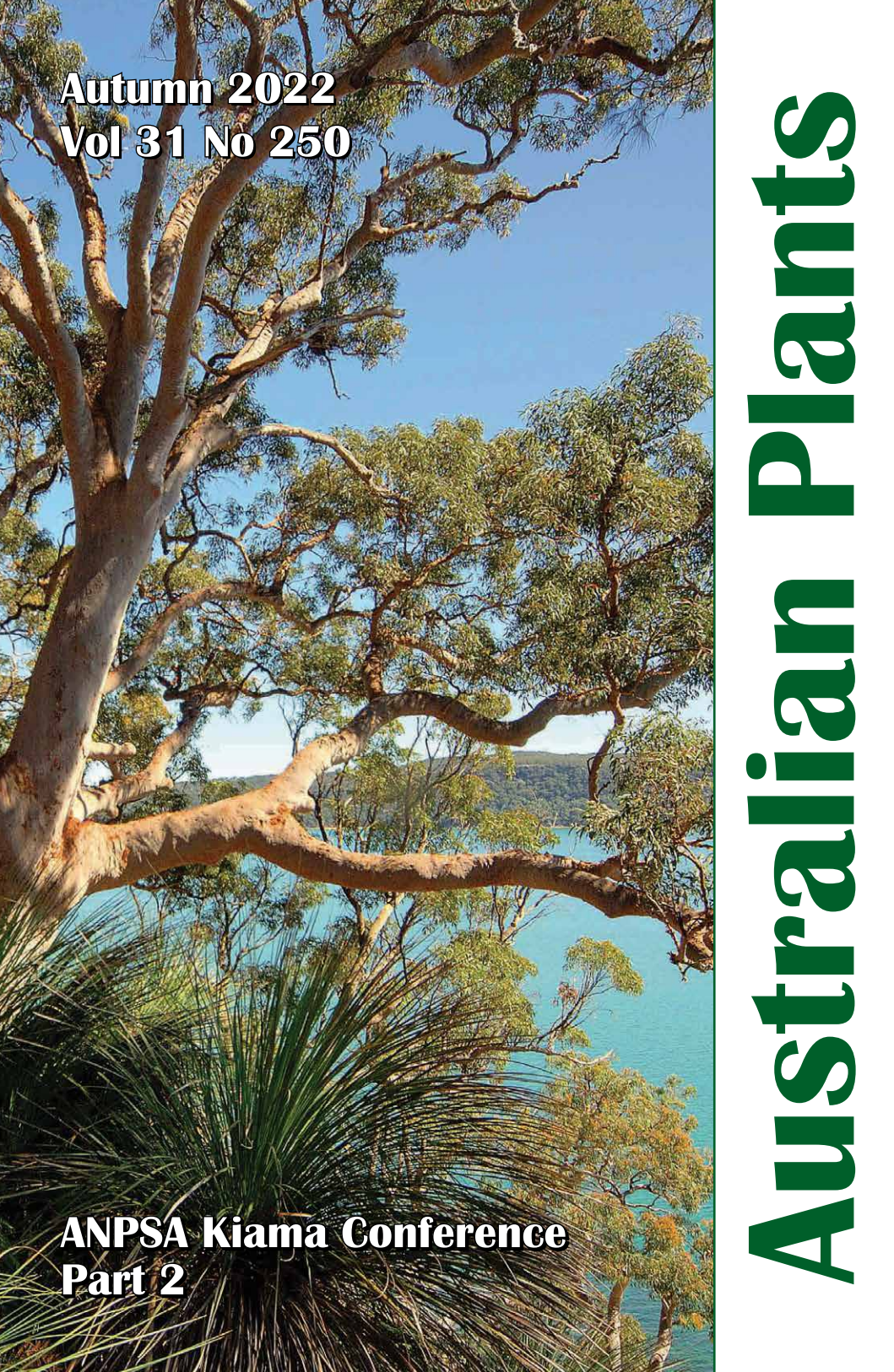




**Autumn 2022
Vol 31 No 250**

**ANPSA Kiama Conference
Part 2**

Australian Plants

Contents

Editorial	Merle Thompson OAM	211
The Hawkesbury Sandstone Flora of the Greater Sydney Area Part 2	Dan Clarke	212
The Gardens of Stone	Merle Thompson OAM	227
Rainforests of the Far South Coast of New South Wales	Kevin Mills	239
A Biodiversity Hotspot Amongst Ancient Landscapes	Heather Miles	250
Subscriptions to 'Australian Plants' and ANPSA contacts		258

Cover photo: *Angophora costata* tree and *Xanthorrhoeas* above Flint and Steel Beach, Ku-Ring-Gai Chase (near West Head) overlooking the Hawkesbury River. Bruce Usher.

Australian Plants articles

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Editorial

Merle Thompson OAM

The fact that you have this journal and are reading it indicates that you have some interest in the native plants of Australia.

But what are your specific interests? These might be many and varied and some of your interests might even conflict with those of others. I am fascinated by the idea of where plants grow and why they grow where they grow. Why are some restricted to a very small area yet they propagate readily? Obviously, geology and climate are significant factors but lack of knowledge in these areas does not negate my interest.

That aspect of my interest relates to plants in their natural habitat. For many people the conservation of plant species and related issues of habitat and the environment are a primary focus.

For others their interest is horticulture, having a native plant garden, garden design and development of more attractive or resilient cultivars.

While these two approaches can appear to be divergent and perhaps contradictory, or even in conflict, in New South Wales we have found when new members list their interests and in surveys a significant number of Society members indicate that they have both interests.

Our Society was founded with the view of growing – our name was the Society for Growing Australian Plants. Yet we have always had conservation of plants and their habitats as part of our aims. In the early years some people adopted the slogan of one nursery – “preservation by cultivation”.

I am writing this because I am musing about what our plants and our environment mean to me, to others who are committed and to the general public who may have very little knowledge.

The theme for the Kiama conference is Australian flora – past, present and future. In our planning we have considered how we can encourage participants to understand the challenges and solutions already in place and what we will face and be doing in the future whether the challenges, actions and successes are in the spheres of conservation, regeneration or horticulture. What can they contribute themselves? Something for everyone to contemplate.

This and the previous issue feature areas to be visited on conference tours. What were they like in the past, what is wonderful in them now, what threats do they face, how will they survive those threats? And they are wonderful areas – come and enjoy them.

The Hawkesbury Sandstone Flora of the Greater Sydney Area

Part 2: The flora assemblages within landscapes

Dan Clarke

Dan Clarke is a botanical consultant in the NSW Ecological Consulting Industry. He is the Conservation Officer for Australian Plants Society, NSW.

Ed: Part 1 of this article appeared in the previous issue of Australian Plants: Vol 31 No 249 Summer 2021/2022. In that part Dan described the geology of the Sydney area. In Part 2 he considers specific landscapes and relates the flora to these areas.

Landscapes and Hawkesbury sandstone flora

The Hawkesbury Sandstone can be found from almost sea level to 1,400 metres above. From my perspective and over 10 years' experience undertaking vegetation survey, Hawkesbury Sandstone flora can exist on ridge-tops and plateaus, higher and lower gullies and slopes, and right down into shaded creeklines, where sandstone boulders and outcrop will still be dominant.

To get familiar with the flora, it helps to break up the landscape into these categories with consideration given to aspect as well. Vegetation on south and east-facing slopes on the Hawkesbury Sandstone, is typically more lush, tall and moist, compared to that on north and west-facing, which are generally drier, more open and exposed (often with a more-frequent fire history).

