NEWSLETTER

WINTER 2015

NUMBER 84

FRIENDS OF THE WAITE ARBORETUM INC.

www.waite.adelaide.edu.au/waite-historic/arboretum

FORTHCOMING EVENTS

FRIENDS OF THE WAITE ARBORETUM EVENTS

Free Guided Arboretum walks
The first Sunday of every month at 11.00 am.
Walks meet at Urrbrae House

Jacob and Gideon Cordover Guitar Concert, Wed. August 26 at Urrbrae House Ballroom.
Refreshments 6 pm. 6.30 - 7.30 pm
Performance of classical guitar and narration of the story of a little donkey and the simple joy of living.

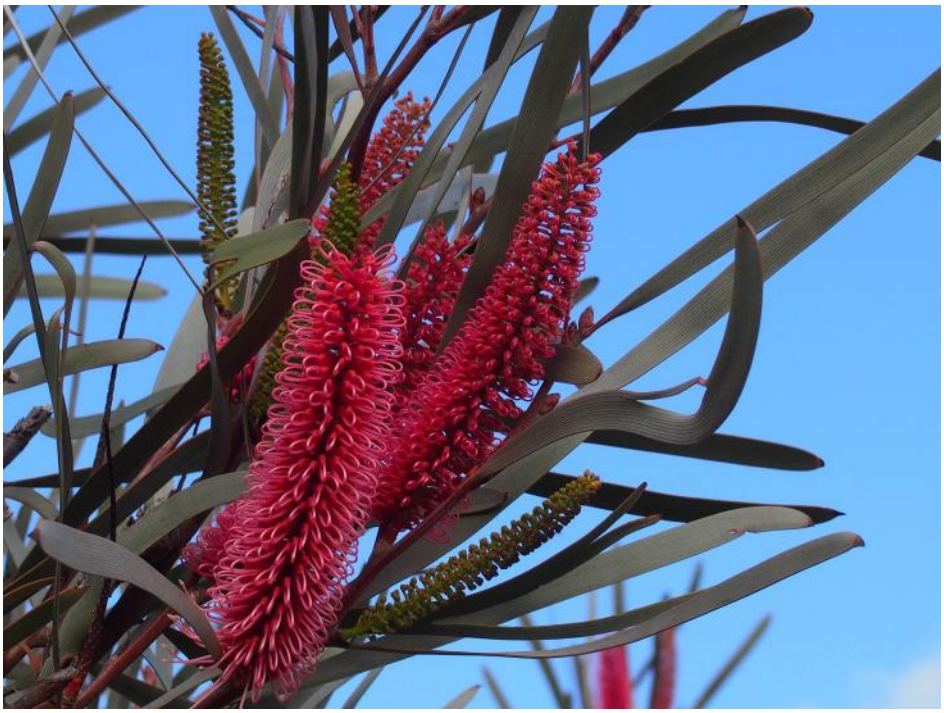
Enquiries and bookings please contact Beth Johnstone on 8357 1679 or bgrich@ozemail.com.au

Spring visit to the historic house and grounds of Anlaby.
Booking deadline extended.

Unveiling of Bee Hotel Signage
11 am Tuesday 18 August

More details at:
http://www.adelaide.edu.au/waite-historic/whatson/

FRIENDS OF
WAITE
ARBORETUM



Hakea francisiana, Grass-leaf Hakea

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FROM THE PRESIDENT

It seems no time since the last Annual General Meeting when I became the President, replacing Henry Krichauff.

Henry had been the President for five years and during that time devoted considerable energy and enthusiasm to the role. He was known for his easy manner and for being knowledgeable about the matters that affect the Arboretum. Fortunately he has decided to stay on the Committee, which thus can retain the benefit from the historical knowledge that he has gained. The Committee is very glad of this generosity because combined and shared knowledge is always beneficial.

Early in May 2015 members of the Friends Group paid a long awaited visit to Sophie's Patch, Mt Barker garden of our Patron, Sophie Thompson. A report of that visit is included in another section of this Newsletter.

Barb Wheaton, Marilyn Gilbertson, Sophie Thomson at Sophie's Patch. Photo Peter Nicholls.

The Friends of the Arboretum President was invited to a Donor's Dinner held by the Adelaide University at the Wine Centre 12 May. This is an annual event.

Since the last Newsletter we have held a very successful film event in collaboration with the Friends of Urrbrae House and the Friends of the Waite Conservation Reserve. It is always a pleasure to cooperate with the other groups and it has become an established procedure now.

The Committee has been having a difficult time in obtaining a Secretary. While a nomination was endorsed at the Annual General Meeting, the candidate was faced with a serious family illness and needed to resign. We recognise that being a Secretary is sometimes a taxing role and does take a few hours of time each month, however we remain hopeful that we can attract one committed member to the role.

The old Cudmore Fountain has been removed from the Rose Garden because it became unstable. It has been stored. Members of the Gardening Volunteers are keen to see a replacement and this will be a focus for the Committee.

Bookings are open for the Cordover Guitar Concert to be held in August. This will be a performance of classical guitar and narration of the story of a little donkey and the simple joy of living. This will be a special event that will be enhanced by being held in the Ballroom at Urrbrae House. The cost is $25 and refreshments are included.

The Treenet Symposium is fast approaching and although no specific activity will occur on Waite Campus this year, members will assist with registrations, etc. as usual.

Planning is underway for the Basketry Exhibition 2016. This event always attracts a lot of visitors to the Precinct and some visitors take the opportunity to go on the basketry walks offered by the Arboretum guides.

We have been informed that the World Rose Forum will be held in Adelaide during 2021 and that the Rose Garden at Urrbrae will be a visiting site for participants.

This is my first President's Report for the Newsletter, although I have been on the Committee for some time and I want to say how much I value the assistance and support of all of the Committee members. It is a wonderful experience to share time and energy with good people for a special cause. The Waite Arboretum is surely one of those.

Beth Johnstone

Spring visit to Anlaby

Booking deadline extended to August 26th.

Some members of the FWA are interested in visiting the historic house and gardens of Anlaby Station in spring. Before making any arrangements we need to know how many people will come.

