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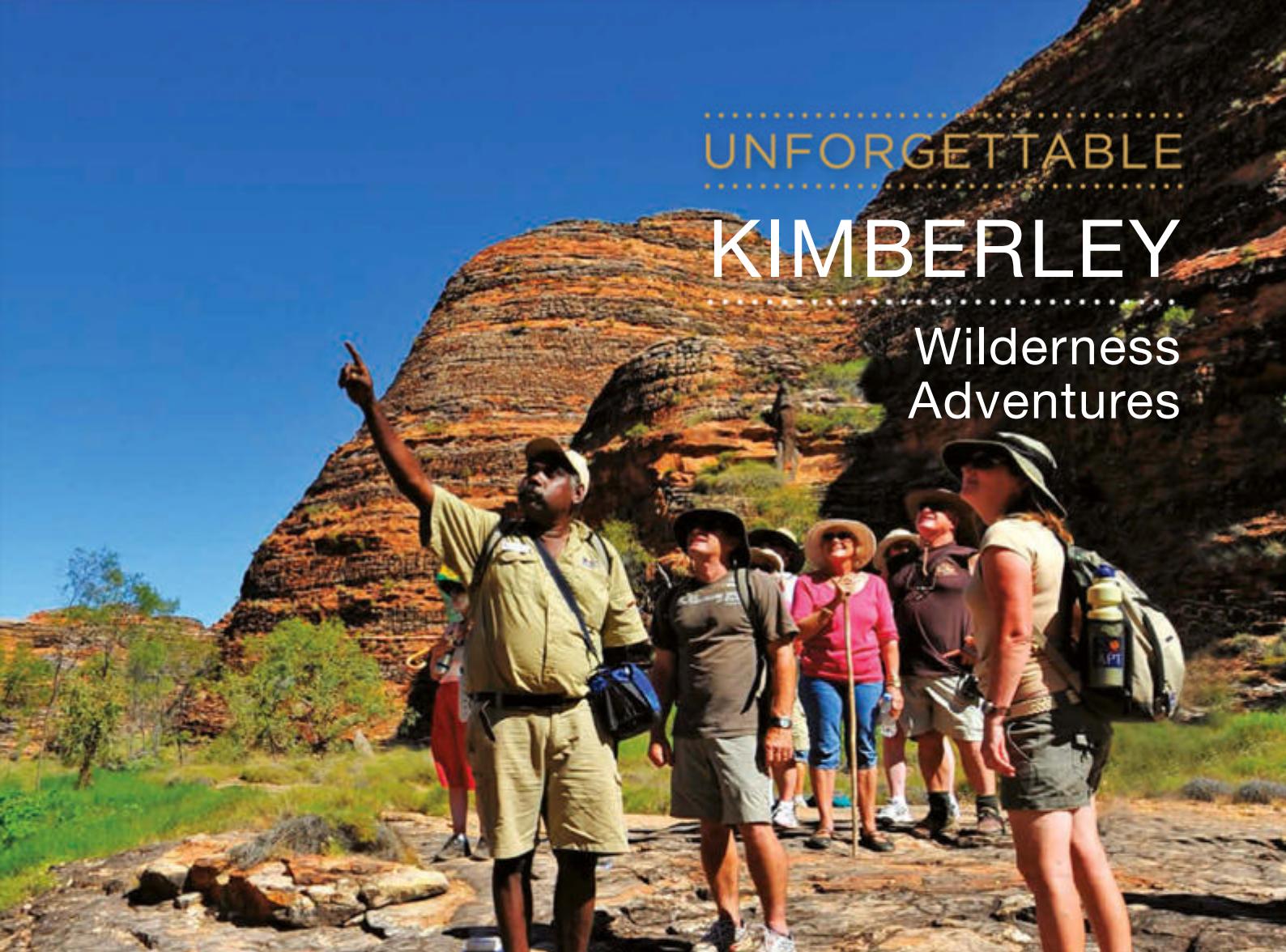
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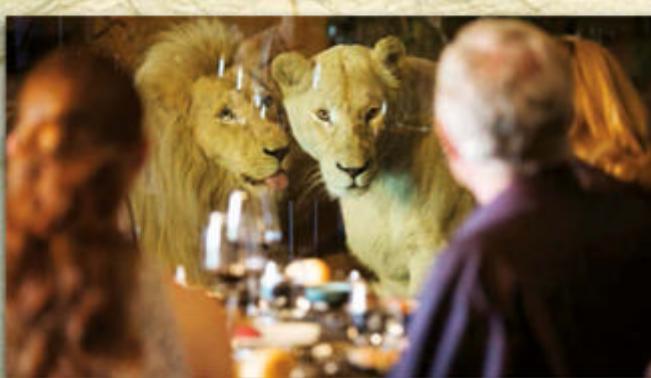
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A Bengal Tiger relaxes metres from your lounge room in one of the Jamala Wildlife Lodge Jungle Bungalows.



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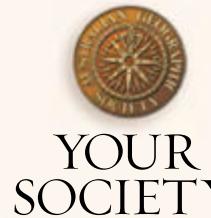
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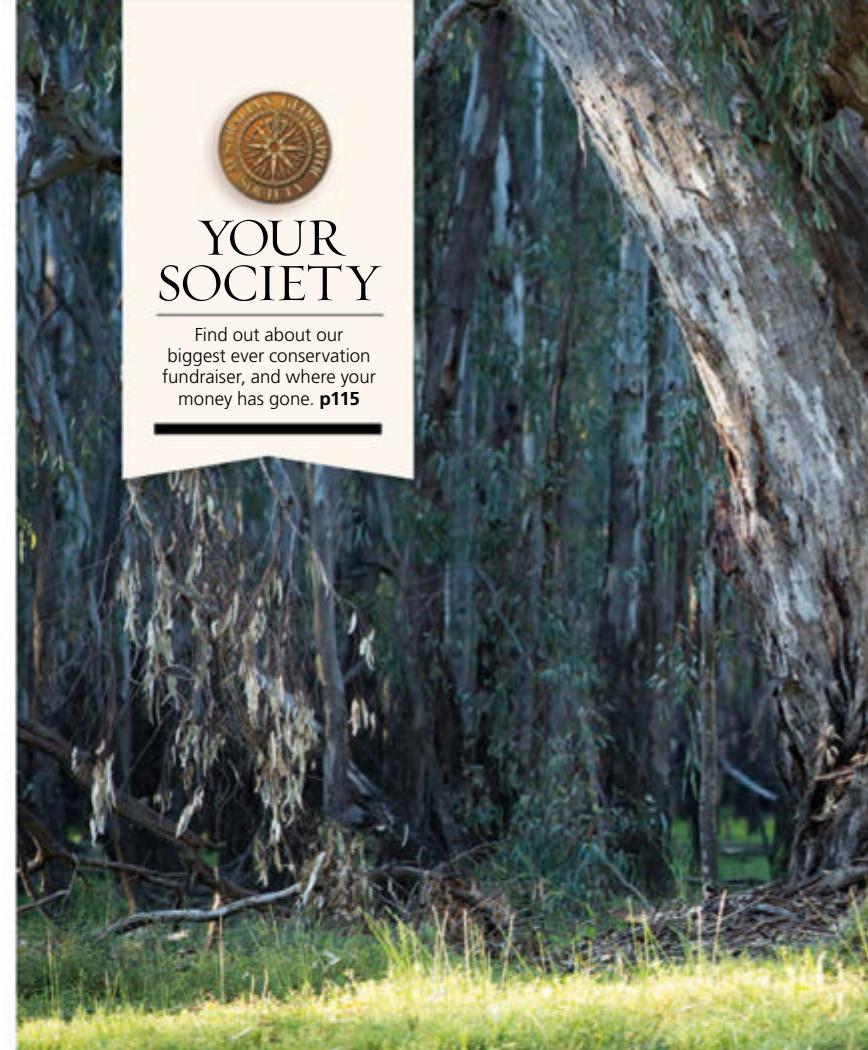
As managers of the majestic river red gums on Australia's Murray River know, it could take the destruction of trees to save a forest.

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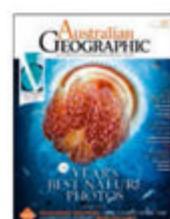
Natural beauties.
Not all cockroaches are household pests (page 20).

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Born in the saddle. Lin Baird (above) grew up exploring the High Country by horseback – now you can too (page 100). **Small blessings.** Ellen Reid (left), of The Bible Museum in St Arnaud, VIC, befriends a monarch butterfly (page 108).



ON THE COVER

"After major rain events in the Exmouth Gulf region, WA, there are blooms of red jellyfish. Beaches are carpeted, and under water at Ningaloo they are everywhere," says ANZANG finalist Ross Gudgeon, who took this issue's cover shot.

ONLINE

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The content doesn't end with this issue of the journal. You'll find thousands more articles, images and videos online. Discover all the stories highlighted here at: australiangeographic.com.au/issue127



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TREE MONITOR'S MYSTERIOUS COLOUR

This lizard from our northern neighbour, Papua New Guinea, sports a type of pigment that's highly unusual in nature.



ECHIDNA PUGGLE ON ROAD TO RECOVERY

After being accidentally dug out of its burrow and injured, a baby echidna is recovering, thanks to Sydney's Taronga Zoo.



INTO THE EYE OF THE DRAGON

Check out this great image from AG Flickr group member Michael Chong – and find out how to submit your own.

THE WORLD IN MACRO

Featured in a photographic competition hosted by Photocrowd.com, these macro images showcase the stunning natural world of insects, bugs and plant life.

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Adélie Penguin by Peter Eastway. Canon EOS-1D X, 200-400mm lens @560mm.

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Victorian splendour

I RECENTLY SPENT two consecutive summer breaks on road trips that started in Melbourne and took me home to Sydney. The first year, we headed west along the Great Ocean Road, eventually turning north up through centres such as Bendigo and Echuca before heading back into NSW. The second year, we journeyed east through Gippsland before crossing the border just past Genoa and travelling homewards up the east coast.

What struck me most during my first trip, and inspired me to go back for the second trip, was the mix of experiences available within relatively short drives of each other. As much as I love an epic outback odyssey, when you've only a week or so to spare, Victoria's compactness is a real gift. Between the natural wonders of the Great Ocean Road's tourist traps and remoteness of East Gippsland's wild coastline, there are countless towns and villages, each with individuality.

character and downright quirkiness – not to mention consistently great food that wouldn't be out of place in one of our larger cities. I still have so much more to explore here, and have relished poring over our brand-new Victoria sheet map (free to subscribers with this issue), with my eye firmly fixed on the state's north-western, arid region, with dreams of a future expedition there. I hope you too enjoy our special Victorian focus this edition, and that it provides fresh ideas for grand adventures ahead.

Journeys are at the heart of our new weekly travel show, *Australian Geographic Adventures*, on Channel Nine and WIN, which has been on the air since May. I hope you have been able to catch these episodes. It's not too late though, because the current series runs until 25 July 2015. Tune in on Saturday afternoons from 3.30pm or 4pm (for full scheduling details or to catch up online go to: www.australiangeographic.com.au/AGadventures). Still to come in the 10-part

series are shows dedicated to driving holidays in outback NSW and walks in Victoria's dramatic Grampians region. On 18 July, our experts will show you how to prepare in detail for your ultimate big Aussie road trip.

Also included in this issue of the journal are photos from the shortlist of the 2015 Australian Geographic ANZANG Nature Photographer of the Year competition. This year saw an amazing increase of more than 40 per cent in the number of entrants, and you can find out who the winners are when they're revealed at the South Australian Museum in Adelaide on 1 August. If you can't get to this superb exhibition in person, check them out on our website.

Happy travels!



Follow me on Twitter at:
twitter.com/chrissigoldrick

Contributors



**Dan
Down**

is an adventurer, nature lover and writer who, after 10 years working on BBC science magazines in the UK, upped sticks for a life in Australia, where he is now sub-editor for *Australian Traveller*. In 2013 he spent a year studying marine biology. Marine conservation work in Madagascar and trekking remote areas of Nepal led to room-sharing with massive cockroaches, which inspired this issue's Nature Watch.

BEAUTIFUL BUGS, PAGE 20



**Michael
Burleigh**

completed his Bachelor of Natural History Illustration at the University of Newcastle and achieved First Class Honours, illustrating an identification guide to the agricultural beetle pests of Timor-Leste in 2014. So far, he has specialised in illustrating insects and other arthropods, which led him to volunteer at the Entomology Collection at the Australian Museum. He is a keen proponent of the importance of scientific illustration.

BEAUTIFUL BUGS, PAGE 20



**Matthew
Newton**

is a photographer and cinematographer based in Hobart, Tasmania. He has filmed numerous documentaries and worked in more than a dozen countries, often in remote locations. He regularly photographs stories for publications throughout Australia; he's most recently been recognised as a finalist in the Australian of the Year awards and the Walkley Awards, for his work documenting the struggle for Tasmania's forests.

ALBATROSS ISLAND, PAGE 34

Contributing editors: Josephine Sargent, Joanna Egan and Karen McGhee **More contributors:** Rachael Alderman, Ralph Alphonso, Esther Beaton, Tony Brown, Anthony Calvert, Quentin Chester, Ray Collins, Nick Cubbin, Kate Fielder, David Fleetham, Don Fuchs, Ross Gudgeon, Justin Gilligan, Gary Holland, Roger Hugelshofer, Karl Kruszelnicki, Randy Larcombe, Fiona MacDonald, Alex Majoli, Dave Mattner, Peter Meredith, Graeme Murray, Paul Raffaele, Ben Saunders, Dan Sheridan, Heather Swan and Paul Tozer.

BIG PICTURE

SUNBURST BY RAY COLLINS

"One of my favourite ways to shoot the ocean is to let waves block the sun. That's when the unexpected happens," says photographer Ray Collins. "Light reflects and refracts along and through the water, making dynamic visuals. I swam out before dawn in a large swell to an offshore reef and waited. A storm had been brewing through the night, but rays of light poked through the cloud. This wave formed ahead and I captured it at its peak."





WorldMags.net

BIG PICTURE

FEELING FINE BY ALEX MAJOLI

Brothers and sixth-generation sheep-and-cattle farmers, Simon and Cameron Wood, take a break in the woolshed on Dog Trap station, their property in Uralla, northern NSW. They rest against piles of superfine fibres, each strand of which is less than one third the width of a human hair. Cameron, at right, classes wool by sight and feel, dividing it into the lines behind them, with top grades destined for luxury European fashion houses.





Blood relations

THE FIRST successful blood transfusion was carried out in 1665 by English physician Dr Richard Lower, using dogs as donors and recipients. When transfusions were first trialled on humans, recipients tended to die. It wasn't until 1900 that Austrian Dr Karl Landsteiner discovered the ABO blood group system,

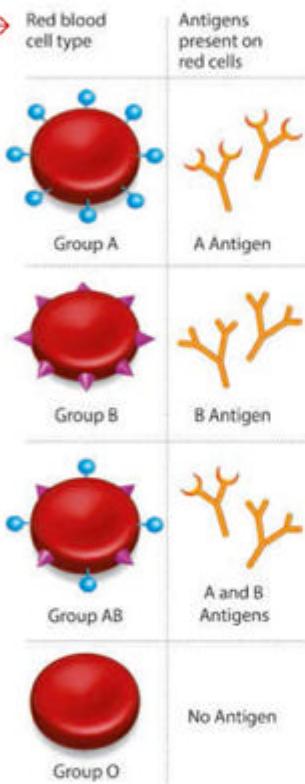
and realised human patients needed to be given compatible blood. He was awarded a Nobel Prize for his discovery.

There are more than 30 blood group systems, but most important for transfusion or transplantation is the ABO system. Every human is of blood group O, A, B or AB (or a minor variant of these groups). In fact, there are only

two determinants in the ABO system: A and B. O is the absence of either A or B, and AB is the presence of both A and B on red blood cells. The A and B determinants differ only in minor ways.

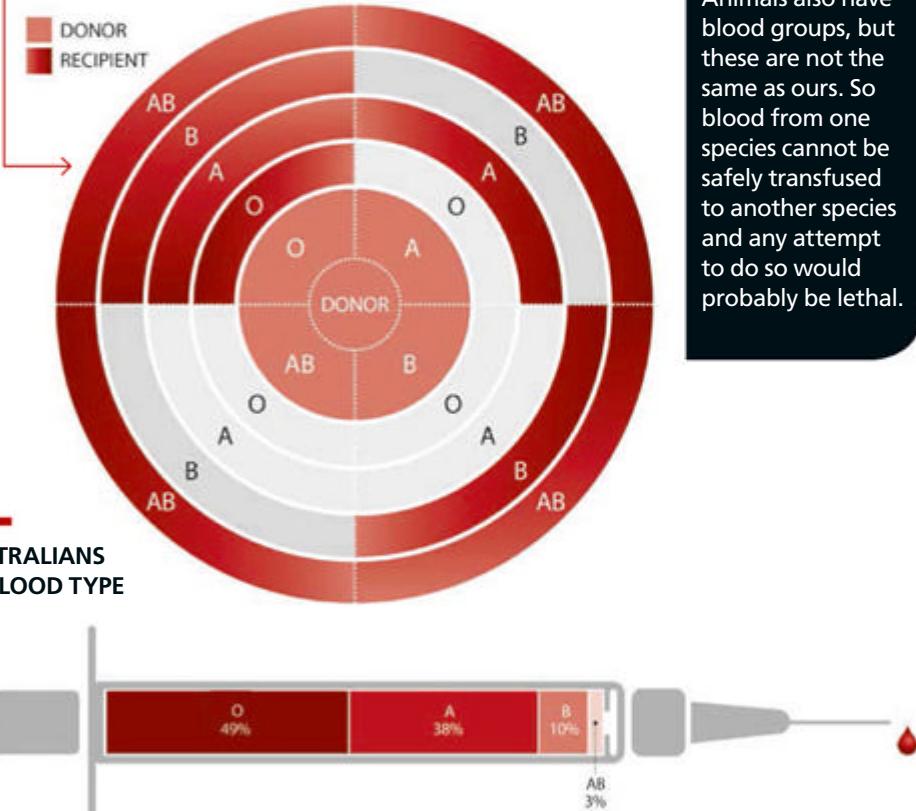
The Australian Red Cross Blood Service always needs blood of all types. Find out how you can donate at: www.transfusion.com.au

Blood groups are determined by a protein or antigen on the surface of red blood cells. So, the ABO system has A and B antigens.

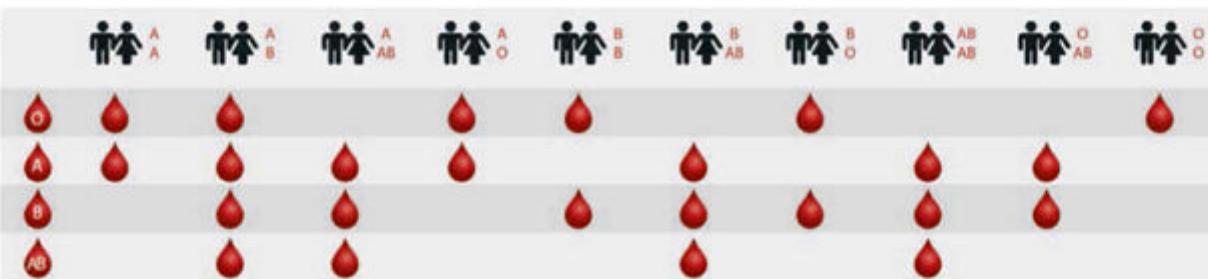


COMPATIBILITY OF BLOOD GROUPS

It's preferable for patients to receive the same blood type as their own. However, each of the main blood groups can safely donate as follows:



Blood groups are inherited in the same way as features such as eye- or hair colour. Here are the possible blood groups that children may inherit according to the combination they receive from their parents.



FACT

The function of blood groups is not known.

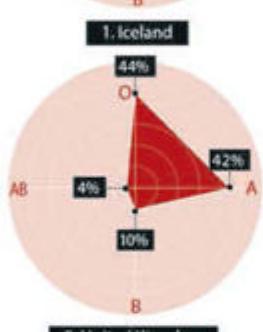
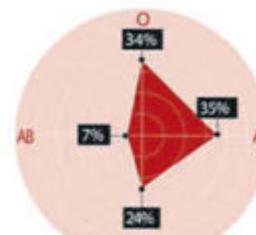
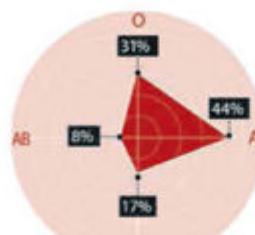
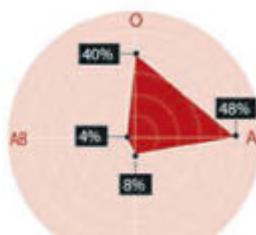
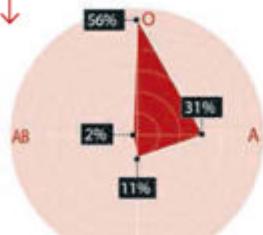
Animals also have blood groups, but these are not the same as ours. So blood from one species cannot be safely transfused to another species and any attempt to do so would probably be lethal.

The distribution of the ABO groups in Australia is about 38% A, 49% O, 10% B, and 3% AB. Distribution differs significantly around the world, with higher levels of B in Asia and more O in Africa. Because blood groups are inherited, some are particularly prominent in people of specific ethnic backgrounds; for example, the O blood type dominates in Native American and Aboriginal Australian groups.



NATIVE AMERICAN

ABORIGINAL AUSTRALIAN

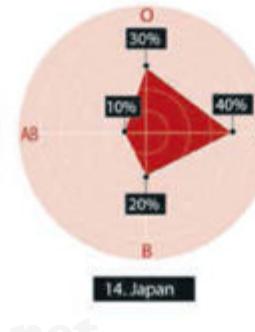
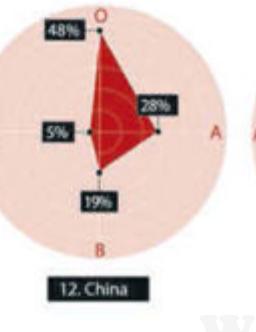
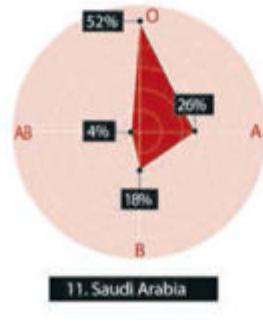
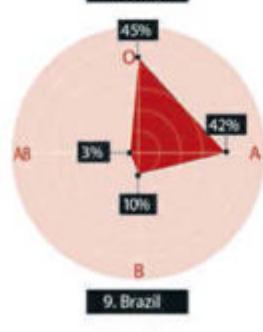
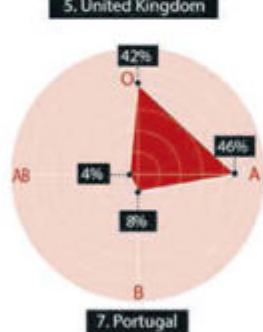


2. Norway

3. Finland

4. Estonia

6. Czech Republic



11. Saudi Arabia

12. China

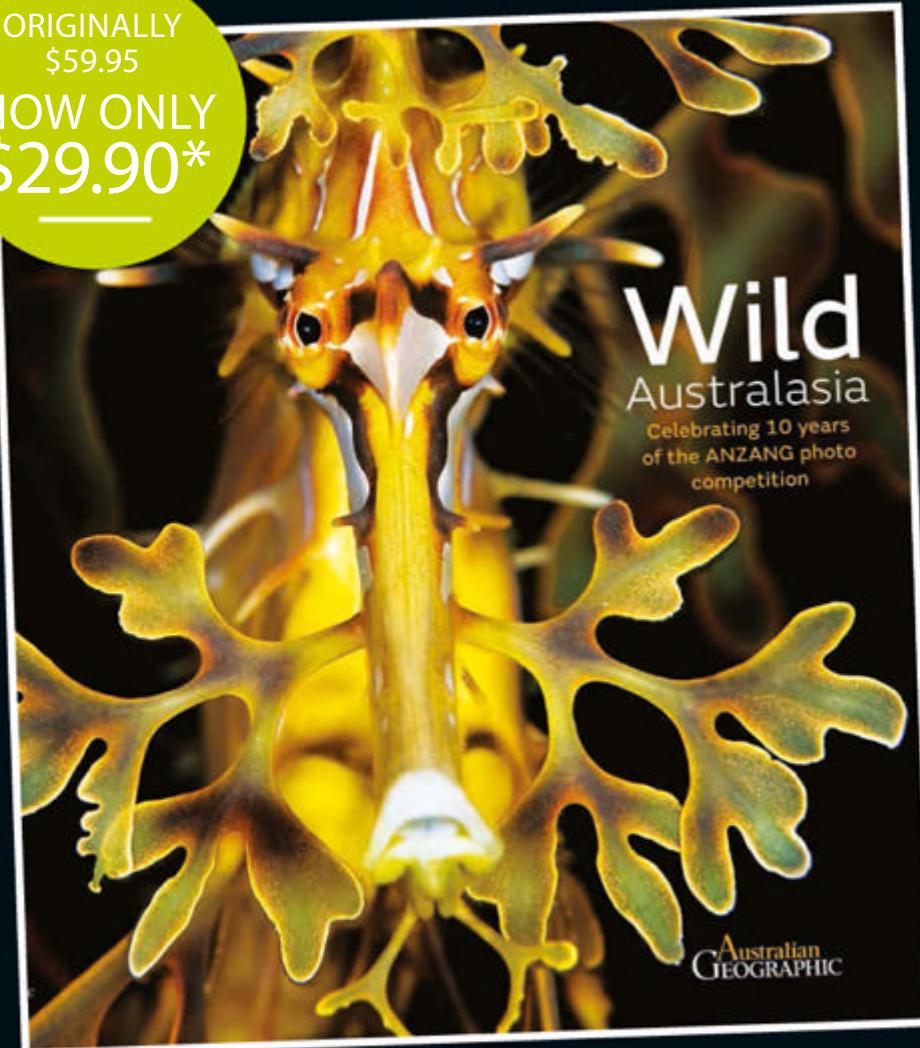
13. Korea

14. Japan

15. Australia

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Logged into oblivion

In the tiny patch of Victoria that the Leadbeater's possum calls home, logging has destroyed most of the mature tree hollows the species needs to survive.

THE LEADBEATER'S POSSUM, one of the world's most endangered marsupials, is in a perilous position, which is why the federal government followed the advice of scientists in April and listed it as critically endangered. Along with the helmeted honeyeater, it is one of Victoria's state faunal emblems, an honour bestowed on this adorable-looking nocturnal creature in 1971.

Leadbeater's possum was already rare when it was discovered in South Gippsland in 1867. Up until 1909, only six specimens had been collected and by the time of the 1939 Black Friday fires it was presumed to have died out. It was officially declared extinct in the 1950s, but the listing was premature, because in 1961 naturalist Eric Wilkinson discovered a small colony 100km east of Melbourne, at Marysville.

Today, the Leadbeater's possum persists primarily within forests of mountain ash trees (the world's tallest flowering plant) in Victoria's Central Highlands. For its survival, this small marsupial requires nest holes in the hollows of living or dead old-growth trees, which are typically more than 190 years old. From these hollows, nesting colonies – each led by a dominant matriarch – venture out at night to forage on the sap of wattles, and on insects that live in the bark streamers of ash trees.

Clear-felling of mountain ash has taken a heavy toll on Leadbeater's possum and logged areas remain unsuitable for more than 150 years after they are cut. The 2009 Black Saturday bushfires also dealt a devastating blow, destroying 45 per cent of suitable possum habitat. In addition, logging has increased the severity of fire in harvested and

regenerated forests (as younger trees can lead to fierce 'canopy' fires), which has contributed to the absence of animals from burnt forests.

The change to the conservation listing of the species this year follows a damning letter – authored by Australian professors David Lindenmayer and Hugh Possingham, and published in 2013 in the prestigious international journal *Science*. The respected pair of experts accused the Victorian State Government of choosing to log forests in ways that accelerate the loss of large old trees, rapidly leading to the demise of the state emblem.

