THE FRIENDS OF THE WAITE ARBORETUM INC.

WAITE
ARBORETUM

NEWSLETTER NO. 65

Spring 2010

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FROM THE PRESIDENT

Life has been quite busy since the last Newsletter in July. The wonderful Guitar Concert, a Classical Guitar Duo, given by Aleksandr Tsiboulski and Jacob Cordover on August 18th to a packed room was indeed a special occasion. Their choice of pieces including works by Assad, Brouwer, Rossini, Scarlatti and Westlake reflected with the audience in the late afternoon timing. The pre concert refreshments provided by the Committee helped promote a relaxed and convivial atmosphere. Thanks are due to all those who helped with the setting up and hosting of the event.

It was all hands to the wheel for supporting the running of the two day 11th National Street Tree Symposium on the 2nd and 3rd of September organised by Treenet. This has become a big event for the FWA and is a good example of groups working together. Thursday saw us at the Wine Centre where many papers were presented by leading experts in the fields of urban design and ecology, open space planning, urban forest renewal, water-wise use and conservation and arboriculture. The second day was the Field Day Programme with six practical sessions, all planned to be mainly held outside. Much wind during the night tested the marquee on the Croquet Lawn. This was followed by increasingly heavy rain throughout the day, which started during the first of the various 9.00 – 9.40 am sessions. When alternative undercover venues couldn't be found hardy souls rugged up as best as possible in their enthusiasm to attend the interesting range of subjects covered.
(One of the main organisers of the event, Jennifer Gardiner, was unfortunately out of action with a very bad cold/flu for the set-up days when she so much wanted to make sure everything was as she had planned. Even though still unwell she then defied the inclement weather to be on deck on Friday to help out).

Running in conjunction with the Symposium, Urrbrae House had on display and for sale some of Les Loffler's attractive miniature profiles of various trees made from wood from the respective subject tree. Over 70 Friends and guests enjoyed the Beryl Martin 'Celebrating Spring' watercolour exhibition on Sunday 10th October which was opened by Prof. Mark Tester. The main hall and drawing room were resplendent with the vivid colours and detailed artistry of Beryl's botanical subjects. At time of writing a good percentage of the works had been sold along with a number of prints and cards.

The Friends' Committee is delighted to announce that Mark has happily agreed to join them. He has a distinguished career in Botany spanning Adelaide and Cambridge Universities and is now Director of The Plant Accelerator at the new Australian Centre for Plant Functional Genomics. We are fortunate in

having him 'on board' as he has long been very interested and enthusiastic about the Arboretum, an additional bonus is being on University staff.

Looking ahead; on Friday 19th November we have a twilight meeting with drinks and nibbles followed by a talk by the sculptor, Meliesa Judge. An example of her work is the piece in the Sensory Garden. We had been considering a suggestion of holding a joint picnic in the Arboretum late in the year in place of the annual Christmas Party at Urrbrae House. Because of time limits and various factors we have decided to look into it as an idea for 2011. So the usual gathering will be on Monday 6th December.