The costs of a visit are:

- House visit $10.
- Garden visit $10.
- Lunch $15.

Groups of less than 10 people can be arranged.

If you can commit to a visit during spring of this year, and you would like us to arrange it,

Please phone Beth Johnstone at 8357 1679

Or email bgrich@ozemail.com.au

Before Wednesday 26th August.

You can find more information about Anlaby Station at: http://anlaby.com.au/web3/

IN THE ARBORETUM - FROM THE CURATOR

New Plantings

Planting this year included trials of grafted *Brachychiton* cultivars 'Bella Pink', 'Jerilderie Red', 'Griffith Pink' and Bella Rosa' (two specimens of each) and two *Eucalyptus* cultivars all donated by Humphris Nursery, Victoria. *Eucalyptus* 'Nullarbor Rose' and 'Nullarbor Lime' were developed by Dr Kate Delaporte at the Waite Campus. An experimental planting of 3 Sandalwood *Santalum spicatum* and 12 Quandong *S. acuminatum* seedlings donated by Dr Ben Lethbridge were planted by Ben and members of the Australian Native Food Society in 5 blocks with hosts of three species of *Acacia: A. pycnantha , A. saligna* and *A. argyrophylla* hosts (one replicate per block). *A. saligna* is a demonstrated good host for Sandalwood. *A. argyrophylla* is a cross over species from a trial conducted by Ben at Australian Arid Lands Botanic Garden (Port Augusta) 1998-2006. Additional quandongs were direct seeded under nearby *Eremophila* and *Hakea* species. This planting will complement the existing Plumbush *Santalum lanceolatum* in the Arboretum. Other species to be planted this year include a variety of saplings donated by Daryl Kinnane, Native Rainforest Flora : Red Cedar *Toona ciliata,* Bleeding Heart or Native Poplar *Homalanthus populifolius,* Malletwood *Rhodamnia dumicola,* Shatterwood *Backhousia sciadophora,* Broad-leaved Whitewood *Atalaya multiflora* and Onion Cedar *Owenia cepidora.*

World Labyrinth Day

World Labyrinth Day, 2 May, brought new visitors to the Arboretum. The University's media team made a video with me that was posted on the University's Facebook and YouTube where it attracted 2,500 views over the next few days.

Community Engagement

The Arboretum continues to be a valuable resource for teaching with students from Flinders University, University of SA, University of Adelaide and TAFE undertaking practical sessions in plant taxonomy, soil science, entomology, vegetation sampling and GIS. Arboretum guides have developed nine themed walks for U3A this year which have been well received and support the Arboretum. In July the Arboretum hosted a one day workshop / seminar 'Clean Green South Australia – Weeding Without Chemicals'.

Rain Moths

In April rain initiated a mass emergence of the spectacular Rain Moth *Abantiades marcidus* (Hepialidae) in the Mallee section of the Arboretum adjacent to Urrbrae House. Female Rain Moths are not only one of the largest of Australian moths with a wingspan up to 170 mm but also hold the world lifetime fecundity record for the greatest number of eggs deposited by a non-social insect – up to 44,100. It is thought that they oviposit in flight. The larvae feed on the roots of eucalypts, especially River Red Gum, and emerge from the ground in autumn after rain, leaving their brown pupal cases or exuviae in or near the entrance of their exit tunnels.

Rain Moth *Abantiades marcidus* pupal case emerging.

Exuvia and emergence hole. Photos Jennifer Gardner.

Waite Arboretum App update

In April Marian McDuie and I gave a joint presentation on the app to the Horticultural Media Association and in the first three months there were about 1,000 installs. Marian and I are now working on an update which will include two more themed walks, social media (Facebook & Twitter) more descriptions and more than 500 images. There will also be an option to choose a Mandarin version. 50% of the international students at the University of Adelaide are from China and there are many Chinese visitors to the Urrbrae House gardens and Arboretum. The new version will be released in September. Android and iOS versions are available free from Google Play and App Store. Feedback from Friends is welcome.

Congratulations to Cultural Historian Denise Schumann OAM

Denise was engaged in the earliest days of the formation of the Waite Historic Precinct to undertake an Oral History Project on the Waite Agricultural Research Institute. She made a major contribution to the implementation of the Garden of Discovery. Her conceptual framework based on her extensive research underpinned the narratives of the scientific research at The Waite which are told in the garden and she scripted and designed the innovative outdoor books and oversaw their production. Extracts from her extensive series of broadcast quality oral history recordings can be heard in the soundposts there and she was an essential partner in obtaining the many grants we secured to implement the Garden of Discovery project. Denise is passionate about our South Australian cultural heritage and in particular acknowledging and celebrating the unsung heros, especially the under-recognised women scientists who did cutting edge research, but are not household names like their male contemporaries. Her recognition with an OAM is richly deserved.

Jennifer Gardner

FRIENDS OF THE WAITE ARBORETUM NEWS

Woman in Gold

The film event at The Capri Cinema on Sunday 31 May was a resounding success. Over 230 supporters of Friends of Waite Arboretum and Friends of Urrbrae House attended the screening of "Woman in Gold". The foyer was abuzz with people chatting and socialising before the film which was thoroughly enjoyed by all. The raffles were generously supported and a total of $720 was raised. Management of the Capri also donated 15% of the bar takings. In total, over $1800 was raised by FWA. The assistance from the team at the Capri was greatly appreciated.

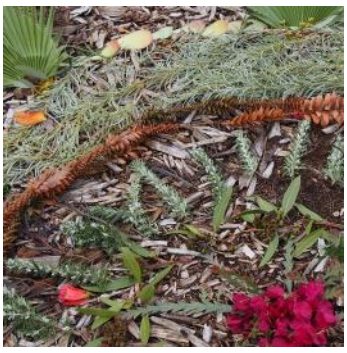
Thank you to members and friends who supported the event. It was very pleasing to collaborate with Urrbrae House Friends for the second time and we are hoping to repeat the success next year if we can secure another great film at a suitable date.

Marilyn Gilbertson

Mandala for Sophie Thomson

Andrew Walters, Brian Richards, Beth Johnstone, Terry Langham, Amanda Jackson and Sophie Thomson. Photo from Sophie's Facebook page.

