

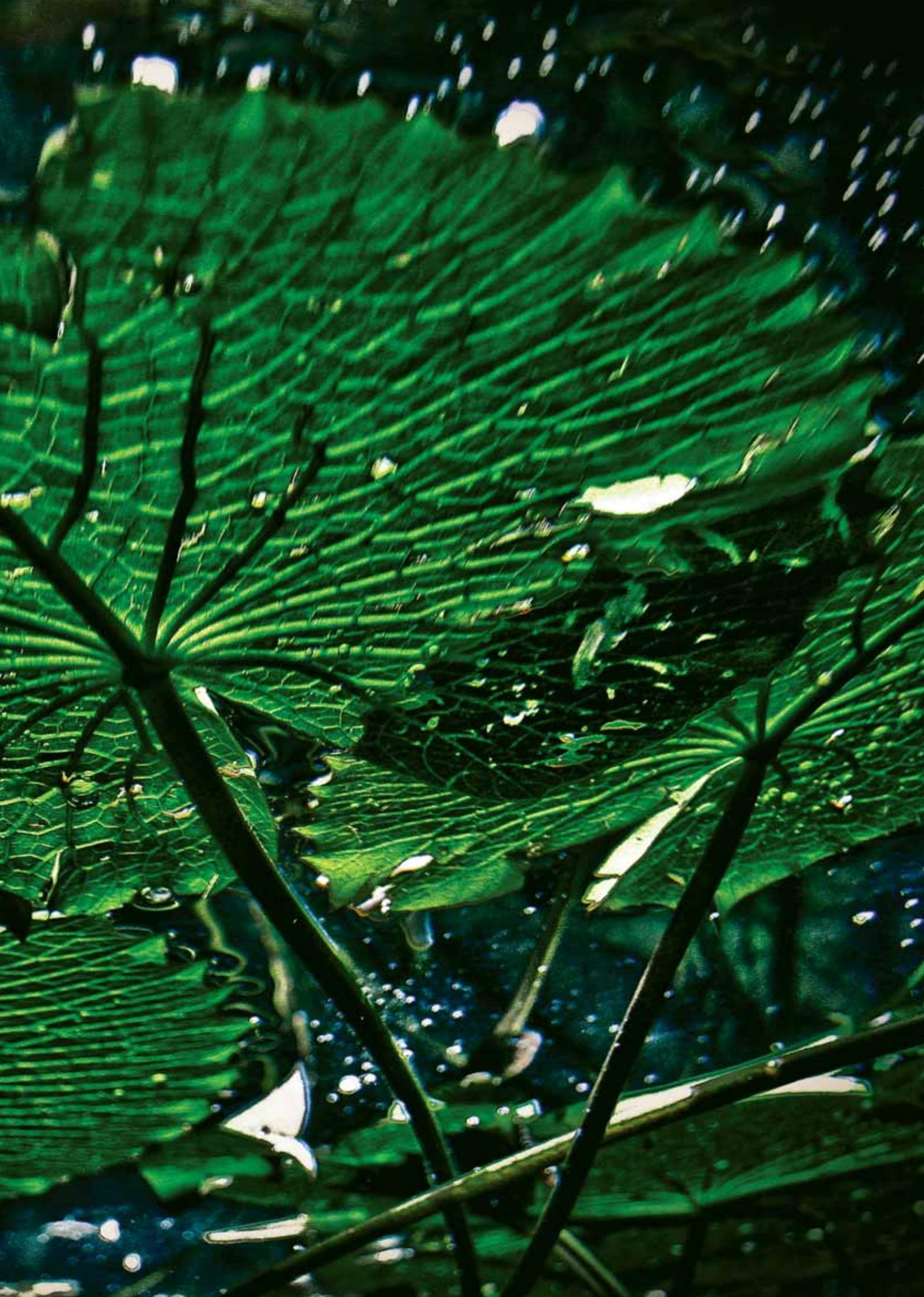
O EDITION 1 2012 ORIGINS



MYSTERIOUS MALE CLAIMS NURSERY SPACE

DARWIN SHADOWS
IN THE PICTURE

BRIGHT FUTURE AWAITS
DESERT ROCKERS

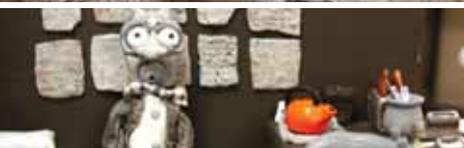


ORIGINS

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ORIGINS

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COVER IMAGE
Marine life image courtesy Timor-Leste Dive
Photo Contest: www.underwatertimorleste.com.



CONTRIBUTORS



PENNY BAXTER

Freelance writer Penny Baxter tells the story of an ancient hand-drawn map of the Makassan Empire that may help protect the biodiversity and resources of the Arafura and Timor Seas. Protection of the shared biodiversity and resources of the seas is critical to sustaining coastal and Indigenous communities in the region.



LEANNE COLEMAN

Staff writer and science communicator Leanne Coleman joins researchers on a tributary near the Adelaide River in the Northern Territory to delve into a century-old mystery about a hatchet-shaped fish found only in northern Australia and southern New Guinea. In another story, she reports on an investigation into the underground life of the giant burrowing frog and its ability to survive the Territory's long dry season.



ROBYN MCDOUGALL

Robyn McDougall has edited *Origins* since 2009. She brings to the magazine her skills as a long-time newspaper journalist and her experience as a journalism academic. In this edition, she interviews environmental scientist Professor Sue Carthew. Robyn is Director of the Office of Media, Advancement and Community Engagement (MACE) at the University.



PATRICK NELSON

Based at the Alice Springs campus, staff writer Patrick Nelson has been writing about Territorians, telling their stories and taking their photos for the past 30 years. In this edition of *Origins*, he accompanies arid zone ecologist Christine Schlesinger on an inspection of her experimental sites in the West MacDonnell Ranges. In another story, Patrick talks with Arrernte musician Chris Wallace about his upcoming desert rock album.

CDU RANKS IN WORLD'S TOP 400

“This result positions CDU firmly within the top 4% of world universities”



Charles Darwin University has made a remarkable entry on to the list of the world's top 400 universities since we last published *Origins* late in 2011.

Even though CDU is Australia's youngest university, the prestigious Times Higher Education World University Rankings has placed us at number 306 in the world. This result positions CDU firmly within the top 4% of world universities.

It is a wonderful result by any measure and should be a source of great pride for the Northern Territory, our staff, students and alumni. Times Higher Education also placed CDU at number 13 in the rankings of Australian universities.

The rankings, which were released in the second half of 2011, are based on data provided by Thomson-Reuters and take into consideration excellence in teaching, research and knowledge transfer, and the international outlook of the university.

These national and international rankings are enormously gratifying given our university's size, relative youth and its location in the far north of Australia. It is an endorsement of years of great work in research, in particular, which is often cited by other researchers and also reflects the high productivity of our staff and postgraduate students.

Of course the challenge for CDU as a regional university is to maintain the ranking in the competitive international system. This certainly is our challenge for the future.

This edition of *Origins* showcases some of the work taking place at CDU that has helped to position us among the world's top 400 universities. It shares some of the positive impacts we are having locally, nationally and internationally.

You will learn how one of our engineering graduates is helping Christchurch in New Zealand to get back on its feet after a series of devastating earthquakes in 2011.

We also talk with a researcher who has recently headed an audit of water supplies in Timor-Leste and her concerns about the impact of climate change there and in other developing countries.

And closer to home, you will discover how the Menzies School of Health Research is spreading the message about healthy food in remote communities in the Northern Territory.

I hope you enjoy this snapshot of CDU.

Professor Barney Glover
Vice-Chancellor



SNAPSHOT

NT PHARMACY STUDENT HAS FIRST SHOT AT NATIONAL TITLE

BELOW

Final year pharmacy student Sarira El Den will represent the NT at the national Alphapharm Pharmacy Student of the Year competition later this year.



The Territory's top pharmacy student will compete at the national finals of the Alphapharm Pharmacy Student of the Year competition.

This is the first year NT students have had the opportunity to compete in the national competition that recognises outstanding skills.

During the recent SA and NT regional finals in Adelaide, CDU pharmacy student Sarira El Den was judged to have recommended the best medicine, securing a place in the finals in Melbourne later this year.

She will compete for a trip to the Netherlands to attend the International Pharmacy Student Federation Congress in 2013.

The Pharmacy Student of the Year award is a joint initiative of the Pharmaceutical Society of Australia and Alphapharm, in collaboration with the National Australian Pharmacy Student Association.



STUDENT TEACHERS TOAST OF THEIR TOWN

Four CDU students were the toast of their town at the recent opening of the Growing Our Own teacher education program at Ltyentye Apurte (Santa Teresa) in Central Australia.

Karina Gorey, Kirsten Braun, Marcus Williams and Anita Gorey are working towards a Bachelor of Teaching and Learning Pre-Service and Inservice, a fully accredited and nationally recognised teacher education program being delivered by CDU through the Growing Our Own program in partnership with the Catholic Education Office.

Pro Vice-Chancellor of the Faculty of Law, Education, Business and Arts Professor Giselle Byrnes said it was an important day in celebrating the achievements of Ltyentye Apurte School in growing the number of Indigenous teachers in community schools.

"The beauty of this program is that it is customised to meet the needs of the students, their community and the local school that they work in," Professor Byrnes said.

On completion, the students will be able to apply for membership of the Northern Territory Teachers' Registration Board. CDU delivers Growing Our Own, funded by the Australian Government, to 10 students across the Territory in Bathurst Island, Wadeye and Santa Teresa.

"The program is truly challenging the frontiers of teacher education. It embodies the idea of two-way learning, which enables an exchange of knowledge and experience. While our students are learning from CDU academic staff, they also learn from the students in new and profound ways," Professor Byrnes said.



