

The background of the cover is a photograph of a coastal landscape. In the foreground, a large, vibrant red flower with many fine, needle-like petals (likely a Banksia) is in focus. Behind it, a green shrub with thick, rounded leaves is visible. The background shows a wide expanse of green coastal vegetation, a sandy beach, and the ocean under a clear blue sky with distant mountains on the horizon.

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This issue has been produced and laid out by Jim Barrow who wrote most of the articles. In each article, photos are by the authors unless otherwise indicated.

Cover: View from west carpark East Mt. Barren *Banksia coccinea*, Photo Margaret Pieroni.

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Editorial and Introduction

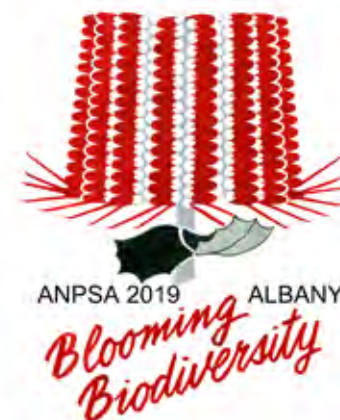
Except where otherwise indicated, articles in this issue were written by Jim Barrow. Jim "retired" from CSIRO as a Chief Research Scientist in 1992. Since "retirement" he has published about 45 scientific papers in refereed international journals as well as devoting much of his time to the Wildflower Society of WA. His contribution is acknowledged by the Wildflower Society Award. He has also written many articles for *Australian Plants*.

In 2005, the Wildflower Society hosted the biennial conference of ASGAP – as it was then called. It was very successful: there were almost 300 attendees, the location of the conference at Hale School was excellent, as were the speakers. Of course, they had something really good to talk about – Western Australian wildflowers. There were three pre-conference and three post-conference tours all of which were fully booked within a few weeks of opening bookings.

That very success posed a problem: what shall we do the next time around? It was tempting to pretty-well repeat the successful recipe, but we felt that so much of the potential market had already had that experience that it would be better to try something different. Let's base it in Albany.

We decided that the conference itself would occupy the week starting Monday, 30 September 2019. The pre-conference tours will be timed to deliver you to Albany on Friday, 27 September. That will give you the opportunity to visit the famous Albany wildflower show on the Saturday. It has been extended so you can see it. There will be short tours offered on Sunday the 29th; during the conference week there will be one-day tours. Postconference tours will depart from Albany on Saturday, 5 October.

Albany is on the south coast of Western Australia, about 400 km from Perth. It has nearly 40,000 inhabitants, the sixth largest population centre in the state. From our point of view it had three advantages: it is regarded as a holiday centre and therefore has a great deal of accommodation both as motel units and



One of our first jobs was to choose a theme and a logo. Margaret Pieroni took our vague ideas and produced this marvellous logo.

as apartments to rent; it is close to several wonderful wildflower areas: and it has a newly-built Entertainment and Conference Centre very near Middleton Beach (look it up on the internet; it's very impressive). For lovers of wildflowers, it also has some special interests. It was in King George Sound that Matthew Flinders anchored and the "scientific gentleman" including Robert Brown went ashore. This was the source of the type specimens for many Western Australian plants. Flinders was not really supposed to call in at King George Sound, the harbour on which Albany is situated (this was the name he used and the name subsequently adopted, rather than "King George the third's Sound" as it was previously known). He referred to it as a 'slight deviation' from the plan! Nor did he intend to call at Lucky Bay. Brown laconically remarks in his diary: "...our situation rather dangerous. And even with the finest weather the navigation so intricate that it was judged prudent to run in with the land with a slight probability only of shelter." That is why Flinders subsequently named it "Lucky Bay". Flinders intended to push on but was persuaded to stay for "two or three days by the scientific gentleman".

King George Sound is one of the best natural harbours in the world with deep water between granite domes.

It was in the sound that the convoy assembled in 1915 to transport Australian troops to the Middle East. Indeed, with its natural harbour, it is interesting to speculate why it did not become Western Australia's major city. It was, in fact, settled more than two years before the Swan River Colony with an expedition from Sydney. Partly, I think, it was the



A granite dome in the foreground, part of the sound in the background.

(false) enthusiasm generated for the Swan River Colony by Stirling and partly because Perth was closer to the goldfields and benefited by the supply of goods to the miners and from the gold that passed through it in return.

Basing the conference in Albany posed some problems in designing the conference tours. There are three really special wildflower areas in Western Australia: the Badgingarra-Mount Leusuer area; the Fitzgerald River National Park; and the Stirling Range. We wanted you to have the opportunity to visit all of them. However, going north to Badgingarra means that we have to add extra days in order to finish in Albany and the Fitzgerald River-Esperance area is so special that we felt we needed extra days there as well. The Stirling Range is within easy reach of Albany and we plan to offer within-conference day trips to there.

Before you come, and of course you will come, get out some of your old copies of *Australian Plants* and refresh your memories of articles about the south-west. Issues of particular importance are as follows.

"Wildflowers of the South West", June 2011, 26, 207. (About the environment and how the plants are adapted to it).

"Touring the south-west", September 2012, 27, 212.

"Trigger plants", Winter 2013, 27, 215

"Proteaceae of South West WA", Summer 2013/14, 27, 217.

"The Goodenia Family", Spring 2015, 28, 224.

"Featherflowers and Coppercups", Spring 2017, 39, 232.

If you can't locate the first two items above, feel free to buy my book "*How to Enjoy WA Wildflowers*". It covers of those items, plus a bit more. My publisher would be delighted.

How will you get to Albany? There are several alternatives. Fly to Perth and attend the Botanic Guides conference (see page 4 of the insert in the middle of this issue) or spend at least one day looking at Kings Park (the gardens are marvellous in September), then either travel to Albany using the railway bus (so-called because it replaced the train service) or fly with Rex Airlines. The bus service is cheaper, it takes longer of course, but you travel through very interesting countryside. Or take one of the tours we provide. A few of you may decide to travel by car across the Nullarbor. In that case, turn south at Norseman and continue along the south coast, or take the "shortcut" from Norseman to Hyden and then turn south.

Check for developments and "express interest" at

<http://www.wildflowersocietywa.org.au/anpsa/>

Comparing East and West

A friend of mine once said to me: south eastern Australia and south western Australia are pretty similar; both have flat land especially inland and both have gum trees. Well, that is true, but there are indeed many differences.

Western Australia was reluctant to join the Commonwealth of Australia, but eastern Australia was even more reluctant to join the continent of Australia. For many millions of years, much of it lazed around on the bottom of shallow seas accumulating sediments. That is why so many rocks in eastern Australia are comprised of sediments from Silurian and Ordovician times.

In contrast, most of the south-west has been sticking up out of the sea virtually since the earth was formed. There are some sediments of course but these are mostly where the edge of the block crumbled. Some of these sediments are quite thick: Perth sits on the edge of the continent and on top of about 7 km of sedimentary material going back to Permian times, more than 220 million years ago.

Another important difference is that eastern Australia has had a great deal of volcanic activity. This is derived from a large hotspot over which Australia has travelled as it moved north easterly. Unlike the Hawaiian, Society Islands and Yellowstone hot spots, which produce a single chain of volcanoes, the hot spot beneath eastern Australia is broad and may take advantage of weak places in the plate to feed magma to the surface. Consequently there are several series of volcanic chains running parallel. One of these chains was started 33 million years ago; it runs from Cape Hillsborough on the central Queensland coast, south-west through central New South Wales to Cosgrove in Victoria. It is nearly three times as long as the famous Yellowstone hotspot tracks in North America. Unlike most hotspots, the East Australia hotspot has explosive eruptions, as well as runny lava flows. Explosive volcanoes occur when basaltic magma interacts with groundwater in aquifers below the surface producing violent eruptions. Mt Gambier in South Australia is a well-known example.