In July members of the Friends of the Waite Arboretum collected flowers and leaves from the Garden and the Arboretum and made a mandala in the Labyrinth to celebrate Sophie Thomson's 10 years with Gardening Australia.

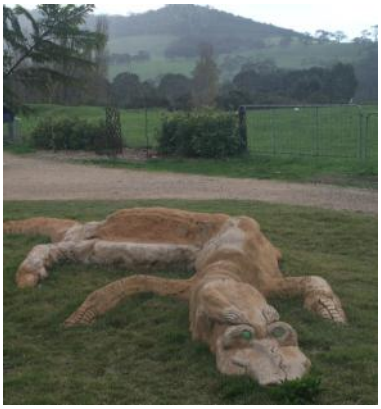


Grey foliage of Sophie's favourite wattle, the Broughton Willow, *Acacia salicina*, dried Bunya Pine foliage, rosemary, red *Eucalyptus tetraptera* fruits, the wing-like phyllodes of *Acacia glaucoptera* and crimson bougainvillea bracts.

Visit to Sophie's Patch

Merrilyn Kuchel, Jennifer Gardner and friends at Sophie's Patch. All photos by Peter Nicholls.

The weather may have been unreliable but the members of the Friends of the Arboretum were on time and well prepared for the visit to Sophie's Patch on 6th May. They were joined by a large group from the Botanic Gardens of South Australia who had missed out on the visit arranged by their group and who wanted the opportunity to see the garden.

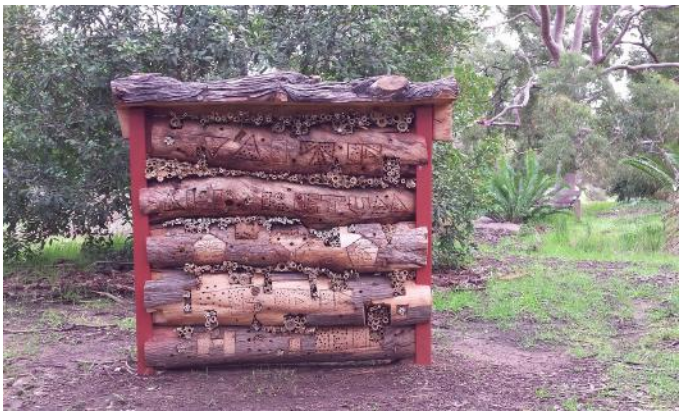


It was a really enjoyable outing because everyone was able to wander along the paths at their own pace and linger over the attractions. There are certainly lots of these. Sophie, with the assistance of her family, (especially her clever husband), has established a unique garden which has so many interesting features. There is a whimsical sense of humour evident, along with the clever use of the exposed slope.

All those present thoroughly enjoyed the visit and although Sophie herself was indisposed on the day, there were lots of wonderful helpers to answer questions and provide a delicious morning tea.

Beth Johnstone

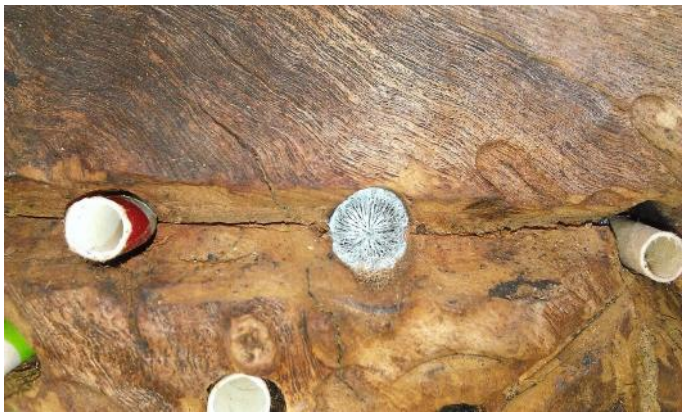
WAITE ARBORETUM NATIVE BEE HOTEL



Waite Arboretum Native Bee Hotel facing east into the Mallee Section. Photo Terry Langham June 2015.

There is evidence of a number of native bees residing in the bee hotel since its opening in December 2014 near the Mallee section of the Arboretum. Three, eight and 16 millimetres diameter holes with depths of 70 mm, 100 mm, 120 mm and 150 mm holes are proving to be the nesting holes favoured by a number of the over eighty species of native bees identified in the Arboretum at this stage.

16 mm nesting hole with as yet unidentified residents. Photo Terry Langham July 2015.



7 mm nesting hole in a timber log with a closure type of a curtain of *'cellophane' strands"* constructed by a Wasp Mimic Bee. Photo Terry Langham January 2015.

Most of the gaps between the timber logs have been tightly filled with ~150 mm lengths of bamboo.

Bamboo lengths fitted into gaps between the logs. Photo Terry Langham 20 June 2015.

A number of the larger diameter timber and bamboo nesting holes have being filled with elderberry, crocus, salvia and wheat materials to create a wider selection of habit for the native bees to reside in.

Mixtures of clay and sand and additional types of plant nesting materials with be added to various hotel 'compartments' to attract the Arboretum's native bees to become hotel residents.

We will likely see a greater increase in native bee numbers residing in the hotel in the coming spring and summer months.