RESEARCH PROJECT TO PRESERVE INDIGENOUS LANGUAGES IN NT

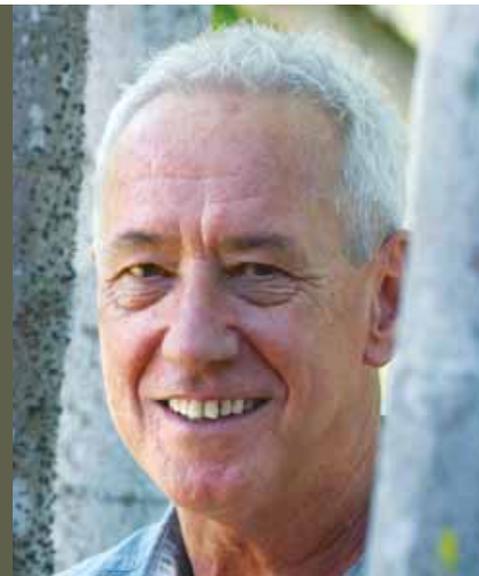
Literature in more than 16 Northern Territory Aboriginal languages will be preserved after CDU researchers secured \$430,000 as part of the Australian Research Council's 2012 Major Grants announcement.

The researchers will create a living digital archive of endangered literature in more than 16 Australian Indigenous languages.

CDU's School of Education Professor Michael Christie

and Associate Professor Brian Devlin will build the archive in collaboration with the communities that own the languages, enabling the researchers to engage with texts (and related audiovisual files) as well as the Indigenous knowledge authorities for the languages.

The project also involves the Australian National University.



SNAPSHOT

RIGHT

Pormpuraaw rangers collect data on the health of wild crocodile nests.

WILD CROC EGG RESEARCH TO BENEFIT INDIGENOUS COMMUNITIES

A collaborative research project exploring the science behind harvesting wild crocodile eggs in Cape York could lead to opportunities for Indigenous communities to manage their land and natural resources directly.

CDU and Darwin-based crocodile specialists Big Gecko are conducting an experimental harvest of wild saltwater crocodile eggs in Queensland's Cape York Peninsula, in collaboration with the Pormpuraaw Land and Sea Rangers.

The move comes after findings from a study that began in 2008 by Big Gecko into whether the saltwater crocodile population inhabiting key rivers in Aboriginal land around Pormpuraaw, in western Cape York Peninsula, could potentially support a sustainable harvest of wild eggs.

CDU senior research associate Dr Adam Britton, also a partner in Big Gecko, said the results strongly suggested that a wild egg harvest in the area would be extremely low risk to wild crocodiles because extensive



annual flooding already killed the majority of eggs.

“By only collecting eggs with a high risk of flood-related mortality before heavy rains, they can be redirected into valuable community development and employment incentives for the local community,” Dr Britton said.

“If the experimental harvest supports the hypothesis that a wild egg harvest in the region is sustainable, there will be strong grounds to continue the harvest and bring economic and management benefits to the area.”

In 2011 CDU and Big Gecko conducted a Certificate II in Remote Crocodile Management for the Pormpuraaw Land and Sea Rangers funded by the Queensland Department of Environment and Resource Management. “The rangers will play a key role assisting Big Gecko with the collection of scientific data, monitoring nesting activity and collecting data on population densities,” Dr Britton said.



HUMANITARIAN ACADEMIC IN MEDICAL MISSION TO THAILAND

A CDU humanitarian specialist joined a medical team earlier this year to provide life-changing surgery for children in Thailand.

The trip to Ubon Ratchathani, near the border with Vietnam, was organised by the US humanitarian agency Healing the Children, which arranges for volunteer medical teams to operate on children whose families lack access to surgical services.

Bachelor of Humanitarian and Community Studies coordinator Dan Baschiera assisted the team that included medical specialists from the Northern Territory and a team of US surgeons and nurses.

The surgeons operated on children with cleft lip and/or palate.

“These are delicate and expensive procedures to repair cleft deformities on children who might otherwise never get the opportunity to have an operation,” Mr Baschiera said.



ALICE SPRINGS LECTURER RISES TO TOP OF CLASS

Alice Springs campus nursing lecturer Robin Cross has been named in a list of the top 15 university lecturers in Australia.

Mrs Cross was placed eighth out of more than 4000 colleagues in the Australian Lecturer of the Year awards run by the online tertiary education portal UniJobs.

It is the highest finish by a CDU lecturer and the third year in a row that Mrs Cross has featured prominently, having finished second among CDU staff in each of the previous two years.

Other CDU staff to rate highly were Angela Sheedy, Dr Vinutha Murthy, Dr Greg Shaw, Cheryl Hunt, Trudi Hill, Joe Acker, Carol Thorogood, Dr Isabelle Lys and Dr Mary Morris.

The award commends the efforts of academic staff who go beyond the call of duty to enrich the lives of students and work colleagues.



BELOW

Alice Springs campus nursing lecturer Robin Cross has been named in a list of the top 15 university lecturers in Australia.





LEFT

Dr Christine Schlesinger at the Simpsons Gap site: "There are measurable benefits to native fauna in environments where buffel grass is controlled".

1

This Spencer's burrowing frog (*Opisthodon spenceri*) was recorded at Simpsons Gap in large numbers after heavy rains in 2010 and is one species that benefits from buffel grass management.

2

A northern spiny-tailed gecko (*Strophurus ciliaris*).

3

A fire-tailed skink (*Morethia ruficauda*).

4

A stripe-faced dunnart (*Sminthopsis macroura*).

5

Long-nosed dragon (*Amphibolurus longirostris*).

TOP RIGHT

A knob-tailed gecko (*Nephurus levis*).



1



2



3



4



5



NATIVE ANIMALS THRIVE WITHOUT BUFFEL GRASS

A Central Australian researcher has found that more native animals live in areas that have been cleared of the introduced pastoral grass *Cenchrus ciliaris* (buffel grass).

Arid zone ecologist Dr Christine Schlesinger has found a distinct difference in the abundance and number of species of frogs, lizards, snakes and small animals in areas where buffel grass has been removed compared with areas that are left unmanaged.

“This is the first clear evidence that controlling the grass has positive effects for native fauna,” she said.

Dr Schlesinger has been gathering data from experimental sites at Simpsons Gap and the Desert Park in the West MacDonnell Ranges since 2008. Half the plots are heavily overgrown with buffel grass while the remainder, which is managed by the Simpsons Gap Rangers and staff from the Alice Springs Desert Park, is dominated by native grasses and forbs.



TEXT
Patrick Nelson

IMAGES
Patrick Nelson
Christine Schlesinger

TE' WRAPS OSCAR'S STORY IN CLAY & FILM



A short film by **TE' CLAIRE** – almost three years in the making – has captured the hearts of viewers and immortalised the life of her grandfather, Oscar.

TEXT

Leanne Coleman

IMAGES

Kate Paneros

In five minutes, the film transports you into Oscar's world, dries your mouth, tightens your chest and leaves you with a sense of loss. Set in the fictional suburb of Mount Bundy, the film's main character Oscar lives alone in the smallest house between two of the tallest buildings on Little Road. His compulsive routines lead him through everyday life as memories from his past piece together his life story.

The narrative of the animated film "Oscar the Owl" is an emotive one. It is based on the true story of Te' Claire's grandfather who battled obsessive-compulsive disorder (OCD) for most of his life and died in 2009.

Passionate about bringing mental illness issues to the forefront, 19-year-old Charles Darwin University student Te' Claire is driven. After hours sculpting her beloved animation characters from wire, foam latex and moulding clays, she delicately hand-paints life into them.

"Each character has 11 to 12 hand-sculpted mouths to give them their expressions," Te' Claire explains, holding a small wooden box with labelled sections for each character.

"It took nearly six hours to construct each character, including their tiny clothes. But their appendages were more difficult. Oscar alone needed 36 pairs of hands. They were very prone to breaking. For one scene I went through eight pairs."

Ms Claire didn't get to say goodbye to her grandfather, but he inspired her film, which she says gives her a sense of pride.

Her journey into film making began with a chance visit to the Australian Centre for the Moving Image (ACMI) precinct at Federation Square while living in Melbourne in 2009. Sitting in a film booth in the library section, she stumbled upon the 2003 Academy Award-winning animated film "Harvey Krumpet", directed and animated by Adam Elliot.

Ms Claire thought it would be amazing to do something similar. She returned to Darwin to finish her year 12 studies at Casuarina Senior College and began her research into stop motion animation.

"I had always been interested in sculpting, and during my year 12 studies I made a similar polymer clay animation film."

Her first venture into "claymation" (an animation technique using clay figures) was a real learning experience. Ms Claire has preserved her first clay character in a wooden box, and she pulled him out to show me. He is a far cry from the professionally sculpted and life-like characters that feature in "Oscar the Owl" today.

Despite her obvious talent in her first attempt, she had been toiling somewhat blind in the techniques of claymation. She needed expert help for her big aspirations. As luck would have it,




TOP LEFT

A slice of a handmade set from the film.

TOP RIGHT

Writer and director of "Oscar the Owl"
Te' Claire.

Al Oldfield, a prominent animator who had worked on the 2009 critically acclaimed stop motion film "Mary and Max" (directed by Adam Elliot) was living in Darwin, running a stop motion animation studio, and Mr Oldfield became her mentor.

"Having the guidance of someone in the industry like Al Oldfield was incredible, even if it was just to be able to call him to give me tips on what tools to use to sculpt my characters' hair. Any time I had a question, or something would crack or break, he was a call away to give me advice and I thank him wholeheartedly for that."

With Mr Oldfield as her guide, and the help of friends and family, Ms Claire's dream was taking shape in reality. She also enrolled in a Certificate IV in Interactive Digital Media with CDU to learn the editing techniques that would enable her to compile her film to industry standard.