The existence of the resulting basaltic soils was important in the social and economic development of eastern Australia. These soils were often high in phosphate and this meant that pastoralists could graze their stock on highly productive pastures – at least until the more-palatable species were grazed out. In contrast, in the south-west, all of the soils

were extremely phosphate deficient. Most of the plants had hard, unpalatable leaves that were difficult to digest and many of the few that have soft leaves were poisonous. This meant that the pastoral industry scarcely developed in the south-west. Agriculture was only possible when superphosphate came into general use and later when copper and zinc deficiencies were identified. This meant that the south-west was settled by farmers rather than pastoralists: an important difference in the sociology.

Inland SE Australia is indeed flat. For example, Echuca is at an altitude of 96 m above sea level and the mouth of the Murray River is about 1500 km away. That means that the river ambles along a gradient of about 6 cm per kilometre. That is of course why it was so much used for navigation in the early days.

Suppose you start somewhere on the flat lands of south-eastern Australia and move eastward toward the sea. You must first cross the Great Barrier Range. This was mostly created as Australia moved northwards and crossed old subduction zones. In contrast, suppose you start somewhere on the flat lands of south-western Australia and move westward towards the sea: you do not meet mountains. Rather you come to the edge of the uplifted country: the Darling scarp. This uplift occurred between 5 and 2 million years ago. It gave the rivers which had previously wandered over flat land a gradient to work with. They started cutting back through the ancient crust. Near the edge of the Darling scarp you have narrow valleys (well narrow by WA standards), but as you move further inland, the rejuvenated valleys become much broader.



Granite boulders exposed on the side of a relatively steep valley in John Forrest National Park on the edge of the Darling scarp. The flowers are *Verticordia huegelii* which start off white and turn pink with age.

The current landscape of the south-west

Starting at the beginning, cooling and solidifying a huge magma begins at the outside. The crystals formed as the rock cools are quite large because cooling is slow. Minerals with a high silica content tend to form first and because of this differential crystallisation, the still-molten magma towards the centre of the mass has a lower silica content and a higher iron content. As cooling continues, the mass shrinks. Cracks develop in the cooling outer layers and into these cracks, some of the more-basic, still-molten magma gets injected. Because the cracks are relatively narrow, this material cools quickly, the crystals are smaller and have a higher iron content and a lower silica content. Because of the smaller crystals, the resulting rocks weather more slowly. Thus, for example, Red Hill near Bindoon is a hill because the rock from which it is formed is resistant to weathering and red because the rock has a high iron content and gives rise to red soil.



An intrusion of fine-grained rock (diorite) forms a slowly-weathering barrier and hence a waterfall in John Forrest NP. Note the cuboid rocks behind the boy's head.



A similar barrier causes rapids in the Swan River. If you use a lot of imagination, the barrier rocks are slightly cuboid. Snake faeces are also cuboid and this was where the rainbow serpent ("Wagyl") paused to defecate as she carved out the valley.

The next major influence on the landscape of the south-west was the formation of Gondwana between a billion and 600 million years ago. When two continental plates collide, one tends to ride over the other giving rise to a mountain chain. Thus, at present, the Himalayas were formed as the northward bound Indian plate crashed into Asia. As one plate is lifted, the more-basic rocks at depth are also lifted, and, with subsequent erosion, appear near the surface. We have two examples of the consequences of this in the south-west. One is the Leeuwin Ridge that forms the "chin" in the south-west corner. The remnants of that ridge can be traced in rocks running northwards to Northampton. The other is the Porongurups north of Albany. The soils formed on the exposed rocks in both of these occasions are relatively fertile (by

Western Australian standards). They carry the fast-growing Karri trees, which need a fairly high phosphate status and of course these soils are very good for vineyards.

A stand of Karri (*Eucalyptus diversicolor*) near Denmark. (Photo: Margaret Pieroni.) If these soils can grow such large trees, they must be good for dairy farms. Let's cut them down and establish farms. Big mistake and the cause of much misery. They didn't understand how much more P pastures need.



The other landscape that shows the influence of Gondwanan times is the triangle of land near Dongara that includes Mount Lesueur and Hi Vallee farm. We think of this as being close to the sea, but in Gondwanan times it was a sunk-land in the middle of a supercontinent with a large mountain range to the west. The landscape of this area is formed from a variety of interbedded rocks including sandstones, silt stones, shales and even coal. The rocks are over 270 million years old from a period when this area was covered with swamps, marshes, rivers and deltas. These rocks were deeply buried until about 140 million years ago when, as Gondwana began to break apart, a series of roughly north-south trending fault lines lifted them to the surface. The flat-topped mountains are covered with laterite, the origins of which will be discussed later.



Mt Lesueur from the lookout and carpark. The yellow-flowered bushes in the foreground are *Melaleuca urceolaris*.

Gondwana eventually broke up, roundabout 160 million years ago. When continents part, there is at first a linear sea between the two masses, rather like today's Red Sea. It is in such basins that sediments accumulate: Perth sits on sediments dating back to the Permian period. If you are lucky you may find oil or gas in such basins. One of the current consequences of that split is the existence of the Darling scarp, a sharply-defined lifted area about 300 m high and extending about 1000 km. (It is not a "range". A range goes up and then down. The Darling scarp goes up and then across.)

The separation from Antarctica did not go smoothly. At first, the trailing edge dropped below sea level and started accumulating sediments. Then the north-moving continent experienced a slight anti-clockwise twisting. The result was that the accumulated sediments were lifted and became a rugged range – the Stirling Range.



Stirling Range from the south.



The Mt Barrens, though superficially similar are much older. Here East Mt Barren from Quaalup Eco Retreat.

Laterite

The popular conception is that the landscape of Western Australia is dominated by sand, and that is fair enough: there is a lot of sand. They don't call us "Sandgropers" without good reason. But that ignores another major component of our landscapes: we also have a lot of iron-rich materials. This includes the materials that form the flat tops of mesa-like mountains such as Mount Lesueur shown earlier.



It also includes the capping on iron-rich intruded rocks such as here near Wongan Hills. As is common, there is an iron-rich layer at the top and a paler, kaolin-rich layer beneath. If you look very closely at the rocks you can see that they appear to be a jumble and consist of smaller components stuck together.



More commonly, the iron-rich layer is not cemented but easily breaks up into rounded pebbles. These sites are popular with shire councils who use the gravel for road making – and with farmers for abandoning old machinery! When the sites are less thoroughly disturbed than here, the regrowth of wildflowers makes them popular sites – and many a wildflower enthusiast has finished in an undignified sitting position as their feet have slipped from under them.

How did these materials form? According to Google, there is no doubt. All the sources quoted say that these surfaces are formed in warm humid climates where strong leaching removes the less resistant soil materials resulting in a concentration of the iron oxides. This is also the story told on signboards in national parks – with the modification that you have to postulate that this material was formed to some 40 million

years ago and subsequent uplift and erosion produced the “edges”.

There are however just a few tiny weeny problems with this explanation. One is that pedologists (scientists who study the formation of soil in the field) think that they can see typical edges of laterite deposits developing in recent roadside cuttings. This suggests that formation of laterite is still occurring today. Another is that if you look at a disturbed laterite boulder, the faces are shiny and smooth. That is not what you'd expect of something formed 40 million years ago and weathered over the last 20 million years. However the killer problem is that the existence of rounded laterite gravel and also that massive laterite appears to be made up of smaller components stuck together.



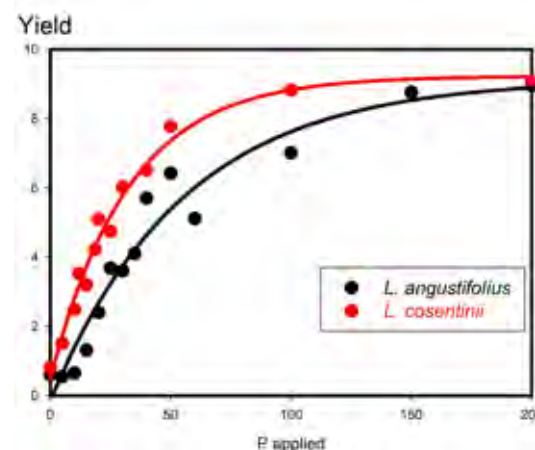
The face of a disturbed laterite boulder. The face is smooth and shiny, but the boulder itself seems to be an aggregate of smaller components.