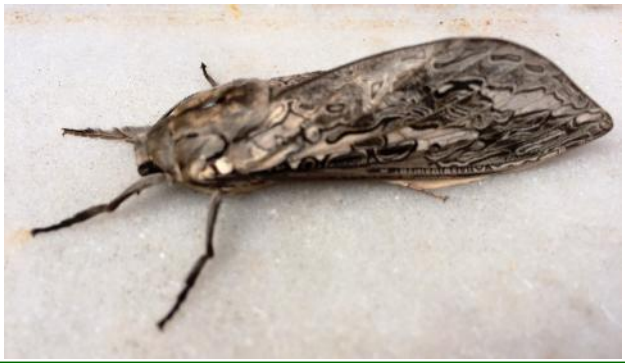
SIGNAGE

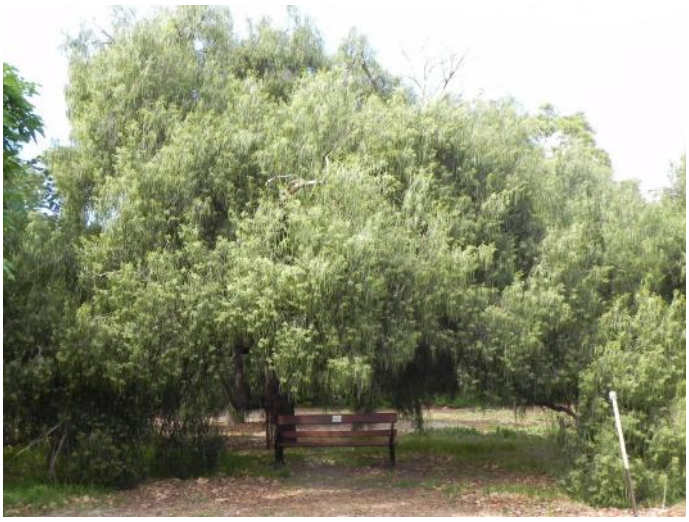
Waite Arboretum Curator Jennifer Gardner is arranging for three information signs to be installed on site. Jennifer has secured funding for the signs from the National Science Week 2015 (South Australian community grants) Scheme. The plan is for the new signs at the Bee Hotel to be unveiled at 11am Tuesday 18 August 2015. All members are welcome to attend and to share morning tea with the Tuesday morning volunteers.

Terry Langham

Acknowledgements to Jennifer Gardner and Katja Hogendoorn for words to describe bee residents nesting hole coverings "closure types - type of curtain of 'cellophane' strands" (July 2015).

Rain Moth *Abantiades marcidus*. Photo Jennifer Gardner





Wilga, *Geijera parviflora* #4.

WILGA *Geijera parviflora*

The common name Wilga is an Aboriginal name describing the tree. It is also commonly known as Native Willow in reference to the form of the tree. *Geijera* is in commemoration of J D Geijer, a botanical author, while *parviflora* is derived from the Latin meaning small flower. Wilga is a member of the Citrus family, the RUTACEAE .

The Wilga pictured above, Arboretum specimen #4, is listed on the National Register of Big Trees. See: http://www.nationalregisterofbigtrees.com.au/listing_view.php?listing_id=474

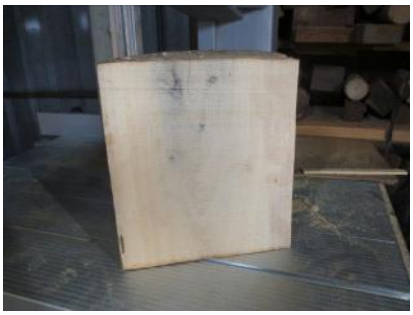
Geijera is a Genus of 5 species of trees and shrubs native to Australia. The most common species in South Australia is Oil Bush or Soap Bush *(G. linearifolia)* which is a small compact, broad woody shrub extending from the Nullarbor through the Flinders and the mallee belt to the Victorian border. Two of the timber species, known commercially as Green Satin-heart *(G. muelleri and G. salicifolia)* are trees of the coastal rainforests of New South Wales and Queensland.

Wilga is a small tree or bush found occurring naturally on red sandy loams inland in semi-arid regions of eastern Australia, from South Australia near Burra, through northern Victoria, New South Wales to Queensland. It may grow to 10 metres tall with drooping or pendant branches. In its natural environment these pendulous branches may reach the ground, almost forming a tall compact hedge. The specimens in the Waite Arboretum certainly show this characteristic, while the specimen in the Mallee section of the Adelaide Botanic Gardens shows a more erect form (through pruning). The drooping branches have linear to spear shaped leaves growing up to 180 mm long and to 10 mm wide. They are pale to bright green in colour and resemble those of the Willow, thus the common name Native Willow.

Flowers and foliage.

The leaves give off a fruity aroma when they are crushed. Aboriginal people chewed the aromatic leaves for alleviating toothache. The small white petalled flowers occur between June and November. The aroma of the flowers is often described as foetid, attracting blowflies or often a contradictory view as strong smelling or citrus scented attracting insects. The fruit are globular in shape, around 5 mm long, having shiny black seeds. Regeneration from fresh seed and cuttings has proven to be difficult. It is suggested that the hard seed coat should be cracked, to assist seed germination.

Although native to the arid areas of eastern Australia, Wilga is now being planted as a shade tree, and the City of West Torrens has planted it as a street tree. In agricultural areas it is useful as a fodder tree. Sheep particularly enjoy grazing on the lower branches, pruning the trees to form a park-lands setting, although trees appear to vary greatly in palatability. Despite being slow growing, it is planted in Australia and overseas as an ornamental. Wilga is reported as being fire and drought resistant.



Section of wood of Wilga . Photo Ron Allen

The wood is pale yellowish brown and is very dense weighing about 945 Kg per cubic metre (c.f. Jarrah 820 Kg per cubic metre). The wood is close grained and has a pleasant aroma when cut. The economic value of the wood is reduced by its tendency to split and contain gum veins. The heartwood often has a greenish colour and the wood is frequently called Greenheart, although that name is more correctly applied to the two larger species from coastal NSW and Queensland *(G. muelleri and G. salicifolia)* which are usually referred to as Green Satin-heart.

In the eastern states Wilga is often confused with Dogwood *(Eremophila bignoniflora)*. Wilga looks very similar to Dogwood from a distance but the most significant difference between the two is the smell. When you crush the leaves, or cut Wilga timber green, it has a lovely fruity smell, while

Dogwood leaves smell like dogs urine, hence the name.

Geijera salicifolia

There are three flourishing specimens of *Geijera salicifolia* in the Northern Arboretum (Grid area E4) which were planted in 2006. You can find them just east of Torben's seat.

Ron Allen

References

Plants of Central Queensland. Eric Anderson. DPI

Native Trees of South Australia. C D Boomsma Woods and Forests Dept.

Wood in Australia. Keith R Bootle. McGraw Hill

Australian Trees. Ivan Holliday. Landsdowne Publishing

Cork harvesting in Parque Naturale Sierra de Grazalema, Andalucia, Spain.