"Government-sanctioned legal logging of the reserve system will significantly increase the chance of extinction," the scientists wrote. "To the best of our knowledge, and despite state and national threatened species legislation, this is the first time an Australian government has taken calculated actions to substantially reduce the viability of an IUCN-listed endangered species with full knowledge of the likely consequences."

The problem now, says David, who is based at the Australian National University in Canberra, is that most of the suitable old-growth trees with hollows have gone and the possums can't wait another 70–190 years for them to grow back. His computer modelling work suggests there's a 92 per cent chance that within 50 years the species' habitat will irretrievably collapse – meaning it won't be able to provide what its inhabitants need to survive.

As readers of this journal will know, the rediscovery of 'extinct' Australian species – such as the night parrot, bridled nail-tail wallaby and

mountain pygmy possum – is not an uncommon occurrence, and one that reflects the fact that we have so many perilously endangered species. But, in most of these cases, swift actions have been taken by state and federal governments to aid in the survival of these creatures.

To find out how you can donate to help Zoos Victoria and the Friends of Leadbeater's Possum conserve this fragile species, turn to page 117 for the details of our Leadbeater's possum fundraising appeal.



JOHN PICKRELL is the editor of AUSTRALIAN GEOGRAPHIC. Follow him on Twitter at: twitter.com/john_pickrell

AUSTRALIAN COCKROACHES

Beautiful bugs

Cockroaches are considered pests and often squashed under foot without a care, yet some native varieties are surprisingly attractive.

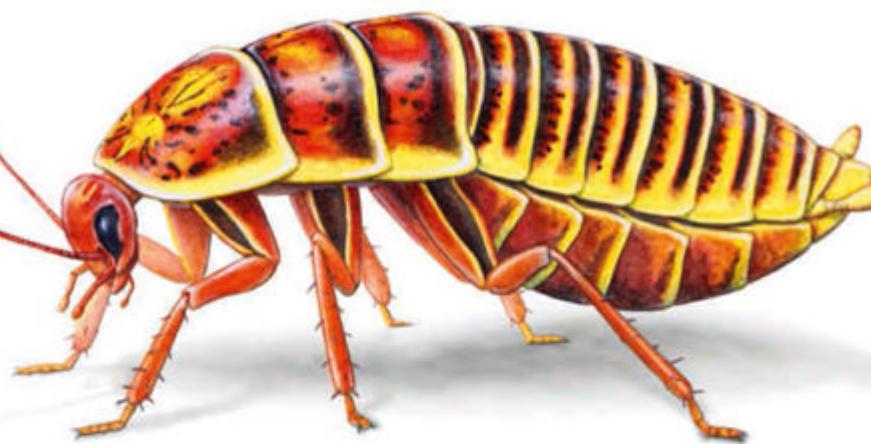
TEXT BY DAN DOWN ILLUSTRATIONS BY MICHAEL BURLEIGH

NEXT TIME YOU reach for insecticide to smite a cockroach out of existence, think twice. Although some are introduced pests, others have been here for millions of years, and are deserving members of Australia's intricate ecosystem. There are more than 530 known species in Australia, about 90 per cent of which are found nowhere else – and experts believe there may be twice that number yet to be discovered.

Cockroaches are closely related to termites and have a characteristic flattened body. Their lives are short but varied and often unique. Some have elaborate mating rituals and others use chemical sprays to defend themselves. Some species take parental care of their young. They range in size from the tiny *Nocticola*, at just 3mm long, to the giant burrowing cockroach at a whopping 8cm and 33g – one of the world's heaviest insects. They can also be far more colourful than the non-native invaders you might see darting about at night. The dazzling greens, reds and even blues of some species hint at the incredible diversity to be found. Cockroaches occupy every type of terrestrial habitat Australia has to offer, from rainforest canopies to caves and beneath the red dirt of the outback. There's even an Australian aquatic cockroach that's yet to be properly studied.

One man who's spent his life exploring the secrets of these fascinating insects is entomologist David Rentz, author of *A Guide To The Cockroaches Of Australia*. "They are extremely abundant and crucial in the breakdown of leaf matter in the Australian environment," says David. "They are also a major food source for vertebrates, such as lizards, frogs and birds, and invertebrates, such as centipedes, scorpions and predatory beetles." Most have interesting life histories that we know little about.

Although it's unlikely you'll see the species pictured here in your kitchen cupboards, they are some of the more extraordinary Australian members of this much-maligned insect family.



MITCHELL'S DIURNAL COCKROACH

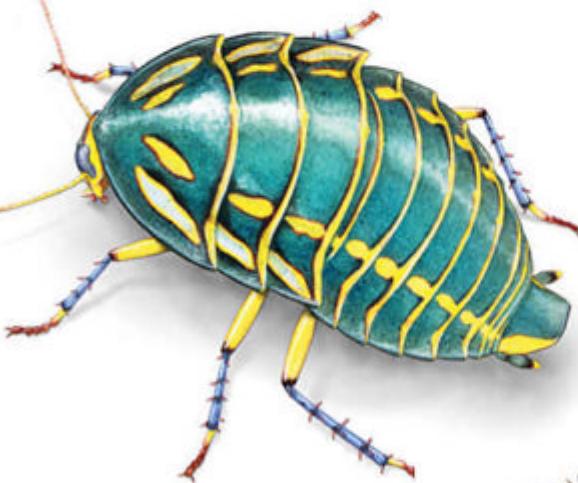
Polyzosteria mitchelli

Surely the most dazzling of all Australian roaches, Mitchell's diurnal cockroach sports a yellow-patterned, green-blue carapace, with striking blue legs. It has a wide range stretching from WA, through SA and into NSW, and can be seen scurrying about around shrubs during the day. Head to the Nullarbor Plain for a chance to spot this colourful insect.

▲ CONFUSING SUN COCKROACH

Pseudolampra rothei

This medium-sized cockroach has vibrant dark-red-and-yellow-striped armour, mottled with black marks. Its head is a rich red-brown with three lighter stripes at the top. This stunning species can be found in SA's vast Lake Eyre Basin, but hasn't been seen outside of the state. The 'confusing' part in the name refers to the fact that it looks very similar to other 'roaches in its genus – a problem entomologists love to tackle.



COMMON ELLIPSIDION

Ellipsidion humerale

This colourful species varies in appearance and is widespread, having been identified in WA, the NT, QLD and as far afield as New Guinea. You'll know it when you see it because it has a striking orange-yellow back and its antennae are often a two-tone black-orange. The species is active during the day and doesn't live in leaf litter – look for it on flowers and leaves, where you may find it supping on pollen.





**EASTERN MONTANE GREEN ▲
COCKROACH**

Polyzosteria viridissima

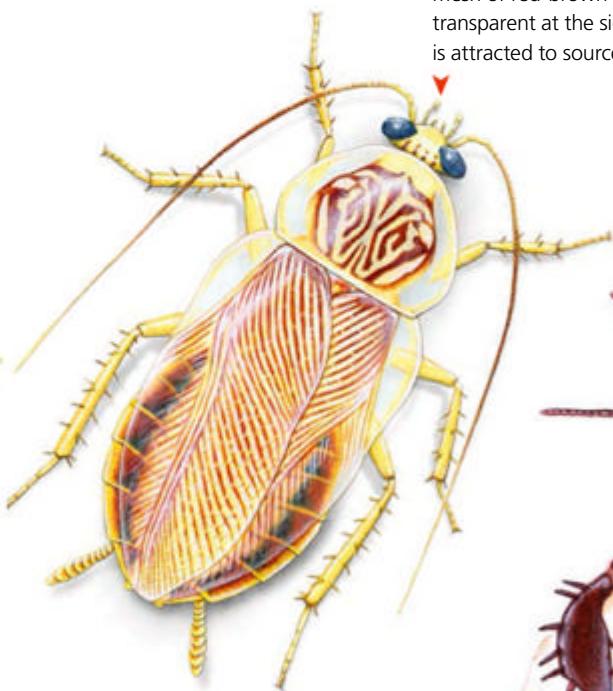
A jewel of a specimen, this emerald-green cockroach is found across NSW. Alpine hikers are often rewarded with views of it sunning itself on low shrubs or snow gums. Take a walk in Kosciuszko National Park and you may be lucky enough to see this flash of green. Antagonise it and it will squirt a foul-smelling fluid at you.



▲ COMMON BANDED COCKROACH

Desmozosteria cincta

Ringed with a creamy-yellow stripe, this cockroach is relatively small, at just 27mm in length. It has a broad range across the arid north of Australia in QLD and the NT. Have a look around spinifex to catch sight of one before it makes a run for it. Tjoritja/West MacDonnell National Park near Alice Springs is a good place to search.



GIANT BURROWING COCKROACH ▶

Macropanesthia rhinoceros

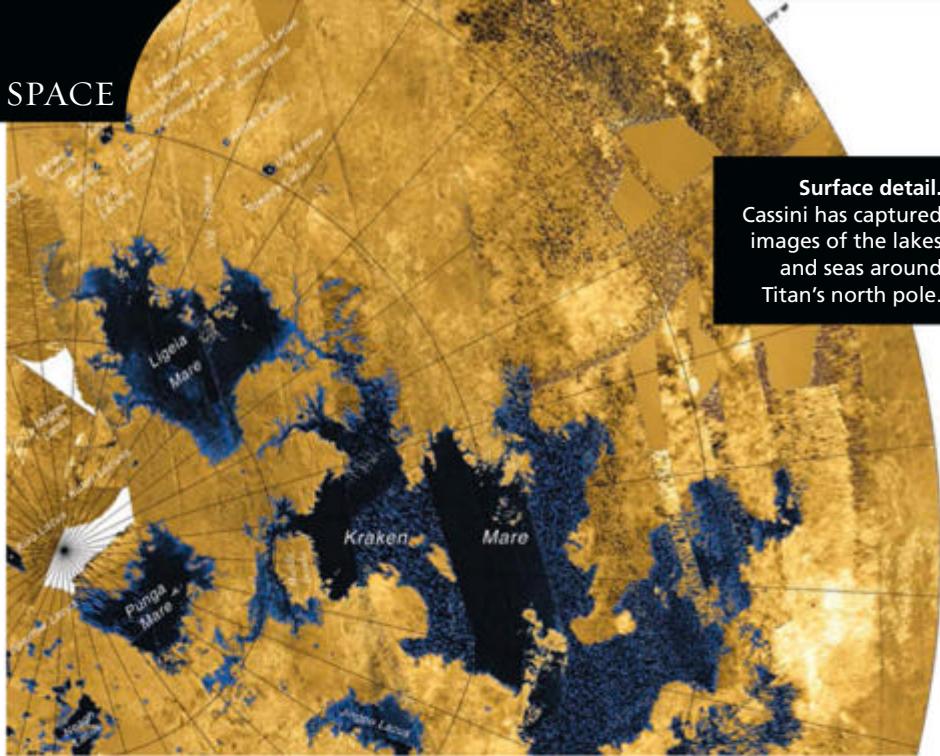
This king of cockroaches can weigh up to 33g. Its burrows may reach lengths of 1m, usually under eucalyptus or acacia trees in the arid soils of NSW and QLD. The bottom of the burrow acts as both nursery and larder, and here females attend their young. You may catch a male wandering around in tropical QLD from November to January when they go on the lookout for females. Get too close and it may try to deter you with a hissing sound.

PRETTY BALTA

Balta verticalis

At just over 9mm in length, this is a small but finely patterned cockroach found in the rainforests of QLD. The wings are an intricate mesh of red-brown and cream fading to transparent at the sides. This nocturnal species is attracted to sources of light.





Surface detail.
Cassini has captured images of the lakes and seas around Titan's north pole.

Exploring the seas of Titan

Getting to the bottom of Titan's unique geography might require an underwater mission, says Fred Watson.



THINKING outside the box is normal for most space scientists, but when the box includes Saturn's biggest moon, Titan, ideas have to be even more audacious than usual. What sets Titan apart is not mere size: it is the only world, other than Earth, known to have large stable bodies of liquid on its surface. And Titan's lakes and seas drive a weather cycle of evaporation and rainfall, exactly as the oceans on Earth do.

That, however, is where the similarity ends. With Titan's average ambient temperature of -180°C , the moisture in its atmosphere is not water vapour, but a melange of hydrocarbons that are best thought of as liquid natural gas – ethane, methane and other compounds. These liquids pool in basins in Titan's bedrock, which is actually frozen water.

Titan's seas and lakes dominate its northern polar region, but there are a few in the south too. And they are large – comparable with North America's Great Lakes in the case of the three biggest, which are designated as 'maria', or seas.

Some 30 smaller lakes, ranging from a few kilometres in length to a couple of hundred have also been identified.

The discovery and exploration of these lakes by remote sensing from the orbiting Cassini spacecraft has raised questions. Are they fed by methane and ethane springs from a 'water table'? Could cyclones form over the larger seas? And do they have hydrocarbon 'icebergs' – as radar observations suggest?

The best way to answer these questions, says Ralph D. Lorenz, a scientist at Johns Hopkins University in the USA, is to send a submarine to Titan. It would be a robotic submarine similar to the unmanned underwater vehicles already in use for military, scientific and commercial purposes. And it could be carried there by a mini space shuttle able to glide through Titan's thick atmosphere – perhaps similar to the US military's secret X-37B space shuttle. Exploring the sea floors of Titan to reveal its chemical and climatic history could be the next big step in our understanding of the Solar System.

FRED WATSON is astronomer-in-charge of the Australian Astronomical Observatory.

Fred answers your questions

Are galaxies rotating? Astronomy has only been around for a few hundred years; surely the rotation measured would be so small as to be negligible in such a short time period?

David Frankland, Perth

You're quite right that the visible rotation of galaxies is infinitesimally small on human timescales. Instead, we measure their rotation with the Doppler effect, which shifts the wavelength of light emitted by moving sources. Measuring the rainbow spectra of galaxies lets us determine their rotational velocities very accurately.

If you have a space question for Fred, email it to editorial@ausgeo.com.au

Glenn Dawes looking up

x1 NAKED EYE Venus and Jupiter are visible, low in the western evening sky. The 'Goddess of Love' is the brighter of the planets. Their meeting with the thin crescent on 19 July will be impressive. In August they are seen only early in the month.

x10 BINOCULARS Look high in the evening sky to Scorpius the Scorpion. Where the tail makes a right-angle turn is an impressive triple star formed by Zeta (1 and 2), Sco and HR 6266. Its star field is rich, including the open star cluster NGC 6231.

x100 SMALL TELESCOPE NGC 6397, in the southern constellation of Ara, is considered to be the fourth-brightest globular star cluster in the sky. It has a brilliant, compact core with the stars more loosely scattered towards the edge.

Glenn Dawes is a co-author of *Astronomy Australia 2015* (Quasar Publishing).

Together we can help save the Tammar Wallaby

As someone who cares for animals, you know the joy that they bring to your life and the importance that they hold to the health of the planet.

Tammar Wallabies need our support and at Zoos SA, we're working with people like you to help save them from extinction.

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WATCH
Use the free *viewa* app
to scan this page and
watch a short film about
the tree kangaroo cross-
fostering technique.



Foster fuzz. 1 When Makaia was just a few weeks old, and his mother died in an accident, he was transferred into the pouch of a yellow-footed rock-wallaby. 2 Despite physical and behavioural differences from a wallaby joey, he was not rejected. 3 At four months of age, Makaia was removed from the pouch and 4 began to be looked after by human carer Gayl Males, the zoo's team leader for native mammals.

Opportunity from adversity

A tragic accident at Adelaide Zoo has led to a world-first trial of a pioneering breeding technique for an endangered tree kangaroo species.

ONE DAY in November last year, zookeepers at Adelaide Zoo awoke to a horrible surprise. A branch in an enclosure had fallen during the night killing Kiunga, one of their pair of endangered Goodfellow's tree kangaroos. Even worse, she was a three-year-old female, thought to have a tiny joey in her pouch.

But all was not lost. For several decades Zoos South Australia, which includes Adelaide Zoo, has pioneered a clever conservation breeding method called cross-fostering (see AG 98). They've successfully increased populations of southern brush-tailed rock-wallabies and mainland tammar wallabies by using less endangered close relatives, such as yellow-footed rock-wallabies, as foster mothers. It meant there was a glimmer of hope.

"As soon as I was called to the exhibit, I checked her pouch and saw that there was a live joey," says Gayl Males, the zoo's team leader for native mammals. "We've been doing this for a number of years, cross-fostering the endangered Victorian brush-tailed rock-wallaby into our yellow-foots here. It's a process we have used a lot to save endangered species, but we'd never tried it on tree kangaroos. It was just a matter of 'Hey, we have to try this.' Without help, this little joey was going to die anyway, so there was nothing to lose by trying the cross-fostering technique."

The procedure for endangered rock-wallabies works like this. Firstly, a female needs to be pregnant at the same time as a female of a closely related non-endangered species. At an early stage, the tiny pouch young of the threatened species is carefully attached to the teat in the pouch of the other mother – a delicate and difficult transfer that's critical to the success of the procedure. The foster mother's original joey is then humanely euthanised. The endangered joey is brought to a viable

stage by its foster mother. And the adult female of the endangered species is free to become pregnant again almost immediately, because kangaroos and wallabies naturally have another embryo 'on pause', ready and waiting to go.

"We know if we remove a joey from a pouch, pretty much bang on 30 days later they will give birth to another embryo, and that's a really predictable time frame we can work towards," says Adelaide Zoo veterinarian Dr David McLelland. "If you do that cycle several times you can increase up to six- or eight-fold the number of joeys they produce in a year. It's a

"It's a neat way of using reproductive biology to our advantage."

really neat way of using their reproductive biology to our advantage to maximise the captive-breeding output."

Using rock-wallaby foster mothers, the technique had only before been attempted on closely related species. And it had never been used for tree kangaroos using any foster species. Not only are tree kangaroos distant relatives of rock-wallabies, they also have many behavioural and physical differences. Notably they live in trees and rarely descend to the ground (see AG 116).

Adelaide Zoo staff had talked about attempting the technique on tree kangaroos, but thought they might be too distantly related for the process to succeed, Gayl says. "We didn't expect it to be successful... We were just hopeful and then surprised when it passed the first 24 hours, which is the first critical period, and then 30 days, which is the second. It was very exciting."

The zookeepers were expecting the cross-foster to fail, Gayl adds, because mother wallabies often instinctively know when there's something different or wrong with joeys and won't invest time caring for them. "This joey was completely different: a different size, different shape and probably a different smell," she says. "Certainly the movement in the pouch was different – this one just wriggled all the time."

The initial goal was to get it to the "eyes-open stage" around the end of January, when hand-rearing by a human carer would be possible. Any day after that would be an added bonus. By 26 February the young joey – which had by now been named Makaia – was still hanging on in the pouch, but there was a danger he'd fall out and be injured. So it was decided he should be removed, and Gayl became his carer 'mum'.

During the day Makaia is looked after at the zoo and at night goes home with Gayl, initially needing four-hourly feeding with formula milk. He'll continue to go home with her until he's down to three milk feeds a day and will be weaned at 15–18 months of age.

It's been hard work, but rewarding. "He's cute, very time consuming and a bit of a terror," Gayl says. "Because he can climb, every time you try to walk somewhere, he runs after you and jumps up and climbs up your leg. This little fellow does have a bit of a temper and has little tantrums, so he's certainly got personality... He loves my husband and snuggles up under his arm and goes to sleep while he's sitting watching TV."

The Adelaide Zoo team will share their findings with other zoos around the world that are also breeding endangered New Guinean tree kangaroo species, and the technique may be successfully adapted to help increase the success of internationally coordinated captive-breeding programs.

JOHN PICKRELL



CARAVAN & CAMPING

Some of our best memories are made on holiday, and there's no better way to relax, unwind and spend time with loved ones than on a caravan and camping getaway.

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Australian
GEOGRAPHIC
Adventures

Coastal cruising. Learn more about the sharks of Port Stephens on the AG Adventures TV series, showing on Channel Nine and WIN in July. Full details at: www.australiageographic.com.au/AGadventures.



In the company of sharks

In the waters off Port Stephens, divers come year-round to experience a vibrant realm of reefs inhabited by endangered eastern grey nurse sharks.

HIdden from view in the Pacific Ocean, endangered grey nurse sharks visit a complex highway of rocky reefs during their annual migration. These sharks – which were the subject of our fundraiser in the previous issue – typically mate in NSW in spring, after which females migrate north to southern Queensland. Here they spend about six months away from sexually mature males, before returning south to NSW in late winter and early spring, where they give birth at a series of sites.

At the centre of this distribution range is Port Stephens. Near this natural harbour, on the coast of the NSW Hunter Region, are sprawling reefs where tropical and temperate

currents collide to form a shark aggregation hotspot. Here, groups of grey nurse sharks shelter within steep-walled gutters and under rocky overhangs among the corals, and it's not uncommon for divers to encounter males and immature females year-round.

Decorated with a diverse array of sponges and invertebrate life, these reefs are also home to other charismatic marine species, including the weedy seadragon, giant cuttlefish and blue grouper. In recent years, hundreds of divers have been drawn to these waters. Some of the most popular sites are amid the gnarled nooks and crannies off Broughton Island, and are suitably named Shark Gutters, Looking Glass, East Head and North Rock.

One advantage for novice divers is that, compared with other popular grey nurse reefs, these areas are at shallow depths and easily reached.

"North Rock is fantastic and I've had some amazing days at the Looking Glass," says Emma Challen, a local diving guide. "It's a huge crack that runs through the island and the light is just awesome. During one memorable dive, we had 20 sharks circling among a giant school of yellowtail scad when a massive bull ray came and swam through the middle," she says. To dive with the grey nurse sharks off Broughton Island should be on every diver's bucket list, argue locals, as these sites must be seen to be believed.

JUSTIN GILLIGAN

PHOTOGRAPHIC HERITAGE

Spirit of Endurance

Harold Cazneaux's famous tree is now part of a major retrospective exhibition of Australian photography.

WITH ITS exposed roots and hollowed-out trunk, 'The Cazneaux Tree' embodies a particularly Australian spirit of endurance. It's a kind of sylvan battler, standing silent and strong against an unforgiving climate and all attempts to undermine it. Harold Cazneaux's famed photograph of this majestic but embattled river red gum was taken in the Flinders Ranges in 1937. It now features in a major exhibition – The Photograph and Australia – which is currently on display at the Art Gallery of New South Wales in Sydney, and will move to the Queensland Art Gallery in Brisbane on 4 July 2015.

Cazneaux was a leading exponent of the pictorial movement that came out of Europe towards the end of the 19th century. "Harold wanted to develop an artistic form of photography," explains Judy Annear, curator of the exhibition and author of its accompanying book. "But he knew that it needed to be a uniquely Australian form of pictorialist photography, which meant embracing Australian light. European Pictorialism was very dark and moody, but he wanted something much brighter."

Harold was among a cohort of photographers who explored the creative potential of the bush as well as the towns and cities of the emerging nation and established a markedly Australian aesthetic. By the time he immortalised the steadfast eucalypt, popular taste had moved on and the movement he had championed had fallen from fashion. He was now working on *The Home*, the upmarket social and art magazine that was then a must-read in every stylish

middle-class Australian home.

Harold had established a close friendship with South Australian painter Hans Heysen in the early 1930s and, through his work, developed a deep appreciation for the Flinders Ranges' extraordinary beauty. Harold made three journeys there from his Sydney home and took the famous photo on his final visit in May 1937. The image was initially titled *A Giant Gum of the Flinders*. That same year it was exhibited in Adelaide and London and appeared in the October edition of *The Home*, to popular acclaim.

"This is one of the very few photographs that became an icon of Australian photography in its own time, in the 1930s," says Judy. "For example, Max Dupain's *Sunbaker*, taken the same year, didn't become an icon until the 1970s. So this is a very important picture because it's Cazneaux, because of what it represented for him, and because people recognise it as a uniquely Australian brand of suffering and endurance in a very dry environment."

The photo was renamed *Spirit of Endurance* after the death of Harold's only son, also named Harold, at Tobruk during World War II, and continued to be regularly exhibited throughout the 1950s. Today the tree is still standing, and neither it nor its surroundings have changed much since Harold – the grandfather of AG's founder Dick Smith – created his famous image. Wilpena Station, on which it stands, is now part of the Flinders Ranges National Park and the site is a popular visitor attraction.

To see our red gum feature, turn to page 80.

CHRISSEY GOLDRICK





Lasting impression. Harold Cazneaux reversed the original negative to make his famous print, so it shows a mirror image of the real scene.

BLADES OF GLORY

THE WORLD'S GREATEST AXEMEN

Originating in Australia, the sport of woodchopping is a game of not only strength, but also precision. And the latest world champions are a cut above the rest.

STORY BY PAUL RAFFAELE

“Axemen, stand to your logs.”

The announcer's command booms across the arena at the Sydney Royal Easter Show. Axemen have travelled from all over Australia, and many of the 19 countries where the sport is practised, to compete.

On the afternoon of the final day, after 11 days of fierce competition, eight of the world's greatest axemen stand ready to race each other in the most prestigious event, the 375mm World Championship Standing Block (log). Spectators crowd the arena and most eyes are on the top pair, New Zealander Adam Lowe and Victorian Laurence O'Toole.

Both have won several world championships, but there the similarity ends.

Adam is built like a bulldozer, while Laurence is woodchopping's version of a racing Ferrari – long, lithe and bristling with dynamic power.

Each grips a racing axe, its steel head polished to a mirror finish. The crowd falls silent. On the announcer's count of three the big men explode into action. Thock! Thock! Thock! Their axes blur into smears of silver. Woodchips sing through the air like bullets as their mighty blows gouge deep into the logs. First on the left, then in the middle and onto the right. Again and again and again.

Adam won the event in 2014 and takes the lead but Laurence is close behind. ▶



Chip off the old block. Pictured here in his backyard in Doncaster, VIC, Laurence O'Toole is an Australian champion and a third-generation woodchopper.



WOODCHOPPING is one of the best-kept secrets of international sport – a thrilling combination of strength, precision and suspense. Its world champions, such as Laurence and Adam, can sever a log in 30 seconds and are so accurate they can split a match lengthwise with one swing of the axe. Most refreshing of all, there are few inflated egos. No tantrums, no steroids, just superb fitness and skill.

“There’s a civility in the sport that’s missing in many sports these days,” says Adrian Howie, president of the Australian Axemen’s Association. “The axemen respect one another, and are always ready to help each other.”

On any weekend of the year you’ll find a woodchop somewhere in Australia, mostly at rural agricultural shows, with competitors ranging from 10-year-olds to fighting-fit septuagenarians. “There are over 2000 registered competitors,” says Adrian, “and many more who take part just for the enjoyment.”

The world’s greatest-ever axeman, 58-year-old David Foster, has won 186 world titles in his four-decade career,



Crowd pleaser. Despite wet weather, the axemen events (top) are a hit. Prior to the competition, Laurence (above, at right) and his team inspect logs.

and still competes at world championship level. He is a man-mountain at 197cm and 159kg. A few days before the Sydney event, at his property in Latrobe, northern Tasmania, David was tapering off his training. “Accuracy is vital,” he says. “You’ve got to hit the right spot, at exactly 45 degrees. More and you’ll bury the axe in the log. Less and it will glance off.”

THE SPORT OF woodchopping began not far from David’s home late in the 19th century. Sawyers and axemen were in great

demand, toppling trees to clear bush for grazing land and for millions of railway sleepers. Proud of their prowess, these toughest of men turned their livelihood into perhaps the country’s most traditional contest.

The first recorded match took place in 1870 at Sprent, near Ulverstone, when Jack Briggs took on Joe Smith for a wager of £25. The first woodchopping carnival was staged 21 years later at Latrobe, 10km from David’s home.

Since then, Tasmanians have been at the forefront, and the very best, including the Australian women’s champion, Amanda Beams, travelled to Sydney for this year’s event. David, suffering from a chronic bad back, has given up competing in the World Championship Standing Block, which he won six times, but this year he’s racing Laurence and others in the 600mm World Championship Double-Handed Saw. He won this event at Sydney 22 years in a row, but has missed out over the past 13 years.