To produce these effects, you need a mechanism by which iron and aluminium become soluble but do not remain soluble for very long and so re-precipitate. For iron there is a simple and well-known mechanism: all you need is mildly reducing conditions as in waterlogged soil and iron will give up one of its oxygen atoms and become more soluble – then re-precipitating when oxygenated conditions return. But that won't work for aluminium which is an important component in laterite, so important that some laterites are mined for their aluminium content. Aluminium oxides really hold onto their oxygen atoms so that mechanism won't work. You need a mechanism that applies to both iron and aluminium.

There is indeed such a mechanism. In the south-west there is a very large representation of Proteaceae, and most Proteaceae bear specially modified roots. These modified roots used to be called “proteoid roots” but with the realisation that they are not confined to Proteaceae, the term “cluster roots” is now preferred. The term applies to sections of the roots which sprout many closely-placed short roots. These short roots exude many organic acids but especially citric acid.

Somewhat surprisingly, it was discovered that about seven species of the Lupin genus formed cluster roots. These include *L. albus*, the sweet lupin grown in the Mediterranean area. It is surprising that it was not previously discovered for this plant has been in cultivation for many hundreds of years – perhaps many thousands. Because the seed is easily obtained and because it is much easier to grow in the laboratory than most of the Proteaceae, this plant has become the laboratory “mouse” of cluster root research.

Do cluster roots indeed help plants get phosphate? This has previously been inferred from their occurrence in roots of plants grown in low phosphate soils. Within the protea family it is difficult to make the required comparison of a plant with cluster roots versus a plant without them. However this is possible within the Lupin genus.

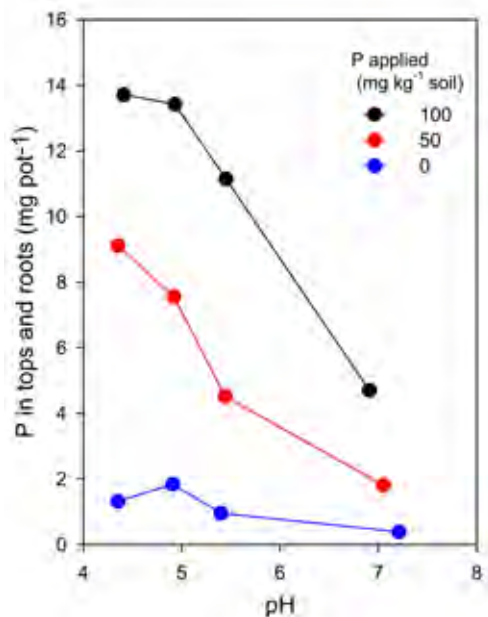


This plot compares the response to phosphate of the non-cluster rooted *L. angustifolius* (the Western Australian sweet white lupin) with that of the cluster rooted *L. cosentinii* (the sand-plain lupin, which is naturalised in Western Australia). This graph should be read “horizontally” – thus to produce the same yield, *L. angustifolius* requires almost twice as much phosphate as *L. cosentinii*. (This plot has never been published before.)

The above shows that cluster roots do “work”: they enable plants to grow better at a lower phosphate supply. The next question is: how do they work? It is easy to show, for example using pH indicators, that cluster roots acidify the soil. This is what is known as an “inconvenient truth” because soil scientists are convinced that the optimum pH for uptake of phosphate is between pH 6 and pH 7. This opinion is reproduced in every soil science textbook I have consulted and it finds its way from there into books on horticulture. It appears to be a “factoid” – something that is uniformly accepted as true based on its frequent repetition rather than on any real basis in fact.

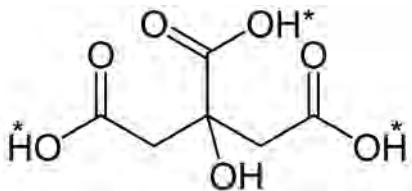
The influence of pH on phosphate uptake has two components: the

effect on uptake by plant roots and the effect of desorption from the soil into the soil solution. To understand this, we need to remember that phosphoric acid (H_3PO_4) is really three acids. It gives up one of its hydrogen ions quite readily at low pH to become H_2PO_4^- but does not give up the second one to give HPO_4^{2-} until pH values near seven (and the third one not until near pH 12). The reason for going into this detail is that the transport mechanism that transfers phosphate from outside the root cell to the inside requires the H_2PO_4^- molecule. So this step is favoured by low pH. On the other hand, desorption of phosphate from soil is the lowest at near neutral pH and increases with decreasing pH. So, in sum, both steps are favoured by low pH.

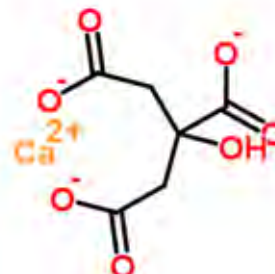


Effect of phosphate supply and of pH on the uptake of phosphate by subterranean clover growing on a West Australian soil. Guess what: the greatest uptake of phosphate is at low pH.

However, roots do not exude just any old acid, they exude several organic acids of which citric acid is the most prominent. Citric acid, like phosphate, is three acids in one. The hydrogen atoms that can dissociate are marked with an asterisk on the formula. This means that, like phosphate you can have molecules with three different amounts of negative charge in solution depending on how many hydrogen ions have departed.



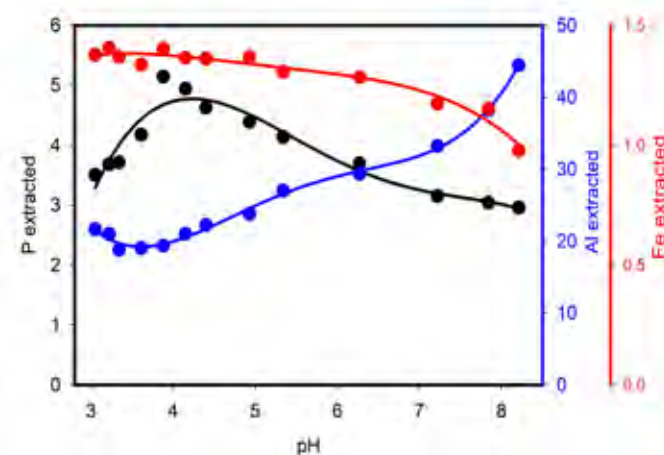
Citrate has another special property. The molecule can bend in the middle and the two ends can come together in a pincer-like structure somewhat like crab claws. The Latin name for crab claws is “chelae” and when something is caught in those claws, the product is called a chelate.



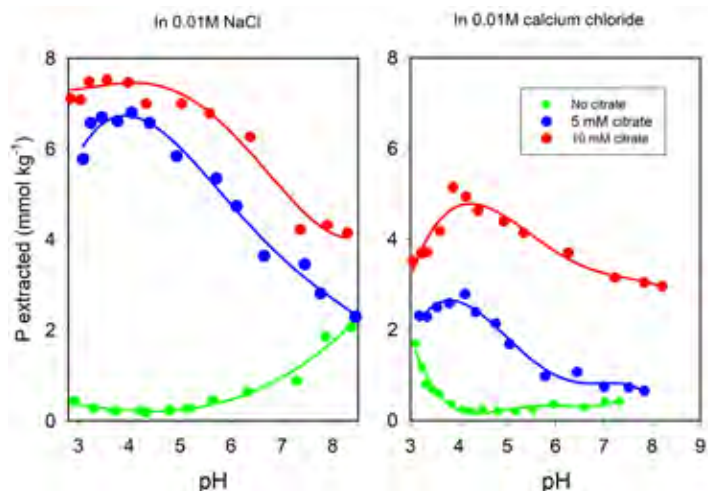
The simplest calcium citrate. The lone negative charge can link up through another calcium ion to another citrate molecule - and so on.

