

WA'S PARKS, WILDLIFE AND CONSERVATION MAGAZINE

LANDSCOPE

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Night sky
Feature
lift-out

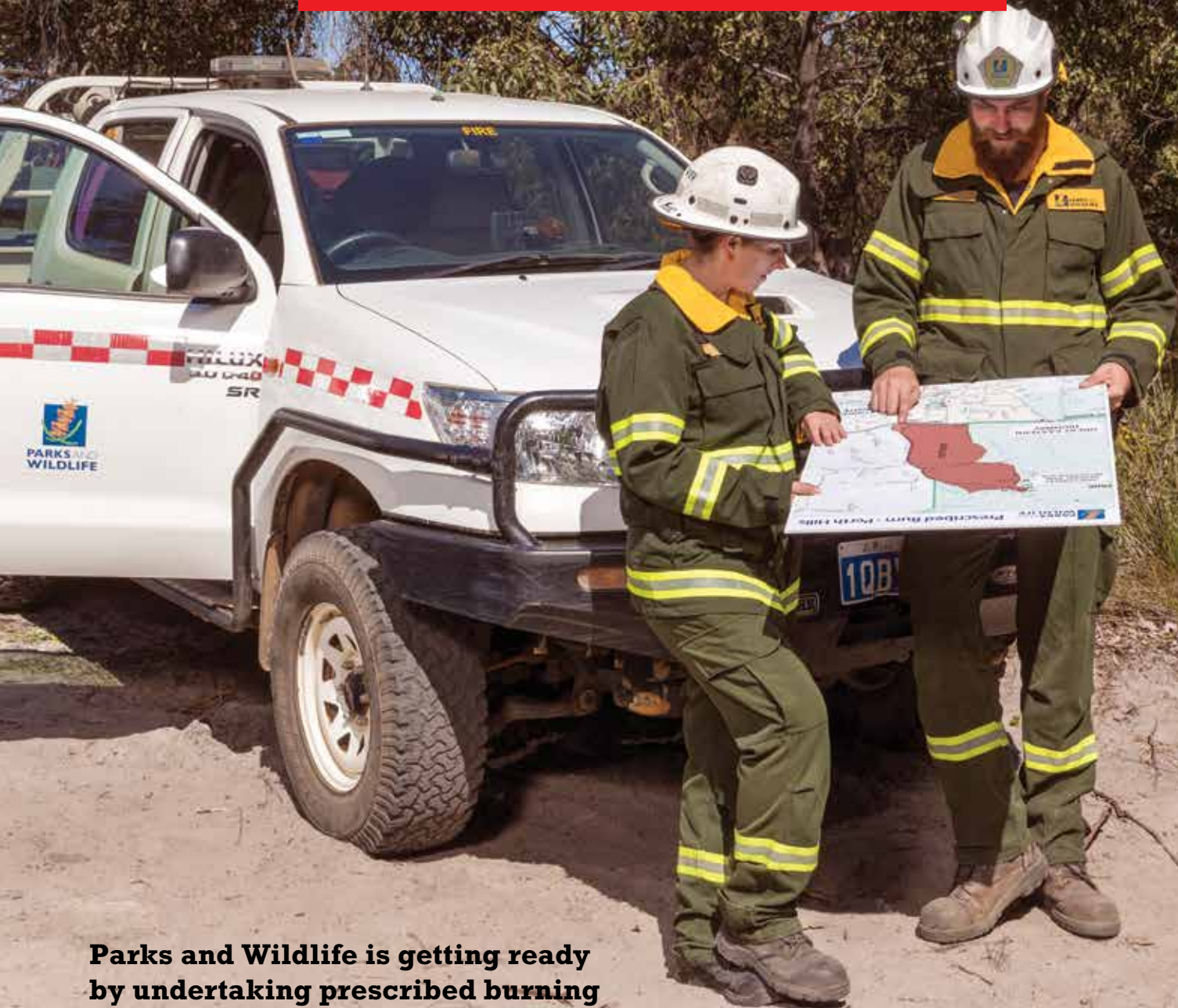
STAR GAZING
Exploring the night sky

Nature Play
Kids outdoors

Natural high
Elevated adventures

**Protecting a
sacred landscape**
Partnering for conservation

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Department of
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ON THE COVER

Front cover Remote parks like Karijini National Park provide the perfect place to pitch a tent and marvel at the phenomenal night sky. Away from the light pollution of the city lights, you can enjoy some spectacular astronomy using just a pair of binoculars.

Photo – Kellie Netherwood

Back cover Every 27.5 days the Moon moves through a complete cycle from New Moon to Full Moon. The New Moon phase is the best time to view deep space objects such as nebulas, galaxies and star clusters.

Photo – Matthew Woods



For the past nine years, I have had the pleasure of spending time at Matuwa (formerly known as Lorna Glen) as part of an ambitious project – *Operation Rangelands Restoration* – to restore the area to its pre-European state. This has involved a number of significant infrastructure projects being carried out as well as feral animal control and native animal reintroductions. It has been nationally recognised as a great example of an adaptive management project. From a scientist’s perspective, this work ticks all the boxes – there are

meaningful partnerships with local Parks and Wildlife staff, the invaluable contribution of a passionate and dedicated team of volunteers, and the opportunity to work with a number of fascinating animals in a spectacular landscape with captivating habitat types. But one significant highlight for me has been working with the traditional owners – the Martu people – and it’s wonderful to see this arrangement entering a new chapter of management as a formal Indigenous Protected Area (see ‘A sacred partnership: managing Matuwa and Kurrara Kurrara’ on page 36).

In another community partnership, the Perth Observatory has entered a new management phase giving the facility, and astronomy in Western Australia, a bright new future (read more on page 26). The WA Herbarium has also been working closely with volunteers to describe 100 new WA plant and fungi species across two volumes of *Nuytsia* (see ‘A taxonomic triumph’ on page 48). And Parks and Wildlife has partnered with BirdLife WA to get a better picture of the enigmatic Australasian bittern which inhabits parts of the south-west (see ‘Big brown boomers’ on page 16).

Western Australians and our visitors don’t necessarily have to be involved in a formal arrangement to have a connection to nature, and Nature Play WA is encouraging kids back into nature to enjoy our natural environment for a raft of physical and emotional benefits. You can read more on page 45.

I hope you enjoy reading about all these terrific projects, and more.

Keith Morris

Senior Principal Research Scientist and Animal Science Program Leader

Department of Parks and Wildlife

Contributing

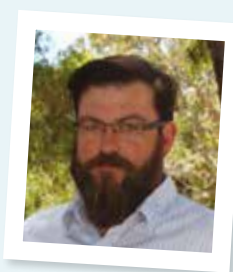
Lauren Emmerson is a project officer working in Parks and Wildlife’s Public Information and Corporate Affairs branch, assisting in the production of the department’s publications. She has worked interstate and overseas, notably spending three years working in Edinburgh and taking the opportunity to explore the rolling Scottish hills, lochs and isles. Lauren has a great love of the outdoors, enjoys camping and hiking, and has a passion for social media.



Alan Clarke is a Parks and Wildlife Wetlands Conservation Program senior technical officer based in Busselton. After completing a degree in surveying and mapping at Curtin University he started with the department as a Geographic Information Services officer. Since 1992 he has worked on a variety of projects across the State, from coastal wetlands and estuaries including benthic invertebrate sampling of the Roebuck Bay mudflats, to remote desert wetlands of the arid interior. Alan is currently focused on the South West Wetlands Monitoring Program and bittern research in south coast wetlands.



Paul Jarvis works with Nature Play WA in an advisory capacity. After a career as a journalist and Ministerial adviser he has spent the past two years working with Nature Play WA to increase community awareness of the costs of the increasingly sedentary recreation habits of children aged 0–12 and push for the recognition of the benefits of unstructured play outdoors. A father of three he also tries to spend as much time as possible in a kayak, on a bike or just hanging out in the bush with his family. He is the principal of Gervasi Consulting.



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LANDSCOPE is printed on recycled paper which is certified carbon neutral, contains 55 per cent recycled fibre and is made from virgin pulp, which is derived from well-managed forests and controlled sources.

This page Enjoying time in nature can be as simple as taking a walk through the bush.

Photo – Damon Annison



Department of
Parks and Wildlife



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PEOPLE**

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Australasian bittern (*Botaurus poiciloptilus*).





READERS' PIC

Eucalyptus salubris

Words and photo by Robert Atkins

"This photograph was taken in the Kambalda Timber Reserve in the Western Australian Goldfields. This gimlet with its multi-stemmed habit emanating from a single large bole typifies the grandeur of the Great Western Woodlands. To me it is one of the most interesting places in the country. The diversity of flora and landscapes is a great incentive to explore and camp in this wilderness."

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@dpaw.wa.gov.au.

New orchids discovered

Western Australia's already rich knowledge of plant life became even richer this year with the discovery and naming of 17 new types of spider orchids.

The orchids were found in areas throughout the south-west from north of Geraldton to east of Esperance. They are all from the genus *Caladenia* and include 11 separate species and six subspecies.

The discovery brings the total number of identified spider orchids in WA to 158, with the vast majority of them found only in the south-west.

The new orchids were formally described in Volume 25 of the Western Australian Herbarium's botanical journal *Nuytsia* (see 'A taxonomic triumph' on page 48).



Above left Clumped spider orchid (*Caladenia denticulata* subsp. *rubella*). **Above right** Red thread spider orchid (*Caladenia erythronema*).
Photos – Andrew Brown/Parks and Wildlife

Endangered tortoises released

Twenty western swamp tortoises have been released into the wild to strengthen populations of Australia's rarest reptile.

The Critically Endangered tortoises were released at Twin Swamps Nature Reserve in Perth's north, where just over 20 years ago the population was down to two individuals.

Since then, populations there and at other swamps north of Perth have increased and stabilised thanks to a collaborative recovery program by Parks and Wildlife, Perth Zoo, The University of Western Australia and the Friends of the Western Swamp Tortoise.

A dry winter meant the tortoises' best chance to thrive was to be released into Twin Swamps, where water levels are supplemented by a bore, and a fox-proof fence reduces predation.

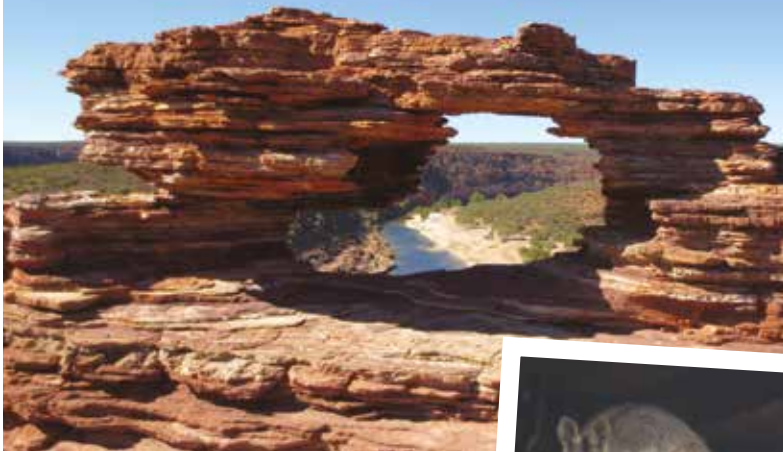
Released tortoises were bred at Perth Zoo and were weighed, measured and marked to ensure their growth and progress could be monitored over coming years.

Above right Western swamp tortoise.
Photo – Gerald Kuchling/Parks and Wildlife

Right Nicola Owens and Riley Peters get ready to release the tortoises.
Photo – Lauren Emmerson/Parks and Wildlife



Direction set for Kalbarri National Park



Above Nature's window in Kalbarri National Park.
Photo – Melissa Mazzella/Parks and Wildlife

Right Black-flanked rock wallaby.
Photo – Remi Vignals



One of the State's most popular parks, Kalbarri National Park, will be managed under a new 10-year plan to conserve its natural and cultural values and enhance tourism experiences.

The park receives more than 300,000 visits a year, with its rugged gorges and scenic lookouts over the Murchison River providing opportunities for a diverse range of activities such as bushwalking, canoeing, abseiling and rock climbing. And a new skywalk expected to be opened in 2017 will provide an opportunity for visitors to experience the park in a different way.

The plan will afford greater protection for the more than 1000 plant species as well as the animals that occur in the park, including the black-flanked rock wallaby, which was considered extinct in the park as they were last seen in 1995 until sighted in September this year. A rock climber spotted two wallabies and forwarded photos and footage to Parks and Wildlife staff. Since they were spotted, remote sensing cameras have been used to photograph the two animals several times – one of which has a pouch young.

The *Kalbarri National Park management plan* is available to view at www.dpaw.wa.gov.au.

Winner

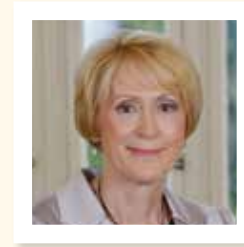
Congratulations to Mike O'Donoghue for winning the beautiful framed *Kunzea eriocalyx* print. And thank you to everyone who took the time to enter.

Right Parks and Wildlife senior graphic designer and artist Gooitzen van der Meer with the stunning prize.



Guest column

**Her Excellency the Honourable
Kerry Sanderson AO**
Governor of Western Australia



Over the years, I have been fortunate to travel throughout Western Australia with my family and have had many opportunities to experience and enjoy the beautiful and special natural places this State

has to offer. We are truly fortunate in having such outstanding national parks and conservation reserves and such incredible biodiversity.

I want all our people and visitors to know just how special these areas in our State are. I want the community to be engaged and increase enjoyment of, pride in and understanding of our national parks, which will help to protect these areas for future generations. Looking after these areas, and protecting our wildlife from introduced species such as feral cats and foxes and protecting our plants from introduced weeds, is a huge task.

While much is being accomplished in protecting the State's world-renowned native plants and animals, and to make visitor experiences in our parks memorable, more needs to be done particularly in areas under pressure such as the peri-urban parks and the Pilbara.

I am proud to be working with Parks and Wildlife to set up a wider parks foundation or friends association as a way to achieve wider community engagement with our national parks. I anticipate that this body will help deliver real on-ground projects that build community support and understanding of the State's natural environment and heritage. I hope that it will also lead to greater community and corporate support of the conservation of our natural areas, manage a much larger-scale volunteer contribution to undertake work and increase appreciation of our wonderful national parks, as well as link like-minded groups working to improve individual parks.

I encourage people to become actively involved in supporting our natural environment.

*Please visit our website
www.ourwaparks.com.au
for more information.*





Logue Brook

With an emphasis on family-friendliness, the new campground at Logue Brook is proving popular among ‘weekenders’ and holiday-makers of all ages who are heading to this beautiful spot to enjoy time in the bush and fun on the dam.

Located 15km north-east of Harvey and less than two hours from Perth, nestled within State Forest, Logue Brook is a favourite spot for family camping among the beautiful jarrah forest. The area is especially popular in summer and at Easter, and standing on the shore of Lake Brockman as the sun rises and the water sparkles, knowing there’s water boiling on your fire ring for a hot cuppa, it’s not hard to see why.

Above Logue Brook Dam offers a range of opportunities for water sports.

Top right The new campground is already proving popular at Logue Brook.
Photos – Sallyanne Cousans

Above right Four camp kitchens are available for use.
Photo – Parks and Wildlife

Opposite page

Far right The pump bike tracks are proving popular with kids.

Photo – Kerry-Anne DeKlerk

Right Fishing is popular on the dam.

Photo – Matt Kleczkowski

CAMPGROUND UPGRADES

Logue Brook is the latest campground to be developed thanks to the State Government’s \$21.05 million *Parks for People* initiative. This program aims to provide affordable and family-friendly opportunities for Western Australians and visitors to get out in the bush. And this outstanding \$3 million development is an example of the ambitious objectives being met and exceeded.

The development at Logue Brook, on the southern edge of Lake Brockman, was completed in two phases – the first in time for Christmas in 2014 and the second in August this year. The impressive end result has delivered five new camping loops with 126 new camp sites that accommodate about 540 campers at a time. Two of the camp sites and all of the barbecue shelters and toilets have wheelchair access.