Henry Krichauff

Beryl Martin and Prof. Mark Tester

Laura Boynes, Beryl and Mandy Martin

IN THE ARBORETUM

FROM THE DIRECTOR

New research projects in the Arboretum

Blue-banded bee breeding

Visitors to the North Arboretum may have noticed a discreet but unusual construction under a mallee near the eastern boundary. Dr Katja Hogendoorn, School of Agriculture, Food & Wine at the Waite has been undertaking research on native blue-banded bees since 2004. With the able assistance of Mark Ziersh, Katja has constructed a prototype bee wall of her own design to locally increase the natural population of the bees for her research into bee pollination. The wall is built with Besser blocks and careful attention was given to orientation, shading and other factors affecting temperature control. The blocks were filled with clay of just the right properties for bee nesting material. Holes were drilled in the clay and the wall was seeded with bee brood from a native aggregation. Like the great majority of the 3,000+ species of Australian native bees, blue-banded bees are solitary. As reported in *The Advertiser* of 10.10.10, Dr Hogendoorn and Associate Prof. Mike Keller have shown, in tasting tests with 113 participants, that pollination by buzz pollinating bees improves the depth of flavour of tomatoes. Well pollinated tomatoes are filled with plump seeds which affect size, amount of pulp, ripening and flavour of tomatoes. Buzz-pollinating bees such as the blue-banded bee are more effective for pollinating tomatoes than honeybees which do not buzz. Thus, if the bee wall works, this would offer home gardeners an opportunity to improve the fruit set, size and flavour of their home grown tomatoes, while at the same time enhancing the native bee populations.

Stop press: the first female blue-banded bee was observed entering the bee wall on 26 October.

Katja Hogendoorn

Mark Ziersch

Bee wall under construction
Photos by: JG, MZ & KH

Katja & Jennifer Gardner

Elm Avenue

Nine neutron probe access tubes have now been installed in Elm Avenue by soil scientist Dr Cameron Grant, School of Agriculture, Food & Wine and his postgraduate students. The first complete set of readings at three depths and measurements of corresponding soil water content of core samples have been done for each site. Cameron will continue to install access tubes each year with his 3rd year class "Soil and Water: Management and Conservation" and monitoring will be on-going.

Ornamental Eucalypt research

Drs Kate Delaporte, Michelle Wirthensohn and Cassie Collins, School of Agriculture, Food & Wine recently secured a substantial grant to provide baseline scientific knowledge about aspects of reproductive biology and hybridisation of a number of ornamental eucalypts. Over the next 3 years they will be conducting studies into pollen longevity, stigma receptivity, cross pollinations and development of reproductive structures. As part of their investigations, 12 Arboretum trees have been tagged for observations and some will be used for stigma receptivity trials over the next 18 months.

Trees and Habitat Creation Workshop

Following a very well received presentation at the Treenet Symposium on the creation of habitat trees by arborists Phil & Pat Kenyon from Victoria, they will return to present two unique workshops in the northwest Arboretum on Friday 5 November. The morning workshop will provide vegetation managers in Local Government and non-government organisations with information about habitat creation to achieve sustainable biodiversity. Ecologist James Smith of fauNature will co-present. The afternoon session will

offer hands-on training in innovative techniques for experienced arborists. A large dead white stringybark *Eucalyptus globoidea* will be pruned for habitat. It is the 3rd dead tree left standing for habitat in the northwest section and two earlier pruned trees are already attracting many parrots. Hollows created in the elm used in the symposium demonstration were immediately inspected by a pair of Eastern Rosellas and vertical slits in the bark offer safe resting sites for microbats.

Treenet Symposium

The 10th annual Treenet Symposium was very successful with outstanding presentations in the National Wine Centre on Day 1. Even the pouring rain on Day 2 in the Arboretum did not dampen delegates' enthusiastic responses. The Friends of the Arboretum again contributed to the friendly ambience of the event and assisted in the packing of conference satchels, staffing the registration desk, serving food on Friday and guiding the groups around the Arboretum. They were rewarded for their efforts with a $5,000 donation from Treenet. Well done to all the volunteers who participated. Another exhibition of exquisite tree silhouettes hand scroll-saw cut by Les Loffler was held in the Drawing Room on the Friday and was a popular attraction with delegates. The Friends of the Arboretum were very pleased to receive a $500 donation from Les.

Fungi and oaks in the Arboretum

The introduced Death Cap fungus *Amanita phalloides* was first discovered in the Arboretum by mycologist Pam Catcheside in 2008. Since then, daily monitoring of the oak collection has been undertaken by Mark Ziersch, volunteer Russell Cook and myself from June to September. The mushroom is very poisonous even fatal if ingested, so all specimens were destroyed and warning signs were posted on every entrance to the Arboretum. The number of death caps collected is as follows: 94 on 7 oak specimens (2008); 358 on 14 oaks (2009) and 365 on 21 oaks (2010). Detailed records and a locality map are kept.