The week before the show, hundreds of kilometres away in Doncaster, Melbourne, 31-year-old



Show stoppers. Adam Lowe (left, at left) races Laurence during the 2015, 375mm World Championship Standing Block event. The sport began in Australia in the early 1870s; pictured above are the competitors at the Sydney Royal Easter Show in 1926.

Laurence, one of the best Australian axemen, was also tapering off after months of solid gym work and chopping hundreds of logs. Laurence has won seven world championships and even beaten the best Americans at lumberjack championships in Hayward, Wisconsin.

As the axemen got ready to travel to Sydney, Peter Knight was preparing more than 4000 logs to be transported to the Easter Show. Peter has had the contract to supply the logs

The axemen dare not look away from their logs.

there for several years and they are taken from regrowth forests in NSW and Victoria. Melvin Lentz, the only American ever to win the 375mm World Championship Standing Block, had told me that the logs are much harder than those in the American lumberjack competitions. "That's why the Sydney Easter Show is the pinnacle of our sport," he says.

On the show's opening day, the woodchopping arena was crowded as the 220 competitors were shepherded through scores of events. Amanda Beams joined Heather Warren in the demanding double-handed sawing, and then competed in the underhand chop where contestants stand on a log

and chop down to halve it lengthwise. "Women don't compete in the standing block because it's too dangerous," she says.

Also at the show is Eddie Fawcett. He is the founder of a dynasty that has crafted Tuatahis – the world's finest racing axes and saws – at his factory in Masterton, New Zealand, for almost half a century. "We get the iron from the one forge in Europe," Eddie says. "It's made with a high-carbonised secret mix."

Next to a backyard axe-head, the Tuatahis are diamonds versus paste. Axemen pay \$600 for one of these top racing axes, and some have dozens. "They're so sharp you can shave with them," David Foster remarks.

Many of the contestants in the World Championship Standing Block are using Eddie's blades. "We may be in for a surprise in the race," he told me, with a mysterious smile, before the world champion event.

Midway through the competition, David nervously lined up for the world championship double sawing. The contestants included Laurence, and David's partner was Jamie Head from Queensland. Each gripped one end of a razor-sharp saw to cut through a huge log, which nowadays is cut commercially with chainsaws. David grunted with the exertion as he threw his frame into the effort, sending sprays of sawdust from the log. The crowd cheered him as, with a final lunge, the severed end fell to the ground. He seemed stunned, unable to

believe he was the world champion again, and then, in a display of triumph, brandished the saw with one hand and thrust a fist into the air.

TO DAY IS the final day, and, moments ago, just before the most important event – the 375mm World Championship Standing Block – a sudden storm sent down a shower. But the spectators are still in their seats, ignoring the drenching.

The axemen dare not look away from their logs to see who is ahead. A split second can mean the difference between being crowned world champion and leaving Sydney as an also-ran. I watch the favourites, Adam Lowe and Laurence O'Toole – the New Zealander finishes one side of the log and is into the second by the time the Victorian races around to the uncut side.

A roar from the crowd alerts me to a surprising sight. Both are behind unfancied Victorian Glenn Gillam, chopping near the end of the line. His axe is a blur, arcing repeatedly at high speed. With his log almost parted, Glenn swings the axe for a final massive blow. Bang! The top half of the log flies through the air.

Adam comes in second with Laurence third. Nearby, Eddie Fawcett is sporting a huge grin. "I said there'd be a surprise," he tells me. "Gillam was...using my latest improved racing axe, a secret, and that made the difference. Next year...they'll all be using it."

SOUTHERN FLOCK

Albatross Island

A tiny fleck of land in the Bass Strait is home to a colony of shy albatrosses numbering more than 5000 nesting pairs.

STORY BY PETER MEREDITH PHOTOGRAPHY BY MATTHEW NEWTON



Coming home to roost.

September is a busy time of year for the birds on Albatross Island; they form partnerships, build their nests and lay their eggs.





ALBATROSS ISLAND is a windswept speck in the Bass Strait. Named for its best-known (but by no means most numerous) inhabitant, the shy albatross, it covers just 18ha and lies some 35km off north-western Tasmania. Some of its rock substrate is exposed to the elements; the rest is carpeted in a vibrant mass of ground-hugging vegetation, including several varieties of succulent.

Although it's a paradise for birds and visually stunning, Albatross Island can be less than comfortable for human visitors. For a start, the locals are prone to making a racket day and night, especially when they're breeding. And the accumulated bird guano gives off a pungent smell that can be detected some way off the island.



It has no human-made structures, and because it is a state nature reserve, you need a permit to land there.

The reason for the island's protected status is the vast numbers of birds that call it home. Some 5200 pairs of shy albatrosses (*Thalassarche cauta*) breed here every year, together with an estimated 20,000 pairs of

Under observation. Dr Rachael Alderman, above, attaches a tiny data logger to an adult albatross. This must be done quickly so as not to disturb the bird and its one-week-old chick – some birds can become stressed by human presence and will nip or bite. From data collected, Rachael will determine where the birds are feeding.

fairy prions, 2000 pairs of short-tailed shearwaters and 350 pairs of little penguins, among other avian visitors. A few fur seals also visit.

Impressive though these statistics are, both bird and seal numbers were higher in the past. George Bass and Matthew Flinders reported seeing the island "almost covered with birds" when they landed there in 1798. It's estimated there were about 20,000 breeding pairs of shy albatrosses on the island then, but in the 1800s ▶

Shared custody. After feeding at sea, an adult bird returns to its partner, which has been minding the pair's newly hatched chick.



The waiting game. Once a chick hatches, the adult albatross broods it, keeping it warm and protected from predators. After a few weeks, the chick can be left alone while the adults forage. Rachael (left) gently removes a GPS tracker from an adult bird; the units weigh about 20g and are taped to the birds' feathers.



sealers put an end to that. After almost wiping out the island's seals, they turned to albatrosses and sold their feathers as hat adornments and for stuffing pillows and quilts. By 1909 the number of albatrosses had plummeted to 250–300 breeding pairs. That turned out to be a low point from which the population recovered steadily, until recently.

From the early 1980s, the island's albatrosses have been the focus of a long-term scientific study that aims to track their numbers and find out where they go and what they do on their travels.

Dr Rachael Alderman, a senior wildlife biologist at Tasmania's Department of Primary Industries, Parks, Water and Environment, began coordinating the program in 2003. She has been visiting the island at least

The global population breeds only on three islands off Tasmania.

twice a year, sometimes four times, ever since. Her visits coincide with critical events in the albatross calendar – such as egg-laying in September and chick-fledging in March.

The shy albatross, with a wingspan of about 2.5m, is smaller than its better-known cousin, the wandering albatross, which has a wingspan of 3.5m. The global population breeds only on three islands off Tasmania –

Happy homecoming. There are four breeding sites on the island – North (pictured above), South, Main and West. An adult albatross will spend, on average, five days at sea before returning to its partner to relieve it of nest duties.

Albatross Island, Mewstone (10,000 breeding pairs) and Pedra Branca (200 breeding pairs).

The shy albatross doesn't range as far as the wandering albatross, which may circumnavigate the globe for several years after it has fledged and left the nest before returning to its birthplace to breed. Non-breeding juvenile and immature shy albatrosses tend to remain in the waters of southern Australia, occasionally crossing the Indian Ocean to South Africa.

When they're breeding, wandering albatrosses may cover thousands of



On the mark. An adult shy albatross has a wingspan of up to about 2.5m. Rachael, above, at left, Julie McInnes and Kris Carlyon check for moulting feathers. At night the scientists camp out in one of the island's caves.

kilometres in search of food. In contrast, breeding shy albatrosses don't stray much more than 200km on their foraging trips and stay away for no longer than about 10 days.

"They keep to the Bass Strait region and return to the colony all year," Rachael says. "One reason for that may be that the Bass Strait environment is productive and predictable enough year-round to allow the birds to stay."

Shy albatrosses are long-lived and slow to reproduce. They live for about 35 years, are in their prime between 10 and 25, and generally form lifelong,

monogamous pairs. A female lays a single egg in September and she and her mate take turns to incubate it over 10 weeks, one sitting on the nest while the other is away foraging. The chick hatches in December, fledge in March and departs in April.

"Of the eggs laid in a given year, fewer than half become a chick that makes it to the end of the breeding season," Rachael says. "And we know from our research that fewer than half the chicks that survive to leave the island make it back again."

How Rachael establishes these facts is down to the strategies she uses in her program. One is to count breeding pairs and chicks every year, yielding a measure of breeding success. Another, termed 'capture, mark, recapture', involves fitting leg bands to chicks before they leave the nest and reading

the bands of returning birds. Rachael and her coworkers also fit GPS trackers to birds to trace their journeys.

All the data from the program are pieces of a gigantic jigsaw puzzle that will one day yield a coherent picture. Some trends are already emerging: breeding success, for instance – the survival rates of juvenile birds and the number of breeding birds have begun to decline in the past 10 years. Why this is happening is still a mystery. It may be linked to the numbers of albatrosses killed as fishing bycatch or to climate change and associated changes in the ocean and the weather.

"With this project we're trying to understand the cumulative impacts of all of the threats the birds face as much as follow single lines of inquiry," Rachael says. "The cumulative impacts can be quite massive." AG



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HUGH MACKAY

Being a good neighbour

It's not where you live, but how you live, that makes a difference, says Hugh Mackay.

RECENT AUSTRALIAN history has not been kind to communities, partly because it has not been kind to ideas such as cooperation, altruism and even self-sacrifice. For the past 50 years, we have been living in the Age of Me, bombarded by propaganda that persuades us to believe nothing is more important than *my* material comfort and prosperity, *my* personal happiness, *my* rights and *my* entitlements.

Consumer mass-marketing has been the most sophisticated contributor to all of this encouragement of self-absorption. But political strategists have also jumped on the bandwagon, 'selling' politicians and their parties like brands designed to appeal to our self-interest.

The 'happiness' industry has not been far behind, with its relentless emphasis on positive outcomes for *me* and the dangerous concept that self-esteem is the greatest gift we can give our children. Even the meditation movement, for all its value, sometimes encourages a degree of self-awareness that can morph into self-absorption.

We are in danger of forgetting that the most interesting question about us isn't "Who am I?" but "Who are we, and what kind of society do we want to create?" All that 'me' talk can easily distract us from the deepest truth about ourselves, which is that we are social creatures who need communities to support, sustain and protect us.

The story doesn't end there. The beautiful symmetry in human nature is that those communities themselves must be nurtured if they are to survive. As social creatures, it is our responsibility to build and maintain communities where people can live harmoniously, creatively and productively, based on mutual kindness and respect.



Yet many of the changes that have been so relentlessly reshaping our society have been distracting us from that noble purpose, by threatening the stability and cohesiveness of local neighbourhoods. For example, the new patterns of marriage and divorce demand difficult adjustments for many families and friendship circles, while our low birthrate reduces the role children have traditionally played as a kind of 'social lubricant' in the neighbourhood. And, with single-person dwellings accounting for more than 25 per cent of all households, there's an increased risk of isolation, and the rise of the two-income household means both partners are often too busy, or too tired, to devote much time to nurturing their local community. We also move house, on average, once every six years, and often commute in our own cars, so the chance of incidental, unplanned encounters with people diminishes.

Then there's the IT revolution, which, while appearing to connect us, actually makes it easier not to see each other.

The list could go on, but the consequences are obvious: we are in danger of becoming more fragmented and that, in turn, fuels our insecurity. We become more wary (an Edith Cowan University study recently revealed that only 35 per cent of us say we trust our neighbours). We are less trusting of institutions, less confident of the meaning of that elusive thing called 'society' and more of us are saying, "We don't know our neighbours."

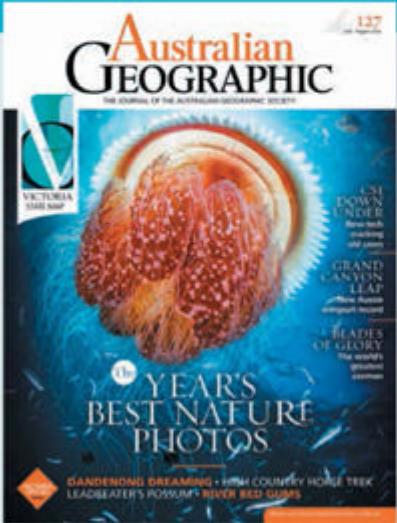
None of this is inevitable – in many parts of Australia, people are resisting these pressures and maintaining a strong sense of community where they live. In fact, the tide might be beginning to turn as more of us realise that 'the state of the nation' starts in our street. It's not so hard to engage: smiling at a stranger, chatting with a neighbour or joining a book club are simple acts that help to build the social capital that makes communities strong.

Although some of us belong to several different communities, our local one is special, because the role of neighbour is unique. Our morality is strengthened by learning how to get along with people who may be quite unlike us and who might never otherwise become friends.

Engaging with people in this way is not only good for the community, but also for us, individually. After all, we don't really know who we are until we find an answer to that nagging question: where do I belong?

HUGH MACKAY is a social researcher and author, most recently of *The Art of Belonging* (Pan Macmillan Australia).

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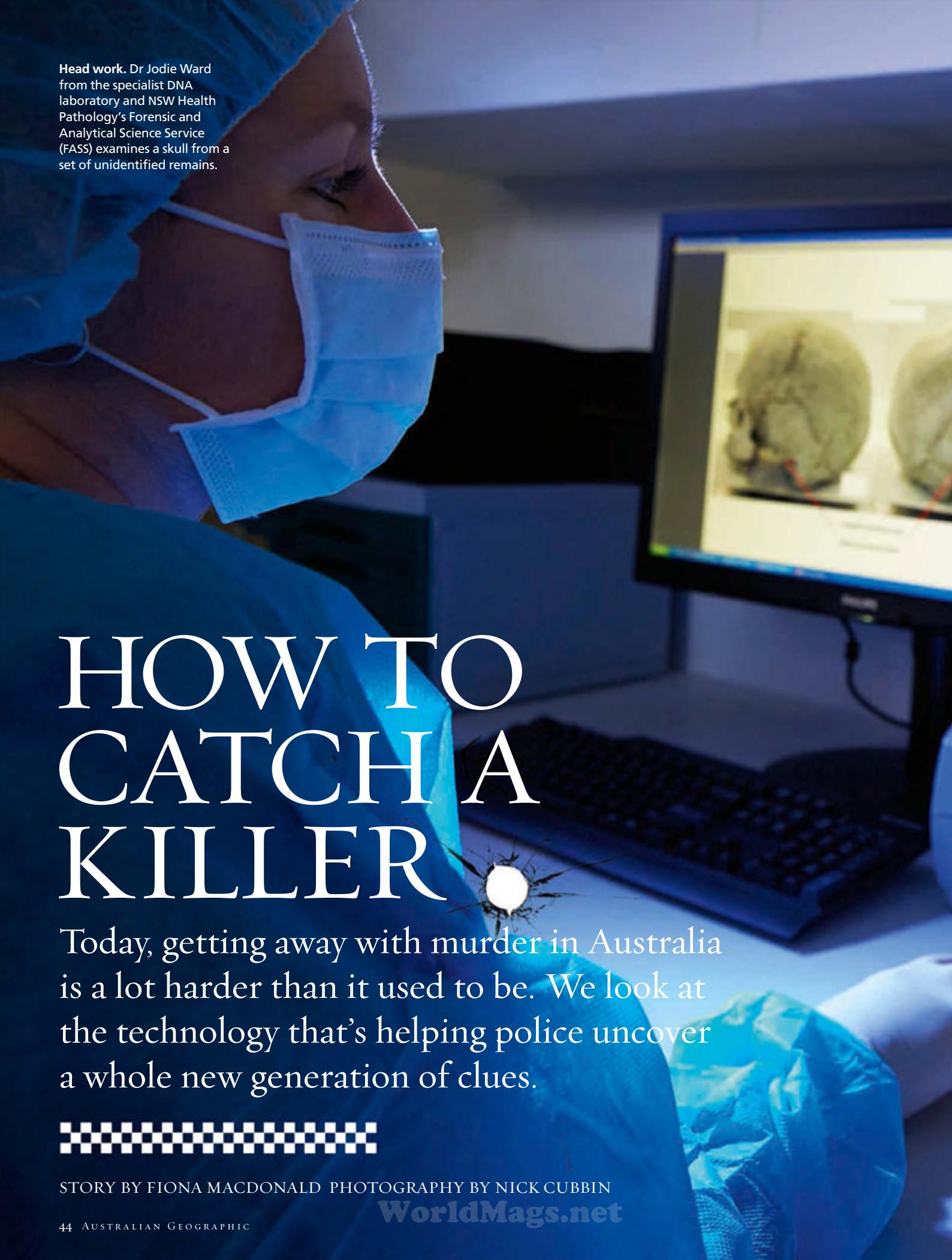


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Head work. Dr Jodie Ward from the specialist DNA laboratory and NSW Health Pathology's Forensic and Analytical Science Service (FASS) examines a skull from a set of unidentified remains.

HOW TO CATCH A KILLER

Today, getting away with murder in Australia is a lot harder than it used to be. We look at the technology that's helping police uncover a whole new generation of clues.



STORY BY FIONA MACDONALD PHOTOGRAPHY BY NICK CUBBIN

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WATCH

Use the free *viewa* app to scan this page and watch a short film about forensic science technologies, or find it on our website.





Fine details. Clint Cochrane, at left, and Rebecca Douglas use a chemical test and LED 'Crime-Lite' to locate biological matter on crime scene exhibits.

WHEN PIA NAVIDA, a 37-year-old Filipino woman, was found brutally slaughtered in Sydney's Royal National Park in 1992, the subsequent investigation failed to identify her killer. The case found its way onto the sad catalogue of unsolved murders on the books of the NSW police, where it remained for the next 23 years. If that terrible crime had happened today, it would never have become a cold case.

By all accounts, it was a clumsy murder that should have been easy to solve – Pia's clothes were left strewn around a nearby walking trail, and the assailant hadn't made much of an attempt to hide her body or the murder weapon, which was a blood-stained rock. But although all the physical evidence was there – including blood under Pia's fingernails – police had no way of linking it to a suspect. So, for more than a decade, her body was stored in a NSW Police freezer, and the trail went cold.

However, in that time, scientists sequenced the human genome – the total sum of our DNA – and the technology became reliable enough to enable police to identify individuals through unique sections of their genes. DNA is now routinely used to place

suspects at a crime scene, identify victims' remains, and even point police to potential suspects by comparing DNA left at the scene with that of known criminals on the national database.

In the hopes that this breakthrough science might finally give police a lead, Pia's remains were retrieved, and, in mid-2014, a man named Steve Isac Matthews was finally convicted of her murder.

Although DNA evidence has been used regularly in murder cases since the early 2000s, Pia's was one of the first cold cases in NSW to secure a murder conviction using this new technology. Sharon Neville, the assistant deputy director of the NSW Health Pathology's Forensic and Analytical Science Service (FASS), remembers the entire investigation

NICK CUBBIN is a Sydney-based freelance photographer whose work has appeared frequently in the journal. His last assignment for us was *Grub's Up* (AG 124), about the potential for insects to feed the planet's burgeoning population.

FIONA MACDONALD is an award-winning science writer in Sydney. Her last story for the journal was *Unseen Sydney* (AG 125), about the unusual images that can now be photographed using remote-piloted aircraft.



ANALYSING A FINGER- PRINT

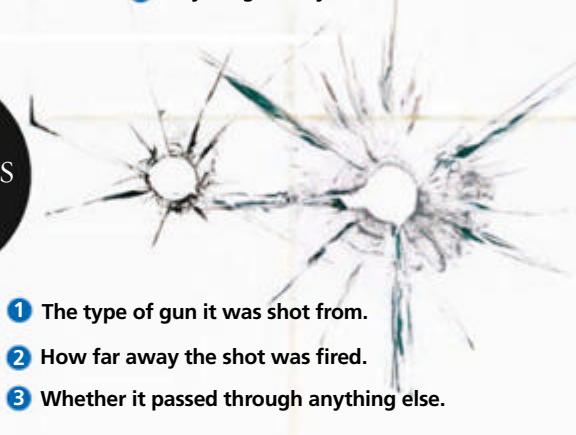


EVERYTHING WE consume leaves chemical traces in our sweat, which is transferred onto surfaces along with our skin cells when we leave a fingerprint. Using a technique known as mass spectrometry, researchers can assess the amount and type of chemicals in that sweat. Although this research is still in the lab stage and isn't yet being used regularly by police, it can reveal:

- 1 What you ate within the past hour.
- 2 What you've touched (including gunpowder residue, explosives or even poisons potentially associated with a murder).
- 3 Any drugs that you've taken.

BALLISTICS

BY STUDYING how a bullet hits its target, researchers can work out:



- 1 The type of gun it was shot from.
- 2 How far away the shot was fired.
- 3 Whether it passed through anything else.

The reality is there isn't much you can do now that someone won't be able to trace afterwards.

well. She had been at the department for three years when the case landed on her desk in 1992.

"I was one of the first to work on the Pia Navida case," she says. "It was frustrating. When we started we had such limited technology that it was difficult to even [know if] the blood under her nails was her own. But by the time Matthews was arrested, we'd been able to recover DNA profiles from three other people."

FASS IS THE external facility that conducts the majority of forensic testing for the NSW Police. It also helps other states with specialist examinations from a new \$5-million, warren-like facility in Lidcombe, in Sydney's west. The secure lab, surrounded by high fences and surveillance cameras, is at the cutting edge of detecting traces of DNA, gunshot residue, explosives and other chemicals.

"When I started in the '90s, we needed a blood stain around the size of a 50-cent piece in order to be able to sample someone's DNA," says Sharon. "Now we only need 20 skin cells from a sample that's so small you wouldn't even be able to see it. In fact," she says, gesturing at my elbow resting on her desk,

"you've probably just left enough cells right there for me to generate a DNA profile."

It sounds remarkable, but scientists can now work out the foods you've recently eaten, or the drugs you take, from a fragment of your fingerprint; they can also find clues in every microscopic piece of fibre or hair that you leave behind.

Even the microscopic bacteria that live upon your skin, or – in unfortunate circumstances – the maggots that end up feasting on your dead body, can betray your recent movements. The new DNA technology is so sensitive that I have to provide a cheek swab before I enter any of the labs in case one of my shedded skin cells places me at the scene of a murder.

Continued page 50 ▶

SECRETS OF THE SCENE

Trace evidence collected at a crime scene can be pieced together to build a picture of events leading to the offence and any potential suspects.



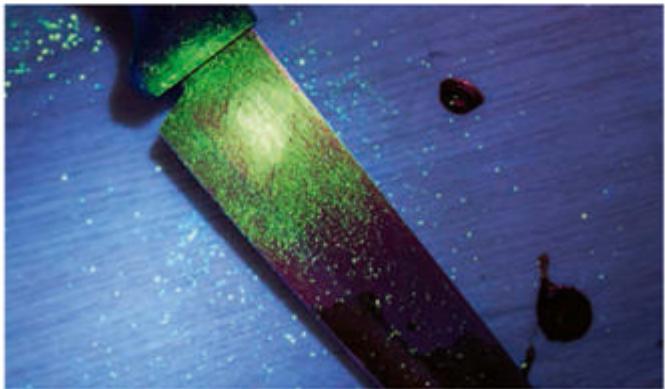
1 CRIME SCENE INVESTIGATION KIT These portable cases contain many tools for finding and sampling evidence, such as LED torches that operate at various wavelengths.



2 MARKING UP THE EVIDENCE Before samples are collected, forensic officers use numbered tags to mark up evidence that needs to be sampled – an often time-consuming task.



3 FOOTPRINTS Blood-stained tracks can give police information on the size and brand of the shoe worn by a potential suspect and their movements at the scene.



4 POOL OF BLOOD This blood pattern, which has been caused by heavy bleeding, most likely came from the victim – it can give clues about how long the body has been here.



5 FINGERPRINTS Fluorescent powder and UV light reveal a fingerprint on the murder weapon's blade. A match with a print on the national crime database could provide a suspect.

6 BLOOD DROPS These little dots are important because they appear to have fallen from a height and could reveal actions by the offender rather than the victim.

A photograph showing a person lying face down on a carpet. A blue LED torch is being used to illuminate the carpet, highlighting textile fibres. A yellow circle on the carpet surface indicates a specific area of interest, which is magnified in an inset. A yellow line points from this inset to a callout box.

7

FIBRES The blue LED torch reveals textile fibres left on the carpet, which can be microscopically and chemically analysed to match them to a particular fabric – another potential link to a suspect.

“What people saw on the TV 10 years ago has finally started happening... Forensics now really have changed the way police think about solving a crime.”



Closing in. Victoria Police forensic investigators assess the crime scene after two men were shot dead on Melbourne's Lygon Street.

Over the past year, the Lidcombe facility has introduced an automated way of processing DNA samples, run entirely by robots.

IF IT SOUNDS LIKE SOMETHING out of a TV show, that's because it is. "What people saw on the TV 10 years ago has now finally started happening," says superintendent Mark Sweeney, the acting commander of the NSW Police Forensic Services Group. "It's been promised to us ever since *CSI* came out, but forensics now really have changed the way police think about solving a crime."

The advances in DNA technology are responsible for the majority of that change, he explains. From those aforementioned 20 skin cells, scientists can now isolate 21 different markers on a DNA strand from a crime scene sample and compare this with a reference sample from a person. If there is a match between the two samples, it's an extremely strong indication that the person is the source of the DNA – the same combination of those 21 markers could be expected to be seen in less than one in 100 billion individuals.

"Actually, that's just the cut-off number we give," Sharon adds. "In reality, the actual numbers generated are far larger. The most common DNA profile occurs in [about] one in a quintillion individuals. When we go to court now, they generally don't challenge who the DNA originates from. That science is solid. It's typically all about how their DNA got there."

And the technology continues to be refined and improved. Over the past year, the Lidcombe facility has introduced an automated way of processing DNA samples, run entirely by robots. This reduces the risk of contamination and means that DNA can now be analysed and reported back to police in just two days.

After those initial 48 hours, the DNA results are compared with every entry on the National Criminal Identification DNA Database, in addition to that of persons of interest, to see if they come up with a match. If a link is found, police will have the



Extracting answers. Dr Jodie Ward drills into a human leg bone from a crime scene. The DNA extracted from the powdered skeletal component may assist identifying the remains.

information they need to make an arrest or obtain a warrant in less than a week – a process that just a decade ago would have taken months, if not years.

And it's only going to get faster and cheaper. A new instrument currently being evaluated at FASS can perform that whole two-day, multi-room process in just 90 minutes, and it's small enough to be deployed to crime scenes.

"What we're providing is intelligence – fast intelligence," Sharon says. "And the biggest change is that police are now getting information in the early stages of their investigation." This has changed the way the force thinks about solving a crime, Mark adds. "It allows us to start hunting and tracking down individuals of interest in a matter of hours or days. The progress of investigations is now driven by these forensic results," he says.

INTERESTINGLY, NOWADAYS it's not just regular DNA that police can examine. In January, FASS launched a specialist mitochondrial DNA facility. The difference with this type of DNA, is that there are thousands more copies of it in each cell – so really old human remains, previously too decomposed to contain useful DNA, can now be identified.

And we mean really old. The technique has already allowed scientists to identify the remains of England's King Richard III (1452–1485) under a parking lot in Leicester, and, according to a slightly controversial book released last year, it may even have revealed that Jack the Ripper was a 23-year-old Polish barber called Aaron Kosminski.

Molecular biologist Jari Louhelainen from the UK's Liverpool John Moores University was able to find traces of 127-year-old mitochondrial DNA on a blood-stained shawl found at the scene of one of the crimes. He compared the results with the female descendants of the two key Jack the Ripper suspects, and found a match with Kosminski's relative.

TYPES OF BLOOD STAINS

BLOOD DROPS

The diameter of a blood droplet can tell police the height from which it was dropped – the smaller the droplet, the closer to the ground it fell.

TRANSFER PATTERN

The pattern left on a surface, such as a bloody footprint or handprint.