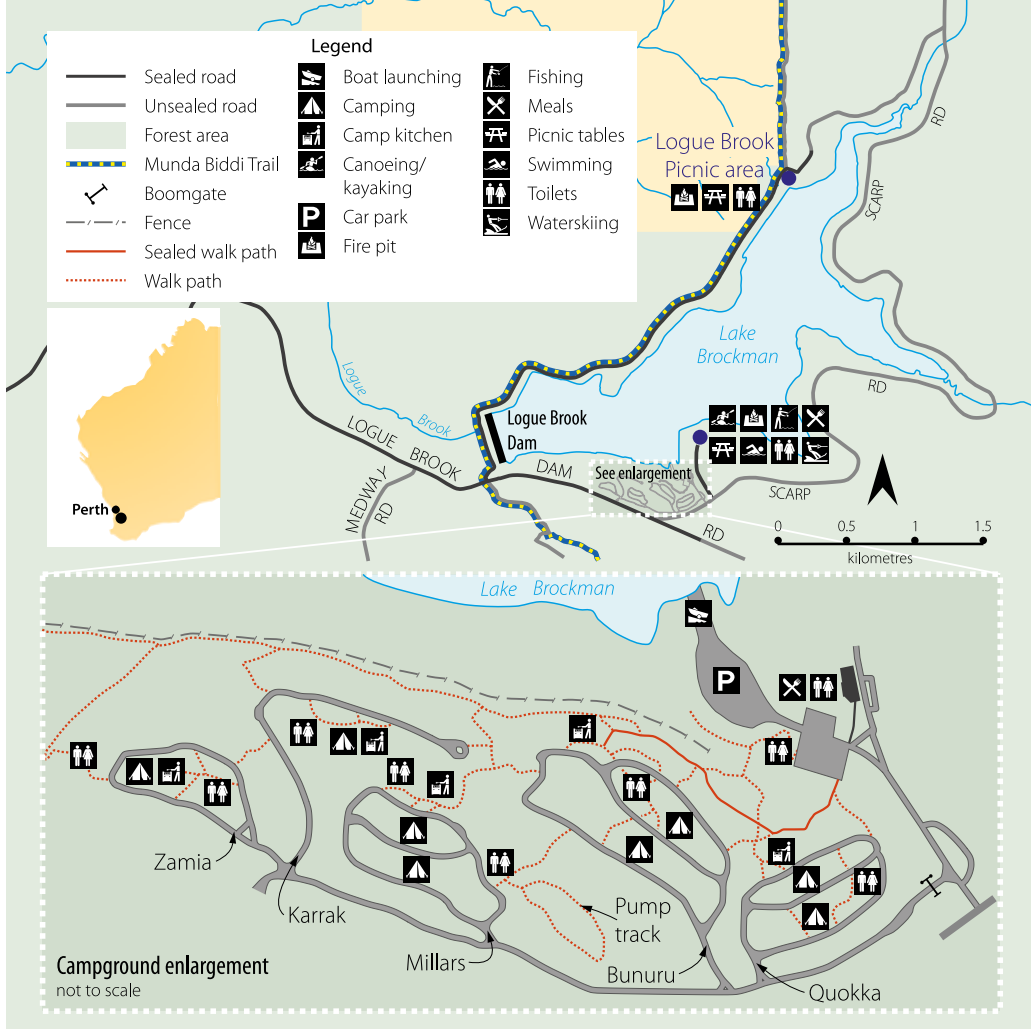
The loops have been designed in a way to ensure each camp site feels spacious and each is fitted with its own fire ring. All of the sites have beautiful views, whether it’s across the dam or onto the stunning jarrah forest. Each loop has its own camp kitchen

fitted with barbecues and picnic tables – perfect for cooking up and feasting on fish and marron caught in the lake.

A NATURAL PLAYGROUND

Fishing and marroning are popular on Lake Brockman, which houses populations of trout, redfin perch and marron. The lake is the perfect spot for waterskiing, canoeing and kayaking, which have been made easier by upgrades to the boat ramp and trailer parking, and the capacity to accommodate boats at some camp sites.

For those who prefer to stay on dry land, there are a number of tracks and trails that provide opportunities for the whole family, including dogs on leads. The Munda Biddi Trail weaves through the area, offering the chance to follow the world-class bike track for a ride that lasts a couple of hours to a full day. Meanwhile, the two pump bike tracks offer a different cycling experience. Two loops of rollers and berms cater to users of varying abilities who can ride with little pedalling, as they are propelled by momentum. The tracks,



one about 200m and the other 80m, are proving popular among all age groups.

The squeals of delight from the kids on the pump tracks are matched by the raucous calls of the red-tailed black-cockatoos which frequent the area year-round, feeding on the seeding marri trees in the area. Visitors should keep a look out for other small forest birds such as scarlet robins, rufous whistlers and fantails that can be found in the area. Those with a keen eye, and at the right place at the right time, might spot some of the other native animals that live in the area including brushtail possums, bobtail lizards and quenda.

A COMMUNITY PARTNERSHIP

As part of a two-year trial, the day-to-day running of Logue Brook campground is being handled by the Lake Brockman Tourist Park. This arrangement is the first of its kind and is already proving successful in providing users with on-ground service and the ability to pre-book sites before



they arrive. Lake Brockman Tourist Park offers powered sites and hot showers, which suit those who are looking for an effortless experience. For those who are staying at Logue Brook campground it's also nice to know that you can drop into the Lake Brockman Tourist Park Café for a meal, to buy some food and other conveniences, or for a hot coffee – particularly handy if the billy is taking too long to boil.

Do it yourself

Where is it? Logue Brook is 15km from Harvey via South West Highway and Logue Brook Dam Road, 23km from Waroona via South West Highway and Logue Brook Dam Road. Logue Brook Dam Road is sealed.

What to do: Waterskiing, mountain biking, swimming, fishing, camping, canoeing/kayaking, bird watching, walking.

Facilities: Camp kitchens, fire rings, picnic tables, toilets, boat launches.

Nearest Parks and Wildlife office: Wellington District Office, 147 Wittenoom St, Collie 6225, phone: (08) 9735 1988.

Department of Fisheries: Check with Department of Fisheries for recreational fishing information.



Discover more about Logue Brook



Scan this QR code or visit the website parks.dpaw.wa.gov.au/park/logue-brook



A growing number of Parks and Wildlife-managed attractions in the south-west are providing thrills to those with a penchant for heights. Well-known attractions such as the Granite Skywalk, Mount Frankland Wilderness View Lookout and the Valley of the Giants Tree Top Walk are extremely popular among the many thousands of people who visit them each year. Now, impressive new upgrades at The Gap in Torndirrup National Park are set to provide visitors with yet another spectacular way to experience the area from a totally different perspective. Take a journey to see how these can be experienced in as few as four fun-filled days.

by Steve Crawford



Standing safely on the edge of the enormous rocks at The Gap in Torndirrup National Park, it's impossible not to be awed by the spectacular natural processes that have sculpted this coastline. For millions of years the Southern Ocean has bashed away at the granite and created 'The Gap' and the Natural Bridge, which today attract more than 200,000 visitors each year.

Until now, viewing opportunities were limited and continued weathering made venturing onto The Bridge unsafe. Thanks to \$5.75 million funding through *Royalties for Regions* and Parks and Wildlife's capital works program, a new development is being built in the area.

When complete early next year, the ambitious and impressive new precinct will include new lookout structures for The Gap and Natural Bridge. These will give visitors an amazing view across the Southern Ocean and along the coastline to West Cape Howe while they experience the sensation of being 'suspended' above the ocean as they view the surge of the swells below. For the more faint-hearted there will be plenty of viewing opportunities that are less 'thrilling', but no less spectacular. At the right time of year, this view might include whale spotting.

The two features will be connected by a wheelchair-accessible path which also links to the new car park. Visitors will also be able to take advantage of a new picnic area and a space to gather. These areas will be fitted out with interpretive information to help visitors understand and appreciate the rich and fascinating natural history of

GETTING HIGH IN NATURE

.....
Opposite page

1 A computer generated visual of the new facilities at The Gap, Torndirrup National Park scheduled to open in February 2016.

Image - Parks and Wildlife

2 The Tree Top Walk, Valley of the Giants Walpole-Nornalup National Park.

Photo - Jiri Lochman

3 The Granite Skywalk at Castle Rock, Porongurup National Park.

Photo - Andrew Hassal

Left The Gap, Torndirrup National Park.

Photo - Damon Annison



Above A steep climb down at Mount Frankland.
Photo – Peter Nicholas/Parks and Wildlife



Above right Mount Frankland.
Photo – Jiri Lochman

Right The Granite Skywalk, Castle Rock, Porongurup National Park.
Photo – Parks and Wildlife



the area. Visitors are also encouraged to drop into the nearby Discovery Bay to view its historic whaling station, botanic garden and Australian wildlife.

The world-class visitor precinct at Torndirrup National Park is the newest south-west attraction that enables visitors to 'get high on nature'. The Granite Skywalk, Mount Frankland Wilderness View Lookout and the Valley of the Giants Tree Top Walk provide visitors with a range of different experiences in nature, catering for those with nerves of steel who are seeking an exhilarating endeavour, as well as families looking for a pleasant way to enjoy nature in a different way.

A WALK IN THE SKY

Head north from Torndirrup National Park and you'll find the phenomenal Granite Skywalk at Castle Rock in Porongurup National Park. A two-hour

uphill walk, which challenges even the fittest walkers, leads to the skywalk. Access to the top viewing platform requires visitors to scramble over rocks and climb up a ladder, but the slog is well worth it. This amazing structure provides a panoramic view out to Mt Gardner and Mt Manypeaks and across undulating farmland, while visitors can enjoy the feeling of being perched on the edge of a massive granite outcrop. For those brave enough to look down, the view to the forest floor below through the grid flooring reveals just how high up the structure is.

TREE CLIMB

A visit to the Southern Forests – Walpole Wilderness is a must on any itinerary through the south-west. The area is a vast natural and wild landscape with many visitor attractions to enjoy. Two standouts that offer an opportunity

to get a view with a difference are the Mount Frankland Wilderness View Lookout and the Valley of the Giants Tree Top Walk.

The Wilderness View Lookout, located on the side of Little Mount Frankland in Mount Frankland National Park, provides breathtaking views across the western side of the Walpole Wilderness with views down to the Frankland River as it makes its way to the coast. Visitors experience a sense of true wilderness in the area, which has little sign of human activity or inhabitation, and have the opportunity to soak up the sights and sounds of the forest. Visitors of all ages and abilities can enjoy this lookout on the universally accessible path. For those with a bit more time and a reasonable level of fitness, a steep one-hour climb to the summit is rewarded with 360-degree views of the area.



1. Warren National Park
2. D'Entrecasteaux National Park
3. Mount Frankland National Park
4. Walpole-Nornalup National Park
5. Walpole and Nornalup Inlets National Park
6. Valley of the Giants Tree Top Walk
7. William Bay National Park
8. Torndirrup National Park
9. Porongurup National Park

Plan your trip

Here's a suggested itinerary for a four-day self-drive 'getting high in nature' tour with optional add-ons with local commercial tour operators licensed with Parks and Wildlife for those travellers with more time.

Day one

If you're setting off from Perth, an early-morning start will maximise your trip. An overnight stay at the WA Wilderness Glamping facility in the magnificent Warren National Park means you'll arrive with nothing to do but relax and enjoy your day. Everything will be set up for you, including your own family or couples tent, bedding and cooking facilities.

Options: Join Pemberton Discovery Tours to experience dense forests, water cascades and the massive Yeagerup Dunes or hop aboard a Donnelly River Cruise and experience the magnificent D'Entrecasteaux National Park.

Day two

Use today to visit the Valley of the Giants Tree Top Walk, and Mount Frankland Wilderness View Lookout and other attractions in the Walpole Wilderness. You'll find a range of accommodation types in and around Walpole or Denmark.

Options: Cruise the waters of the Walpole and Nornalup Inlets with WOW Wilderness Cruises or take a trip with Out of Sight Tours to West Cape Howe National Park.

Day three

Drive towards Albany via William Bay National Park and onto Torndirrup National Park. Visit The Gap and Natural Bridge

and enjoy the new facilities when opened in 2016. Visit the Granite Skywalk in Porongurup National Park in the afternoon and return to Albany for the night or stay locally in Mount Barker or Porongurup.

Option: If time permits take a detour to Discovery Bay (near Torndirrup National Park) and enjoy a helicopter ride to Breaksea Island with Skyhook Helicopters.

Day four

Set off on a leisurely drive back to Perth via Albany Highway.

Option: Stop off in Kojonup and visit The Kodja Place, a fascinating visitor centre that provides insight into country life that will delight and move you.

Stay connected

ParkFinder WA is a great way to plan your trip and stay on route while you're away. It has information about 150 parks and reserves in Western Australia, including photos to inspire your journey and park alerts to keep you up-to-date with the latest park news. Meanwhile, *CampingMate* helps campers plan their next camping trip (see 'In review' on page 15).

These apps can be downloaded for free from the Apple Store and Google Play.

The *ExploreParks WA* website gives you all the information you need to start planning your trip – see parks.dpaw.wa.gov.au.



Tree Top Walk Pass Giveaway

Win a Family Pass (two adults and two children) to the Tree Top Walk by sending an email to touring.wa@dpaw.wa.gov.au with **LANDSCOPE** in the subject line and tell us the four must-see 'getting high in nature' sites.*

*All entrants will automatically receive a copy of Touring Western Australia — a Department of Parks and Wildlife electronic newsletter detailing the latest nature-based tourism news and events for park visitors and tourism businesses.

WIN!



Licensed tour operators

For more information about the licensed commercial tour operators mentioned go to:

WA Wilderness Glamping

www.wawilderness.com.au

Pemberton Discovery Tours

www.pembertondiscoverytours.com.au

Donnelly River Cruises

www.donnelyrivercruises.com.au

WOW Wilderness Eco Cruises

www.wowwilderness.com.au

Out of Sight Tours

www.outofsighttours.com.au

Skyhook Helicopters

www.skyhookhelicopters.com.au

Other visitor attractions mentioned include:

Discovery Bay

www.discoverybay.com.au

The Kodja Place

www.kodjaplace.com.au

Left Tree Top Walk.

Above and far left The new public viewing platforms at The Gap, Torndirrup National Park, scheduled to open in February 2016, will provide access for those with wheelchairs, prams and other walking aids.
Images – Parks and Wildlife

The magnificent and popular Valley of the Giants Tree Top Walk has delighted more than three million visitors since it was opened in 1996. The award-winning structure soars gently upwards to a dizzying 40m into the foliage, before descending to the forest floor and the Ancient Empire Walk. Along the walk, visitors journey through the forest, among the gigantic tingle trees, getting a birds' eye view of the forest below.

People of all ages and abilities can enjoy the facility, with full wheelchair and pram accessibility. Those looking to enhance their experience can up the ante, and take part in one of the holiday programs held at certain times of the year. Back on solid ground, visitors can peruse locally sourced crafts and artworks in the shop.

A LONG WEEKENDER

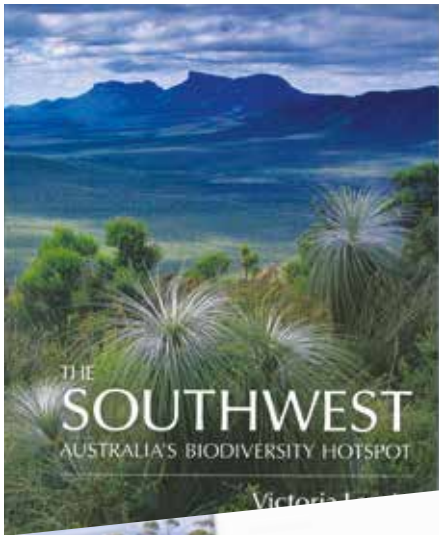
These features can be enjoyed over a four-day trip from Perth and many of them enjoyed by people of varying ages and abilities (see also 'Access for all', *LANDSCOPE*, Spring 2015). They provide an opportunity to experience the south-west from a different perspective and to get

a different view of the plants and animals that occur there. There's nothing like going spot-lighting for brushtail possums in the tingle forest from 40m in the air, viewing the Southern Ocean crashing beneath your feet or having 360-degree views across untouched wilderness to make you feel connected to nature.