From here, I'll discuss the typical flora assemblages in these categories (from a very general perspective), as there are some consistent trends regarding species occurrence and prevalence that can be observed.

There are too many species to mention, but I aim to state the most common ones encountered.

Ridgetops and Plateaus (and general higher ground)

These are, obviously, the high points in the landscape with very little soil purchase. In some locations, these areas can consist of large sandstone sheets or ramps interspersed with "islands" of native shrubs and ground-dwelling plants. I sometimes refer to these islands as "sandstone bonsai gardens".

They also tend to be locations for Indigenous rock carvings and are regarded as historic meeting places of Indigenous significance, so please tread carefully.

Unfortunately, more and more, they are also the places where development is proposed.

Plateaus and ridges can be long and wide or very narrow with steep gullies on either side. They are very sun and fire exposed. The vegetation here might be described as a low open-woodland with mallees or short trees to 10 metres tall, or open shrubland, as well as a wet or dry heath. These areas also include cliff-tops next to the ocean.



Sandstone Ridgetop
Woodland
Berowra Valley NP,
Berowra –
Corymbia gummifera,
Allocasuarina littoralis,
Eucalyptus sieberi.

From the top-down, species typical on plateaus and ridges are the scribbly gums: *Eucalyptus haemastoma*, *E. sclerophylla*, *E. signata* and/or *E. racemosa* along with stunted *Angophora costata* (Smooth-barked Apple) and *Corymbia gummifera* (Red Bloodwood).

Other species can include *Angophora hispida* (Dwarf Apple), *Angophora bakeri* (Narrow-leaved Apple) (usually if some shale capping is present) and *Corymbia eximia* (Yellow Bloodwood) – all depending on location. *Eucalyptus punctata* (Grey Gum) can also be common in some areas.

Stringybarks may also feature, such as *Eucalyptus sparsifolia* and *E. globoidea*.

The other very common tree is *Eucalyptus sieberi* (Silver-top Ash) with its foliage that glistens in the sunlight.

Mid-storey species are typically those of major families Myrtaceae and Proteaceae but include a host of others as well: *Leptospermum trinervium* (Flaky-barked Tea-tree), *Leptospermum polygalifolium* subsp. *polygalifolium* (Tantoon), *Kunzea ambigua* (Tick Bush), *Banksia ericifolia*

(Heath Banksia), *Banksia serrata* (Old Man Banksia), *Lambertia formosa* (Mountain Devil), *Isopogon anemonifolius* (Drumsticks), *Allocasuarina littoralis* (Black Sheoak) along with *A. distyla* (Scrub She-oak).

Hakea laevipes and *H. teretifolia* are common along with *Darwinia fascicularis* – which can be prolific on plateaus.

Rutaceae members might be *Crowea saligna* and *Eriostemon australasius* (Pink Wax Flower) along with *Boronia ledifolia* (Sydney Boronia), *B. pinnata* and *B. floribunda*.



Morgan Rd, Belrose Sandstone Ridgetop shrubby woodland with some moist-swamp influence – *Corymbia gummifera*, *Eucalyptus oblonga*, *Boronia ledifolia*, *Hakea teretifolia*, *Acacia obtusifolia*, *Allocasuarina littoralis*, *Grevillea buxifolia* subsp. *buxifolia*, *Grevillea speciosa*, *Pultenaea tuberculata*, *Caustis flexuosa* and *Lepyrodia scariosa*.

Acacia suaveolens (Sweet Wattle) is commonly sighted. The epacrids *Woollsia pungens* and *Epacris pulchella* (Wallum Heath) are also very common.

There may also be *Persoonia levis* (Broad-leaf Geebung) as well as *P. lanceolata* (Lance-leaf Geebung). The grevilleas I would mention are *G. sericea* (Pink Spider-flower), *G. speciosa* (Red Spider-flower – north of Sydney Harbour) and *G. oleoides* (Red Spider-flower – south of Sydney Harbour), along with two grey-spider flowers – *G. buxifolia* subsp. *buxifolia* and *G. sphacelata*. All are very common.

Groundlayer species might be sporadic but may include *Lomandra longifolia*, *Lepidosperma laterale*, *Entolasia stricta*, *Pomax umbellata*, *Mitrasacme polymorpha*, *Actinotus minor* (Lesser Flannel Flower), *Caustis flexuosa*, as well as some orchids (such as *Thelymitra ixioides* (Sun Orchid) and *Calochilus paludosus* (Red Beard Orchid) amongst others).

Other very common groundlayer species are *Patersonia sericea* and *P. glabrata* (Purple-flag) as well as the popular *Actinotus helianthi* (Flannel Flower). A last mention would be *Gonocarpus teucroides* (Rasp Wort) which can be very prolific.

In many places, the ridgetop rock can be impregnated with, or have a top lens of laterite. Laterites are sandstone rocks impregnated with a high amount of iron or aluminium (referred to as Ironstone). So, you may hear the term “lateritic ridges” or “caps”. These have also been mined in the past for iron resource. Some species are more likely to be found here such as the isopogons and petrophiles (*Petrophile sessilis* (Conesticks)), as well as threatened species like *Eucalyptus camfieldii* (Camfield’s Stringybark).

The plateaus and ridges can also include wet heathland, especially in areas like Royal National Park where they exist on shallow boggy sand with sandstone outcropping. A slightly different diversity of species can be observed here along with some of those above. These might be *Sprengelia incarnata* (Pink Swamp Heath), *Epacris obtusiflora* (Blunt-leaf Heath); a range of peas such as *Pultenaea stipularis*, *Phyllota phyllicoides*, myrtles such as *Baectea imbricata*, *Kunzea capitata* and *Leptospermum squarrosum* (Peach Blossom Teatree). *Banksia oblongifolia* (Fern-leaved Banksia) can feature more strongly here but happily grows in drier areas too as does *Banksia marginata* (Silver Banksia).

A diverse range of groundlayer species can be observed, although some are tricky to learn, such as *Empodisma minus*, *Ptilothrix deusta*,



Schoenus imberbis, *Lepyrodia scariosa* and *Chordifex fastigiatus* along with our fascinating *Drosera* species. There are some orchids that also thrive here in wet heath, such as *Prasophyllum elatum* (Tall Leek Orchid). And of course, the grasstrees *Xanthorrhoea media* and *X. resinosa* can also feature strongly, mostly in dry heath.

Kunzea capitata
Wendy Grimm

Plants of the ridge tops



Clockwise from top: *Kunzea ambigua* Harry Loots; *Darwinisa fascicularis* Wendy Grimm; *Lambertia formosa* Jill Darl; *Boronia ledifolia* Jill Dark; *Crowea saligna* Harry Loots

Upper and lower slopes / gullies

One of the best bushwalking experiences is to always eventually head down into the gullies along an established track. It can be arduous, but usually worth the effort. In the gullies, the Hawkesbury Sandstone exhibits itself in the form of steps, shelves, large boulders, caves as well as sheer walls with vertical sections. At times, water flow or seepage can be observed from these structures.

A transition can be noticed, as we pass from the shorter ridge-top plateau vegetation to taller trees on the upper and lower slopes that carry drainage lines to the creeklines below. The scribbly gums can still persist, but these tend to drop out as soil and shade become deeper. Species such as *Angophora costata* come into their own here; this is their prime territory. They increase in height and share the space with *Corymbia gummifera*. In some areas, however, especially north-west Sydney, the canopy can be dominated by *Corymbia eximia*.