SWIPES

Made when something bloody rubs up against a surface.

EXPIRATORY BLOOD

Blood that's been coughed up or breathed out, which creates a misty splatter.

SHADOWING

An empty space within a blood splatter, which suggests something was blocking the spray.

CAST-OFF STAINS

These are made when blood flies off an object that's swung through space, such as a murder weapon.



Fine details. A technician fills the liquid nitrogen container of a scanning electron microscope, which can reveal details less than 1 micron (one-millionth of a metre) in size.

Locally, the new FASS lab is also helping police to identify old, unidentified human remains, kept in a so-called bone room in Sydney, and return them to their families. Also, previously unusable evidence, such as shed strands of hair, which don't contain a cell nucleus or normal DNA, can now be processed.

Professor Chris Lennard, a forensic scientist from the University of Western Sydney, which houses the Crime Scene Investigation Training and Research Facility for NSW police forensics' teams, as well as students, believes that we're now about to enter an entirely new world of evidence.

"The next breakthrough, which is still largely in the research phase, will be next-generation DNA profiling methods," Chris says. "So when a...sample doesn't match a suspect, or someone on the database, forensic biologists will be able to provide some physical characteristics of the person to go on."

"While DNA profiling systems already exist that can provide information such as likely hair colour, eye colour and ethnic background, future systems will provide information such as facial features," he adds. "There are labs around the world developing systems that will even give a molecular photo fit of the individual who left DNA trace at the crime scene."

What's more, in the distant future, criminals could be tracked down by their bacteria alone. A paper published in the journal *Science* in 2014 revealed that each of us leaves our own unique microbial 'aura' behind after spending less than a day somewhere, and these could one day be analysed and monitored to give police clues about who's been at a crime scene.

"The next breakthrough...will be next-generation DNA profiling methods."

"If you combine the future possibilities in chemical profiling of fingermarks and DNA profiling, you could come up with a reasonably good description of an offender, their habits and recent activities without them being on any of the databases," Chris adds.

WITH THESE tools being rolled out in the next 5–10 years, the challenge now lies in what should be done with this information, and how to use it to identify crime patterns, says Professor Claude Roux. As the director of the Centre for Forensic Science at the University of Technology, Sydney, he works with Chris and Sharon, as well as the NSW Police Force, the federal police, and other law enforcement agencies.

"The three basics of forensic science are: trace recognition and field collection; analysis; and sharing the information with end users, whether they are investigators, intelligence analysts or policymakers," Claude says. "The challenge comes before and after that: working out which surfaces to swab to find invisible DNA, which trace evidence to look for and where, and then working out what those results mean."

"Solving a crime is still about so much more than the 'who,'" he adds. "This intelligence might help us understand the 'why' or the 'how.'" Despite all of the new technology, Claude believes that forensic science is still very much the same mind game that's portrayed in fictional tales of Sherlock Holmes.

"At the end of the day, forensics is simply the study of traces left behind at a crime scene. It's about using science and logical rules to make sense of observations," he explains. "Just like archaeologists study artefacts, we study these traces, these remnants of people's presence and activity, to work out what happened in the past." **AG**

DNA AND COLD CASES

The role forensic science has played in Australia's most famous cold cases:



1965



THE WANDA BEACH MURDERS, NSW

A biological sample taken in January 1965 could have revealed the identity of the murderer of two teenage girls, but it couldn't be found in archives when the case was reopened in 2007.

When assessing whether to investigate a cold case, police look for:

- 1 The amount of physical evidence collected.
- 2 Whether it's recent enough that the investigation could result in a conviction. Few cases prior to 1970 are assessed.
- 3 Whether there are still witnesses alive who can help put any new forensic evidence into context.



1974 THE MCCULKIN FAMILY MURDERS, BRISBANE

Scientists recently uncovered new evidence from the four-decade-old murder case, which led to the arrest of two suspects in late 2014. The kind of evidence has not been revealed, because the court case is ongoing, but it's something previously inaccessible due to insufficient technology.

2001

PETER FALCONIO MURDER, NT

New technology proved that DNA found on the T-shirt of Johanna Lees, Peter Falconio's abducted partner, was 150 quadrillion times more likely to belong to convicted killer, Bradley John Murdoch, than anyone else. Researchers were also able to link DNA found on Murdoch's handcuffs to Falconio, even though his body hasn't been found.



NATURALLY BEAUTIFUL

Welcome to the 2015 Australian Geographic ANZANG Nature Photographer of the Year shortlist. Now in its 12th year, this annual celebration of nature and photography goes from strength to strength, with a record number of entries.

The winners will be announced at the South Australian Museum in Adelaide on 31 July, and the exhibition will open there on 1 August. Check our website to see which image takes out the top prize.

ANIMAL BEHAVIOUR

KAKADU LIGHT

BROLGA, *Grus rubicunda*

Ben Neale, Queensland

The abstract nature of the clay lake and contrasting interplay between the individual birds is compelling. Shooting from the air with my landscape lens I had to get low to capture the brolgas in detail. With many sharp turns and some near misses, the composition came together in one frame out of 200.

■ **Kakadu, Northern Territory**

■ **Canon EOS 5D Mk II, 24–105mm, 1/640,
f/11, ISO 800, handheld from a paraglider**







ANIMAL BEHAVIOUR

LYREBIRD IN THE MIST

SUPERB LYREBIRD, *Menura novaehollandiae*

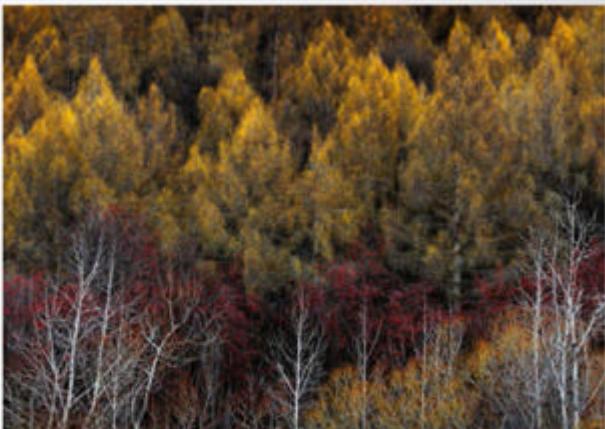
Judith Deland, Australian Capital Territory

I found this superb lyrebird in a heavy mist. It was calling to another bird close by from the granite boulders that crown the top of Mount Ellery in East Gippsland.

■ **East Gippsland, Victoria**

■ **Canon EOS 5D Mk III, Canon zoom lens EF 24–105mm, 1/800, f/6.3, ISO 1600, handheld, focal length 98mm**

Australian GEOGRAPHIC | ANZANG Nature Photographer of the Year



INTERPRETIVE (TOP)

TAPESTRY

Tim McCullough, South Australia

A pine forest in winter on the South Island of New Zealand showcases a stunning, rich tapestry of colour and texture. With the stark, bare white birch trees beautifully framed by vibrant red and orange foliage behind, it reminded me of a matchstick flame, perfectly mimicked in nature's glory.

■ Arrowtown, New Zealand

■ Canon 5D Mk II, EF 70–200mm f/2.8L IS II USM, 90mm, 1/18, ISO 50 tripod with cable remote

MONOCHROME

THE WHALE SHARK

WHALE SHARK, *Rhincodon typus*

Scott Portelli, New South Wales

The whale shark is the largest fish on the planet and spends its time in nutrient-rich waters filter-feeding on small plankton and fish. Late afternoon in Cenderawasih Bay, West Papua, they congregate close to local fishing platforms, called bagans, anticipating an easy meal as small fish escape the fishermen's nets.

■ Cenderawasih Bay, West Papua

■ Canon 5D Mk II, Canon 15mm fisheye, 1/125, f/9, ISO 320, 2 x 161 Ikelite strobes

JUNIOR (TOP)

MANTID MACRO

PRAYING MANTIS, unidentified species

Kieran Palmer, Queensland, aged 17

I caught this close-up portrait of a praying mantis, which was out enjoying the buffet of bugs that some recent rain had brought out.

■ Muttaburra, Queensland

■ Canon EOS 50D, EF 100mm f/2.8L macro IS USM, 1/125, f/16, ISO 160, flash, handheld

ANIMAL PORTRAIT

BIRD BELCH

CAPE BARREN GOOSE, *Cereopsis novaehollandiae*

Henry Cook, Queensland

Cape Barren geese spend much of their time with their heads down, picking at grasses, grazing like little avian cows. Occasionally they lift their heads and silently open their beaks – maybe a threat display, maybe to let the gas from fermenting grass in their guts escape.

■ Maria Island, Tasmania

■ Nikon D800, 500mm f/4 VR, 1/1250, f/7.1, ISO 200, monopod



BOTANICAL SUBJECT

LIFE AND DECAY

Unidentified species

Alan Kwok, New South Wales

The riverbank is covered in decaying leaves in various states – some still green, others shades of brown. Breakdown of the softer parts of the leaves reveals the extensive and beautiful network of veins within – and in this case a silver sheen not often seen.

■ **Stroud, New South Wales**

■ **Canon 1DX +, Canon**

MPE-65mm, 1/250, f/16, ISO 400, Canon MT24EX twin flash

ANIMAL BEHAVIOUR

CRASHING HOME

FIORDLAND CRESTED PENGUIN,
Eudyptes pachyrhynchus

Doug Gimesy, Victoria

Fewer than 2500 breeding pairs of Fiordland crested penguins now survive. They are unique among penguins in that they breed and nest north of the subtropical convergence in the temperate rainforests of New Zealand's rugged south-west coast and its outlying islands. Coming back to shore is not always easy.

■ **North of Haast, western coast
of New Zealand (South Island)**

■ **Nikon d750, Nikon 80–400mm
f/4.5–5.6, 1/2000, f/5.6, ISO 320,
UV filter, handheld**



Australian GEOGRAPHIC

ANZANG Nature Photographer of the Year



LANDSCAPE

MYSTIFY

Dylan Fox, Western Australia

I had beautiful conditions while photographing the karri trees of Boranup Forest – next to no wind, warm morning light and fog. As I was wandering through a section of the forest this tree caught my eye. It was alone and had great foliage on the forest floor around it.

■ Boranup, Western Australia

■ Canon 5D Mk II, Canon 16–35mm
Mk II, 0.4, f/16, ISO 100, tripod

A close-up photograph of a Spotted Bowerbird in mid-air, performing a courtship display over a shallow waterhole. The bird's wings are spread wide, showing intricate patterns of brown, black, and white. Its head is turned back, revealing a vibrant pink nuptial crest and a bright red gape. Its legs are spread, and it is landing on the water's surface, creating a small splash. The background is a soft-focus landscape of trees and sky.

ANIMAL BEHAVIOUR

SPOTTED BOWERBIRD

SPOTTED BOWERBIRD,
Chlamydera maculata

John Van-Den-Broeke, New South Wales

I was in a bird hide each day for three weeks by a waterhole on private property. You start to feel at one with nature; it was an amazing feeling. Sometimes I felt a bit lonely by myself, but it was moments like this that kept me there.

■ **St George, Queensland**

■ **Canon EOS-1D Mk IV,
EF 70-200mm, f/2.8L is USM +1.4x,
1/500, f/8, ISO 1250, handheld**

Australian
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INTERPRETIVE

BLUE LAKE

Yan Zhang, New South Wales

It was a cold morning and when the first light appeared we witnessed a dramatic change of the sky – a magical transition from night to day. This image was made from six shots, and captures the entire lake and its surrounding mountain features.

- **St Bathans, South Island, New Zealand**
- **Nikon D800, Nikkor AF-S 14–24mm f/2.8G ED, 10-15-30, f/2.8, ISO 400–ISO 800, GT2531EX Gitzo CF6X Explorer 2, BH-55 Ballhead**





OUR IMPACT (TOP)

ROAD TO ICE

**Marcus Arnold,
Canterbury, New Zealand**

Antarctica is often seen to be untouched and pristine, and rightfully so. However, being such a desolate and fragile place, the smallest activities can have a huge impact on the environment, even if it is just aesthetic. I believe this image captures a part of the impact we have there.

■ **Castle Rock, Ross Island,
Antarctica**

■ **Nikon D810, Tamron SP
24–70mm, f/2.8 Di VC USD,
1/400, f/7.1, ISO 64, handheld**

JUNIOR

WATERFALL

**Ryan North (aged 16),
New South Wales**

Captured in this image is the stunning detail of light flickering through falling water – a minute phenomenon that normally would go unnoticed.

■ **Fitzroy Falls, New South Wales**
■ **Nikon D3200, 18–105mm
f/3.5–5.6, 1/10, f/22, ISO 100,
tripod**

ANIMAL HABITAT (TOP)

BLACK-WINGED STILT IN THE MIST

**BLACK-WINGED STILT,
*Himantopus himantopus***

Heyn de Kock, New South Wales

A wind-free misty morning created an ideal setting for this black-winged stilt, walking in shallow water.

■ **Pitt Town Lagoon,
New South Wales**
■ **Nikon D800, Nikon 200–400mm
VR f/4, Nikon 1.4x TCE II
(Converter), 1/1000, f/7.1,
ISO 2000, Skimmer Pod with
Wimberly Sidekick**

THREATENED SPECIES

ON THE BRINK OF EXTINCTION...

**GOLDEN-SHOULDERED PARROT,
*Psephotellus chrysoterygius***

STATUS: ENDANGERED

Ofer Levy, New South Wales

A male golden-shouldered parrot sits on a termite mound, where he and his mate have dug their nest. This endemic bird is listed as endangered, with surveys pointing to a total wild population of about 2000 birds, and only about 300 breeding pairs.

■ **Cape York, Queensland**
■ **Canon EOS 1D IV, Canon 800mm
f/5.6 L IS, 1/1600, f/10, ISO 125**



THREATENED SPECIES

OLDEST OF THEM ALL

THROMBOLITE (MICROBIALITE) COMMUNITY

STATUS: CRITICALLY ENDANGERED

David Rennie, Western Australia

Thrombolites are structures formed by microbial communities. Situated in an internationally protected Ramsar region, and with scientists claiming they are billions of years old, we should be doing everything we can to protect them. In Dreamtime tales, these are the eggs of the Woggle, and they made all the lakes, rivers and waterways.

- **Lake Clifton, Western Australia**
- **Canon 1DS Mk III, 24mm, 1.3, f/11.3, ISO 200, tripod and cordless remote**



ANIMAL PORTRAIT (TOP)

KANGAROO IN SPRING

KANGAROO, *Macropus* sp.

Andrew Holt, South Australia

This male kangaroo in Kaiserstuhl Conservation Park was overlooking his harem ready to defend against the advances of other males. His amorous and defensive preoccupations allowed me to quietly approach and capture this shot. The late afternoon light set the scene with nice backlight, illuminating insects on the wing.

- **Kaiserstuhl Conservation Park, South Australia**
- **Nikon D7100, Nikon 200–400, 1/640, f/4, ISO 800, handheld**

MONOCHROME

SEA-EAGLE

WHITE-BELLED SEA-EAGLE,
Haliaeetus leucogaster

**John Van-Den-Broeke,
New South Wales**

I had been paddling and drifting down the creek for two hours when I came across this sea-eagle diving again and again trying to pick something up. The sea-eagle did eventually get it. I'm still not sure what it was, but it was a very special moment.

- **Cudgen Creek, Kingscliff, New South Wales**
- **Canon EOS-1D Mk IV, EF70–200mm f/2.8L IS USM +1.4x, 1/1600, f/8, ISO 3200, handheld from canoe**



ANIMAL PORTRAIT

RED JELLYFISH

unidentified species

Ross Gudgeon, New South Wales

Several weeks after a major rain event in the Exmouth Gulf region there is a bloom of these red jellyfish. Beaches are carpeted with them and under water they are everywhere. This image was captured during an event that ran for a couple of weeks in autumn 2009.

- Ningaloo Reef,
Western Australia
- Canon EOS 50D, Tokina 10-17
fisheye at 10mm, 1/250, f/11,
ISO 200, handheld, 2 x Inon Z240
underwater strobes, Subal C40
underwater housing



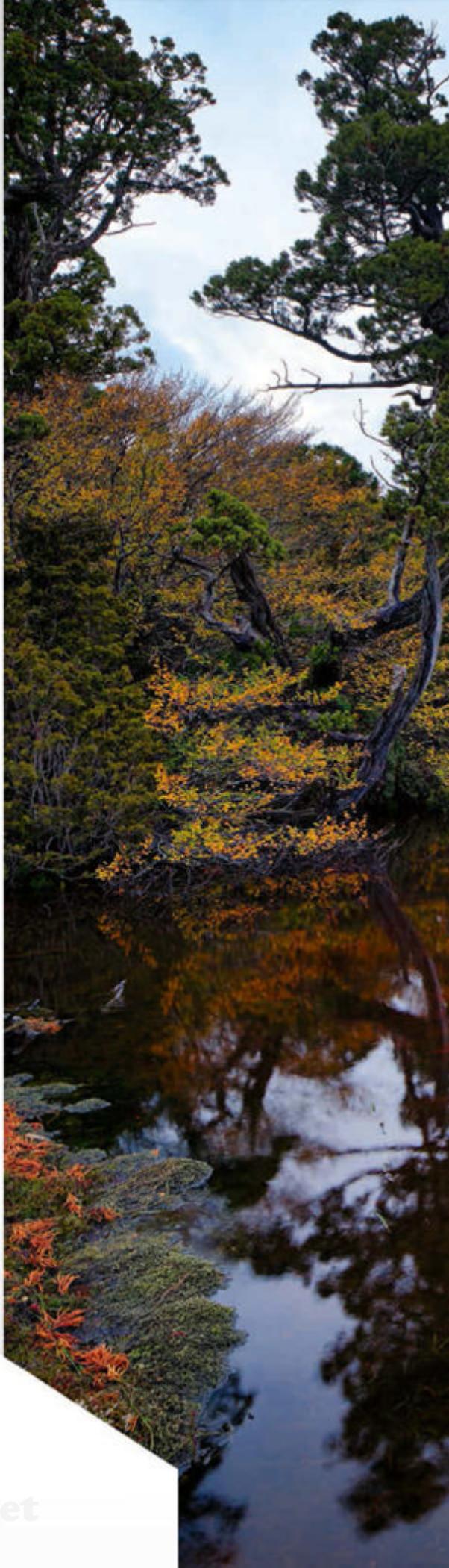
LANDSCAPE

FIRST LIGHT
ON LITTLE HORN

Luke Tscharke, New South Wales

The first direct rays of an autumn sunrise reached Little Horn, a summit of Cradle Mountain, and bathed it in a red glow for several fleeting minutes. The peak was reflected in the seemingly tranquil waters of the Twisted Lakes among pencil pines and golden fagus trees.

- Cradle Mountain-Lake St Clair National Park, Tasmania
- Sony A7R, Canon TS-E 24mm f/3.5L II Tilt Shift lens, 0.2, f/11, ISO 100, tripod







ANIMAL HABITAT (TOP)

EMUSCAPE

EMU, *Dromaius novaehollandiae*

David Stowe, New South Wales

We were camped near a dam in a dry and remote area of western Queensland, photographing a flock of bronzewings. Scattered over a vast area, a mob of emus appeared over the shimmering horizon, as they came in for a drink. Their natural curiosity drew them closer to us allowing me to capture this 'emuscape'.

■ **West of Astrebla Downs**

National Park, Queensland

■ **Canon EOS-1DX, EF 24-70, f/2.8L, 24mm, 1/400, f/14, ISO 800, Gitzo tripod**

BOTANICAL SUBJECT

WINTER'S EMBRACE

SNOW GUMS,
Eucalyptus pauciflora

Tim Wrate, New South Wales

The conditions on this day were flat and uninteresting, with white-out conditions rendering visibility to only a few metres. I had found this cluster of snow gums crusted in ice from some rain the previous night and used the conditions to create a sense of mystery and depth.

■ **Mount Hotham, Victoria**

■ **Fuji GX617, Fujinon 90mm f/8 SW, 1/4, f/22, ISO 50, Fujichrome Professional Velvia RVP50 film, tripod, centre filter mounted**



ANIMAL PORTRAIT (TOP)

ICY LOOKS

EASTERN GREY KANGAROO,
Macropus giganteus

Charles Davis, New South Wales

I found this female eastern grey kangaroo high in the Australian back country during one of the biggest storms of the season. The snow was so deep her fur was covered in ice. We both sheltered behind the snow gum, understanding that the wind was scarier than either of us.

■ **Cascade Trail, New South Wales**

■ **Nikon d800e, Nikon
28–300mm, f/5.6, 1/500, f/8,
ISO 500, 28mm, handheld**

MONOCHROME

FISH OUTTA WATER

FLYING FISH,
Family: Exocoetidae

Brad Sivior, South Australia

Flying fish don't actually fly, but glide above the surface of the water using updrafts for lift and their tail for propulsion. Often while sailing through the tropics these fish are disturbed by the boat, causing them to glide along the surface and scuttle off to safety.

■ **Timor Sea**

■ **Canon EOS 7D, Canon
100–400mm, 1/640, f/7.1,
ISO 250, handheld**

THREATENED SPECIES (TOP)

YELLOW-EYED PENGUIN

YELLOW-EYED PENGUIN,
Megadyptes antipodes

STATUS: THREATENED

Johan Larson, Queensland

The yellow-eyed penguin is one of the world's rarest penguin species, with an estimated population of 4000 individuals. This individual had just come out of the water and started its arduous journey up the steep slope towards its nests when I caught it peeking over a boulder.

■ **Otago Peninsula, South Island,
New Zealand**

■ **Canon 50D, Canon EF 300mm,
f/4L IS USM, 1/500, f/5.6,
ISO 250, handheld**

ANIMAL HABITAT

WHIP GOBIES AND EGGS

WHIP GOBIES,
Bryaninops yongei

Richard Smith, United Kingdom

Whip gobies live along the wire-like whip corals of Indo-Pacific reefs. Just a few centimetres long, the fish lay eggs that are invisible to the naked eye on the whips, where they guard them from predators. The protective behaviour of these parents indicated that they were guarding an egg clutch.

■ **Raja Ampat, West Papua,
Indonesia**

■ **Nikon D2Xs, Nikkor 105mm,
1/125, f/13, ISO 100, Twin
INON Z240 strobes, Subal
underwater housing**



ANIMAL HABITAT

CAMOUFLAGED EEL

MORAY EEL, FAMILY: MURAENIDAE

Justin Gilligan, New South Wales

The Poor Knights Islands Marine Reserve offers some of the best temperate water diving in the world. The kelp-covered reefs provide shelter for a range of species. This moray eel was barely discernible among the kelp – the perfect cover for an ambush predator.

- Poor Knights Islands, New Zealand
- Nikon D800, Nikon 10.5mm, 1/250, f/10, ISO 400, Ikelite housing, twin DS161 strobes, handheld



BROWSE

Use the free **viewwa** app to scan this page and see all the finalists in the Australian Geographic ANZANG Nature Photographer of the Year competition. You'll also find them on our website at: www.australian-geographic.com.au/ANZANG

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Experience the flowering of magnificent megaherbs which paint the landscape vibrant colours. Visits to these UNESCO World Heritage Sites are strictly regulated so very few people have witnessed the islands' colourful floral displays and prolific wildlife.

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This year, experience a Christmas like no other on the ultimate wilderness voyage. Spend Christmas Day strolling around wildlife rich Enderby Island and New Year's Eve at Campbell Island, home to the majestic Southern Royal Albatross. Enjoy two days at Australia's wildlife sanctuary, Macquarie Island.

Subantarctic Islands in Focus: Capture better wildlife photographs 2 – 12 Jan 2016 *

Improve your photography skills on this voyage where celebrated wildlife photographer Tui De Roy will be aboard to help frame that perfect shot. Extended excursions ashore will provide extra time to wait for exactly the right light and conditions.

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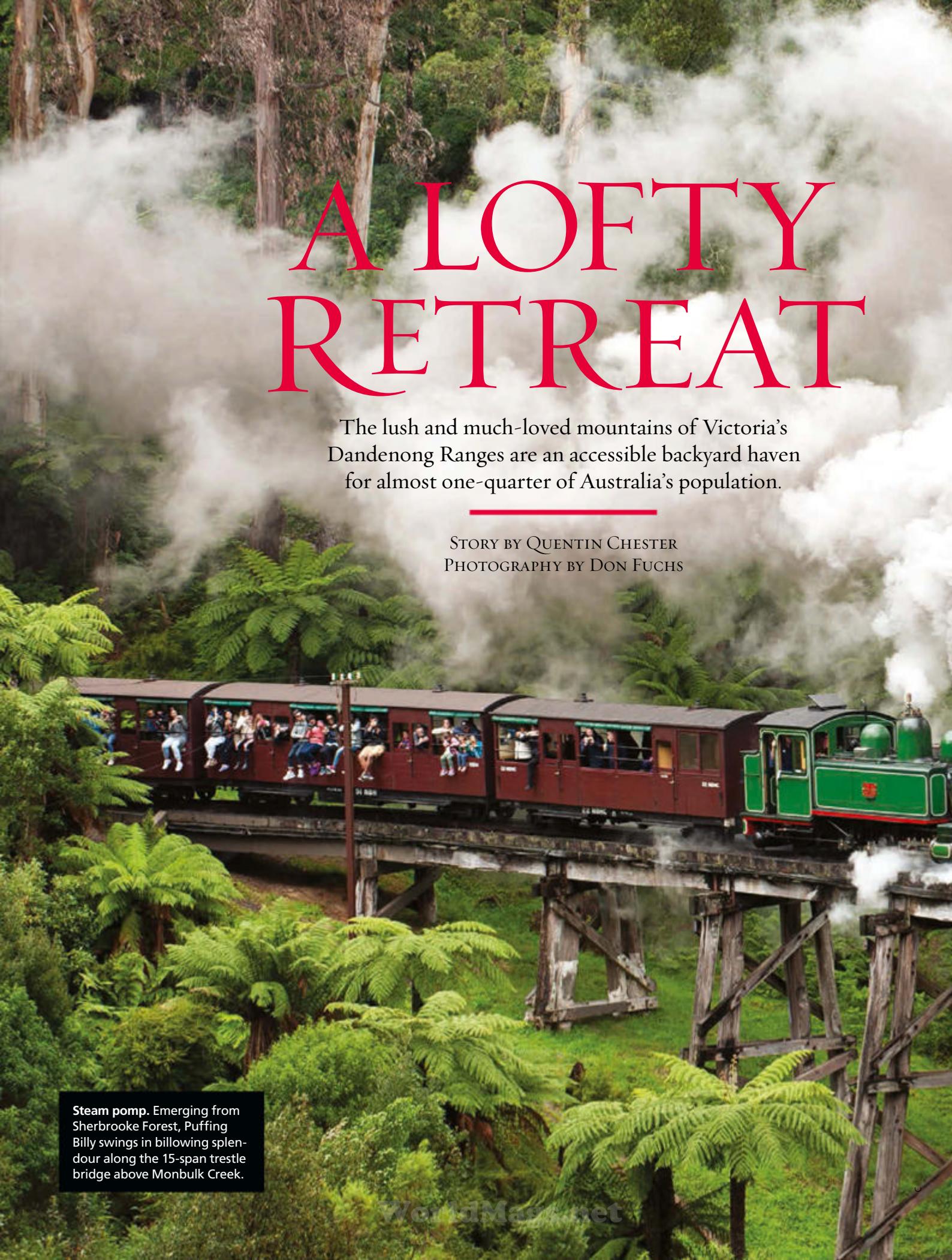


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ALOFTY RETREAT



The lush and much-loved mountains of Victoria's Dandenong Ranges are an accessible backyard haven for almost one-quarter of Australia's population.

STORY BY QUENTIN CHESTER
PHOTOGRAPHY BY DON FUCHS

Steam pomp. Emerging from Sherbrooke Forest, Puffing Billy swings in billowing splendour along the 15-span trestle bridge above Monbulk Creek.





