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Australian Plants SOCIETY NSW

NORTHERN BEACHES GROUP
November 2017


pic Andre Porteners

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Next Meeting: **7.15 pm Thursday November 2, 2017** at Stony Range Botanic Garden, Dee Why.
Presentation: Jayden Walsh."Backyard Conservation".
Supper: **Peter & Jane**

Coming Up:

2017 APS NSW Quarterly Meeting hosted by **APS North Shore Group** on **Saturday November 18, 2017** at Ku-ring-gai Wildflower Garden, 420 Mona Vale Rd, St Ives. Guest speaker Bronwen Roy will be speaking about native bees. .

AUSTRALIA'S ROCK ORCHID TELLS STORY OF EVOLUTION AND CLIMATE CHANGE

Blog.csiro.au October 13, 2017 Andrea Wild

The spectacular flowers of Australia's rock orchid.

The Rock Orchid, *Dendrobium speciosum*, which grows along the east coast of Australia, has shown us how climate change can drive the evolution and survival of species.

Past climate change drove the evolution of this orchid into two subspecies, increasing its genetic diversity, but future climate change is likely to severely reduce its diversity.

Genetic analysis carried out by researchers at the Australian Tropical Herbarium and the Australian National Herbarium has revealed the rock orchid, once thought to be a group of 11 different species, is a single species made up of a northern subspecies, which grows north of Mackay to Cape Melville in Queensland, and a southern subspecies, which grows south of Rockhampton to Genoa in Victoria.

The researchers modelled the past distribution of the species, which they based on climate reconstructions from 21,000 years ago, during the Ice Age, and the current distribution recorded from herbarium specimens. They found that the northern and southern subspecies evolved during glacial periods in earth's history when the populations were separated due to unsuitable climate conditions between Rockhampton and Mackay.

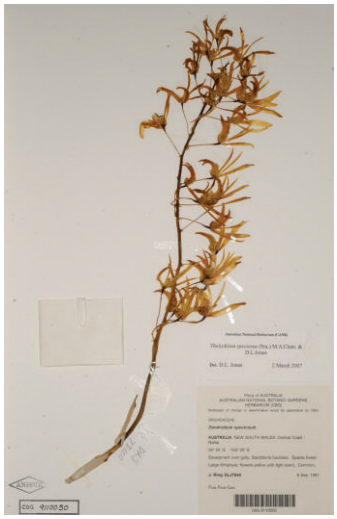
The researchers then looked at climate scenarios predicted for the next seven decades and found the northern subspecies would be the most severely impacted.

"If average global temperatures warm beyond a two degree increase, we found that by 2080 people wanting to see the rock orchid's spectacular flowers in Queensland's bush would only be able to do so in the Wet Tropics," said PhD student Lalita Simpson of James Cook University.

"However, if warming was contained below a two degree increase, suitable habitat would be maintained in several regions along Queensland's east coast. The southern subspecies is not as greatly affected as its relatives in the north, although lowland populations along the coast are threatened," she said.

"The rock orchid is one of the first species to show us that climate change, acting over thousands of years, has been an important driving force in the evolution of genetic diversity. Unfortunately, rapid climate change over the next century is likely to wipe out much of that genetic diversity," said Dr Mark Clements of the Australian National Herbarium.

This research was made possible by rock orchid specimens that were collected over the past 30 years across the species' entire range of more than 2,500 km along the east coast of Australia. The distribution modelling relied on more than 300 herbarium specimens, many of which are held at the Australian National Herbarium in Canberra.



Rock_orchid_specimen - Rock Orchid specimen collected from the NSW Central Coast in 1991, held at the Australian National Herbarium in Canberra.

rock_orchid_FNQ - The northern subspecies of Australia's rock orchid growing in its natural habitat in Far North Queensland.

rock_orchid_northern - Photographed at the Australian National Herbarium, the northern subspecies of the rock orchid has a longer, thinner penduncle (the stem from which the flowers bloom).

rock_orchid_southern - Now finished flowering, the southern subspecies of the rock orchid is recognisable by its shorter, fatter penduncle (the stem from which the flowers bloom).