Citrate can chelate calcium ions. This means that in the presence of calcium ions, the effectiveness of citrate in releasing phosphate from soil would decrease.

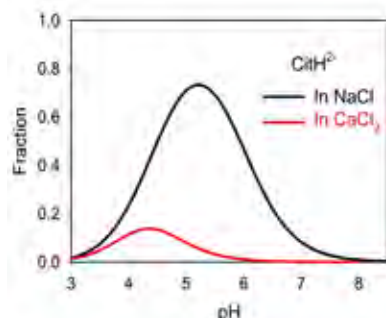
Citrate can also chelate iron and aluminum and it is widely believed that this is the mechanism by which it releases phosphate.



However, there are two problems with this explanation. One is that the effect of pH on the release of phosphate is quite different from its effect on the release of aluminium and iron. The other problem is, if phosphate is released by this mechanism, what is there to keep it in the solution so that plants can use it? Rather, it would be expected to react again with suitable particle surfaces. This is where citrate comes in. It competes with the released phosphate for sorption sites. Of course it also, of itself, competes with phosphate directly and releases it.



The above shows you what a large effect citrate has on phosphate desorption from soil. It also shows that citrate is most effective at pH 4, or thereabouts and less effective in the presence of calcium.



It is pretty clear that the effects of pH on phosphate desorption by citrate have a lot to do with the divalent citrate ion. As you can see from the diagram on the left, it is "squeezed" between the other citrate ions and so reaches a peak at pH 4 – 5. Indeed, a complicated model in which the divalent citrate ion competes for sorption with the divalent phosphate ions describes the observed effects very closely.

The final component of this puzzle is that cluster roots don't last very long and furthermore, the exudation phase during which the roots pour out citrate (and other) ions is even briefer – about 2 to 3 days. That is about as long as it takes for soil microorganisms to build up their numbers by feasting on the citrate even though the acidity acts, to some degree, as a preservative.

So there you have exactly the mechanism required to explain the formation of a laterite: a process that dissolves iron and aluminium and then re-precipitates it.

Further reading

Barrow, N.J. (2016) The effects of pH on phosphate uptake from the soil *Plant and Soil* 410:401–410.

Barrow, N. J., Debnath, A. & Sen, A. (2017) Mechanisms by which citric acid increases phosphate availability. *Plant and Soil*. p. 1-12.

The Peas

For a long time, botanists argued about how to view the legumes: were there three families (peas, mimosas, and cassias) together comprising one "super" family (the legumes)? However, the consensus is now that there is just one family with three distinct tribes. To be consistent with the rule that the name of a family derives from that of its type genus, the name of the family is Fabaceae – and the three subfamilies are "Faboideae" (Papilionaceae), Mimosoideae (Mimosaceae) and Caesalpinioideae (Caesalpiniaceae). All three subfamilies will be seen on the tours and comprise a striking component of the flora.

Faboideae (Papilionaceae), the peas.

There are four reasons for giving them a special mention.

- 1) Many of them are very pretty and you may want to know how to put names to them.
- 2) There are a lot of them so they are often a striking part of the show.
- 3) Some are very important because they are poisonous. The poison they contain is sodium fluoroacetate which is commercially known as "1080". It is therefore important (and difficult) for farmers to be able to recognise the poisonous ones. However, many native animals – both herbivores and carnivores, have a fair degree of immunity to the poison. So 1080 baits can be used to control pests such as foxes without harming the native animals. Where baits have been used on a large scale, many of the native animals which were near extinction have come back to considerable numbers. They are now using 1080 baits to control foxes in most of the jarrah forest and re-introducing the animals from reserves.
- 4) The classification has been a bit of a mess. The first problem was that similar plants were shoved into different boxes. This arose because the number of "peas in the pod" (ovules) was used at a fairly high level in the classification. This has now been abandoned. For any of you looking at old books – or even at old plant lists – the genus *Burtonia* was put into *Gompholobium* in 1991. However there is a large group of peas that have proved difficult to put into boxes. In 1991 a genus called *Nemcia* was differentiated from *Gastrolobium* on differences in the inflorescence. It seemed neat because it also differentiated non-poisonous *Nemcia* from poisonous *Gastrolobium*. It only lasted 15 years and the latest is that they are all now in *Gastrolobium*. That means that some plants have had 3 different genera within 16 years!

In sum this means that anything once called *Oxylobium*, *Nemcia*, *Jansonia*, and most *Brachysemas* are at the moment *Gastrolobium* –

which makes it easy to identify the genus but not so easy to identify the species! I write “at the moment” because no-one has much confidence that this classification will last. Some argue that the *Mirbelia* group is just a Western version of *Pulteneae* and they should all go into that genus.

Many of the peas of WA are “egg and bacons” – flowers with egg-yolk-yellow combined with bacon-red. The biggest group is the *Mirbelieae*. The main characteristic of this tribe is that the filaments of the stamens are all free. Here are the genera of the *Mirbelieae* you are most likely to see.

Mirbelia

After Charles Francois Brisseau de Mirbel, French botanist. There are more than 20 species in WA

The flower colour varies from purple through mauve to typical egg and bacons - so it is difficult indeed to spot at a glance. The diagnosis is in the ovary/pod which seems to be two pods lying parallel - that is, the pod is more-or-less divided along its length.



Mirbelia trichocalyx



Mirbelia dilatata

You can see the problem: three very different looking plants but in the same genus. Partly this is a response to environment. *M. trichocalyx* was photographed towards the eastern end of the wheat belt and therefore a fairly dry environment. *M. dilatata* occurs in a much wetter environment, this one in the Jarrah Forest. *M. floribundum* is widespread on gravelly soils.



Mirbelia floribundum

And of course the pollinators are presumably different.

Chorizema

From Greek *chorizo* to divide, *nema* thread referring to the stamens. Not as some think from *choros* dance and *zema* drink and thus to dance with joy. There are about 26 species in WA

These are the flame peas and most are very striking. Typically, the standard is orange with a yellow centre spot, the wings are a different hue often pink. The wings are spreading and hide the keel which is shorter. If the standard is a different colour, the wings are usually a darker colour. The leaves usually have a conspicuous network of veins on the upper surface. They are mostly low straggling shrubs, but *C. diversifolium* is a twiner or climber..



C. dicksonii



C. varium



C. glycinifolium



C. aciculare

C. dicksonii is commonly seen on the gravel soils of the Jarrah forest. *C. varium* is very rare in the wild. It is a member of a closely related group that includes *C. ilicifolium* and *C. cordatum* which are widely grown and which differ in leaf shape, as can be deduced from their names. *C. glycinifolium* is a scrambling shrub with attractive flowers here photographed at Harrismith airport. *C. aciculare*, with its reduced leaves is adapted to drier regions.

Gastrolobium

From Greek *gastros* paunch/belly *lobos* pod – refers to the ovoid pod.

As currently proscribed contains 109 species in WA including those previously in *Nemcia*, *Jansonia* and *Brachysema*. It is now a very diverse group ranging at one extreme from plants with flowers that seem to be adapted to bird and/or mammal pollination and are non-poisonous, to plants that are very poisonous.



G. bilobum heart-leaf poison.



G. calycinum York road poison.



G. parviflorum prev. *Oxylobium parviflorum*
Box poison.



G. ovalifolium runner poison.



G. celcianum prev. *Brachysema celcianum*
Swan River pea.



G. hookeri prev. *Nemcia hookeri*.

Only a small proportion of native plants of the south-west have well accepted common names. Mainly this is because there are simply so many of them. The poisonous *Gastrolobium*s are an exception: all of them have well-recognised common names. This is, of course, because it is so important to recognise them and be able to talk about them to other people. Often the common name refers to an obvious characteristic of the plant (heart-leaf poison, runner poison), sometimes it refers to a location (York road poison), and sometimes it is difficult to discern the origin (Brother-brother poison). One can hardly complain if common names are preferred: they are a lot more stable than the scientific names.

