, cutting gorges and rivers into the landscape. Sometimes he broke through the surface to check for the scent, creating a waterhole before disappearing underground again.

While the rocks are regarded as being old, they are only about half the age of the Earth, having been deposited between about 2800 million years ago and 2200 million years ago. They were laid down on the Pilbara Craton, mostly in shallow seas. Geologically they contain the world's best-preserved sequence of volcanic and sedimentary deposits of Archean to Proterozoic age. The iron-

rich rocks are thought by most geologists to have been deposited in response to the Great Oxidation Event, arguably the greatest environmental change the Earth has ever experienced, when organisms started to enrich the atmosphere with oxygen. However, since deposition of the sediments, the region has been little-affected by earth movements except being uplifted, and so the sedimentary layering is still horizontal.



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Above Fortescue Falls, Karijini National Park.
Photo – Jiri Lochman

Above right Hamersley Range viewed from Mount Meharry.
Photo – Cliff Winfield

Right Dales Gorge, Karijini National Park.
Photo – Marie Lochman



STIRLING RANGE

**400 kilometres from Perth,
95 kilometres from Albany**

The Stirling Range or Koikyennuruff in the south of the State stretches for 65 kilometres from east to west as a series of rugged ranges and isolated peaks. The range is home to Bluff Knoll or Bular Mial, the tallest peak, standing at 1095 metres above sea level and a place where the local Menang people believe the spirits of Noongar people go after death. Several other peaks rise to between 700 metres and 950 metres. The area is within the Stirling Range National Park, originally gazetted in 1916.

The bedrock of the Stirling Range consists of quartzite, sandstone, shale and slate. These were sediments deposited in a sea possibly as early as 2000 million years ago. Later, at about 1140 million years they were subjected

to earth-movements and heating that metamorphosed the sedimentary rocks, converting some of the shales to slates and sandstones to quartzite. This occurred when the range was thrust upwards to its present elevation. The quartzite is tough and resists erosion and is the rock that preserves the highest peaks. The geological setting is enigmatic and still not clearly understood. The Stirling Range rocks sit on Yilgarn Craton rocks, which are at least 500 million years older, and are on the northern margin of the Albany-Fraser Orogen, the site of a collision between two continental plates between 1300 and 1100 million years ago. There are suggestions similar rocks occur in India as the Indian subplate once was connected to the west coast of Australia that split apart during one of the Gondwanan break-ups about 130 million years ago.

When first upthrust, the range was originally much higher than it is today. The large amount of erosion that removed much of the former range has carved the present range into various spectacular formations, especially on the craggy higher peaks. Being so high and surrounded by lowlands between 150 metres and 250 metres altitude, the range creates a climate of its own and, along with that, there is a huge diversity of more than 1000 species of wildflowers, more than 100 of which are unique to the Stirling Range.



.....
Top left Talyuberlup Peak, Stirling Range National Park.

Photo – Jiri Lochman

Left White mountain myrtle (*Hypocalymma phillippsii*).

Photo – Ann Cochrane

Below View from the top of Bluff Knoll, Stirling Range National Park.

Photo – Marie Lochman





CAPE RANGE

1300 kilometres from Perth,
50 kilometres from Exmouth

The Cape Range peninsula lies within the Carnarvon Basin geological province, the host to the huge oil and gas reservoirs of the North West Shelf. The range was formed as a result of uplift associated with tectonic compression during the break up of Gondwana. This tectonic uplift has resulted in an anticline extending for 100 kilometres in a north-south direction with a structural relief of 450 metres comprising spectacular limestone hills, gorges and coastal scenery.

The range hosts an extensive karst system of national and international significance, its importance being that it was formed over a sequence of different climatic phases from wet to arid conditions. This has been an important driver of biological evolution as demonstrated through the significant speciation and adaptation evident in the subterranean fauna of the area (see 'Endangered! Subterranean animals of the North West Cape', *LANDSCOPE*, Spring 2001). Of major note is the presence of

unique local biodiversity in different cave systems, showing the evolution of the troglofauna and stygofauna (animals that live in caves, either in the air or under water) in isolated cave systems and did not mix with other systems along Cape Range.

Local cavers have recorded more than 580 caves in this karst landform. It is important because it is a relatively young limestone whereas most other karsts in Australia are formed in older limestone. The karst system is still active, particularly on the flanks of the range and beneath the coastal plain, and it demonstrates simultaneous erosional and depositional karstic processes.

Bundera sinkhole lies within the Cape Range peninsula anchialine system and hosts rare and unique aquatic subterranean animals. It is the only known habitat of remipedes in Australia;



a class of blind, colourless crustaceans (*Kumonga exleyi*).

While the State's national parks contain magnificent fauna and flora, they are also home to some wonderful landscapes, landforms and geologic features, many of which have been interpreted on sign boards and brochures within the parks. So, next time you visit one of WA's parks, take time to appreciate the landscape and landforms as they underpin all that lies above.



Above Bundera sinkhole, a Cape Range peninsula anchialine system.

Photo – Tiffany Taylor

Above right Cape Range National Park.

Photo – Tourism WA

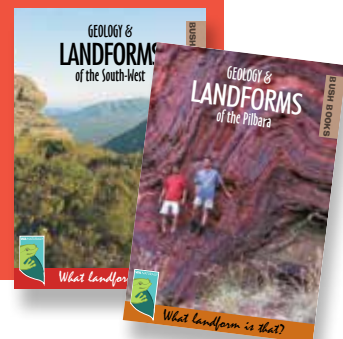
Right Yardie Creek, Cape Range National Park.

Photo – Cliff Winfield

Professor Ross Dowling AM is an Honorary Professor of Tourism at Edith Cowan University where he specialises in research on geotourism and geoparks. He can be contacted at r.dowling@ecu.edu.au or 0419 930 987.

Mike Freeman is a widely experienced geologist and amateur naturalist who loves spreading the word to the community of the fundamental joy that can be obtained by a knowledge of the geology that is all around us. He can be contacted at mike.j.freeman@bigpond.com or 0412 689 978.

WA's beloved Bush Book series features publications about the geology and landforms of Pilbara and South-West. You can purchase them for \$6.95 each from shop.dbca.wa.gov.au.



*William Edward
Blackall*

DOCTOR AND BOTANIST



After an honourable career as a medical officer, helping to raise two children and serving in the Great War, Dr William Blackall's passion for collecting and recording wildflowers couldn't be quashed. Little did he know, his some 5000 floral specimens and their illustrated keys would serve as the quintessential reference for identifying Western Australian wildflowers.

by Bruce and Peter Blackall

William Edward Blackall was born at Folkestone, Kent, in England in 1876. Even as a small boy he was interested in wildflowers and roaming in 'the warren', a nearby nature conservation site. On one occasion, young William happened upon a man who was looking at a flower through a magnifying glass. The man, seeing the young boy's interest, allowed him to look for himself and the beauty he saw launched his lifelong interest and love of wildflowers.

Following his graduation as a medical doctor from University of Oxford in 1904, Dr Blackall and his wife, Ethel, migrated to Western Australia. When asked why Western Australia, he said he had heard how lovely the wildflowers were and he had accepted a position as a medical officer at the Fremantle Asylum, mental illness being one of his professional interests. Between building a medical practice, helping to raise two children and serving in the Great War, Dr Blackall could only rarely indulge his love of botany, slowly building what was to become the 'Blackall Collection' of some 5000 specimens of Western Australian wildflowers.