Steve Crawford is Parks and Wildlife's visitor communications manager. He can be contacted on (08) 9334 0214 or by email (steve.crawford@dpaw.wa.gov.au).

WA Naturally's The best of the South West is a collection of our favourite stories from around the south-west. It's perfect to take along with you to help guide you around, flick through as you plan your next trip or as a souvenir of your most recent journey. It is available for \$14.95 from WA Naturally Publications by calling (08) 9219 9071, online at shop.dpaw.wa.gov.au or from good book shops and tourist centres.





THE SOUTHWEST – AUSTRALIA'S BIODIVERSITY HOTSPOT Book



In *The Southwest – Australia's biodiversity hotspot*, award-winning journalist and author Victoria Laurie invites readers to take a deeper look at the south-west that extends beyond the beauty of its 'tamed' landscapes of wineries, timber towns and fields of grain. The book celebrates the mind-blowing species richness and diversity of this area in the complex context of Aboriginal and European history and modern-day uses.

What's really special about this book is that Victoria has interspersed her fascinating and thoroughly-researched technical and scientific information with beautiful and evocative descriptions. There are also quotes from a range of people she's spoken to including scientists, Indigenous elders and activists that add another charming dimension to the book.

The exquisite photos by Jiri and Marie Lochman, and others, adorn the pages and visually present the beauty of the area.

A thorough index and the sort of meticulously researched information that you'd expect from a journalist and author of Victoria Laurie's calibre makes this a valuable reference book. And the beautiful writing and photos make it a highly enjoyable read. This is definitely one for the Christmas list.

The 232-page The Southwest – Australia's biodiversity hotspot by Victoria Laurie was published by UWA Publishing and is available in paperback for \$45 from UWA Press, many good book shops and online retailers such as Amazon.

CAMPINGMATE Application



Parks and Wildlife's newest app – *CampingMate* – has been designed to help people get on the road easier, with everything they need for their next camping trip organised in one place.

The app has a comprehensive list of pre-loaded items, which is really helpful for those new to camping or those who tend to only remember things they need once they've pulled up at the camp site. You can also share the list with others to make sure nothing is missed and you can save it for next time.

The app also has handy information about camping, including where to camp and how to book, and details about some of WA's tracks, trails and partner organisations.

CampingMate can be downloaded for free from iTunes or Google Play.



ALGAE OF AUSTRALIA: MARINE BENTHIC ALGAE OF NORTH-WESTERN AUSTRALIA, 1. GREEN AND BROWN ALGAE Reference book



LANDSCOPE has featured several articles about John Huisman's fascinating work on algae, including on page 22 of this issue. For the past 10 years, John, together with students and colleagues, has been collecting and studying the marine plants of WA's north-west coast in an effort to increase knowledge of the species found in the area. This publication is the first of two volumes that document his findings with this one focussing on green and brown algae and the next to document red algae species.

Algae of Australia: Marine Benthic Algae of North-western Australia, 1. Green and Brown Algae is the first of its kind to detail marine plants and includes 68 genera and 171 species. It includes information about the species' name, morphology and its taxonomy, and documents a number of taxa for the first time. The coloured plates in the book bring to life the weird, wonderful and highly diverse shapes and sizes of algae found in the State's north-west.

Algae of Australia: Marine Benthic Algae of North-western Australia is available from CSIRO publishing for \$150.



With links to the mythical bunyip, the enigmatic and elusive Australasian bittern is a fascinating feature of Western Australia's south-west. Now, thanks to a collaboration between BirdLife WA and Parks and Wildlife, we're getting a more comprehensive picture of how and where these birds live, and how we can better protect them.

**by Robyn Pickering, Alan Clarke, Sarah Comer,
Deb Sullivan and John Graff**



Big brown boomers

The Australasian bittern



Imagine you're camping alone near a remote, rushy swamp in late spring. You lie quietly in your tent, fighting for sleep against a deafening chorus of frog calls, when a deep, eerie, booming from the swamp reverberates through the darkness. Suddenly, sleep is the furthest thing from your mind as you sit up in your tent, senses heightened. Your mind goes to warnings from the local settlers and Aboriginal people about the bunyip, a malevolent swamp beast, and you feel a rising sense of fear. Fortunately for you, this booming denizen of the swamp is not a bunyip. In fact, you're hearing the booming call of the Australasian bittern (*Botaurus poiciloptilus*), a wetland bird species, whose calls comprise two to five deep, fog-horn like booms, each preceded by a gasp. However, if you're fortunate enough to have heard an Australasian bittern, it's easy to understand why their calls were sometimes thought to be made by the mythical bunyip!

MYTHICAL BUNYIPS

Australasian bitterns are large, mottled-brown waterbirds which inhabit vegetated wetlands. They are shy and unobtrusive, preferring wetlands with large areas of sedges and rushes. They are a top-order predator that eats a variety of wetland animals such as insects, fish, gilgies, frogs and even small birds. The species is highly cryptic and it is often only their calls that give away their whereabouts. With a global population of fewer than 2500 individuals, they are listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* in Australia, and globally on the IUCN Red List of Threatened Species.

The population of Australasian bitterns in Australia has waned following the loss and decline of wetlands across the country. For the past 38 years, Parks and Wildlife and its predecessors have been

monitoring water depth and chemistry at more than 100 significant wetlands as part of the South West Wetlands Monitoring Program (SWWMP). This monitoring has shown that a number of wetlands in the south-west have declining water levels and increasing salinity and acidity. This long-term monitoring is important in assessing the status and condition of important bittern wetlands.

WHERE ARE THE WESTERN AUSTRALIAN 'BUNYIP' BIRDS?

In Western Australia, Australasian bitterns live mainly in coastal or near-coastal wetlands from Perth to Cape Arid, east of Esperance on the south coast. Unfortunately, their original distribution largely corresponded to the areas of the State which have had the highest level of housing, agriculture and industry development.

Many suitable wetlands in south-western Australia have been lost or degraded through clearing, salinisation and acidification, and available bittern habitat is diminishing. The *State of the Environment Report: Western Australia 2007* found that there was a loss of 80 per cent of wetlands on the Swan Coastal Plain which means those remaining are of high conservation significance. Unsurprisingly, few Australasian bitterns are found in this largely developed environment. In fact, Australasian bitterns could be considered to be the endangered frogs of the bird world – highly susceptible to environmental changes and a strong indicator of wetland health.

Today most Australasian bitterns are found on the south coast and in the Muir-Unicup wetlands, east of Manjimup. These areas have more wetlands of conservation significance than the Swan Coastal Plain and Wheatbelt, where Australasian bittern numbers have declined more significantly.

Main Australasian bitterns are well camouflaged but have a loud, booming call.

Photo – Peter O'Connell/Parks and Wildlife

Inset Parks and Wildlife officer Ian Wheeler examines broken egg shells from an Australasian bittern nest.

Photo – Alan Clarke/Parks and Wildlife



“... in order to find wetlands where bitterns are present and to learn more about them, BirdLife WA and Parks and Wildlife embarked on a collaborative partnership. A variety of survey methods and equipment have been employed to achieve this goal.”



Left An Australasian bittern flies over West Sister Swamp Nature Reserve.
Photo – Robyn Pickering

Above A camera trap provides footage of an Australasian bittern.
Photo – Alan Clarke/Parks and Wildlife

Important Bird Areas (IBAs), including wetlands, have been identified by BirdLife WA as sites of international significance for bird conservation. In WA, noteworthy IBAs for Australasian bitterns include Bengier Swamp, the Muir-Unicup Wetlands, Owingup and Boat Harbour Swamps, the Lake Pleasant View System, and wetlands in the Two Peoples Bay and Mount Manypeaks areas. Recent surveys indicate that one other wetland complex north of Cape Le Grand National Park is also highly significant. Most wetlands with Australasian bitterns present are protected by the nature reserves and national park system managed by Parks and Wildlife. But there are still a number of bittern wetlands that aren't formally protected. Some landowners are lucky enough to have wetlands that support bitterns on their doorsteps, and working with them is critical for long-term protection of these areas.

CRACKING THE SECRETS OF THE 'BUNYIP BIRD'

Finding Australasian bitterns and discovering how they live is a major challenge since it is estimated that there

are fewer than 150 remaining in WA and they live in densely vegetated wetlands and usually only call during the breeding seasons. So in order to find wetlands where bitterns are present and to learn more about them, BirdLife WA and Parks and Wildlife embarked on a collaborative partnership. A variety of survey methods and equipment have been employed to achieve this goal.

Listening for the calls of the male bittern has been one of the primary survey methods for Australasian bitterns. They are usually most vocal during their breeding season in spring and early summer. Their deep booming call can carry for several kilometres when weather conditions are favourable, making this an efficient survey method for trained observers. Listening surveys usually involve standing or sitting at the edge of a wetland just after sunset for 20 minutes or more. Listening to the frog chorus as a wetland is bathed in the glow of sunset can be a very enjoyable task!

Between July 2007 and June 2012, more than 500 listening surveys were carried out by staff and volunteers. Many more have been conducted since

then, but from 2013 these surveys have been increasingly replaced by the use of automated recording units (ARUs), which can be deployed to 'listen' in wetlands for weeks or months at a time during peak bittern activity (see 'Moggies on the marsh', *LANDSCOPE*, Spring 2014). Computer software programs are now able to scan these recordings to recognise bittern calls. At some wetlands the ARUs have been paired with continuous water depth loggers. The data can be used in combination to examine how calling activity is influenced by changes in water depth, and how this factor triggers or influences the breeding cycle of bitterns.

A second survey method was rather more strenuous. Volunteers, led by BirdLife WA or Parks and Wildlife staff, waded through well-vegetated wetlands to search for signs of Australasian bitterns such as moulted feathers, evidence of breeding and feeding platforms. And, when they spotted a bittern, they recorded details about its location and habitat, such as water depth and vegetation type and structure.

Initial data collected from these investigations suggests that the breeding

Right Volunteer John Blyth searching Frenchman's Peak Wetlands.

Below right Cape Le Grand National Park wetlands.

Photos – Sarah Comer/Parks and Wildlife

and associated feeding habitat preferences of the Australasian bittern in south-west WA are quite specific. Australasian bitterns require wetlands with a minimum amount of tall sedge, mainly jointed rush (*Baumea articulata*), at the right density and structure in which to build their nests, together with associated areas of low, fine sedge at suitable feeding depths. As large top-order predators they require a steady supply of prey to eat and sustain their growing young. They are in competition with the more numerous purple swamphens and other opportunistic heron species, so unsurprisingly they seem to prefer large wetlands. These specific requirements result in few wetlands supporting breeding activity in any given year. Then, to add greater challenge to their plight, once the birds have bred in late spring and early summer and the water in these wetlands is receding, the young are vulnerable to attack from native predators such as swamp harriers and, when feeding in shallow water, terrestrial predators like feral foxes and cats. These predators have been regularly seen on remote cameras deployed in feeding areas at this time of year.

In recent years, a number of Australasian bittern nests have been discovered by Parks and Wildlife researcher Alan Clarke assisted by volunteers. Information has been collected on nest structure, water depth and vegetation at these nest sites. Further work will be required to find more nests so that we can better understand the habitat requirements for successful breeding.



IMPORTANT FIRST STEPS IN CONSERVING THE BUNYIP BIRD

Over the past eight years, work by BirdLife WA and Parks and Wildlife staff has significantly increased our understanding of the Australasian bittern, enabling an estimate of the size of the population in WA. The last time that a clear indication of the population of this cryptic species was obtained was in the early 1980s when BirdLife WA with the then Department of Fisheries and Wildlife conducted waterbird surveys throughout the south-west. Comparison of both data sets suggests that the population in WA has declined by 25 to 50 per cent since the 1980s. It is estimated that there are now fewer than 150 adult Australasian bitterns

remaining in WA. Little wonder bitterns have become more difficult to find!

Information from surveys conducted in the late 2000s resulted in the conservation status of the species in WA being reassessed, and in August 2010 it was uplisted from Vulnerable to Endangered due to the alarmingly low population size. With similar work being done in other parts of Australia, the species was also listed as Endangered nationally in March 2011. These listings are an important step in recognising that the species is in need of action to ensure its future.

In early 2013, an interim recovery plan was drafted by the Australasian Bittern Working Group (with members from both Parks and Wildlife and BirdLife WA) for the species in WA. The draft plan is

Challenging research is uncovering more secrets

Recently, Parks and Wildlife researcher Alan Clarke deployed remote cameras on feeding platforms and other places of interest in order to collect more information about these enigmatic birds. Heavily-vegetated swamps are challenging places to conduct observational studies, especially on the secretive and well-camouflaged Australasian bittern. Remote cameras provide an opportunity to record the activity of these birds and some of the challenges they face.

Trials have been carried out to assess the value of using cameras in such difficult conditions. The cameras are surrounded by water and in soft mud, while masses of tall, fine sedges waft across the target area in the slightest breeze, easily triggering cameras! Techniques were developed and tested for setting cameras to have the best chance of capturing the Australasian bittern. It took some time before there were any successes but in recent trials cameras have shown their potential for providing a window into the secretive world of the bittern.

The cameras have also recorded foxes and even a cat patrolling through water 15cm deep in areas where Australasian bitterns have been seen. One camera also captured a fox with an adult purple swamphen between its jaws. Given that bitterns are a similar size to the swamphen, this suggests that foxes can prey upon both adult and juvenile bitterns.

Remote cameras have already provided images of important bittern behaviour. More intensive studies using cameras will be carried out to investigate feeding behaviour, diet, food supply and the relationship between water levels and vegetation in sustaining chicks, recently fledged young and adults. Cameras will also be used to study the density and effects of introduced and native predators at various life cycle stages. This information can be used to determine recovery actions that will help to increase the breeding success and long-term recovery of the Australasian bittern.

Top right A fox captured on a camera trap in bittern habitat. **Middle** A swamp harrier collecting nest material. **Right** A camera trap installed to learn more about Australasian bitterns and other swamp inhabitants.

Photos – Alan Clarke/Parks and Wildlife



currently being finalised, and summarises key actions that can be implemented to protect and improve the conservation status of Australasian bittern.

This collaborative work has also discovered important wetlands for bitterns that are not currently protected in the reserve system. These wetlands can now be targeted for better protection where possible, to give Australasian bitterns the best chance for survival.

For wetlands that have been identified as important for bittern breeding, Parks and Wildlife has undertaken associated hydrological studies. This work has involved the monitoring of water levels

and rainfall by means of continuous recording equipment. This data will be used to model the filling–drying cycles of these key sites under conditions of declining rainfall, as currently forecast.

BirdLife WA has collected information on the amount of available vegetation habitat and chemistry data for more than 100 wetlands in south-west WA. This is important baseline information to enable characterisation of wetlands that Australasian bittern use, and will enable changes to be monitored into the future. Vegetation mapping has also been conducted by botanists at five important bittern wetlands. This information,

together with the data from the remote cameras, ARUs and nest habitat data, contributes to our understanding of the general wetland preferences of the species.

THE PRESENT

Other work has been conducted by John Graff, an honours student from The University of Western Australia, who aimed to investigate calling patterns of Australasian bitterns and to test whether calls can be used to identify individual bitterns, and then to track their movements from one year to the next. The results of this work suggest that Australasian bittern calls do vary subtly



“These wetlands can now be targeted for better protection where possible, to give Australasian bitterns the best chance for survival.”

between individual bitterns; however, further work is required to determine whether long-term re-identification of individuals is possible. Several technical challenges need to be overcome in order to use vocal individuality as a practical method of ongoing identification of individual bitterns. The research also indicated that although bitterns call throughout the night during the breeding season, the peak period for calling activity occurs during the last hour or so before sunrise.

BirdLife WA and Parks and Wildlife are continuing to collaborate and work towards goals of protecting the species and wetland habitat and securing and increasing the Australasian bittern population. Specifically, members of the

team are working together to raise the profile of the species, learn more about its habitat preferences to guide wetland protection and restoration, and document the important life history characteristics and ecological processes that will, in the longer term, assist with understanding how to conserve this iconic bird.