Taeniophyllum_malianum - If you look closely you might spot a tiny flower to the left of on this easily overlooked orchid, Taeniophyllum malianum.

Underground_Orchid - The Underground Orchid spends its life below ground.

The orchid family is the world's largest group of flowering plants. Australia has more than 1,300 species that we know about so far and most of them occur only within Australia. Like the rock orchid, some have an iconic form recognisable by anyone who could spot a potted orchid at the supermarket.

Other Australian orchids are far stranger, like the ribbonroots (*Taeniophyllum*), which has tiny yellow flowers and roots that function as leaves as it clings to trees.

The underground orchid (*Rhizanthella*), known from only a handful of locations around Australia, is an extremely rare find, spending most of its life resembling a small, pale piece of root.

The hammer orchid (*Drakaea*) grows in grassland and has flowers that mimics female Thynnid wasps to encourage pollination by male Thynnid wasps. Caladenia actenisis, a threatened species from the Australian Capital Territory, uses the same strategy.

The Australian Tropical Herbarium is a joint venture between CSIRO, Australian and Queensland Governments and James Cook University.

APS NORTHERN BEACHES WALK AT WEST HEAD OCTOBER 15, 2017.

Penny Hunstead


Xanthorrhoea arborea pic:Richard Hunstead

A planned walk from the Resolute Picnic Area to West Head was put off in March, due to rain. However, despite predictions of rain, again, we had lovely weather conditions for our walk, this time, mild and cloudy.

The walk from Garigal Picnic Area to West Head is one of the shortest of the West Head walking tracks. Seven of us assembled for the walk, in the Garigal Picnic area, a popular place for barbecue lunches, under tall *Syncarpia glomulifera* and *Angophora costata*. Picnics there can be hazardous, on hot summer days, when lace monitors are likely to sneak up on your food.


Red Hands Cave pic:Richard Hunstead

A short walk from the picnic area took us to the Red Hands Cave. This was the home of the Garigal people and archeologists estimate that the ochre-blown hand prints of a person of this group was made about 2,000 years ago. Although the hand prints (one in particular) were interesting, the formation of the cave itself, was quite lovely, with various colours from weathering.

From the Red Hands Cave to West Head, the walk was through forest of the following species; *Allocasuarina torulosa, Angophora costata, Corymbia gummifera, Elaeocarpus reticulatus* and *Syncarpia glomulifera*. A moderately steep series of well-made steps took us through plant communities which showed the effects of Sydney's Sept-Oct six weeks of drought. Wilted and dying shrubs, smaller than usual flowers and heavy leaf fall from suffering trees. The dominant species


Astrotricha floccose pic:Richard Hunstead

included *Gahnia sp, Lepidosperma laterale, Leptospermum squarrosum, Xanthorrhoea arborea, Macrozamia communis* and *Astrotricha floccosa*. There were very few species in flower and those that were included *Glycine clandestine, Hemigenia purpurea, Pimelea latifolia* and *Xanthosia tridentata*.


Glycine clandestine pic:Richard Hunstead

The half-hour walk terminated at West Head Lookout. The spectacular site encompasses views north, across the Hawkesbury River to Lion Island and the Central Coast and across Pittwater to Barrenjoey Head and south, almost to the city. The dominant trees at the headland are *Angophora costata*, many with beautifully twisted and knobbed branches.

After the walk, we had lunch at Flower Power, on the Mona Vale Road and some talk reflected on the state of the bush, in the present dry conditions.


Airy home beside the track. pic: Ed.