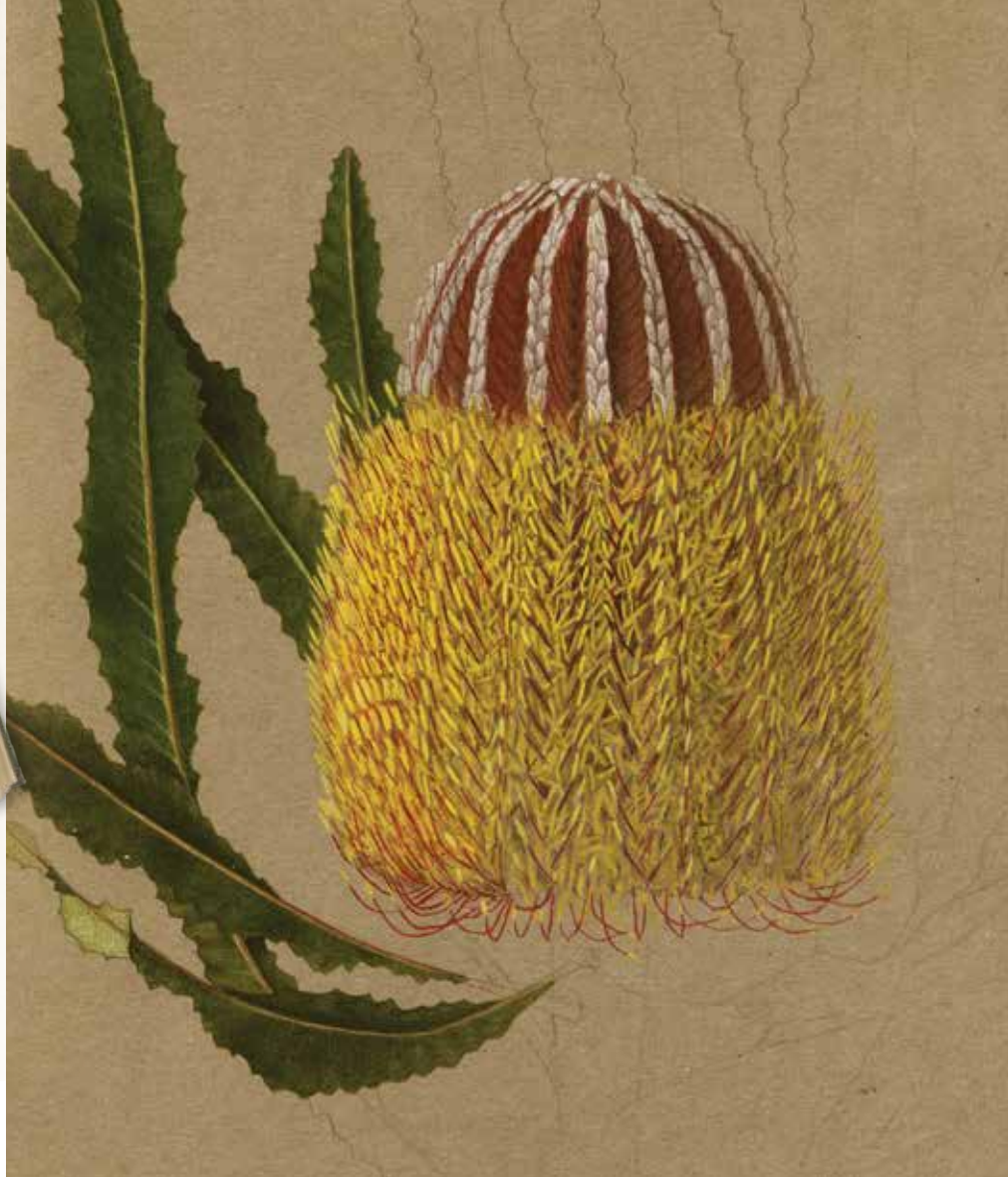
During the period from 1908 to 1910, Dr Blackall painted ninety-three watercolours of Western Australian wildflowers, now housed in the DBCA library. These beautiful paintings show Dr Blackall's artistic skills as well as his keenly developed powers of observation. The paintings incorporate detailed and carefully labelled drawings, illustrating floristic and structural features. This technique was to feature prominently in his subsequent flora identification project, an illustrated key designed to enable people with an interest in learning about wildflowers to do so even without significant technical botanical knowledge.

During the 1920s, Dr Blackall built a reputation as an outstanding and compassionate doctor, as a general physician, surgeon and obstetrician. However, despite his significant medical workload, Dr Blackall's interest in wildflowers remained. His collection of specimens continued to grow as did the development of his illustrated key. It was initially not known how Dr Blackall came to develop his illustrated key method. It was Professor Grieve from the University of Western Australia who formed the view that it may have been influenced by Gaston Bonnier's books on botany. It was not until May 1984 that a copy of one of Bonnier's books, purchased by Dr Blackall when in France during the war, was uncovered in the DBCA library, as it had been gifted by his wife after Dr Blackall's death in 1941. With the words 'mentor' inscribed in Dr Blackall's handwriting, the mystery was finally solved.

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Main Featherflower (*Verticordia etheliana*) named in honour of Dr Blackall's wife, Ethel.
Photo – Eddy Wajon/Sallyanne Cousans Photography

Inset far left Watercolour by Dr Blackall of a species of spider orchid dated September 1910.

Inset left Dr William Blackall.
Images courtesy Blackall family



Hear more about Bruce and Peter's research journey

Scan this QR code or visit Parks and Wildlife Service's podcast.



VOYAGE OF DISCOVERY

Dr Blackall made many collecting trips around the State, the longest in 1931 when Government Botanist Charles Gardner joined him for the first two months of a nearly six month trip. The pair travelled in a converted delivery van,

Top Dr Blackall's inscription in Gaston Bonnier's book, including the date '1918' and the word 'mentor'.

Above The illustrated key in Gaston Bonnier's book that inspired Dr Blackall's method of identifying WA wildflowers.
Photos – DBCA

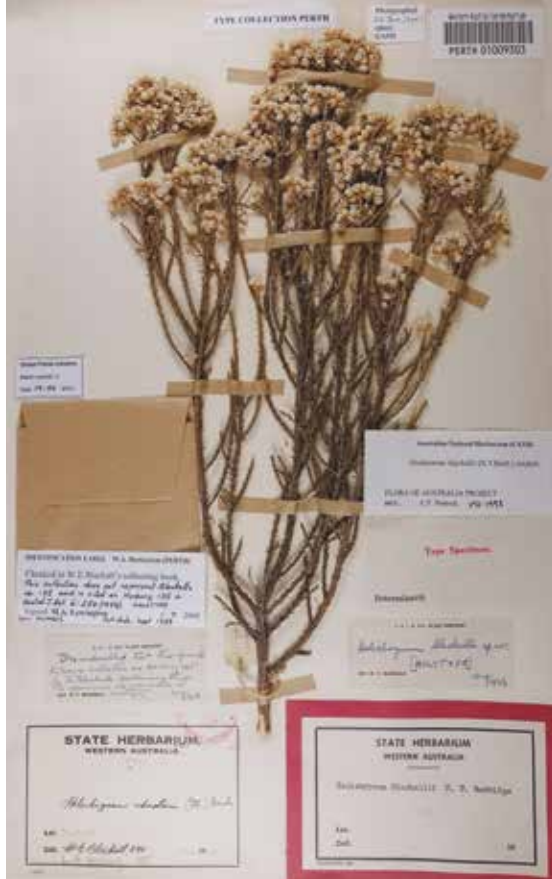
Above right Dr Blackall's watercolour of a firewood banksia (*Banksia menziesii*).
Image – Courtesy Blackall family

like those used by department stores in the 1930s, collecting wildflowers at every opportunity. The rough roads and basic facilities did not dampen their enthusiasm for the task, and in every sense, this was a 'voyage of discovery' by two explorers.

In 1935, Dr Blackall and Ethel spent some months in England, working in the Kew Herbarium. He had taken many specimens of WA wildflowers with him and, on his departure, left several specimens with the Herbarium. Back in Australia, Dr Blackall spent most of his time collecting and working on his illustrated keys, to such an extent his wife complained that it was becoming 'a tyranny of labour'. Unfortunately, he did not live long enough to complete his work, dying of cancer in October 1941. Despite the sadness of his relatively early death, he left behind a wonderful botanical legacy.

This legacy, comprising paintings, herbarium specimens and a diary of his collecting trips, were donated by Dr Blackall's wife in May 1942, to what was then called the State Herbarium Board. The botanical collection is now housed at the Western Australian Herbarium. As important as these are, there was another component of Dr Blackall's legacy that was to have a lasting impact on the study of botany in Western Australia: the production of illustrated keys for the identification of the State's wildflowers.

Dr Blackall had started work on his illustrated key project in the early 1930s, but it remained incomplete on his passing, at which time the Government Botanist advised he was unable to complete the work as staff were committed to other projects. As a result, the manuscript languished for several years.



COMPLETING THE KEY

In 1948, Dr Blackall's family commenced discussions with the Chancellor of The University of Western Australia and Dr Brian Grieve, then Professor of Botany, on whether there was interest in completing Dr Blackall's 'Key to Flora'. At that stage it was anticipated a single volume would be produced, with additional volumes in future years to supplement work done by the Government Botanist of the day. Approval for this work was given by the UWA Senate in December 1948.

The first volume 'How to Know Western Australian Wildflowers' by W.E. Blackall was published in 1954 and edited by B.J. Grieve. Further volumes followed and while credit is given for the original work done by Dr Blackall, enormous credit must also be given to Professor Grieve for his years of dedicated research in producing the many subsequent volumes.

Possibly the nicest compliment was a letter to Professor Grieve from Mrs Blackall in December 1958 where she wrote, "I only wish you had been here in his lifetime, what a help and pleasure it would have been to him to have worked

with you. You and the whole staff have been so very loyal to his name, my very grateful thanks to all of them."

LIVING ON

In 1942, Dr Blackall was honoured by having a new genus *Blackallia* named after him; it contains just one species, *Blackallia nudiflora*. In the same year, a new species *Verticordia etheliana* was named after his wife Ethel Gray Blackall. In 1958, an everlasting daisy was named *Helichrysum blackallii*, now known as *Ozothamnus blackallii*. A further honour was bestowed on Dr Blackall in 1974 when a new genus *Nigromnia* was created, a play on the name Blackall. It also contains just one species, *Nigromnia globosa* (now called *Scaevola globosa* following taxonomic revision).

As a final tribute to Dr Blackall's legacy, the W.E. Blackall Prize in botany was commenced in 1953 by the Blackall family to be awarded to the student who shows ability throughout the Bachelor of Science with botany course, with the greatest promise in botany. The memory of Dr Blackall lives on through generations of young people with not only an interest in botany but also an interest in the wildflowers of Western Australia.



Top left Herbarium specimen of *Ozothamnus blackallii*, which was once called *Helichrysum blackallii*.

Top Bruce Blackall being shown the Blackall paintings by WA Herbarium Research Associate Margaret Lewington.
Photos – DBCA

Above The volumes of Dr Blackall's 'How to Know Western Australian Wildflowers' have been reprinted many times since 1954.
Photo – Jiri Lochman

Bruce Blackall is the grandson of Dr Blackall and a retired tax partner of Ernst & Young, Chartered Accountants. Bruce currently spends his time researching the life of his grandfather and can be contacted at blackall@iinet.net.au.

