CALEYI

Australian Plants SOCIETY NSW

NORTHERN BEACHES GROUP

austplants.com.au/Northern-Beaches

September 2018

Australian Plants Society Northern Beaches Group
Contact us at
northernbeaches@austplants.com.au

President
Dr Conny Harris (02) 9451 3231
Vice-President
David Drage (02) 9949 5179
Secretary
Julia Tomkinson (02) 9949 5179
Treasurer
Lindy Monson (02) 9953 7498
Regional Delegate
Harry Loots (02) 9953 7498
Librarian
Jennifer McLean (02) 9970 6528
Talks Co-ordinator
Russell Beardmore 0404 023 223
Walks Co-ordinator
Penny Hunstead (02) 9999 1847
Catering Officer
Georgine Jakobi (02) 9981 7471
Editor
Jane March 0407 220 380

Next Meeting: **7.15 pm Thursday September 6, 2018** at Stony Range Botanic Garden, Dee Why.
Presentation: Show & Tell, Don't forget to bring your specimens, photos and annecdotes to share. Always a fun session.
Supper: Julia & David.

Coming Up:
Sunday September 9 Stony Range Spring Festival. Set up 9 am Saturday September 8. More volunteers are needed for plant advice and coffee service on Sunday. Please let me know if you can spare an hour or more on 0407 220 380.

From the Editor
Thankyou Jennifer for the terrific report of the visit to Conny's regeneration area and to Conny and Anthony for the great sourdough bread, cheeses, coffee and cake.

Please send your stories, photographs etc that other members would enjoy to me at march@ozemail.com.au

AUGUST WALK AT BELROSE

Jennifer McLean

This month Conny, our President, invited us to visit the bush regeneration project that she and a team of volunteers have been working on for nearly four years.

The site, owned by the Aboriginal Land Council, is north of Morgan's Road, Belrose, adjacent to private properties on the southern boundary and otherwise surrounded by Garigal National Park. From the highest vantage point there is a view across the valley to the communication towers of the SES and RFS at Terry Hills.

In less than four years the site has been totally transformed from its weed infested state to a delightful, recovering dry schlerophyll forest. Together with the dedicated weeding program and a prescribed control burn, the abundant seed bank hidden beneath the weeds has revealed its potential.

This is bushland we could never have imagined on our previous visit several years ago.

Surviving large trees include *Eucalyptus punctata, E racemosa E gummifera* and *Angophora hispida*. Unfortunately, in a newly created water course caused by an unsympathetic development, many of the oldest trees have died due to water logging.

Perhaps, due to this extended wet area, and certainly where wet is naturally occurring, prolific numbers of different Sedges and Rushes occur. Of these we noted two species of *Ghania* one being *G erythrocarpa*, two species of *Restio, R gracilis* and *R complanatus, Schoenus melanostachys* and *Caustis flexuosa.* Also *Viminaria juncea* thriving here.

Among the shrubs we saw, was the early coloniser *Dodonaea triqueta*. Also *Kunzea ambigua, Phebalium squamulosum, Woolsia pungent,*

Boronia ledifolia and *B pinnata,* and *Eriostomen australasius.* There were several *Lomandras* including *L filiformis* and *L obliqua. Xanthorrhoea resinosa* is also in abundance.

Smaller species include the stink weed, *Opercularia aspera, Actinosis helianthi* and *A minor, Tetratheca ericifolia, Damperia stricta* and one Stylidium species. There are too many to mention, but others include plants of Poaceae and Ferns and, although we didn't see it on the day, the rare onion orchid, *Microtis angusii* also grows here.

Gahnia research time. Ed.

At the end of our tour, Conny provided us, for our refreshment, her delicious home made sour dough bread with cheeses and fresh vegetables which we washed down with pure rainwater and freshly brewed coffee, whilst enjoying the company and conversation of our fellows. Thank you Conny for your hospitality and showing us the great result of your dedication to our native environment.