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Above Tony Bush has contributed hundreds of volunteer hours and significant expertise to bittern research. He is pictured here at the site of a recently discovered Australasian bittern nest.

Above right Australasian bittern eggshells in a typical flat-structured nest.
Photos – Alan Clarke/Parks and Wildlife

Robyn Pickering was employed as the BirdLife WA Bittern Project Co-ordinator but is now a consultant, casually contracted to BirdLife WA. She can be contacted on (08) 9287 2204 or by email (perthbirdsandbush@gmail.com).

Alan Clarke is a Parks and Wildlife senior technical officer located in Busselton. He can be contacted on (08) 9752 5534 or by email (alan.clarke@dpaw.wa.gov.au).

Sarah Comer is Parks and Wildlife’s South Coast Region regional ecologist. She can be contacted on (08) 9842 4513 by email (sarah.comer@dpaw.wa.gov.au).

Deb Sullivan is a project officer with Birdlife Australia. She can be contacted by email (deb.sullivan@birdlife.org.au).

John Graff completed his Honours on Australasian bitterns through The University of Western Australia with funding from BirdLife. He can be contacted by email (jgraff2@hotmail.com).

The work conducted since 2007 could not have been completed without the hard work of Alan Clarke, Robyn Pickering and more than 140 volunteers, and the great support given by BirdLife Western Australia and Parks and Wildlife. Significant funding has also been provided by Lotterywest and South Coast Natural Resource Management Inc. The support of the Australasian Bittern Working Group in steering coordinated conservation efforts for this species in Western Australia is also gratefully acknowledged.

See remarkable footage of an Australasian bittern



Scan this QR code or visit <https://goo.gl/f78CFU>



Sunken Treasures

words and photos by John Huisman

Until recently, if you believed what you read, you might have concluded that there are next-to-no seaweeds in Western Australia's tropical north. However, a series of surveys undertaken over the past 20 years has revealed a remarkably diverse flora, with many hundreds of species recorded including more than 70 that are new to science. Sometimes all you need to do is look.



Western Australia's marine environment is celebrated worldwide for its spectacular habitats, iconic wildlife, and as home to one of the most diverse collections of marine species in the world. In part, this is undoubtedly due to the State's unique geography, with a coastline aligned roughly north-south and spanning some 22 degrees of latitude, encompassing habitats ranging from the colder, granite dominated temperate southern coasts, to the warm waters of the tropical coasts with their fringing coral reefs. The north-south latitudinal range of WA spans a distance of some 2500km, but the coastline travels a very convoluted path, with numerous bays, inlets, and offshore islands and atolls, all creating small but significant habitat variations that provide specialised niches for marine creatures. If one measures the actual coast at the high water mark, and not a straight line approximation, the WA coastline spans an impressive 24,000km, a distance equal to more than half the circumference of the Earth. About 75 per cent of this length (18,000km) lies north of the Tropic of Capricorn, from just south of Coral Bay on the Ningaloo coast to the WA-Northern Territory border. Based on this measure alone, and knowing that the ranges of most species are governed by temperature tolerances (and therefore latitude), one might reasonably expect the WA tropics to host an incredibly rich marine biodiversity. We know this to be true, but how do we know this to be true?

Before attempting to answer that question, let's look at how biodiversity is measured. The simplest way is to count the number of species known to exist in a given area; the area with the greatest number of species is regarded as the most diverse. This approach is somewhat simplistic as it doesn't take into account the diversity at higher taxonomic levels.



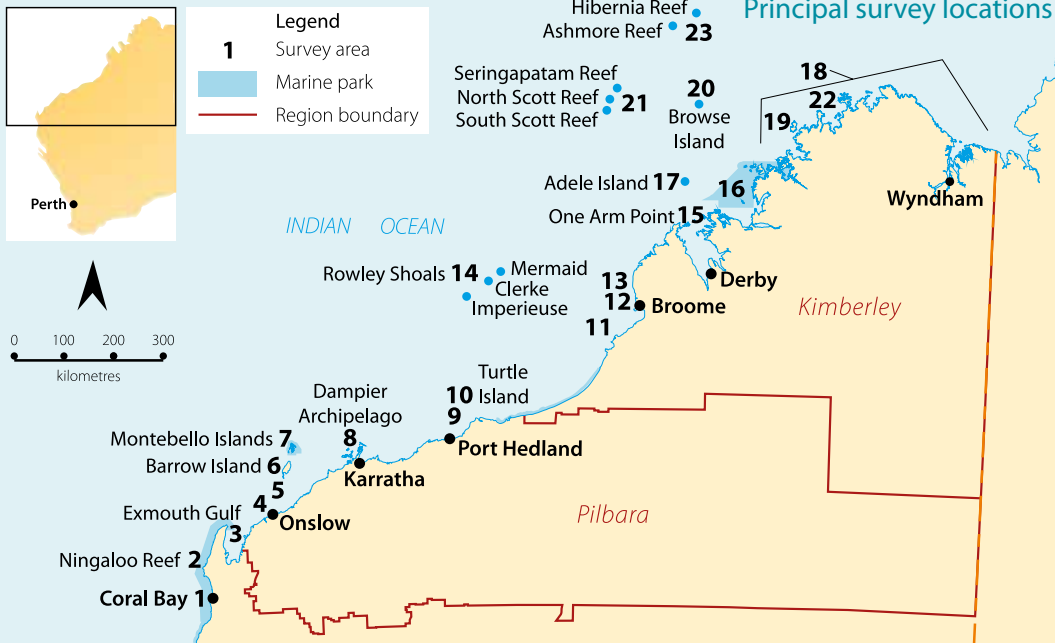
For example, is an area with 100 species in one genus more diverse than one with 99 species in 10 genera? Probably not, and that's why biologists often talk of 'species richness' rather than 'biodiversity'. The next question is, how do we know which species exist in a particular area? The only way this can be reliably assessed is by detailed surveys, undertaken by taxonomists trained to recognise the various species, and by collecting what are known as 'voucher specimens' that are then lodged in Parks and Wildlife's WA Herbarium (in the case of plants, algae or fungi) or the WA Museum (for animals). Voucher specimens are extremely important; in the case of species new to science they are an essential requirement in the process of describing the species, as they provide an exemplar (known as a 'type' specimen) that the name of the species is permanently tied to. Vouchers can also future-proof species records, as they enable taxonomists to reassess identifications in the light of subsequent taxonomic revisions.

WA's tropical marine diversity is primarily known through surveys undertaken by the WA Museum and Parks and Wildlife, with contributions from CSIRO and universities. However, this knowledge is not spread evenly across the

Left top The rare coralline red seaweed *Rhizolamellia collum*, found at Scott Reef.

Left Marine researchers using scuba to explore the subtidal habitat of Scott Reef.

Above A new species of the red seaweed *Martensia*, which was found on reef flats in the Kimberley.



Above The red seaweed *Kallymenia maculata*, first collected from Makassar Strait, Indonesia in 1899 and not seen again until the survey of Ashmore Reef in 2013.

Far left A new genus of red seaweed that grows in the dark recesses of undercut reefs in the Kimberley.

Left A new species of the iridescent red seaweed *Champia*, found at Cassini Island.



“The seaweed flora of the WA tropics is now known to include more than 450 species, and the number will probably surpass 500 once studies are completed.”

taxonomic groups, and often a particular group is only well-surveyed if an expert in that group has taken part. This can also result in the unusual situation where certain groups can be virtually ignored, leading to a serious under-representation in diversity assessments.

SEEING RED (AND BROWN AND GREEN)

A prime example of this phenomenon is seaweeds. WA has been of great importance historically in the recognition of Australia’s seaweeds, but this has essentially concentrated on the State’s south-west. Until recently, the tropical north coast has been relatively unknown. If you counted the number of seaweed species recorded from the north in literature published before the 1990s, the result would be a paltry eight, and this in an area that earlier authors suggested

would host about 200 species. The number of recorded species jumped slightly to 28 in that decade, but it was not until I took part in a series of surveys that there was a dedicated interest in collecting and describing the seaweed flora.

WHERE ARE WE NOW?

Surveys have been carried out during the past two decades at numerous places, from Coral Bay just north of the Tropic of Capricorn to the northern Kimberley and offshore atolls, venturing as far north as Hibernia Reef. While we knew that these surveys would lead to many discoveries, the results have far exceeded expectations. The seaweed flora of the WA tropics is now known to include more than 450 species, and the number will probably surpass 500 once studies are completed. From the collections so far, six new genera have been described, and another five

genera and more than 70 species new to science have been recognised. The results will be published in two books, the first describing the green and brown seaweeds, which is available now (see ‘In review’ on page 15), and the second describing the red seaweeds is due for release in 2016. Rather than the depauperate marine flora that past perceptions might have suggested, we now recognise that WA’s tropical coasts host an impressively rich marine plant life, one that places it as one of the most diverse regions of the world. Sometimes all you have to do is look.

John Huisman is a contract seaweed specialist at the WA Herbarium and research fellow at Murdoch University. He can be contacted by email (john.huisman@dpaw.wa.gov.au). John thanks the WA Museum for the invitation to participate in several surveys (funded by Woodside Energy).

Scientists are increasingly using molecular sequences to understand the complexity and evolutionary history of life on Earth. Advances in methods used to compare DNA between organisms can be used to explore the relationships between different phyla and the differences between species and the genetic make-up of individuals. What may have seemed like a pipedream a couple of decades ago, is now being routinely performed in laboratories around the world. Molecular tools can also be used forensically to establish links between larvae and adults of insects, or seeds and whole plants.

In 2008, researchers from Museum Victoria (Luke Shoo, Rebecca Rose, Jeremy Austin and Jane Melville) and the Western Australian Museum (Paul Doughty) published a research paper which used molecular sequence data to show that there were multiple different lineages of Australian pebble-mimic dragons (genus *Tympanocryptis*) in the Australian arid zone. And their differences weren't small ones. The genetic divergence between the various populations they studied suggested that they had been separate evolutionary lineages for more than two million years in most cases. But like many other scientific publications that study genetic divergences of the Australian biota, the researchers were unable to confirm that these lineages represented different, distinct species, or whether they were simply long-isolated populations of a single widespread species.

The only way to settle this was to head back to the museum collections and examine as many specimens as possible, including the specimens that had been used in the original molecular analysis, to see if there were any morphological characteristics that could be used to test the hypothesis that they were distinct species. Most models of speciation events – the process by which populations become reproductively isolated from each other – suggest that lack of gene flow occurs first, followed by morphological change. And while it is usual that different species have differing morphology, it's not always the case, especially in 'cryptic' species where



Pebble-mimic dragons

molecular differences are large but there are no obvious morphological differences.

Seven years after the original publication on pebble-mimic dragons, some of the authors of the original paper (Paul Doughty, Luke Shoo and Jane Melville), plus a new researcher (Luke Kealley) joined forces to examine the morphology of the Western Australian specimens and compare them to the phylogenetic analysis. They found that while differences in colour and scale patterns were fairly subtle, there was sufficient morphological change for them to propose that there are five distinct species in the region.

One of them, *T. cephalus*, was described by Albert Günther in 1867 from specimens collected at Nickol Bay, Karratha. The second already had a name which had been regarded as a synonym of *T. cephalus* for several decades. The authors have resurrected the name *T. gigas* and applied it to the populations from the Gascoyne region. They didn't have access to any tissue samples of *T. gigas* for the molecular analysis but ascertained it was a distinct species based on the subtle colour and morphological differences compared to the other species. The other three represent new species, two from the Pilbara, and one widely distributed in the Goldfields. The

widespread species is the one that's been figured in reptile textbooks as *T. cephalus*.

By any standard, this is an outstanding result – what was once thought to be a slightly variable complex of species has been proven to consist of five discrete species with non-overlapping (allopatric) distributions. This discovery highlights the value of using and interpreting molecular sequence data to uncover relationships between organisms, to test species concepts using a combination of molecular and morphological data. In fact, this study would not have been possible without the large collection of reptiles lodged in the WA Museum. Many of those used in the study were collected during the Pilbara Biodiversity Survey by Parks and Wildlife's predecessors and the WA Museum.

And finally, it shines a light onto a fascinating group of lizards, renowned for their ability to mimic a small rock by lying motionless even when closely approached. This cryptic behaviour has allowed them to avoid predation in some of Australia's harshest ecosystems.

Above A new species of *Tympanocryptis* from Matuwa (formerly Lorna Glen).
Photo – Ryan Ellis

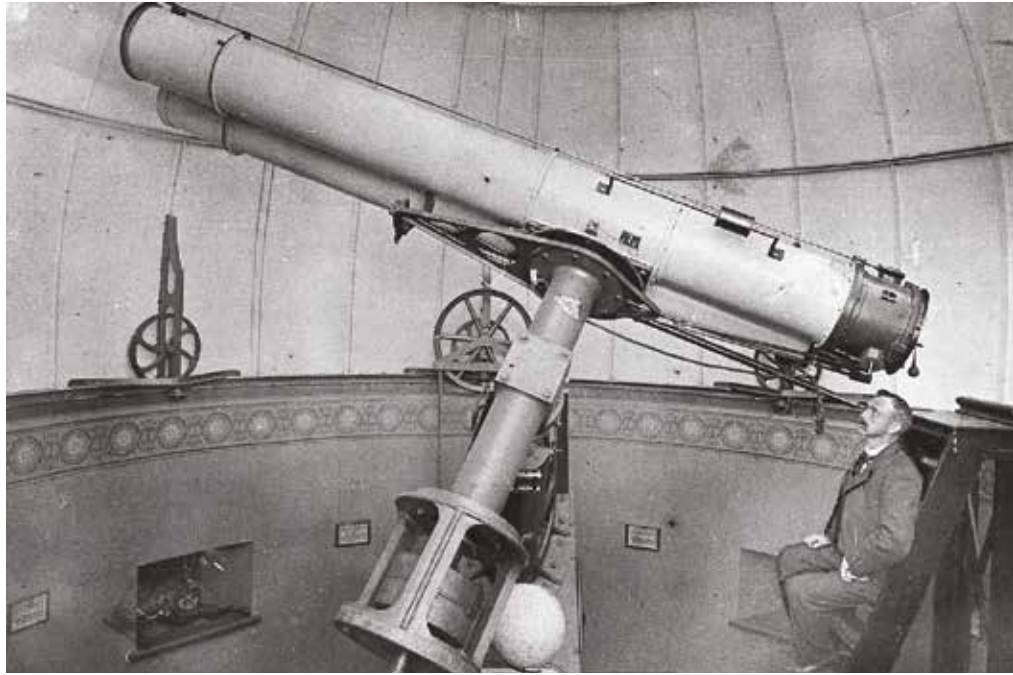




Gazing upwards, moving forwards

by Matthew Woods, Roger Groom,
Greg Lowe and Rhianna King

For more than 119 years, the Perth Observatory has provided a gateway to the galaxy for awed school students, a community of amateur star gazers, and local and visiting professional astronomers. It has also contributed valuable information to international collaborations and made some exciting discoveries. A new partnership agreement between Parks and Wildlife and an active and passionate group of volunteers marks a new chapter for this amazing facility and the future of astronomy in Western Australia.



The stars, planets and galaxies that light up our sky have enchanted and interested people for millennia. What we now term ‘astronomy’ – the study of celestial objects – was undertaken first by Aboriginal people who used stories to interpret tides, eclipses, and astronomical events such as comets and meteors. They also used the changing positions of stars and planets, and the rising and setting times of the sun and moon, to help interpret the seasons and guide what foods were available and when, and to determine when certain animals were more likely to be caught. Astronomy also played a profound role in Greek mythology and ancient philosophy. Philosopher Plato wrote “Astronomy compels the soul to look upwards and leads us from this world to another” and if what he said is true, then the Perth Observatory in Bickley is WA’s gateway to that other world.

LIGHT-YEARS OF HISTORY

The first proposal for an Observatory in Perth was made by Premier John Forrest in 1891. It took five years until the first foundation stone was laid at Mt Eliza, on the site that is now Dumas House opposite Kings Park, and another year and seven thousand pounds to complete. The Observatory operated on this site until 1963 when the new Perth Observatory was opened in 1966 at Bickley in the



Darling Range, 35km east of the city and 380m above sea level where light pollution that hindered star viewing was reduced. At this time the world was captivated by astronomy and this state-of-the-art facility enabled WA to contribute a number of significant discoveries and meaningful data to the international scientific arena.