Cork

In his article on *Quercus suber* (Cork Oak), (Newsletter #82), Ron Allen described the harvesting and manufacturing of cork and some of its uses to man, from Roman times to the present. But, what use is it to the plants which produce it? The major use of cork is protection, primarily from desiccation but also from attack by microorganisms and insects.

But why do woody plants need cork to protect them when herbaceous plants manage very well without it?

The stems and roots of woody, vascular seed plants (i.e. dicotyledons and gymnosperms) increase in girth from the inside outwards due to the activity of the vascular cambium (a cylinder of cells in the cortex of stems and pericycle of roots) which become meristematic and divide to form cells which differentiate into the secondary xylem (water conducting cells) on the inside and secondary phloem (food conducting cells) on the outside. This increase in girth occurs annually and usually eventually ruptures the outer protective layer of the stem or root. Prior to this another meristematic region, the cork cambium develops towards the inside of the outer layer and the cells that it produces differentiate into secondary cortical cells on the inside and cork on the outside. Cork is composed of the hydrophobic substance suberin and is impermeable, buoyant and elastic as well as being a fire retardant. Hence its protective function.

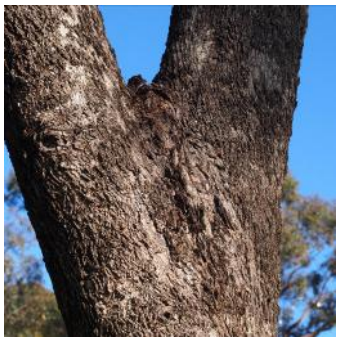
The vascular cambium continues to produce more cells, mostly in the spring and summer and the old cork is usually ruptured and shed, sometimes annually and sometimes less frequently. A new cork cambium develops inside the old one prior to the shedding of the old cork, producing more cork and these processes continue for the life of the plant. Each year the cork cambium moves further inward and so the stem of an old tree is likely to consist of the innermost, non-functional wood, the functional wood, the vascular cambium, the phloem derived from this, the cork cambium and cork. The vascular and cork cambia in the root behave similarly and the root cork is similarly protective. In some plants e.g. *Quercus suber* and some other species, the cork is retained for years and as more and more is formed, the cork layer becomes very thick and is harvested every ten years or so as described in Ron's article. If the cork is left untouched, as is the case with the *Q. suber* in the Arboretum, it does of course remain on the tree although with time the outer layers tend to crack and split.

The bark of a tree is defined by some as all of the tissues from the vascular cambium to the outside of the tree and by others as merely the cork layer. Regardless of which definition is favoured, the bark presents different forms depending on the species

and these different forms can sometimes be used as diagnostic features. For example, the bark can be stringy or fibrous and shed in long strips as in the stringy barks *Eucalyptus obliqua* and *E. baxteri*, it can become hard, compacted and furrowed with age, as in the ironbarks e.g. *E. crebra*, *E. sideroxylon*. The colour of the bark varies between light grey, dark grey and black.

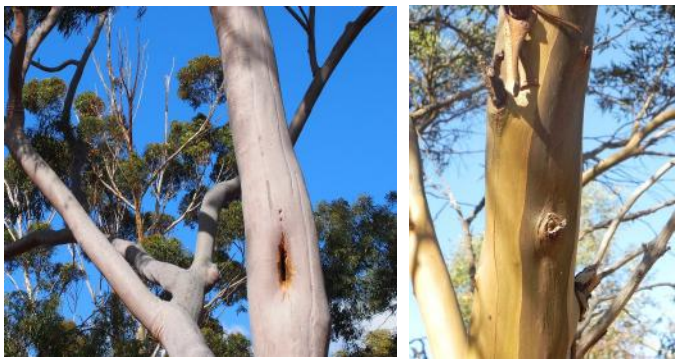
In some species, e.g. *Corymbia ficifolia,* and other bloodwood species the outer bark breaks up into small flakes. This is called tessellated bark.

Tessellated bark *Corymbia eximia,* Yellow Bloodwood.



Box bark *Eucalyptus microcarpa,* Grey Box.

Smooth bark is shown by *C. maculata*, *C. citriodora* among others. Smooth bark occurs when the dead bark is shed annually in various stages during the year, leaving a smooth or perhaps mottled surface.



Smooth bark: *Eucalyptus diptera,* Two-winged Gimlet and *Corymbia citriodora, Lemon-scented Gum.*

The bark of many trees is thick rough, dark brown or black or thin greyish and fibroid. This variation means that perhaps bark is not a very reliable taxonomic characteristic and species identification is best made by examination of the flowers and fruits.

Jean Bird

References

Eames, A.J. and MacDaniels, L.H. (1947) An Introduction to Plant Anatomy McGraw-Hill Book Co. New York and London

en.wikipedia.org

www.anbg.gov.au/cpbr/cd-keys/Euclid/sample/html/roughbark.htm#top

www.botgard.ucla.edu/html/botanytextbooks/generalbotany/barkfeatures

CORK AND THE DISCOVERY OF CELLS

The cell was first discovered and named by English scientist Robert Hooke in 1665 after looking at a slice of cork through his microscope - one of the first such instruments. He remarked that it looked strangely similar to cellula or small rooms which monks inhabited, thus deriving the name. Hooke also reported seeing similar structures in wood and in other plants.

Hooke's microscope from http://www.history-of-the-microscope.org/robert-hooke-microscope-history-micrographia.php

Cork cells

In 1838 two German scientists Matthias Schleiden, Theodor Schwann (with later additions by Rudolph Virchow) proposed Cell Theory which is the basis of modern biology. Among other things the theory tells us that the cell is the structural and functional unit of all living things, that all cells come from pre-existing cells by division, that cells contains hereditary information which is passed from cell to cell during cell division and that all cells are basically the same in chemical composition.

Diarshul Sandhu

THE CONIFERAE, CONIFERS:

Conifers are the largest class of one of the two great divisions of the seed plants; the Gymnosperms.

The existing Gymnosperms are put into four classes which are distinctly different: Cycads, Ginkgos, Conifers and Gnetales. The classes are so different that they are not capable of interbreeding. Both Cycads and Conifers are represented in the Waite Arboretum.