It took rather a long time (1837) to realize that the plants that were killing sheep were legumes. These were thought to be good forage. It was not until 1964 that it was discovered that the toxic principle was fluoroacetate. The concentration in the plants varies considerably with time and with location. The young, actively-growing tissue has the highest concentration. The highest recorded concentration is 0.26% in heart-leaf poison. After such a long exposure, native animals have become resistant to the poison (commonly known as 1080) and so baits containing this can be used to control feral animals.

I have always thought it a pity that Agatha Christie did not live in the south-west. If she had, she would surely have written a mystery in which the victim was poisoned by 1080, say as a tea made from the leaves of heart-left poison. Only problem is that I do not know how M. Poirot would have solved the mystery because the poison would not be detected.

Callistachys

From Greek *calli* beautiful and *stachys* ear of corn, and here flower head. There is only one named species. It is an attractive small tree common on the south coast including near Albany. It has often been mistaken for a poison plant (you can see the superficial similarity) and therefore grubbed out. It often occurs near creeks and hence the common name.



Callistachys lanceolata, prev *Oxylobium lanceolatum*
native willow.

Leptosema

From Greek *lepto* narrow and *sema* referring to the standard (the central petal). The genus now has 8 species four of which were gained from *Brachysema* (which no longer exists as a valid name). The leaves are reduced to small scales and the standard is indeed narrow, as specified by the name. The genus includes the two rather bizarre “upside-down peas” in which the flowers appear at the base of the plant. Shown here is *L. daviesioides*. The species name refers to the spiny foliage, which reminded the botanist of a *Daviesia* (see later).



L. aphyllum previously *Brachysema aphyllum*. Ribbon pea.



L. daviesioides, an upside-down pea. (Photo H Dempster).

Sphaerolobium

From Greek *sphaira* ball and *lobos* pod. There are nearly 20 species in WA. Typically they are small broom-like plants with pea flowers up the stem. They flower from the bottom up, so the pods, which are globular, are at the bottom of the stem.



Far left, *S. macranthum* from near Badgingarra.
Near left *S. drummondii* from Mt Lesueur.



S. medium is a widespread species. This picture was taken near Kojonup, a region in which it is particularly prominent. With its ability to grow in a range of soils, it is surprising that it is seldom seen in gardens.

Gompholobium

From Greek *gomphos* club and *lobos* pod. There are about 28 species in WA. The leaves are compound with three or more usually sessile leaflets and there are two “peas in the pod” i.e. ovules. Often they look vaguely like a vetch. But the real give-away is that the flower colour is uniform with little indication of the pattern seen in the rest of the tribe. The petals are fairly plain coloured in shades of yellow, pink and mauve.



G. cyaninum.



G. knightianum.



G. aristatum



G. scabrum, painted lady.

Daviesia

After Hugh Davies, Welsh botanist. There are 55 species in WA

This genus usually has the leaves greatly reduced. The easiest diagnosis is the pod which is more or less “D” shaped. You’ve got to admire a plant that tries to tell you its name! Some of them flower fairly early so you will be more likely to see (and hear - shake the bush - they rattle) the pods than the flowers.



D. cordata, bookleaf.



D. divaricata.



D. purpurascens.



D. decurrens.

These pictures give you some idea of the diversity within the genus. For “bookleaf”, bracts grow up to enclose the pods. In the group to which this species belongs, the flower stalks arise from a common point. The inflorescence is an umbel. *D. divaricata* is a wide-spread species. *D. purpurascens* was photographed in Fitzgerald River National Park. The flower buds and the central part of the flower are a deep purple. *D. decurrens* is quite variable. This plant, again photographed in Fitzgerald River, has broad phyllodes rather like a shark’s fin. More commonly, they are much narrower.

Euchilopsis

The name comes from a genus called *Euchilus* plus Greek *opsis* appearance. *Euchilus* is a member of the pea family named by Robert Brown from *eu* well and *chilos* a lip because the upper lip of the calyx was large. However, in *Euchilopsis* two calyx lobes are enlarged.

There is only one species.



Euchilopsis linearis.



Isotropis

From Greek *isos* equal and *tropis* keel – the keel petals are about as long as the wings. There are 10 named species in WA, mostly undershrubs and herbs.



Isotropis cuneifolia “Grannies Bonnet” So named because the back of the standard has red-purple stripes running towards the edge. The common name is well chosen. The leaves are simple and the flowers are on long pedicels.

Jacksonia

After George Jackson, Scottish Botanist. There are over 50 species in WA. The leaves are reduced to scales and in some species the stems are flattened and leaf-like. The flowers are mostly “egg and bacons”



J. restioides.



J. nematoclada.



J. acicularis.



J. sternbergiana.

Jacksonia restioides is a straggly shrub growing on gravelly soils near the Darling scarp from south of Perth northward. The name tells us that it is rush-like. *J. nematoclada* is low shrub growing on the eastern edge of the wheatbelt. *J. acicularis* is an erect prickly shrub growing near Dalwallinu. *J. sternbergiana* is a small weeping tree common on sandy soils especially in the Perth area.

Dillwynia and Eutaxia

These small genera are conveniently treated together. There are only 6 named species of Dillwynia on Florabase. It is so named for Lewis Weston Dillwyn, English botanist. There are rather more Eutaxias, about 2 dozen. The name means “in good order” and is thought to relate to the regular arrangement of the leaves.

This small group is diagnosed by having a 2-lipped calyx and leaves that are generally in-rolled. For Eutaxia the leaves are alternate or scattered: for Dillwynia the leaves are opposite



Eutaxia myrtifolia.



Dillwynia laxiflora.

Urodon

No one seems to know the meaning of the genus name, perhaps because it was first published in Moscow in 1849. It is a genus of two named species.

Easily recognized from the mop-like end to the flowering stem and hence the common name “Mop pea”

Urodon dasyphyllus.



One of the other tribes is the Bossiaeeae. (Yes, that is how you spell it: six vowels in a row.) In this tribe, the filaments of the stamens are united in a closed or an open sheath. Some think that the Daviesia group should be transferred to here (Daviesia, Gompholobium, Spherolobium) You will probably see only one genus.

Bossiaea

After Joseph de Bossieu de la Martinière medical officer and botanist on La Pérouses voyage. About 26 species in WA.

This is a fairly diverse genus with about 20 species of egg and bacons.



Bossiaea eriocarpa, common brown pea, is indeed a very common plant.

The remainder of the ones we will deal with have the stamens in an open sheath but with one stamen free. The bean tribe Phaseoleae contains many of the beans used for food. Two members of this tribe occur in the South West.

Kennedia

After John Kennedy, English nurseryman. There are 11 species in WA.

It is a genus of very attractive climbers or runners with lobed leaves and flowers which are red, yellow and even black but never blue.



K. coccinea



Kennedia prostrata, running postman, occurs across southern Australia.

Hardenbergia.

For Franziska countess of Hardenberg, sister of Hügel. (Baron von Hügel, Austrian traveller and naturalist, is one of the most-frequently honoured people in WA botany with 16 species bearing his name.)

There is only species of this genus in WA. It is a purple-blue flowering creeper or climber with lobed leaves. (A second species which occurs in the eastern states has a single leaf. It is also very pretty.)



Hardenbergia comptoniana.

Popular etymology has it that the plant was so named because the countess had green eyes. It's a nice story that "ought" to be true. Besides, only some plants have "eyes" as well developed as here.

Hovea and Templetonia used to be included in the Bossiaeeae but it is now thought that they belong in a South American tribe.

Hovea

For Anton Pantaleon Hove collector of plants for Kew. There are six species in WA.