Peter Blackall is the great-grandson of Dr Blackall and has worked in Australia and overseas in the development sector while developing a keen interest in global botany and photography. He can be contacted at peter.blackall@gmail.com.



The secret life of grasswrens

The charismatic but elusive western grasswren are locally extinct on Dirk Hartog Island. Now with a translocation plan in preparation, scientists are taking the time to learn a little more about the secretive, mouse-like birds before the big move.

by Aline Gibson Vega
and Kelly Rayner





The cryptic cousins of the better known fairywrens, grasswrens have long been an obsession for serious birdwatchers. Lacking the vibrant hues of fairywrens, these birds have been described as drab in colour, and as a result they seamlessly blend in with their arid environment. Australia is home to 13 species of grasswren, which are not only hard to spot, but often only found in the most isolated parts of the country. The joy of spotting a grasswren is not just from the bird itself, but also the adventure that it brings from travelling to these remote, arid locations.

While charismatic, grasswrens are extremely secretive. They prefer to stick close to the ground, hopping from shrub to shrub, and are sometimes seen scuttling in the undergrowth. It's no wonder these birds have often been described as 'mouse-like'. Nests are hidden in the thickest of shrubs and the birds will flee into the vegetation at any sign of danger. Their secretive lifestyle means the species requires habitats containing dense shrubland but this necessity is thought to be one of the downfalls for grasswrens across Australia. Many species



are now threatened or are thought to have declining populations due to land degradation, which has resulted in the deterioration of the dense vegetation required by grasswrens.

DISAPPEARING GRASSWRENS

One particular grasswren, the western grasswren (*Amytornis textilis*) was previously found throughout much of the semi-arid rangelands of southern Australia but is now restricted to a small area of South Australia and Shark Bay in Western Australia. Their decline has primarily been attributed to the degradation of suitable habitat caused by heavy grazing from sheep, goats, cattle and rabbits. However,

Previous page

Main Perched female western grasswren (*Amytornis textilis*) at Hamelin Station Reserve.

Above left Male western grasswren having caught an insect at Francois Peron National Park.

Photos – Aline Gibson Vega

Above Coastal *Acacia* shrubland can also be suitable grasswren habitat.

Photo – Kelly Rayner

feral cats are also thought to have played a role in this decline, potentially preying upon these ground-dwelling birds, particularly in areas lacking the thick vegetation providing shelter from predators.

MANAGING THREATS

In Shark Bay, grazing pressure is being controlled in multiple areas. DBCA's Parks and Wildlife Service has removed goats and sheep from within Francois Peron National Park. The result is a thick *Acacia* shrubland on the peninsula. At the southern end of Hamelin Pool lies Hamelin Station Reserve, managed by Bush Heritage Australia. This property is also in the process of being destocked



“The cryptic cousins of the more better known fairywrens, grasswrens have long been an obsession for serious birdwatchers.”

to ease grazing pressure and help restore habitat. Introduced predators are also being controlled.

In addition to in-situ conservation actions, a translocation of the birds to Dirk Hartog Island is planned. This island in Shark Bay once had western grasswrens but they became locally extinct during the island’s time as a pastoral lease. This is part of the broader Dirk Hartog Island National Park Ecological Restoration Project, *Return to 1616*, which aims to return the island to a state similar to that when first discovered by Europeans 400 years ago.

A translocation is proposed but before that takes place, ecological and biological

research is being conducted to inform management actions. DBCA Biodiversity and Conservation Science staff, in collaboration with researchers from The University of Western Australia (UWA) and Bush Heritage are taking time to learn more about the western grasswren before the big move, to ensure the highest possible likelihood of a successful outcome.

LEARNING ABOUT THE SNEAKY BIRDS

PhD candidate Aline Gibson Vega from UWA is researching key pillars of the western grasswren’s ecology. One component of her research has been a

colour banding project, allowing her to follow individuals over multiple years. Aline has been documenting every territorial dispute and carefully finding

Top Aline Gibson Vega (left) and Kelly Rayner (right) carrying two birds in bags, and the netting equipment. Landscape is the typical chenopod shrubland in which they can be found.

Photo – Michelle Hall

Above Aline Gibson Vega measuring the head-bill length of a western grasswren.

Photo – Kelly Rayner



hidden nests (often found in the prickliest of shrubs) and has already gained valuable insight into the social structure of this species, as well as key nesting preferences. In addition, Aline has been conducting behavioural experiments to better understand how western grasswrens perceive unknown intruders in their territories.

A second component to inform decision making for the translocation to Dirk Hartog Island is the genetic structure of the source populations. Aline and collaborators from DBCA and Bush Heritage have successfully collected enough genetic samples over the last two years to investigate where best to source western grasswrens to establish the most

genetically viable population on Dirk Hartog Island.

FUTURE PLANS

All the information gathered from the research into western grasswrens in Shark Bay will directly inform the translocation plan for the *Return to 1616* project, hopefully resulting in a successful translocation.



Above left Western grasswren perched in *Acacia tetragonophylla* at Monkey Mia Reserve.

Above Banded female western grasswren, part of our study population at Hamelin Station Reserve.

Left A female western grasswren where it most feels at home, within shrubs.

Photos – Aline Gibson Vega

Aline Gibson Vega is a PhD candidate at the School of Biological Sciences.

She can be contacted at aline.gibsonvega@research.uwa.edu.au.

Kelly Rayner is a senior technical officer within DBCA's Biodiversity and Conservation Science. She can be contacted at kelly.rayner@dbca.wa.gov.au.

My earliest memory of mussels is from attending dinner parties in the early 1970s with my parents, and discovering new cuisines—olives, kabana, cheese cubes, salami, prawns and smoked mussels. It was radically different from our standard meat and three veg dinners but, as a fussy, spotty teenager, I wasn't particularly fond of any of these new flavours. Mussels were at the very bottom of my list. However, they have been a rich food source for indigenous Australians for millennia as they are highly nutritious and easy to harvest from seashore and freshwater habitats. Middens formed from thousands and thousands of discarded shells can be found around our shoreline testifying to their abundance and culinary appeal.

Mussels belong to a diverse class of molluscs called Bivalvia, so named because they bear a pair of 'valves', forming the shell that protect the animals' innards. They open them to feed, breathe, mate and give birth, and can snap them shut using the strong muscles attached to each valve. Freshwater mussels occur all over the world, but the sole freshwater mussel found in south-western Australia is Carter's freshwater mussel, (*Westralunio carteri*). This endemic species is unique, while the eastern Australian fauna comprises other, more distantly related genera.

A recent study published in the journal *Hydrobiologia* by Michael Klunzinger, Alan Lymbery (Murdoch University/WA Museum), Manuel Lopes-Lima, Andre Gomes-dos-Santos, Elsa Froufe (Portugal) and Lisa Kirkendale (WA Museum) took a new look at *Westralunio carteri* by obtaining DNA from various populations across south-western Australia. The results are fascinating. The researchers found three distinct genetic groups. The most northerly group was found from Gingin Brook, through the Darling Range to the Preston River. The most southerly group occurred from the Blackwood River to the Waychinicup River. The third group was restricted to Margaret River. Although the northern and southern groups were highly divergent, the Margaret River group was more closely related to the



Freshwater mussels

southern group, suggesting a more recent evolutionary history.

What did they deduce from their study? First, they're old. The Western Australian *Westralunio* populations living today had a most recent common ancestor during the mid-Miocene, ca. 11 million years ago—that's a very old mussel-ly Eve. And the southern and Margaret River populations separated during the late Miocene/Pliocene, ca. 5 million years ago. This also coincides nicely with the geology of south-western Australia, which formed two drainages, one on the south coast and the other on the west coast, during the Eocene (56–34 million years ago). Furthermore, an earlier study by Michael and other collaborators discovered that *Westralunio* separated from most of the eastern Australian species during the Jurassic, ca. 170 million years ago, when dinosaurs walked the Earth.

Second, mussels don't migrate and have a limited dispersal ability. This seems rather obvious as they live their entire lives in the sediments of freshwater ecosystems. The genetic data prove the three groups lack gene flow between regions, spending their entire lives in different water catchments.

Third, the authors suggest each of the three *Westralunio* groups should be managed for their own unique conservation values, as the molecular evidence suggests they represent more than one biological species,

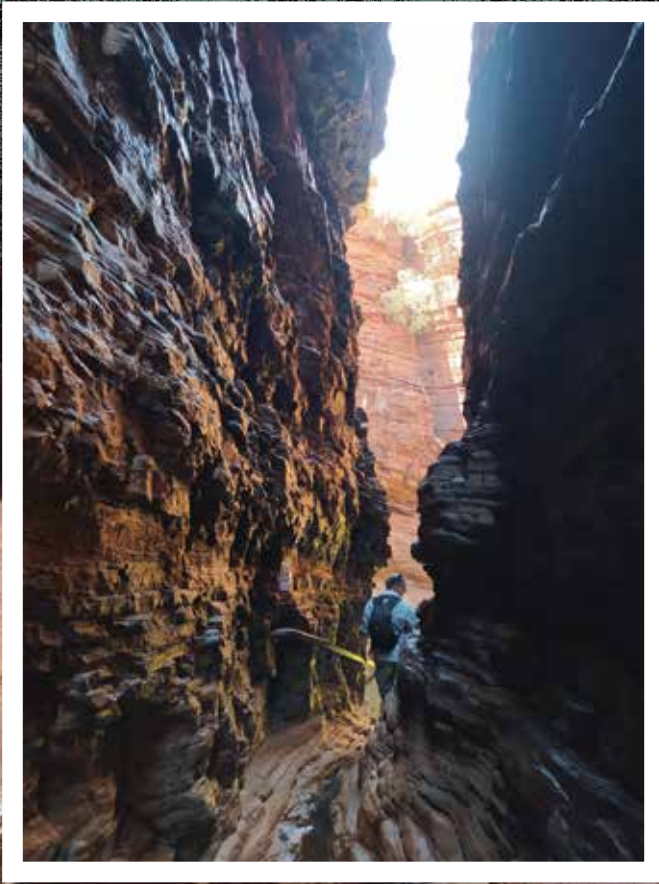
Above Freshwater mussels (*Westralunio carteri*) show significant genetic divergence across south-western Australia.
Photo – D.L. Morgan

even though morphological differences in their shells appear to be lacking.