EVOLUTION OF CHINA'S FLOWERING PLANTS SHOWS EAST-WEST DIVIDE BETWEEN OLD, NEW LINEAGES

www.sciencedaily.com January 31, 2018 Florida Museum of Natural History

New research shows that eastern China is a floral 'museum' with a rich array of ancient lineages and distant relatives while the western provinces are an evolutionary 'cradle' for newer and more closely related species. Credit: Florida Museum photo by Jenny Xiang

An international team of scientists has mapped the evolutionary relationships between China's 30,000 flowering plant species, uncovering a distinct regional pattern in biodiversity. Eastern China is a floral "museum" with a rich array of ancient lineages and distant relatives while the western provinces are an evolutionary "cradle" for newer and more closely related species.

The findings highlight the need for more conservation efforts in densely populated eastern China, home to many threatened plant species and the country's top biodiversity hotspots.

Better connecting eastern China's nature reserves and parks, currently fragmented by urbanization and provincial borders, would help conserve plant lineages and the animals that depend on them, said Pam Soltis, one of the study's senior authors and a distinguished professor and curator at the Florida Museum of Natural History.

"Conservation is not just about protecting species numbers but also protecting evolutionary diversity and processes," said Soltis, who is also the director of the University of Florida Biodiversity Institute. "Focusing just on how many species are in an area, rather than how different they are from one another genealogically, could lead to conservation practices that miss important sections of the Tree of Life. Both are key measures of biodiversity. This study helps spotlight what is missing in China's current protective strategies."

In a study led by Li-Min Lu of the Chinese Academy of Sciences, researchers produced the first dated phylogeny -- a family tree of organisms showing when new species appeared -- for all of China's flowering plant species, or angiosperms, and mapped their distributions using 1.4 million museum specimen records.

The team published its results today in the online edition of Nature. Co-senior authors are Zhi-Duan Chen of the Chinese Academy of Sciences, Jian-Hua Li of Hope College and Pam Soltis and Doug Soltis of the Florida Museum and UF.

The researchers found that about 66 percent of angiosperm genera in China did not originate until the early Miocene, about 23 million years ago. Mean species divergence times -- when species first appeared -- were 22-25 million years ago in the East and 15-19 million years ago in the West.

Over the past 30 million years, herbaceous plants -- those without a

woody stem -- diversified much more quickly than woody plants such as shrubs, trees and vines.

China is home to about 10 percent of the world's flowering plant species, outstripping the number of angiosperm species in the U.S. by more than 3.5-fold. Its varied geography and climate contribute to its wealth of biodiversity. The hills, lowlands and plains in the warmer, more tropical East gradually rise to the West's rugged mountains, deserts and the Qinghai-Tibetan Plateau, the highest tableland in the world.

Unlike North America and Europe, China did not undergo the dramatic ecological turnover driven by glaciation in the ice age about 2.58 million to 11,700 years ago, allowing ancient plant lineages to persist in the East and newer lineages to be folded into ever-diversifying plant communities.

"China didn't experience that big type of cataclysmic event," said Doug Soltis, a distinguished professor and curator at the Florida Museum and professor in the UF department of biology. "That allowed it to be more of a museum than other parts of the Northern Hemisphere."

The uplift of the Qinghai-Tibetan Plateau in the West, caused by India's collision with Eurasia, spurred the region's evolutionary explosion of new species by opening up myriad new habitats and creating a cool, arid western climate. The West became a cradle for newer herbaceous plants while the East remained a museum for older herbaceous plants and both a museum and a cradle for woody plants.

The study shows that eastern China is home to the country's top biodiversity hotspots of flowering plants, such as this magnolia. But conservation areas in the region tend to be small and highly fragmented. Credit: Zhi-Duan Chen

The researchers used species distribution data to map China's areas of genetic richness, pinpointing several eastern provinces as home to the country's greatest genetic diversity of flowering plants: Guangdong, Guanxi, Guizhou, Hainan and Yunnan. Conservation in the East, however, is carried out on a much smaller, more fragmented scale than in the sparsely populated West, where large swaths of land are preserved.