They are small shrubs with a purple-blue flower and are most attractive. The pods are short and fat.



Hovea trisperma (left) flowers in late winter and is welcomed as an indication that spring is not far off. *Hovea pungens* (above) prickles are forgiven because of the attractive flowers.

Templetonia

For John Templeton, Irish botanist. There are 11 species in WA.

Unlike Bossiaea, the anthers are alternately long and short and unlike Hovea, the pods are long. The flowers are mostly yellow brown.



Templetonia retusa, (Cockies tongue), left, is the best-known species, but is unusual in the genus in that it is adapted for bird pollination. The standard is folded back and the petals are red. It is common on coastal dunes near Perth. It adapts well to gardens and readily seeds in.

The Fitzgerald River National Park and the Ravensthorpe Range

Margaret Pieroni

Margaret is one of Australia's leading botanical artists. Her drawings and paintings have appeared in numerous scientific publications but perhaps she is best known for her paintings of all the Verticordias in the book of that name. She has an encyclopaedic knowledge of all of our plants, but her first love is Dryandra. She is a life member of the Wildflower Society and leader of the Dryandra Study Group.

Fitzgerald River National Park is one of the 'jewels in the crown' in the South- West Botanical Province of Western Australia; the only International Biodiversity Hotspot in Australia. It lies between Bremer Bay and Hopetoun, crossing a wide plain that surrounds the Barrens, a low range of hills. These hills are hard quartzite rock of the Proterozoic age. In more recent, Tertiary geological time, the Barrens were islands in the sea. Soft spongolite beds were deposited and, following their uplift, rivers, such as the Fitzgerald and the Hamersley cut through them, forming colourful cliffs. The peaks have many plants peculiar to them and most of the vegetation is heath, (kwongan) but there are also swamps, tall shrublands and mallee habitats.

The area was originally an A class reserve but after an unauthorised track was bulldozed by a mining company, and a concerted conservation campaign, a coal mining application was rejected. A report by the Geological Survey Branch of the Dept. of Mines revealed that the mining company's estimate of the coal (lignite) ore body was vastly over-estimated. The area became a National Park in 1973 and then the first in WA to be declared a Biosphere Reserve in 1978. Biosphere reserves are approved by UNESCO after ratification by its International Co-ordinating Council.

A visit to the Biosphere Garden at Jerramungup is recommended. Many of the plants in the region are represented. A spectacular mallee, *Eucalyptus mcquoidii* which flowers in autumn, has been planted here.

The first Europeans to visit this part of the south coast were in the Dutch ship *Gulden Zeepaerd*, under Thyssen, who sailed to about 1,600 km east of Cape Leeuwin, in 1627. Pieter Nuyts, a passenger on the ship gave his name to a stretch of the Great Australian Bight, Nuytsland and the WA Christmas Tree, *Nuytsia floribunda*. The French sailed along the coast in 1792 in the *Recherche* and *Esperance* under Admiral

d'Entrecasteaux. They landed near Esperance, where La Billardiere collected the first specimens of a Kangaroo Paw, (*Anigosanthos rufus*) and *Nuytsia floribunda*.

Matthew Flinders sailed past the area in early 1802 naming the three peaks; West, Middle and East Mount Barren. In 1841 Edward John Eyre, with his aboriginal companion Wylie passed through the area on their way to Albany after crossing the continent. Eyre called it "a wretched and arid-looking country". John Septimus Roe, the first Surveyor-General of the Swan River settlement was sent to the area in 1848 where he explored and named many features such as Mount Desmond, the Eyre Range, Culham Inlet, Mount Bland and the Fitzgerald River.

Important for major botanical collections were: William Baxter (1828), J S Roe (1848), James Drummond (1847-48) and George Maxwell (1863). When Sir William J Hooker, the director of the Royal Botanic Garden in Kew, England, received Drummond's 1848 collection he wrote that he had "rarely seen so great a number of fine and remarkable species arrive at one time from any country"

In 1846, Drummond, with Maxwell, discovered the hakea for which the area is famous and named it for Queen Victoria: *Hakea victoriae*.



Hakea victoria from near Quaalup.

Drummond felt obliged to send specimens to his various subscribers and so he tied up 16 branches of the prickly shrub with the stems of the climber, *Kennedia nigricans* and hung them over his poor pony's back. Carrying an almost 4 m long branch in his hand, he proceeded to Cape Riche where the specimens were sent by sea to Albany. He collected a good amount of seed, believing that the plant would soon be in cultivation in famous European gardens.

The most colourful examples of the Royal Hakea, now *Hakea victoria* (without the 'e'), are found at the western end of the park. It occurs throughout the park and in the Ravensthorpe Range. Several small populations also occur on hillsides between Bremer Bay and Point Hood, further to the west.



Close-up of *H. victoria* from the western end of the park. (Photo: Jim Barrow)

Plants are killed by fire and new plants, from seed, take several years to flower and produce the large, cabbage-like floral leaves, on tall, columnar branches. In successive years, these turn from yellow to orange and then red. There is a good stand of *H. victoria* on Gairdner Rd south of Mt. Maxwell. Unfortunately, too frequent fires are reducing the chances of seeing old-growth plants at their colourful best.

It is no longer possible to drive the length of the National Park as old tracks have been closed. Gravel roads are also subject to closure after heavy rain. Heavy traffic is restricted.

The western end of the park can be approached by the recently sealed Devils Creek Rd and a gravel road as far as the Quaalup Homestead Wilderness Retreat. There are several walking tracks from here

A Nature Trail through the natural heathland with labelled plants is well worth a visit. Outstanding plants here are *Petrophile prostrata* and *Actinodium cunninghamii* – a plant in the Myrtaceae family.



Actinodium cunninghamii the Swamp Daisy.

When the road is open, West Mount Barren and Point Ann can be visited by car. Point Ann is known as a whale watching spot, in season.



Point Ann with whale (very enlarged).

There are many interesting plants to see and a walk track to climb West Mount Barren. Plants such as *Banksia media* and *Dryandra cirsioides* and other normally tall shrubs and trees are very low or almost prostrate – growing on the exposed hillsides. The Bonsai Featherflower, *Verticordia oxylepis* can be found on the track to the western viewing platform and *Dryandra obtusa* grows in white sand patches.

At the eastern end of the park, from Hopetoun, south of Ravensthorpe, Hamersley Drive is sealed as far as the western side of East Mount Barren and to a few nearby beaches. At the first carpark, at the foot of East Mount Barren, there is a short walking track from which most of the rare plants that occur here, can be seen. Look out for: *Stylidium galioides*, a creeping Triggerplant with large yellow flowers, *Adenanthos venosa* with rather inconspicuous flowers among colourful new leaves, *Banksia baueri* – a rusty-coloured form, *B. oreophila* with its blue-green leaves and *Melaleuca citrina*. The outstanding plant is, of course the Barrens Regelia, *R. velutina*, which is restricted to the area. Another plant for which the Fitzgerald and Ravensthorpe areas are famous is the Quaalup Bell, *Pimelea physodes*. It can grow to about a metre high with numerous stems arising from near the ground. The pendulous flowers are small, hidden within the showy bracts which persist for months; the pink colour darkens with age. It can be seen throughout the area at various times and places but some plants have been re-located to the carpark.



Stylidium galioides, a creeping Triggerplant.



Pimelea physodes Quaalup Bell. This plant is thought to trick pollinators by imitating Darwinia flowers. (Photo: Jim Barrow).