Sydney Sandstone Gully Forest – Morgan Rd, Belrose
Angophora costata,
Eucalyptus piperita,
Doryanthes excelsa,
Elaeocarpus reticulatus

If one pays attention, it does not take too far down the slope for a very common sandstone tree to become apparent, that is *Eucalyptus piperita* (Sydney Peppermint), with its fibrous bark, smooth upper limbs and blue-green foliage which, when crushed, smells very strongly of peppermint. This is a dominant tree in Sydney sandstone gullies and further afield. Its fruit (capsules) can often readily be found on the ground, to confirm identification. *Eucalyptus resinifera* (Red Mahogany) can also be locally common and should always be considered here, especially north of the harbour, close to Sydney CBD.

As foliage height increases with deeper soil purchase and moisture run-off, some typical species (in addition to those already mentioned above)

occur such as *Ceratopetalum gummiferum* (NSW Christmas Bush), *Leucopogon lanceolatus* and *Elaeocarpus reticulatus* (Blueberry Ash).

One of the very common species is *Dodonaea triquetra* (Common Hop Bush). This species can number in the thousands, especially after a fire event. The pea *Dillwynia retorta* is often seen. *Platysace linearifolia* is a very (very) common and numerous sandstone shrub with its leaves smelling of carrot. *Banksia spinulosa*, along with its very close relatives will occur along with the very common *Persoonia linearis* (Narrow-leaf Geebung) with its crepe-paper bark. Also, the much loved *Xylomelum pyrifforme* (Woody Pear) can be very common.

At times, one can enter areas which typify the magical iconic Hawkesbury Sandstone gully (and I have observed most of these along Mill Creek at Menai and further down Heathcote Road towards Heathcote). These are gullies holding large-ish sandstone boulders, interspersed with hundreds of *Doryanthes excelsa* (Gymea Lily) and *Telopea speciosissima* (Waratah), all growing under a forest of advanced grandiose *Angophora costata*. I found one such gully, well-off track up Mill Creek in spring, as a much younger botanist. I sat here silently for an hour before I left. I must return one day.

Other shrubs commonly observed are *Ricinocarpus pinifolius* (Wedding Bush) along with pea-shrubs *Aotus ericoides*, *Gompholobium grandiflorum* (Large Wedge-pea) and *Pultenaea daphnoides*.

Often, *Pittosporum undulatum* (Native Daphne) will be here too. Sometimes, it seems very numerous and might be flagged for control. At other times, it may be part of the landscape, especially well downslope along creeklines. Another common shrub might be *Myrsine variabilis* (Muttonwood).



Doryanthes excelsa Wendy Grimm

Many species of *Hibbertia* can also be seen, depending on location. *Hibbertia dentata* (Trailing Guinea Flower) is one to watch for, as is *H. nitida*, *H. linearis* and *H. monogyna* amongst others.

Several species of *Hakea* can also be seen commonly including *H. sericea* (Needlebush), *H. gibbosa*, *H. propinqua* and *H. dactyloides* (Forest Hakea).

Some wattles may be common including *Acacia myrtifolia*, *A. linifolia*, *A. irrorata* and *A. longifolia*.



Sandstone Gully Forest on Walumarra Track in Royal NP. *Syncarpia glomulifera*, *Angophora costata*, *Eucalyptus pilularis*, *Pteridium esculentum*, *Xanthosia pilosa*.

Groundlayer species (including those already mentioned) are diverse and include *Lomatia silaifolia* (Crinkle Bush), *Xanthosia pilosa* (Woolly Xanthosia) and large *Xanthorrhoea arborea* with its wide leaves.

Two ferns, *Pteridium esculentum* (Bracken Fern) and *Calochlaena dubia* (Rainbow Fern) feature strongly, along with several other species of *Lomandra*.

Dianella caerulea and *D. prunina* (Blue-Flax Lily) are also very common.

Some common grasses and sedges include *Anisopogon avenaceus* which has its very large glumes, *Microlaena stipoides* (Weeping Grass) and *Cyathochaeta diandra*; a very ubiquitous sedge throughout the Hawkesbury Sandstone.

Plants of the gullies



Banksia spinulosa



Dipodium



Epacris longiflora



Xanthosia pilosa



Hibbertia dentata



Ceratopetalum gummiferum
(All photos by Heather Miles)

Species such as *Epacris longiflora* (Fushcia Heath) and *Gleichenia dicarpa* (Pouched Coral Fern) can also dominate where water seeps out of rocks in gullies.

The orchids of the genera *Cryptostylis*, *Dipodium* and *Pterostylis* are also commonly seen.

Further downslope, on enriched sandstone soils, we may be treated to a more grandiose and taller canopy with, potentially, species such as *Eucalyptus pilularis* (Blackbutt) and *Syncarpia glomulifera* (Turpentine) dominating. Tall blackbutt forests are a joy to behold, whether on enriched Hawkesbury Sandstone or otherwise. Species that like it a bit moister and shadier may become common such as *Zieria smithii* and *Cissus hypoglauca* (Water Vine).

Creeklines

Any trip down a Hawkesbury Sandstone Gully usually ends at a creekline, whether major or minor. The going can be easy but often there are large sandstone boulders or steep drop-offs to negotiate.

There are some species that occur very commonly on the more-open creeklines (often with rockpools and waterfalls) including the shrubs *Bauera rubioides* (River Rose) and *Epacris longiflora* which can also grow below and near sandstone walls and caves, as well as *Schoenus melanostachys* – a large clumping sedge with black spikelets.

Further down the creeks, especially where water is flowing, *Persoonia pinifolia* (Pine-leaf Geebung) can be seen along with various *Leptospermum* spp. A common wattle which may make an appearance is *Acacia terminalis*.

Where creeklines support dense vegetation, a very common species is *Callicoma serratifolia* (Black Wattle) with its wattle-like globular flower heads, and it can form dense thickets in places. You may also see *Lomatia myricoides* (River Lomatia).

In many a deep and narrow sandstone gully across the Greater Sydney area, a narrow band of rainforest vegetation can be found. These tend to be dominated by three main canopy species: *Acmena smithii* (Lilly Pilly), *Ceratopetalum apetalum* (Coachwood) and *Doryphora sassafras* (Sassafras) – with the smell of its leaves akin to polished wooden furniture. All three species have opposite leaves but can all be easily identified with practice.

Plants of the creeklines



Bauera rubioides



Persoonia pinifolia flower



Persoonia pinifolia fruit



Tasmannia insipida (Jill Dark)



Tristaniopsis laurina



Callicoma serratifolia
(All photos by Heather Miles unless otherwise indicated)

In some places, such as Ousedale Creek at Appin, I have seen large-jagged sandstone boulders on a dry creekline, dominated by *Tristaniopsis laurina* (Water Gum) – a species which can also be seen growing in running water in the Royal. In other places, such as around Lake Burragarang, the creeklines support extensive bands of *Backhousia myrtifolia* (Grey Myrtle) creating a very picturesque forest.



Sandstone Creekline at Helensburgh

The diversity of rainforest (or mesic) species may vary but common species include *Sticherus flabellatus* (Umbrella Fern), *Blechnum cartilagineum* (Gristle Fern) and *Cissus antarctica* (Kangaroo Vine). *Livistona australis* (Cabbage Tree Palms) may also be seen. You may also see *Tasmannia insipida* (Brush Pepperbush) with its peppery-smelling leaves that put one in the mood to cook a stew! (especially after a long walk).