FOR WHOM THE BELL TOLLS: CATS KILL MORE THAN A MILLION AUSTRALIAN BIRDS EVERY DAY

Theconversation.com October 4, 2017 John Woinarski, Charles Darwin University; Brett Murphy, Charles Darwin University; Leigh-Ann Woolley, Charles Darwin University; Sarah Legge, Australian National University; Stephen Garnett, Charles Darwin University; Tim Doherty, Deakin University

Galahs are among the many native species being killed by feral cats. Mark Marathon, Author provided

Cats kill more than a million birds every day across Australia, according to our new estimate – the first robust attempt to quantify the problem on a nationwide scale.

By combining data on the cat population, hunting rates and spatial distribution, we calculate that they kill 377 million birds a year. Rates are highest in Australia's dry interior, suggesting that feral cats pose a serious and largely unseen threat to native bird species.

This has been a contentious issue for more than 100 years, since the spread of feral cats encompassed the entire Australian mainland. In 1906 the ornithologist A.J. Campbell noted that the arrival of feral cats in a location often immediately preceded the decline of many native bird species, and he campaigned vigorously for action:

Undoubtedly, if many of our highly interesting and beautiful birds, especially ground-loving species, are to be preserved from total extinction, we must as a bird-lovers' union, at no distant date face squarely a wildcat destruction scheme.

His call produced little response, and there has been no successful and enduring reduction in cat numbers since. Nor, until now, has there been a concerted effort to find out exactly how many birds are being killed by cats.

Counting the cost

To provide a first national assessment of the toll taken by cats on Australian birds, we have compiled almost 100 studies detailing the diets of Australia's feral cats. The results show that the average feral cat eats about two birds every five days.

We then combined these statistics with information about the population density of feral cats, to create a map of the estimated rates of birds killed by cats throughout Australia.

We conclude that, on average, feral cats in Australia's largely natural landscapes kill 272 million birds per year. Bird-kill rates are highest in arid Australia (up to 330 birds per square km per year) and on islands, where rates can vary greatly depending on size.

IWe also estimate (albeit with fewer data) that feral cats in human-modified landscapes, such as the areas surrounding cities, kill a further 44 million birds each year. Pet cats, meanwhile, kill about 61 million birds per year.

Overall, this amounts to more than 377 million birds killed by cats per year in Australia – more than a million every day.

Which species are suffering?

In a related study, we also compiled records of the bird species being killed by cats in Australia. We found records of cats killing more than 330 native bird species – about half of all Australia's resident bird species. In natural and remote landscapes, 99% of the cat-killed birds are native species. Our results also show that cats are known to kill 71 of Australia's 117 threatened bird species.

Birds that feed or nest on the ground, live on islands, and are medium-sized (60-300g) are most likely to be killed by cats.

It is difficult to put a million-plus daily bird deaths in context without a reliable estimate of the total number of birds in Australia. But our coarse assessment from many published estimates of local bird density suggests that there are about 11 billion land birds in Australia, suggesting that cats kill about 3-4% of Australia's birds each year.

However, particular species are hit much harder than others, and the population viability of some species (such as quail-thrushes, button-quails and ground-feeding pigeons and doves) is likely to be especially threatened.

Our tally of bird deaths is comparable to similar estimates for other countries. Our figure is lower than a recent estimate for the United States, and slightly higher than in Canada. Overall, bird killings by cats seem to greatly outnumber those caused by humans.

In Australia, cats are likely to significantly increase the extinction risk faced by some bird species. In many locations, birds face a range of interacting threats, with cat abundance and hunting success shown to increase in fragmented bushland, in areas with high stocking rates, and in places with poorly managed fire regimes, so cat impacts compound these other threats.

Belling the cat

What can be done to reduce the impact? The federal government's Threatened Species Strategy recognises the threat posed by feral cats, albeit mainly on the basis of their role in mammal extinctions.

The threatened species strategy also prioritised efforts to control feral cats more intensively, eradicate them from islands with important biodiversity values, and to expand a national network of fenced areas that excludes feral cats and foxes.