Conifers are among the most frequently seen trees over almost all the temperate regions of the world. As a group many are known by sight by the obvious fact that most of them bear cones – a guide to their identity. The common name 'conifer' is derived from two Latin words: conus 'a cone' and fero 'bearing'

Form, or Appearance:

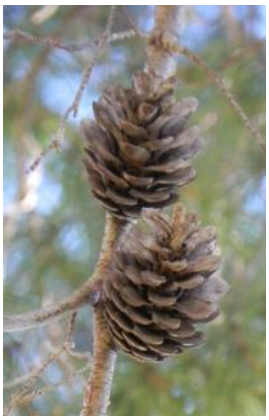
A typical wild conifer is characterised by its regular branch system and a single trunk, growing naturally into an upright, pyramidal shape when young. When mature, especially in woodland and forest, many conifers shed their lower branches leaving vigorous conical growth at the top of the tree. Apical dominance is strong with vertical growth when possible. Lateral branches tend toward horizontal growth, with bilateral symmetry, and often cluster in whorls. Conifer genera vary greatly in stature. The smallest species is the prostrate, subalpine Pigmy Pine, *Dacrydium laxifolium* from New Zealand which may reach only 8 cm at maturity, while the world's tallest tree species, the Californian Coast redwood, *Sequoia sempervirens*, can reach 115 m. The world's oldest living trees are conifers. A Great Basin Bristlecone Pine, *Pinus longaeva* is over 5,000 years old and several Rocky Mountains Bristlecone Pines, *Pinus aristata* are almost 3,000 years old.

The Arboretum is a tree garden in which species and varieties are set out from the start in widely-spaced positions as single trees or small groups of 2 to 4 individuals. Consequently, they tend to 'grow to be sexy' from the start; this is the first imperative of being a tree. In the natural world there tend to be too many neighbours (especially those of the same species) which have to be suppressed, before a tree can acquire optimum foliage to support seed production.

Structure (Morphology) is the main basis for classification as relationships between existing and extinct species are difficult to pin down.

Genera present in the Arboretum shown in **bold green**

Races, Families and extant Genera of the Coniferae (Revised 2001).



Race	Families	Genera
Ginkgoales	Ginkoaceae	*Ginkgo*
Taxales	Taxaceae	Amenotaxus, Austrotaxus, Pseudotaxus, Taxus, Torreya.
	Cephalotaxaceae	*Cephalotaxus*
Coniferales	Araucariaceae	***Agathis, Araucaria***
	Cupressaceae	*Actinostrobus, Austrocedrus,* ***Callitris, Calocedrus, Chamaecyparis,*** *x Cupressocyparis,* ***Cupressus,*** *Diselma, Fitzroya, Fokenia,* ***Juniperus,*** *Libocedrus, Microbiota, Neocallitropsis, Papuacedrus, Pilgerdodendron,* ***Sequoia,*** *Sequoiadendron, Taiwania,* ***Thuja, Tetraclinis,*** *Thujopsis,* ***Widdringtonia***
	Pinaceae	*Abies, Cathaya,* ***Cedrus,*** *Keteleeria, Larix, Picea,* ***Pinus,*** *Pseudolarix, Pseudotsuga, Tsuga.*
	Podocarpaceae	*Acmopyle,* ***Afrocarpus,*** *Dacrydium, Microcachrys, Microstrobos,* ***Podocarpus,*** *Saxgothaea*
	Phyllocladaceae	*Phyllocladus*
	Taxodiaceae	*Athrotaxis, Cryptomeria, Cunninghamia, Glyptostrobus, Metasequoia,* ***Taxodium***
	Scadiopityaceae	*Scadiopitys.*

History of Global Distribution

Conifers exist now preponderantly across the mid-latitudinal belts of both hemispheres with temperate climates. Climates have an inverse relationship between latitude and altitude. Conifers tend to be favoured by the cool-temperate climates of higher latitudes at lower altitudes and low-to-mid altitudes at lower latitudes. This preference probably has existed for several hundreds of millions of years, since they first appeared.

This was when there was only a single vast continent, Rodinia, which accumulated terrain from 1300 My to 1100 My ago. Rodinia broke up from 830 to 735 My ago into separate continents that drifted but recombined after 200 My had passed. By 520 My ago a supercontinent called Gondwana had assembled in the southern hemisphere. The last terrains to join it were current Africa and South America. Eventually Gondwana started to break up. Parts moved radially northwards whilst its core remained over the South Polar Region (where it remains today). Australia, one of the last parts to break away, split from Antarctica from 91 My ago. Before that occurred, Laurasia (a large part of Rodinia that had drifted northwards and divided) appears to have remained close to the NW part of Australia for some time. These changes are reflected in fossil coifer species from now widely separated places.

The Ginkgoes and the conifers appear in fossils during the Permian period (290 My ago), survivors of the Permian extinction phase, and have persisted ever since without there ever being a major 'age of conifers'. The Cycads also appeared as long ago in the early Permian, but peaked in abundance in the Jurassic period (200-150 My) and, like the forests of Tree Ferns, have declined to a few genera that have remained since the Eocene period (34 My ago). They did survive another two major catastrophic species extinctions and probably several lesser calamities. These show in animal species loss, but are linked as land animals' primary source of food. There are only 3 genera in the Gnetales race; too few for their antecedents to have been elucidated.

Each hemisphere has a distinct set of coniferous families that have survived, initially from common heritage in Rodinia, to distinct ones of which the Gondwana set is clearly geologically determined. In both situations, north and south of the equator, conifers have a huge presence. Conifers have thrived across millennia and colonised across broad distances. E.g., *Pinus sylvestris*, Scots Pine, is distributed naturally across Eurasia from Ireland in the west to Siberia in the east. Conifers evolved earlier in geological time to precede the other great division of seed plants, the Angiosperms or flowering plants.

Sex is casual in conifers, perhaps another of the fruits of a long evolutionary existence. Pollen does not fertilize the sporophyll for weeks or even months; seed may take from 18 months to 6 or more years to mature. Seed once shed, buried in the ground may take several years to germinate. E.g., the large-seeded Bunya-bunya Pine, *Araucaria bidwillii*.