The humble mussel isn't flamboyant (although they have gorgeous nacre on the inside of the valves). In fact, the only evidence I have ever seen of them is their discarded shells on the side of pools and rivers. And now I come to think of it, how did the shells get there? Natural events? Pigs? Humans? Natural predators such as rakali (water rats)? Water birds? Or perhaps our iconic marron? The shells rarely exceed eight centimetres, and they may live up to 50 years, making them a long-lived and iconic element of our south-western fauna. They play an important role in maintaining healthy ecosystems with their filter-feeding activities.

If you are not able to see them in the wild at your local waterway, you can find them in the WA Museum's new showcase museum, Boola Bardip, where they are featured in the Wildlife Gallery.

Michael, his collaborators and indeed other researchers are shining a bright scientific light into a very dark place and uncovering ancient animals that deserve some love from us.



ROCKING THE PATTERNS

KARIJINI NATIONAL PARK

The cool, smooth rocks of Weano Gorge provide refuge from the searing heat of Karijini National Park. Liz Grant dives into the pools among the ancient rock formations and explores the sanctuary of the gorge's hidden caverns.

photos and text by Liz Grant

I have a thing about patterns. And rocks. The former are mesmerising, the latter, powerfully grounding and when in huge formations, awe-inspiring. This is what drew me to Karijini National Park. Patterns and rocks. Patterns of rock.

I am in sensory heaven—except for the persistent flies and the relentless baking daytime heat (it is late October and the tail-end of the best season for exploring Karijini). The rocks I love so much here—with their mouth-wateringly attractive banding reminding me of the layers of Viennetta ice-cream cake—are iron rich. Karijini is amid the banded iron formation of the Hamersley Range.

To me, the rocks are noticeably heavier than those I encounter in and around Perth and seem to be especially hot. I speculate it is the iron in the rocks that make them so very effective in taking up the heat and releasing it long into the

night. This makes the shade and chilly water in the gorges especially appealing. The river-gouged gorges are deep and, in many places, sheer-sided, which creates a wonderfully cool refuge.

Respite from the baking heat that dulls my senses gives me a chance to not just look, but to really see. After looking up at the immense cliff-face in Weano Gorge with its rock-on-rock layers sandwiched together by geological processes, and sometimes smooshed in folds and angles when the rock buckled under the pressure of horizontal compression, I notice the texture of rock down here, under my feet and hands. Worn smooth by millions of tons of water loaded with tumbling rock debris over eons, the satin surfaces I can reach are as polished as my ex-neighbour's kitchen floor (it was impressive).

Karijini has deep significance for its traditional owners and I can sense its importance. The rock passages leading to Handrail Pool heighten all my senses, especially balance. It is slippery underfoot and it's a novel experience to be so acutely aware of every step, feeling the contact between my trusty reef shoes and the unreliable rock surface, feeling for grip. Striding the pavements of Perth is no training for this. Whoever came up with the phrase 'walk in the park' wasn't talking about Karijini!

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Main A tapestry of time etched in rock—Hancock Gorge on the way to Kermit's Pool.

Inset The narrow passage in Weano Gorge opens to a roofless cavern cradling Handrail Pool.

Below Knox Gorge sentinel—a snappy gum (*Eucalyptus leucophloia*) grips the rocky red earth with gnarled and knobbly roots.



Culture etched in stone

Karijini National Park is the traditional lands of the Banyjima, Kurrama and Innawonga Aboriginal people. The Banyjima name for the Hamersley Range is Karijini, meaning 'hilly place'.

Do it yourself

Where is it? Karijini National Park is located approximately 1400 kilometres north of Perth and around 80 kilometres by road north-east of Tom Price.

Planning your trip: Warning! Flash floods can occur. Your safety is our concern, but your responsibility. Check travel conditions with Parks and Wildlife Service on (08) 9182 2000 or the Shire of Ashburton on (08) 9188 4444.

Visitor safety: Karijini National Park offers a variety of hiking trails classified according to Australian standards. Please select to suit your level of ability.

- Do not enter the gorges if there is significant rain in the area. If you are already in the gorges, leave promptly.
- Be prepared. Wear sturdy hiking shoes to get in and out of the gorges. Before hiking through water, change your shoes to those that can grip slippery wet rocks.
- Take enough water to stay hydrated while you are hiking, a minimum of 4 litres per person. There is no drinking water in the park.
- Keep your gear on your back and keep your hands free to help you balance.
- Stay on established trails and stand well back from cliff edges.
- Take care in the gorges. Rocks are smooth and slippery, particularly when wet.
- Walk with a companion. Do not enter these gorges two hours before sunset. You **cannot** follow these trails in the dark.
- Water in the gorges can be very cold, especially between April and September, and hypothermia can occur. During this time, the middle of the day is the best time to hike.
- Do not dive or jump into water.
- Do not take glass or alcohol into the gorges.

Protecting the park: To protect the park, drive, hike and camp only on designated roads, tracks and camping areas.

Park entry fees apply in Karijini National Park



REVERENT ROCK

In this narrow chasm in the earth there is a church-like hush. Well, until we start chatting and laughing, then sound echoes and rebounds off the walls and two people sound like a group of six or more. The water is chilly and each time we step or plunge into it we can't help but gasp and giggle.

We smile at strangers doing the same, partners in crime almost. This place

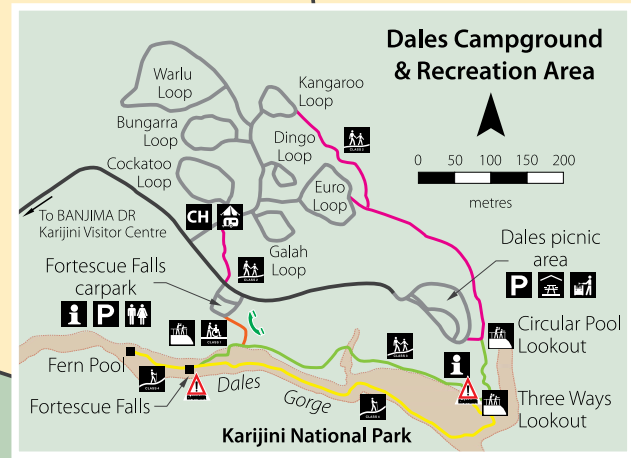
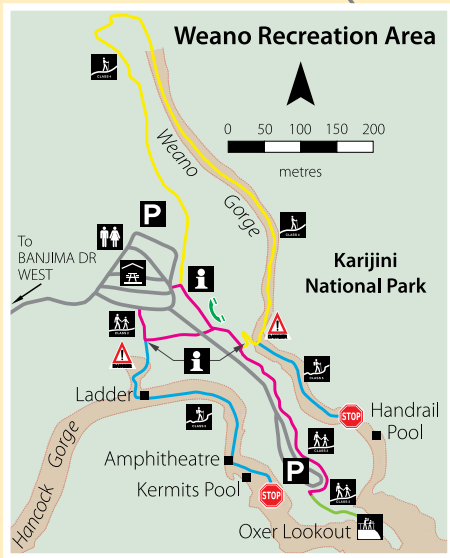
deserves reverence and our noise is just that, noise. But it falls away quickly and the aura of the place is undiminished. Not surprising really, these rocks have been around for some 2000 millions years and have been carved into the landform we now love to look at. Human existence is a mere ant in the path of the giant bulldozer that is geological time.

The immensity of this record of history visible in the slices of exposed rock face is mind-boggling. These gorges are like a vast library of books, so many that no one person could ever hope to read them all. Yet the library is a place of promise and full of hope. That's how I feel here, I can't read all the stories told by these layers of colour, whorls of texture. The patterns fascinate me, the beauty of them and the knowing there is much more to the story. As the

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Top Rockface reflections in Handrail Pool.

Above Rock sandwich with a swirl at Fortescue Falls, Dales Gorge.

Left Clumps of spiky spinifex carpet the landscape along the rim of Joffre Gorge.



Legend

Walk trail classifications

- Class 1 (Red)
- Class 2 (Pink)
- Class 3 (Green)
- Class 4 (Yellow)
- Class 5 (Blue)

Other symbols:

- Ranger's office
- Scenic lookout
- Information
- Toilets
- Parking
- Sheltered picnic table
- Gas barbecue
- Camping
- Campground hosts (seasonal)

Safety information

- Emergency radio
- Change in trail classification. Make sure you meet criteria.
- Do not proceed penalties apply. For enquires contact park staff.