But while fences can create important havens for many threatened mammals, they are much less effective for protecting birds. To save birds, cats will need to be controlled on a much broader scale.

We should also remember that this is not just a remote bush problem. 'Roughly half of Australias cats are pets, and they also take a considerable toll on wildlife.

While recognising the many benefits of pet ownership, we should also work to reduce the detrimental impacts. Fortunately, there is increasing public awareness of the benefits of not letting pet cats roam freely. With such measures, cat owners can help to look after the birds in their own backyards, and hence contribute to conserving Australia's unique wildlife.

We acknowledge the contribution of Russell Palmer (WA Department of Biodiversity Conservation and Attractions), Chris Dickman (University of Sydney), David Paton (University of Adelaide), Alex Nankivell (Nature Foundation SA Inc.), Mike Lawes (University of KwaZulu-Natal), and Glenn Edward s (Department of Environment and Natural Resources) to this article.

PETALS PRODUCE A 'BLUE HALO' THAT HELPS BEES FIND FLOWERS

Sciencedaily.com October 18, 2017 University of Cambridge

Ursinia speciosa is a member of the Daisy family. The region at the base of the petals contains a dark pigment, but appears blue due to the presence of disordered floral nanostructures on the cell surface.Credit: Edwige Moyroud

Latest research has found that several common flower species have nanoscale ridges on the surface of their petals that meddle with light when viewed from certain angles.

These nanostructures scatter light particles in the blue to ultraviolet colour spectrum, generating a subtle effect that scientists have christened the 'blue halo'.

By manufacturing artificial surfaces that replicated 'blue halos', scientists were able to test the effect on pollinators, in this case foraging bumblebees. They found that bees can see the blue halo, and use it as a signal to locate flowers more efficiently.

While the ridges and grooves on a petal surface line up next to each other "like a packet of dry spaghetti," when analysing different flower species the researchers discovered these striations vary greatly in height, width and spacing -- yet all produce a similar 'blue halo' effect.

In fact, even on a single petal these light-manipulating structures were found to be surprisingly irregular. This is a phenomenon physicists describe as 'disorder'.

The researchers conclude that these "messy" petal nanostructures likely evolved independently many times across flowering plant species, but reached the same luminous outcome that increases visibility to pollinators -- an example of what's known as 'convergent evolution'.

The study was conducted by a multidisciplinary team of scientists from the University of Cambridge's departments of plant sciences, chemistry and physics along with colleagues from the Royal Botanic Gardens Kew and the Adolphe Merkele Institute in Switzerland.

"We had always assumed that the disorder we saw in our petal surfaces was just an accidental by-product of life -- that flowers couldn't do any better," said senior author Prof Beverley Glover, plant scientist and director of Cambridge's Botanic Garden.

"It came as a real surprise to discover that the disorder itself is what generates the important optical signal that allows bees to find the flowers more effectively."

"As a biologist, I sometimes find myself apologising to physicist colleagues for the disorder in living organisms -- how generally messy their development and body structures can seem."

"However, the disorder we see in petal nanostructures appears to have been harnessed by evolution and ends up aiding floral communication with bees," Glover said.

All flowering plants belong to the 'angiosperm' lineage. Researchers analysed some of the earliest diverging plants from this group, and found no halo-producing petal ridges.

However, they found several examples of halo-producing petals among the two major flower groups (monocots and eudicots) that emerged during the Cretaceous period over 100 million years ago -- coinciding with the early evolution of flower-visiting insects, in particular nectar-sucking bees.

"Our findings suggest the petal ridges that produce 'blue halos' evolved many times across different flower lineages, all converging on this optical signal for pollinators," said Glover.

Species which the team found to have halo-producing petals included Oenothera stricta (a type of Evening Primrose), Ursinia speciosa (a member of the Daisy family) and Hibiscus trionum (known as 'Flower-of-the-hour'). All the analysed flowers revealed significant levels of apparent 'disorder' in the dimensions and spacing of their petal nanostructures.