"It's good to preserve these areas with recent radiations of new species, but what's missing is extensive protection of these older eastern lineages," Doug Soltis said. "This study helps us better see the discrepancies between where conservation areas are and where the diversity actually is located. Scientists didn't realize the importance of protecting genetic diversity -- and not just rare species -- until the last few decades, but we couldn't measure this type of diversity in a rigorous way until the last 10-15 years."

The researchers pointed to the value of museum collections in enabling this country-scale study of thousands of plant species spanning millions of years of evolution. Each plant specimen, painstakingly collected and preserved in herbaria over the past century and digitized, contributed to an enormous dataset that offered a detailed snapshot of China's diversity of flowering plants.

"How do you do something like this without relying on millions of collections?" Pam Soltis said. "Without all those data, it's impossible. The question of how communities of organisms came together and changed over time is unanswered for nearly all groups. Pinning down the history of 30,000 species -- nearly 10 percent of the planet's flowering plant life -- is a major leap forward."

Lead author Lu said the study provides a model for many other landscape-scale studies of biodiversity.

"We feel that the importance of this study extends beyond plant biology to other lineages of organisms and other regions of Earth," she said. "Both the approaches used and the results are also of broad interest to scientists and the public who are concerned with the conservation of biodiversity."

PARROTS EXPLOIT QUANTUM PHYSICS TO PRODUCE THEIR COLOURFUL FEATHERS

ABC Science July 4, 2018 By science reporter Belinda Smith

Unlike most birds, the colours on this yellow-naped amazon parrot don't come from its diet. (Getty Images: Joel Sartore, National Geographic Photo Ark)

Parrots boast some of the most vibrant and varied colour palettes in the animal world — and it seems they have quantum physics to thank.

New Zealand research published in the Royal Society Open Science journal found a parrot's red feathers contain the same pigment molecules used to make yellow feathers - just arranged differently.

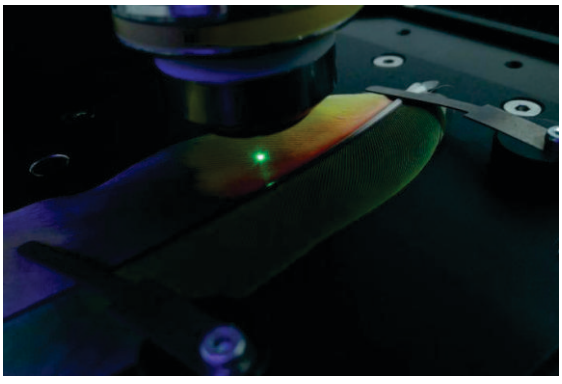
Unlike other birds, parrots don't rely on what they eat to colour their feathers red, orange and yellow. Instead, they get their warm hues from a particular group of pigments called "psittacofulvins", said Monash University ornithologist Kaspar Delhey, who wasn't involved in the study. But exactly how these special pigments do their job has been a bit of mystery.

Shine a light on parrot feathers (literally)

For the new study, the researchers, led by University of Otago physical chemist Jonathan Barnsley, got hold of a multicoloured tail feather from a yellow-naped amazon parrot (Amazona auropalliata).

They looked at its yellow and red patches using a technique called Raman spectroscopy, which takes advantage of the fact molecules vibrate when illuminated by laser light.

"Each molecule can have a number of different vibrations which make up a signature 'chord' and we detect that," Mr Barnsley said. "This vibration information tells us what the molecules are and what they're up to in the sample."



In Raman spectroscopy, molecules vibrate when bathed in laser light, and this tells chemists about how they are arranged. (Supplied: Jonathan Barnsley)

They found both yellow and red patches contained the same type of psittacofulvin pigment molecule - one that usually bestows a yellow hue.

