



**Celebrating the 25th Anniversary
of the Australian Botanic Garden,
Mount Annan**



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Australian Plants





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Cover: The Connections Garden perennial display. Photographer Jaime Plaza

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Australian Plants articles

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John Aitken and Merle Thompson
Editors, *Australian Plants*
PO Box 5026, Old Toongabbie NSW 2146
E-mail edap@austplants-nsw.org.au Fax (02) 9631 4293

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Introduction to the Australian Botanic Garden, Mount Annan

Caz McCallum, Director, the Australian Botanic Garden, Mount Annan

Caz has managed the Garden since 2005 and worked for the Royal Botanic Gardens & Domain Trust for 16 years. Prior to that, she worked as a landscape manager in many high profile Sydney locations and as a trainer.

The Australian Botanic Garden, Mount Annan is a fascinating work in progress. The 1984 proposal by Premier Neville Wran to the Royal Botanic Gardens and Domain Trust (Trust) to find a site for an Australian plant botanic garden, as a bicentenary project, has proved visionary. The site's undulating landscape and low rainfall (half that of Sydney) were the deciding factors in choosing the ex-dairy farm site. Existing, ecologically significant remnants of Cumberland Plain Woodland, of which less than 7% remains in Western Sydney, have been a bonus. Today, the Garden's total area is 416.6 hectares.

On 2 October, 1988, Mount Annan Botanic Garden was opened by the Duke and Duchess of York (Prince Andrew and Sarah Ferguson). They would be amazed to see the themed gardens and arboreta today. Struggling tubestock are now full size, special collection specimens, shade trees or flowering shrubs. Dusty areas have been replaced by rolling green hills and fine turf and picturesque lakes have become a haven for native birds and wildlife. Unfortunately many visitors view it as a park, only.

The Garden's recent name change to the Australian Botanic Garden, Mount Annan means people now expect to see Australian plants rather than roses or camellias, on display. The opening of the Australian PlantBank scientific research facility last October, has reinforced that Australian focus. It has also caused significant, increasing interest in the Garden's science and conservation work.

The functional complexity of the Garden and its stewardship is difficult to explain simply. The following articles will hopefully assist understanding what 25 years of hard work, dedication and passion (of staff and volunteers) can achieve. We invite you, also, to share in this very young Australian Botanic Garden's future.





Achieving the green vision for the Australian Botanic Garden

Peter Cuneo – Manager, Natural Heritage

Peter has worked on the horticultural development of ABG since its inception, and is now responsible for conservation programs including the management of natural areas and the PlantBank seed collecting program. His research interest is the weed ecology of African olive and ecological restoration.

Although still a relatively young garden, in just 25 years the Australian Botanic Garden, Mount Annan (ABGMA) has developed into a unique landscape that continues to attract an increasing number of visitors each year. The grand vision for this contemporary botanic garden was a combination of recreational space, horticultural display and plant conservation. Despite the challenges of size (416 ha) and the tough western Sydney climate, the entire landscape has developed and evolved to become a diverse mosaic of woodlands, grasslands and horticultural display areas. Small remnant woodland areas have expanded over the past 25 years to become an integral part of the landscape, and now provide excellent fauna habitat. Known as Cumberland Plain Woodland, this plant community is now listed as critically endangered, due to the pressure of urban development and weed invasion.

Managing the large scale ABGMA landscape has always been a great challenge, particularly weed control. We have experienced 'first hand' the impact of weed invasion, with the relentless spread of the highly invasive African olive tree throughout the Garden since 1988. The small black fruits are readily spread by birds, and in 2005 over 70 hectares of dense olive had established on steep hillsides. Fortunately olive invasion was controlled in woodland conservation areas, and we have commenced the enormous task of controlling dense olive forests along the eastern ridge and Mount Annan. These pure stands of African olive are mechanically 'wood chipped' by specialist contractors without disturbing the soil profile, and leave the sites with a thick olive mulch. So far, 40 hectares of olive invasion have been mechanically treated, and we are now looking towards our seed collections held at PlantBank to 'kick start' the regeneration of local native plants. The ecological restoration of these 'ground zero' cleared olive sites, includes direct seeding of native grasses to commence the process of restoring Cumberland Plain Woodland.

After many years studying and growing our local woodland plants, they now feature in the impressive Australian PlantBank landscape.



The PlantBank landscape design features local species which merge into the adjacent woodland conservation area.

Over 25,000 Cumberland Plain plants were sourced on site and grown specifically for the PlantBank landscape, including threatened species like *Pimelea spicata* and local ferns produced in the lab from spore culture. The PlantBank landscape merges with the adjacent woodland conservation area and provides a direct link to the important conservation work inside PlantBank.

The past 25 years developing the Garden has truly has been a 'grand experiment'. We have learnt so much about growing and displaying our unique flora. Underpinned by science and horticulture, there is little doubt that ABGMA will continue to redefine the role of a contemporary botanic garden, and present a unique balance between horticultural and natural landscapes.



The olive chipping machine in operation.