Left Like craters on the moon, these pockmarks catch the eye on the Dales Gorge Trail.

Below Polished to a shine by floods of water. Kermits Pool, Hancock Gorge.

rocks weather, the pattern emerges and reveals the truth of the rock's composition. My fingers trace the bands, feeling for the story I can't translate but I can appreciate at a sensory level.

QUIET CAVERN

The narrow rock passage leading to Handrail Pool is dim but there is a sliver of bright light beaming through the tall gap ahead. The breeze feels cooler, smells wetter. But as I reach the narrow opening I get only a glimpse of the pool because the smooth rock floor drops away and I have to grasp the rail with both hands to inch my way around and down.

Safely seated I can explore the cavern with my eyes. It feels like a womb, the rock-enclosed pool is protected on all

sides, open only to the sky above, which is reflected in the surface of the pool. As is the rock face that rises high above us. Reflected light ripples across the cliff face as swimmers create gentle wave patterns on the water surface. The magic of light, rock reflecting on water and water reflecting on rock. Karijini is full of magic. The call of birds just before dawn and the creaky sound of crested pigeons' wings as they fly overhead. The glint of spiders' eyes in torch light at night. Water cascading down Fortescue Falls polishing the rock and creating a microclimate for ferns and other damp-loving plants. The gnarled roots of snappy gums digging in and clinging to the slopes above the gorges. The stiff white shafts of spinifex that somehow manage to look soft.

I'm in sensory heaven. Except for the flies, and the mind-numbing heat.



Liz Grant is an education communications officer with DBCA's Public Information and Corporate Affairs branch. She can be contacted at liz.grant@dbca.wa.gov.au or 9725 4300.

Editor's note As this article was going to print, an incident occurred at Handrail Pool that sadly resulted in the loss of a life. The LANDSCOPE team sends our condolences to the family and urges everyone visiting Karijini National Park to take the utmost caution, especially around the narrow passages within Weano Gorge that can be slippery underfoot.

THE HEAT IS ON

Flatbacks and a changing climate



Flatback sea turtles (*Natator depressus*) are special, nesting only on the beaches of northern Australia, with a number of key rookeries in Western Australia. A study is underway to assess the effects of climate change on flatback nesting sites in Western Australia's North West Shelf.

by Malindi Gammon and Carolyn Thomson-Dans



We are lying face-forward on the beach at Thevenard Island, off Onslow, still and quiet. Just in front of us, a female flatback gently rocks back and forth, releasing her glistening white eggs one by one into a perfectly formed egg chamber. Sea turtles have been around for 100 million years and witnessing the culmination of this—the nesting process—makes the exhaustion and occasional frustration of turtle research worth every sleep-deprived second.

Despite their persistence over evolutionary time-scales, today six of the world's seven species of sea turtle are internationally listed as Endangered or Critically Endangered by the IUCN. The only exception is the flatback turtle, which is classified as Data Deficient. The flatback is the only marine turtle with no oceanic stage in its early life history—it grows to maturity in the shallow waters of Australia's continental shelf. The flatback has the smallest geographic range of all sea turtle species, so it is particularly important to understand whether its nesting sites are vulnerable to the effects of a changing climate.

A study by PhD student Malindi Gammon, from The University of Western Australia, aims to provide crucial information to prioritise conservation actions for flatback turtles in the face of a changing climate. The project is part of the North West Shelf Flatback Turtle Conservation Program, which aims to improve flatback turtle conservation, management and research. This major long-term study of flatbacks that nest along the North West Shelf is funded through the Gorgon Joint Venture and managed by DBCA.

RISING OCEANS, HOT SAND

The nests of all sea turtle species are sensitive to climate change, due to increases in beach temperature, sea level and storm frequency. Sea turtle eggs develop in underground nest chambers on coastal beaches, where they can't avoid climatic effects such as flooding or suboptimal temperatures.



Previous page

Main Flatbacks produce smaller clutches than other sea turtle species, but their eggs are bigger and produce larger hatchlings with better swimming abilities and greater energy reserves, which presumably allow them to be better able to avoid predators in coastal shallow waters.

Photo – Malindi Gammon

Background Turtles leave distinctive tracks in the sand.

Photo – DBCA

Inset Adult female flatbacks can weigh 50–120 kilograms.

Photo – Jiri Lochman

Above Female flatback laying eggs.

Photo – Andrea Whiting

Right Flatback hatchlings have dark margins around their carapace scutes, giving their carapace a honeycomb appearance.

Photo – Kevin Crane/DBCA



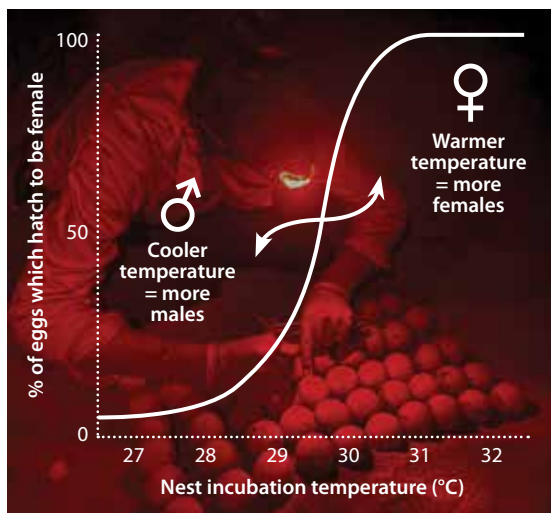
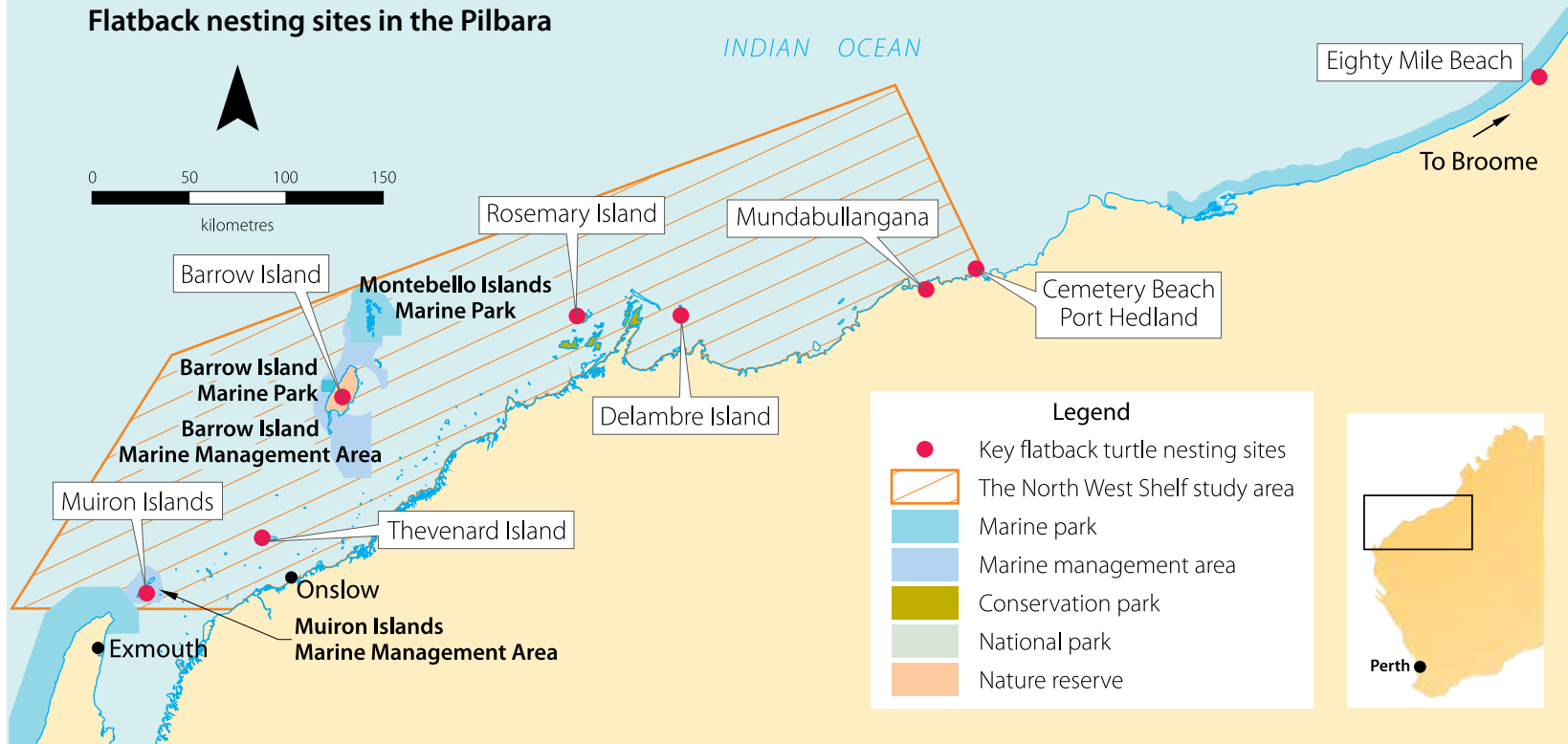
Incubation temperature influences everything from nest hatchling success to the sex of hatchlings, and even hatchling fitness and their chances of making it to the ocean. For the eggs to successfully hatch, a nest must remain above the high-water mark and stay within a narrow temperature range. Cooler temperatures produce males, while females develop at warmer temperatures. The temperature

effect on sex varies in different genetic stocks, so population-specific data are needed to accurately predict the impacts of climate change on specific populations.