TELESCOPES

The original Perth Observatory had two telescopes, the Astrographic Telescope (built in 1897 by renowned Irish instrument maker Howard Grubb and last used in 1999) and the Troughton & Simms six-inch Meridian Transit Circle Telescope (built in 1899 and decommissioned in 1957). While old in age, the Astrographic Telescope took more than 28,000 glass plates which helped to discover 29 asteroids between 1970 and 1999.

Previous page

Main Domes at the Observatory house powerful telescopes.

Photo – Roger Groom

Above left The Observatory can be visited during the day for tours as well as at night.


Photo – Matthew Woods

Above William Ernest Cooke, Western Australia’s first Government Astronomer.

Photo – Perth Observatory

The Meridian Transit Circle Telescope was used to accurately determine Perth’s longitude position, which meant the Observatory could provide the citizens and transport services of WA, as well as ships off the coast of Fremantle, with the exact time. The Meridian Transit Circle Telescope was also used to determine an accurate trig point for Perth which allowed for better surveying. It is now on display in the foyer of the Observatory’s main office in Bickley.

In 1910, the Perth Observatory took ownership of its third telescope. The 12-inch reflector Calver Telescope (fashioned by George Calver) was sent to WA for the 1910 passing of Halley’s Comet but unfortunately it missed the pass due to missing parts and malfunction. Although it missed the pass, the Calver Telescope was taken on the 1922 Wallal



“Today, while the science is more advanced, and the telescopes are more powerful, the wonderment and awe of those who visit remains the same.”



Above Night tours are popular from September to May.
Photo – Roger Groom

Left The roof of the domes open to reveal the sky.
Photo – Matthew Woods

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Solar Eclipse Expedition where it was used at Eighty Mile Beach, between Port Hedland and Broome, to assist in the photography conducted by Lick Observatory personnel. With these plates, the expedition was able to perform calculations to further confirm Einstein’s theory of general relativity. The Calver was restored in 1996 and is still used today during night tours of the Observatory.

The year after the facility opened in Bickley, it took delivery of a Repsold 19cm Meridian Transit Circle telescope from the Hamburg Observatory as part of a four-year project. The telescope was the first automated multi-slit photoelectric micrometer of its kind in the world. Using this telescope, a German expedition of astronomers and Observatory staff produced the Perth 70 Meridan catalogue, which provided important data on star

positions in the southern hemisphere night sky. The telescope remained on loan after the German expedition left and was used to compile the Perth 75 and Perth 83 catalogues before being returned to Germany in the late 1980s.

In 1971, the Observatory’s arsenal of telescopes was bolstered with the addition of the Lowell 61cm reflector telescope, which was installed as part of NASA’s International Planetary Patrol Program to continually photograph atmospheric and surface features of the planets. The program involved seven telescopes around the world and focused on Jupiter and Mars as well as Saturn. It was this telescope that collected the images in 1977 that contributed to researchers concluding that Uranus is surrounded by rings.

In 1985–86 the Lowell Telescope also produced images that helped astronomers

better understand Halley’s Comet including discovering jets of Copernicium gas on the comet. In addition, the Astrographic Telescope was responsible for producing 10 per cent of all the ground-based observations. These were used to guide the ESA spacecraft Giotto which flew by the comet. Both telescopes enabled the Perth Observatory to play a significant role in the international study of this once-in-every-76-year-event.

In 2006 using gravitational lensing (where light from a distant star is bent and magnified by the gravity of a foreground star and planet causing an additional small increase in the intensity of magnified light), the Perth Observatory and the European Southern Observatory La Silla Observatory in Chile discovered a super-earth exoplanet, which was gifted the unceremonious name OGLE-2005-BLG-3901b.

OUT-REACHING TO THE STARS

The Perth Observatory’s long-running outreach program dates back to its roots at Mt Eliza when people visited the facility to view the stars and attend public lectures using a 12.5-inch Calver telescope which is still in use now. Today, while the science is more advanced and the telescopes are



Above The moon's surface is visible through the Observatory's telescopes.
Photo – Matthew Woods

Top right Volunteers engage with a range of people through the Observatory's outreach program.
Photo – Roger Groom

Above right A 'celestial walk' at the Observatory maps out the planets by relative distance.
Photo – Matthew Woods



more powerful, the wonderment and awe of those who visit remains the same.

On certain nights from late-September through to May, the Perth Observatory offers night tours. The phase of the moon and the amount of cloud cover in the sky determine what visitors can see. On nights when there is a Full Moon, the telescopes focus on the moon's surface, while on 'dark sky nights' – when there's no moon – fainter objects such as the Tarantula Nebula in the Large Magellanic Cloud are easier to see. 'Moonlit nights' are when the detail on the moon is most visible and

star clusters and bright nebulae can also be seen. On occasion, a satellite or a meteor might flash past too, delighting those who see them.

These night tour evenings are run by experienced and passionate volunteers who demonstrate the telescopes and share their immense knowledge about the history of the Observatory, astronomy and the telescopes themselves which they tailor to the group's knowledge level. To ensure visitors can maximise their time at the facility, each telescope is manned by a volunteer who receives immense satisfaction from the 'WOW's and ensuing 'ohhs' and 'ahhs' that come from people as they peer down the eyepieces and off into another galaxy.

The Observatory also runs day-guided tours of the facility, where visitors enjoy a celestial sky show in a lecture room and look at the sun through a telescope. These tours are popular for school excursions and other group outings. A day visit to the Observatory can also be done as part of a whole day spent in the hills, which could

also include a trip into the surrounding national parks, including Beelu National Park where the Perth Hills Centre is located, a walk on the Bibbulmun Track or a ride on the Munda Biddi Trail, with lunch at one of the area's wineries. There's also a chance to spot some of the neighbourhood kangaroos that visit the Observatory grounds to graze on the lawn.

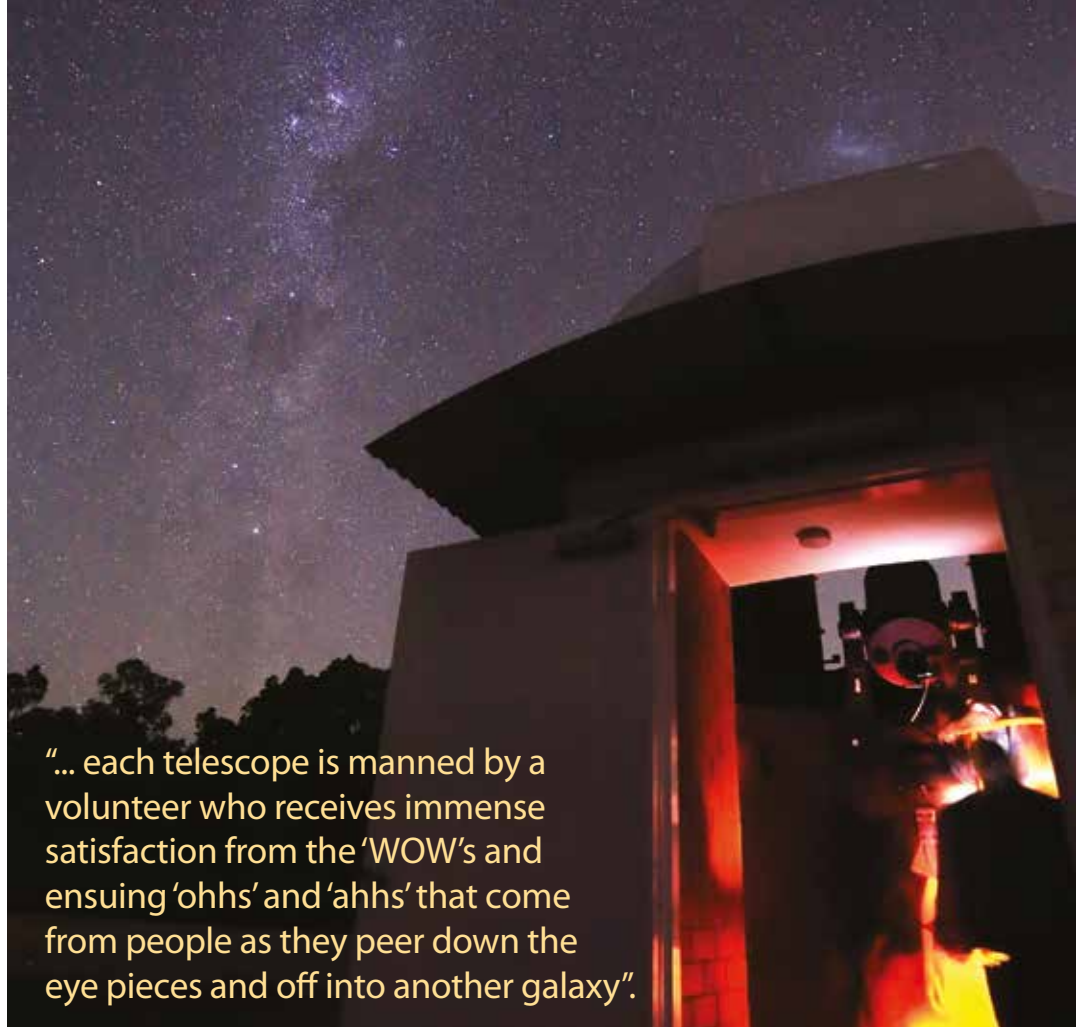
In an effort to diversify its potential as a world-class facility, the Observatory is also opening its doors to be hired for private functions such as weddings and conferences. It is also planning to expand its program to take the Observatory on the road and provide 'incursion'-type experiences to groups off-site.

For those who would like to 'own' their own piece of space, the Perth Observatory runs an adoption program where stars are sponsored. This is popular among people who would like to honour someone who has passed away or celebrate the arrival of a new baby. It also has been known to be taken up by romantics looking for a grand gesture.



Above Perth Observatory Volunteer Group Secretary Christine Coulstock and Chairperson Diana Rosman with Parks and Wildlife Director General Jim Sharp and Science and Conservation Director Margaret Byrne.
Photo – Karla Graham/Parks and Wildlife

Right Visitors to the Observatory can view features of the night sky.
Photo – Roger Groom



“... each telescope is manned by a volunteer who receives immense satisfaction from the ‘WOW’s and ensuing ‘ohhs’ and ‘ahhs’ that come from people as they peer down the eye pieces and off into another galaxy”.

Another way that people can engage with the Perth Observatory is through the Skynet telescope program through the University of North Carolina’s global network of telescopes called Skynet (<https://skynet.unc.edu>). Users around the world can operate the telescopes remotely, which is perfect for school students and researchers on the other side of the world who can look at our night sky during their day time hours. For another type of arm-chair astronomy, the Perth Observatory has developed an active and engaging online presence and uses its Facebook page and Twitter account to provide information about upcoming celestial events, promote the Observatory and engage with other astronomers and astronomical agencies and communities.

VOLUNTEERS SHINE

A management agreement between Parks and Wildlife and the Perth Observatory Volunteer Group was signed in June 2015 and sees the two groups partner to continue to expand the public

outreach program. The 80-strong force of volunteers who range in age from university students to retirees bring an extraordinary gamut of experience, skills and expertise to the Observatory. Their contributions range from answering email enquiries from home while juggling young children to working tirelessly to fix and maintain the telescopes, with a range of tasks in between.

Some of the volunteers have been with the Observatory for between 20 and 35 years while others have joined the group more recently, after answering a call for people to join the group in the last few years. Regardless of their length of service, the volunteers share an optimism that the public outreach program can be expanded and have hopes that the research aspects of the Observatory can get back up and running. Another thing the volunteers share is a genuine passion for astronomy, whether they developed it in their childhood while they watched the moon-landing or on camping trips while they gazed at the night sky. For some it’s something they developed later in life

when they were looking for an interest to occupy their post-work lives. And with enthusiasm like that, surely the sky’s the limit for this beloved institution.

Matthew Woods is a volunteer and marketing/media coordinator for the Perth Observatory Volunteer Group as well as a bonafide space nut.

Roger Groom is a software developer/consultant by day, astrophotographer and amateur astronomy researcher by night and landscape and nature photographer by the weekend.

Greg Lowe is a Perth Observatory volunteer and worked as an astronomical officer for more than 41 years.

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The authors would like to acknowledge material gleaned from 'Perth Observatory History', compiled by Heritage Council historian Wayne Moredoundt for the Perth Observatory heritage listing.

Tips for viewing the night sky



- Viewing the night sky can be as easy as stepping out your back door at home or taking a weekend drive to a country location for dark skies. The darker the sky of your location, the less light pollution, the more stars, galaxies, nebulae and other objects you are going to see.
- In typical suburban Perth with just your eyes you will see the bright stars and planets, and maybe a faint hint of the Milky Way snaking across the sky. If you're on the fringe of Perth city you will see a lot more, including the definite structure of the Milky Way as well as large and small Magellanic clouds, both being companion galaxies of our own Milky Way.
- To view the night sky let your eyes adjust for at least 15 minutes, without bright lights such as phone screens and outdoor lights around you. The stars will seem to appear as your eyes adjust.
- Binoculars are great for stargazing. Ideally they would be a medium quality set of 30mm to 50mm aperture and low magnification (up to 10x magnification). The combination of large aperture and low magnification will make your viewing experience more rewarding.
- Over time you might try to perfect the art of 'averted vision'. By using the receptors at the sides of your eye you will be able to see faint detail in the night sky more clearly. Try glancing to the side of where you want to look, and looking at the object out of the corner of your eye. It takes some practice but can let you see much more.
- If you wish to graduate from binoculars to a telescope, do so after you have familiarised yourself with the night sky and are able to invest more than \$500 in the telescope, as cheaper telescopes are rarely better than a good pair of binoculars (which might be worth about \$200). You should invest some time in researching your options and consider portability, usability and stability of the instrument.



Right Southern Cross.
Photo – Roger Groom

Aboriginal Dreaming

Aboriginal people are regarded as the world's first astronomers. They used the changing position of the stars and planets and the rising and setting times of the sun and moon to help guide what foods were available and determine the behaviour of certain animals. They used stories to interpret tidal movements, eclipses and astronomical events. These stories vary between language groups and played an important role in their spiritual connection to country.

The story begins with the tale of two spirit people – a man and a woman. The spirit people were standing in the dimness listening to the other spirits singing and dancing. They towered over the landscape when they spotted shining eyes on the ground all around them.

"They became inquisitive, as they just had to find out what all these little shining eyes were.

So over they walked and the spirit woman bent down and picked up a pair, and when she realised that they belonged to this beautiful little spirit child, she became so emotional that she could not bring herself to put the child back on the ground so she put it in her hair. This huge spirit woman had beautiful long white hair that flowed right down her back. She saw another little child so she collected that one to put it into her hair, and then another, and another...

The spirit woman wandered right down through the south around up past where Perth is today, all the while she was collecting the spirit children. By this time there were many thousands of the children in her hair, which was by now tied up like a net...

... one of the children became loose and fell, the instant it hit the ground it turned into stone and the stone was strong enough to hold up the sky ... as she ran across the country with the children falling from her hair she left a trail of stones all along the way.

I know that we have all been outside on the dark night and seen a shooting star streak across the sky, I have heard some people say make a wish, when we see this we always say *by-ee coolunger nyina*, which means little spirit children returning to earth. When they reach earth they are nothing more than a little stone, some are a bit bigger than others, and some don't make it at all.

The spirit children return to earth all the time, with a known pattern of large showers about every 33 years, that is when we believe that our spiritual energy is at its strongest."

This is an abridged version of a story written by Noel Nannup called 'Carers of Everything', which was included in the Swan Region Strategy for Natural Resource Management.

Background and top

William Bay National Park.
Photo – Peter Nicholas/
Parks and Wildlife

Above Geminids meteor shower.