There are many species not mentioned but the above provides a nice suite of commonly encountered species.

In passing, the Wallumarra Track in the Royal NP takes one on a transitional journey through the Hawkesbury Sandstone, from the high to low ground, commencing at Black Gin Ridge in heathland, and heading down Bola Gully to the rainforest at Bola Creek where sediments of the Narrabeen Group are exposed. This walk is a common educational one due to its topographic, vegetation and geological changes. However, there are other walks in greater Sydney that serve the same purpose.

Swamps

Lastly, a vegetation type that needs to be mentioned is the swamps that are found on Hawkesbury Sandstone and which are a well-studied and important component.

Swamps are typically associated with wet heath areas on perched watertables or springs, often at the headwaters of many creeks that run through sandstone landscapes. The swamps create excellent habitat for frogs and reptiles. The nature of swamp vegetation can vary. Trees are often scarce but, in some cases, swamps can be dominated by trees and shrubs, featuring species such as *Melaleuca linariifolia* (Flax-leaved Paperbark) – with a great example at “The Glen” at Bonnet Bay;

Leptospermum juniperinum (Prickly Teatree), *Banksia ericifolia* and *Callistemon citrinus* (Crimson Bottlebrush) occur and sometimes create dense barriers; or monocotyledons may dominate – the clumping graminoids such as *Machaerina* spp. (formerly *Baumea*), *Restio* spp., *Chordifex* spp. and *Gahnia* spp. Species such as *Drosera* spp., *Utricularia* spp and *Xyris* spp. will also be present in large numbers where habitat is open and sunny. Also commonly seen are dense impenetrable patches of the afore-mentioned *Gleichenia dicarpa*.

There is a listed threatened ecological community recognised called *Coastal Upland Swamp in the Sydney Basin Bioregion*, occurring on waterlogged soils on Hawkesbury Sandstone plateaus.

You are likely familiar with the term “hanging swamps”, especially in the Blue Mountains where swamps occur on steep sides of sandstone gullies and cliffs. The nature of the sediments creating impermeable barriers, below the swamps, traps the water and creates a permanent moisture source allowing swamp-vegetation to occur. These are very ecologically sensitive and important areas and have undergone large-scale regeneration efforts.

The Hawkesbury Sandstone vegetation is an incredibly diverse wonder to behold. Its survival through the ages with adaptation to fire and climate change deserves our respect as well as our protective management actions.

The manner in which its large array of species survive and even thrive in a harsh, fire-prone and nutrient poor landscape, gives us pause for thought, that such species may possess biological and physiological secrets not yet realised. Increasingly, these habitats are under threat, due to enhanced anthropogenic engineering techniques, and to other factors, i.e. development on the Cumberland Plain having nearly reached capacity.

Plants of the swamps



Drosera



Banksia ericifolia



Gahnia

The spring-time flower display, especially when conditions are favourable, creates a spectacular show, which is also a huge tourist attraction, especially in the Royal NP. Many a Sydney Hawkesbury Sandstone bushland reserve provides refuge for fauna, especially those that have found it difficult to persist in urban environments.

Hopefully, we continue to see increased protections for the Hawkesbury Sandstone flora, and the natural wonders it exhibits.

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Landscape images by the author



Royal National Park

The Gardens of Stone

Merle Thompson OAM Co-editor

For whom this area is almost "backyard".

In the last issue of Australian Plants (Vol 31 No. 249) Margaret Baker's article provided an overview of the Greater Blue Mountains World Heritage Area (GBMWhA) and the geology and flora of this special area. One of the eight protected areas within the GBMWhA is the Gardens of Stone National Park (GoSNP).

The Gardens of Stone area

The area which is generally thought of as the Gardens of Stone (GoS) is far larger than the area included in the National Park.

Only recently (12 November 2021) there was a very positive announcement from the NSW Government. New reserves are being established covering 31,500 hectares including: the Gardens of Stone State Conservation Area (total 28,944 ha) [GoS SGA] which is being created by the transfer of three State forests and Crown land. There is also a small area added to the Gardens of Stone National Park (342 ha) and additions to the Wollemi National Park (2,259 ha).

It is with pleasure that I am able to make a late addition to this article. On Friday 6 May 2022 these areas were officially reserved under the National Parks and Wildlife (NP&W) Act. A message from a departmental officer stated: "These important additions to the national park reserves have been a longstanding priority, protecting rich eucalypt forests, an array of threatened species and ecological communities, and important Wiradjuri cultural heritage values".



The Drift – Julie Favell

Yet this does not protect the whole area with threats from on-going coal mining.

You can get an idea of how people feel about the area from these quotes from the Blue Mountains Conservation Society's website:

'The Gardens of Stone is a lost world – scenic and unique in its geological complexity and depth of diversity.'

'It is a land of rock pagodas, natural sandstone pinnacles, endangered ecological communities and threatened plant and animal species.'

'A natural paradise, like nowhere else on earth. Within a few hours of Sydney lies this awe-inspiring monument to Australia's geological creation. Spectacular and mesmerising, the Gardens of Stone, has been in the making for 250 million years. Home to incredible landscapes and ancient Aboriginal culture, fragile pagoda rock formations, rare and threatened plants and animals and relics from the past, the Gardens of Stone region has it all.'

It is the pagoda rock formations which are the dominant feature in the landscape. The scenic beauty of these iconic formations was what was first recognised. Some of the names given to areas and specific rock formations are evocative. The Lost City, the Temple of Doom and Dobbs Drift appear on maps while others, such as "The Sphinx of Lithgow", (pictured below) have been devised by local enthusiasts.



Photo Julie Favell

We are now aware of the area's major significance geologically and for biodiversity, not just relating to the pagodas themselves but the broader region including areas such as Newnes Plateau and the Wolgan Valley.

Much of the National Park and the new State Conservation Area is only accessible to fit walkers with some access for those with 4-wheel drive vehicles. The Government's media release announcing the new GoS SGA emphasised the tourism potential: "a new eco-tourism and adventure destination on the edge of the Blue Mountains near Lithgow. The centrepiece of the investment will be the Lost City Adventure Experience, an iconic project, that will include Australia's longest zipline and a spectacular elevated canyon walk. It will also feature NSW's first Via Ferrata rock-climbing opportunity". There is also proposed "an iconic great walk – set to become one of the world's great long distance walks" – a six-day walk with eco cabins.

For the time being access, especially for buses, is limited but participants on the Blue Mountains pre-conference tour will be able to experience the area and see pagoda rock formations and flora of the area as we plan to visit Dobbs Drift, Wolgan Gap and Wolgan Lookout. The more agile might also like to climb to Maiyingu Marragu.