Cumberland Plain Woodland Ecology

Lotte von Richter

Lotte von Richter has been a technical officer at the Australian Botanic Garden for 19 years. She has worked on developing Flannel Flowers as a cut flower crop, carried out seed germination studies and assisted in Cumberland Plain Woodland research.

In 1984 the site chosen for a new Botanic Garden in Sydney's south-west was surveyed by Royal Botanic Garden, Sydney staff who recognised that a vital piece of natural vegetation existed within its boundaries. This remnant vegetation had survived for decades as large Eucalypt trees in cultivated paddocks. The land was set aside as 'not to be developed' during the Botanic Garden construction phase.

Once the Garden began to establish, Ecology staff began a 20 year conservation monitoring program. Twelve permanent plots were set out and monitored annually. The aims were to learn about the longevity, relationships between species, growth, flowering and fruiting of plants within the Cumberland Plain Woodland (CPW).

In 1997 CPW was recognised as an important and ever decreasing vegetation type in Western Sydney and listed as an Endangered Ecological Community under the *Threatened Species Conservation Act* 1995. By 2009 this rating was upgraded to Critically Endangered under both the state and federal legislation.

Research in the Woodland

During the past 25 years at least 210 native species and over 120 exotic species have been recorded in the natural woodland and grassland areas in the Garden. The three main tree species are *Eucalyptus moluccana* (Grey Box), *E. tereticornis* (Forest Red Gum) and *E. crebra* (Narrow-leaved Ironbark). The shrub layer is dominated by *Bursaria spinosa* (Blackthorn). This most diverse and fascinating component of the woodland is its understorey layer comprising more than 170 herbs and grasses. These herbs exist as individual isolated plants or clusters. Unfortunately, but inevitably, after years of farming there is also a significant number of weed species.

The species composition has not varied much over the past 25 years. Stock removal did allow understorey regrowth. Drought and wet periods have also impacted species growth, many surviving as seeds in the soil seedbank or as fleshy rootstocks which resprout after fire or rain.

What is so special about our Woodland?

- There is about 7% of Cumberland Plain Woodland left in Western Sydney so any significant remnant in a protected area is highly valuable. Compared to other sites there is a good proportion of large, mature Eucalypt trees here, many containing hollows suitable as habitat for birds and animals. In total there are about 30ha of good quality woodland in the Garden.



Woodland Conservation Area in 1988

Photo P. Quirk



The same Woodland Conservation Area in 2009 Photo S. Cottrell

- The site is also a good representative of Shale Hills Woodland, one of the eleven vegetation groups that make up the vegetation on the Cumberland Plain. A listed endangered plant, *Pimelea spicata* (Spiked Rice Flower) occurs in large stable numbers and the endangered mollusc *Meridolum corneoviens* (Cumberland Land Snail) is found here. A small population of *Marsdenia viridiflora*, a listed plant population, is also present.



- The Garden is one of the few Botanic Gardens to have horticultural displays alongside a Critically Endangered Ecological Community requiring conservation. It is a privilege to have a conservation area that is still accessible to the public.
- The areas are large enough to be significant habitat for a host of birds, animals and invertebrates with sufficient connectivity to facilitate animal movement across the site. It has become quite a biological haven within the sea of houses and roads that border the Garden.
- This stable, safe site has enabled more than 20 years of ecological monitoring by staff, several postgraduate student projects and is an ideal location for outdoor classroom activities for school children.
- We have managed and utilised fire to our advantage, to study its effects on the vegetation and weed control.

What has the research monitoring taught us?

- Species do not move significant distances in 20 years without intervention! Reconstructed woodlands require input of plant material by sowing seeds or planting tubestock. There is no point just waiting for something to happen if the site has been very degraded. Seed dispersal distances are usually minimal and in most cases weeds manage to colonise first.
- A mosaic pattern of fire applied in our woodland can manipulate the vegetation. Frequent burning results in a more open, less shrubby



Ecological burning as a management tool in the Cumberland Plain Woodland. Photo L. von Richter



Pimelea spicata. Photo L. von Richter

bushland. Infrequent fire results in a dense *Bursaria* shrub layer to the detriment of the herbaceous layer. Fire was not found to be a significant trigger to seed germination in this vegetation, unlike Sandstone vegetation communities. Rather it opened the ground layer to light and moisture for recruitment in niches.

- Grazing exclusion by fences has perpetuated weeds! The surrounding areas are comparatively weed free due to rabbits and macropods.
- Threatening weed encroachment, particularly by *Olea europaea* subsp. *cuspidata* (African Olive) and *Nassella neesiana* (Chilean Needle Grass) are significant challenges we face on site.

Information about the Ecology of the Cumberland Plain Woodland Plants

Since 2006 web pages have provided information about the ecology of Cumberland Plain Woodland plants, including ecological observations and images of all the vascular plants and their parts, both native and exotic, found in the woodlands in the Garden. There are also photos of mosses, lichens, animals, birds, reptiles and invertebrates that have been sighted and information about their relationship. The information is continuously refined as we learn more about the biodiversity of this fascinating plant community.