Tetraclinis articulata cones

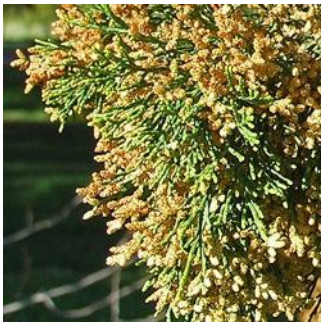
Gymnosperms typically bear 'naked' seeds. Their more primitive basic nature is shown by the carpels. They are not fully folded together and so are unable to form an ovary round the ovules; also, the female prothallus (the endosperm) is formed before fertilization by pollen. Seeds are borne in carpels that have evolved to form a firm base to support one or two developing seeds, and to protect them from the weather. However, not all conifers' fruits are the familiar pear-shaped cones. Some have seeds held within a globular body, composed of tightly-closed scales, or the scales have fused into a fleshy cupule (Yew, *Taxus*) or plum-like coat (*Podocarpus*).

Podocarpus elatus fruit

Pollination is by wind. In conifers the pollen is produced in relatively few pollen sacs borne on tiny leaf-like scales. Despite this the annual dispersal flow is immense.

Woody cones, when mature, ripen and open to reveal tough horizontal scales. Globular, scaly types of cone open to reveal hobnail-shaped scales (some of you may remember hobnailed work boots?). However, they only open under fairly specific environmental conditions to which they have evolved. Consequently, cones may retain seed for several years, up to 30 years: tests of cones in successive annual whorls on long branches of radiata pine, *Pinus radiata*, in the west of Ireland have shown seed stays viable on the tree for at least 26 years.

At the furthest extent of their natural range conifers tend to have years of high seed production at wider intervals ('mast' years: mast is the name given to the appearance of abundant seed-fall lying on the surface litter in closed woodland). Two- and three-yearly intervals are common, reaching up to 11 years in Noble Fir, *Abies nobilis*.



Callitris gracilis pollen

Callitris canescens cones

Soil and Site Factors:

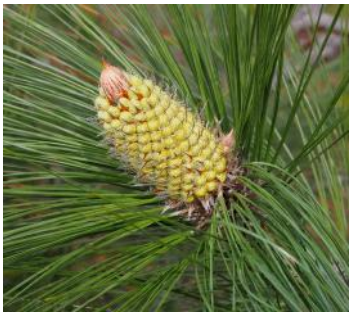
All conifers are woody and most are trees (albeit with several genera with varieties that are prostrate or shrubby). None live as epiphytes and only one is a parasite. Since the Cretaceous (100 My ago) the conifers have been steadily replaced by the huge presence of the seed-bearing flowering plants. They too, have woody tree-form species and varieties. Conifers now flourish in habitat conditions that flowering plants find difficult, especially climate. They are found to tolerate cold from the near- arctic at high latitudes or high altitudes in mountains and high seasonal warmth into the Tropics. Drought tolerance is corresponding high, ranging from *Cupressus dupreziana* in the centre of the Sahara to the tundra and alpine deserts. Remember a frozen soil is just as dry to plant roots as soil with no moisture.

Conifers are usually successful pioneers on disturbed ground lacking in balanced fertility. Soils with natural fertility but on steep or upland, exposed sites are suited to conifers. They come into their own where soils lack major nutrients or trace elements. They have a coarse-root strategy suited to lighter, sandier soils, supplemented by symbiotic associations with fungi called ecto- (outside) mycorrhiza. These invest short roots on the suberised (corky) sections of larger roots between the trunk and the tips of exploratory conifer feeder roots. They harvest nutrients in static positions in the soil leached from the humus layers 'fed' by leaf-fall and waste pollen. Conifers with their long evolutionary history are adept at it.

Many conifers are called 'light-demanders' and they compete through most of their lives to gather an optimum supply of sunlight. In natural woodland where they tend to be even-aged, living tree trunks appear very closely spaced compared to flowering trees, and limit the number of shade-tolerant understorey flora. A number of conifers have their own seedlings and dwarfed, shade tolerant in ground flora. In the event of devastating opening of the canopy by wind storms, rock falls or fire, they are an 'advance' cohort to start sustained recovery of the vegetation. They can do well in company of Angiosperm species but usually to the extent they have to overshadow them.

Human Interaction:

This has been huge. The sheer abundance of conifers and their ease of working has lead to a wide range of uses. In earliest times conifers were used for fuel and shelter. The economic, defensive, and commercial value of wood produced by conifers has been appreciated for millennia. Wood was shaped to form handles for stone tools. The combination of stone axes and the added leverage of wooden handles lead to further uses. Then bronze and iron replaced the heavier stone tools with the same shape but sharper, more durable, cutting edges. Resin, a viscous fluid collected from ducts within the wood of conifers has provided essential "naval stores", varnish, solvent turpentine, and not least wine preservatives. Conifers have been essential through the course of human history from Classical times to the present. They have long provided human resources, sadly, only seen as renewable in the last 300 years. Angiosperm trees' timber replaced the softwood for tools but not for bulky uses until the last few centuries.



Immature *pine* cone.