What differed, though, was how the molecules were arranged. In the yellow patch, pigment molecules appeared to be separated. But in the red, they were snuggled up close.

So how does the closer arrangement of yellow pigment molecules turn a feather red? Here we enter the gnarly world of quantum physics. If you move molecules closer or further apart, what's called the "energy gap" also changes.

This gap affects what wavelengths of light are absorbed and reflected or transmitted — and changes the colour we see.

Evolutionary conundrum

That parrots can create colour by arranging molecules poses an interesting evolutionary question, Dr Delhey said. In other birds, reds and yellows are created by pigments called carotenoids which come from food.

The classic example is the flamingo, which gets its pink blush from its diet of shrimp and algae.

Flamingos' feathers, legs and face are coloured by their food, which is rich in carotenoid pigments. (Pixabay: allyartist)

"If you can eat a lot of food that has those pigments, and you can put them in your feathers," Dr Delhey said.

This could have an evolutionary advantage, he added, as more vibrant colour might demonstrate the bird is a good forager, for instance, and be more attractive to the opposite sex.

But given parrots create vibrant colours independent of diet, this raises the question: why bother with the colours at all? "Parrots are interesting because they're one of the most colourful groups and we don't know why," Dr Delhey said.

During his work, Mr Barnsley also noticed some parrot species' feathers absorbed ultraviolet light, which is invisible to us, and re-emitted it as visible coloured light — known as fluorescence.

How and why this happens is a mystery, but he suspects this quirk also hinges on pigment arrangement. Still, we'll soon know how widespread this pigment trick is in parrots. Mr Barnsley is giving other parrot species the Raman spectroscopy treatment.

And in the meantime, materials scientists could pick up a few tricks from our feathered friends. Instead of designing new expensive molecules, they might find new ways to "tune" and reorganise simpler, cheaper materials. "Nature starts with simple materials and, through interactions, results in some really complex materials," Mr Barnsley said.

"I think we can learn a lot from that."

KOALA GENOME SHOWS HOW THE ADORABLE MARSUPIAL LIVES ON EUCALYPTUS LEAVES

washingtonpost.com July 2, 2018 Joel Achenbach

A sleeping koala. (Rebecca Johnson/Australian Museum Research Institute)

Before we get to the science, let's all just admit we want a koala. So cute!

The koala challenges the kangaroo as the most iconic Australian marsupial. It is a very peculiar animal, spectacularly specialized, living in eucalyptus trees and surviving almost entirely on their leaves, which are highly toxic to most organisms.

But not just any eucalyptus trees: There are about 600 species of eucalyptus, and koalas can be found in just 120 of them, of which only 20 species provide the bulk of the koala diet. And koalas are fanatically choosy about their leafy greens, favoring the ones high in nutrition and water content and pausing to bury their adorable Yoda-like faces in the leaves for a big sniff before nibbling.

So they're definitely not generalists. "You're talking about a niche within a niche," says Rebecca Johnson, director of the Australian Museum Research Institute. Johnson and dozens of Australian colleagues on Monday published the full koala genome in the journal Nature Genetics.

The biological instructions for the making of a koala shed light on how this animal survives. One finding is that the koala has an unusual number of genes that encode for enzymes that can break down toxins in leaves.

The genetic information could prove crucial in conserving koalas, which are a threatened species because of disease and habitat fragmentation. One immediate goal for conservationists would be to use the genetic data to improve vaccines already being deployed to prevent the spread of chlamydia, a bacterium that causes blindness and urinary tract inflammation among koalas, said study co-author Katherine Belov, a University of Sydney professor of comparative genomics.

They're big sleepers. A koala sleeps about 14½ hours a day. The remainder of its day is devoting to eating and resting. It moves, on average, four minutes a day.

The koalas, Johnson said, "are basically wombats that decided to go into the trees." They must have faced less competition for food in the trees as they evolved.