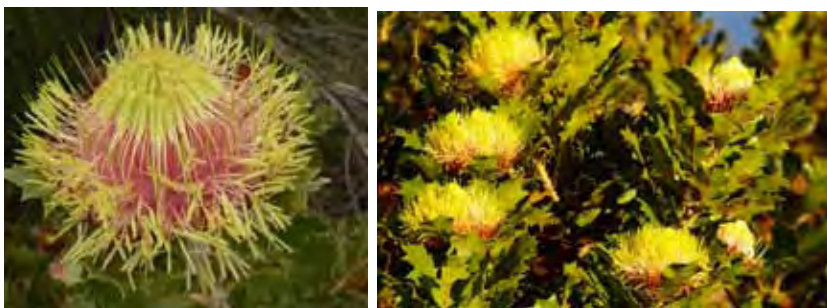
Quartzite rocks near the top of East Mt Barren photographed from the eastern carpark. These rocks, and the soils derived from them, are almost pure silica. It is marvelous that anything can grow on them – but of course they grow very slowly.



Lovely views can be seen to the east, overlooking Culham Inlet. In common with several other inlets on the west and south coast, this inlet closes over the summer when longshore currents cause a sand bar to build up. The inlet may then open spectacularly in winter as the winter rains raise the level of the water backed up behind the sand bar.

Between the eastern and western car parks, several taller banksias can be seen; *B. coccinea*, *B. speciosa* and *B. baxteri*. The extremely rare *Verticordia pityrops* with its mini pine tree-like habit grows on the quartzite slopes between the car parks. It flowers in summer.

The second, (western) car park is sited on flat bench-like area. This is a wave-cut platform formed when these mountains were islands. From here there are walking tracks, one of which goes to the summit of East Mount Barren. Magnificent views are to be had from the car park, looking west to the other peaks and beautiful coastal scenery.



Dryandra quercifolia, a spectacular plant, mainly confined to the Fitzgerald and Ravensthorpe areas and found in many locations. Left, a pink flowered form (Photo: Margaret Pieroni), right, the more-common yellow flowered form showing the oak-like leaves from which the plant takes its name. (Photo Jim Barrow)

Dryandra quercifolia flowers are mainly produced in autumn but the odd flower head can be seen at any time of the year. In some populations, the perianths of the flowers are various shades of pink rather than yellow. If you happen to be visiting in autumn, pink-flowered plants can be found just outside the park on Devils Creek Rd and near the northern end of Gairdner Rd.

Continuing along the gravel Hamersley Drive, *Eucalyptus sepulcralis*, the Weeping Gum, can be seen on the sky-line. There is a carpark at Sepulcralis Hill, where the trees used to be concentrated. Now they are scattered around the area because the trees are killed by fire. Its pale yellow flowers bloom in summer and its urn-shaped fruits are quite large. Further north, large swathes of verticordias can be seen, mostly the yellow *V. chrysantha*. A pink flowering kunzea is also dominant.

Hamersley Drive continues north to join the South East Highway west of Ravensthorpe. North and east of the town lies the Ravensthorpe Range where much of the flora of the Fitzgerald National Park is also found. The range however, has many endemics too, mostly confined to the peaks of the range. The main peaks are: Mount Short, in the north, Mount Benson, just north of the town and Mount Desmond, on Elverdon Rd, east of the Ravensthorpe–Hopetoun Rd.

The endemic *Dryandra corvijuga*, (named for Ravensthorpe) with long, rusty-coloured protea-like bracts, occurs on or near all three peaks, as does the locally named Shaggy Dog Dryandra, *D. foliosissima*. Its large, pale yellow flower heads, in autumn and winter, are usually hidden among the long, drooping, narrow, prickly leaves. *Hakea laurina*, *H. obtusa* and *H. verrucosa* also occur in the ranges. All three flower in autumn.

11 km south of Ravensthorpe on the road to Hopetoun, at the junction of Elverdon Rd, grows the Mount Desmond Mallee *Eucalyptus desmondensis* with its open, rather weeping habit and pale yellow flowers. Another plant to look for here is the low-growing, dense, *Cooperhooikia polygalaceae* (in family Goodeniaceae) with its bright purplish blue flowers.

At the carpark, at the top of Mount Desmond, reached from Elverdon Rd, can be found: *Calothamnus pinifolius* with its short, densely packed needle-like leaves, the glorious red and yellow/green *Beaufortia orbifolia* which flowers for most of the year and the Bushy Yate, *Eucalyptus lehmannii* with heads of long, narrow bud caps and balls of greenish yellow flowers.

Banksia lemanniana occurs here as well as *Dryandra foliosissima* and *D. quercifolia*. Plants of the rare grevillea, *G. fulgens*, a tall, open shrub with red flowers have been translocated here to the carpark.

North of Ravensthorpe, about 9 km on Floater Rd on the way to Mount Benson, a new road leads to a carpark. About half-way to it is a patch of *Beaufortia orbifolia*. The old track to the top of Mount Benson can be seen before you get to the carpark. A short walk along this track is very rewarding. There are many plants in the Proteaceae family: *Dryandra pallida*, a narrow, upright plant with pale green foliage and pale yellow flowers, *D. cirsioides*, another columnar but shorter plant with narrow-lobed leaves which has a very widespread distribution, *D. corvijuga* and *D. foliosissima*, *Banksia lemanniana*, with pendulous, yellow flower heads and *B. laevigata* subsp. *laevigata*, the Tennis Ball Banksia. Its globular flower heads begin to open in October. *Petrophile glauca* with its intricate foliage and pale yellow flowers grows here along with an un-named species of isopogon, not unlike an upright version of *I. polycephalus*. *Grevillea patentiloba*, (winter flowering) and *Hakea obtusa* (autumn flowering) occur here. The Boomerang Triggerplant, *Stylidium breviscopum* can be seen on the ground and a beautiful, small spreading shrub, *Acacia heterochroa*.



Banksia laevigata ssp. *laevigata*

Floater Rd continues north and a left fork is Mount Short Rd, (a track, really) which turns west to join the Ravensthorpe-Lake King Rd. Towards the end of the track before meeting the well-formed gravel road, pale pink and white *Verticordia inclusa* grows on rocky ground and *Dryandra corvijuga*, *D. pallida* and tall, bushy, yellow flowered *Grevillea shuttleworthiana* subsp. *shuttleworthiana* can also be seen.

Although the peak flowering time for most plants is in spring, many of those that I have mentioned flower in autumn so that is a good time to visit the areas as well.

The Southeastern tour will visit several of the places mentioned (Sun 22/9 - Fri 27/9 & Sat 5/10 - Thurs 10/10).

The Tours

The tours, especially those before and after the conference, are an important part of every ANPSA meeting. That is especially so in Western Australia where you can see those plants you struggle to grow in your garden thriving in their natural conditions. We are offering a wide selection of tours, designed to include some of the best places to see wildflowers in the West. But first some legal stuff.

The Wildflower Society reserves the right to change the route of any tour and to cancel any tour if in their judgement there are insufficient participants.



This sketch map shows the routes of the proposed tours in diagrammatic form. (We can't show all the details on this scale.) For the tours starting or finishing in Perth, the arrows show the before-conference directions.

Tour 1, 7 days, Wildflowers of northern heaths and inland woodlands.

Tour 2, 2 days, Forests of the Darling Scarp and central wheatbelt woodlands.

Tour 3, 6 days, Hidden gems between Fitzgerald and Cape LeGrand National Park.

Tour 4, 5 days, Southwest coastal forests and views.

Highlights of the individual tours.

Tour 1, 7 days, (Sat 21/9 - Fri 27/9 & Sat 5/10 - Fri 11/10).

First stop on this tour is the Gravity Centre just west of Gingin. Seems an odd place to stop but there is a nice patch of coastal plain bushland there. It was there that I photographed the *Gompholobium scabrum* and the *Euclilopsis linearis* shown earlier.



You will need sharp eyes to spot hammer orchids like this one, but Pepper and Salt (*Philotheca spicata*) is easy to see. Why the common name? Because pepper and salt go well with bacon and eggs!