If climate change continues unabated, widespread feminisation of turtle populations is likely, and many nesting beaches could become too hot for turtle embryos to survive. A changing climate induced by human activity is also predicted

“The nests of all sea turtle species are sensitive to climate change due to increases in beach temperature, sea level and storm frequency.”

Flatback nesting sites in the Pilbara



to increase the mean global sea level and storm frequency, which would expose nesting beaches to flooding, erosion, and more extreme storm events. Nesting females return to the same region from which they hatched, so may not be able to respond to these changes by moving their nesting sites.

DIGGING FOR DATA

To study the effect of sand temperature on the success of a turtle nest, timing is everything. Malindi must be on the beach at the exact moment a female turtle starts to lay. Each egg is delicately removed in a specific order,

counted and a random sample of the eggs measured, weighed and marked. The eggs are then gently replaced in the nest in the same position from which they were removed, with temperature loggers deployed at the bottom, middle and top of the nest. Malindi then covers the nest with sand, taking great care to camouflage it in the same way a turtle does. To ensure no impact on nest survival, this process must be completed within an hour of laying. The researchers return once the eggs have hatched (approximately 50 days later) to record hatching success, and download data from the temperature loggers, which enables Malindi to analyse

Above left Graph showing how nest incubation temperature impacts sex of hatchlings.

Above left background Malindi Gammon excavating a flatback nest.

Above Thevenard Island jetty and beach—a key flatback nesting area.

Photos – Carolyn Thomson-Dans

Discover more about flatback turtles

Scan this QR code or visit Parks and Wildlife Service's 'LANDSCOPE' playlist on YouTube.



NO GLOW, MOVE SLOW, STAY LOW

If you are lucky enough to see a turtle emerging from the ocean STOP, DROP AND ACT LIKE A ROCK and ensure you are 15 metres away with no torch light. Turtles are easily spooked and can return to the ocean if they see movement on the beach. To understand the nesting process and the associated viewing rules check out DBCA's 'Turtle Watching Code of Conduct' and other information at flatbacks.dbca.wa.gov.au



the effect of temperature on hatchling success rates.

Volunteers and researchers with the North West Shelf Flatback Turtle Conservation Program play an important role in this work. To date, with the help of many hands, Malindi has excavated 45 nests over three seasons. This work is carried out at various rookeries throughout the North West Shelf, including Thevenard and Delambre islands, and Cemetery Beach at Port Hedland

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Above Green turtles also nest on Thevenard Island and can often be seen returning to the ocean in the early morning.

Photo – Carolyn Thomson-Dans

Above right Flatback turtle hatchling.

Photo – Andrea Whiting

(administered by Care for Hedland). This builds a picture of incubation temperature and hatch success variation across the stock, with about 400 nests excavated in the past five years.

INNER WARMTH

Predicting incubation temperatures 10, 50 or even 100 years from now quickly gets complicated when embryos also produce their own heat.

Although sand temperature is often used as a proxy for nest temperature, the temperature of a sea turtle nest is not driven by sand temperature alone. Sea turtle eggs themselves generate heat as the embryo grows and develops. While the heat produced by a sea turtle egg is low, sea turtle nests contain 50–120 eggs depending on the species, and the heat produced by all eggs within a nest

(metabolic heat) collectively drives nest temperature well above that of the surrounding sand. This variable makes it harder to accurately predict incubation temperatures, highlighting the need to account for it.

Malindi aims to fill this gap by creating a biodigital model of the sea turtle nest, which demonstrates how multiple drivers, including climate and metabolic heat, interact to produce an embryo's microclimate. This model will advance our ability to predict the impact of climate change on sea turtle populations, and improve our understanding of the variables influencing the nest microclimate. Small differences in temperature can have a large impact on hatchling success. For example, if nest temperature is already at the upper limit for flatback eggs to successfully hatch (33–35 degrees Celsius) and metabolic heat



increases incubation temperature by just two degrees Celsius, this could lead to a very high mortality rate within the nest.

Malindi's model is being developed using flatback turtles, but she aims to develop an approach that can be applied to other sea turtle species.

THE PATH AHEAD

Around the world, researchers are assessing how vulnerable various sea turtle nesting sites are to our changing climate. Such assessments provide data to inform and prioritise management interventions such as beach shading to reduce sand temperature.

Malindi's project will undertake a vulnerability assessment for flatback turtles. She will use the information collected in her study to assess the vulnerability of flatback nesting sites in

the North West Shelf to the predicted changes in sea level, storm frequency and temperature. This will allow both wildlife managers and industry to prioritise management actions to protect Australia's only endemic sea turtle.

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Top Adult flatback turtles can be identified by their smooth carapace with upturned edges.
Photo – DBCA

Above left A rare sighting of a turtle nesting during daylight, with Malindi keeping a respectful distance.
Photo – Malindi Gammon

Above Red lights are used at night to limit any disturbance to turtles.
Photo – Carolyn Thomson-Dans

Right Flatback Turtle.
Illustration – Mandy Nielsen/DBCA

Malindi Gammon is a PhD Candidate at the School of Biological Sciences UWA. She can be contacted at malindi.gammon@research.uwa.edu.au

Carolyn Thomson-Dans is a former LANDSCOPE editor with DBCA and volunteers for the North West Shelf Flatback Turtle Conservation Program. She can be contacted at carolyn.thomsondans@gmail.com.

To get involved with the North West Shelf Flatback Turtle Conservation Program visit flatbacks.dbca.wa.gov.au

As this article was going to print, photographer and long-time LANDSCOPE contributor Kevin Crane sadly passed way. The authors and LANDSCOPE team send their condolences to Kevin's family.





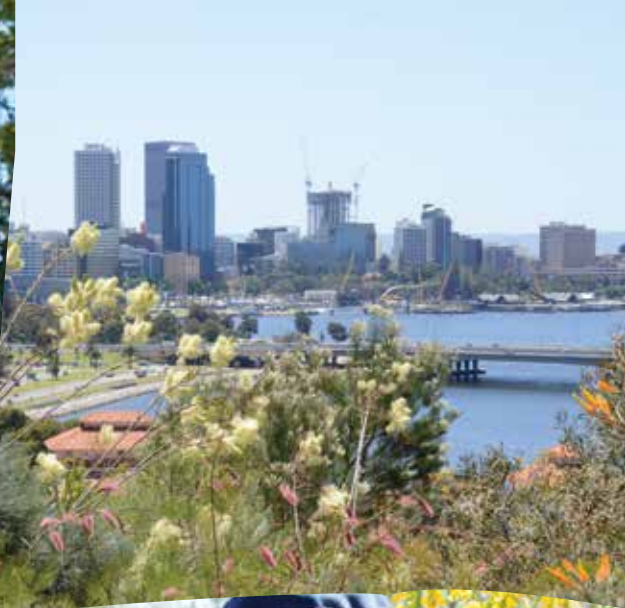
Top marks for KINGS PARK

Western Australians were asked for their thoughts on Perth's largest inner-city park and the results are in. Kings Park was rated 4.7 out of five stars by the WA public, and their views have contributed to a plan to ensure the iconic park and its incredible biodiversity will be enjoyed for years to come.

by **Scott Heffernan**

Western Australians have returned a glowing report card for Kings Park and Botanic Garden in a community survey conducted in 2020, with clear expectations for the park's role in conserving the State's flora and supporting the health of the community in its future management.

Much loved by visitors from all over the globe, Kings Park or Kaarta Koomba is one of the world's largest inner-city parks, covering 400 hectares and located 1.5 kilometres from central Perth. It sits on Mount Eliza, a major topographical



feature of Perth, and provides spectacular views over the city, the Swan River (Derbarl Yerrigan), Canning River (Djarlgarro Beeliar) and the Darling Range (Katamordo) further east.

GLOWING REPORT

More than 4500 survey respondents rated the park an average 4.7 out of five stars as a Perth visitor attraction. A desire for biodiversity conservation in line with remaining a safe and welcoming place for people of all ages and abilities ranked as top priorities for the community.

“There is an expectation that Kings Park will continue to provide high quality open spaces and amenities for recreation, play and community activities,” Botanic Gardens and Parks Authority (BGPA) Executive Director, Alan Barrett said.

“Many people are interested in learning about Whadjuk Noongar connections to Kings Park as well as receiving credible, locally relevant information on how to take action for the environment and improve their understanding of local biodiversity issues and sustainability,” Alan said.

Main Kings Park Festival.
Photo – Jason Thomas

Top View of Perth from Roe Memorial.
Photo – Dave Blumer

Above Kings Park education programs are very popular.
Photo – Jody D’Arcy



When asked to prioritise Kings Park's most important roles, survey respondents ranked the top five in the following order:

- 1) Sanctuary for native plants and wildlife
- 2) A place for WA families and the community
- 3) Environmental research and conservation
- 4) A significant place for Noongar people
- 5) A tourist attraction.

FUTURE PLANNING

The survey was timed to inform the drafting of the next management plan for

Kings Park and Botanic Garden. The plan considers the need to respond to population growth and urban infill as well as environmental challenges, the State Government's tourism goals, mobile information technology and community appetite to connect with nature for physical and mental health.