Koalas endured a die-off roughly 30,000 years ago for unknown reasons and then took another hit when Europeans arrived in Australia more than two centuries ago and used koala fur to make hats.

Koalas live all along the east coast of Australia, where most of the human population is, but they form two distinct genetic populations. In the north, they are genetically diverse but falling in number because of urbanization and deforestation.

In the south, they're all over the place, and indeed in many cases are starving as they strip trees bare. But they descend from a tiny founder population, probably established from captive animals two centuries ago after European colonists wiped out most of the wild population. They're inbred.

"When you have very low genetic diversity, the animals become essentially immunological clones. So any change in disease, change in temperature, change in climate, can potentially affect the entire population," Belov told The Washington Post. "You can say there's a lot of animals but that doesn't mean there's a genetically healthy population."

A niche existence, especially an inbred one, is precarious on a rapidly changing planet experiencing global warming and the direct impacts of human civilization.

Koalas experienced a precipitous population decline about the same time that much of Australia's megafauna vanished more than 30,000 years ago. Human predation seems unlikely, Johnson said. According to traditional knowledge among Aborigines, koalas were considered sacred in many communities, Johnson said. Archaeologists have not found koala remains in human middens, she said.

So it's unclear what drove the collapse of the prehistoric population. "It's very likely to be some large-scale environmental change," Johnson said.

BOONGALA NATIVE GARDENS & RAINFOREST OPEN DAYS

Plant sales, open gardens & rainforest walk.

Enjoy a walk around 'Boongala Native Gardens' an 11 acre property which displays a diverse collection of native flora from around Australia. The gardens have been developed over a number of years by Mal and Jenny Johnston and includes a lush rainforest which has been maturing for the last 25 years.

Open Friday, Saturday, Sunday & Monday – 10am to 4pm
from Friday 31st August to Monday 24th September 2018
Entry to gardens – Adults $2, Children free (Donated to the Royal Flying Doctor) Rainforest Guided Tour – Adults $3, Children free
Address – 76 Pitt Town Road, Kenthurst

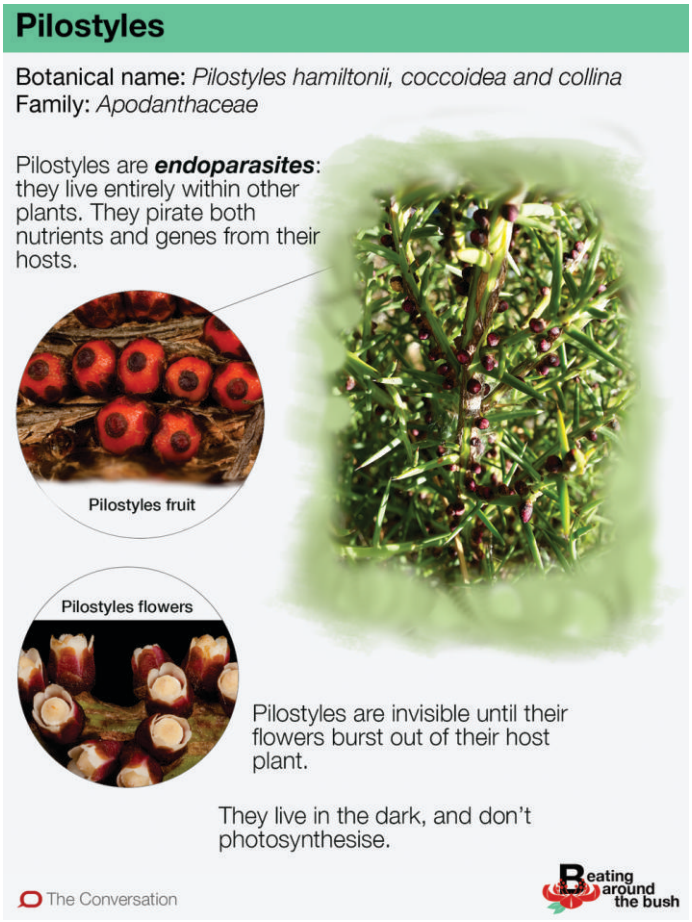
THE MYSTERIOUS PILOSTYLES IS A PLANT WITHIN A PLANT

The Conversation August 10, 2018 Steve Wylie, Murdoch University, Jen Mccomb, Murdoch University, Kevin Thiele, University of Western Australia

Pilostyles are only visible when their fruit and flowers erupt out of their host plants.