In May this year fruiting bodies of another fungus of concern Australian Honey Fungus *Amillaria luteobubalina* was identified under a Blue Oak *Quercus douglasii*. While this native fungus occurs in southern Australia in balance within a healthy, biologically active natural system, in disturbed or drought stressed trees this root and butt rot fungus can reduce growth, cause branch dieback and leaf drop and eventually death. Biological control using a competitive soil fungus *Trichoderma* has been trialled over 3 years in South Australia by arborist Kym Knight, Tree Environs and proved to be very effective against the disease. All three Arboretum Blue Oaks were recently treated by spraying and soil injection with a dilute solution of *Trichoderma* and the Arboretum trees are expected to recover fully.

Garden News

The Gardens are looking their best ever after good winter rains. The roses in particular are now spectacular in full bloom thanks to the quality pruning by the Tuesday morning volunteers and members of the Heritage Rose Society. You may have seen our rose garden featured on Channel 10 News & Weather recently. Volunteer Laurel Crouch has made a great improvement to the Coachhouse Garden with stone walling and supplementary planting. The Mediterranean Garden Society (SA Branch) have held three working bees this year and shortly permanent plant labels will be in place to increase the educative value of the garden. The labels will be purchased with a grant from the MGS. The on-going support by Neutrog Australia Pty Ltd with the donation of over 600 kg of Sudden Impact for Roses is gratefully acknowledged.

Acknowledgements

Finally I thank all the arboricultural companies which have donated mulch this year: over 570 truckloads to date. A complete list can be found on the Arboretum website: www.waite.adelaide.edu.au/arboretum/. I also acknowledge the dedicated efforts of Arboretum groundsperson Mark Ziersch throughout the year.

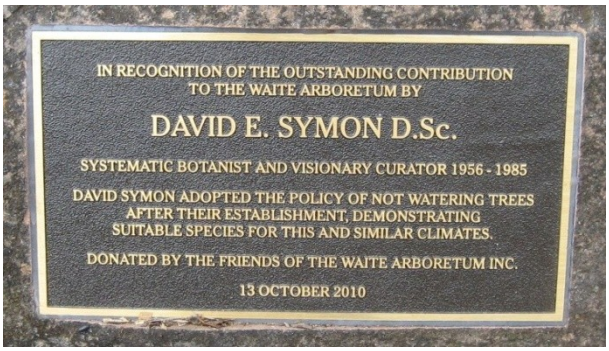
Jennifer Gardner

POT POURRI

BIRTHDAY CELEBRATION

On Wednesday 13 October the FWA hosted a party for David Symon who was 90 that day. More than 80 friends, family and colleagues, both past and present, of David gathered in the Arboretum beside of one of his beloved Dragon's Blood Trees. The President began with a few introductory words and then David was called upon to unveil the plaque which had been erected in his honour in recognition of his service to the Arboretum and his visionary approach. David was surprised (as we had hoped) since he had thought that the celebration would involve just the Arboretum Guides. He was also very pleased (as we had also hoped he would be). After he had unveiled the plaque, David described the path which had led him to the Waite and hence to the Arboretum. David was followed by Jennifer who paid a personal tribute to him, describing how she had first met him when she was a primary school student, how he had helped her then and how he had continued to do so, always willing to share his knowledge unstintingly, even to a 12-year old girl (as she had been at the time of their first meeting). We then adjourned to Urrbrae House to partake of a splendid morning tea, including a magnificent birthday cake decorated, of course, with a Dragon Tree and David had an opportunity to talk to the many friends who had gathered to pay him tribute.

David and Judy Symon



The plaque

David and the plaque

The cake

THE STRANGE CASE OF THE DISAPPEARING MONTEREY PINES

Part 2: The Demise of Monterey pines on the Adelaide Plains.