Photo – Roger Groom

Explore the night sky with LANDSCOPE

Night sky
Feature
lift-out



1. Orion Constellation

Orion Constellation

The Constellation of Orion is one of the most easily recognised constellations in this area of the night sky, whether you know it as Orion or give it the more typical Australian name 'The Saucepan', you are sure to recognise it when above the horizon. Summer is the time to look at Orion, and with many telescopes being given as Christmas presents, it is often the first area people see. Orion contains the easily distinguished red supergiant star Betelgeuse, the bright Great Orion Nebula (within Orion's Sword), the Flame Nebula (at one end of Orion's Belt) and many other features distinguishable through binoculars or a telescope.

Pleiades

Pleiades (also known as the Seven Sisters) is an open cluster of bright distinguishable stars, which from our southern hemisphere location appears high in the north. With photography the cluster shows brilliant blue and about 20LY large. To the unaided eye Pleiades appears as a small group of bright stars about two degrees wide (four times the apparent size of the Moon). With binoculars many more stars become visible. This open cluster is best viewed with binoculars or a small telescope due to its large apparent size. Many different cultures around the world have varying stories regarding Pleiades due to its prominence in the night sky.



2. Pleiades



3. Eta Carina

Eta Carina

The Eta Carina nebula is a complex nebulous region in the Milky Way, on the opposite side of the Southern Cross to the pointers Alpha and Beta Centauri. Eta Carina itself is a star, predicted to go nova within approximately the next million years. In the process of dying this star is expelling material, which is visible through telescopes as lobes or 'homunculus'. Within the larger Eta Carina Nebula are several notable features such as the Keyhole Nebula and Trumpler 16 open cluster. Eta Carina is approximately 260LY distant and the nebula is about seven times the size of the Great Orion nebula. View the Eta Carina nebula through binoculars, or the star itself through a telescope where you will see a hint of the Homunculus Nebula in a medium to large instrument.



4. Tarantula Nebula

Large Magellanic Cloud

The Large Magellanic Cloud (LMC) is a companion galaxy of our Milky Way and at only ~160,000LY distance is the third-closest galaxy to the centre of our Milky Way. The irregular shape of the LMC is thought to be caused by gravitational disruption by the 10 times larger Milky Way. While the LMC is another galaxy its close proximity allows us to observe great detail within, such as the Tarantula Nebula and many star clusters and other areas of nebulosity. To the naked eye under dark skies the LMC stands out as a cloud-like structure. Almost too large for binoculars, use your naked eye or zoom in to see more detail of specific areas with binoculars or a small telescope.

Small Magellanic Cloud

The Small Magellanic Cloud (SMC) like the LMC is a companion galaxy of our Milky Way, although slightly more distant at ~200,000LY and appears fainter to the naked eye. While the SMC has less notable features than the LMC it is conveniently positioned near the spectacular globular cluster 47 Tucanae (NGC 104). Unlike the LMC, the SMC will typically fit just within the field of a pair of typical binoculars, and when viewed at higher magnification, significant detail can be seen in the enormous ball of stars which is 47 Tucanae. Together with the LMC, the SMC provides great targets for casual star gazing, and we are lucky to have them visible in our southern skies.



5. Small Magellanic Cloud



6. Milky Way

How to use this liftout

This lift-out has an all-sky chart featuring our wonderful southern hemisphere night sky. The chart is drawn for the sky above Perth on 15 December at 10pm. Holding this chart under clear dark skies with a dim torch you can identify some of the wonders that can be observed through the telescopes at the Perth Observatory on Star Viewing Nights. What you will see in the night sky changes for your location on the Earth and over time as the months progress.

The best way to view the night sky is with your eyes, a pair of binoculars such as 8x40 or 7x50 or a telescope. Telescopes are great if you have one, but often binoculars are easier and more rewarding to use than an entry level telescope. Let your eyes adjust to the darkness, give them at least 15 minutes with no torch, phone or outdoor light to adapt, and then keep your surroundings dark (outer Perth metropolitan, away from the city, is best) while you enjoy the night sky. You might even see the Magellanic Clouds. From there you can 'star hop' to identify the other objects labelled here.

LY=light years SMC=Small Magellanic Cloud LMC=Large Magellanic Cloud

Photos - back ground images, 1,3,4,6. Roger Groom, 2, 5. Andrew Lockwood

Enjoy a night under the stars

Visit the Perth Observatory for a night tour and you can see these objects plus more through one of the public viewing telescopes, housed in the white observatory domes. Knowledgeable guides at each telescope will help you make the most of your time at the eyepiece, and the host will talk to you about the greater night sky above. Bookings can be made at www.perthobservatory.com.au.

Adopt a star

The Perth Observatory runs a Star Adoption program where you can have your name registered in a database against a star of your choice. You get a private viewing session for you and a small group of your family/friends, a certificate, and help continue the education and outreach activities of the Perth Observatory through the licence fee paid.

When is it best to look at the night sky or join a tour?

Months	Best opportunities
December–March	Well-known constellations such as Orion, Gemini, Taurus, Cancer and Aries along with the open cluster Pleiades (Seven Sisters) dominate the northern horizon, while bright regions of the Milky Way, such as Eta Carina, rise in the south. Towards the end of this period Jupiter becomes visible in the north-east. This is a great time for all-round viewing.
April–May	The Southern Cross is high in the sky along with the spectacular Eta Carina as the core of the Milky Way including Scorpius rises in the east. Saturn and Mars become prominent in the east while Jupiter remains high in the north. Virgo is up in the north with our nearest galaxy groups.
June–September	The Milky Way is dominant overhead with all its glory and endless possibilities for viewing nebulas and star clusters. Saturn and Mars are high in the sky with Saturn at its best. Cold clear nights mean great opportunities for quality time under the stars, but rug up.
September–November	The Milky Way remains visible, setting in the west earlier but still with plenty to see. This is a time for galaxies with Fornax, Grus, Andromeda and Sculptor high in the sky. The Magellanic Clouds become star attractions as they rise in the south-east.

* Note: This information is appropriate for 2015–16 and will vary beyond that timeframe.

The night sky changes throughout the year, so you can plan your visit to the Perth Observatory for a time that suits what you want to see.

Every 27.5 days the Moon moves through a complete cycle of New Moon to Full Moon. The New Moon phase is the best time to view deep space objects such as nebulas, galaxies and star clusters. You will also see the Milky Way and Magellanic Clouds best during this phase. Full Moon will show you all the craters and shapes on the Moon, you can pick out where the Apollo craft landed, and still enjoy bright deep space objects such as bright star clusters and planets.

Weather, of course, has a big impact on viewing and January, February and May are generally regarded as best times for clear skies, with May recognised as Perth's best month for clear and steady night skies. While the middle of summer increases the chance of a clear sky, there is an increased likelihood of smoke, heat and dust in the air, which can impact viewing.

Above Perth Observatory at night.

Photos – Roger Groom (1,2) Geoff Scott (3) Matt Woods (above)



1. Alpha Centauri



2. Night tour at Perth Observatory



3. A lunar eclipse

Did you know?

The volunteers at Perth Observatory operate a robotic internet-connected telescope known as 'R-COP' under the Skynet international network of telescopes. This telescope is used for outreach activities with groups such as secondary students.

You can get involved in the Perth Observatory by becoming a volunteer. For more information email volunteering@perthobservatory.com.au.

Once a year the Perth Observatory hosts a summer lecture (the next session is scheduled for 9 February 2016). Come and enjoy the observatory grounds set amongst beautiful bushland, have a sausage sizzle or bring a picnic and listen to an entertaining talk.

The Perth Observatory is available for functions. Guests will be treated to a unique experience whether in the day or at night.

A sacred partnership

MANAGING MATUWA AND KURRARA KURRARA

In the centre of Western Australia, 170km north-east of Wiluna on the southern edge of the Little Sandy Desert lies an extraordinary place. Here, traditional owners are working in partnership with Parks and Wildlife to restore almost 600,000ha of semi-arid country to the way it was before European settlement and to protect its cultural values. Lorna Glen, or Matuwa as it is known by the local Martu people, and neighbouring Earahedy, or Kurrara Kurrara, are entering a new chapter of management as a formal Indigenous Protected Area.

BY EMMA O'LEARY AND IAN KEALLEY







“The area is a meeting place, where Martu law and culture have been practised and stories told through the generations.”

Martu people have occupied the area around the Little Sandy, Great Sandy and Gibson deserts for more than 40,000 years. While some remain living in the desert, others have moved into remote towns and communities. Many of the Martu people call the water holes, creeks, claypans, sand dunes, mulga forest and rocky country at Matuwa and Kurrara Kurrara home. This area, with its diverse land systems, is of immense cultural value.

Matuwa and Kurrara Kurrara are places where many important *jukurrpa* (Dreaming sites) and *jukurrpa tjina* (Dreaming tracks) are found. The Martu people recognise the underground water as part of the *tjukurrpa* (songline) of the *pikuta* (Euro kangaroo), which created the creeks as it travelled. While surface water is infrequent, rainfall creates a temporary but frenetic bloom of desert life. These interlinkages of ground and surface water are celebrated by Martu people as the rich animal and plant life supports important activities like camping, gathering food and bush medicine.

The area is a meeting place, where Martu law and culture have been practised and stories told through the generations. It has some of the most significant men’s and women’s cultural sites in the desert. For instance, Matuwa contains a significant

men’s area that is known across the entire western desert and is often still visited by senior men from other areas. Several exclusive women’s sites are also very important, given that they connect Matuwa and Kurrara Kurrara to the major women’s Dreaming track that crosses the western desert region. By looking after country and its resources, the Martu people have kept *jukurrpa* alive and strong.

Such is the cultural significance of the area that, in 2013, the Tarlka Matuwa Piarku Aboriginal Corporation, which is the organisation representing the Wiluna Martu people, obtained exclusive possession native title at Matuwa and Kurrara Kurrara.

EUROPEAN SETTLEMENT

In 1874, the explorer and later Western Australian Premier John Forrest led an expedition into uncharted land along the Murchison River and then east through the unknown desert centre of Western Australia. His expedition passed within 16km of the north-east corner of what is now Kurrara Kurrara, but then headed further east, leaving the map for the area blank. It wasn’t until some 60 years later, in the 1930s, that Lorna Glen and Earahedy (as they were otherwise known) became working pastoral stations.



Previous page

Main The spectacular expanse of Matuwa.

Above Matuwa and Kurrara Kurrara are of immense cultural significance.

Photos – Jennifer Eliot/Parks and Wildlife

Over the next 70 years, pastoralists ran sheep and then cattle, and grew peanuts, cotton and lucerne hay in an irrigated area on the two properties. During this time, the Martu people started working as station hands, drovers and housemaids, integrating into pastoral life. Most of the fences on Matuwa and Kurrara Kurrara were built by Martu men in the early 20th century. They built houses, birthed and raised their children and buried their people there, and continued to teach the next



generations about *jukurrpa*, never letting go of their connection to the area.

The properties have many sites where Martu and non-Martu histories have come together. For example, Yimbin Rock Hole at Kurrara Kurrara is where Martu people first camped when they arrived from the desert and is also associated with Dreaming stories, yet it was the main pastoral recruitment zone for Martu station hands. From the 1970s, the pastoral viability of the properties started to decline and eventually the era of Martu and non-Martu living and working together there ended. Much of the pastoral infrastructure remains and continues to be maintained and used, including the Lorna Glen homestead, fences, roads and tracks.

REVERSING THE CLOCK

The early pastoralists brought cattle, camels, horses and sheep into the area, while rabbits, feral cats and foxes had also found their way to WA's arid interior and established significant populations. These introduced species have had a big impact on native animals through predation and loss of habitat.

Many animals that once roamed the arid zone in abundance, including bilbies, possums, boodies and some bird and reptile species have all but disappeared. Many species are now long gone from the area and on the brink of extinction across the country. Some of these species still hang by a thread on the mainland, while

others survive on islands off WA's coast or in protected sanctuaries.

In 2000, after 70 years of Matuwa and Kurrara Kurrara being used as working pastoral stations, the leases were purchased by the State Government for conservation. The properties were considered to be in good condition, with diverse land systems. However, the decline of native animals in Australian deserts, including central WA, was of significant concern, and in 2004 an ambitious and groundbreaking wildlife reconstruction project was started by Parks and Wildlife's predecessor, the Department of Conservation and Land Management, in consultation with the Martu people.

Operation Rangelands Restoration, funded by the State Government and Chevron's Gorgon Gas Project offset funds, set out to restore Matuwa and Kurrara Kurrara to their pre-European settlement state, including the reintroduction of 11 native mammals that once occurred across the arid zone. Restoration activities included initially working with the outgoing pastoralists on destocking and decommissioning man-made water points. Aerial baiting was then carried out to control introduced predators and a managed fire regime based on traditional Aboriginal burning practices began. By working with neighbours on boundary fencing, feral camels and cattle were less of a problem. A 1100ha predator-free acclimatisation compound was built, enabling threatened native mammals

Above left Tommy Ningibong, an early and well-known Aboriginal identity, helping with Earraheedy shearing.

Photo – supplied by Ross Quartermaine

Above Martu community members and Parks and Wildlife staff releasing a radio collared golden bandicoot.

Photo – Jennifer Eliot/Parks and Wildlife

to be introduced free from predation by feral cats (see also 'Restoring the rangelands' on page 41). So far, golden bandicoots, boodies, bilbies, Shark Bay mice, brushtail possums and mala have been translocated inside and outside of the compound. Some of the translocated mammals originate from Barrow Island off the Pilbara Coast. Captive-bred animals from Parks and Wildlife-run captive breeding programs at Shark Bay and Dryandra, near Narrogin, have also been used to provide animals for reintroduction. Following almost two decades of research under its *Western Shield* program, Parks and Wildlife developed the *Eradicat*[®] cat bait and an associated baiting regime that has significantly reduced the feral cat population on Matuwa.

With new generations of mammals being born at Matuwa and Kurrara Kurrara, conservation efforts so far have been successful. Many native reptile, mammal and bird species are now seen in record numbers. Captive-bred bilbies were reintroduced in 2007 and a recent



survey has shown the population has more than doubled and recolonised large parts of Matuwa. The successful free-range establishment of bilbies in the wild is an Australian first. This program is one of the world's largest and most extensive science-based wildlife reconstruction projects, and the biggest arid zone project ever undertaken in Australia.

A STRONG PARTNERSHIP

With the signing of a memorandum of understanding in 2004 to start joint management of Matuwa and Kurrara Kurrara, and the *Operation Rangelands Restoration* project, for the first time since the pastoral days the Wiluna Martu people were able to physically reconnect to this important country that they had spiritually never left.

Since then, local Indigenous rangers have been employed and trained, and now work in partnership with Parks and Wildlife on a range of land management activities. The Martu rangers and community have helped Parks and Wildlife control pest animals, manage and research fire, monitor threatened species populations and construct and maintain infrastructure. The Martu people have been instrumental in building and repairing boundary fencing, which has reduced cattle grazing pressure, soil erosion and weed introduction on to Matuwa and Kurrara Kurrara. This has improved the health of native vegetation, paving the



way for recovery of native animal species.

The Martu rangers have also protected the area's cultural values by maintaining cultural sites, working with elders to pass down stories and looking after *jukurrpa*. Support for traditional and customary activities including hunting, camping, sacred site protection and ceremonies have been an integral part of the partnership between Parks and Wildlife and the Martu people.

TRADITIONAL BURNING

For thousands of years, Aboriginal people regularly burnt small patches of spinifex in the western desert for hunting, signalling, access, and for spiritual reasons. However, traditional Aboriginal burning had diminished in the area since the 1960s, resulting in massive spinifex 'megafires' that have threatened people, communities and the environment. As Aboriginal people have returned to the western desert, obtained native title and instigated land management they have reintroduced fire management around communities, access tracks, sites and hunting areas.

At Matuwa and Kurrara Kurrara, the combination of western science and Indigenous knowledge and skills is creating a prescribed burning regime that reflects traditional Aboriginal burning practices. Developed and carried out by Parks and Wildlife and Martu rangers, this regime has been vital in reducing fuel to protect important sites and infrastructure, such



Top left Parks and Wildlife staff trap and log information about animals at Matuwa.
Photo – Jennifer Eliot/Parks and Wildlife

Top right Prescribed burning is an effective way to reduce fuel loads to help protect historical and ecological sites in the area.
Photo – Parks and Wildlife

Above A boodie at Matuwa.
Photo – Judy Dunlop/Parks and Wildlife

as the compound and homestead, and neighbouring properties, against massive lightning-caused bushfires. It has also been important to the health of the bush, with fire being a natural part of ecosystem processes. Regular patch burning and buffers are applied in strategic locations to create a variety of vegetation at different stages since the last fire.