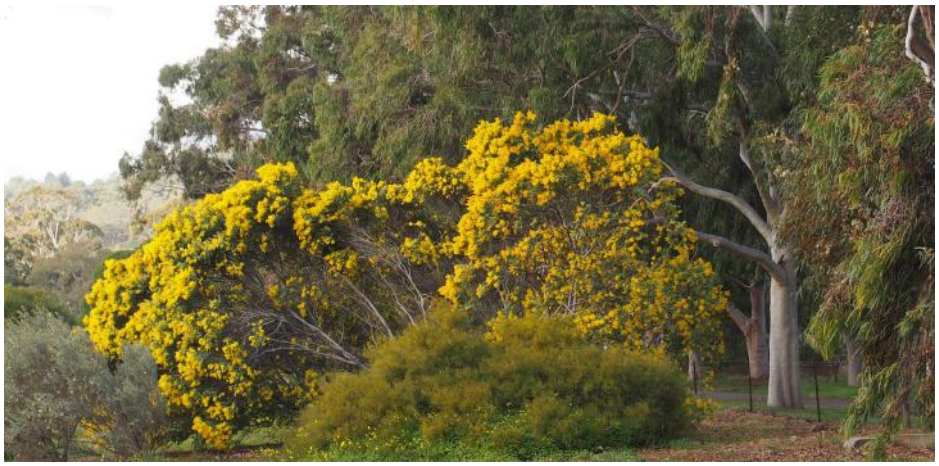
There has been another human impact on the conifers, a foible. Populist namers of trees have saved their full powers of obfuscation for the conifers. The appellation 'pine' is rife, for trees and timber: whether red pine, white pine or yellow pine, it often has little affinity to the species of the genus *Pinus* itself. It is applied to most conifers in the Southern hemisphere; e.g. Kauri Pine, Hoop Pine Huon Pine, Parana Pine. The 'true' pines, Pinus are the most abundant species utilized and are followed by *Abies* spp., 'Fir' and *Picea*, Spruce: one of the two largest sets of plant families in the World and of global distribution.

Brief descriptive notes on species in the Arboretum are available on the APP site.

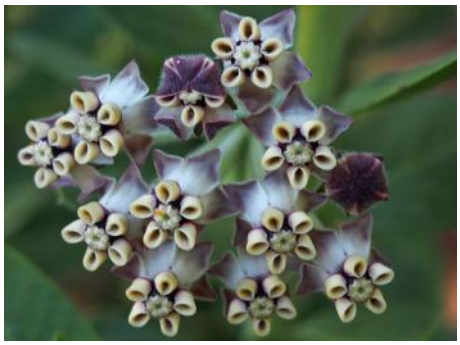
Notes based on the "A Dictionary of the Flowering Plants And Ferns" by J.C. Willis,1955, 6th edition, Cambridge University Press; "The Secret Life of Trees" by Colin Tudge (2005) Penguin,; the Introduction to "Garden Conifers in Colour" by Brian and Valerie Proudly, 1976. A.H & A.W Reed Ltd. Wellington, NZ.; "Trees and Timber in the Ancient Mediterranean World" by Russel Meiggs, (1998). Oxford University Press, and the "Geology of Australia" by David Johnson, 2nd edition. (2009) Cambridge University Press, Melbourne.

WINTER IN THE ARBORETUM

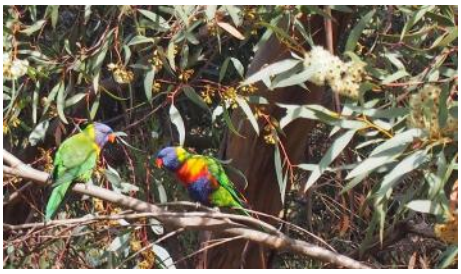
Corymbia citriodora has pear-shaped buds in clusters of three which are aggregated into compound inflorescences borne in the axils of leaves. Origin NSW, Qld.



Along Sir Walter Young Avenue the bright yellow ball-shaped flowers of the Crescent-leaved Wattle, *Acacia semilunata,* contrast with the fragrant green leaves of the Lemon-scented Gum, *Corymbia citriodora*. Origin Qld.



Gomphocarpus cancellatus, Broad-leaved Cotton Bush is the larval food plant of the wanderer butterfly *Danaus plexippus*. Originally a garden plant, now a common weed around Adelaide. Origin SW Africa.

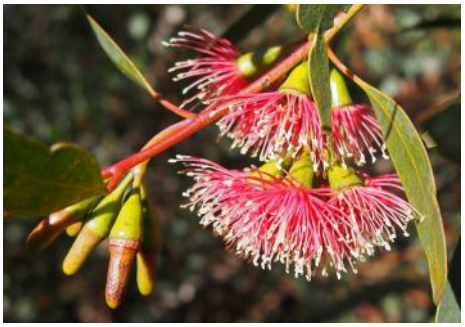


Rainbow Lorikeets harvest nectar and pollen from flowers. They usually nest in a hollow limb of a gum tree.

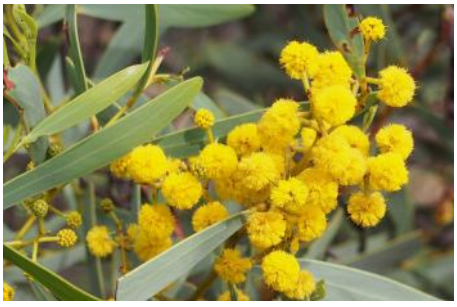
Trachycarpus fortunei, Chinese Windmill Palm is dioecious. The bright yellow inflorescence erupts from a packet-like bud. On female plants the flowers are followed by small blue fruits (1.3 cm diam.) Origin China.

Eucalyptus lansdowneana subsp. *lansdowneana*, Crimson Mallee Origin SA.

Eucalyptus sporadica, Origin WA.



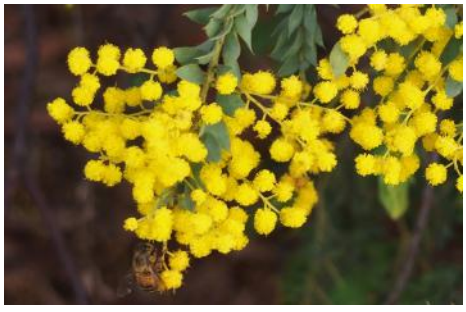
Eucalyptus thamnoides subsp. *megista.* Origin WA.



Acacia notabilis, Flinders Wattle is a bushy, spreading, hairless shrub, with dark reddish-brown branchlets and narrow leathery phyllodes. Common in parts of SA, listed as endangered in NSW, vulnerable in Vic.

Acacia imbricata, Imbricate Wattle. Origin SA.

Pleiogynium timorense, Burdekin Plum. Fruit is edible raw or cooked but is astringent. Origin Qld, PNG.



Acacia vestita, Weeping Boree is a graceful, free-flowering shrub with weeping branches and 'downy' foliage. The phyllodes are obliquely ovate-elliptical in shape with a fine point. Origin NSW.