"It took years to develop the characters," she said.


RIGHT

Characters from "Oscar the Owl", an animated short film by CDU Creative Arts student Te' Claire.

Below is the anatomy of Te' Claire's five-minute labour of love that is "Oscar the Owl":

- 28 months to make
- A storyboard of 51 panels mapped the film scenes
- Shot in 46 hours over one week
- Six hours to construct each of the five puppets, including 1.5 hours to sculpt each head and one hour to paint three layers for each head
- Three hours to make the clothing for one puppet
- 55 individual mouth expressions
- Recycled material from opportunity shops was used for the costumes and stitched on to the puppets. Buttons were sculpted from Fimo and cooked, painted and sewn on to clothing. Each button took 30 minutes to make. Six pairs of shoes were created for each character
- 20 LED lights were made, taking nine hours to solder and connect. Oscar's mining hat also had a wired LED light
- Grass was made from teddy bear fluff, brown dye, coffee bean and salt
- The rigging used to move characters around the sets took three weeks to construct.



OSCAR THE OWL

**BELOW AND
PAGES 8,9**

Te' Claire created the polymer-based characters and sets by hand.



ABOVE

Each of the five characters has around 11 separate mouth expressions.

"I wanted to make sure I accurately captured the life of my grandfather."

Ms Claire then developed the storyline, designed the characters and sets before beginning months of still animation filming, where a single frame could mean hours of work. Overall, she took more than 10,000 still photographs during sessions lasting up to 13 hours to create her five-minute film.

An OCD sufferer herself, Ms Claire immersed herself, working diligently to perfect her craft and ensure every detail of the sets and storyline remained true to her grandfather's story. She not only replicated his home inside and out, she even filled the jars on the shelves on the sets with the contents her grandfather had kept in them, including miniature teeth.

Everything in the film has been handmade, including the characters' tiny clothes. The teeth alone took her two weeks. "I made sure I had everything right, down to what he ate for his dinner and snacks," she said.

"My grandfather was always interested in research and knowledge and was a bit of a hoarder, collecting newspapers on major events, teeth and even toenails.

"I created 45 individual newspaper clippings and articles using Fimo [a brand of polymer clay] and paint, depicting some of the major subjects he was interested in."

In the film, Oscar also had tiny replicas of two televisions in his lounge room that were highly representative of his character. "I remember visiting him as a child," Ms Claire said. "He had one large wooden TV with no sound for the picture and a smaller TV he used for the sound."

Ms Claire's film received rave reviews and an award at the end-of-year show for CDU's Creative Arts students in 2011. She said that although she didn't make the film for acclaim, it is satisfying after all the hard work.

"I felt bad at the screening when I saw a small child in the audience start to tear up at the end of the film, but I am also happy that people can identify with Oscar and his struggles. The real purpose of the film was to bring attention to mental illness," she said. "I think it is important to understand what people with mental illness go through."

Based on a true story "Oscar the Owl" is a five-minute stop motion animation created by Te' Claire in collaboration with Al Oldfield and Helena McKerlie.



FIONA'S FRAME OF SHADOWS

TEXT

Patrick Nelson

IMAGES

Fiona Morrison

PUTS DARWIN IN THE PICTURE



ABOVE:

Laneway #6

Light from a street lamp cuts through the overgrowth to bring out the detail in an otherwise dark laneway on a hot and humid tropical night.

Photographer and artist **FIONA MORRISON** uses her camera and tripod to shed a little light into Darwin's dark and mysterious suburban shadows.

There's something dark and curious about many of the images created by Charles Darwin University's award-winning photographer Fiona Morrison. It probably has a lot to do with her fascination for nocturnal photography.

There have been many nights when Fiona has explored the darkened streets and alleyways of Darwin's suburbs capturing long exposures of buildings, walls and latent humanity.

It's a practice that stems from her early adult life in Melbourne, when walking home from nights out on the town. "We'd be walking through the inner city suburbs after having watched a band. I always had my camera and loved the challenge of shooting long exposures without a tripod," she said.

"I came to love the blur that a long shutter speed created in certain images."

Fiona moved to Darwin in 2000 with plans of staying for a year before venturing into South-East Asia with camera in hand. "That was 12 years ago and I'm still here. Who knows, I'll probably never leave," she said.

Late last year Fiona and fellow artist Anna Reynolds spent two exciting months in Beijing on an artists' residency program facilitated through 24Hr Art.

LEFT
Huantie Night 6 (part 2)
Won the inaugural New Territories Art Prize at 24Hr Art last year.

MIDDLE
Stuart Park, 7.37pm
The interior light from the window juxtaposes the soft lilac hues of the darkening sky beyond the palms, capturing a moment in the changing colours of Darwin by night

RIGHT
Laneway #1
From the series "Trace", developed after completing a Master in Photography at CDU.



“There have been many nights when Fiona has explored the darkened streets and alleyways of Darwin's suburbs capturing long exposures of buildings, walls and latent humanity.”



“I took my six-year-old daughter and Anna brought her five-year-old son and we lived in a two-bedroom mezzanine that featured a huge studio space in Huantie Art City.

“Often I would venture into the night streets of Beijing, although never further than I was willing to cycle. Leaving my daughter home asleep with Anna, I would strap the tripod to the child’s seat and carry the camera in the front basket with a torch taped

to the back of the bike as a makeshift light.”

Fiona is not sure what drives her to capture the dark of night but does recall the night she “discovered” Darwin.

“I had been in Darwin four or five years and had struggled to find subject matter that enthused me.

“It was night and I was riding my bicycle through Nightcliff when I passed a block of units with a bright orange light mounted in the centre of the

wall. It struck me that there were no doors or windows on view from the street. Then I began noticing other buildings with similarly strange facades and from there my fascination with night time suburban Darwin grew.”

It ultimately became the project for her Masters in Photography, which she completed through CDU last year.



LEFT

Malak, 8:10pm

A 30-second exposure after dark brings out a rich array of colours not visible to the naked eye.

RIGHT

Nightcliff, 7:08pm

This wall and this light sparked Fiona’s desire to photograph Darwin at night.



CDU photographer and part-time lecturer in photography Fiona Morrison, along with Batchelor-based artist Anna Reynolds, is preparing a collection of works for display in Darwin.

The images, featuring the architecture, public places and people of Beijing, were made collaboratively by the artists when they participated in the 24Hr Art International Studio Residency program in China last year.

“The exhibition will feature about 15 large-scale photographic-based works,” Fiona said. “One measures 1.1m by 4.5m in length, so the impact will be strong.”

The exhibition will open in the Flinders Gallery at the Museum and Art Gallery of the Northern Territory on 7 July and remain on display until the end of November 2012.



ENGINEER SIFTS THROUGH NZ'S RUBBLE AND RUIN



There's a good chance the earth will move in Christchurch today ... and tomorrow ... and the next day. **BRYAN DAVIES** helps the shaky city to get back on its feet.

TEXT

Patrick Nelson

IMAGES

The Press,
New Zealand

There have been more than 10,000* quakes, tremors and aftershocks “above magnitude 2” since the 7.1 quake that rattled the bones of New Zealand’s second-biggest city in September 2010.

As large as it was, the legacy of a lesser magnitude quake (6.3) in February 2011 has been far worse.

With a death toll of 181 and a repair bill of an estimated NZ\$30 billion, the quake in February 2011 lays claim to the dubious distinction of being the third most costly in the world.

New Zealand Prime Minister John Key said that among the rubble and ruin were about 10,000 houses that would have to be demolished.

A member of the enormous response effort is CDU engineering graduate Bryan Davies, who inspected dozens of broken buildings during a three-month tenure in the Shaky Isles.

“I condemned four houses in the first month. The risk was too high to enter, and too expensive to repair, so they’ll have to be demolished,” he said.

“A lot of buildings have big cracks in their walls. Many have already been taken down and there are a lot of vacant blocks; some of which they’ll never build on again.”

Mr Davies had been working in the Darwin-based office of Aurecon, a global engineering and project-management consultancy firm, following his graduation from CDU with a Bachelor of Engineering in 2009.

LEFT

Rubble from the Cathedral of the Blessed Sacrament’s collapsed bell tower buries a motor vehicle in the city centre.

LOWER

Office workers in the 18-storey Forsyth Barr building are rescued through windows after the building’s stairwells collapsed in the February 2011 quake.





With a death toll of 181 and a repair bill of an estimated NZ\$30 billion, the quake in February 2011 lays claim to the dubious distinction of being the third most costly in the world.

LEFT

Jeff Barber, Peter Kelly and Jim Cohen of the New Zealand Government's Earthquake Commission inspect damage to River Road in Christchurch.

RIGHT

The spire and part of the tower of Christchurch's heritage-listed Anglican Cathedral collapsed in the February 2011 earthquake causing severe damage to the remaining structure.

"The Christchurch office became very busy, so I moved there to fill a multi-area role that involves inspecting houses, churches, commercial and industrial buildings for structural weaknesses and damage. I made a lot of calculations, wrote a lot of reports and assisted with identifying repair solutions."

Mr Davies was yet to arrive in New Zealand when a third big quake (13 June, magnitude 6.4) caused about \$6 billion in further damage, but he was at home near downtown Christchurch when a 5.5 struck in October.

"It lasted a fair while and was quite noisy. It caused buildings to flex and twist and turn, but I was on the ground floor in the apartment, which is quite stable."

The fate of the building that had housed the previous Aurecon office, a stone's throw from the landmark Christchurch Cathedral, is typical of hundreds of others in the central business district.

"It has been earmarked for demolition, as have 60 to 70 per cent of buildings above five storeys."

Mr Davies said despite the high frequency of quakes and shocks in Christchurch many go unnoticed by the populace. "You'd probably feel a 3.5 and up, but it depends on other factors such as intensity."