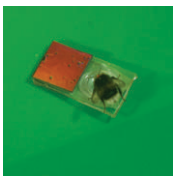
“The huge variety of petal anatomies, combined with the disordered nanostructures, would suggest that different flowers should have different optical properties," said Dr Silvia Vignolini, from Cambridge's Department of Chemistry, who led the study's physics team. "However, we observed that all these petal structures produce a similar visual effect in the blue-to-ultraviolet wavelength region of the spectrum -- the blue halo.”

Previous studies have shown that many species of bee have an innate preference for colours in the violet-blue range. However, plants do not always have the means to produce blue pigments.

"Many flowers lack the genetic and biochemical capability to manipulate pigment chemistry in the blue to ultraviolet spectrum," said Vignolini. "The presence of these disordered photonic structures on their petals provides an alternative way to produce signals that attract insects.”

The researchers artificially recreated 'blue halo' nanostructures and used them as surfaces for artificial flowers. In a "flight arena" in a Cambridge lab, they tested how bumblebees responded to surfaces with and without halos.

Their experiments showed that bees can perceive the difference, finding the surfaces with halos more quickly -- even when both types of surfaces were coloured with the same black or yellow pigment.



Using rewarding sugar solution in one type of artificial flower, and bitter quinine solution in the other, the scientists found that bees could use the blue halo to learn which type of surface had the reward.

"Insect visual systems are different to human ones," explains Edwige Moyroud, from Cambridge's Department of Plant Sciences and the study's lead author. "Unlike us, bees have enhanced photoreceptor activity in the blue-UV parts of the spectrum.”

“Humans can identify some blue halos -- those emanating from darkly pigmented flowers. For example the 'black' tulip cultivar, known as 'Queen of the night'.”"However, we can't distinguish between a yellow flower with a blue halo and one without -- but our study found that bumblebees can," she said.

The team say the findings open up new opportunities for the development of surfaces that are highly visible to pollinators, as well as exploring just how living plants control the levels of disorder on their petal surfaces. "The developmental biology of these structures is a real mystery," added Glover.

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QUANDONG — THE VERSATILE OUTBACK SUPERFOOD THAT CAN CURE A TOOTHACHE

ABC October 16, 2017 Aimee Volkofsky

A haul of quandongs harvested in Menindee in a wooden bowl made by Ngiyampaa elder, Beryl Carmichael. (ABC: Aimee Volkofsk)

Stewed, dried or raw the quandong is one of Australia's most versatile bush foods — so versatile in fact that it can also be used to aid with foot massages or cure toothache.

The native fruit, a member of the sandalwood family, grows throughout arid and semi-arid areas of Australia.

In far-west New South Wales the fruit trees are sought out and cultivated enthusiastically, being one of the few drought-tolerant fruit trees around.

An authentic Australian dessert.

Greg Reghenzani from Broken Hill, said he loved the tree's resilience and versatility. "The fruit's good for you, full of vitamin C, you can dry them and they'll keep for eight years, and the seeds can be used for essential oils too," Mr Reghenzani said.

Beryl Carmichael, a Ngiyampaa elder from Menindee, said the quandong kernel, inside the seed, could also be used for toothache.

"If you had a sore gum, or gum boil, or tooth ache, they'd make a paste out of it and put it on their gums," she said.

Mr Reghenzani said he had found many uses for the seeds, including using a bucket-full to tread on for a foot massage, and giving them to people make essential oils from the kernel.

But it is their taste that has people coming back.
The sweet and tangy fruit is enjoyed raw and very often stewed and used as a pie filling.

Mr Reghenzani said the fruit was ready just at the right time to enjoy during the festive season. "Friends leave here with quandong pies all the time, it's a beautiful thing to have around Christmas."

Just a beautiful tree

If you are serious about quandongs you have to have an eye for spotting the trees, in the wild, or in your neighbourhood.