As you continue north, you will enter the Brand Highway at Muchea. This Highway was constructed in the 1960s to give access to the newly-developing Badgingarra area. Most of this area had been “undeveloped” because no one was able to grow agricultural plants. The problem was due to severe deficiency of zinc and copper. It was not until 1929/30 that academic research showed that these elements were necessary for plant growth and it wasn’t until the 1950s that it was realized that severe shortage of them was of the problem in this area. This led to a frenzy of land clearing. The government boasted that 1 million acres per year were cleared. Mostly this was by “conditional purchase”. The condition was that the purchaser had to clear a certain fraction of the farm each year. Ironically farmers are now fined if they clear any land without permission. Fortunately, conservationists, considered to be ratbags at that time, managed to save some important areas such as Mount Lesueur NP. Some farmers also refused to comply, saving important areas of bushland on their farm. This included Don and Joy Williams who saved a large area and use it to show to guests.

You will spend the rest of the first day and all of the next three days in this area. It sounds a lot, but you won’t be bored for one second. Then you will move inland to see that some plants of the northern wheat-belt. The next page will show you some of the plants you may see near Badgingarra and in the wheat-belt..

Don Williams will welcome you to his Hi Vallee farm and tell you a lot about the flowers. He will also tell you some rather tall stories. Do not believe him when he tells you that he gets up early to sprinkle gold dust on the flowers nor that the aboriginal people used to use the fruit of the propeller banksia on their outboard motors to drive their canoes.



Fruit of *B. candolleana*, the propeller banksia.



Some of the flowers you will probably see on subsequent days.



Macropidia fuliginosa, Black Kangaroo Paw.



Cyanostegia lanceolata. Tinsel Flower.



Thysanotus multiflorus, Fringe Lily.



Lambertia multiflora.



Petrophile linearis.



The well-named *Grevillea excelsior*.



The related but nevertheless distinct *Grevillea eriostachya*.



The extraordinarily popular “Wreath Flower” (*Leschenaultia macrantha*). We will go to infinity (and beyond) to show you these flowers but they can be quite elusive.

On the final day of this tour, you will visit Boyagin reserve and Boyagin rock. Why do people want to visit these rocks? For some it is a matter of climbing to the top of the rock and pretending to be king of the castle – or, more charitably expressed, to enjoy the view. For others, especially wildflower people, it is a matter of looking at the special adaptations of plants such *Kunzea pulchella* which grows in the incredibly tough conditions provided by cracks in the rocks. And when it flowers, unfortunately rather later than your visit, bright red flowers stand out against the grey of the rocks. And especially to look at the mini-gardens growing in small depressions in the rocks, examples of which are shown below.



Panorama from the top of the rock.



Kunzea pulchella, grows in the cracks in the rock.



Lawrencella rosea, growing in a moist spot.

Some other plants found growing in moist spots.



Thelymitra antennifera, lemon orchid.



Utricularia multifida, bladderwort.



Drosera macrantha, climbing sundew.

Tour 2, 2 days (Thurs 26/9-Fri 27/9 & Sat 5/10-Sun 6/10).

This tour is designed for those with limited time. It will get you to Albany in two days. That is a pretty short time to see all the goodies on the way so the tour is packed with features. Even so, you will have to bypass many good spots because there just isn't time to fit them all in.

It starts with a bang, a visit to the marvellous Ellis Brook Valley Reserve. This is an area just outside suburbia on the scarp of the Darling Range. It is best known for a waterfall that tumbles over diorite rocks (see earlier) and then runs down a steep valley. There is a single-file path beside the stream leading to the waterfall which some of you may choose to follow. Interesting though that is, I prefer the somewhat exposed west-facing hill that is just a mass of flowers in spring.



A small part of the hill. The sea of yellow is comprised of Verticordias and Hibbertias. The grass trees with the reflexed leaves are *Xanthorrhoea drummondii*. The small tree to the left of the picture is the Western Australian Christmas tree (*Nuytsia floribunda*).



Calothamnus torulosa.



Calothamnus rupestris.



Verticordia huegelii



Verticordia acerosa



Verticordia plumosa.

In common with many other plants in the south-west, the spent flowers of *V. huegelii* and *V. acerosa* turn red. That makes them invisible to insect pollinators who then don't waste their time on spent flowers.



Dryandra nobilis ssp nobilis.

Your motel in Narrogin is directly opposite a good patch of bushland. Your itinerary is so crowded that there may not be an opportunity to fit it in, but feel free to stroll across the road before dinner or before breakfast. You will be well rewarded. Among the many plants are some fine specimens of *Dryandra nobilis*.

Next stop Harrismith. It is a tiny town but it looms large in the travel map of wildflower enthusiasts because there is a large patch of bush with a collection of unusual and attractive plants. Why the patch of bush? Because of the "airport". Truly! There are two long and wide runways (though they are not very flat).

Landings are rare, but nevertheless it is a good idea to walk along the edges. We will start the walk just behind the pub because that takes you to a patch of sheoaks where there are often orchids. After that, there are many hectares to explore.



Caladenia falcata, the green spider orchid.



Grevillea cagiana. The name honours Charles Austin Gardner, who for many years was the government botanist and who was known by his initials.



Above, *Chloanthes coccinea* and its relatives used to be in their own family Chloanthaceae but this family is now sunk into Lamiaceae.

Right, *Chamelaucium megalopetalum*, large flowered wax, is used as the parent of horticultural hybrids of wax flowers.



Tour 3, 6 days, (Sun 22/9 - Fri 27/9 & Sat 5/10 - Wed 9/10)

The highlight of the first day of this tour is a visit to Yalgorup National Park, just south of Mandurah. There you will see Lake Clifton, a long and narrow lake occupying the swale between the two dunes. The special aspect of this lake is a large population of thrombolites in the shallow water on the eastern edge of the bay. These are living rocks. They are not as well known as the stromatolites of Shark Bay, which live in an



The characteristic rounded appearance of the thrombolites

arm of the bay too salty for competitors and are largely made of silica. In contrast, thrombolites live in fresh water and are mostly composed of calcium carbonate. To understand their presence here, we need to consider the hydrology of the sandy soils of the coastal plain. Excess rainfall

penetrates quickly until it meets the groundwater, the level of which is determined by slow movement sideways either to the ocean on one side or to the river on the other. Lake Clifton is a groundwater lake; it receives a continuing supply of calcium-rich water from the eastern side thus providing an ideal environment for thrombolites.



Diagrammatic representation of the dune system of the Perth Coastal Plain.



Two attractive plants you may see in the Yalgorup National Park. The blue lace flower *Trachymene coerulea* also occurs on offshore islands and is therefore sometimes called Rotnest Island daisy(left) and *Diplolaena dampieri* (right).



Further south, you may be surprised to find *Pimelea ferruginea* growing between granite rocks often quite close to the ocean.

On the second day, you will visit the Whicher Range. Here are a few of the very many attractive plants you will see.



Pimelea spectabilis.



Grevillea bronwenae was named by Greg Keighery in honour of his wife and fellow botanist, Bronwen. She subsequently returned the honour by naming a plant after him. She said it was appropriate because they were both covered by fine golden hairs.



The low growing *Grevillea ilicifolia*, the holly-leaved grevillea.



Hibbertia stellaris is one of the three non-yellow Hibbertias. It grows in damp places and is fairly easy to propagate but doesn't often last long in gardens.

Most of the rest of the trip will be spent in the big-tree, high-rainfall area of the south.



Karri trees (*Eucalyptus diversicolor*) can be very large indeed.



However a special charm of the Karri forest is the tangle of undergrowth, here *Kennedia coccinea*, *Clematis pubescens* and *Hovea elliptica*.



Yellow Tingle, *Eucalyptus guilfoylei*.



You may wish to test your fitness (and bravery) by climbing the Gloucester tree, a "king Karri", one of a system of trees topped by lookouts previously used for fire spotting.

And when you visit the Valley of the Giants, you will of course do the tree-top walk, but don't forget to also visit the Ancient Empire, the walk that shows you the base of the Tingle trees. Do not be alarmed that they will not harm you.

Highlights of the southeastern tour (Tour 4, 5 days) have been covered by Margaret Pieroni's article and it won't be further described here.