In 1946, forestry officer Charles Hamilton found something unusual on a shrubby native pea plant growing in Mundaring, near Perth. The pea had strange knobs on its stems, which looked like odd (and very un-pea-like) flowers.

When he showed these to government botanist Charles Gardner, Gardner initially dismissed them as "galls" (the plant equivalent of warts). However, a closer look quickly changed the story. Gardner realised he was holding a specimen of one of the world's most extraordinary flowering plants. In 1948, he described it as Pilostyles hamiltonii.



Botanical Aliens

To get a sense of Gardner's initial dismissal and later fascination, we need to describe Pilostyles. Most plants have a familiar structure of roots, stems, leaves and flowers, and grow in the ground. But a few plants abandon these to become parasites.

The strikingly beautiful Western Australian Christmas tree (Nuytsia floribunda), for example, looks like a normal tree, but it has specialist root structures that tap into the roots of other plants, stealing a free meal from them.

Pilostyles has taken parasitism to another level as an "endoparasite": it lives inside its host. Unlike almost all other plants, Pilostyles has abandoned stems, leaves and roots. When not flowering, it lives inside its host, as pale threads of cells within the host's roots and stems, from which it acquires all its nutrients.

Only when flowering is Pilostyles visible externally, the flowers erupting from the stems of its host like a weird botanical Alien.

Three species of Pilostyles occur in Australia, all of them in Western Australia. Each has a specific host. Pilostyles hamiltonii only grows in plants in the genus Daviesia, P. collina in the poison-pea genus Gastrolobium and P. coccoidea – described only a few years ago – in Jacksonia.

Another seven species occur outside Australia, and they also infect shrubby relatives of peas.

Pilostyles flowers are about the size of a match head. They appear on stems after its host has finished its own flowering. Thus, the host plant seems to flower twice in a year, but with completely different flowers.

Curious creatures

Much mystery surrounds Pilostyles. Unlike its host plant, Pilostyles plants are either male or female, and the two sexes rarely, if ever, colonise the same host plant. They seem to be able to recognise a host that is already occupied by another Pilostyles plant. The pollen from a male flower must find its way to a female flower located on another host plant.

Although various insect species have been seen feeding on their flowers, it is uncertain which are effective pollinators and if Pilostyles has specialist pollinators.

Its fruit rots quickly when it falls to the ground. The tiny seeds are less than 1mm long, and each has an embryo of only eight cells and a very small amount of stored food. How the seeds are distributed, and how they recognise their host species amongst all the other plant species growing nearby is unknown. Other parasitic plants recognise root exudations from their hosts, but this is not proven for Pilostyles.

Because Pilostyles lives in the dark and doesn't photosynthesise, it has no apparent need for chloroplasts, the cell structures that synthesise sugars from carbon dioxide, water and sunlight and give other plants their green colouration.

Chloroplast have their own genomes because they are thought to originate from free-living cyanobacteria that themselves parasitised other cells to become the first plants.

Surprisingly, Pilostyles still retains remnant choloroplasts with tiny genomes that contain only five or six active genes. These are the smallest chloroplast genomes ever described. In comparison, the chloroplast genome of wheat encodes about 230 genes.

Several genes in the Pilostyles nuclear genome closely resemble genes of its host, suggestive that the parasite is not only pirating nutrients from its host, but also its genes. This phenomenon is called horizontal gene transfer, and it is relatively common amongst plants that are parasites.