DAYBREAK APPROACHES at Burkes Lookout in the Dandenong Ranges. This opening in the stringybarks on Mt Corhanwarrabul is reached by a quick trot up a gravel path. As look-outs go, it's hardly swish; graffitied boulders flank a steel-mesh ramp used as a hang-gliding launch pad, and a security fence above protects a gangly trio of TV towers. Even the view – across to the suburbs and industrial estates – barely registers on the wow scale. But then, with the sun edging up behind the mountain, the close proximity to Melbourne sharpens into focus and warm light floods 35km across the plain all the way to the CBD's glinting glass towers and Port Phillip Bay.

With 4.25 million people camped on the doorstep of these ranges, it's no wonder they attract a huge following. In reality, however, the appeal of the Dandenongs is more complex; as tangled as the terrain itself, with its knots of ridges and deep, mist-draped gullies. Generations of Melbournians have escaped here to take in the mountain air, commune, picnic and stride out. Looking west from Corhanwarrabul to suburbia is but a sideshow. Far more compelling is the view within from the sublime sanctuary of tall timber.

Head just 6km south along the range from Corhanwarrabul and you arrive at the headwaters of Sherbrooke Creek. Nine walking tracks dip into the valley below. From the ridgetop flurry of traffic and village shops, you're transported into the seclusion of lush forest and the realm of Earth's tallest flowering plant, *Eucalyptus regnans*, the mountain ash.

To enter the company of these giants is uplifting, a little unnerving and often neck-straining. Massive columns of wood, mountain ash can soar upwards for more than 100m. With their canopies almost out of sight, the lower trunks fill the forest's stage like the pillars of a temple. Marbled in splotches of soft grey and silvery sage, they stand in contrast to a crowded understorey of tree ferns with lacy fronds spreading like feathery green parasols.

This fern-eucalypt association is the Dandenongs' signature. Every track or mountain road swooping down the eastern and southern flanks of the ranges seems to reveal another lavish, frond-filled gully. Among them, Sherbrooke Forest is one of the prime strongholds of temperate rainforest – a haven of mountain ash, mountain grey gums, silver wattle, soft tree ferns, blackwood and southern sassafras. Far from the nearest road, the only sounds in the valley stillness

The only sounds in the stillness are the distant screeches of cockatoos.

are the distant screeches of sulphur-crested cockatoos and the gurgle of water from the creek below. It's not hard to imagine how potent this place must have once been as a summer refuge and hunting ground for the Wurundjeri people.

Even on a damp autumn day the enfolding forest is all-powerful and overshadows Sherbrooke Falls – a modest splash of white water over rocks. "We probably should really call it a cascade," notes Matt Hoogland, chief ranger at Dandenong Ranges National Park. A short footbridge spans the creek at the falls. "We just replaced this crossing," he says, pointing to the fallen remains of a colossal mountain ash lying across the creek. "It came crashing down a few months back and wiped out the old bridge." ▶





Walk the line. For the past eight years former Puffing Billy driver Peter Stowell has presided as stationmaster at the busy Menzies Creek stop.

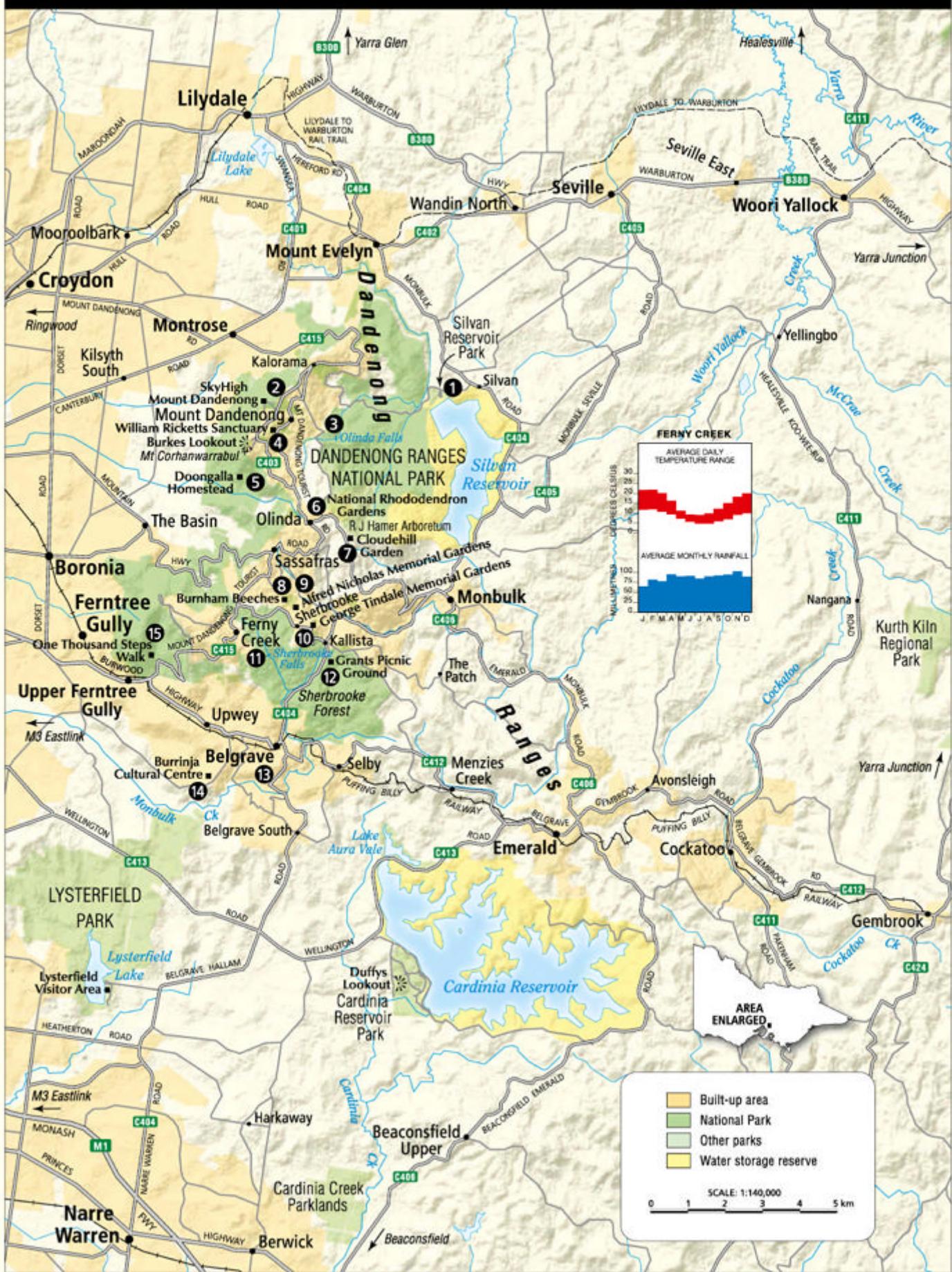


Sylvan spirit. William Ricketts devoted 59 years to sculpting a personal, unified vision of art, nature and Aboriginal culture; more than 90 works nestle amid his lush Mt Dandenong sanctuary.



Forest pump. Morning joggers on Kyeema Track. Local workouts include The Thousand Steps and Kokoda Track Memorial Walk – more than 50,000 enthusiasts a year make this ascent of One Tree Hill.

THE DANDENONG RANGES





About face. Cloudehill Nursery and Garden dates back to the 1890s. Its elaborate, many-faceted gardens incorporate more than 50 engaging artworks and installations.

WHEN TO GO

The Dandenong Ranges are a year-round destination. Spring and autumn are the most popular seasons – especially for enjoying colourful European-style gardens. In summer the shaded forest walks and picnic grounds are a welcome refuge.

GETTING THERE

The Dandenong Ranges are less than an hour's drive east of Melbourne. The Mt Dandenong Tourist Road links the villages along the main ridge. Metro Trains run regular rail services to Belgrave.

WHERE TO STAY

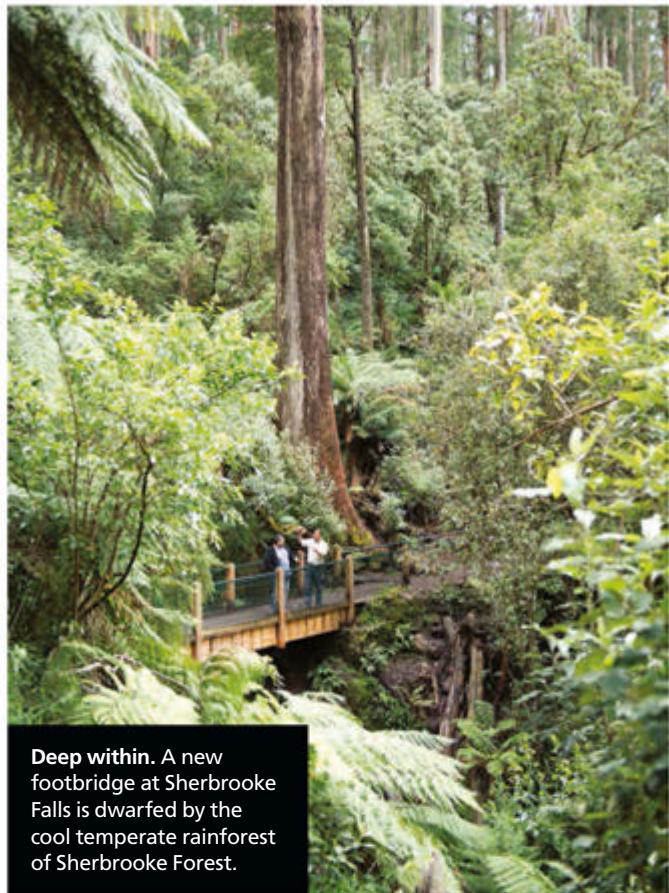
The ranges offer a huge array of B & B accommodation, from secluded cabins and historic cottages to modern self-contained apartments. Many venues are within walking distance of the ridgeline villages and eateries.

USEFUL LINKS

- Dandenong Ranges National Park
www.parks.vic.gov.au
- Tourism Victoria
www.visitvictoria.com
- Puffing Billy
www.puffingbilly.com.au
- Cloudehill Garden
www.cloudehill.com.au
- Burnham Beeches
www.burnhambeeches.com.au

POINTS OF INTEREST

- 1 Silvan Reservoir Park
- 2 SkyHigh Mount Dandenong
- 3 Olinda Falls
- 4 William Ricketts Sanctuary
- 5 Doongalla Homestead
- 6 National Rhododendron Gardens
- 7 Cloudehill Garden
- 8 Burnham Beeches
- 9 Alfred Nicholas Memorial Gardens
- 10 George Tindale Memorial Gardens
- 11 Sherbrooke Falls
- 12 Grants Picnic Ground
- 13 Puffing Billy Railway/Belgrave Station
- 14 Burrinja Gallery
- 15 One Thousand Steps Walk



Deep within. A new footbridge at Sherbrooke Falls is dwarfed by the cool temperate rainforest of Sherbrooke Forest.

AT 800ha, Sherbrooke is the largest tract of forest in what's now the Dandenong Ranges NP, which evolved from the 1882 creation of a reserve in nearby Ferntree Gully. The park, which now encompasses 3500ha, is a cluster of protected areas flanking the Dandenongs' main 22km north-south ridge. Interspersed with small villages, roads and housing subdivisions, this fragmented estate poses a daily list of challenges for Matt and his ranger team. "We have about 40,000 residents in the area [including] more than 1200 direct neighbours," he explains. "But those pressures are offset by having so many people who are local and who care about the place."

At least 23 volunteer groups help drive the community push to promote and protect the district's natural blessings. They include mobs such as the Sherbrooke Lyrebird Study Group. Now in its 57th year, the group helps ensure these valleys continue to resound with the serenade of their famed ambassador, the superb lyrebird. By the 1980s the number of individual birds here had dwindled down to the 30s. Thanks to a concerted effort that's included fox-baiting, cat controls and weed management, these virtuoso songsters now have a stable population of about 160.

Up close, their forest appears ageless but the lyrebird's leafy auditorium is the result of a long journey of ecological change that began with a volcanic eruption. About 300 million years ago, four separate lava flows spilled from a nearby volcano to the present-day township of Olinda. These basalt



outpourings have weathered into lofty ridges and fertile, deep-soil valleys – seriously good earth that's dark, rich and chocolatey, yet free-draining. Add a long-term average rainfall of 1200mm and you've got habitat heaven for mountain ash.

With this species' ability to grow upwards at a rate of 3m a year, the life force of these forest hideaways might seem unstoppable. That illusion was shattered, however, on 7 February 2009 by the catastrophic natural disaster that became known as Black Saturday. Although the Dandenong Ranges were spared the worst fires – infernos that engulfed towns such as Marysville, about 70km to the north – their mighty mountain stands revealed the fearful potential of these trees when exposed to a perfect firestorm.

"The ranges are in one of the highest fire-risk areas in the world," acknowledges Matt's boss and Parks Victoria area manager Craig Bray. "These wet mountain ash forests are incredibly hard to manage."

"Big sooks," Craig calls them. "Basically, if you put fire in they die, and on a day like Black Saturday they go like a cut cat."

Bushfires have always been a brutal fact of life in the Ranges. Major blazes hit the region in 1939 and 1961. Partly in response to the latter fire, land was set aside to create a buffer of protection close to the township of Olinda. This included the R.J. Hamer Arboretum and nearby National Rhododendron Garden. With a strategy to clear scrub and create a less flammable line of defence on the upper flanks of the ridge, in went woodland plantings of deciduous trees and an understorey of non-natives.

STATELY TREES MIXED with showy exotic shrubs were nothing new in this neck of the woods. Since the early decades of the 20th century, well-heeled Melbourne families had embraced the lofty nooks of the Dandenongs as cool summer retreats. In the tradition of colonial hill stations that meant a rambling manor house, perhaps in the style of the Arts and Crafts movement. With bountiful rains and productive soil there was also scope for a garden backdrop of shade trees, paths, ponds and tiered flower beds.

In 1929 the Nicholas family bought 30 acres (12ha) across the road from Sherbrooke Forest. Five years later their holding had increased to 130 acres (more than 52ha). Having made a fortune from making and selling aspirin in Australia under the Aspro brand, Alfred Nicholas commissioned an army of gardeners and

stonemasons to realise his vision of a majestic estate. The result was a terraced parkland descending to a secluded lake encircled by ginkgo trees and liquidambers. Just as sumptuous was his three-storey mansion, Burnham Beeches. With its streamlined, Art Moderne architectural design, it hovered within the garden like a 1930s ocean liner sailing through a sea of foliage.

This verdant inspiration lives on; Alfred's is one of several grand local gardens bequeathed to the public and now maintained by Parks Victoria. Meanwhile, the Burnham Beeches mansion is in the throes of being reimaged as a deluxe retreat by Melbourne chef Shannon Bennett, who has more than just fancy digs in mind. A bakery and cafe are already up and humming. Out the back, his lush patch of Dandenongs dirt supports vegetable gardens, greenhouses, an emu enclosure and a 500-tree orchard inoculated with truffle fungus. And that's just the start.

Historic horticultural endeavour flourishes across the region. Everywhere you look someone's working with the legacy of priceless plantings, some a century old. At Cloudehill, onetime West Australian wheat ►



Menura novaehollandiae



Filigree sentinels. Smooth tree ferns mark the start of the walking-track descent to Olinda Falls, deep within the Dandenong Ranges NP.



Superb songster. A male superb lyrebird, which you may be familiar with from the 10 cent coin. Sherbrooke forest now has a population of about 160 lyrebirds, up from just 30-odd in the 1980s.

Mountaintop rendezvous. Michael Audet and Steve Wells enjoy a monthly catch-up at Mt Dandenong eatery The Deli Platter – the pair first met setting up a soup kitchen in nearby Montrose.



Immersing artist. In her home kitchen Jacqueline Grace unfurls her latest colourful collaboration with the forest debris of the Dandenongs.



and sheep farmer Jeremy Francis has conjured a beguiling English-style multi-roomed garden from the site of a dormant flower farm. Near Olinda, Kenloch's new owner, Tim Orpin, is reinvigorating one of the district's most acclaimed woodland gardens. Meanwhile, stonemason John Champion has taken on the renewal of Mawarra Manor's gardens, arguably famed Australian garden designer Edna Walling's finest intact creation.

This nurturing spirit has always drawn recluses and dreamers to the hills, as well as some of the biggest names in Australian art. Tom Roberts, Arthur Streeton and Fred Williams all lived and worked for a time in the Dandenongs. Perhaps the most enduring image of the area is *Ferntree Gully in the Dandenong Ranges*, painted by 19th-century German-born artist Eugene von Guérard. An intricate portrait of a sheltered vale depicting lyrebirds dwarfed by an arbour of tree ferns, it's a tantalising glimpse of cool, serene seclusion that first captured the Australian public's imagination more than 150 years ago.

It was first shown in 1857 and within a few years tourists were making outings from Melbourne to experience the luxuriant realm of the Dandenongs' gullies firsthand. By 1889 the railway line from the city had reached Upper Ferntree Gully, now an outer suburb of Melbourne. Eleven years later a narrow-gauge railway extended 29km further east to Gembrook. When the government decided to close this service in 1954, a committed volunteer group of train buffs banded together to keep the line operational.

"In the forest there's this overwhelming sense of belonging in nature."

This is the cherished Puffing Billy Railway. Since reopening in 1962, it has carried more than 10 million passengers on a rattling journey through tall forest. Today it ranks as one of the world's best historic railways. Powered by the romance of steam and infectious glee of 850 volunteers, it realises childhood dreams every time Puffing Billy's whistle blows.

DESPITE ITS REAL estate attraction for the wealthy and elite, the Dandenongs have never been the preserve of a select few. Proximity to the big smoke has meant their swathes of forest have remained a beloved egalitarian space. Every year more than 1 million visitors make the excursion to the national park alone. For Matt Hoogland this popularity is a welcome problem. "It's a breathtakingly beautiful place and I love to see people reconnecting," he says. "In the forest there's this overwhelming sense of belonging in nature. And it's the simple, spontaneous things that are really important."

You hear variations on this sentiment everywhere you go – from gardeners, bushwalkers, chefs, artists, train drivers, B & B hosts and rangers. For all the commanding grandeur of the trees, it's the forest's intimacy and nourishing spirit that lingers longest. One local artist, Jacqueline Grace, has found a way to capture a sense of this experience by laying leaves on fabric and rolling them into tight bundles. These bubble away on her stove overnight so that the colours and patterns of the leaves steep into the fabric.

For Jacqueline this process is always exciting and unpredictable. "What I love is that I don't have to be in control. I put the leaves in and let them speak," she says. The outcome is art that's wearable, allowing her patrons to don an indelible memory of the forest. "I like that it's like a skin," Jacqueline says. "I'm gifting them something of the environment so they feel the significance of wearing their place on their body." **AG**

Herb heaven.
Burnham Beeches head gardener, Rob Proudlock, with herbs destined for chef Shannon Bennett's seven Melbourne venues, including the famed *Vue de Monde*.



Use the free **viewa** app to scan this page and watch a video about the Dandenongs.

Axis all eras. Evoking classic English style, the lush borders of Cloudehill garden's major axis lure the eye to historic specimens of beech and weeping maple.





River guardians

As the managers of majestic river red gums on the Murray River know, it could take the destruction of trees to save a forest.

STORY BY NATSUMI PENBERTHY
PHOTOGRAPHY BY RANDY LARCOMBE

A young girl with blonde hair, wearing a blue tank top and a blue tiered skirt, is climbing a massive, ancient tree. She is barefoot and is gripping the rough, textured bark with her hands and feet. The tree's bark is light-colored with deep, dark fissures and patches of lichen. The scene is outdoors in natural sunlight.

Child's play. Ali McDonald plays hide-and-seek around a tree that is thought to be more than 500 years old, in Barmah Lake campground.

MOST PEOPLE WILL TELL YOU

that the Barmah-Millewa Forest is at its spectacular best when it's flooded with water. But we're here in the driest part of the year, and near the end of a long drought, and even now there's a certain magic to this region of the Murray River.

The twisted river red gums that rise up around us are a recurring feature of the Australian landscape: long valued by Aboriginal people, often depicted by landscape artists such as Hans Heysen, and highly sought after by timber-getters who once made a living from their wood. Across the continent, red gums have a strong link to water bodies, be they creeks, billabongs, floodplains or thundering rivers.

Here, about 200km north of Melbourne, this remarkable forest habitat straddles the narrowest reach of Australia's longest river. Forming much of the border between NSW and Victoria, the Murray is the source of irrigation water for some of the nation's key agricultural regions. It's also famed for its highly variable flow – it can slow to a trickle between summertime pulses of life-giving waters that come from rainfall in its catchment and melting snow in the Australian Alps.

Occasionally, the Murray breaks its banks and nutrient-laden water spills out to create fertile floodplains. It's been doing this for hundreds, possibly thousands, of years at the aptly named Barmah Choke (see "A historic course", p84) and the Barmah-Millewa Forest is the result. When flooded, it transforms into a verdant expanse of swamps and waterholes that ripple with opportunistic life – waterbirds, frogs, insects and small mammals reproduce en masse, in a desperate, short-lived frenzy. But the most enduring feature of this internationally renowned wetland is a gnarled network of highly specialised trees, which make up Australia's largest stand of river red gums.

Few other trees survive the dual rigours of drought and flood as river red gums do (see "Extreme specialists", p88); in fact, they need both extremes to reach the sorts of proportions seen in the Barmah-Millewa Forest. Trees here can be as tall as 10-storey buildings

and may be 500–1000 years old; many are knobbly and contorted by the struggle for survival against environmental extremes. The irony for wetland managers is that, to protect such spectacular old specimens and the ecosystem they support, they have to sacrifice large numbers of young red gum saplings.

THE RIVER RED GUM, *Eucalyptus camaldulensis*, has the widest natural distribution of any eucalypt. It's found right across the continent, except for isolated spots of the mainland in the far south-west and pockets of the eastern seaboard, and Tasmania. However, it only forms great forests on the floodplains of the Murray, Murrumbidgee and Lachlan rivers and their tributaries. As the largest of these, the Barmah-Millewa Forest covers 66,000ha; Barmah (29,500ha) lines the Victorian side of the river, and Millewa (36,500ha) the NSW side.

Few people know and understand this river-dependent forest as well as Keith Ward. A wetland ecologist with Goulburn Broken Catchment Management Authority, Keith has been working in this ecosystem for more than 25 years and contributed during that time to almost every major report on its conservation and management. Currently, he says, the survival of flood-dependent Moira grass (*Pseudoraphis spinescens*) – lesser known than the spectacular red gum but equally important – is one of the forest's major management issues.

As Keith and I wade through a huge plain of the lush green, floating plant, he explains that this native species now covers less than 5 per cent of its original range in this forest. These grasslands have a unique problem, he says, pointing to a nearby stand of spindly red gum saplings that shouldn't be there. More than a century of logging and flow restrictions on the Murray have created a complex problem for the Barmah-Millewa Forest – too many small trees.

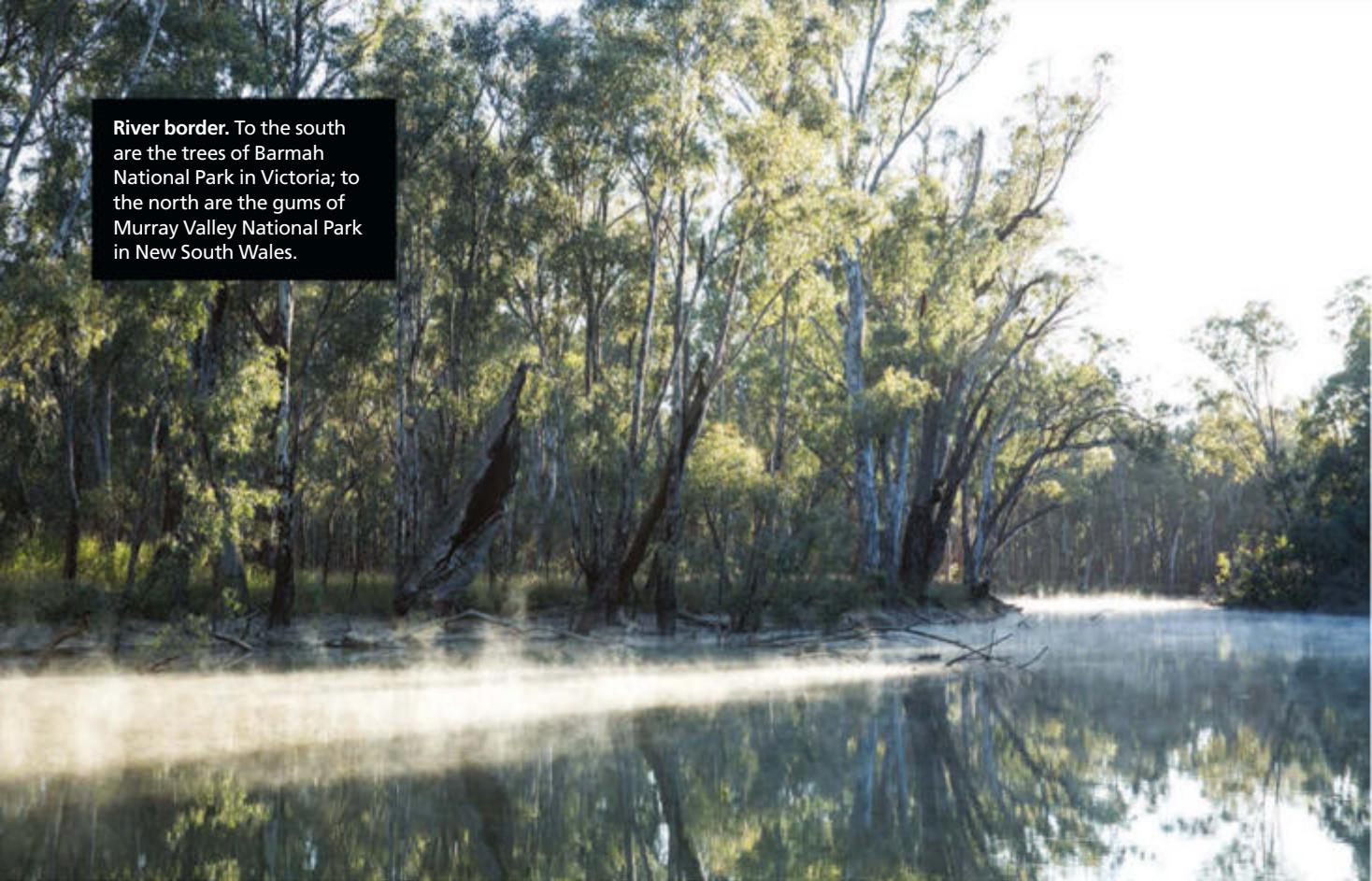
It's not just an issue for the grass plains. Too much competition for resources and "the trees strangle each other", Keith says, explaining that this means ▶

Randy Larcombe has been an AG photographer since 1996. In issue 91 he covered silt and salinity problems at the South Australian end of the Murray. His last story was *The makers*, which was about rare trades (AG 121).

A photograph of an environmental manager, Rick Webster, sitting on a large, gnarled tree root system. He is wearing a yellow long-sleeved shirt, blue jeans, and a tan wide-brimmed hat. He is looking towards the right side of the frame. The background shows a river with greenish water flowing through a forest of eucalyptus trees under a blue sky with scattered clouds.

Taking stock. Environmental manager Rick Webster sometimes requests water flows from Hume Dam, which will intentionally drown saplings, so mature trees have room to reach their potential.

River border. To the south are the trees of Barmah National Park in Victoria; to the north are the gums of Murray Valley National Park in New South Wales.



none can grow into the carbuncled, grandfatherly proportions of the mature trees. Instead, they're condemned to remain stunted and spindly.

HUGE MIDDENS in the Barmah-Millewa Forest attest to the fact that this highly productive stretch of the Murray once supported one of Aboriginal Australia's highest population densities. The history of the Yorta Yorta is written in the red gums. Shane Charles, a Yorta Yorta man and education coordinator at the Yenbena Indigenous Training Centre, shows me scars on trunks where bark was excised to make canoes, bowls and shields – and he points to circles created by thick mottled branches. These were made by tying them together when the trees were saplings, and they act as signposts for good hunting grounds or places of significance.