The Drift Photo: Heather Miles

The name

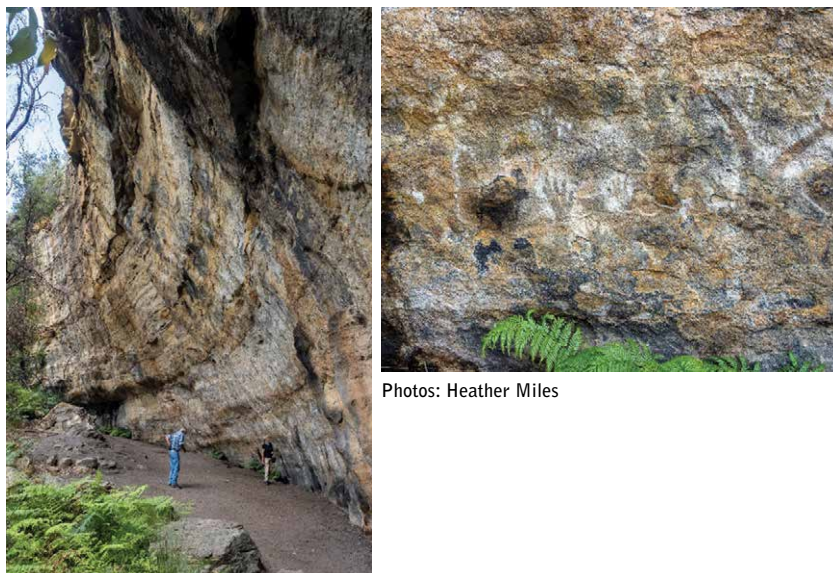
The name "Gardens of Stone" was coined by renowned environmentalist, Haydn Washington.

Heritage and significance

The area is significant for its Aboriginal cultural heritage; European industrial heritage; geoheritage and geodiversity and biodiversity.

Aboriginal cultural heritage

The Wiradjuri people have been, and still are, custodians of the land. There are many sacred sites within the area. Maiyingu Marragu is the best known site with its rock overhang containing paintings depicting hands and weapons. It was an important meeting site and there are men's and women's areas of significance for educational and cultural activities.



Photos: Heather Miles

European cultural and industrial heritage

The GoS area is in the vicinity of the City of Lithgow. In 1815 the first road across the Blue Mountains was constructed and passed through the area. Inns were opened and settlement increased. In the 1860s the railway line was opened through the area. Coal mining has been important from that era and it, and power generation, are still the mainstays of the local economy. In intervening years there have been other industries, including some “firsts”: flour mill, iron milling, copper smelting, meat refrigeration and pottery. In World War 1 the Small Arms Factory opened and had a major role for the armed services. The industrial heritage which is within the GoS area relates to the towns and shale oil mines at Newnes and Glen Davis.

Geoheritage and Geodiversity

This terminology was unfamiliar to me until I read the article *The geoheritage and geomorphology of the sandstone pagodas of the North-western Blue Mountains Region (NSW)* by Haydn Washington and Robert Wray.¹

The authors comment that the term “geoheritage” is usually applied in Australia to geological features, not geomorphological or soil features but they applied the term to the pagodas because “they are uncommon and significant geomorphic sandstone landscape features”. Geodiversity applies to an understanding of all factors – geological, geomorphological and soil features.

They describe two types of pagodas. Smooth pagodas have a beehive type appearance and are also found in other parts of Australia such as the Bungle Bungles and overseas such as in the central-west USA.

“Platy pagodas are in our view distinct and significant features, as we are not aware of any other rock formations in Australia or overseas that mimic the geomorphology of platy pagodas.” “The regular stepped-cone shape of platy pagodas is a distinct geomorphic feature.”

In their conclusion they state that “the platy pagodas are certainly a distinct and significant part of Australia’s geodiversity.”

Biodiversity

To quote a NSW document relating to the plan of management of the GSNP “the important values of the park include the spectacular wild and rugged scenery, a diversity of natural environments, a large number of eucalypt species, the occurrence of threatened or restricted native plant and animal species, and its cultural heritage.”

From a perspective of native plants, it is the diversity of natural environments and the associated diversity of flora, including the rare, threatened or restricted plant species, which is our focus. In fact, the range and diversity of environments and species is so great



Beehive pagodas – Julie Favell

that it is not possible to adequately do justice to this topic in a short article. Rather, I hope to give a “taste” by sharing a few ideas on the diversity of environments and, in particular, the threatened ecological communities, then touch in a little more detail on three special aspects. The references provide information for those who would like to delve further into understanding this special area.

While the pagodas are the best known geological feature of the GoS area there are many other environments, each with a distinctive flora. The pagodas, other rocky outcrops, high cliffs and open hill tops are exposed areas, as are heath areas, while canyons provide a very sheltered environment. Watercourses and swamps are also highly significant.

Even the vegetation mapping project undertaken by Benson and Keith in the late 1980s,² which had broad categories, listed 18 vegetation communities, most of which would be considered in the GoS area: Forests (four classifications), Woodlands (9 classifications) plus Newnes Plateau Shrub Swamps, Cox’s River Swamps, Montane Heath and Pagoda Rock Complex. Forests, woodlands, heaths and swamps, each with its own altitude range, geology, habitat and canopy species as well as other associated plant species.

Later surveys are more complex with more specific divisions [see references]. They also highlight the endangered or threatened ecological communities. The proposal document for the GoSNP stage 2, which only covered the newly reserved areas and some not yet reserved, noted 33 communities.

Communities shown as Endangered Ecological Communities were: Capertee Rough-barked Apple-Redgum-Yellow Box-Grassy Woodlands, Newnes Plateau Shrub Swamp, Newnes Plateau Hanging Swamp, Newnes Plateau Rush-Sedge-Snow Gum Hollow Wooded Heath, Mountain Hollow Grassy Fen, Cox’s River Swamps.

Within just the area covered by the proposal there were 42 species regarded as rare or threatened, one of which, *Persoonia hindii*, does not occur outside that area. Other species, such as *Leucochrysum graminifolium*, are endemic within the broader GoS area.

Pagodas

In their article Washington and Wray wrote: “Given that biodiversity often is dependent on geodiversity, it is not surprising that the pagodas are a biodiversity hotspot for rare and threatened species. Pagoda areas offer many different habitats to species and also offer a refuge



Leucochrysum graminifolium, Photo: Andrew Valja

from fire and grazing to some plant species. Thus species survive there which may have gone extinct in the rest of the landscape. “

Of the many species which grow on or near pagodas those which are almost entirely restricted to pagodas or predominantly found on them include *Leucochrysum graminifolium*, known as the Pagoda Daisy, *Prostanthera hindii* and *Leionema scopulinum*. Some of the rare or threatened species which occur in the vicinity of pagodas include *Pseudanthus divaricatissimus*, *Banksia penicillata*, *Acacia asparagoides*, *Epacris muelleri* and *Philothea obovalis*.

Swamps

The NSW Office of the Environment describes Newnes Plateau Swamps as: “An ecological community dominated by shrubs and sedges that occurs on sites with impeded drainage in low slope headwater valleys on the Newnes Plateau in the upper Blue Mountains.

The community is characteristically dominated by shrubs, with a variable cover of sedges. Shrubs have a dense to open cover, and include *Baeckea linifolia*, *Grevillea acanthifolia* subsp. *acanthifolia*, *Epacris paludosa* and *Leptospermum* species. The cover of sedges varies inversely with shrub cover. Common sedges include *Baloskion australe*, *Empodisma minus*, *Lepyrodia scariosa* and *Lepidosperma limicola*, while herbs include *Patersonia fragilis* and *Xanthosia dissecta*. *Gleichenia dicarpa* and *Gymnoschoenus sphaerocephalus* may occur around drainage lines, while *Lomandra longifolia* may be prominent around the swamp margins. Floristic composition varies locally in relation to soil moisture gradients within the swamps.”



At Wolgan Swamp Photo: Heather Miles



Grevillea acanthifolia subsp. *acanthifolia* is an indicated species of a Newnes Plateau Shrub Swamp. Julie Favell

They also mention *Dillwynia stipulifera* and *Boronia deanei* as occurring in these swamps.