Intensity – or peak ground acceleration – is a measurement of how violently the earth shakes at ground level, whereas magnitude is a measurement of the energy released.

"Intensity is important in determining building codes in earthquake zones and is of particular interest to structural engineers." Mr Davies cited intensity as one of the key factors in how the lesser quake of June 2011 caused more damage than the bigger quake in September 2010.

"Its intensity was very high at 2.2g (i.e. 2.2 times the acceleration of gravity), making it a very violent event. Its epicentre was just 11 km from the city centre, it was relatively shallow at 5 km underground and many buildings had already been damaged by previous quakes."

Mr Davies said that while some people had moved away from Christchurch, there was plenty of will among remaining locals to rebuild the city.

"The rebuild hasn't really kicked in yet. It's complicated work that will require the destruction of more large buildings and the design of new subdivisions. Painters and plasterers are very popular at the moment, but it will take 10 years to fix the city and get it back to where it was before the earthquake."

* Visit www.christchurchquakemap.co.nz for updates on seismic activity in the city.



12 BIGGEST EARTHQUAKES SINCE SEPTEMBER 2010*

DATE	TIME	MAGNITUDE**
4 Sep 2010	04:35	7.1
13 Jun 2011	14:20	6.4
22 Feb 2011	12:51	6.3
23 Dec 2011	15:18	6.0
22 Feb 2011	14:50	5.9
13 Jun 2011	13:01	5.9
23 Dec 2011	13:58	5.9
22 Feb 2011	13:04	5.8
4 Sep 2010	04:56	5.6
6 Jun 2011	09:09	5.5
9 Oct 2011	20:34	5.5
2 Jan 2012	05:45	5.5

* www.christchurchquakemap.co.nz/largest

** Magnitude: A measure of the energy released by an earthquake at its source. Magnitude is commonly determined from the shaking recorded on a seismograph. Each unit of magnitude on the scale represents a substantial increase in energy, for example a magnitude 5 releases 30 times more energy than a magnitude 4. (www.geonet.org.nz)

MYSTERIOUS MALE CLAIMS NURSERY SPACE

TEXT
Leanne Coleman

IMAGES
Kate Paneros



ABOVE
The researchers set their nets in the remote Marrakai Creek in the Northern Territory.

Few researchers have to battle the Northern Territory's iconic saltwater crocodile in a quest for answers. But for **TIM BERRA** and **DION WEDD**, it's all in a day's work as they conduct the first research on the nurseryfish in almost a century.

In a tributary called Marrakai Creek just off the Adelaide River in the Northern Territory, two researchers stand aboard their 4.9 metre boat gently hauling in their catch. Fat clouds of humidity hang in the sky above the murky water. The deep silence along this tributary is broken only by the splash of fish, including large barramundi and threadfin salmon, being returned to the water.



MAIN PICTURE

The nurseryfish has some unusual characteristics including the male having a small hook on its head that holds the egg mass.

RIGHT

Nurseryfish are found only in northern Australia and southern Papua New Guinea.



The researchers, Professor Tim Berra and Dion Wedd, are single-minded in their fishing. They are not interested in the highly prized table fish, the barramundi, or the salmon. They want just one species from the creek: a little-known, hatchet-shaped fish that carries its eggs resembling a bunch of grapes on a small hook on its head.

As the dinghy carrying our *Origins* team approaches the researchers, we hear a splash. Within moments, the large head of a saltwater crocodile emerges near the bank, a sobering reminder of the perils of undertaking this research. All limbs are pulled well within our vessel.

As we come alongside their boat, Professor Berra tells us of being stalked by the resident five-metre saltwater croc that locals call “Agro”. And it’s easy to see how he gained his name. Attracted to the catch the researchers were hauling in, Agro tore a huge hole in the fish net just before our arrival.

Despite the real dangers, Professor Berra says he finds the crocodile-rich environment stimulating, and after 10 years of working on the hatchet-shaped nurseryfish (*Kurtus gulliveri*) he is determined to discover the reasons for its unique adaptation of the hook found on the head of the male fish and why he carries the eggs.

Professor Berra has seen males carrying eggs and has collected males and egg masses separately, but he has been unable to catch one with an egg mass attached, which could potentially solve the question of genetics and whether the males are carrying their own offspring.

“I have caught more than 1300 nurseryfish, some with nearby egg masses suggesting they were dislodged from the male’s hook, but never any actually attached,” he says, retrieving a male and female nurseryfish to show us the structural features that distinguish them.

While the female has a small hump on the top of the forehead, the male has a significant hook-like protrusion. “These egg masses can hold thousands of eggs, each connected by a long filament that the male carries on his clamp-like hook. What we don’t know is how the eggs become attached to the hook and whether the male fish is a paternal match.

“DNA analysis that I published recently has revealed very low genetic variation within the nurseryfish population, which makes it difficult to say with certainty that any given male is the genetic father of the embryos within the egg mass,” Professor Berra says. “However, we strongly suspect that the male carrying the egg mass is the father of those embryos. Multiple paternity is not involved.

“We think that egg carrying is an adaptation that protects the eggs from tidal flow and siltation and enables the male to move the eggs to a safe location.”

The fish itself is iridescent silver, shimmering blues and purples, with translucent ribs and mouth parts. “You can actually see light through the ribs of the fish,” Professor Berra explains as he holds the fish up to the sun.

To find out more about how these fish live, Professor Berra and co-researcher Dion Wedd, Territory Wildlife Park curator, sit in the boat removing the otoliths (ear bone) of their catch. “The otolith records the age and locality of

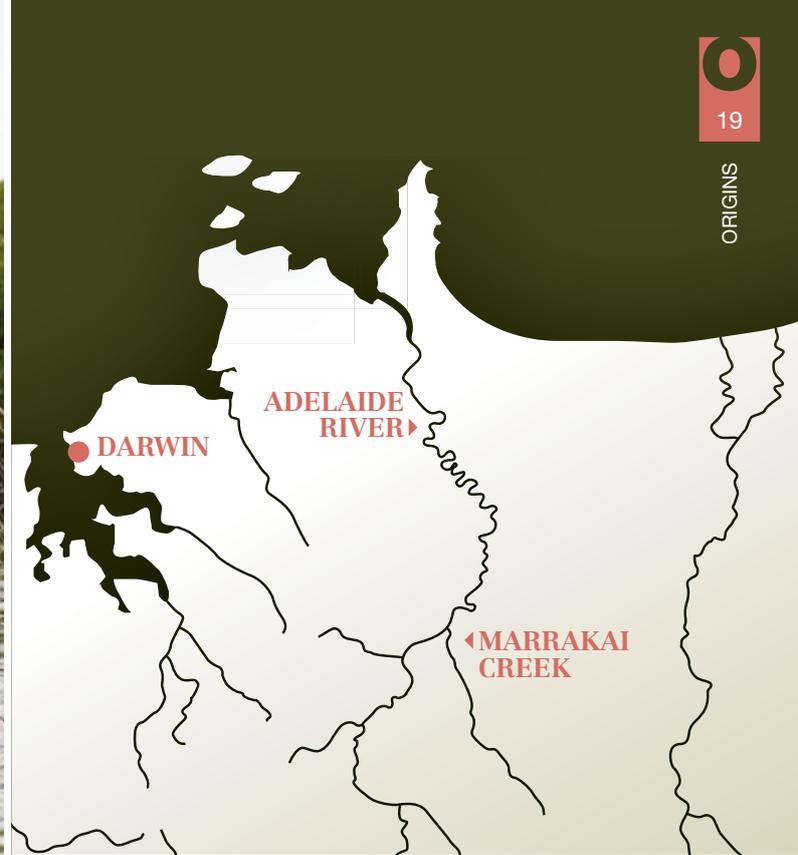


ABOVE

Three-time Fulbright Fellowship winner Professor Tim Berra.

LEFT

Co-researcher and Territory Wildlife Park curator Dion Wedd.



the fish,” Mr Wedd says, as he places the tiny scale-like bone into a small yellow envelop and Professor Berra calls out the fish weight and measurements for recording.

Like the rings of a tree, the otolith can provide insights into the life of the fish. When cut into ultra-thin layers and analysed under a powerful microscope, the bones can provide detailed information on the activities of the fish.

Mr Wedd first saw nurseryfish in another iconic Northern Territory waterway, the Daly River, which also is known for its crocodile population. “I guess you could call me a fish nerd,” he confesses as he diligently labels envelopes containing samples. “I like to collect fish and the first time I caught a nurseryfish I thought it was weird and totally unlike anything I had seen before.”

Formerly head of the aquarium at the Territory Wildlife Park located just outside Darwin, Mr Wedd is now curator of the park. “Because the environment is so hostile the only way we will find out more about the breeding behaviour of these fish is by breeding them in captivity,” he says. He has tried, but even with all his years of experience with Territory fish, he has been unsuccessful so far.

“These fish are very difficult to keep in captivity. They won’t eat and are very docile. We think the next step would be to try to grow them from juveniles in captivity.”

Professor Berra’s research in the NT is supported by CDU and the Northern Territory Government through the Territory Wildlife Park and NT Fisheries. He has received previous support from the National Geographic Society.



LEFT

Living up to his name, the five-metre saltwater croc “Agro” leaves a huge hole in the researchers’ net.

SOLVED!

This is not the first fishy mystery for Professor Tim Berra, a three-time winner of Fulbright Fellowships to Australia (1969, 1979, 2009) and author of more than 75 scientific papers and six books.

Inspired by legendary American explorer William Beebe, Professor Berra is an international expert in freshwater fish, with a reputation for solving long-standing mysteries.