While he has many of his own, Mr Reghenzani prides himself on knowing the whereabouts just about every tree in Broken Hill.

"They're native, you don't have to water them, we don't spray them or do anything with them, they're just a beautiful tree," he said.

"They're such a prolific tree that I think it overwhelms people sometimes."
He said he was not afraid to knock on a door if he saw fruit going to waste.
"Sometimes they'll be falling on the ground," Mr Reghenzani said. "Let me put it this way, you gotta know how to jump a fence."

The fruit grows wild throughout far west NSW and was highly sought after by Indigenous groups before white settlement and during times families were displaced or mover on to missions.

Ms Carmichael, said she vividly remembered the first time she ate a quandong. "We were heading out to Wirryilka station (where her mother worked) and on the road there was this great big quandong tree, a really big one," she said.

(ABC: Aimee Volkofsky)

"Mum said 'Oh, there's the quandongs!', so all the kids jumped out the wagon and went over and sat under it and picked and picked and ate and ate. "That was the first time and I've never looked back."

Ms Carmichael said quandong season was greatly anticipated by the Ngiyampaa people. "We call it the Kawantha, or wild peach," she said. "The kids would rave over them, even the old people, once they seen the bush fruits coming alive on the trees, they'd just run to get them and eat them. "When they went gathering you were told to only take from the tree what your needs were, not to be greedy, just take what your needs are, no more."

Ms Carmichael said her mother taught her to make pies but she had found many other uses for the fruit. "You can make juice and have a drink out of it, you can store them or freeze them to use later on, make quandong pies, or tarts," she said.

SEASHORE SCIENCE

Connected Catchments & CoastDiscover the fascinating science behind our favourite places on the Northern Beaches in a series of talks throughout **November**.

Waterways - Wed 1 Nov, 6 - 7.15pm
Lagoons - Form Function and Environment
A fascinating talk about the four Northern Beaches lagoons, their history, changes to their catchments
Resilient waterways – Restoring our lagoons and wetlands
Associate Professor Will Glamore is a highly awarded Principal Research Fellow at the Water Research Laboratory based at Manly Vale.

Microplastics - Wed 15 Nov, 6 -7.15pm
Microplastics: More than a drop in the ocean
Ecotoxicologist Dr Scott Wilson from Macquarie University
Drowning in Debris – Microplastics and Marine Mammals
Dr Michelle Blewitt from the Coastal Environment Centre is an expert on marine mammals.

Sydney's cryptic corals - Wed 22 Nov, 6 -7.15pm
A/Prof David Suggett a coral expert from the University of Technology Sydney will talk on the vibrant coral populations corals that live in Sydney Harbour.

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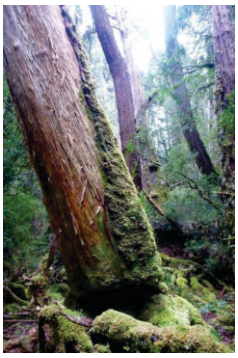
WRITTEN IN KING BILLY'S TREE RINGS: 1700 YEARS OF CLIMATE HISTORY

Science matters October 2, 2017 Eisha Gupta, University of Melbourne

The iconic King Billy Pines of Cradle Mountain offer a glimpse into climate history, with the publication of one of the longest tree-ring chronologies in the Southern Hemisphere.



Hikers traversing the world famous Overland Track between Cradle Mountain and Lake St Clair in western Tasmania occasionally find themselves wandering from alpine scrubland into forests of towering King Billy Pines.

Found only in Tasmania, these conifer trees, named for Tasmanian Aboriginal William Lanne (known as King Billy), can live for more than 1000 years, and their wood contains an environmental history of every one of those years.

Tasmania's iconic King Billy pines offer an insight into the area's climate history. Picture: Supplied

After eight years of sampling, measuring, cross-referencing and computer matching, an international research team has built a 1700-year King Billy Pine tree ring chronology. It is only the second Australian tree-ring chronology to exceed 1200 years, and it is the first published King Billy Pine chronology to exceed 1000 years.