There are two classifications of swamps: *Newnes Plateau Shrub Swamps* and *Newnes Plateau Hanging Swamps*. The Lithgow Environment Group's [LEG] *Swamp Watch* website provides descriptions and flora lists for each.

Why is there *Swamp Watch*? Because many of these swamps have been damaged, are still at risk with no protection or only recently protected. Below – Before and after photos of Farmers Creek Swamp.



Heath

I have a special memory many years ago of a late afternoon excursion with my sister. We parked and walked along the gravel road which leads from Bells Line of Road to the Glow Worm Tunnel. We would have only walked a few hundred metres but we could not count the number of plant species which we encountered in that small area. We then drove further along the road and met more roos and wallabies in a short time than we have ever seen elsewhere. When we stopped, we sat in the car mesmerised by the vocal performance of song and mimicry with which a lyrebird was serenading us. In reality, it would have been a potential mate who was his intended audience, but we could think it was us.

That was my introduction to the Newnes Plateau. Although it was probably the second one. We took part in the "Banksia Crawl" to map the occurrence of banksia species across Australia. I still have photos from that day of two rare plants – *Banksia penicillata* and *Isopogon prostrata*. [Pity I couldn't locate them.]

The Plateau is an area of special biodiversity with a high number of plant species including many which are rare, localised or threatened. I believe the area where I walked was in Montane Heath. Using Benson



Banksia penicillata Photo: Alan Page

and Keith's map and their terminology I also would have traversed Montane Gully Forest and Blue Mountains Sandstone Plateau Forest.

They nominate the dominant species in Montane Heath as *Allocasuarina nana*, *Leptospermum attenuatum*, *L. arachnoides*, *Isopogon anemonifolius*, *Banksia ericifolia*, *Hakea dactyloides*, *H. propinqua*, *Brachyloma daphnoides*, *Epacris microphylla* and *Monotoca scoparia*. Understory plants include *Patersonia longifolia* and *Dampiera stricta*.

That was probably in the 1990s. At a similar time (November 1995), Ian Cox, a life member of APS NSW, went on a two-day walk with an overnight camp. His report on that experience was published in "Native Plants for NSW" and has been on the ANPSA website.³ Their walk started in that same area as mine but went far further, through the Glow Worm Tunnel and to the more northern area of the Plateau. Ian describes the landscapes and plant species from swamps, sheltered forests and pagodas. Some of the species he mentions in the heath area include *Persoonia recedens*, *P. myrtilloides* ssp. *myrtilloides*, *P. chamaeepitys*, bordering the road in vibrant light-green carpets, *Boronia microphylla* and the heath form of *Hakea dactyloides*.

He concludes his report with the following statement: *The Newnes Plateau is shrouded in an aurora of mystery for native plant lovers. It is a place where you expect the unexpected. As usual we left convinced that there must be more unknown species awaiting discovery here. Who could disagree? After all, the "Wollemi Pine" is only tens of kilometres away!*

Would it then surprise you that it was on the Plateau in 2020 that Chris Jonkers of the Lithgow Environment Group found a rare ground orchid which had not been seen for over 130 years. He named it *Genoplesium reflexum* but it has also been named as *Corunastylis reflexa*. The next day he took his partner, Julie Favell, to photograph it – on Julie's birthday and she regarded it as a very special present. During March and April they found it at five locations in Newnes State Forest. Julie wrote that all were in areas which had been burnt, but none severely. "Always in rocky-gravelly soils in montane heath, edge of Newnes Plateau shrub swamps, or edge of hanging swamps, open sunny areas with little competition from other vegetation. Interestingly many other orchids grew with it including *Genoplesium simulans*, *Genoplesium superbum*, *Genoplesium ansatum* (densum), *Pterostylis* (*Specularantha*) *crebra* and *Pterostylis* (*Specularantha*) *antennifera* (two new ones recently described by Jones), and *Eriochilus cucullatus*."



Genoplesium reflexum – Julie Favell

Fire ephemerals

I will indulge myself by referring to my article in the Spring 2021 issue of *Australian Plants* in which I wrote of the pink flannel flower, *Actinotus forsythii*. This species is one of those identified as a fire ephemeral as it is only known to appear after fire. Some of my encounters with the pink flannel flower were at Dobbs Drift in the GoS.

The Future and threats

While the new declarations are so positive, only part of the area in the proposal was declared and there are 39,000 hectares still unreserved, particularly in the: Ben Bullen, Wolgan and Newnes State Forests. Mining is continuing with actual and potential damage from subsidence

under pagodas and drainage in swamps. There is currently damage from uncontrolled camping and off-road use of four-wheel drives and bikes. Increased frequency and intensity of fire is a major threat and exacerbated by both climate change and human activity. The mega-fire in late 2019 was initiated by lightning but that in October 2013 was related to human activity. The interval was too short for some species to adequately recover. It would be tragic to lose such a special area and its flora and fauna.

Endnotes

- 1 Washington, Haydn G. and Wray, Robert A.: The geoheritage and geomorphology of the sandstone pagodas of the North-western Blue Mountains Region (NSW) 2011, 131-143. ro.uow.edu.au/scipapers/3063
- 2 Cunninghamia Vol 2 No. 2 1990, National Herbarium of NSW and The natural vegetation of the Wallerawang area 1:100 000 map sheet
- 3 anpsa.org.au/APOL18/jun00-6.html

References

Blue Mountains Conservation Society

bluemountains.org.au/#gos

bluemountains.org.au/gos2/index.shtml

Gardens of Stone Visitors Map

Gardens of Stone video

Colong Foundation for Wilderness – historic story GoS proposal from the beginning starts with Myles & Milo Dunphy

www.colongwilderness.org.au/campaigns/the-gardens-of-stone/about-gardens-of-stone

Gardens of Stone Alliance

www.bluemountains.org.au/gos2/proposal

Includes references for the following vegetation maps:

- DEC (2006), Vegetation of the Western Blue Mountains, covering Newnes State Forest, Wolgan State Forest, Ben Bullen State Forest east of the Great Dividing Range and small areas on the western escarpment between Clarence and Lithgow;
- Blue Mountains City Council (2002), covering most of the western escarpment Gardens of Stone Stage Two reserve proposal from Medlow Bath to Bell;
- Coalpac (2012), covering the south-western part of Ben Bullen State Forest west of the Great Dividing Range

Destination Pagoda

www.destinationpagoda.com.au/visit-gardens-stone

Lithgow Environment Group

www.lithgowenvironment.org

www.lithgowenvironment.org/swamp%20watch.php

Rainforests of the Far South Coast of New South Wales

Kevin Mills

Kevin Mills studied the Illawarra rainforest for his PhD and has written extensively on the flora of the New South Wales south coast over the past 35 years.

“... although rainforest occupies a very small total area [south of Batemans Bay], its scientific importance as the various species and communities approach their southern limits is very great indeed.”

Alex Floyd, rainforest botanist, 1982.