Pilostyles was once regarded as being closely related to an equally bizarre plant, the famous giant-flowered Rafflesia from South-east Asia, which grows as an endoparasite inside a tropical vine. (Also known as the "corpse flower", the only visible part is the enormous flower that smells like rotting meat.)

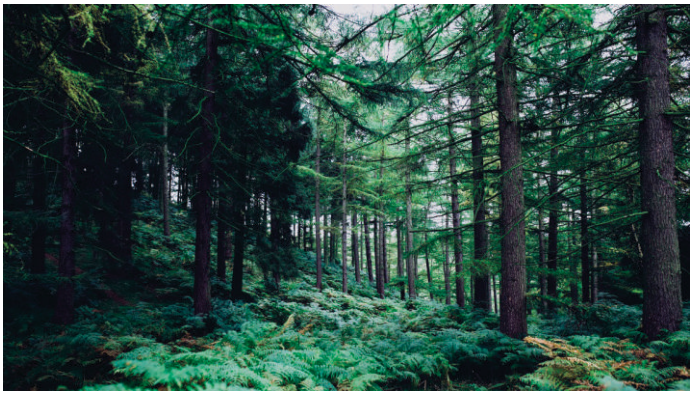
At that time, taxonomists classified plants according to overall resemblance, and Pilostyles and Rafflesia resemble one another – in both being endoparasites. However, DNA extracted from Pilostyles flowers shows that resemblance is deceiving. Pilostyles is, in fact, more closely related to pumpkins than it is to Rafflesia.

The ancestor of today's Pilostyles rejected life as a green plant living in sunlight, instead worming its way into the body of another plant. Over evolutionary time, Pilostyles has survived ice ages and tectonic plate movements and now exists as ten described species living on five continents. The mysterious Pilostyles reminds us of the incredible tenacity and adaptability of life.

FORESTS PULL OFF A USEFUL LIGHT TRICK

australiascience.tv August 22, 2018 Associate Professor Alan Duffy is an astronomer and physicist at Swinburne University of Technology, Melbourne.

Volatile gases emitted by trees scatter light to increase its availability to leaves.



Forest trees emit volatile compounds that scatter sunlight so that it reaches more leaves.

That “pine-smell” you enjoy during a walk in the woods doesn't just lighten your mood. It lights the entire forest itself.

Research published in the journal Nature Geoscience Letters, and led by Alexandru Rap of the University of Leeds in the UK, has found that the “smell” of a forest, caused by vast quantities of biogenic volatile organic compounds (BVOCs), increases the scattering of direct sunlight and allows it to reach the wider plant-canopy.

Illuminating more of the canopy leads to increased overall growth, more than offsetting the substantial cost in creating the volatiles to the plants, that captures an additional 1.23 billion tonnes of carbon each year.

The impact of these BVOCs was estimated in a simulation framework that included a global aerosol model to track their release across different habitats. It also employed a radiation model that changed the resultant sunlight, and a land surface scheme to model the resulting growth. These models have previously been used to estimate the impact of mass burn-offs in the Amazon region.

The modelling allowed researchers to explore the relatively uncertain range of global BVOCs production, as well as their changing impact on plant response – with some regions actually suffering a small decrease in growth.

The greatest impacts were in South America and central Africa, where direct sunlight scattered into an additional 10 watts of diffuse lighting across each square metre. This drove growth which sequestered an additional 0.2 grams of carbon per day per square metre. Taken globally, the growth more than compensated for the decline in certain regions.

The global impact of BVOCs is a positive feedback loop in which the drive they give to increased plant growth leads to boosted production of BVOCs, which, in turn, further help the plants to grow. Researchers claimed the “magnitude of this feedback is also likely to rise as global climate warms”, and hence that this “diffuse radiation fertilisation effect” should be included in future terrestrial carbon sink models of Earth.

Unfortunately, future land use change, such as large-scale land clearances, have the opposite impact and may partially negate these benefits in the future. For now, at least, the sweet smell of the forest is good for your mood as well as the planet.