In 1936, during what's thought to have been Australia's first act of indigenous civil disobedience (see "Cummera's rich history", p90), more than 200 people camped here for months amid the giant gums. Charles says many Melbourne-based Yorta Yorta continue to return here to feel the connection to country. His grandmother used to sit here with him beneath an old red gum, passing on cultural knowledge; it's one of the reasons he's returned to Barmah as a teacher.

The Yorta Yorta were granted joint management of Barmah when it was gazetted as a national park in 2010, amid fears about the river's health (see AG 92) and red gum dieback at the end-of-the-millennium drought. Across the river in NSW's Millewa Forest, the other *Continued page 88*

Uplift stroll. Paul Childs and Rick Webster walk along the Cadell Tilt.



A HISTORIC COURSE

South of Mathoura township in southern NSW, you can see the strange uplift of the Cadell Tilt. It formed 20,000 years ago as a result of the Cadell Fault, which slowly tipped a wedge of land up to form a natural dam for the mighty Murray River, and pooled water to create an ancestral lake. It also forced the Murray to travel north; that section now forms the Edward River, Bullatake Creek and Gulpa Creek. Somewhere between 550–8000 years ago, the Murray broke through the Tilt to the south. The lake drained and the Murray turned south to form the constriction now known as the Barmah Choke. This narrow channel regularly overflows onto the floodplain left by the drained lake, forming ideal conditions for the river red gums of the Barmah-Millewa Forest. To this day, for a 4–5km stretch of the Cobb Highway that runs parallel to the forest, visitors are treated to the strange sight of the shivering tops of red gums, their trunks hidden below the dip of the Tilt.

BARMAH-MILLEWA FOREST REGION



Timber treasures. Echuca is home to a large fleet of historic paddle-steamer (right). The Discovery Centre and Wharf (below) was restored in 2014 using huge red gum beams.



RIVER TOWNS

ECHUCA AND MOAMA

Established in 1854, Echuca soon became one of Australia's busiest river ports and today its paddle-steamer and river trade history are a major tourist drawcard. It's located on the Victorian side of the Murray. Its counterpart on the NSW side is Moama.

NATIONAL PARKS

BARMAH NATIONAL PARK

Located about 220km north of Melbourne, this 28,500ha Victorian national park was created in 2010 to protect critical river red gum habitat on the Murray River. It's also an internationally recognised wetland and one of Victoria's largest waterbird breeding areas.

MURRAY VALLEY NATIONAL PARK

Protecting the forest on the NSW side is this 38,632ha enclave, which is home to 60 species of threatened animals. Here, similar to the Victorian side, there are scar trees – evidence of Aboriginal people having carefully cut bowls, shields and canoes out of the red gum bark.

POINTS OF INTEREST

- 1 Cadell Fault
- 2 The Gulpa Creek Walking Trail
- 3 Edward River canoe and kayak trail
- 4 Reed Beds Bird Hide boardwalk
- 5 Moira Lake
- 6 Yamyabuc Discovery Trail; Lakes Loop Track; Broken Creek Loop Track; Barmah Lake
- 7 Moama Five Mile mountain bike trail
- 8 Echuca Wharf

USEFUL LINKS

Visit the bygone paddle-steamer era in Echuca:
www.echucamoama.com

For information about Barmah NP:
www.parkweb.vic.gov.au and
www.nathaliabarmah.com.au

Find out about visiting Murray Valley NP:
www.nationalparks.nsw.gov.au

Discover caravan parks, campsites and accommodation at: www.turu.com.au



Water hazards. Dead river red gum boughs can fall without warning with deadly results, earning these trees the name 'widow makers'.



Use the **viewa** app
to scan this page
and watch a film
about the Barmah-
Millewa Forest.



LIFE IN THE RED GUMS

Each mature river red gum tree supports a complex community of native animals.

- 1 **Musk lorikeets** *Glossopsitta concinna*
Collecting pollen and nectar from red gum flowers using their specialised brush-tipped tongues, these lorikeets also eat seeds, fruits and insects.
- 2 **Brown thornbills** *Acanthiza pusilla*
These small birds, 9–10cm in length, eat insects, particularly psyllids (see leaf close-up).
- 3 **Superb parrots** *Polytelis swainsonii*
Vulnerable nationally – just a few thousand remain.
- 4 **Squirrel gliders** *Petaurus norfolkensis*
These marsupials feed on sap that drips from notches they nibble into the bark of gum trees.
- 5 **Red gum lerp psyllids** *Glycaspis brimblecombei*
These small sap-sucking insects create white conical shelters of wax and sugar called 'lerps' in their juvenile stages. These covers help conceal the psyllids while they feed on leaves.
- 6 **Gumleaf skeletoniser caterpillars** *Uraba lugens*
They voraciously consume fresh green red gum foliage, leaving a lacy lattice of oil cells and veins; they can strip whole stands in summer and spring.
- 7 **Green grocer cicadas** *Cyclochila australasiae*
Juvenile nymphs live in the soil for up to seven years, sucking sap from tree roots. They emerge as adults in spring, lay eggs in dead or dying branches and then die themselves within six weeks.
- 8 **Lesser long-eared bats** *Nyctophilus geoffroyi*
Nocturnal dwellers of cracks and hollow limbs.
- 9 **Bardi grubs** *Trictena atripalpis*
These live in tunnels below ground, feeding on tree roots. They emerge as adult moths to lay up to 45,000 eggs on a tree, more than any other non-social insect.
- 10 **Azure kingfishers** *Alcedo azurea*
These pretty birds dig nests around red gum roots.
- 11 **Murray cod** *Maccullochella peelii*
Our largest freshwater fish, they are endangered nationally. Most are found within 1m of a gum snag.

EXTREME SPECIALISTS

Few trees anywhere in the world have the capabilities of river red gums to survive both flood and drought. Their range of adaptations to enable this include huge 'xylem' vessels (through which water and nutrients are drawn up the trunk and branches) that are among the largest of any tree, making them highly efficient at transporting water. Mature trees also have very deep root systems to extract groundwater from the soil in summer. And they don't mind getting their feet wet for months or even years, developing floating root masses that can extract oxygen from the air during floods.





Bark heritage. Yorta Yorta man Shane Charles with the scars of where an ancient canoe was peeled off in a single piece of bark.

CUMMERA'S RICH HISTORY

On the edge of the Barmah-Millewa Forest, the former Cummeragunja Mission is now just a handful of houses and a medical centre – a seemingly unlikely location to help shape Australia's indigenous civil rights movement. But in 1936, with its residents galvanised by standard conditions, 'Cummera' became the site of a nine-month protest that saw 200 residents walk off the mission and camp among the red gums across the river. When requests for better housing and water supply were ignored and the strike defeated, it deeply politicised the region. The resulting 'Australian Aborigines' League' became an advocate for political representation and full citizens' rights for indigenous peoples. It was this group that announced a Day of Mourning on 26 January 1938, when many were celebrating the 150th anniversary of European settlers landing at Botany Bay. Later, Sir Douglas Nicholls, who was born at Cummera, played a key role in Australia's civil rights movement. Knighted in 1972, he became the first Aboriginal federal politician and, in 1976, governor of South Australia. He is buried in the Cummera cemetery.

Hollowed-out trunks and branches are perfect nesting sites for wildlife.

Former timber-getter Lee McCann, 91, who waves two red gum walking sticks and jokes that he has "sawdust on the brain", is a lifelong resident of Barmah township. His house, constructed from red gum, once sat on the site of the abandoned Barmah sawmill but was moved by a bullock team in the 1940s. "I've forgotten more about this forest than you'll ever know," he says, dwarfed by one of the sawmill's upturned logs.

IT REMAINS CONTROVERSIAL, but Barmah and Murray Valley NP managers are tackling the problem of proliferating red gum saplings using techniques borrowed from the forestry practice of silviculture, which carefully manages the growth of a forest. Retired farmer and timber-getter Tim Mannion, who grew up beside the forest, says his father remembers riding a buggy through the trees. Now you can barely walk through some of it. "There needs to be thinning, or they grow too thick and never reach their potential," he says.

To an extent, he's right, says Keith. A century or more of modified flood regimes on the Murray and 150 years of logging have had an impact. With smaller spring floods and longer summer flows, the saplings are in "seventh heaven" he says. Most are no longer drowned by the spring flood, which used to inundate the forest to depths of many metres.

Silviculturalists once kept the forest productive for logging by thinning it, says Keith, to grow tall, straight trees for better logs. "We like the 'bad' ones as well," he says. The old hollowed-out trunks and branches are perfect nesting sites for wildlife, such as the superb parrot, which occurs here (see previous page).

As for the grass plains, by looking at aerial photos from the 1940s, Melbourne University's Dr Leon Bren has concluded that within 100 years they would cease to exist because they'd be replaced by red gums. Keith says his most recent work suggests that without serious intervention that might now occur in as little as 50 years. And, if the grass plains go, it could mean a slow death for other components of the ecosystem. AG

 **FIND** more images of Randy Larcombe's images on our website at: www.australiageographic.com.au/issue127

A color photograph of a man, Kevin Hutchinson, working on a large wooden boat. He is wearing a blue cap, a red and blue polo shirt, and dark overalls. He is holding a long wooden beam across his shoulder and is leaning against a vertical wooden post. The boat's hull is made of many horizontal wooden planks. The background shows trees and a clear sky.

River stalwart. Kevin Hutchinson, the Port of Echuca's senior shipwright. He has been steaming and bending red gum planks around historic paddle-steamer frames for more than 40 years.





AUSTRALIAN GEOGRAPHIC
SOCIETY SUPPORTED

CROSSING THE CANYON

With AGS support, Aussie wingsuit pilots Heather Swan and Glenn Singleman have set another world record by gliding 11km across the USA's Grand Canyon.

STORY BY HEATHER SWAN

Flying in formation. (L-R) Wingsuit pilots Heather Swan, Roger Hugelshofer, Glenn Singleman and Vicente Cajiga soar across the remote North Rim of the Grand Canyon.



I'M AT AN ALTITUDE of 28,000ft, above the North Rim of the Grand Canyon, and sitting in the open door of a Cessna Grand Caravan Supervan. I am being blasted by a 140-knot (260km/h) wind that's trying to rip me out the door. Beneath me, the canyon stretches as far as the eye can see. Looking similar to the surface of Mars, its numerous fissures glow red and gold in the early morning light. The temperature is -50°C and I'm fighting to control my leg wing. Any second now, I will jump from the plane, inflate my wingsuit and fly across the canyon, with my husband and teammates beside me.

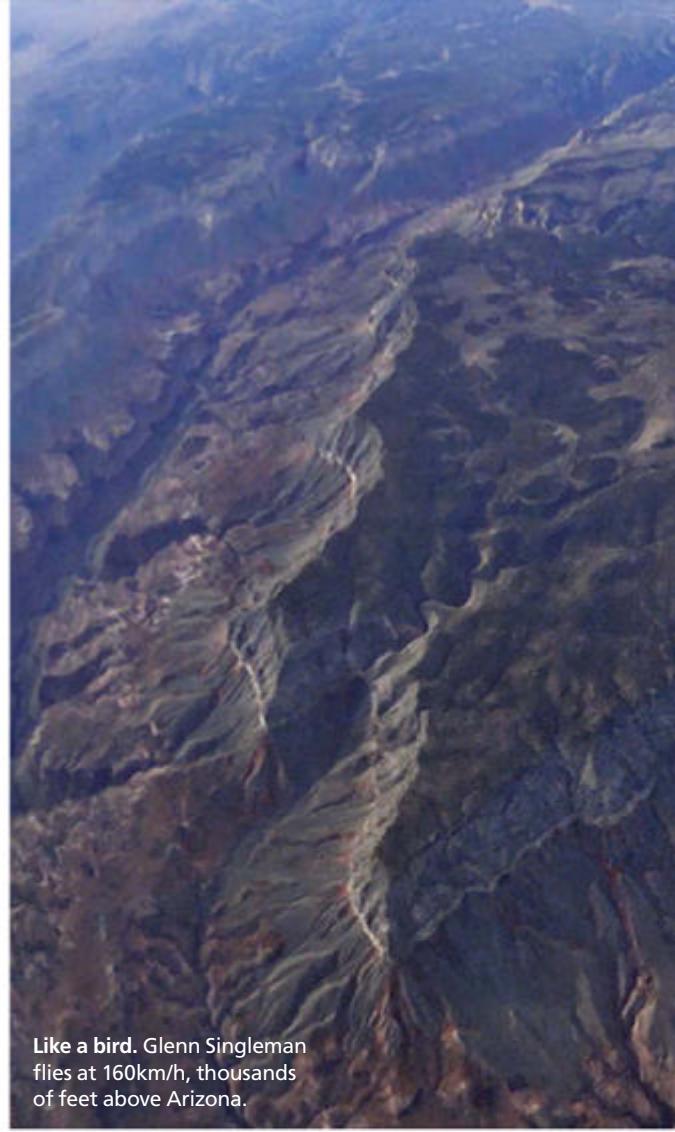
The Grand Canyon is one of the world's most spectacular natural wonders. It attracts more than 4.5 million visitors every year, but no-one has flown over it in a wingsuit. Could we be the first? I first posed this question to my husband and fellow wingsuit pilot, Dr Glenn Singleman, in January 2014. I was at home in Sydney marvelling at a panoramic photo of the South Rim at sunset when it struck me – wouldn't it be incredible to fly across that landscape in a wingsuit, just like a bird?

Glenn and I have been flying wingsuits since 2004. We've flown custom-made suits that transform a skilled skydiver into a human glider, over the Himalaya (AG 84), outback Australia (AG 93), Sydney Harbour, Brisbane's CBD and many other spectacular places, but never anything as ambitious as the Grand Canyon.

The dream was inspiring but the challenge immense. Even at its narrowest point, the canyon is about 8km wide (rim to rim) and the top of the rim is more than 2000m high. We could cover the distance in our wingsuits, but only by flying from an elevation of at least 28,000ft (8534m). In aviation, altitude is measured in feet; 1ft = 0.305m). At that altitude, useful consciousness can be counted in seconds, so we would need full bail-out oxygen systems and a purpose-fitted skydiving plane.

At first we were overwhelmed by the enormity of this project, but, by following an analytical risk-management process we use for all our big goals, we decided it was achievable. It took a year to prepare a detailed operations plan, assess the risks and complete the complex permit process that would enable us to make the flight from the North to South rim. The Hualapai, the Native American landowners in this part of Arizona, gave us permission to land on their 4000sq.km reserve.

Working with US-based, high-altitude skydiving expert Tad Smith, and Australian engineer David Goldie, Glenn designed a system with an oxygen bottle inside each arm-wing of our wingsuits. The bottles connected to a modified military oxygen mask and regulator similar to those worn by fighter pilots, and provided about 22 minutes of pure oxygen – more than enough to make the five-minute flight.



Like a bird. Glenn Singleman flies at 160km/h, thousands of feet above Arizona.

It was an elegant, effective, but relatively cumbersome collection of gear that required practice to master, so we jumped it from our normal exit height of 14,000ft at Sydney Skydivers until we felt completely comfortable.

It was during this training that we added skydiving camera flyer Paul Tozer and a little later our friend and fellow wingsuit pilot Roger Hugelshofer, to our team. We completed more than 100 training jumps together, including a demanding flight over Brisbane city. Our other teammate was Vicente Cajiga, an American wingsuit flyer who had flown across Sydney Harbour with Glenn and me in December 2011. We were all flying the highest performing wingsuits in the world – Apache Rebels made by TonySuits. With four pilots, and Paul filming, we hoped to fly an ambitious, high-performance diamond formation across the canyon. ▶



Dr Glenn Singleman and Heather Swan are an Australian husband-and-wife team. They work and play together, and their partnership has produced three world records and two Australian records in extreme sport, including the world's highest BASE-jump in a wingsuit from 6604m on Mt Meru in the Indian Himalaya.

WATCH

Use the **viewa** app to scan this page and watch a video of the flight. You can also watch it on our website.



Careful planning. Glenn (far left) gives American wingsuit pilot Roger Hugelshofer some help marking the landing area. Paul Tozer, Vicente, Glenn, Roger and Heather (above, L-R), moments before they exit the Cessna Grand Caravan Supervan (left) high above the Grand Canyon.

HOW WINGSUITS WORK

Advanced technology enables wingsuit pilots to soar at unprecedented heights

WITH MORE than 300 individual panels, these custom-made suits have wings between the arms and legs, which the skydivers use in conjunction with a parachute system. The suits are constructed of high-tech fabrics such as 'zero-porosity' nylon and Mylar plastic sheet. They are light but incredibly strong and use gravity to transform speed into lift, enabling skilled pilots to achieve horizontal speeds of about 200km/h and reduce vertical speeds to 70km/h or less.

Much like a bird's wing, these act as aerofoils, directing airflow over the top, and creating a lower pressure above the wing than below. This generates lift and allows the pilots to move forwards 3m for every 1m they fall vertically.

LAYERS
The suit consists of four layers: a compression suit worn against the skin; woollen thermals; wind-proof thermals; and the custom-made outer wingsuit.

FLYING SURFACE
The total area of the wingsuit during flight is around 1.5sq.m, creating a large aerofoil for flight, but requiring significant body strength to hold in the correct position.



WE TRAVELED TO a specialist high-altitude skydiving drop zone in Davis, California, for our practice jumps on 1 April 2015. Our final jump at Davis was a full trial from 30,000ft. To guard against decompression sickness we had to breathe pure oxygen for an hour before take-off at daybreak. Under our wingsuits we wore several layers of thermals and a wind stopper. Our helmets housed cameras, GPS, audible altimeters and Bluetooth communication devices.

Once we'd settled in the plane and connected to the onboard oxygen system, we could all contemplate what lay ahead. Everyone was quiet. I concentrated on the slow even breathing that helps me stay focused in stressful situations, and visualised each part of the jump from exit to landing.

The plane climbed to 30,000ft in 30 minutes. Five minutes before exit we began the awkward business of turning on our personal oxygen systems and cameras, and disconnecting from the umbilical cord of the plane's systems. At our predetermined exit coordinates, Tad opened the plane door. It was -48°C outside. Within moments we were out and flying, moving into the formation we'd practised.

We flew across the patchwork fields of Davis for six minutes (double our normal flight time). The sun was low in the sky, bathing the alternating green and brown paddocks in silver. It was breathtakingly beautiful, but cold. With a forward speed of

more than 160km/h, the chill in my hands was painful. We all put down safely, completely elated that everything had worked perfectly. We were ready for the Grand Canyon.

After a 14-hour drive from Davis to Peach Springs in Arizona we met Bennett Jackson, who was to be our guide and main Hualapai liaison. Bennett's family has lived in the Peach Springs area for centuries. He has a strong and intimate connection to the land on the South Rim of the Grand Canyon.

From Peach Springs we followed his four-wheel-drive along a rough dirt track for almost three hours, before reaching a remote part of the canyon where, he told us, no-one but Hualapai had ever been before. The track ended abruptly on the edge of a cliff. The view in every direction was as spectacular as it was daunting. We walked around the forested peninsula, behind a feature known as McKee Point, for five hours, looking for a clearing to land our parachutes.

With a forward speed of more than 160km/h, the chill in my hands was painful.



Eagle-eye view. Heather (opposite) was stunned by the sheer vastness of the Grand Canyon (above) as she and the team set off just after sunrise on their world-first flight across a remote stretch of this natural wonder.

Landing site. After successfully completing the first wingsuit crossing of the Grand Canyon, Glenn (left) floats safely into the small landing area, surrounded by potentially dangerous trees.

On the way back to the car, Bennett pointed out wildflowers and explained their medicinal uses. We saw a 'wigwam' that he said dated from the early 20th century. Wild horses ran across the ridge above and unconcerned antelope watched from a distance.

The night before we were due to jump, Bennett performed a traditional Hualapai blessing for us, using an eagle's feather and incense, while reciting an incantation to guide our safe return. It was comforting, but, for me, anxiety had taken hold.

Could I do this? A problem on this jump was potentially a big problem. The flight was across a proverbial no-man's land, and the small landing area was surrounded by parachute-tearing trees. Self-doubt plagues me before every big jump. I can look back at diary entries, and the emotions and thought patterns are the same with each challenge. Only experience, mindfulness and breath control keep me focused and stop me giving in to fear.

WE TOOK OFF just after sunrise on 9 April 2015. I watched the benign desert plain disappear and the canyon lands rise up to take its place. I'd never been to the Grand Canyon before. I'd seen many photographs and studied our flight path on Google Earth, but I was stunned by the sheer vastness of it. It is not one canyon, but many. It's immeasurably beautiful, powerful and intimidating.

Ten minutes to the jump. Outside temperatures are -50°C.

Personal oxygen systems on and plane systems disconnected. We lined up in the door of the plane and looked down for the prominent feature of our exit point over Toroweap Point. When Glenn saw it, he nodded to us. I jumped first.

I was flying, but Glenn, Roger, Vicente and Paul all barrel-rolled in the thin air. This was not part of the plan. I held my breath and to my great relief they all recovered quickly. They were a long way beneath and in front of me, so I put my suit into a dive to catch them. I got to Glenn about 10 seconds later. We were all together, although our diamond formation looked more like a misshapen rectangle.

We passed the deepest part of the Canyon at more than 100mph (160km/h). I could hear Glenn's laboured breathing in my headphones – he was head down, flying fast. I felt like an eagle as we soared over the V-shaped formation of our marker point on the South Rim of the Canyon. We were across.

I opened my canopy and took in the ancient landscape around me. Everything glowed in the early morning light. A sheer cliff wall fell away 300m beneath my feet. Beyond that, the central part of the Canyon dropped another 1000m. We'd done it!

The first wingsuit crossing of the Grand Canyon was complete. Sharing the experience with Glenn and our team heightened the intense elation and self-confident joy that accompanies conceiving and achieving a grand dream. **AG**



Join us next issue

Come with us on an adventure to SA's rugged **Wilpena Pound**. Also this issue, we explore the **lighthouses** dotting Australia's 36,000km coastline; take to the air with the **flying padre** – the reverend whose NT parish is bigger than many countries; visit the remote **APY Aboriginal lands** in SA's north-west; explore the stunning national parks of the **Cumberland Islands**, Queensland; and hit the beach at Broome for an unusual **polo tournament**. Also – FREE to subscribers – a fold-out kangaroo guide! Out early September.

While you're waiting for your next issue, get your daily hit of fascinating AG stories and stunning photography at www.australiangeographic.com.au

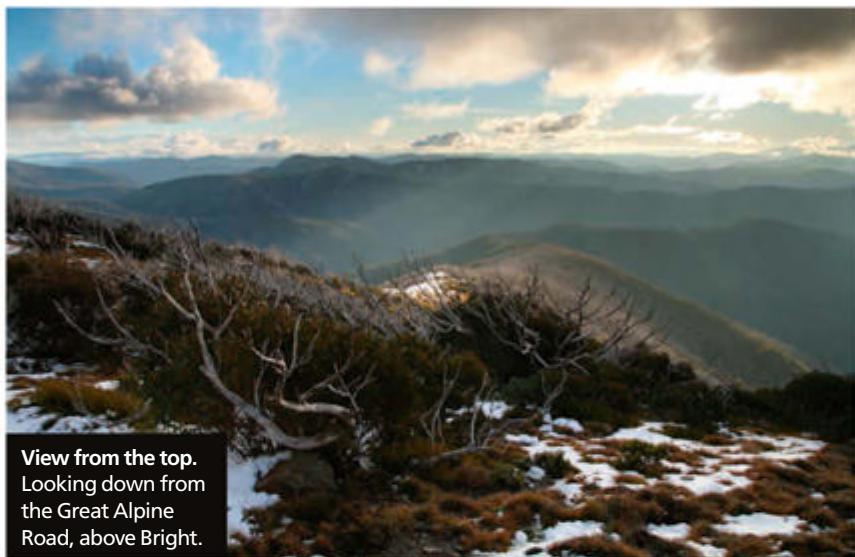
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OUT BACK

TRAVEL & DESTINATIONS, YOUR SOCIETY, YOUR AG



DESTINATION HIGHLIGHT: VICTORIAN HIGH COUNTRY

Natural highs

Whether on foot, wheels or horseback, it's a place for archetypal Australian experiences.

THE NATION'S PIONEERING spirit remains strong in Victoria's High Country. It can be seen in the dilapidated mountain huts built by cattlemen on summertime drives to fresh alpine pastures. And it's evident in the gold rush legends and the bushrangers celebrated in towns and hamlets.

The first Europeans here were explorers Hume and Hovell, in 1824. But evidence of Aboriginal occupation stretches back at least 20,000 years. These days Victoria's High Country is most appreciated as a location for indulging the senses and experiencing the outdoors. It's famed for clean crisp mountain air, sparkling unpolluted streams, and scenic beauty. There's a wide range of well-marked walks, notably in the Alpine National Park and adjacent villages, such as Falls Creek.

Early November to late May is the best time for walking; for much of the rest of the year snow-covered ground provides opportunities for snowboarders and skiers.

Late spring and summer are also popular for trekking on horseback, and for the experienced this can be enjoyed through to early winter. Cycling, both on roadways and mountain-bike tracks, is hugely popular year-round. Although the region has a reputation for some of cycling's toughest road climbs, there are also a lot of options for less accomplished cyclists. For a more leisurely exploration of Victoria's High Country from the comfort of a car, the area offers many beautiful drives that wind through picturesque hills and valleys.

5 OF THE BEST

VICTORIAN HIGHLAND SPOTS

1 HIGH COUNTRY RAIL TRAIL

Walk, ride or cycle along Lake Hume. The 43km route uses a historic railway line running from Wodonga to Old Tallangatta.

2 HIGH COUNTRY BREWERY TRAIL

Combine a walk or cycle through stunning alpine scenery with a tour of some fine breweries. You'll sample four along the route, which takes you from Glenrowan to Mount Beauty.

3 THE GREAT ALPINE ROAD

Take in the High Country's most beautiful scenery along this 339km, five-hour drive on the Great Alpine Road from Wangaratta to Bairnsdale.



4 MT BOGONG VIA STAIRCASE SPUR TRAIL

Reach the summit of Mt Bogong, the highest mountain in Victoria. The Staircase Spur trail takes you on foot through a peppermint gum forest, alpine scrub and snow gums, and out onto the summit plain at 1986m.

5 HISTORIC HUTS RUN AT FALLS CREEK

While tough road races for cyclists are held in the High Country, there are also family friendly trails. This 14km route is suitable for most riders and takes in historic mountain huts.

RIDING

STORY AND PHOTOGRAPHY BY AMY RUSSELL



Running free. Riders traverse Hollands Knob, along the flourishing meadows of the Bogong High Plains.

HIGH

A multi-day, highland horse trek is a spectacular way to experience Victoria's alpine peaks and plains.



Learn more about the Aussie Alps on the AG Adventures TV show, showing on Channel Nine and WIN in July. Full details at: www.australiageographic.com.au/AGadventures.

Australian
GEOGRAPHIC
Adventures

AMOSAIC OF lush alpine foliage passed swiftly beneath us. With Eskdale's flyaway mane tight in my left hand, I urged the gelding forward with nudges to his side. As his canter quickened and I eased into its rhythm, the ride became smoother and we moved with a fluidity that felt akin to flying.

The majestic Bogong High Plains opened up in front of us. A vast, gently undulating carpet of cushion grasses and white and gold everlasting stretched to the horizon, where the snowless ridgeline of Mt Bogong loomed under ominous grey clouds. The silhouette of my guide Lin Baird came into view ahead; he was astride Midnight and had Willow, one of our six packhorses, trailing behind him.

Having ascended Timms Spur, and circled around the dome of Mt Nelse, we were now deep into Alpine National Park, in north-eastern Victoria, once the stomping ground of Australia's High Country cattlemen. The Plains and the surrounding peaks – including Mt Feathertop and Mt Hotham – all belong to the Victorian

Alps, part of the Great Dividing Range.