Sites in SA have a central position in the combination of rainfall and temperature regimes for which Radiata pine has been found suited (Booth, 1969). From the climatic aspect SA can be regarded as a home-from-home for Monterey pine. It is surprising to learn, therefore, in the Central Region of SA, that the Radiata pine avenue in the Botanic Garden, which was the initial source of seed for the State plantations, has not existed for a long time. More, that several Radiata pines that once lived in the Waite Arboretum have all died out. Both examples were apparently healthy semi-mature or older specimens. Other pines species originating in California, Digger pine (*P. sabiniana*) and Torrey pine (*P. torreyana*), and those from the Mediterranean region, Canary Island pine (*P. canariensis*), Aleppo pine (*P. halepensis*) and Brutan pine (*P. brutia*) all grow well. The Arboretum with an average rainfall of close to 600 mm is just in the climatic 'comfort-zone' at the lower end.

Radiata pine has a remarkably good health record against both harmful soil fungi and wood rotting fungi. Soil pathogens have affected seedlings but not well-established trees. The number of diseased tree stumps and logs found with signs of rot when trees have been felled has been very few indeed, less than a dozen instances in over 100 years (Woods & Forests Dept. & Forestry SA records).

The problem faced by Radiata pine specifically in the Arboretum thus appears likely to be associated with several site factors: a relatively abrupt reaction, a 'tipping point' was reached in mid-life in its tolerance of some soil characteristics, or with an unusual aspect of the climate, and the interaction of each, singly or in combination with genetic traits.

Soil factors, sufficient to interrupt fatally the seasonal growth, relate (1) to moisture available to the trees, (2) to soil depth and (3) soil texture being influenced by a dominant aspect of soil chemistry or physics. The soil type at the Arboretum and slope make it unlikely that excessive wetness is a factor so the opposite extreme, drought becomes evident. The critical combination is probably triggered by a climatic factor that concerns Radiata pine but not many, if any, other species in the Arboretum. As the past records have shown, the SA climate is subject to lengthy spells of below- or above-average rainfall. The answer to the riddle probably lies in a gradual accumulating effect in this direction. The next sections will look at local experience in SA forestry locations in which I have been directly involved.

First some basics to set the scene. The proportion of rainfall that can be preserved as accessible soil moisture over a season is a function of soil depth and texture. Depths less than 45 cm generally limit moisture supply even on sandy soils because there is insufficient pore space to accept it all; heavier textured soils more so. Whilst light soils tend to be relatively infertile (by agricultural standards) trees do not display drought symptoms with adequate depth. Heavier textures such as clay loams are liable to be drought prone because they release moisture less readily. This includes the soils at Urrbrae.

Medium to heavier-textured soils are usually predominantly red-brown and from a nutritional aspect are normally more fertile. In SA, red-brown coloured soils are common and range from rare red basaltic soil on volcanic rocks, through widespread *terra rossa* to red-brown earths. There are well-drained soils found on limestone or on consolidated dunes formed from shell-sand in higher rainfall areas. In Mediterranean climate zones in SA there is, typically, a result of many millennia of soil formation, secondary (i.e. soil-generated) deposit of lime. These soils are typically found from 250 mm upwards to 700 mm average rainfall.

In 1981, Sparrow speculated on the impact of the nature of various types of limestone deposits at shallow depth in mallee ecosystems in SA. Although there are many *Eucalyptus* species described with the mallee growth-form habit, on the ground it is unusual to find more than two or three species growing together in distinct ecological associations. Such species distributions imply a genetic adaptation. Sparrow focussed on reasons for this separation and upon variation found in the lime deposits that often persisted across wide areas. Secondary limestone development can vary considerably correlated with