Restoring the rangelands

By Jennifer Eliot

A recent trip to Matuwa has given me a new appreciation of spinifex. Previously, I didn't see any beauty in it – just a prickly bush I thought – but today thanks to an opportunity to volunteer with the Department of Parks and Wildlife's golden bandicoot (*Isodon auratus*) translocation program, it has become a symbol of hope.

Golden bandicoots are small ground dwelling marsupials, similar to the quenda found in the south-west, that until as recently as the 1930s were found in much of northern Australia's spinifex sandplain country.

Sadly, predation by feral cats in particular has decimated mainland Australia's population, and now they only survive on some offshore islands and small areas of the Kimberley and Northern Territory mainland. That, however, is about to change.

Parks and Wildlife's *Operation Rangelands Restoration* project aims to return 11 species of native mammals to the Matuwa Indigenous Protected Area, north east of Wiluna.

The golden bandicoot is one of these species and in 2010 golden bandicoots from Barrow Island were translocated to a feral-proof enclosure at Matuwa, the first step in returning these vulnerable animals back to their rightful place. The second step, and real challenge, was to establish them outside the fenced enclosure.

It was an honour to have played a part in such an exciting project and when I responded to the call for fit and enthusiastic volunteers, I had no idea that I had just stepped into an experience of a lifetime.

When I arrived at Matuwa, the serious work of reducing feral cats in the release area outside the fenced enclosure had been done, although this work will remain ongoing.



My journey began on a crisp September morning inside Matuwa's fenced enclosure as we cleared traps, set the evening before, and I looked down at my first golden bandicoot, its pointed nose and small dark eyes looking back at me.

From that moment, I was hooked and revelled in long days which began as the sun rose and often continued long after it had set as we processed animals for release, fitted radio collars, reset traps and helped with feral cat control.

It might be easy to believe that the highlight of the trip was releasing golden bandicoots.

There is no question that it was exhilarating watching these animals take their first tentative steps into the wild, but for me the highlight came in the days after as we began radio tracking to monitor their progress.

Hearing the beep... beep... beep that signalled that our animals were still alive and seeing golden bandicoot tracks in Matuwa's pindan soils, where for too long there had been none, was as good as it gets.

An added bonus was to see abundant signs of bilbies which had been reintroduced to Matuwa 2007–09, and have now established and spread throughout their rangeland home.

The golden bandicoot's future in the wild remains uncertain; however, with the dedicated team of Parks and Wildlife



scientists on their side, they are now, at least, in with a fighting chance.

Their work has already seen the successful reintroduction of bushtail possums and bilbies to Matuwa. Let's hope they can add golden bandicoot to the list.

By the end of the trip, I had no doubt that it is vital that we continue to put energy into protecting our ecological heritage and work towards saving our vulnerable and endangered animals.

We owe it to our children.

Clockwise from top Fitting a golden bandicoot with a radio collar; the quintessential spinifex.

Photos – Jennifer Eliot/Parks and Wildlife
Jennifer Eliot with a camera trap.

Photo – Keith Morris/Parks and Wildlife

If it had not been for this practice, a lightning-caused bushfire in early 2015 that was burning under hot, dry and windy conditions could have burnt extensive areas of vegetation and been disastrous for the successfully

reintroduced mammals and other wildlife that have been gradually returning to the area. Prescribed burning under the implemented fire management plan stopped the fast-spreading fire front, enabling fire crews to quickly contain the

bushfire. It burnt about 5000ha, but had the potential to burn much more, which would have been costly and dangerous to suppress and would have caused significant heritage, environmental and infrastructure damage.



INDIGENOUS PROTECTED AREA DEDICATION

On 3 July 2015, the Tarlka Matuwa Piarku Aboriginal Corporation, which holds exclusive possession rights and interests in the two properties on behalf of the Wiluna native title holders, signed an agreement with the Commonwealth Government to dedicate Matuwa and Kurrara Kurrara as an Indigenous Protected Area (IPA). A signing ceremony was held at the homestead, and was attended by more than 200 people, including the Wiluna Martu people, Parks and Wildlife staff, Central Desert Native Title Services, the Commonwealth Government and many other stakeholders.

This significant conservation partnership is the 69th IPA in Australia and sees a continuous corridor of IPAs extend from the Tanami bioregion in the Northern Territory through to the Murchison bioregion in WA. The development of the IPA is underpinned by a unique three-way partnership

“With the IPA agreement in place, native title determined, a management plan in place and strong partnerships forged, Matuwa and Kurrara Kurrara now have a robust and stable foundation for future holistic management.”

established over the past few years. It also brings together resources from the State and Commonwealth governments, the community and other partners to continue to restore and protect the outstanding natural and cultural values of the area while generating valuable local employment and enterprise opportunities.

With the IPA agreement in place, native title determined, a management plan developed and strong partnerships forged, Matuwa and Kurrara Kurrara now have a robust and stable foundation for future holistic management. By embracing the traditional elements of Martu culture and land management while also recognising the mixed European and Indigenous history, this area is a shared space where

the long-term vision of the Martu people can be worked towards. This vision is to protect and enhance the understanding of the cultural, historical and natural values of the area, and look after the wellbeing of future Martu generations. It is also a priority for the Martu people to continue with scientific programs and the training and employment of the local community through working with Parks and Wildlife as part of the *Operation Rangelands Restoration* project, and explore ecotourism and cultural options to ensure diversification and economic viability. Building this shared vision is set to bring Matuwa and Kurrara Kurrara into a new, dynamic era of land management as an important model for IPAs.

.....
Above Members of the Martu community gather to celebrate the signing of the Indigenous Protected Area agreement in July this year.

Photo – Stephen van Leeuwen/Parks and Wildlife

Above right Tracking radio collared animals.

Photo – Jennifer Eliot/Parks and Wildlife

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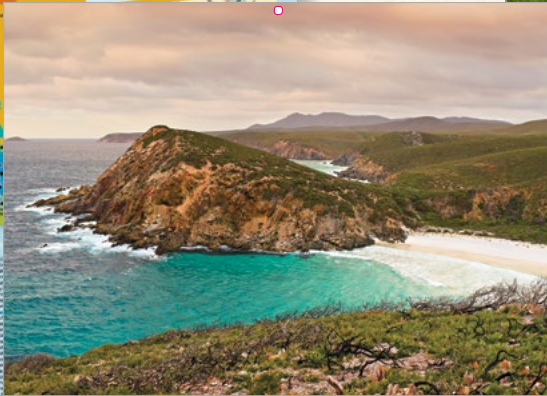
The Matuwa and Kurrara Kurrara Indigenous Protected Area Country Management Plan can be viewed at www.centraldesert.org.au.



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Nature Play

GETTING KIDS OUTDOORS

Western Australian kids are heading back outdoors to get their hands dirty and feet wet, thanks to Nature Play WA – a bold program based on a raft of scientific research and a touch of common sense. This is producing happier, healthier kids who are experiencing a range of physical, cognitive and emotional benefits.

by Paul Jarvis



In 2011 Nature Play WA was developed with the simple aim of getting more kids outdoors more often for unstructured play so they can reap the benefits of playing, learning, being physically active and connecting to their community. The initiative was developed in response to a mix of historical trends and societal factors that have resulted in our children spending less time outdoors and interacting with nature and their community than any other generation in history. The program was started as an initiative of the WA Department of Sport and Recreation and was inspired by the ideas of American social commentator Richard Louv and the Children and Nature Network. Happily, it's going from strength to strength and attracting the attention of child health specialists, the media and governments.

BACK TO BASICS

Nature Play is founded on an understanding of the intrinsic value of time at play in nature and is underpinned by a growing body of research that shows the physical, cognitive and emotional benefits that come with unstructured play outdoors. The program is focused on finding ways to make communities and public spaces where 'mucking around outside' is part of children's everyday lives and the noise of children playing becomes a key component of the soundtrack of a connected community.

Long-term research identifies a point sometime in the past 20 years when child recreation shifted to become increasingly sedentary, indoors and screen based, as opposed to active, outdoors and largely

.....
Left Nature Play WA runs a number of community events and 'play out days' throughout the year.

Above Getting dirty feet is an important part of childhood.
Photos – Nature Play WA



Above Nature Play WA partnered with Parks and Wildlife to offer a geocaching family challenge at Wharnccliffe Mill in Bramley National Park. The sell-out event was held in May and saw families venture out for a weekend to uncover hidden containers (known as geocaches) and bridge the gap between technology and active play.
Photo – Nature Play WA



Above right Felix Anison and Palenque Blair discovering nature together.
Photo – Damon Anison



Right Nature Play passports provide activities and information.
Photo – Nature Play WA

unstructured. And while the amount of organised sport that children are doing has not changed much over the past 30 years (if anything it has increased) the amount of physical activity has decreased significantly. The long-term impacts of this are not yet fully understood but it is clear that the decrease in nature play is paralleled by increasing rates of childhood-obesity, depression, attention-deficit disorder and a disconnect from the world and the community around young people. Just as importantly, research also highlights the value of unstructured play in developing children’s imagination, their ability to make decisions, resolve conflict, develop resilience and build a broader physical fluency as a foundation for more specialised sports and activities.

While the most immediate and obvious benefits of nature play are to child health

and development, land developers, natural resource managers and urban planners are increasingly recognising the potential broader community benefits it also brings. Another key consideration, and one that has been readily recognised in Queensland and South Australia where natural resource managers have led the charge to instigate Nature Play organisations, is the need to engage children in a longer-term narrative of environmental stewardship.

FOLLOW THE LEADER

Nature Play WA has become a local success story with the strategies and tools of engagement developed in WA during the past four years now being used by partners in South Australia and Queensland as well as in Seattle, USA. These ‘sister’ organisations are built on the Nature Play WA model and, while no two

communities are the same, Nature Play WA’s initiatives and programs are proving transferable, and partnering agencies are developing and deploying jurisdiction-specific solutions that help address what is a universal challenge being played out in vastly different contexts. These programs and resources such as the ‘Passport to an Amazing Childhood’, family nature clubs, active school diaries and play spaces are recognised as innovative and world leading.

NEXT GENERATION

It is very easy to look at the trends associated with our increasingly sedentary kids and point the finger squarely at the rise of personal screens and the difficulty of competing with the action, excitement and general mayhem being played out on a range of virtual worlds. Not only does this narrative set up the sort of ‘us and



How to get involved

You can take part in 'nature play' any time of the year wherever you are – whether it's gardening in your backyard, having a play in your local park, forming a family nature club, taking a walk in the bush, going camping, fossicking in rock pools, exploring wetlands or going for a bike ride. And if you're stuck for ideas then head to www.natureplaywa.org.au for ideas and handy resources.

Parks and Wildlife also runs a range of programs for schools and community members through its *Nearer to Nature* program (see www.dpaw.wa.gov.au/get-involved/nearer-to-nature for more information). Special events are also held throughout the year, including school holidays, in parks and reserves throughout the State (see parks.dpaw.wa.gov.au/whats-on).



“The program is focused on finding ways to make communities and public spaces where ‘mucking around outside’ is part of children’s everyday lives and the noise of children playing becomes a key component of the soundtrack of a connected community.”

them’ dichotomy that has a real tendency to alienate, it also fails to recognise the incredible benefits that can be had from effectively using the single most important human tool since the invention of the printing press.

A key challenge for those looking to find strategies to get kids outside and active in unstructured play is to weave in ways for them to use tools they are familiar with, and the ability to successfully wield a smartphone is a given from a very young age. An electronic

‘Swiss army knife’ that puts easily accessible GPS, mapping, geocaching, photography and communication abilities in the palm of your hand is undeniably cool and useful, and it will prove to be one of the biggest allies in our attempts to get young folk outside and active. These tools will hopefully help to realise a generation of well-rounded and engaged young people who go on to lead happy and fulfilling lives thanks to having spent time in nature and experiencing physical, cognitive and emotional benefits.

Top ‘Nature play’ playgrounds are popping up in suburban parks such as in Kings Park.
Photo – Rhianna King/Parks and Wildlife

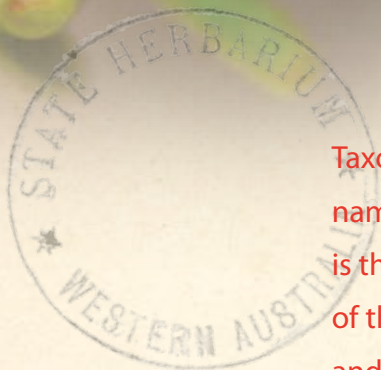
Above Rope courses help kids of all ages to develop a range of skills.
Photo – Wharcliffe Mill

Above left Sometimes a stick and some water is all you need.
Photo – Nature Play WA

Paul Jarvis works with Nature Play WA in an advisory capacity and is the principal of Gervasi Consulting.

For more information about Nature Play WA visit www.natureplaywa.org.au or email info@natureplaywa.org.au.





Taxonomy – the discovery, description, naming and classification of organisms – is the main game for staff and associates of the Western Australian Herbarium and 2015 has been an extraordinary year, with 100 new WA plant and fungi species described in *Nuytsia*, a botanical journal managed, produced and curated by Herbarium staff.

by Juliet Wege

Western Australia is a brilliant place to work as a taxonomist. The incredible diversity of plant, algae and fungi species, many of them unique to the State, are not only of immense scientific interest, but a source of wonder, inspiration and (at times) complete bewilderment. But it is the frequent discovery of new species that really tickles the fancy of botanists at the WA Herbarium. It's not unusual to hear a yelp of excitement emanating from the Herbarium's specimen vaults as a new species is detected, or to witness a beaming botanist perform a celebratory boogie in the bush as a new species discovery is confirmed and the all-important reference samples are collected.



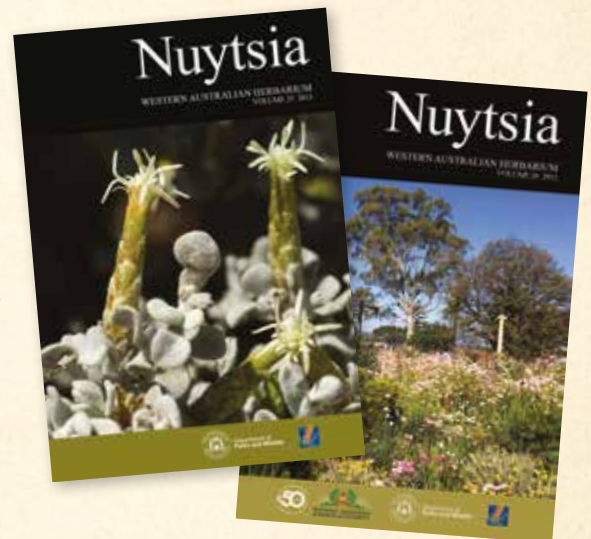
A taxonomic triumph

Many of the State's new species are named and described in *Nuytsia*, a peer-reviewed journal that has been publishing original papers with a focus on WA flora since 1970. During this time, about 2420 new names (of new genera, species, subspecies, varieties and combinations) have been published, and an average of 34 species that are completely new to science have been described every year. This year's effort, which includes the description of 100 new species across two volumes, is one of a handful of standout years for the journal and caps a remarkable year in which the 10,000th vascular plant species was recorded for the State (see 'Discovered: *Angianthus globuliformis*', *LANDSCOPE*, Spring 2015).

The 100 new species come from across WA – from the remote and rugged Kimberley to our spectacular south coast – and span a range of different plant groups. They include a tiny mitrewort from the Gibson and Little Sandy deserts (*Mitrasacme katjarranka*), two unusual aquatic plants that flourish in ephemeral pools and streams in the Kimberley (*Nymphoides astoniae* and *Eriocaulon rivicola*), a plethora of peas (*Indigofera* spp.) from the semi-arid zone, a buttercup from banded ironstone ranges in the Midwest Region (*Hibbertia cockertoniana*), a boronia that thrives on vertical sandstone cliff faces (*Boronia cremnophila*) and numerous orchids (*Caladenia* spp.) from our south-western forests and woodlands.