They also produced reconstructions of historic streamflows in western Tasmania from hundreds of years ago and are working on reconstructing historic temperatures.

The streamflow reconstructions will help us to better understand the natural variability in water resource availability over time. Tasmanian water managers will, for example, be able to use these long reconstructions to test just how unusual the dry winter period between 2015 to autumn 2016 was, and whether the floods and heavy rain in the winter and spring of 2016 were unprecedented.

These studies collectively help to build a clearer picture of our climate history, stretching back over the last millennium and beyond. In particular, they are allowing researchers to put current changes into a longer-term context.

Reading the trees

To build the 1700-year Cradle Mountain chronology, published in the journal Dendrochronologia, the team of researchers from Australia, the U.S. and New Zealand, collected over 200 core samples from both living and dead trees from Weindorfers Forest and Mount Kate, near Cradle Mountain in the Tasmanian Wilderness World Heritage Area. Using a hand-held increment corer, the researchers extracted samples that were thinner than a drinking straw. They were taken to a laboratory where they were dried and rubbed down with sandpaper so that the annual rings stood out clearly – even cellular details were visible.

Lead author Dr Kathy Allen, from the School of Ecosystem and Forest Sciences at the University of Melbourne, says these rings contain much more information than just the age of the tree.

“Details like the thickness of a tree-ring, the density of the wood and the morphology of cells, can give insights into temperatures, water availability and major disturbances like bushfires,” she says.

To build a coherent chronology from the many cores they collected, researchers used a technique called cross-dating, in which a long series of ring width patterns are matched across the site. This is first done visually, after which the rings are measured under a microscope using a sliding measurement scale attached to a computer. The final stage involves the use of statistical methods, such as correlation-based techniques, to confirm the chronological age of the samples. As long as the researchers could keep finding cores that overlapped in time, they could continue to build longer and longer chronologies.

Building a climate history

Recurring fires are threatening the iconic snow gum.

One of the keys to this cross-dating is what are called pointer years. Pointer rings are identified as years for which a large proportion of samples across the site have a very wide or a very narrow ring that typically reflect the impact of either very severe or very benign conditions over the growing season, e.g. low temperatures, drought or heavy rainfall. By identifying these pointer years across many of the trees at the site, a 'site pattern' is built that helps with the cross-dating process.

“For instance, in 1912, the trees laid down a very narrow ring because of cool conditions,” says Dr Allen.They found wood from trees that had died around the late 800s AD, with some having end dates earlier than that.

The researchers compared their King Billy Pine chronology to a 3600-year tree-ring chronology of fire-sensitive Huon Pine trees from nearby Mount Read. Based on the composition of the Mount Read chronology, it is apparent that many trees were established after 1150 AD, suggesting good conditions for establishment at that time, such as an absence of fire. In contrast, the much more consistent establishment pattern at Cradle Mountain is consistent with an absence of intense fires for the entire 1700 year record.

Collecting a core sample from a King Billy pine. Picture: Supplied

Dr Allen says this shows the importance of collecting and comparing multiple data sets to get a more complete picture of the role fire, or climate parameters like temperature and rainfall, have played in the landscape over long periods.

“The chronology is one piece of a big jigsaw puzzle that is building a record of past environmental conditions,” she says. “On its own, you wouldn't use this chronology to reconstruct the past climate because the climate signal is not particularly strong. However, it may make a useful contribution in a temperature reconstruction model that uses many other records as well. When we have sets of climate-sensitive chronologies we can start to build a picture of what the past climate was like, though always with some uncertainties.”

The research into tree chronologies gives a longer term perspective into climate and temperature records that can help understand current climatic patterns.

“If we understand what climate was like in the past and how this affected the environment, it can provide some important clues as to what we might expect to happen as the climate continues to change into the future,” Dr Allen says.

This study was part of an Australian Research Council funded project.