rainfall. It can exist as sparse to dense nodules with low average rainfall, through chunky concretions or 'floaters' with rainfall between 300 and 450 mm to a continuous sheet calcrete and a dense chalky layer with higher rainfall. These deposits occur at depth where an equilibrium occurs arising from a seasonal, contra-flow weathering cycle: leaching of calcium in soluble and fine particles during the winter rainy season with low rates of evaporation, and upward conduction of moisture during high evaporation in summer. The first and last of these forms present a barrier to root penetration whilst the scattered, broken forms permit roots to penetrate to greater depth. The lime usually comes to occupy a stable position 30 to 50 cm below the surface in the majority of mallee soils, and the distribution of mallee species is often closely associated with a particular kind of limestone deposit, mediated by topsoil reaction (pH) and soil texture (see Fig 7.2, Sparrow, 1981). The red-brown earths with higher rainfall, such as occur in the Waite Arboretum and the Southern Flinders ranges, tend to be fairly uniform and have a well-established lime deposit though at greater depth 50-70cm, associated with moderately high rainfall and match the lower limits for Radiata pine development. Radiata pine prefers mildly acid to neutral top-soils, but does grow healthily near the coast with mildly alkaline *terra rossa* soil in higher rainfall areas.

Drought impacts on trees can vary markedly, depending often on whether there is prolonged or abrupt development of reduction in plant available moisture. Prolonged drought, common in SA with about a ten-year cycle, has the ground water table gradually falling to lower depths, at some point often going below access by sinker roots. Roots tend to follow the receding moisture front and supply the tree. More vigorous trees do this more rapidly. Abrupt tree decline and sometimes death can arise when the roots encounter a dense layer in the subsoil and moisture has to be drawn from solution held at increasing resistance, called osmotic pressure. In these circumstances, the chemical strength of the soil solution provides the pressure. If this is a reasonably-balanced solution of nutrients then it can be relatively benign.

Autumn Brown-top (ABT) found in the SE of SA is a relevant example of the most common wilting of the upper crown of Radiata pine. ABT is liable to occur when there is a sudden late start to the dry season and there is no opportunity for the trees to acclimatise gradually from October. It is rarely fatal and not all trees are affected. Trials to thin out the crop to increase individual growing space in anticipation of ABT did not prevent some residual trees being affected. This hinted that drought intolerance might be a factor which affected only a sub-population, hence lacking genetic control.

There is a genetic aspect that has been revealed by plant physiology. Laboratory research on this aspect, which used Radiata pine as the experimental subject was conducted. Experiments on the impact of increasing water stress on the root systems of selected Radiata pine seedlings were undertaken by Dr. Roger Sands when he was based in the CSIRO Division of Soils at Urrbrae during the 1980s. Seedlings I was asked to provide for the experiment came from several families produced in the Radiata pine-breeding programme. Their parents had been selected in SA and New Zealand for superior vigour. The study revealed two alternative strategies. Those seedlings identified by the mother clone Family #80121, originating in New Zealand, closed off water uptake, and hence transpiration, at a moderate tension (that is, whilst the osmotic pressure (OP) was moderately low, equivalent to a slightly damp soil) and they were able to survive until that moderate level of tension was restored as part of the trial protocol. They survived this hiatus which lasted for several weeks. Two other families, one from SA (#50048) and (#80055) also originating in New Zealand simply kept on transpiring at slower and slower rates as the tension (OP stress) increased higher and higher. These seedlings, in contrast, would keep on extracting water until they used it up. So in the open forest, they would eventually wilt and die. The solution strength producing the high tension was deliberately reduced again just before this happened, gradually, to see if they would recover. They did, very slowly at first then more rapidly. This behaviour showed up a spectacular difference between the two NZ parents. In NZ the locations had a much wetter and cooler climate and lacked a summer dry season so that the presence of two alternative strategies did not matter there. In several progeny tests in SA, the offspring of these two parents behaved quite differently and mirrored the trial results. The families of the pair #50048 and #80055 grew as vigorously as their parents did and, as expected, topped the results. The NZ family (#80121), in effect, stagnated through a 'dry' spell and outdoors it might have survived SA's summer climate until drought-breaking

rains fell. This family grows relatively much more slowly in SA than in NZ. This difference was consistent over a range of sites in SA over a number of years and clearly reflects a genetic response.