He taxonomically separated the trout cod from the Murray cod in the Murray River, and solved the mystery of the disappearance and reappearance of the tiny salamander fish in south-western Australia. He found that the salamander burrowed into the watertable when its freshwater pools dried up and reappeared when the pools replenished.

He also was involved in the preservation of a five-metre megamouth shark in 1988, a species seen only twice previously.

Professor Berra is a University Professorial Fellow at CDU, and Research Associate the NT Museum, Darwin. He is a world-renowned Charles Darwin specialist and Emeritus Professor of Evolution, Ecology and Organismal Biology at the Ohio State University, USA.





MAKASSAN MAP CONNECTS SCIENTISTS AND COUNTRIES

TEXT

Penny Baxter

IMAGESPortrait by Fiona Morrison
Other images supplied by
Karen Edyvane, Timor-Leste
Dive Photo Contest

A 400-year-old map shows the extent of the ancient Makassan Empire, which surprisingly included part of the Northern Territory. Marine conservation biologist **KAREN EDYVANE** believes the shared heritage binds together the four countries that border the Arafura and Timor Seas.

LEFT

Professor Karen (Bonba) Edyvane, Arafura Timor Research Facility and Research Institute for Environment & Livelihoods (RIEL). Professor Edyvane is currently at CDU on secondment from the NT Government, Department of Natural Resources, Environment, the Arts and Sport (NRETA).

An ancient map hidden among the royal garments and fading photographs of the palace of the 16th King of the ancient Makassan Empire is revealing more than the exotic maritime ancestry of the Northern Territory. It also may help to protect the rich biodiversity and resources of the Arafura and Timor Seas.

The hand-drawn map was found by two Darwin researchers while they explored the ancient city of Gowa and the palace of the Sultan Hasanuddin on the Indonesian island of Sulawesi.

The map bears the title *"Gowanese kingdom and areas that accepted Gowanese sovereignty until 1660"* and encompasses the Indonesian archipelago, Timor and, most surprisingly, Arnhem Land in the Northern Territory, a region known as "Marege". While the map was reproduced originally from an Indonesian text published in 1967, the veracity of the Makassar claim of sovereignty or hegemony over Marege, remains a topic of controversial and historical debate.

Unearthing the map was a major surprise for marine conservation biologist Professor Karen Edyvane, from the Research Institute for the Environment and Livelihoods at Charles Darwin University, who was on a research visit to Hasanuddin University in Makassar, the capital of Sulawesi.

"We were absolutely stunned to see the Northern Territory was included as part of the accepted Kingdom of Gowa, which is also known as the Makassan Empire," Professor Edyvane said. "We know the Makassans were visiting the north coast of Australia over 400 years ago, from the early 1600s to 1907, primarily to harvest trepang (sea cucumbers) to sell as a delicacy to China. But we didn't realise that northern Australia and specifically the Northern Territory was also considered part of the sovereign Kingdom of Gowa."

This early contact and the 1600km annual monsoonal journeys of the seafaring Makassans to the shores of Arnhem Land, two centuries before British colonisation, could now be one of the keys to protecting the future of the Arafura and Timor seas.

It was like stepping back in time with an eye on the future for Professor Edyvane.

"While this fascinating cross-cultural relationship has been the subject of intense study by social scientists, such as historians, archaeologists and anthropologists, we are only just beginning to explore this research area as scientists. Future studies may tell us a

lot about not only the history of human migrations in our region, but also climate change and the impacts on coastal and marine resources.

The passionate marine scientist also sees the map as reinforcing the strong cooperative marine research programs rapidly developing between the four countries bordering the Arafura and Timor Seas: Indonesia, Timor-Leste, Papua New Guinea and Australia.

"Similar to the Mediterranean Sea, the Arafura-Timor Seas are classified legally by the United Nations as a 'semi-enclosed sea', with obligations and responsibilities for cooperative management and scientific collaboration. These seas are just rich in marine biodiversity and fisheries resources, much of the resources are 'shared', due to the shallow, semi-enclosed nature of these seas."

CDU is playing a major role in international scientific cooperation in the Arafura-Timor Seas, both in its collaborative marine research and education relationships with key universities in the region, such as Hasanuddin University in Makassar. It also participates in major regional marine forums, such as the Arafura-Timor Seas Experts Forum (ATSEF), established in 2003 through a Memorandum of Understanding between the governments of Indonesia, Timor-Leste and Australia.

In a major boost to marine science and regional collaboration, ATSEF recently received more than \$8.7 million in funding, including from the United Development Program, for regional planning, research and training in the Arafura-Timor Seas. Through regional partnerships, the ATSEF program will

help to address some of the key priorities in the Arafura-Timor Seas, including food insecurity, illegal fishing, unsustainable fishing, pollution and the impacts of human use and climate change.

Within the Northern Territory, collaborative marine research activity on these "shared seas" is centred primarily around the Arafura Timor Research Facility (ATRF) in Darwin, a major collaborative national marine research facility established in 2006 dedicated to research in the region for researchers from CDU, the Australian National University, the Australian Institute of Marine Science and the NT Government.

Professor Edyvane, who is a lead researcher at the ATRF, said she believed international and regional commitment and scientific cooperation were critical to understanding and protecting the shared biodiversity and resources of seas, which provide food and livelihoods for millions of coastal and Indigenous communities in the region.

She said that while the map at the tomb of the Sultan Hasanuddin was not a new discovery, it undoubtedly reinforced the cross-cultural relationships and exciting regional marine science collaborations being undertaken at CDU and the ATRF.

"This unique, shared Makassan heritage binds us together across the whole region and importantly, is very significant for our partners and our cooperative relationships in the region," she said.

"What is particularly exciting for scientists in the Northern Territory is that we now know that we are building on a very close and special, shared maritime and cultural relationship spanning over 400 years."



SHELVES DO THE TALKING TO PROMOTE HEALTHY FOODS

TEXT
Jen Pinkerton

IMAGES
Frances Knight

Indigenous communities are taking up and spreading the healthy foods message, with help from the **MENZIES SCHOOL of HEALTH RESEARCH.**

At the local store in Galiwin'ku, the largest community in East Arnhem Land, a band of community women walks the aisles. Running fingers over “healthy foods” labels, their faces flicker with pride. These “shelf talkers” they’ve designed — eye-catching icons that make nutritious options shout from shelves — are a community-wide effort.

Frances Knight, project officer from the Menzies School of Health Research, said the women knew that people in the community would be proud. “They created it. The system belongs to them.”

For these women, stressing the importance of Yolngu food, as well as store-bought food was key. “They wanted to keep that connection to country and show that bush foods nurture health, as does food from the store,” Frances said.

Labels were designed with a “dhanyia” or traditional basket image, half-filled with Yolngu bush tucker and the other half with *balanda* (or “white fella”) food.

The Menzies’ Nutrition Promotion and Education in Remote Community Stores Program encouraged consumption of fruit, vegetables and water. Beyond that, it hoped to raise intake of fibre, iron and protein and to lower consumption of food high in added sodium, sugars and saturated fats.

LEFT
(From left) Menzies’ project officers Lawurra Maypilama and Frances Knight with ALPA nutritionist Clare Brown and Doris Yittun from Galiwin'ku, and the good food dhanyia basket.





RIGHT
Manymak Ngatha shelf labels in place in the Galiwin'ku Store Yittun.

ABOVE
Enlarged section of shelf labels.



A large proportion of the national Indigenous health gap is attributable to diet-related causes, including obesity and low intake of fruit and vegetables. Diabetes, heart disease and under-nutrition were flagged as issues by many remote community leaders.

Shelf-talkers hope to address some of these issues as part of the Menzies' nutrition program, which was launched in 2011. It follows on from remotely based nutritionists' reports that community members and store staff are eager to show clearly which store items are healthy food choices but are unsure of how to do this.

"We know various projects have responded to the need for better nutrition in the past, yet no evaluation or research has been published indicating which tactics work best and, indeed, which foods to label as 'healthy,'" Frances said.

It became clear that people working in remote communities to promote nutrition need further resources to do so. A number of international projects based on community-wide nutrition promotion have included shelf-talker systems and found that these systems could bring about positive changes

in customer knowledge and food-purchasing behaviours.

Funded by the Fred Hollows Foundation, the Menzies nutrition project includes activities in four communities across Cape York, Central Australia, Arnhem Land and the Torres Strait.

A different labelling system is being piloted in each of the locations to help inform the development of a new package of resources for use in establishing, running and evaluating shelf label projects with remote communities.

In Pormpuraaw, a remote community of about 600 people on the western coast of Cape York Peninsula, music sells the message. Menzies teamed with the Retail Stores Branch of the Queensland Department of Communities and the Jimmy Little Foundation, which brought musicians to the community and helped children write their own "healthy eating" songs.

"The song was turned into a fantastic film clip and then replayed at community video nights. It spread the message: 'thumbs up for good tucker,'" Frances said.

Mabuiag in Queensland's Torres Strait has a "tick" system similar to that

run by the National Heart Foundation. And the fourth community, Titjikala in Central Australia, devised a system using local artwork and language to spread the message.