With all these factors considered and the results of the survey analysed, BGPA developed the *Kings Park and Botanic Garden Management Plan 2021–2025*. It outlines the activities and strategies 'to practise and inspire environmental conservation and celebrate local

identity by immersing and empowering communities in world-recognised botanic gardens, parklands and urban bushlands.'

While BGPA has statutory responsibility for the management of Kings Park, stewardship of its inherent values and cultural heritage is a role shared with the community.

"Strengthening community engagement and the participation of traditional custodians, key stakeholders and the broader community to achieve a shared sense of place, identity and belonging is a priority," Alan said.



Discover more about visiting Kings Park

Scan this QR code or visit Kings Park and Botanic Garden YouTube channel.





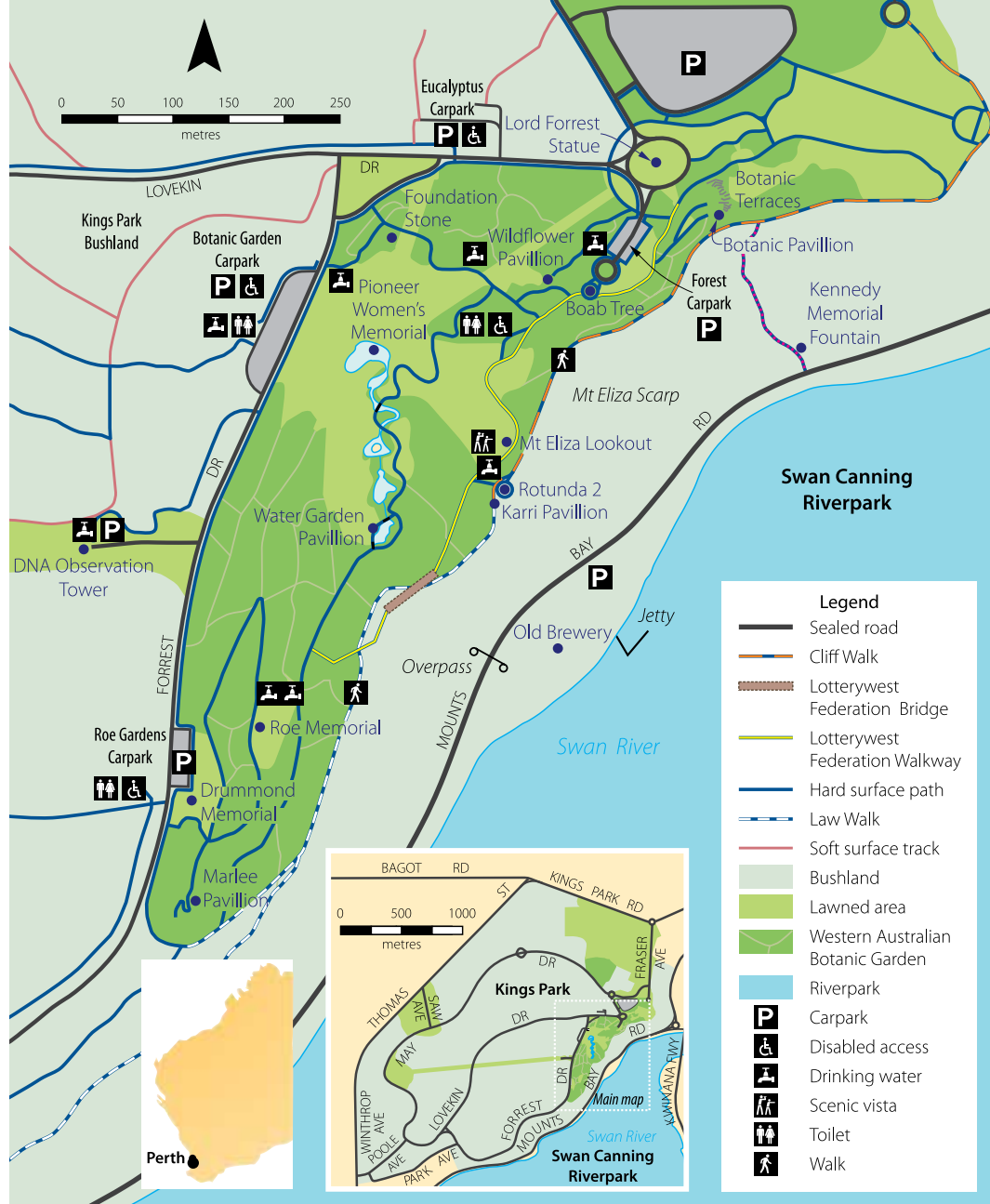
LIVING MUSEUM

The Whadjuk people of the Noongar nation are the traditional custodians of the land referred to as Kings Park and Botanic Garden. It is also known as Kaarta Koomba and Mooro Katta. The cliff face of Mount Eliza is also known as Kaarta Gar-up. The land has historic and continuing cultural significance to Aboriginal people and contains significant sites actively used today. These elements contribute to the rich cultural fabric of the park and underline its importance as a significant place for all Western Australians.

The area of the park was set aside for public purposes in 1831, and first gazetted as a public park in 1872. It was officially created as a class A reserve in 1900, affording it the highest level of protection available for public land under Western Australian law.

Today, more than two thirds of Kings Park is comprised of remnant banksia and tuart woodlands. The bushland is an important refuge for 327 native plant species, providing habitat for around 80 bird species, 20 reptile species, more than 300 species of fungi and an unknown number of different invertebrates.

BGPA's scientists are an important part of DBCA's Biodiversity and Conservation Science, and contributes valuable data on plant research and evidence-based outcomes. Survey respondents agreed protecting native biodiversity was the most important priority for Kings Park



in the next five years, with 87 per cent rating it as very important. The majority of respondents also regard BGPA's role in plant conservation and research as being very important.

ALL TOGETHER NOW

Displays and interpretation feature strongly around the park and promote Western Australian flora, conservation and the significance of plants to life on earth, making this living museum an environmental educational resource.

More than 1000 volunteers and supporters help to maintain Kings Park, which is a reflection of the great sense of community and connection between the park and the people of Perth.

Opposite page

Above left Rio Tinto Naturescape, Kings Park.
Photo – Jason Thomas

Far left Kings Park's dedicated volunteer guides.

Photo – Dave Blumer

Left Picnics near Pioneer Women's Memorial.
Photo – Jason Thomas

Above left Ceremonial dance in Kings Park.
Photo – Mark Griffin

Scott Heffernan is the manager of communication, marketing and sponsorship at the Botanic Gardens and Parks Authority. He can be contacted at scott.heffernan@dbca.wa.gov.au or (08) 9480 3684.

National parks in your pocket

The remoteness of some of Western Australia's parks and reserves is a drawcard for many, but can also pose problems with navigation. The WA Parks Foundation has teamed up with DBCA and BHP to create topographical maps that can be used offline on a smartphone for a growing number of national parks and reserves.

by Ainslie de Vos





Western Australia's spectacular network of terrestrial and marine parks encompasses more than 31 million hectares, including three World Heritage areas. The greater south-west of the State is one of only 36 internationally recognised biodiversity hotspots.

However, navigating around this vast natural estate of extraordinary beauty, biodiversity and cultural heritage can be a challenge in itself.

Recognising the need for park visitors to be able to download topographical maps for off-line use, the WA Parks Foundation developed Smart Park Maps

to assist with preparation, exploration and better experiences in the natural environment.

HOW IT WORKS

The idea is to download the Smart Park Maps onto the Avenza app before heading out. The maps are free to download from the Avenza map store, with the Avenza app freely available for Android or iOS devices.

Provided the maps are downloaded while there is an internet connection, they can be used in real time in the parks without a network connection or roaming charges.

The maps are useful for planning, providing information about accessibility, camping areas, caravan sites and other facilities as well as recreational things to do.

Once in the park, even when out of internet range, the maps can be used by park visitors to pinpoint where they are, see what is nearby, navigate trails, show the roads and campgrounds and find the way to sites of special interest.

The interactive maps enable you to see how far you have hiked or driven, plot photos and drop and move placemark pins with a tap of the finger.

SMART SERIES

Karijini is WA's second largest national park, and was the first park to be mapped in the Smart Park Maps series. Six other

Main Frenchman Peak, Cape Le Grand National Park.

Photo – Tourism WA

Inset left Smart Park Maps can be used in real time without an internet connection.

Above Kangaroo at Lucky Bay, Cape Le Grand National Park

Photo – Tourism WA



Discover more about the WA Parks Foundation

Scan this QR code or search for the WA Parks Foundation on YouTube.





much-visited national parks have since been mapped, Kalbarri, Cape Range, Stirling Range, Francois Peron, Cape Le Grand and Fitzgerald River.

“I had the pleasure of trialling the new maps for that superb park and was amazed at the ability to track my location even from the bottom of some of Karijini’s most spectacular gorges and rock formations,” the Hon Kerry Sanderson AC CVO, WA Parks Foundation Chair said.

“As well as being helpful from a safety viewpoint, the maps are fun to use.

“Recognising that many of our national parks have little or no mobile reception, we adopted the development of downloadable maps as one of our priority projects and the rollout on a priority list of 15 parks is going well.”

MANY HANDS

The Smart Park Map series has been developed in partnership with DBCA and is sponsored by BHP.

The joint aim is to have geo-referenced maps developed for all of WA’s national parks, now numbering more than 100.