Main Triplet babingtonia (*Babingtonia triandra*).
Photo – Fred and Jean Hort

Below This year's *Nuytsia* includes the description of 100 new species across two volumes.



Remarkably, several of the new species grow in patches of urban bushland in Perth, including the coastal plain babingtonia (*Babingtonia urbana*), quenda lepidella (*Amanita quenda*), stilt walker (*Stylidium araeophyllum*) and Oldham's sword sedge (*Lepidosperma oldhamii*). The known populations of others are restricted to national parks and reserves managed by Parks and Wildlife, such as the Prince Regent River boronia (*Boronia interrex*) and Mount Trafalgar spinifex (*Triodia celsa*), both of which grow in the spectacular Prince Regent National Park in the Kimberley. The beautiful lasiopetalum (*Lasiopetalum venustum*), which is confined to a nature reserve near Gingin, is one of several beautiful and horticulturally promising species.

STORIES OF DISCOVERY

There are some amazing stories associated with these new species that involve chance finds in the field, targeted surveys of unexplored habitats, helicopter flights to remote locations, and painstakingly detailed research. None is more remarkable than the Herbarium-based discovery of a new species from the Hibiscus family that hasn't been seen for nearly 100 years. The New Norcia lasiopetalum (*Lasiopetalum cenobium*) was named and described using herbarium specimens collected from the monastic town of New Norcia in 1918 (the species name is derived from a Latin word for monastery). Numerous searches in the region have failed to relocate this species, which means that it may well be extinct. The publication of a description of this species, along with notes on its close allies, will improve its chances of being rediscovered in the wild, if it still exists.

The discovery of a potentially extinct species among the specimens housed at the WA Herbarium highlights the importance of this collection, and of ongoing taxonomic research based on this collection – there is no doubt that many new species await discovery. In fact, many of the new species described this year were either discovered in the collection, or found in the field and subsequently



Above Prince Regent River boronia (*Boronia interrex*).

Photo – Russel Barrett

Right New Norcia lasiopetalum (*Lasiopetalum cenobium*) is only known from specimens collected in 1918.

Photo – Julia Percy-Bower

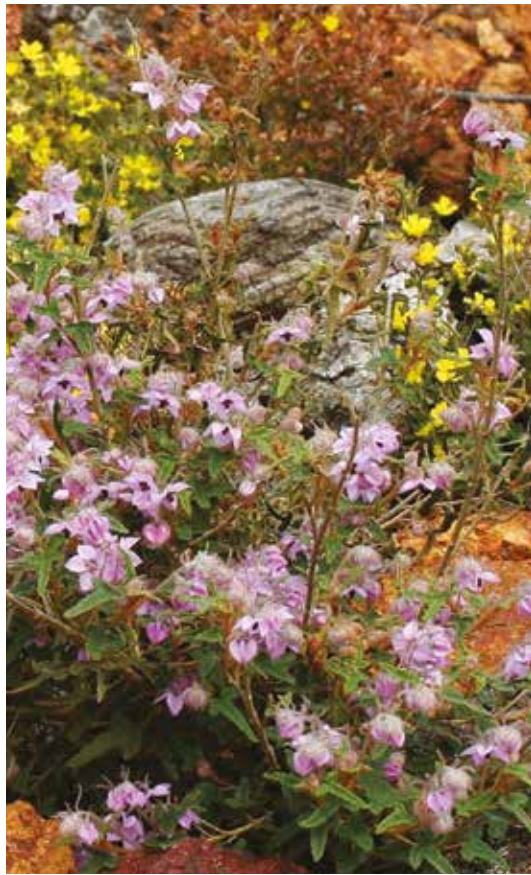


“There are some amazing stories associated with these new species that involve chance finds in the field, targeted surveys of unexplored habitats, helicopter flights to remote locations, and painstakingly detailed research.”

matched to existing collections. For example, the notch-fruited beard heath (*Leucopogon incisus*) was first collected in 1948 by Bob Royce, a former curator of the Herbarium, but it wasn't until this species was recently recollected by an environmental consultant that it could be studied in the field, confirmed as new and described.

Discoveries in the field are less frequent than in the Herbarium but are still happening regularly in WA, particularly when botanists survey unexplored or under-collected regions, or conduct repeated surveys in the same area at different times of the year. A number of such discoveries were described in *Nuytsia* this year, including the pavement laceflower (*Trachymene pavimentum*). This

species was first collected during targeted surveys of sandstone pavement habitats in the Kimberley in 2005 and is still only known from the original population despite extensive follow up surveys over many years. In contrast, the Bindoon pea (*Daviesia localis*) was opportunistically collected in 2001 when a botanist with a keen eye for the unusual was searching for another plant species. As with these two examples, there is often a lag between the first collection of a new species and its formal description. While follow-up field surveys are often required to gather more information, make additional collections, or to examine allied species, sometimes all that is needed is a window of time or some dedicated funding to conduct the detailed research that taxonomy demands.



Above Beautiful lasiopetalum (*Lasiopetalum venustum*).

Photo – Fred and Jean Hort

Above right Juliet Wege collecting voucher specimens for the WA Herbarium.

Photo – Carol Wilkins

Right Volunteers are involved in a variety of work at the WA Herbarium.

Photo – Juliet Wege/Parks and Wildlife

COLLABORATION AND COMMUNICATION

WA has a taxonomic backlog of more than 1400 plant species and subspecies awaiting formal taxonomic description, which is no small task. One of the key strategies to reducing this tally is through scientific collaboration. Collaborations come in many forms, from the simple division of labour to the sharing of expertise on particular plant groups, geographic regions or scientific methodologies. Often it is simply a case of putting two (or more) heads together to nut out a thorny problem or to achieve a particular taxonomic goal. Herbaria across Australia and the world

The Western Australian Herbarium

The Western Australian Herbarium, part of the Science and Conservation Division of the Department of Parks and Wildlife, has a collection of more 750,000 scientific specimens of plants, algae and fungi collected from across WA and beyond. This collection forms the basis of our knowledge of WA's botanical biodiversity and is used by taxonomists at the Herbarium, and in other herbaria in Australia and around the world, to describe and document the species that occur in WA, and to build knowledge of the relationships of species to each other and to the environment.

Herbarium staff members are also responsible for the care of the collection and for keeping the associated databases up-to-date, including an authoritative census which lists all plant species native and naturalised in WA and serves as the basis for research, policy and conservation of the State's flora. The census is communicated through *FloraBase*, a botanical information portal which also includes descriptive information, specimen data, distributions maps, conservation information, identification tools and the Herbarium's flagship journal *Nuytsia*.

The Herbarium provides taxonomic and identification expertise to government, industry and the community, including an identification service that provides about 3000 identifications each year. It also maintains a reference herbarium, which is a public-access facility that houses representative specimens of WA's native and naturalised species. This is used widely by industry consultants, researchers and the public to help them identify wildflowers and weeds.

A popular volunteer program has been running at the Herbarium for more than 30 years. Volunteers are involved in a variety of work such as preparing and identifying specimens, capturing and processing images for *FloraBase* and creating electronic keys, and are considered an integral part of the Herbarium team.

Visit the Herbarium's Facebook page for behind-the-scenes snippets and botanical titbits www.facebook.com/WesternAustralianHerbarium.



are a pivotal part of this collaborative effort, facilitating research on their collections while supporting the collection efforts of botanists.

Nuytsia too is a collaborative endeavour. The journal's editorial committee works with authors and experts from across Australia and overseas to progress submitted manuscripts to publication while the Herbarium's collections team and

FloraBase experts ensure that the Herbarium specimens are curated, associated databases are updated, and that the most recent information is displayed on *FloraBase*. Indeed, communication of up-to-date taxonomic information is a fundamental role of the Herbarium and recent changes to *Nuytsia* are helping to do just that. Papers are now published online through *FloraBase* once they are finalised – a move made possible



Left Theda cross-flower (*Mitrasacme thedae*).
Photo – Russell Barrett

Far left Quindanning spider orchid (*Caladenia hopperiana*).
Photo – Andrew Brown/Parks and Wildlife

Below left Bennett's violet (*Hybanthus bennettiae*).
Photo – Russell Barrett



by changes to the *International Code of Nomenclature for algae, fungi and plants* – which means the very latest science on the WA flora is published quicker, and is freely and more broadly available.

This year's publication of a special issue of *Nuytsia* (Volume 26), in which 50 new species are published to celebrate the 50th anniversary of Kings Park's Botanic Garden, is a fabulous example of botanists working together to communicate a wealth of new information on WA's flora. It represents a unique collaboration between the WA Herbarium and the Botanic Gardens and Parks Authority involving 27 scientists who wrote, reviewed or edited papers, and the collections team and volunteers at the WA Herbarium who processed the associated herbarium collections. Together with the 50 species published in Volume 25, it has made for a simply tremendous (albeit exhausting) year.

INFORMING CONSERVATION

Many common and widespread species were discovered and named early in the taxonomic history of WA, with recently discovered and named species increasingly likely to be rare and geographically restricted. This, along with increasing threats to our biodiversity, means that it is more important than ever to document what species occur in WA, where they grow and how rare they are. To this end, all WA species and subspecies published in *Nuytsia* undergo a conservation assessment by Parks and Wildlife's Species and Communities branch as part of the review process. This information is then fed directly into the *Threatened and Priority*

Flora list for WA, associated databases and *FloraBase* to ensure that accurate information on the conservation status of our flora is captured and broadcast.

Of the 100 species described this year, 72 are conservation-listed, most of which require further survey to better understand their distribution and conservation status. Some are threatened or known from only one or a few populations, including the Roe River commelina (*Commelina roensis*), Quindanning spider orchid (*Caladenia hopperiana*), Theda cross-flower (*Mitrasacme thedae*), Bennett's violet (*Hybanthus bennettiae*), triplet babingtonia (*Babingtonia triandra*) and Anderson's mulla mulla (*Ptilotus andersonii*). The publication of descriptions and associated taxonomic information for these species will increase the chance of more populations being uncovered and will improve our ability to conserve and manage them, which is ultimately what being a taxonomist in WA is all about.

Juliet Wege is a senior research scientist at the Western Australian Herbarium and the managing editor of *Nuytsia*.

For more information about *Nuytsia*

Scan this QR code or visit the website

<http://florabase.dpaw.wa.gov.au/nuytsia/>





Annual Kimberley Bush Rangers camp

Bush Ranger cadets from across the Kimberley gathered at Lake Argyle recently for their fourth annual camp, featuring challenging and educational outdoor activities. Working in teams during the week-long camp, cadets conquered their fears on a flying fox and abseiling course, canoed through Lake Argyle's sheltered bays, participated in a GPS treasure hunt, searched for cane toads and took part in botanical drawing workshops.



"Camp was fantastic, it was awesome to see some of the kids from the last regional camp and I really enjoyed making friends from different schools."

Harmony Watts, Year 10

Above left Broome Bush Ranger cadet Tariq prepares for descent. **Left** Broome Bush Rangers instructor Jeremy Cussen and cadet Harmony Watts.

Photos – Broome Senior High School

Wetland adventures

River Rangers recently spent the day at Perth Cultural Centre Wetland releasing a wide variety of fauna, including native clicking frogs, pygmy perch and macro-invertebrates. Students also learnt how to test water quality and how to identify native wetland frogs, taking particular delight in the calls of the moaning frog.

"The macro-invertebrate activity was very interesting because I got to see all the different varieties of the invertebrate in the pond and I also enjoyed the frog activity equally the same because I learnt so many different facts about the motorbike frog and I was even able to see one!" Justine Pan, Year 6



"Throughout all the activities, the best was when releasing the frogs and scooping little creatures out of the river. The frogs were very fascinating to look at because of the abilities they have."

Kieu Nguyen, Year 6



Top Releasing fauna into the wetland to increase biodiversity of the area.

Above Frog spotting and identification.

Photos – Jennifer Eliot/Parks and Wildlife

Left Moaning frog.

Photo – Babs and Bert Wells/Parks and Wildlife



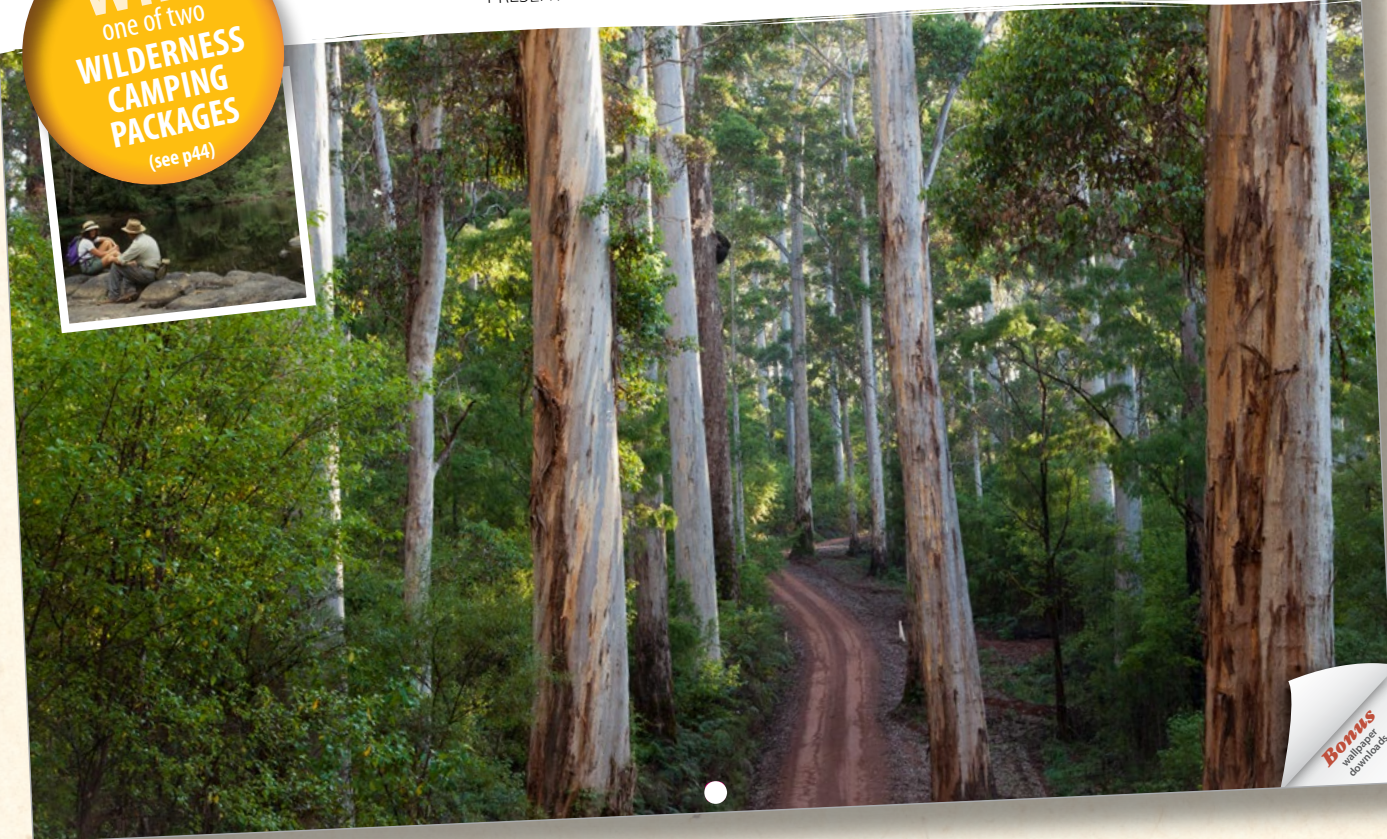
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Australasian bittern (Botaurus poiciloptilus)

The shy and unobtrusive Australasian bittern lives in wetlands with large areas of sedges and rushes. The males defend their territories with loud booming calls in the breeding season and the females construct a rough platform nest made of the surrounding reeds and rushes.

Illustration by Gooitzen van der Meer

Reference photo by Hans and Judy Beste/Lochman Transparencies



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