This article was first published by Cosmos and is reproduced here with permission.

CA-RANG-GEL SANCTUARY

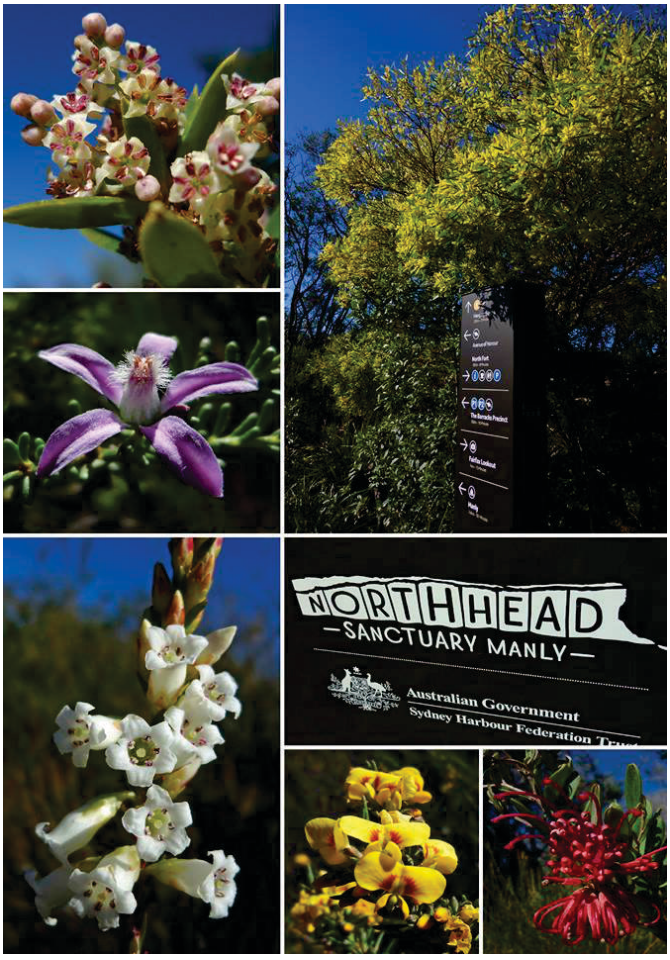
North Head Sanctuary Foundation; Sydney Harbour Federation Trust. Photos: Wildlife Willoughby

Eastern Suburbs Banksia Scrub is a Critically Endangered Ecological Community that once occupied around 5,300 hectares of land between North Head and Botany Bay in Sydney's eastern suburbs. Much of it tragically has been destroyed and built on, leaving only surviving stands totalling approximately 146 hectares that have been recorded from the local government areas of Botany, Randwick, Waverley and Manly.

Ca-rang-gel Sanctuary (also called North Head Sanctuary) at Manly is the closest area to Willoughby where this complex and beautiful habitat of heathland and hanging swamps can be easily explored. A network of boardwalks throughout the site not only make for easy walking but also protect the habitat from foot traffic.

Rich in history and a special place for the Aboriginal people, the dramatic cliffs of North Head form a memorable entry to Sydney Harbour. You'll see not only diverse wildlife and flora but military fortifications and memorials as well as stunning views of the city and harbour from the cliff tops.

As we head towards spring, the heathlands start to bloom with an awe-inspiring array of wildflowers including the following pictured clockwise from left: Tree Broom Heath (Monotoca elliptica); Sydney Golden Wattle (Acacia longifolia); Red Spider Flower (Grevillea speciosa); Heathy Parrot Pea (Dillwynia retorta); Blunt-leaf heath (Epacris obtusifolia; and Wax Flower (Philotheca salsolifolia).



An excellent guide to the wildflowers of this area and more information about this fascinating place can be found on the North Head Sanctuary Foundation's website at
www.northheadsanctuaryfoundation.org.au/…/Flower%20D…