BHP’s Minerals Australia President, Edgar Basto said Smart Park Maps help educate more people about responsible and safe experiences.

“BHP is pleased to partner with the WA Parks Foundation to support

the Smart Park Maps project, which enables an impressive level of detail and streamlined navigation to be shared with visitors while they are exploring some of WA’s most beautiful landscapes,” he said.

DBCA assistant director of Parks and Visitor Services Rod Annear said Smart Park Maps offer an alternative to the traditional park brochure with a map.

“The maps are useful and provide confidence for hikers, campers and park visitors, by providing them with as much information as possible, in real time,” he said.

“Users know what facilities, trails and activities are available when preparing their visit, as well as discovering where the next lookout, toilet, picnic area or swimming hole is as they adventure through the park.”

WA Parks Foundation’s Robin Piesse had the pleasure of venturing out into the wilderness to test the validity of the maps through ground truthing surveys.

“Our plan is to have another three national parks smart mapped within the 2021 financial year—Purnululu, Mount Augustus and Millstream Chichester,” she said.

Above left WA Parks Foundation Chair, Hon Kerry Sanderson AC CVO (centre) and friends, enjoying the Smart Park Maps in Karijini National Park.

Photo – Kerry Sanderson

Above Fitzgerald National Park is the latest park in the map series.

Below Francois Peron National Park.

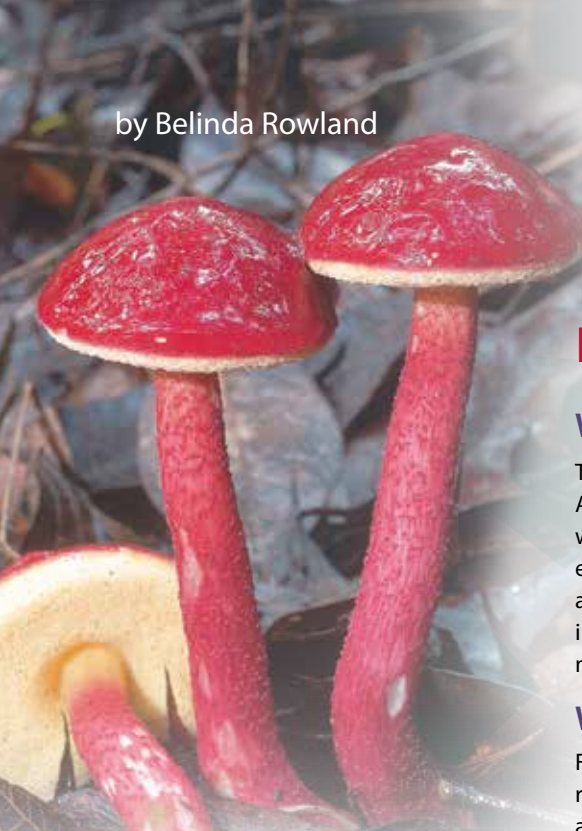
Photos – Tourism WA



Ainslie de Vos is a director with the WA Parks Foundation. She can be contacted at info@ourwaparks.org.au.

You can find out more about Smart Park Maps at ourwaparks.org.au/project/smart-park-maps/ and can download the Avenza app from the Apple store or Google Play.





Above Rhubarb bollette (*Boletellus obscurecoccineus*) is a very common species found in eucalypt forests.
Photo – Richard Robinson

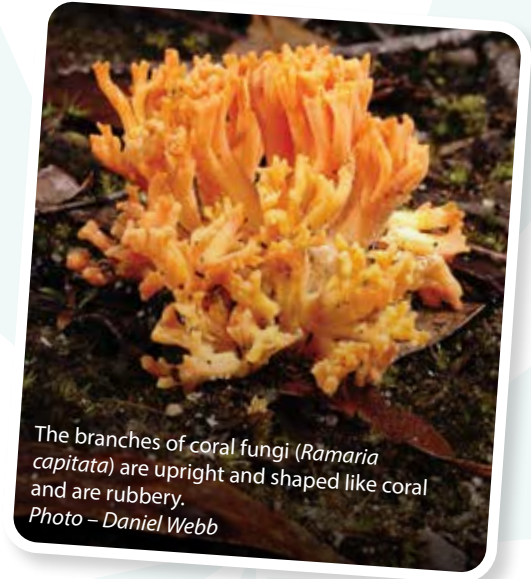
Funky Fungi Facts

Where do fungi live?

The tingle forest in the south-west of Western Australia has a wide range of fungi with wonderful colours. Fungi like to live on dead eucalypt trees and logs, especially ones that are fire damaged. Most of the fungi fruit in the autumn. Fungus fruit is what we call mushrooms, toadstools or brackets.

Why are fungi important?

Fungi are important decomposers, they are responsible for breaking down organic matter and they release carbon, oxygen, nitrogen, and phosphorus... all the things that plants love. They are essential in many households for making bread, and certain cheeses.



The branches of coral fungi (*Ramaria capitata*) are upright and shaped like coral and are rubbery.
Photo – Daniel Webb

Tingle forest wordsleuth

E R A H T B S J D C P F K L A
D Q I N J R O H K W C D L A P
R E T U W R E D T I N G L E A
I Y U A N I S E L Q Q X T F B
S Y U C S D L T T I P V K P T
W F J F A S E D T O A D C W X
O U D H U L E R F J P V L E A
R N M Y H B Y L S L T W T B H
D G W B Q S Q P F T O L A U I
G I Y R E E O U T L O W H L Z
R W B K A R R I O U O R E S K
A N C I E N T W U K S W E R O
S M I Y S C Z V J O K G E Y S
S F O R E S T E E R R A W R G
P Y S R O U U K Z Q R W U Z F



Curry punk is a bracket fungus. It gets its name because it smells of curry and gets stronger with age. It becomes stained orange by the orange flesh and its yellow pores leak out yellow juice.
Photo – Belinda Rowland

Look for the words below, which are hidden amongst the letters:

- Tassel flower
- Wildflowers
- Eucalyptus
- Red Tingle
- Quokka
- Karri
- Tree Top Walk
- Sword grass
- Understorey
- Ancient
- forest
- Fungi

Did you know
Fungi are part of the fungi kingdom, they are not animals or plants





Flatback turtle (*Natator depressus*)

Flatbacks can be identified by their smooth shell with scales that don't overlap. They are an olive green colour on top and pale on the underside. All recorded nests for flatbacks are in northern Australia, from the Pilbara and Kimberley in Western Australia through the Northern Territory down to southern Queensland. Hatchlings feed on tiny animals in the water (zooplankton) and adults on soft-bodied sea creatures that live on the ocean floor such as sponges, soft corals, feather stars and sea pens.

Illustration by Gooitzen van der Meer

Reference photo by Carolyn Thomson-Dans

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SPLENDID TREE FROG
(*Litoria splendida*)

The magnificent or splendid tree frog is a striking-looking tree frog that occurs in the Kimberley and has a superficial similarity to the green tree frog (*Litoria caerulea*). The splendid tree frog is the largest Western Australian frog (excluding the introduced cane toad).

DESCRIPTION Males grow to around 10.6 centimetres in length and females are larger, up to 11.8 centimetres long. The body is olive or green, spotted with usually circular sulphur-yellow or white spots. Sometimes these spots are ringed with black. There are enormous protruding parotid glands behind the eyes and over the top of the head. These glands are known to secrete peptides with antibiotic qualities.

DISTRIBUTION It is found across most of the Kimberley to the north and east of Derby and south to the Bungle Bungle Range. It is also found in a small area of the Northern Territory adjacent to the Kimberley.

PREFERRED HABITAT It is most frequently observed in sandstone caves or on rocks and trees along rocky watercourses. It is occasionally encountered in houses and amenities blocks.

LIFE HISTORY Following heavy wet season rains, males commence calling from rocks several metres from a creekline. Eggs are laid on or beneath the surface of the water. The tadpoles hatch in water. Up to 6400 eggs have been laid by a female in captivity.

CALL The call is a slow, deep bark rising slightly in pitch and it does not form large choruses like the green tree frog.

RELATED SPECIES The cave frog (*L. cavernicola*) only occurs in the north-west Kimberley in caves or trees among massive sandstone boulders—a habitat it shares with the splendid tree frog.

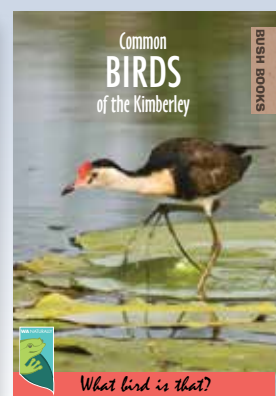
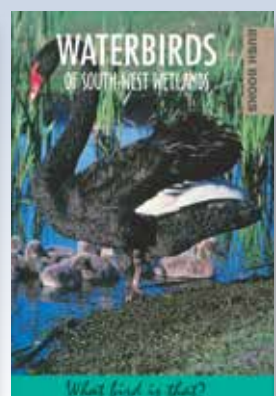
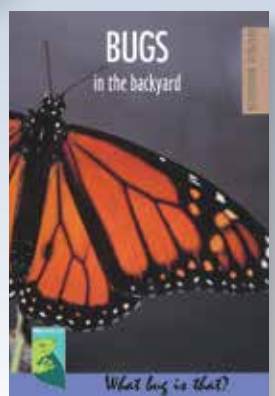


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