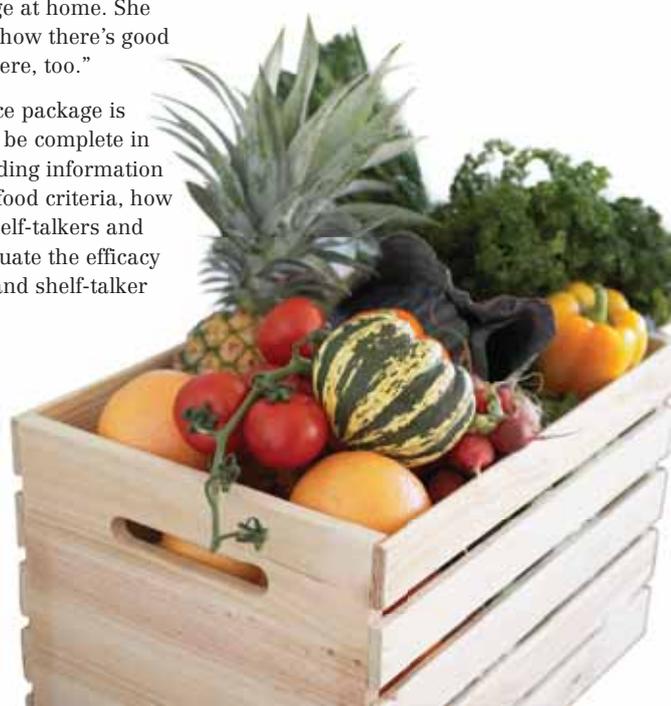
While the project evaluation phase continues, small success stories emerge. Good tucker talk, it seems, is in the air. In one store, the manager reported dramatic increases to the sales of newly labelled dried fruit and nuts.

In Cape York, children greeted freshly pinned posters with delight, Frances said. "One girl ran up to poster and shouted, 'Thumbs up good tucker!' Her mother asked for a Thumbs Up sticker to put on her fridge at home. She wanted to show there's good tucker in there, too."

The resource package is expected to be complete in June, providing information on healthy food criteria, how to create shelf-talkers and how to evaluate the efficacy of signage and shelf-talker programs.



Thumbs up for good tucker



FULBRIGHT SCHOLAR TO PROBE NEW ERA IN RIVER RESEARCH

BELOW
TRaCK Director
and Fulbright
Scholar Professor
Michael Douglas.



Southern Australia's increasing demand for water is driving pressure to develop the country's northern catchments, but how do we do it sustainably? **MICHAEL DOUGLAS** will investigate a new phase of river research when he takes up a Fulbright Scholarship to the United States.

Northern Australia is regarded widely as a special place. The interplay between an ancient landscape and monsoonal weather patterns has created vibrant communities and rich Indigenous cultures, while maintaining largely intact ecosystems.

But there is a perception in some quarters that wet season flows in the north are "wasted". Research from the Tropical Rivers and Coastal Knowledge (TRaCK) consortium shows, however, that the north's unique biodiversity and the landscape's resources depend on these dramatic floods.

The question that arises for policy makers and researchers alike is how can Australia develop the north in a sustainable manner? This and planning for a new phase of river research will occupy the Director of TRaCK, Professor Michael Douglas, as he undertakes a Fulbright Scholarship in the United States starting in June.

A survey of more than 1000 people across Australia conducted by TRaCK researchers in 2009 found most respondents valued a balance between agricultural and other ecosystem services. Yet periodically, politicians call for large-scale agricultural

schemes involving dams and pipelines across the north.

"People have to be aware that these decisions are about trade-offs. If you take water out to benefit one sector, you are likely doing so at the expense of another," Professor Douglas said. "Dams involve very expensive infrastructure with potentially irreversible consequences for the environment and downstream communities, so politicians and water managers must ensure they are using the information available when making decisions.

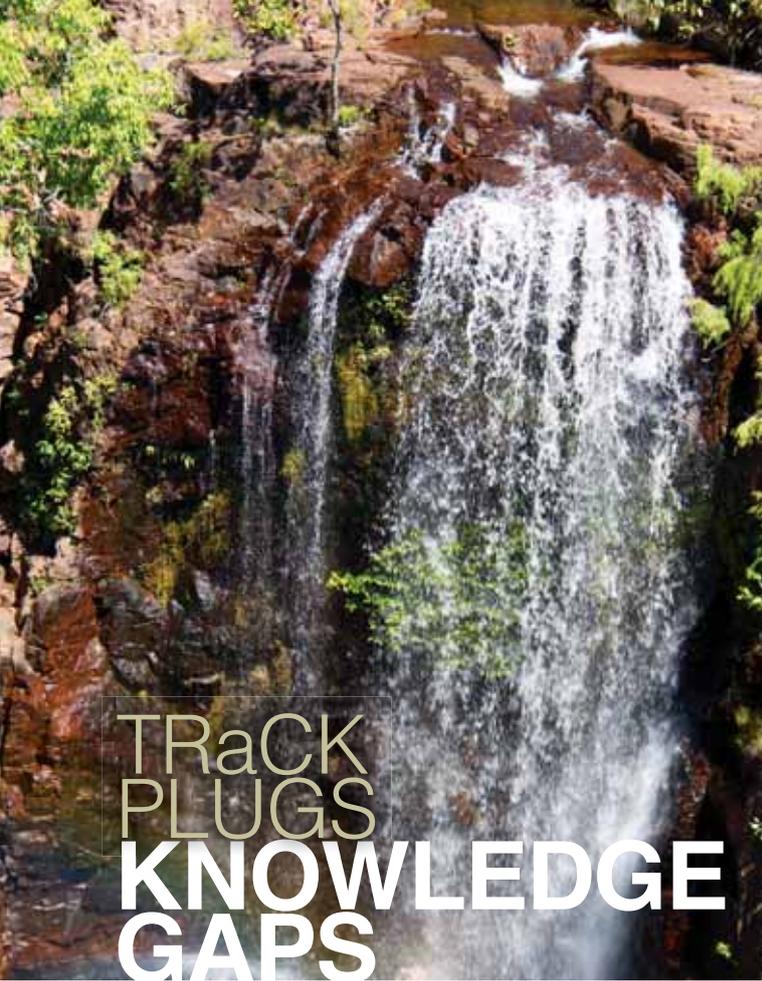
"We are classified as living in the wet-dry tropics, but

perhaps a more realistic description for our climate is the 'dry-wet tropics' because, for the most part, we live in a desert that happens to be wet for a while."

TRaCK's research has drawn together a significant body of work on the importance of wet season flows. The annual wet season floods:

- Connect the floodplains to the river and allow movement throughout the entire river system
- Transport nutrients and sediments and reconnect habitats
- Boost plant growth, providing habitat into the drier months





TRaCK PLUGS KNOWLEDGE GAPS

LEFT

The wet transports nutrients and sediments, and reconnects habitats in northern Australia.

The Tropical Rivers and Coastal Knowledge (TRaCK) consortium was set up in 2007 to address fundamental knowledge gaps about how tropical rivers work and how they are valued.

While research has been happening across the north for some time, the formation of a consortium of more than 70 of Australia's best tropical river and coastal scientists signalled critical mass in terms of a collaborative effort from different disciplines and institutions.

TRaCK Director Professor Michael Douglas said the driving force behind setting up the program was a growing understanding that rivers were among the most threatened ecosystems on the planet and most had suffered serious environmental degradation.

"I want to ensure that we avoid making the same mistakes that have been made in managing rivers elsewhere, because once ecosystems are degraded, it's expensive and difficult to turn back the clock," Professor Douglas said.



- Increase the commercial and recreational catches of coastal fish such as barramundi and king threadfin
- Provide better opportunities for harvesting customary aquatic resources such as black bream and long-necked turtle, which make an important contribution to Indigenous people's diets and household budgets.

Work has also been carried out by economists to estimate the number of local jobs that would be created by expanding various sectors. This research showed that

where development was detrimental to stream flows and wild aquatic resources, it is possible that the net effect of that development on Indigenous communities could be negative.

While the north's ecosystems are relatively intact, there are threats that will become more persistent over time. Even the most conservative estimates indicate sea level rises will push saltwater into the wetlands of northern Australia, which are internationally significant for migratory birds and important breeding grounds for the iconic barramundi.

"Many of these wetlands are little more than a metre above sea level, so we need to start planning now to preserve areas with high conservation values," Professor Douglas said.

"Feral animals have really impacted on a lot of those floodplains as well. A lot of resources have gone into it and the health of some wetlands is improving, but it's a big public investment and it needs to be maintained.

"The first phase of TRaCK research has concluded and we are now involved in a new research program under the Commonwealth-funded

National Environmental Research Program. But there are still significant gaps in our knowledge.

"I'll be using my time in the United States to examine the approach American scientists have been using, which aims to build knowledge about rivers as part of an integrated system. It's very important we study rivers in their entirety – from the headwaters to the coast."

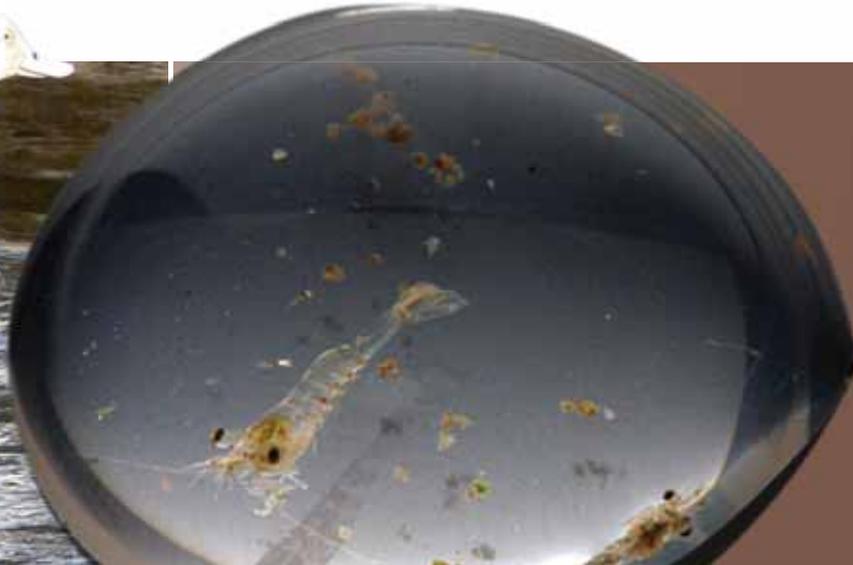


TEXT

Amy Kimber

IMAGES

Dave Wilson
Michael Douglas
Fiona Morrison



FAR LEFT

The annual wet season in the north allows movement throughout the entire river system.