Importantly, the experiment applied water stress in two ways that introduced the factor of soil chemistry with controlled strengths of nutrient solution. Neither would or did harm seedlings even at relatively high strength. These were either an inorganic benign nutrient solution (as used in hydroponics), or organically, with polyethylene glycol (PEG), also known to motorists as 'antifreeze) with no nutritional value. Drought *per se* is unlikely to be sufficient hazard for widespread mortality.

This trial demonstrated that a more drastic situation than physical drought alone seems necessary for an explanation for rapid wholesale mortality. The probable explanation is that drought leads to roots being trapped in a situation where the increasingly stronger soil solution is dominated chemically but exceptionally; one in which one or two nutrient chemicals predominate but in ionic form. This is likely to be fatal despite the tree possibly having genetically-based drought tolerance. These circumstances can be rare where species normally succeed, but can be fatal over a few weeks. The most common soil chemicals likely to be involved are two cations: *calcium*, partnered by anions, hydroxide, carbonate and bicarbonate; and *sodium* with chloride (common salt). Is there any evidence of this happening?

Wholesale mortality triggered by drought after years with below average rains has been far from common in SA. The probable cause of fatalities is not usually obvious, especially when neighbouring tracts of the same species appear unaffected. Examples that affected Radiata pine that shed some light occurred in the droughts of 1966 and 1973. These occurred at Wirrabara in 1966, and also near Williamstown and the South Para Reservoir in 1973. Both cases were singular in that Radiata pine died in broad strips whilst adjacent trees remained scarcely affected. Soils on steeply dipped Pre-Cambrian strata of the Mt Lofty and the Southern Flinders Ranges were involved. I was closely involved with examination of soils at Wirrabara. An intensive soil survey was made in adjacent affected and unaffected parts of plantations across the landscape. The top soil was similar in texture and colour and all had similar trends in pH; also, all borings reached a very pale coloured hard layer in the subsoil at depths around 45-50 cm regardless of the trees' condition. The layer was dense and a barrier to rooting. It had a pale, chalky or amorphous consistency. It was only when we tested this layer for soil reaction that we found drought-stricken trees were on subsoil which was highly alkaline (pH 8.5 and above.). It had developed from limestone so the layer was dominated by calcium ions. Meanwhile, healthy trees above and below on the slopes were on subsoil with high acidity. They grew on strata which produced acid subsoil (pH 4, indicating it was a clay, kaolinite or commonly known as 'China clay') and these were favourable for survival of Monterey pine even in a severe drought.

Not all soils formed on Pre-Cambrian limestones were directly implicated in 1966, but another area affected within a few kilometres had strip plantings of Bishop's pine (*Pinus muricata*) and Canary Island pine planted beside Radiata pine. All the Canary Is. pine trees and about a quarter of the Bishop's pine survived but none of the Radiata pines; they all died in the course of a few weeks. Here species tolerance or intolerance was demonstrated, genetic predisposition of different intensity was shown to high concentrations of calcium ions under similar edaphic conditions, similar in altitude, depth and texture during a severe soil drought.
The nature of the chemistry in the subsoil may have been the crucial factor in the Waite Arboretum fatalities. But are these rare events the most likely, bearing in mind that the Arboretum was irrigated until 1991? It is clear that we need to consider any limitations that may apply to genetic factors, for we also know more about the genetic traits and variation of *Pinus radiata*.

This review has brought out a fundamental problem of Arboreta. This is the very restricted breadth of the gene pool present. Usually less than four specimens are planted. The parent trees of the fruits or cones, let alone the seeds themselves very few are likely to be used, at best.