South of the Illawarra and the Shoalhaven River, the rainforest types mirror those described in my piece on the Illawarra rainforests (*Australian Plants* Summer 2021). The difference is that the diversity of these more southern stands is lower, decreasing as latitude increases down the coast. From north to south, many plant species drop out as their southern limit of distribution is reached, largely determined by the lower temperatures. Species distribution is not a gradual loss of species with higher latitudes, rather there are distributional nodes. This means that ‘southern limit’ species tend to congregate in groups at certain locations, with no further occurrences of any of them further south. These nodes occur where there are nutrient-rich igneous soils; the most obvious locations are the Illawarra (Permian volcanics), the Milton area (Milton Monzonite) and Mount Dromedary (Mount Dromedary igneous complex). The significant drop in average rainfall, related to the general absence of near-coastal mountains beyond the southern limit of the Sydney Basin near Batemans Bay, is also important for species distribution.

The species that drop out, and some that appear heading south, are subtropical species and cool temperate species, respectively. The subtropical species are closely associated with the above igneous soils, disappearing from north to south so that the subtropical element in the rainforest reduces along the latitudinal gradient to near-absent south of Mount Dromedary.

Some rainforest plants are widespread and abundant, while others are highly restricted, constrained by soil type, altitude and/or rainfall. General features of these southern rainforests are that they are dominated by a small number of tree species, contain an abundance of ferns and have fewer ‘northern features’, such as deciduous trees, lianas and palms. The most diverse stands, occurring on the igneous

rocks mentioned above, can be termed subtropical – warm temperate rainforest, although in the north near Milton the stands are typically subtropical in character. The trees that characterise the subtropical patches include Figs *Ficus* spp., Red Cedar *Toona ciliata* (north only), Bloodwood *Balohia inophylla*, Yellow Wood *Sarcomelicope simplicifolia* and Giant Stinging Tree *Dendrocnide excelsa*.

The less diverse warm temperate rainforest, at least in terms of woody plants, occurs in deep, moist gullies from near the coast to the highest altitudes on the inland mountains. Typical trees in this rainforest include Sassafras *Doryphora sassafras*, Lilly Pilly *Syzygium smithii*, Crabapple *Schizomeria ovata* and Rosewood *Synoum glandulosum*. Vines may be reasonably common, including Gum Vine *Aphanopetalum resinosum*, Common Milk Vine *Marsdenia rostrata*, Water Vine *Cissus hypoglauca* and Sweet Morinda *Gynochthodes jasminoides*. The fern flora is often diverse, ranging from tiny filmy ferns to tall tree ferns; the ground cover may be a dense growth of terrestrial ferns such as Creeping Shield Fern *Lastreopsis microsora* or Jungle Brake *Pteris umbrosa*.

Cooler mountain sites, such as in Monga National Park, contain an abundance of ferns and some species preferring a high altitude, such as Plumwood *Eucryphia moorei*, Musk Daisy-bush *Olearia argophylla*, Black Olive Berry *Elaeocarpus holopetalus*, Blackwood *Acacia melanoxylon*, Fieldia *Fieldia australis*, Prickly Currant-bush *Coprosma quadrifida* and Soft Tree Fern *Dicksonia antarctica*.

Many gullies and creek-sides across the region support somewhat simple rainforest, containing few species. The tree Ironwood *Backhousia myrtifolia* forms dense stands on rather dry sites throughout the region; only a few other species are usually present in these stands. Elsewhere, Lilly Pilly *Syzygium smithii* rainforest occurs on wetter sites, again with few other species. Many of the tall forests near the coast have a ‘rainforest’ understorey, that is, one that contains many rainforest species. These are usually dominated by the rampant Water Vine *Cissus hypoglauca*, which forms a tangled canopy engulfing the trees and shrubs below. These stands can be seen on the side of the highway all the way to the Victorian border.

On the coast, littoral rainforest ranges from the diverse stands on Beecroft Peninsula to simple wind-sheared stands overlooking the ocean; this rainforest may be growing on sand dunes or the local geology. Typical littoral rainforest trees in the south of the state include Cheesetree *Glochidion ferdinandi*, Red-fruited Olive-plum *Elaeodendron australe*, Black Plum *Diospyros australis* (in the north), Plum Pine *Podocarpus elatus* (in the north) and Hard Corkwood *Endiandra sieberi* (in the north).



The diverse littoral rainforest at Long Beach North, Beecroft Peninsula. The two large trees are Small-leaved Fig *Ficus obliqua*.



Wind-sheared littoral rainforest growing above Long Beach, Batemans Bay. Much of the canopy is composed of large spreading specimens of Port Jackson Fig *Ficus rubiginosa*.



The coastal, wind-sheared canopy of subtropical-warm temperate rainforest at Bunga Head, Mimosa Rocks National Park.



Warm temperate rainforest on the Goodenia Rainforest Walk, South East Forest National Park, west of Pambula.

Species that occur at high altitudes south of Sydney, appear at lower and lower altitudes as one travels southwards, such as Musk Daisy-bush *Olearia argophylla*, Prickly Currant-bush *Coprosma quadrifida* and Native Mulberry *Hedycarya angustifolia*. A few species are absent from the northern rainforests, having their northern most occurrence in the region, such as Blanket Bush *Bedfordia arborescens*.

Plant species distribution is a complex story; a species habitat preference is a combination of soil type, altitude and moisture availability, associated with an over-arching response to increasing latitude. While the rainforest types that we like to differentiate gives us the ability to discuss this vegetation, in nature it is not so simple. Certainly there are clear patterns to be observed, but in reality what we call rainforest is very variable in its floristic composition and changes along several environmental gradients, as noted above. There are many opportunities to see rainforest throughout the south coast region, so instead of worrying about the technicalities of defining rainforest, get out and enjoy the forest.



Warm temperate rainforest on the Rainforest Walk, Bodalla State Forest north of Narooma. Rainforests in this region contain an abundance of ferns.

Common plants of the south coast rainforests



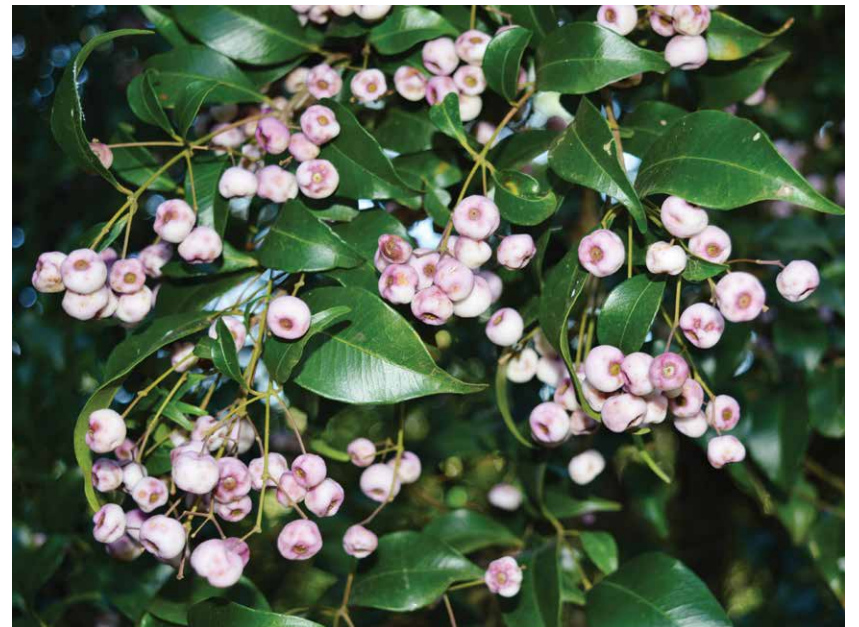
Backhousia myrtifolia



Olearia argophylla



Doryphora sassafras



Syzygium smithii



Cissus hypoglauca

Species at their southern limit of distribution



Podocarpus elatus, occurs south to Beecroft peninsula.