During winter the Alps receive some of Australia's heaviest snowfalls, but in spring and summer the vegetation bursts into life. From the mid-1850s until a decade ago, stockmen from the surrounding valleys embraced these temperate climes. They would drive their cattle through the lush pastures and onto the surrounding mountains and muster them down again in autumn before the first major snowfalls.

This lifestyle, and the pioneering spirit of the Australian cattleman, has long been celebrated. But, since 2005, when the last of the state government's High Plains grazing leases expired, all that remains are the cattlemen's huts and scattered remnants of stockyards.

For more than 30 years, Lin and Clay Baird, and their parents Kath and Steve, have led packhorse trips into the plains. Under the banner of their company Bogong Horseback Adventures, the trips set out from their 45ha farm at Tawonga, on the Kiewa River, 77km south of Albury. The goal of this seven-day expedition was lofty: we were headed to Rocking

Stone Saddle, just below the 1986m summit of Mt Bogong, Victoria's highest peak.

The mountain was named by local Aboriginal people (the title comes from 'Bugung', the Ngarigo word for moth), who came from far and wide to feast on the Bogong moths that migrate here in spring. Horses are prohibited on the summit, and the Saddle is the highest point in Australia you can venture with a horse.

RAIN LASHED relentlessly at the sides of Kellys Hut, inside of which we huddled, clad in our bush hats and damp oilskins, sipping steaming mugs of silty billy tea. It was our second night camped on the head of Wild Horse Creek, among mighty stands of gnarled snow gums.

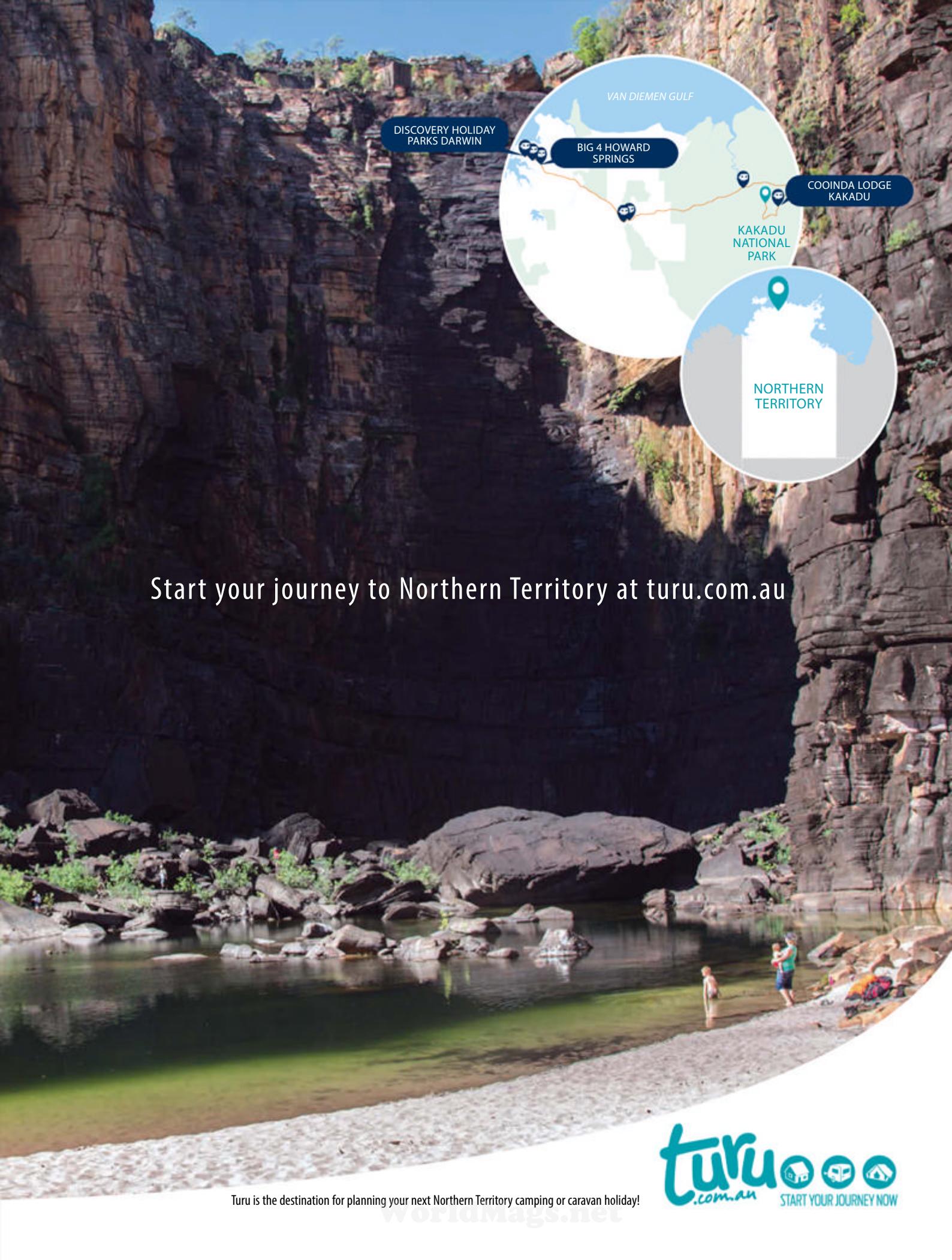
The previous afternoon we'd been headed to a different camp, at Cemetery Spur, when a spectacular ▶

Well-bred. Lin Baird (below left) washes the horses at Bogong Creek after a day's ride. The Baird family train their horses themselves, and the animals soon become accustomed to the steep mountain tracks, such as Eskdale Spur (below).





Life on the land. In a celebration of the cattlemen heritage, the Bairds lead horse treks from their farm on the Kiewa River (above). Stockmen used to drive their mobs onto the High Plains (top) and up Mt Bogong (centre), but today cattle are banned from these areas. Lin (left, at right, on Mt Nelse) grew up exploring the Plains, and the region is as familiar to him as his own backyard.



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VICTORIAN HIGH COUNTRY HORSE TREK**OFF THE BEATEN TRACK**

Travelling more than 100km through the Victorian High Plains and along historic routes to cattlemen's huts (above), this seven-day horse trek exposes the wilds of the High Country. Find out more: www.bogonghorse.com.au

lightning storm sparked small fires. A few feeble coils of smoke rose in the distance and a helicopter buzzed overhead in a hazy pink sky as we were given the all clear to continue through the park and on to Kellys Hut. The small weatherboard hut was purchased for just £15 in 1958 and reassembled at Wild Horse by Pat and Kelvin Kelly, mountain cattlemen from Omeo. It provided refuge during the musters, but today is used by trekkers and skiers travelling cross-country.

We were grateful for its presence as we sheltered from the downpour – which had hit us thick and fast at the end of a day spent lazily loping across the Plains – and Lin regaled us with tales of stockmen caught, literally, out in the cold. One such story was that of legendary cattleman George Fitzgerald, the Kellys' neighbour on the Plains, and Billy Batty, who survived two nights in the snow without food or blankets before digging a 1.6km trench to drive their mob home.

The following day, under a persistent drizzle that caused our soaked horses to shiver, we picked our way through more local history. Track 107 led us south-east, from Wild Horse, down to the Mount Wills Historic

Area and our next camp at Big River, which rushes between the Bogong High Plains and Mt Bogong.

Snaking through the Glen Wills valley, 107 was hand-laid in the early 1860s by pastoralist Angus McMillan. He was head of the Alpine Expedition, a government-funded project to open tracks between goldmining areas in the mountains, and he and his men paved nearly 350km over 12 months. McMillan was paid about "a pound a mile", Lin said, which doesn't seem like much for a job that saw him crawling on his hands and knees in the bush, often on his own after his men had abandoned him to join the rush to strike it rich. In the end "he died, basically a broken man, trying to complete his contracts".

Some of the original stones were still visible as the horses gingerly negotiated the steep, slippery path, just wide enough for a wheelbarrow to be pushed along. They jumped over fallen logs and we ducked to avoid low-hanging branches. As the rain eased and steam rose from the rumps of the horses ahead of me, the only sounds to be heard were their heavy breathing and the crunch of leaf litter under their hooves.

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HAD THERE not been mist swirling all around as we charged up The Long Spur, we would have glimpsed the twisting Mitta Mitta River through gaps between the papery snow gums. Instead, with the vapour obscuring all but the 20m ahead of us, we pushed past bulging bushes of alpine pepper and plum pine so tall they clawed at my cheeks as I hunched over my horse's neck and held on.

There are several steep tracks leading up Mt Bogong. We were riding The Long Spur – a sheer, winding path up the mountain's southern flank – having left our camp at Big River that morning. We'd spent the previous day near the town of Glen Valley at Mittagundi's annual bush dance and festival; this working farm runs an outdoor education program and its New Year celebrations offered a chance for the horses to catch their breath.

That reprieve seemed far away, however, as we struggled upwards along the overgrown – often indiscernible – track. The Bairds are the only operators with a licence to take horses over Bogong, and, apart from the handful of pack trips they lead up there each year, Long Spur is little used.

Pack school. The Bairds often coach novice horsemen, such as Joel McCarthy, pictured here at Rocking Stone Saddle. He plans to ride the Bicentennial National Trail to raise money for Beyondblue.

It wasn't until we stopped in a pretty clearing, where tiny moths fluttered about our heads and sprigs of pink trigger-plant flowers pushed up from the ground, that we discovered a packhorse was missing. After stumbling up a steep, rocky section of track she'd become stuck and had to be freed by Lin, who then removed the packs from the discomfited horse and loaded them onto another.

The packing of a horse is considered serious bushcraft, one from which some mountain cattlemen working for surveyors and tourists up until the 1940s made a living. Gear needs to be evenly balanced and positioned so as to avoid sores on the animal's back and ribs, and the practice is the cornerstone of any successful expedition. Tim Cope, the AG Society's 2006 Adventurer of the Year, trained with the Bairds before he ventured on his three-year journey from Mongolia to Hungary in 2004 (AG 89), as have many others.

As we traversed Rocking Stone Saddle on our final day, there was no sign of the weather that had plagued us up the mountain. The azure sky was clear and the sun so bright that we squinted against its glare. Our uninterrupted view of the rolling High Plains, cloaked in their blue-grey eucalypt haze, was dazzling; from this height we could see as far as the Main Range of Mt Kosciuszko to the north-east and Mt Buller and beyond to the south.

Before we made the final push down Eskdale Spur, a 1000m descent over just 4km, we stopped by the Saddle's namesake. The emu egg-sized rock sits within a larger chunk of stone, and is thought to have formed during glaciation within the last ice age.

"In a big, blowy wind, it rattles," Lin said. "That's how you know it's cold. Well, you probably know before that." And by all accounts, in their heyday, the mountain cattlemen needed no rocking stone to tell them so. **AG**

AUSTRALIAN GEOGRAPHIC THANKS Tourism North East for their assistance with this story.

FIND more horse trek images online at: www.australiageographic.com.au/issue127



LAT LONG: **36° 37' S 143° 15' E**

ST ARNAUD

A small Victorian town about 100km west of Bendigo is attracting visitors with its unique museum and an artistic pub landlord.

STORY AND PHOTOGRAPHY BY **IAN KENINS**

AT THE PEAK of the decade-long drought that tested the resilience of rural Australia, things in the Victorian township of St Arnaud were visibly bleak. The nearby Wimmera countryside was drier than usual, while an increasing number of empty stores blighted the architecturally charming retail strip. The town needed a miracle of biblical proportions, and, in 2009, it seemingly received one.

Into St Arnaud came two women with more than 1000 Bibles and a host of other artefacts, which were laid out on display in what became Australia's first Bible museum. However, not all locals were convinced that Ellen Reid and her daughter, Jean, were the messiahs. "Some thought we were the weirdos at the end of the street," says Jean. But establishing a tourism venture signified the town had something to offer.

After looking around Australia for many months they had settled on St Arnaud. "We wanted a shop in a country town with at least one major highway [passing through] and banks, because that meant the town was viable," says Ellen. "It also...had to be extremely cheap because I had no money."

The building was originally a butcher-turned-antiques store in desperate need of refurbishment. "The windows were all boarded up because they were broken, it had nine live termite nests and was otherwise pretty dilapidated," remembers Jean.

While Jean stripped, repaired and painted, Ellen made 30 trips in a van and trailer laden with books and furniture from their then home in Ferntree Gully on the outskirts of Melbourne, 280km away. "We had no money for removalists," says Jean. "Mum made the trips because she could only afford the petrol."

Ellen bought her first Bible in 1981 during an English holiday with husband, Jim, and their two young children, Jean and James. The couple was Christadelphian, a small denomination that closely adheres to the Bible. "We found a 1599 Geneva Bible, which was a translation before the King James Bible, for £200 in an Oxford bookshop. It was a bargain."

Decorative elements.

Many grand buildings, such as the Old Victoria Inn, right, line Napier Street, St Arnaud's main strip. They are the legacy of a more prosperous era.



Holy overhaul. St Arnaud's Bible Museum (above) is housed in what was once a butcher and then an antiques store. Local John Dods (right) was a regular visitor to the museum before becoming a volunteer.

It was also the start of an obsession for Ellen and Jim, and later Jean. Six months later they returned to their home in Perth with seven tea chests filled with books, including 50 Bibles, and 50 pages from a 1611 first edition print of the King James Bible. "That was the first mass-produced bible that had numbered verses and chapters," says Ellen. "They're made from rag paper and today each page is worth about \$100. We hand it around [to visitors] because most people have not touched something 400 years old."

36° 37' S 143° 15' E



Green thumb. Ellen Reid (below), founder of The Bible Museum, picks leaves for monarch caterpillars to eat. Monarch butterflies (centre) are a feature in her garden.



On display. A 1616 version of the King James Bible, left. The original 1611 version was the first Bible to be mass-produced and to have numbered verses and chapters.



House of prayer. Ellen, right, and her daughter, Jean, in their museum, which houses an incredible array of Bibles, including one with a metal-embossed cover and semi-precious stones.

In the ensuing years Ellen and Jim returned to London to live. Ellen continued her career as a pharmacist, while Jim opened a second-hand bookstore, aptly named Reid Books. Upon their return to Australia in 1999 they needed a shipping container to freight their books to Ferntree Gully.

"The whole house was filled with them and almost all my life I've had to walk sideways down passages," says Jean, who returned home when her father was diagnosed with amyloidosis, a condition that results in organ failure. He passed away in 2005.

Several years later Ellen and Jean visited the Shrine of the Book in Jerusalem, where the Dead Sea Scrolls are housed. The two were inspired and Jean suggested they open a museum. Today their collection has versions from dozens of different denominations in more than 300 languages, including some Australian Aboriginal dialects, and some in Pitman shorthand.

There are also Bible covers made from mother-of-pearl and olive-tree timber, military versions in camouflage colours and miniature ones with a magnifying glass. There's even a section with humorous versions.

Somewhat incongruously, The Bible Museum also has butterflies, not inside but fluttering about in a garden at the rear of the premises. Ellen's love of gardening grew from a pharmacy studies assignment she did on natural antibiotics. Now she spends as much time propagating as she does preaching and shows visitors butterflies at different stages of their life cycle.

Most visitors to the museum are from out of town – such as church Bible classes, Probus and Rotary clubs, and even Ulysses clubs, the over-40s motorcycling fraternity – and Jean believes that taking tour groups

BEARINGS: ST ARNAUD

Population: 2500

Where: 244km north-west of Melbourne

Founded: The area was settled in the 1850s, when a tent town was erected during the Victorian gold rush

Named: In honour of Jacques Leroy de St Arnaud, a French commander during the Crimean War. He was buried in Paris in L'Hôtel National des Invalides, the same complex as Napoleon

The Bible Museum entry: Free

Other sites: Opened in the 1940s on an old goldmine site, Pioneer Park is the only remaining public park in Australia designed by renowned horticulturalist Edna Walling

Local rag: *North Central News* was edited by Ella Ebery from 1981 until 2013, when she retired at 97 (see AG 115)

through the garden helps to soften the crowd. "We get a lot of people from retirement village groups who say they would not have come if they'd known the trip was to a Bible museum. But once here they say they're glad they came because it gave them a lot of pleasure."

Attracting day-trippers has long been a tough task for St Arnaud, but there's another couple in town attempting to turn that around. Peter Bloomfield and his partner, Samantha Pritchard, have spent the past 12 months refurbishing the formerly derelict Manchester Arms Hotel, which they hope will attract the well-heeled arts community. "We're looking for people who enjoy good food, wine and art, and plenty of well-to-do art collectors would enjoy coming into the countryside and staying in an area like this," says Peter.

In conjunction with Regional Arts Victoria, the local Northern Grampians Shire Council and renowned curator Maudie Palmer, the couple has established an artist-in-residence program. "We could see there were fabulous buildings and hidden treasures that artists would find an absolute delight to work in," Peter says.

The first artworks appeared early this year when James Geurts adopted an aquatic theme, based on the 1924 flooding of St Arnaud's main street and the town's relationship with water. It took the form of a series of installations on several shop fronts, and a mural that covered much of the supermarket frontage.

Val Salter and her dog, Penny, pass the artworks each morning. "As you walk along and see those installations floating there [in shop fronts] and the mirror images in the water, it makes you think," she says.

Barry Robertson, a member of the St Arnaud Community Action Network, and a green thumb who helped establish the town's community garden club, adds, "The artworks are good, if you like that sort of thing, and some may end up in galleries throughout the world. I find that astonishing because it might just put St Arnaud on the map." **AG**

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Night of nights. Guests enjoying the 2014 Gala Awards dinner. Right, from top: Catriona Rowntree, Bindi Irwin, Dick Smith with Greg Mortimer, and HRH Prince Harry.



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ADVENTURE GRANT AWARDEE

Sandy Robson awarded the 2015 Nancy-Bird Walton sponsorship

This intrepid Australian receives the grant to help her complete an epic paddle from Germany to Australia.



En route. Sandy poses for a picture in the Bay of Bengal, and (inset) shows her kayak to fans in Bangladesh.

HER MISSION WAS inspired by German canoeist Oskar Speck, who, from 1932 to 1939, paddled a folding kayak from Germany to Australia. Now in the final stages of her epic five-year journey, Sandy Robson has been awarded the 2015 Nancy-Bird Walton Sponsorship for female adventurers. The sea kayaker is retracing Speck's route as best she can, and hopes that her journey will inspire more female adventurers and highlight the importance of taking care of our oceans.

"I have realised how lucky we are in Australia to have such a rich and diverse ecosystem and people who do

not pump plastic into the oceans," she says on her website. "We need to keep working on preserving and protecting these unique ecosystems and the environment that is the support system for our planet."

Sandy is currently kayaking through South-East Asia on the fourth stage of her five-leg journey. By the end of her half-decade-long endeavour, Sandy will have travelled more than 22,000km through 20 countries. By the time she arrives home, she will have completed a number of world firsts, including being the first person to circumnavigate Sri Lanka by kayak.

JAMES O'HANLON

AGS CHAIRMAN'S LETTER



Come dine with us!

Come to meet our star conservationists and adventurers.

ACH YEAR we host the Australian Geographic Society's annual awards dinner, where we revel in bringing fantastic awardees in the fields of adventure and conservation together with our loyal readers and supporters. Last year was our biggest event ever; 350 guests enjoyed a lovely evening in downtown Sydney, mingling with special guests including Bindi Irwin, Dick Smith and wingsuit flyers Heather Swan and Glenn Singleman (see page 92). Tickets are now on sale for our 2015 dinner. This is our most important fundraising event and we're hoping you'll be there to support our vital work, and pull out all the stops to make this our best awards night yet! The dinner will be held on 28 October. Find out how to book on the opposite page, and don't delay, as it will sell out fast. I look forward to seeing you there.

Gregg Haythorpe

Gregg Haythorpe, AG Society Chairman

Patron: Dick Smith **Advisory Council:** Chris Bray, Ian Connellan, Chrissie Goldrick, John Lleece, Kerry Morrow, Greg Mortimer, Jo Runciman, Todd Tai, Howard Whelan

Chairman: Gregg Haythorpe **AGS Administrator:** Nicola Conti

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Ancient seafarer. A green sea turtle with schooling fish off the island of Bali.



CONSERVATION CAMPAIGN

Sea turtle fundraiser most successful to date

Record donations will go a long way towards securing the future for sea turtles in Australia.

RISING \$79,000 between November and December 2014, our sea turtle appeal has been our biggest campaign yet. The AG Society runs six fundraisers each year, through the Australian Geographic stores, and our website and journal. The Sea Turtle Foundation – a Queensland-based conservation group, which protects sea turtle populations, as well as their migration routes and habitats – has been the much-deserving recipient of the donations.

"This year, the Sea Turtle Foundation is concentrating on coordinating marine animal stranding responses," says project manager Julie Traweek. "We will be building partnerships by hosting sea turtle health and rehabilitation workshops, and assisting with research to learn more about

migration patterns and turtle health."

Seven species of sea turtle inhabit the oceans, although human impacts have depleted populations to the point where five are listed as endangered or critically endangered. The Sea Turtle Foundation will use the donations from Australian Geographic supporters to learn more about the turtles of Heron Island via satellite tracking. This will help researchers discover where the turtles travel after breeding in waters around the island.

Funds will also go to Sea Turtle Foundation research partners from James Cook University working on Raine Island. This island is

Australia's largest green sea turtle rookery, but has seen a decline in nesting success in recent years. Researchers plan to look into the possible microbial causes of egg failure to determine the best way to help these long-lived sea creatures.

PHOEBE BALDWIN



Thank you! Green turtles such as this will benefit from your generosity.

MAIN AND BELOW: DAVID FLEETHAM/OCEANWIDE IMAGES; INSET: JUSTIN GILLIGAN



In retreat. This Mt Kenya glacier, at centre, once extended across this entire area. Tim (inset) at Mt Kenya's Point Lenana.



ENVIRONMENT

25zero project to highlight plight of equatorial glaciers

Australian Geographic Society adventurer Tim Jarvis will draw attention to the fragility of the last glaciers found on the equator during the COP21 UN Climate Change Conference.

TIM JARVIS, the AGS 2013 Adventurer of the Year, is raising the profile of the world's last 25 equatorial mountains that support glaciers. His 25zero campaign will coincide with the COP21 United Nations Climate Change Conference, to be held in Paris in December.

Records show that some of the world's equatorial glaciers have receded by more than 50 per cent in the past 30 years. Scientists now suggest that, due to climate change, the last 25 equatorial mountains harbouring glaciers will lose them within 25 years.

"Equatorial glaciers were brought to my attention when I climbed Mt Kenya [one of the 25 mountains] in 2008. My 20-year-old guidebook then referred to there being 11 glaciers on the mountain," Tim says. "Sadly, in 2008 there were only three."

To raise awareness of this and other climate change initiatives Tim will be encouraging many teams to make simultaneous

ascents of all 25 mountains during the 12-day COP21 conference. A core team led by Tim will scale three mountains on three continents: the Carstensz Pyramid (Pancak Jaya) in Asia, Kilimanjaro in Africa, and Chimborazo in South America.

Those who want to take part, but can't get to one of the 25zero mountains, will be able to use a personal accelerometer to climb the equivalent height of a 25zero peak in their local surrounds.

Each participant will raise funds for 25 projects combating climate change. Beyond COP21, 25zero will continue to use the decline of the equator's glaciers as a global call to action and future climbs have been planned for 2016 and beyond.

"It's too late to save the equatorial glaciers, unfortunately," says Tim. "We can, however, save the planet by acting decisively now to curb the worst effects of climate change."

NATSUMI PENBERTHY

SOCIETY FUNDRAISER

Rescue the possum magic!

Help secure our populations of Leadbeater's possum.



LEADBEATER'S POSSUM was classified by the federal government as critically endangered in April (see page 19). In response, the AG Society is raising funds for Zoos Victoria and Friends of Leadbeater's Possum (FLP) to support the conservation of this iconic Victorian species. Zoos Victoria will continue two decades of survey work and further develop a captive-breeding program to protect the limited genetics of the possum's lowland population at Yellingbo Conservation Reserve, east of Melbourne. FLP will install and monitor nest boxes and support habitat revegetation as part of a range of conservation responses. Community support is fundamental to securing the possum's recovery, and plays a part in both programs.



DONATE

Use the free **viewa** app to scan this page and donate to our appeal.

OR VISIT www.australian-geographic.com.au/society,

or send a cheque to: The Australian Geographic Society administrator, Level 9, 54–58 Park Street, Sydney NSW 2000.



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AUSTRALIAN GEOGRAPHIC subscribers are eligible for all manner of discounts. Here are some of the special offers available when you quote your membership number.



SOUTH GEORGIA & ANTARCTICA PHOTOGRAPHY EXPEDITION

WHEN: 21 November to 8 December 2015

SAVE: 10% discount

BOOKINGS: auroraeexpeditions.com.au or phone 1300 076 131

Save more than \$1400pp when you book on this exclusive photography expedition to South Georgia and Antarctica. Travel alongside master photographer Peter Eastway, and capture the pristine landscapes and amazing wildlife as you learn all you need to know for photographing in the polar regions. Quote 'AG' when booking. Conditions apply.



A ROOM WITH A ZOO!

WHERE: Jamala Wildlife Lodge, Canberra

WHEN: For stays between 2 July and 30 September 2015

SAVE: 10% when you quote 'Australian Geographic', or enter the promo code 'AUSGEO' online*

BOOKINGS: 02 6287 8444 or info@jamalawildlifelodge.com.au

WEBSITE: www.jamalawildlifelodge.com.au

*Not valid with any other offer/discount

Experience 22 hours of adventure, luxury and excitement during one of the world's great overnight experiences. At Jamala Wildlife Lodge you could sleep or have a bath next to a tiger or bear, feed a giraffe from your balcony or have an aquarium and monkeys in your living room! Tours, meals and drinks are included.



CORAL PRINCESS CRUISES

WHERE: New Zealand

WHEN: 12 NIGHTS: Auckland to Queenstown on 27 December 2015 / Queenstown to Auckland on 24 January 2016.

8 NIGHTS: Queenstown to Wellington on 08 January 2016 / Wellington to Queenstown on 16 January 2016.

BOOKINGS: 1800 079 545 or reservations@coralprincess.com.au

*New bookings made 2 July–2 August 2015. Conditions apply.

Join us and discover the very best of beautiful New Zealand. Our expeditions will take you into the heart and soul of this wonderful country and show you more of it than you ever thought possible. With a choice of eight or 12 nights on one of our summer cruises you will have plenty of time to discover the scenic beauty and cultural highlights of New Zealand.



Upcoming expeditions

Head off with a group of like-minded travellers on one of these unforgettable experiences and you'll also be contributing vital funds to the AGS.



KIMBERLEY WITH SPICE

WHO: Lindblad Expeditions – National Geographic

COST: from \$12,830pp

BOOKINGS: 1300 361 012 or www.expeditions.com

Join us on a 14-night expedition from Broome to Bali; discover dramatic landscapes etched with the Kimberley's ancient human history, explore the pristine waters of the Spice Islands and search for Komodo dragons. You'll be joined by *National Geographic* photographer Bob Krist. Quote 'MAGAUSGEO' to receive \$200 per person onboard credit, valid for new bookings only.



MOUNTED NOMADS OF WESTERN MONGOLIA
WITH TIM COPE

WHO: World Expeditions

COST: \$6470pp

BOOKINGS: 1300 720 000 or www.worldexpeditions.com

Discover the ancient nomadic cultures of western Mongolia on this journey with Tim Cope. Travel from remote desert landscapes to glacier-capped peaks and one of the most isolated, yet vibrant, towns in Central Asia. Highlights include a three-day horse trek with nomads, and attendance at the annual eagle festival – the largest gathering of its kind.



PERSIAN HERITAGE

WHO: Odyssey Travel **COST:** from \$5850pp

WHEN: Oct 2015 and April 2016 (guaranteed 2015 departure)

BOOKINGS: 1300 888 225 or www.odysseytraveller.com

Unlike its neighbours, Iran did not adopt Christianity. It was the explosive spread of Islam, without the Arabic language or customs, that helped unite the culture and greatly enrich Persian heritage. Our 17-day program includes the great cities of Iran, historic sites, mosques, gardens, bazaars and teahouses.