LEFT

A water droplet rich with life.

ALBUM,
TOUR &
BRIGHT
FUTURE

AWAIT DESERT ROCKERS

TEXT AND IMAGES
Patrick Nelson

FAR RIGHT
Ready to rock ... Gavin Hayes (left)
and Chris Wallace of the Southeast
band based at Ltyentye Apurte.



Central Australian desert rocker **CHRIS WALLACE** and his **SOUTHEAST** band might just be the next big thing in Indigenous music.

Following an impressive first-up performance at the Garma Festival in East Arnhem Land, a four-piece Indigenous hard rock band, Southeast, stole the show last year at the Bush Bands Bash in Alice Springs. The band is now waiting on confirmation to participate in this year's Sand Tracks tour.

"We're just taking it one day at a time but basically I'm looking forward to it if we make the cut," Chris said from the backyard of his eastern Arrernte home in dusty Ltyentye Apurte (Santa Teresa).

Chris, who completed a music course at Charles Darwin University in 2011, has enrolled in a follow-up course this year.

Contemporary Music lecturer Cain Gilmour said Southeast was fast developing into a formidable act.

"We sing about life,
about our history and
about being strong"



“They have a unique sound and perform well on stage and have a place as a new Indigenous rock band on the scene,” he said.

“If they continue to work hard and develop their skills I won’t be surprised if they crack it in a commercial sense.”

Chris grew up in a country music environment, although he quickly developed a liking for the sounds of ’80s rock.

“My uncle played a lot of Slim Dusty songs and he taught me the notes on a guitar, but I liked the metal bands like AC/DC, Megadeth and Stryper.”

Chris and Derek Hayes, Gavin Hayes and former drummer Earl Hayes, combined their considerable talents in 2007, naming the band Southeast because of their town’s proximity to Alice Springs.

“Santa Teresa is 76 kilometres south-east of Alice so we decided to call ourselves Southeast.

“We wanted to create a new hard rock sound a bit like AC/DC but a bit different; something from the desert.”

Chris, who plays rhythm lead, writes most of the songs and shares vocal duties with Gavin while Derek plays bass.

“We sing about life, about our history and about being strong.”

“Being strong” is a key message for the young people who Chris works with in his day job as a family support worker at Santa Teresa.

“I teach them what I’ve learnt from my uncles and aunts and grandparents and try to pass the knowledge on to them. Sometimes they listen, but sometimes they’re more interested in having fun.”

It’s a role that affords him opportunities to deploy his horse-handling skills.

“We take the young students on trail rides for a reward if they work hard at school.

“Sometimes we go for a week and teach them about plants and trees and paintings, and tell them stories about the land and cultural stuff.”

Southeast has started work on its first album.

“It’s a big project but we’ve got some songs sorted out and we’re working on others so hopefully this year ...,” he said.



GIANT FROG HAS HYDRATION ALL WRAPPED UP

In wetlands and creek systems around the Top End, frogs are beginning to take shelter, on a mission to find a hidey-hole to stay hydrated and survive the Northern Territory's tough dry season. **STEPHEN REYNOLDS** investigates the secret life of frogs.

TEXT

Leanne Coleman

IMAGESFiona Morrison
Gavin Bedford
Martin Dziminski
Stephen Reynolds

Charles Darwin University PhD graduate and herpetologist Stephen Reynolds has been investigating the secret underground life of the giant burrowing frog (*Cyclorana australis*), and its ability to shelter in the earth during the Northern Territory's long dry season.

Dr Reynolds is passionate about "ecophysiological" research – that is, how animals at the organism level are in harmony with their environment.

His PhD research began in 2005 when he started chasing frogs around at night in Mickett Creek, in the northern suburbs of Darwin. The frogs were equipped with radio transmitters, which would help to uncover the truth about their lives during the "dry".

"Our radio transmitters were tiny so as not to interfere with the frogs, but that also meant the aerials on the transmitters were tiny so the frogs could only be tracked up to a distance of around 50 metres," Dr Reynolds said. "We had to radio track them

Frogs shed their skin every few days

BELOW
Burrowing frogs are active during the wet season



at night, because that is when they were active, to see where they moved so we didn't lose them in the creek system."

For three months towards the end of the Top End's monsoonal wet season, Dr Reynolds and collaborators followed the frogs and as the weather began to dry up the frogs began to disappear underground.

"Giant frogs in the Top End spend almost six months each year in the total darkness of their burrows during the dry season awaiting the monsoonal rains," he said.

"Frogs need moisture to survive and because burrowing frogs spend so much time underground we wanted to know how they protected themselves when the soil dried out."

To investigate Dr Reynolds dug up frogs at various intervals during the dry season and measured the dryness of the soil. He found that the frogs had formed a layer around their bodies, offering protection from the soil.

"Frogs shed their skin every few days," he said. "We found that while they were in the

burrow they built up their layers of skin to form a cocoon to reduce water loss in the dry soil, allowing them to maintain their skin moisture."

As part of his PhD thesis, entitled "Body fluid osmolality and hydric relations of frogs from monsoonal northern Australia", Dr Reynolds wanted to know more about the function of the cocoon, when the frogs formed the cocoon underground, and how it prevented water loss to the soil.

"Frogs don't drink like your average animal. They hydrate through the process

of osmosis, absorbing water through their skin like a sponge," Dr Reynolds said.

"Frogs can also extract water from the soil while in their burrows. However, once the soil around them becomes too dry and they can no longer physically absorb moisture, the cocoon they form protects them from the soil taking its moisture back.

"The cocoon completely covers the frog's body (and looks a bit like glad wrap) except for their nostrils so they can breathe.

Giant frogs in the Top End spend almost six months each year in total darkness



“While in their cocoon, the frogs slow their metabolic rate until they are in a state of ‘aestivation’ (similar to hibernation, but for dry conditions). They don’t eat, drink or urinate, and keep hydrated by reabsorbing water stored in their bladders, which they fill to capacity before burrowing underground.”

There the frogs remain confined in their underground burrows until the first monsoonal rains of the next wet season moisten the soil enough for them to break free of the dry soil crust that has formed around them.

“Growing a cocoon to shelter from dry conditions is one of the survival adaptations allowing the giant burrowing frog to survive within its habitat. There are 10 different species in the genus *Cyclorana* that all have unique survival adaptations, including The desert water-holding frog (*Cyclorana platycephala*). While the giant burrowing frog burrows down around 20 to 30 cm, the desert water-holding frog can burrow down a metre or more. It is generally believed that it can stay underground for several years, but this has never been confirmed. In general it will emerge whenever there is sufficient rain.”

LEFT
Forming a cocoon helps the frogs stay hydrated while underground.

ABOVE
There are approximately 15 species of burrowing frogs in the NT.

Dr Reynolds is interested primarily in the behavioural and physiological adaptations of animals to their environment and is currently working on a new project at CDU to maximise the growth rate of crocodiles.



LIMITED EDITION

Elizabeth Nyumi was born c. 1947 at Parwalla. Her skin is Nungurrayi and her principal language group is Pintubi. Elizabeth lives at Billiluna, one of Balgo's outlying communities. She grew up along the Canning Stock Route before settling at Balgo with her father (her mother tragically died quite young from a dingo bite). Elizabeth trained in domestic help and worked throughout the region for pastoralists. Together with her husband she remains a strong and active advocate for teaching her culture to the next generation.

She began painting for Balgo in the late 1980s, her style initially quite muted. More recently, her canvases and prints convey a thick build-up of dotting typically embedded with such things as camp settings, coolamons, bush tucker and scrub. Elizabeth has travelled overseas and throughout Australia for her art, which is garnering increasing attention and widespread recognition.

Elizabeth was one of the few Indigenous artists represented at the 2004 Sydney

Biennale. Her work is represented in the Holmes a Court Collection, and at the Museum and Art Gallery of the NT, among others.

CDU's Northern Editions Studio print makers will travel to Balgo in September to work with the Warlayirti Artists in Japanese-style woodblock printing and etching.



Elizabeth Nyumi
Parwalla
Created 9 October 2003
Screen print, edition 25

IMAGE SIZE
104 x 69 cm

REF NO
03/46

PRINTER
Northern Editions Print Makers

W: northerneditions.com.au

RESEARCHERS AUDIT WATER USE IN TIMOR-LESTE

TEXT

Penny Baxter

IMAGES

Portrait by Fiona Morrison
Other images supplied by Tania Paul

Water, like blood, is the essence of life for people who survive off the land. But this life-blood for the people of Timor-Leste is in danger from the threat of climate change, as **TANIA PAUL** discovers.



LEFT

CDU senior horticulture lecturer Tania Paul's investigative research helps to determine the vulnerability of the water supply in Timor-Leste

Trekking over the mountainous landscape of the highlands behind Dili in search of water is already a matter of life or death for the people who live in farming villages. Poverty is common in these communities where the water is poor quality and scarce, and the country's long dry season causes many life-giving springs to dry up for months at a time.

A joint project between Geoscience Australia and researchers at Charles Darwin University (CDU) has painted a vivid picture of water use so the Government of Timor-Leste can protect this precious resource from the threats posed by climate change.

Temperatures in Timor-Leste are expected to rise by 0.4°C to 1°C by 2030; cyclones and rain events will become less frequent but more intense; and the sea level is expected to rise by 6 cm to 15 cm, according to the climate change predictions of the Pacific Climate Change Science Program.

This means Timor-Leste will experience intense rainfall events similar to the 2010–11 wet season when heavy rainfall ran through the island nation's engorged streams, creeks and rivers out to the ocean, without replenishing the underground aquifers.