Dicksonia antarctica



Sarcomelicope simplicifolia can be found as far south as Mount Dromedary.



Baloghia inophylla occurs south to Mount Dromedary



Schizomeria ovata occurs south to Mount Dromedary.



Pennantia cunninghamii grows as far south as the Batemans Bay area.



Syzygium paniculatum, an endangered tree found in littoral rainforest around Jervis Bay.

A biodiversity hotspot amongst ancient landscapes

Heather Miles

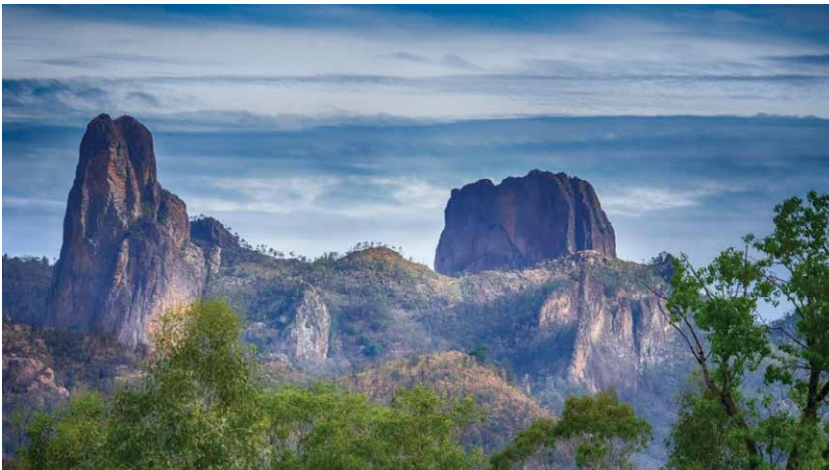
Heather is the President of the Australian Plants Society NSW. She has a very keen interest in native plants and walking in the bush as well as being an avid photographer.

Lying 500 kilometres north west of Sydney, the dramatic Warrumbungle National Park and Pilliga Forest is a botanic and geological feast.

The staging point for Warrumbungle National Park is Coonabarabran, a small country town, known as the stargazing capital of Australia due to its unimpeded view of the celestial sky.



The Warrumbungles began life as a volcano. By the time it became extinct 13 million years ago, it had built up a massive shield extending 50 km across and 1,000 m above the surrounding countryside. Erosion led to an impressive jumble of spires, dykes and domes, which characterise the inside of a volcano.



The rock formations and vegetation of the Warrumbungles are best seen by walking the many tracks of various grades.



Extensive fires in 2013 wiped out much of the national park, but the recovery has been accelerated by good rains over the last few years.



The ridges are populated by callitris, eucalypts and casuarinas with an extensive understorey of heathland plants, grasses, shrubs and herbs best seen by wandering the many paths.



From top left, clockwise: *Dianella revoluta*, *Dillwynia* sp., *Dichopogon fimbriatus*, *Pomax umbellatum*, *Astrotriche longifolia*.

The Pilliga Forest (or Pilliga Scrub) comprises 5,000 km² of semi-arid woodland, the largest continuous remnant of such forest in NSW. This iconic landscape comprises the Pilliga Nature Reserve, Timmallallie National Park, Pilliga West, and East State Conservation Areas.



The forest contains at least 900 plant species, including many threatened species. The Pilliga is dominated by *Callitris*, Cypress Pine, but there are also a range of other ecosystems including those where *Casuarina* (Sheoaks) and *Eucalypts* dominate.



An understorey of *Wahlenbergia*, *Chrysocephalum*, and paper daisies delight the senses.

On Gamilaroi land in the Pilliga Nature Reserve, the Sandstone Caves walking track passes through scenic forest to arrive at the impressive sandstone caves, containing ancient Aboriginal rock art and engravings.



Sandstone Caves

At Sculptures in the Scrub, award winning sculptures celebrate Aboriginal culture and history. Wandering along the many paths gives a close up view of the abundant flowering shrubs and grasses.



From top left, clockwise: Paper daisies, *Calytrix tetragona*, *Ozothamnus obcordatus*, *Pelargonium australe*, *Senna aciphylla*, *Grevillea sericea*.

The forest is a haven for native fauna including wallabies, squirrel gliders, koalas, bettongs and many birds, including emus!



Near Narrabri is Mt Kaputar, with its sub-alpine zone, dominated by Snow Gum, Ribbon Gum and Mountain Gum, as well as heathland species near the windswept summit.

An easy walk beside a shady creek bed takes us to the spectacular volcanic rock feature called Sawn Rocks. These are one of Australia's best examples of a rock formation called 'organ-piping' – a fascinating reminder of Mount Kaputar's volcanic past.



Sawn Rocks

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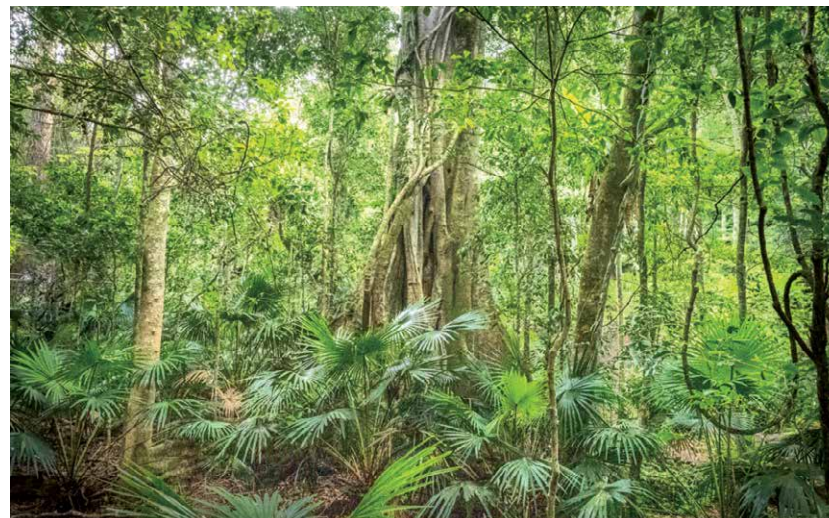
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ANPSA Biennial Conference, 10 – 16 September 2022



APS NSW is excited to be hosting the next ANPSA Biennial Conference in Kiama in September 2022. We aim to bring you a wide range of interesting speakers and enjoyable activities. We will be operating at the highest Covid standards to keep ourselves safe and healthy.

Theme: Australian flora – past present future. Explore the flora of 40,000 years ago, understand opportunities and threats we face now and consider how the future might unfold, along with our role in that.

Location: Kiama, on NSW's magnificent South Coast, with the conference to be held at the Kiama Pavilion.

Excursions: Robertson Rainforest, Fitzroy Falls, Wollongong Botanic Gardens, Minnamurra Rainforest, Royal National Park, Kamay – Botany Bay National Park, Bulli Grevillea Park and native plant reserves in Southern Sydney. A complimentary tour of the Kiama region on Saturday 10 Sept, with a market fair and plant sale on the Sunday.

Pre and post conference tours: Lord Howe Island, Warrumbungles and the Pilliga, Blue Mountains, Sydney and the South Coast.

For further information, and to register interest in the conference or tours, visit the APS NSW website: (www.austplants.com.au/ANPSA-Biennial-Conference-2022) or send us an email: office@austplants.com.au