PREHISTORIC BRITAIN

WHO: Odyssey Travel **COST:** from \$10,970pp

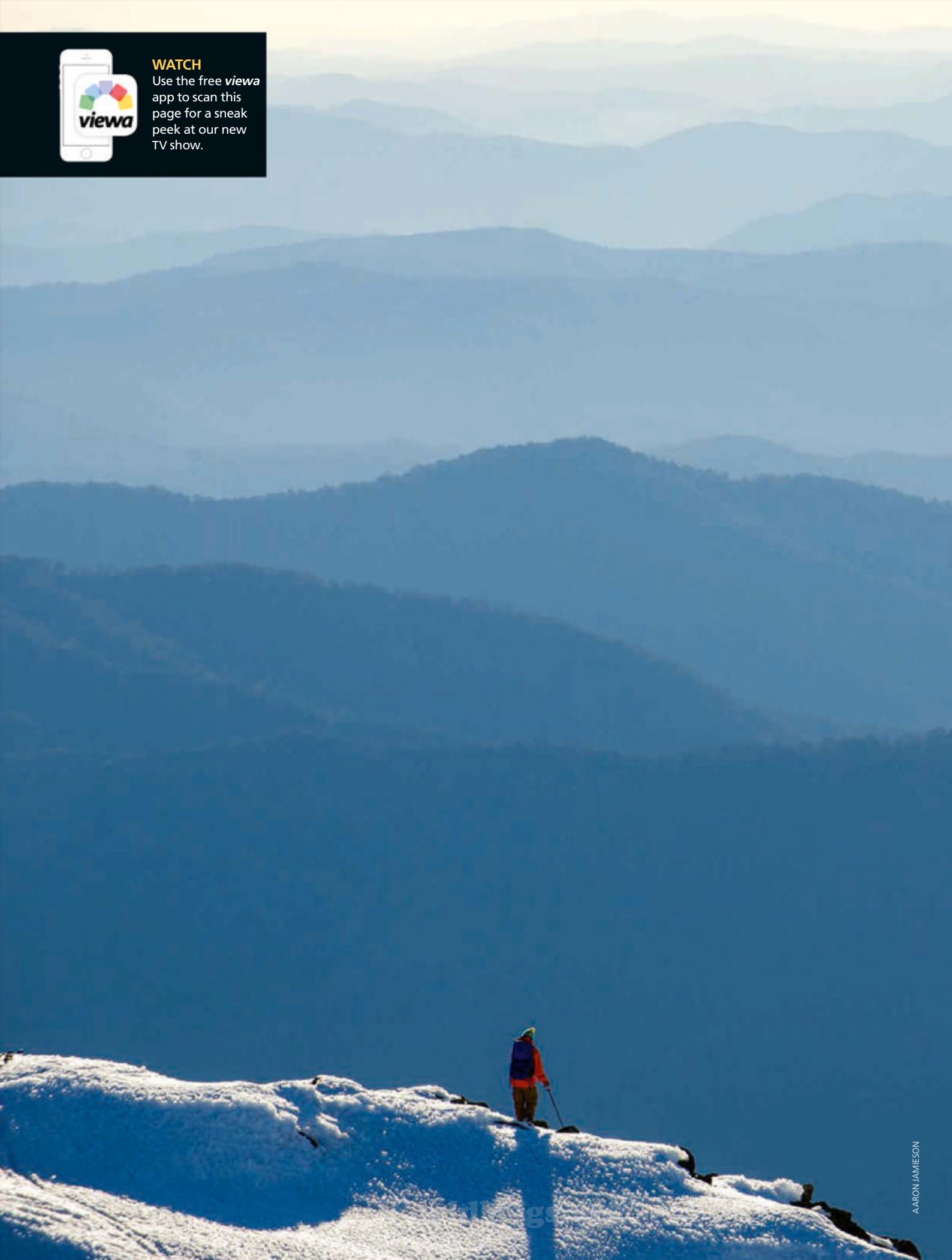
WHEN: August 2015 and 2016 (guaranteed 2015 departure)

BOOKINGS: 1300 888 225 or www.odysseytraveller.com

Landscapes and archaeological features that represent some of the important prehistoric sites in Britain are explored on this 19-day program. These include the stone rings on Orkney, excavated villages on Shetland, standing stones in the Outer Hebrides, tomb sites on the isle of Anglesey, Wales, and the earthen henges around Avebury and Stonehenge.



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Use the free *viewa* app to scan this page for a sneak peek at our new TV show.



adidas



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GEOGRAPHIC
*Adventures***

Tune in to Australian Geographic's brand new TV show

WHEN TO WATCH AUSTRALIAN GEOGRAPHIC ADVENTURES

The 30-minute show will be broadcast on Channel Nine at the following dates and times.
Check your local TV guide for broadcast times on WIN.

EPISODE 6
27 June, 4.00pm
Northern Queensland

EPISODE 7
4 July, 4.00pm
Dubbo and
Warrumbungles

EPISODE 8
11 July, 3.30pm
Broken Hill

EPISODE 9
18 July, 3.30pm
Top 10 tips for the
Great Aussie
Road Trip

EPISODE 10
25 July, 3.30pm
Grampians
Walking Track

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**McPherson
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South Eastern
Australia**

Moreish, black, turbo-charged 15% big blockbuster from lofty Andrew McPherson – it's like two bottles crammed into one!

**Yarrunga Reserve
Shiraz Durif Saint
Macaire 2014
South Eastern
Australia**

A very special Reserve ... Shiraz adds spice, Durif, power, and old Bordeaux variety, Saint Macaire, a certain 'je ne sais quoi'!

**Browns of
Padthaway
T-Trellis Shiraz
2011
Padthaway, SA**

Dark, smooth as silk Shiraz crafted by the Browns family – if it said Barossa on the label it'd be twice the price!

**'Hamilton Block'
by Leconfield
Cabernet
Sauvignon 2013
Coonawarra, SA**

Noble, double Gold Coonawarra Cabernet – from prized soils and the heroic Hamilton clan, plus it's exclusive!

**Circle of Life
Shiraz 2013
Great Southern, WA**

Paul Byron and Harold Dunning make a more savoury and peppery style of Shiraz in this remote and chilly part of WA. It's Shiraz – but not as you know it.

**The Cure
GSM 2012
Barossa Valley, SA**

Fetch your big glasses for this utterly warming, succulent and very juicy Barossa GSM – that's Grenache, Shiraz and Mourvèdre – ideal with hearty beef stew.



Readers of Australian Geographic are invited to taste a dozen reds from quality estates in classic regions, delivered to your door by the Australian Geographic's own wine service ... at below cellar-door prices.

Perfect for keeping warm on cooler nights, these richly rewarding reds are only \$139.99 – you save \$113. Plus receive **3 FREE bottles of a double Gold medal Thorn Clarke rarity** (worth \$75) with "excellent purity as well as personality ... 90 pts" (Robert Parker). That's **\$327.99 worth of wine for only \$139.99** and **FREE DELIVERY**.

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and phone number, to editorial@ausgeo.com.au or to Australian
Geographic, GPO Box 4088, Sydney,
NSW 2001. Letters will
be edited for length and clarity.

Edited by Lauren Smith

YOUR AG

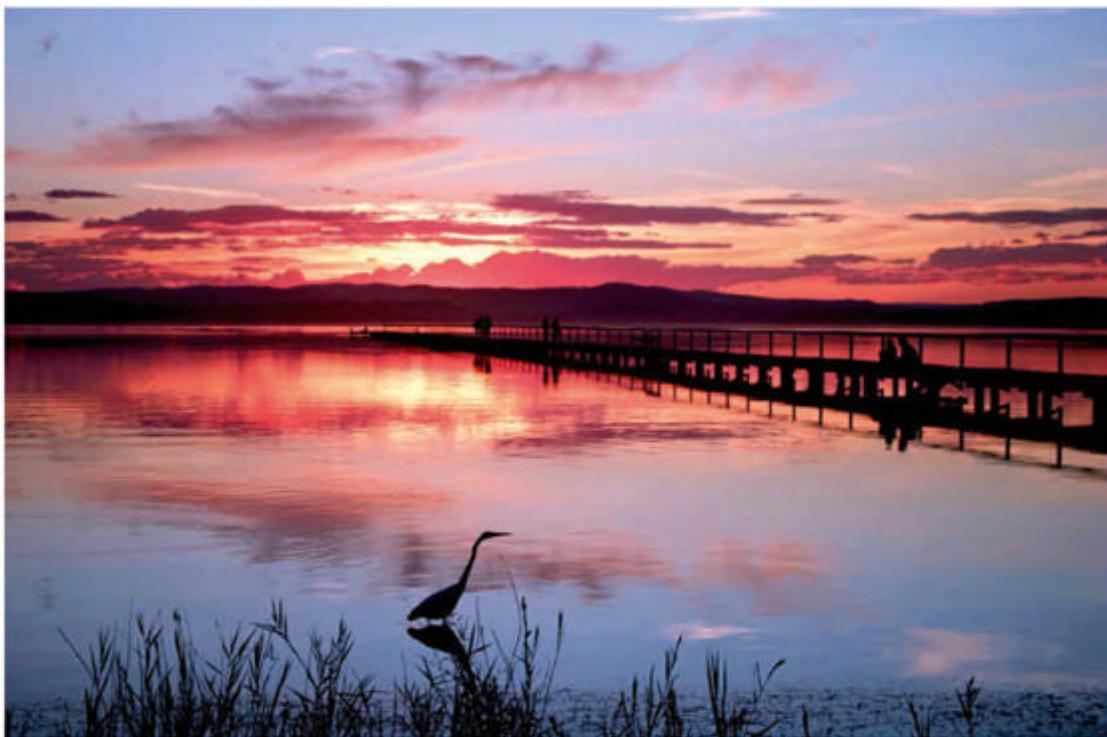
FEEDBACK, READER PHOTOS, BOOK REVIEWS & ASK AN EXPERT

YOUR PHOTOS

Dusky rose
by Gary Holland

I was lucky enough to capture this snap of a waterbird at sunset at Tuggerah Lakes, a wetland system of lagoons on the Central Coast of NSW.

Submit your photographs
for possible publication:
www.australian-geographic.com.au/yourpics



THORNY RESIDENTS

It was with interest that I read your article about the crown-of-thorns starfish on the Montebello Islands, and the threat they pose to Ningaloo Reef (AG 126).

You may like to know that they have already been there for some time. My wife and I moved to Exmouth in 1973, and in 1975 I developed the first dive shop in town: Nielsen Diving, which later became Exmouth Diving Centre. In November 1985 I took some people



on a dive on the south-west corner of North Muiron Island, north-east of Exmouth and in about 8m of water came across a crown-of-thorns starfish. Later, in June 1986, I had a charter dive in the same location,

9–12m deep, and we spotted five more. The last time that I spotted a crown-of-thorns starfish was on a wrecked barge near the American Pier at the tip of North West Cape in November 1987. I hope this information may be of interest to you and CSIRO scientist Damian Thomson.

HENNING E. NIELSEN, MANDURAH, WA

SAVING THE PARROTS

I write to update your readers on some western ground parrot conservation developments. On 6 July 2014, seven members of one of WA's most endangered species of birds were moved to a secluded area of Perth Zoo, in hopes of breeding and releasing individuals back into the wild. *Pezoporus wallicus flaviventris* is currently only found in two national



Parrot advocate. Perth-based reader Matthaus Atkins (top) with a feathered friend. The endangered western ground parrot (bottom).

parks: Fitzgerald and Cape Arid, both located near Esperance. In these parks, there are just an estimated 140 individual birds remaining. It was these disturbing statistics that motivated volunteers, researchers and zookeepers to create a captive breeding program, in hopes of reviving the population.

After 45 days in quarantine, pairs of the birds were released into the specially designed aviaries to improve chances of breeding. The breeding program is funded mainly by donations from the public or local businesses, grants by the Department of Parks and Wildlife (DPaW) and the zoo. Without the captive breeding program, the western ground parrot has a bleak future and extinction caused by predation from cats and foxes, and bushfires, is all but inevitable. I work with the Friends of the Western Ground Parrot, who update and inform the general public about the captive and wild populations. With luck, their work, alongside Perth Zoo and DPaW, will help save this reclusive species from extinction.

MATTHAUS ATKINS, PERTH, WA

Continued page 126



NEED TO KNOW

WITH DR KARL KRUSZELNICKI

BIONIC EAR

HEARING LOSS IS a major disability. People have been working on this for centuries. Beethoven was totally deaf, and would clench a pencil between his teeth and press it against the top of his piano to feel the sound vibrations. But today we have the Bionic Ear.

First, let's look at the human ear. The outer ear catches incoming sound and directs it to the eardrum. When you are listening to the quietest sound you can hear, the eardrum vibrates back and forth by a distance equal to the width of a hydrogen atom. The eardrum then passes the sound energy to three small bones. The last of these pushes on a membrane in the cochlea (the inner ear). This membrane sends sound energy into the liquid inside the cochlea, which ends up bending some of its 16,000 hair cells. This generates electricity, which is then sent via the auditory nerve to the brain, which decodes it into what we perceive as sound.

The Bionic Ear, partly developed in Australia, bypasses most of this, and directly stimulates the hair cells. The Bionic Ear has three external parts, and two internal parts.

Externally, it has a microphone to pick up the sound. It also has a sound processor – which is tuned to detect and process human speech, split it into channels and send it to the third part, the transmitter. The transmitter sits behind the ear, and (a bit like an electric toothbrush charger) sends electricity to the receiver.

Inside the body, the receiver is tethered to the bone. It picks up the incoming signal through the



Sound solution. More than 300,000 people around the world now have cochlear implants.

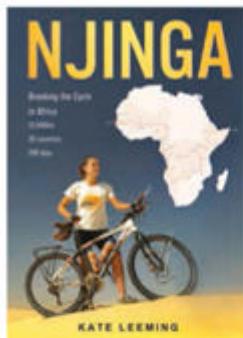
skin, and sends it to the electrodes. Finally, this array of up to 22 electrodes is inserted into the cochlea, to directly stimulate the hair cells. However, 22 electrodes are far fewer than 16,000 hair cells – so there is a loss of quality. Even so, the modern cochlear implant is surprisingly good.

Four countries were involved in its development – Australia (under Professor Graeme Clark), Austria, the USA and France. Australia's system is arguably the best. Today, nearly a third of a million people have cochlear implants.

DR KARL is a prolific broadcaster, author and University of Sydney physicist. His new book, *House of Karls*, is published by Pan Macmillan. Follow him on Twitter at: twitter.com/DoctorKarl



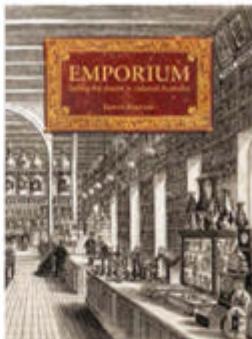
AG'S BOOKSHELF



Njinga: Breaking the Cycle in Africa

KATE LEEMING, VIVID PUBLISHING, \$44.95

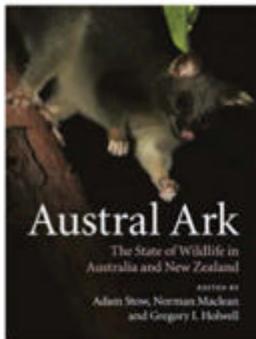
Kate Leeming's engaging account of her world-first 22,000km cycle expedition from Senegal to Somalia takes readers on a fascinating voyage through the wilderness of Africa. On the way she dodges pirates, rebels, and insurgents, in an intimate story of mental grit and physical endurance. Her journey was also highlighted by the United Nations, so while Kate conquered harsh terrain she was also tackling the huge task of raising awareness for African health, education and sustainability programs.



Emporium: Selling the Dream in Colonial Australia

EDWIN BARNARD, NATIONAL LIBRARY OF AUSTRALIA, \$49.99

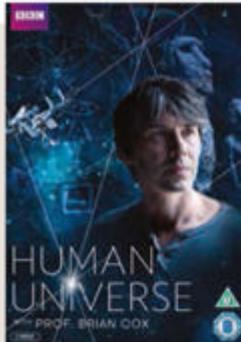
Edwin Barnard has put together a lively and entertaining account of 19th-century Australian life through the lens of long-forgotten advertisements. *Emporium* explores Australian culture and history by showcasing this past century's answer to everything from "lost manhood" and "failing sexual vigour" to baldness and greying hair. These ads offer a quirky peek into the daily desires and anxieties that shaped colonial Australia.



Austral Ark: The State of Wildlife in Australia and New Zealand

ADAM STOW, NORMAN MACLEAN & GREGORY I. HOLWELL, CAMBRIDGE UNIVERSITY PRESS, \$69.95

Australia and New Zealand's array of flora and fauna have changed dramatically since European colonisation. Intertwining contributions from three leading experts in conservation biology, *Austral Ark* gives readers a sweeping overview of the recent history of Australasia's biota. In it, the experts look at the processes, challenges and successes that have shaped the trajectory of some of the region's most unique and fragile species.



Competition

We're giving away five copies of the BBC's *Human Universe*, thanks to Roadshow Entertainment. Professor Brian Cox tackles big questions, investigating how humankind arrived at the present day and what will happen in the future. At one point, he tests the theory of gravity with a feather and a bowling ball inside a sealed vacuum. This imaginative series will leave you with new answers to old questions.



You can enter by downloading the free **viewa** app and using your smartphone or tablet to scan this page, or by visiting: www.australiageographic.com.au/issue127



ADELAIDE

THE AUSTRALIAN GEOGRAPHIC ANZANG NATURE PHOTOGRAPHER OF THE YEAR 2015

See the very best of the thousands of entries in Australia's most prestigious nature photography competition. Categories include: Animal Portrait, Botanical, Junior Photographer and much more.

When and where: 1–30 August, South Australian Museum, Adelaide, SA

More info:

www.anzang.samuseum.sa.gov.au

MELBOURNE

OPEN HOUSE

For history and architecture lovers, Open House allows you to explore extraordinary spaces, which are usually inaccessible.

When and where:

25–26 July, Melbourne, VIC

More info:

www.openhousemelbourne.org



CANBERRA

MOUNT STROMLO OBSERVATORY WORLD RECORD NIGHT

Wrap up and head to Mt Stromlo Observatory to be part of two Guinness World Record attempts: 'Most People Stargazing at a Single Site' and 'Most People Stargazing Across Multiple Sites in a Country'.

When and where: 7–9pm, 21 August, Mt Stromlo Observatory, Canberra, ACT

More info: rsaa.anu.edu.au/news-events/mount-stromlo-observatory-world-record-night

DARWIN

DARWIN ABORIGINAL ART FAIR

With a range of styles on display and the opportunity to learn about how the art is made, the 9th Darwin Aboriginal Art Fair offers a unique way to experience artwork.

When and where: 7–9 August, Darwin Convention Centre, NT

More info:

www.darwinaboriginalartfair.com.au



YOUR PHOTOS

**Blasted Tor,
Frozen Tarn**
by Tony Brown

One day in early May we headed up the road to the top of Mt Kosciuszko and then to North Rams Head. All the rocks were covered in rime and the wind howled making it hard to even stand up.



HINCHINBROOK MEMORIES

I was delighted to see the article on Hinchinbrook Island's Thorsborne Trail (*Trekking the tropics*, AG 125). It's an area for which I have many fond memories. In 1987 I was a planner with the Queensland National Parks and Wildlife Service based in Townsville, where I prepared a management plan for the island.

At that time there were three small vessels operating out of Cardwell, which took visitors to Ramsay Bay on Hinchinbrook. A number of rough, informal trails headed out from there – one ended on top of a cliff and others just petered out in the bush. The visitors, many of whom were backpackers, were inexperienced in tropical Queensland conditions and regularly got themselves into bother.

One option to solve the problem was to prohibit access, the other – much better option – was to develop a marked trail. So, I proposed a trail from Ramsay Bay to George Point on the south of the Island, a place where there was boat access from Lucinda. Approval was given, provided the expenditure was minimal. A small group of staff and volunteers mapped out a route, and a year or so later the trail was opened. Initially it went only as far as Zoe Bay, but within a year extended all the way to George Point. The complete trail was opened in 1989, at that time known as the East Coast Trail. In February 1991 the name was changed to the Thorsborne Trail, a fitting tribute to Arthur and Margaret Thorsborne.

I was pleased to read that the limit of 40 people is still being maintained. Increasingly, there are few places on the tropical Queensland coast where a visitor can enjoy a spectacular wilderness experience without crowds of people. During the preparation of the Hinchinbrook Management Plan, I was fortunate to spend a day touring Hinchinbrook Island with Dick Smith in his helicopter (*Hinchinbrook*, AG 25).

DR BILL LAVARACK, BUDERIM, QUEENSLAND

DARK DAYS

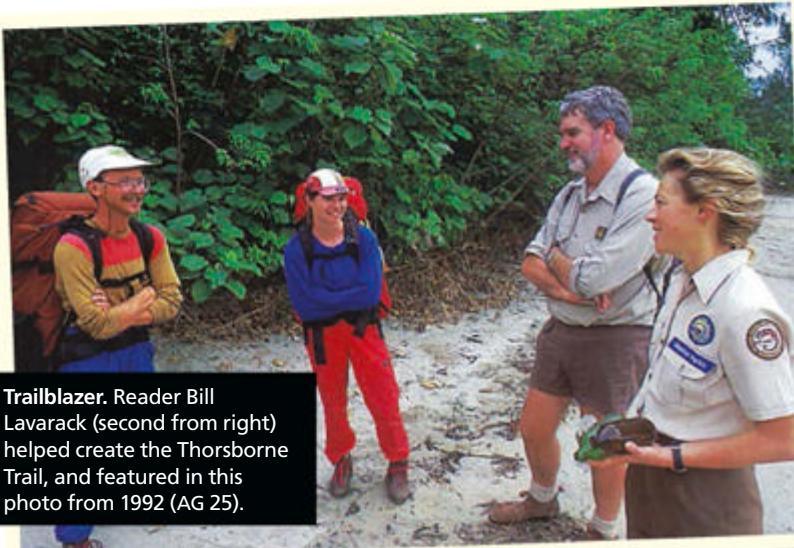
The article on light pollution in AG 126 got me scribbling. Here's a copy. I don't know if you're into poetry...

THE LOSS OF STARS

We've come far

*Since those star-decked nights
When ancestral man sat hemmed
By hulking shadows, comforted
By the precious fire's glow.
Distant generations fashioned
Tales of heroes, gods and deeds
From those luminous seeds of light
Cast over that fertile field of sky.
Those brightly blazing lights
Guided their ways and days,
Illuminated their imagination
And kindled that which made apes man.
And still, today, we love things bright:
Abhorring darkness, we throng to light.
But the fruit of the tree is bitter-sweet
And gain brings loss, I fear
And bright lights steal what we held dear.
The more the night sky drowns in light,
Those nurturing jewels are veiled from sight.*

OTTO FISCHER, ADAMSTOWN HEIGHTS, NSW



Trailblazer. Reader Bill Lavarack (second from right) helped create the Thorsborne Trail, and featured in this photo from 1992 (AG 25).



ASK AN EXPERT

GOT A
QUESTION FOR
AN EXPERT?

Email it to
editorial@ausgeo.com.au



Q Why do leaves turn red in autumn?
GARY NUNN, WATERLOO, NSW

A DR SCOTT MCADAM,
PLANT PHYSIOLOGIST AT THE UNIVERSITY OF TASMANIA, SAYS:

Some plants need to lose their leaves in winter because the days become too short and cold for them to work properly. In autumn, an increase in pigments called anthocyanins turns leaves red. These pigments help plants in two ways. The first is to act as a sunscreen to protect the leaves from bright light, as the tree breaks down and reabsorbs all of its valuable nutrients. The second is to trick insects into believing the tree is sick or poisonous, so that they might choose another tree to attack or lay their eggs upon.

Q Do we know how other animals perceive time?
DEBORAH ALLEN, MARRICKVILLE, NSW

A DR BRONWEN CRIBB,
ENTOMOLOGIST AT THE UNIVERSITY OF QUEENSLAND, SAYS:

Perception of time is tricky enough to understand in humans, but through research we do know something about it in animals. Perception of time is related to metabolism and sensory ability. For example, a fly is able to process images of the world much faster than humans can, which is a good thing or it would constantly crash as it buzzed around. This faster perception means time is cut into finer slices. So we think that, for a fly, time goes by much more rapidly than it does for us. Rather like those scenes in the film *The Matrix*, a human would appear to be moving in slow motion for the fly. Time also goes by faster for a dog, but just a little: not the mythical rate of seven human years to one dog year.

Talkb@ck



We asked you about your top spots to see wild platypuses. Here were your suggestions on our website and social media.

I watched a pair chasing each other around the riverbank and in the shallows, while camped by the Lachlan River, NSW, a few years back. It was an absolutely magical experience.

ANDREW JEN SZ

Seeing a platypus in the wild is an amazing experience. We saw several when we were fly fishing in Tassie.

EMMA BIGWOOD

Blue Lake by Jenolan Caves in the Blue Mountains, NSW.
MARK NATHAN

Crows Nest Show Grounds out past Toowoomba is a great place to see them. I saw a small colony when I was camping there as a kid.

ADRIAN FOGARTY

Another spot is in the Meander River at Deloraine, Tasmania.
MICHELLE WATSON

Eungella, north-west of Mackay, QLD, is a good spot to see them.
HILARY THACKER



GET INVOLVED IN THE CONVERSATION
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NOVEMBER 2016



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JANUARY 2016



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Who: Chris Bray Photography (2 weeks)
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Scene of the crime

HOW TO CATCH A KILLER 44

GETTING TO THE bottom of why Australia is at the forefront of forensics research was a grisly task for science writer Fiona MacDonald. As part of her investigation, she found herself (above, at left) alongside forensics lecturer Dr Val Spikmans at the University of Western Sydney's Crime Scene House, where police officers learn how to collect evidence. "Walking into the Crime Scene House and seeing the legs of the murder victim dummy sticking out through a doorway, surrounded with blood, was pretty frightening," says Fiona. "But we've come so far from the days of fingerprinting and basic DNA tests; I can't believe anyone risks getting away with murder these days." And did the thought cross her mind? "I'm clearly not planning to kill anyone," she says. "But after spending weeks researching how police catch criminals, you can't help but think about how you might outsmart the science."

Wading in

RIVER GUARDIANS 80

PHOTOGRAPHER RANDY LARCOMBE had to get his feet wet for our story on the problem of river red gum management in the southern Murray-Darling Basin. It was a mission that took him to the far reaches of isolated wetlands.

Pictured here, at right, with ecologist Keith Ward, they had travelled up a creek to get shots of some red gum saplings, a particularly challenging place to operate. "Water is one thing you don't really want around studio flashes," says Randy. "And forgetting that you have waders on and squatting down so that the waders fill up with water is always fun too!" Despite the conditions and a close call with a snake, Randy says: "As a photographer I get to go to the most amazing places with people who are experts in their field. These interactions with both people and the environment are easily the best part of the job."





A day at the races

PHOTOGRAPH BY THOMAS WIELECKI AG 71, JUL–SEPT 2003, OUT TAKE

REVELLERS PERCH IN anticipation of the day's events in the grandstand at Broken Hill's Silver City Cup races. Donning their finest hats and frocks, these ladies seem impervious to the scorching 40°C heat. Otherwise known as the 'Oasis of the West', Broken Hill is Australia's oldest active mining town and epitomises the outback's harsh beauty. The annual extravaganza sees a six-race program culminating in the Silver City Cup, a fond reminder of the once-bustling bush racing scene that thrived in the post World War II years. First run in 1899, the event was the lifeblood of tourism for Broken Hill, attracting the entire city and those from beyond. Today, it's no longer the highlight of the local social calendar, but roughly 3000 loyal, country racing enthusiasts – such as these ladies – remain dedicated to preserving the tradition, despite the steady decline of rural racing nationwide. The Silver City Cup signals the start of the tourism season for many in the far west, and, while it might not be the race that stops a nation, Broken Hill's competition is certainly no less fun or frilly than Melbourne's famous Spring Carnival.

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