In the case of Radiata pine we know more about the SA antecedents of this species than probably any other species in the Arboretum, as discussed in the first part of this essay. To recap, a few dozen potted seedlings were imported into Melbourne, provided from the few original 'mother' trees taken from the

population at Monterey, California, and it was their offspring which were sent as potted plants sent to Adelaide Botanic Garden. Thereafter, until the 1960s, this limited seed source has been the progenitor of later generations used widely in SA. Seeds for trees planted in the Arboretum probably came from trees planted between 1910 and 1920, members of a third or fourth local generation. It was probably seed from a single parent, then only from a single cone, and less than a fifth of the 50-odd seeds in a single Radiata pine cone. This emphasises the dilemma that seedlings planted in the Arboretum are subject to most acutely limited genetic variation by this inevitable selection process.

Thus the most likely explanation for the demise of Radiata pine *under rare circumstances* is they represent a species with *calcifugous* tendencies leading to increased susceptibility on less suitable soils, especially vulnerable after a prolonged spell of below average rainfall leading to acute soil drought, aggravated by acutely-restricted genetic variation.

This answer raises real questions on the selection of long-lived species and management of arboreta in general, which is surely a subject for another essay.

Boardman, R., 1978. Perspectives on managed ecosystems for the semi-arid zone of Southern Australia. Paper. 50th ANZAAS Congress, Section K. Agriculture and Forestry, Adelaide. pp.15.
Booth, T.R. 1969. Proc. Jt. mtg. Forestry Research Working Groups 1 (tree breeding & genetics) and 3 (soils), Traralgon, Vic.).
Sparrow, A. 1989. Mallee vegetation in South Australia; in (ed) J. C. Noble & R.A. Bradstock. "Mediterranean Landscapes in Australia – Mallee Ecosystems and their Management", pp.109-124. CSIRO Australia.

Robert Boardman

NEW MEMBERS

We warmly welcome new members: Miss Ramute Stankevicius, Seaview Downs, Carol and Ray Bailey, Mt Barker, Dr Ken and Joy Shepherd, Rose Park, Nicholas Thomas and family, Kingswood and Keith and Sue Langley, Netherby and Monica & Paul Renwick, Myrtle Bank who have re-joined the Friends.

FORTHCOMING EVENTS

Friday 5 November. 'Trees and Habitat Creation Workshop' (see www.treenet.org to register)

Friday 19 November. 'Twilight Sculpture walk and talk' presented by Meliesa Judge, Liquid Metal Studios. 5.00 - 6.30 p.m. presentation. Cost $15 per person including light refreshments (champagne/soft drink & nibbles). Bookings essential.

Monday 6 December. Combined Friends' Groups Christmas Party. 6 - 8 pm

Free Guided Walks
A reminder to Friends that there are free guided walks in the Arboretum on, the first Sunday of every month, from 11 a.m. – 12.30 p.m. Come along and bring your friends.

Christmas is rapidly approaching so why not choose from the list below and support the Arboretum at the same time?

All items are available from the Arboretum Office (8303 7405) and at the Friends' Christmas party.

Suggested Christmas presents

A gift membership to the Friends of the Waite Arboretum makes an ideal Christmas present. Membership forms can be downloaded from www.waite.adelaide.edu.au/arboretum/friends/

Jewellery

Exquisite silver jewellery by Pat Hagan, including the Arboretum brooch (Dragon's Blood Tree), earrings and many more. All are beautifully handcrafted and feature Australian plants and animals. They make unique gifts for overseas friends and family. Prices $30 - $120.

Greeting cards & prints

Colourful Beryl Martin greeting cards $5 ea or your choice of 5 for $22.50
High quality Gicleé prints 140 mm x 210 mm signed by Beryl Martin, mounted, shrink-wrapped with backing. $40 each.

Books

Eucalypts of South Australia by Dean Nicolle $25
Hakeas – A Field and Garden Guide by Ivan Holliday $30
Melaleucas – A Field and Garden Guide 2nd edn by Ivan Holliday $32
Gardener's Companion to Eucalypts by Ivan Holliday & Geoffrey Watson $30

Arboretum T-shirts $15