The heavy rains destroyed most of the country's food crops of rice, maize (which is like a corn) and cassava (a root eaten for carbohydrates). The loss also meant the Timorese had only a few crops to plant for the next season.

There are fears that as the temperature of the earth rises, crops such as coffee (which needs cool temperatures to survive) could be threatened.



As geologists mapped the type, quality and size of the underground aquifers in Timor-Leste, the researchers from CDU's School of Primary Industries spent 18 months mapping the human impact and use of water in the young nation.

The small team of researchers included Bronwyn Myers, Rohan Fisher and Andrew Campbell, and was headed by horticultural researcher Tania Paul.

They spent two months meeting the people who live in areas supplied by the three different aquifer types – sedimentary, fractured rock and limestone – to gauge how water was treated differently and its impact on their livelihoods.

Ms Paul says it was not just the way people used the water that varied, but also the impact of water on the local economy, how it was involved in religious and cultural beliefs and the perceived ownership of the valuable resource.

“We heard some amazing stories, like people who had to trek up to 10 kilometres twice a day through the mountains to fill a small bucket up with water,” she says. “You could see the hardship in their faces.

“Some families have to move from their homes in the mountain to be near water, which means the children can't go to school.”

This project combined life-long passions for South-East Asia and horticulture for Ms Paul, who visited more than 30 villages with Marcal Gusmao from the National University of East Timor to talk to residents about water.

In some villages, the cultural and religious beliefs surrounding water are so strong that they prevent certain people using it,

and sacrifices are necessary to please the underground spirits who look after the water.

“In some villages, people believed you couldn't drink rainwater because it was somehow contaminated,” she says.

With Timor-Leste's population of 1.7 million people expected to grow by 2.4 per cent, the Government of Timor-Leste is under pressure to make sure there is enough water to go around.

The researchers identified an estimated 44 per cent of the country's population live in areas where the water source is low quality and low in quantity, making them more vulnerable to predicted changes to the water source from climate change.

The joint Geoscience Australia and Charles Darwin University research will provide advice to the Government of Timor-Leste to ensure reliable water and food supplies for the people of Timor-Leste into the future. Priority actions include monitoring groundwater resources to better understand water availability; irrigation maintenance; diversifying agriculture and reducing waste; and over use of the existing water supplies.

Ms Paul says she hopes the comprehensive research project, which was funded by the Australian Government under the Pacific Adaptation Strategy Assistance Program, through the International Climate Change Adaptation Initiative, with help from the National University of Timor Loro Sae, could lead to further research and capacity building to help fight the effects of climate change in developing countries.



UPPER LEFT

Senor Gusmao tends his vegetable garden, which is hand watered using river water.

UPPER RIGHT

Looking south over the bridge to Laleia and the Laleia River in Timor-Leste.

LOWER LEFT

The highly invasive weed *Chromolaena odorata*, which is taking over much of the pastoral and farming land in Timor-Leste.

LOWER RIGHT

Bamboo is used to divert rain from the roof into a small water storage tank.

FACULTY HEAD

SETTLES INTO NEW CULTURE

Environmental scientist **SUE CARTHEW** is Pro Vice-Chancellor of the Faculty of Engineering, Health, Science and the Environment. Sue recently moved 3000km north from her former home in Adelaide to take up the position in Darwin.

You joined CDU earlier this year to lead the Faculty of Engineering, Health, Science and the Environment. How would you describe your first six months in the position?

It's been a whirlwind of getting to know people both within and outside the university, understanding the breadth of the Faculty and the challenges it faces, and getting to grips with a completely different culture. So I suppose I could describe my time so far as exciting, scary and energising.

What do you find is the greatest challenge in the position?

So far, getting to know how things work and how to get things done. I've spent quite a bit of time feeling as though I don't know anything, and that's hard when you are used to knowing people and a place well. But I'm slowly getting there. One of the other challenges is to get my head above the day-to-day: there is so much going on across the Faculty it's easy to get lost in that, but it's important to take time to look at the big picture.

Have you been able to maintain your research interests in ecology and environmental science?

It's a bit early to judge yet because I've been pretty busy getting to know the university and the Faculty, so I haven't started any primary research. However, in my "spare" time I have been working on several manuscripts I already had in train and hope to submit them shortly. I have one PhD student, based in Alice Springs, who's just started work on a small threatened marsupial and its relationship with fire/land management, and I still have quite a few PhD students based in Adelaide, whom I regularly Skype – so I am trying to keep my hand in. I also can't wait to get out into the field up here and see what the possibilities are, but for the moment my focus has been on the Faculty.

How do you find living in Australia's most northerly capital city?

So far I'm really enjoying it – even the fact that we came at the start of the wet season. I just loved those big storms and the huge downpours of rain, although the humidity has taken a bit of getting used to after the hot, dry summers of Adelaide. We tend to like an outdoor lifestyle, and so the fact you can swim, have BBQs and eat outside all year round is great. I also love the closeness of everything. It used to take me over an hour to get to work (from the edge of the Barossa to the city). Now it takes me 15 minutes, and living less than five minutes from the city is very convenient.

Have you had the opportunity to explore the Northern Territory's impressive environment?

Being outdoors people, my husband and I are really keen to explore the region and make the most of being in such an amazing environment. So, most weekends we've been trying to get out and about a bit, and as the dry season gets going this will be easier. We went to Kakadu for the first time over Easter and can't wait to get back there once it becomes easier to get around. The waterway around Yellow Water at dawn was just beautiful, and the birdlife spectacular. We've also been out to Litchfield National Park and Fogg Dam. In an attempt to get to know the birds up here, we've biked and walked around East Point and Lee Point a few times.

Is there anything you would do differently in your career if you had your time over?

Other than spend more time with my kids when they were little, not really. Academia presents so many possibilities. It's challenging but rewarding, it's flexible, you get to work with some of the brightest people around, and you can mostly be a master of your own destiny. How can you beat that? I've also had some wonderful opportunities and met some amazing and inspiring people during my career. And having been in a leadership position in recent years, I've relished the opportunity to facilitate excellence in others.

Who or what inspires you?

My parents – who told me I could do and be anything I wanted: something I have always believed and have tried to instil in my children. The natural environment – pretty self-evident really.

What are you reading at the moment?

I am an avid reader and read all sorts of things: biography, mysteries, quirky stories, comedy, leadership ... At the moment, I'm reading *Why People Fail* by Siimon Reynolds and *Chasing the Dime* by Michael Connelly.

What is your favourite film?

I've always been a bit of a fan of old movies, although I don't have a lot of time to watch them these days – so I probably don't have one favourite film. A couple of favourites: *Gone with the Wind*, *Moulin Rouge*, *Erin Brockovich*, *Shirley Valentine*, *Dead Poet's Society*, *Rear Window* ...

What is the best advice you have received and who offered it?

Two things come to mind. One was when I was writing up my PhD thesis and an academic turned consultant, whom I'd done some work with, reminded me that it was really the only time in your life that you get to concentrate on a single thing that is all about you. I was essentially writing a story of my achievements and I should make the most of that time. That spurred me on and kept me going when I got bogged down in it (which was often!). The other one is something that came from a leadership course that I found really useful when I was Head of School. It's about depersonalising conversations. When people are upset or angry about something, and it might be a decision you have made or a consequence of something you have done, remind yourself they are not attacking you, they are attacking their perceptions of an issue. Taking this approach means so much less tension in the room, and makes the situation much less stressful.

Which four people, living or dead, would you like to have to dinner?

David Attenborough, Charles Darwin, Robin Williams and Catherine Hamlin.



INTERVIEW

Robyn McDougall

IMAGE

Fiona Morrison



SITTING AT THE EDGE OF APY LANDS

Senior Yankunytjatjara elder and traditional healer Whiskey Tjukangku is a founding member of Iwantja Arts and Crafts at Indulkana. This is one of the largest communities at the gateway to Anangu-Pitjantjatjara-Yankunytjatjara (APY) Lands, situated south-east of Fregon and Mimili and just west of the Stuart Highway in South Australia.

In his words: “I was the first man to start being an artist at Iwantja, so I was the original member ... I paint a lot and I learned linocuts ... I remember culture designs that no one else knows.”

Tjukangku grew up in Ernabella and De Rose Hill, South Australia, working as a stockman for many years driving cattle throughout the region, until he grew “homesick” for his *ngura* (country), returning to reside again at Indulkana. His paintings reflect on his extensive travels and experiences throughout desert country often unrelated to his *Tjukurrpa* (Dreaming), yet recalled in his memory and art as influential to his sense of self and identity as a senior Yankunytjatjara man.

Wampataku – Hunting 2010 depicts “a good place to camp down in the creek bed”. A man who has gone hunting for emu and kangaroo sits in the shade of trees between the hills. A work of great vitality and energy, it is a triumph of scale over size, its figurative elements hark back to a moment in the history of Western Desert painting before attenuated abstraction became the norm. The artist’s signature depiction of *punu* trees – jagged and meandering – dramatically divides the composition diagonally, like the airborne fall of a hunting spear. The organic forms echo the esoteric designs incised on weapons and ceremonial or utilitarian objects made from the same *punu* sourced by Yankunytjatjara men, revealing the inextricable relationship between the natural world and ceremonial life.

Whiskey Tjukangku held his first solo exhibition in April-May 2011 and has participated in group shows at major galleries interstate since 2010. His work is represented in the National Gallery of Victoria and the South Australian Museum.

BELOW

Whiskey Tjukangku
Wampataku – Hunting
2010

Acrylic on linen
60 x 50cm

Charles Darwin University Art
Collection – CDU2072

*Purchased through the CDU
Foundation, 2011*

Image © the artist & courtesy Iwantja
Arts and Crafts, Indulkana, SA

TEXT

Anita Angel
Curator, CDU Art
Collection and Art Gallery