The web site can be found at this address:

www.rbgsyd.nsw.gov.au/science/Evolutionary_Ecology_Research/Ecology_of_Cumberland_Plain_Woodland





Remnant tree management in the Botanic Garden

Geoffrey Goodwin

Geoffrey has been working for 25 years for the Botanic Gardens & Domain Trust across two sites, the Royal Botanic Garden, Sydney, and the Australian Botanic Garden. He achieved a level 5 qualification through Ryde and Richmond TAFE Colleges and has been a Casual Teacher of Arboriculture for the last seven years at Richmond TAFE college

The Australian Botanic Garden is not a typical horticultural display garden. Although over 400 hectares, horticultural displays and arboreta throughout the site are interspersed with remnant native grasslands and Cumberland Plain Woodland. We call it a 'Woodland Garden'. Some of our horticultural plantings occur under the cover of some of the largest remnant trees in South West Sydney.

One of my challenges, besides arboreta development, is to successfully manage these giants in the landscape and balance the safety of visitors and staff with the ongoing role of these trees, as habitat for animal and insect populations.



Critically endangered Cumberland Plain Woodland. Photo: Jaime Plaza



Remnant *Eucalyptus tereticornis*

Habitat Management

The site consists of large pockets of natural vegetation, home to the dominant remnant tree species found on site: forest red gum (*Eucalyptus tereticornis*), grey box (*E. moluccana*) and narrow leaved iron bark (*E. crebra*). These species are crucial to wildlife including the birds, arboreal mammal populations, reptiles and invertebrates, termites, spiders, native and exotic bees, leaf psyllids and numerous other insects that together form the site ecology.

In combination with various natural processes, these organisms form hollows and cavities that can impact the structural integrity of the trees. Large mature trees occur in groups within woodland, as single trees in grasslands or as isolated specimens retained to provide shade, structure and aesthetic value in our picnic gardens. Each tree requires a measure of management that differs according to its role within our complex 'landscape'. We must take into account proximity to pathways, car parking, picnic tables and other features, whilst recognising that our 'natural' site is designed to provide experiences, in some ways similar, to national parks.





There are consequently difficult decisions to be made about balancing and managing the important role of old trees in the ecosystem with the very real and somewhat unpredictable hazards they provide. Sometimes we compromise, reducing the tree to bare bones whilst retaining known habitat hollows. On other occasions we sacrifice a majestic healthy specimen with a suspect structure in the interest of safety.

So how do you maintain the habitat needs of the native fauna without exposing staff and the visiting public to an unacceptable level of risk? This is not an exact science. We employ a range of tools and assessment techniques to assist in ensuring we retain as many and as much as possible. It's a risk management process. While we don't take the approach of some local government bodies that try to eliminate all possible threats (we'd have nothing left), we remain determined to provide a safe and interactive environment for our most important mammals - you and me. Public risk of tree failure is only as great as the target exposed to it. The higher the number of visitors to an area, the greater potential for risk from tree-related issues.

Grey box (*E. moluccana*) is the most dominant remnant species, contributing over 50% of the woodland canopy and often higher in picnic areas. The common fault with this particular species is its provision of great habitat for termites that hollow out the centre of trunks and major branches, while still appearing as a healthy tree. While it sounds bad, in fact it's a natural process, often associated with fungal infection from a local species of bracket fungus. It eventually breaks down the cellulose and weakens the cell walls, enabling and encouraging termite incursion. While the tree appears unaffected, these branches can eventually fail due to loss of structure (and go on to provide great opportunities for habitat). Of course, if they are located in a high traffic area, this can increase exposure to branch strikes. Before you worry too much, this will generally occur during periods of high stress such as storms or high wind events when most people are indoors.

Field study of individual trees over many years at the Australian Botanic Garden has provided an opportunity to analyse these issues in detail - what to look for when these defects form and increase the likelihood of branch failure. We learn from each tree that is removed or pruned, captured in our individual tree assessments, and apply this to future management practices. Trees are assessed on their 'target' and 'failure' potential, providing data that aids our work by calculating risk, prioritising work locations and identifying individual specimens that require most attention. Sometimes this may mean public exclusion, such as diverting pathways or installing signs and fences because we



continue to value the tree's role in the landscape and potential to live on for many years to be admired from a distance.

As eucalypt trees can live for hundreds of years, we don't just rely upon anecdotal information for making life and death decisions surrounding a tree's health. Fortunately having a good record database system in place for our botanic collections also allows us to keep accurate records of our remnant trees. In combination with the use of GIS mapping and a specifically developed software package (Tree-Logic), information can be archived to support developing tree management programs for individual trees in specific locations. In this way, staff can access treatments, assessments or changes recorded over the observational life of the tree. Photographic images, pesticide treatments, sonic tomographs and other diagnostic test reports may be undertaken on a signature tree and collated to help build an almost sub-cutaneous picture. Identifying these hidden details, degree of decline over time and obvious defects in conjunction with our regular VTA (Visual Tree Assessments), means we can develop a management program with which to monitor and maintain our collection. Besides, staff may move, transfer or retire well before management of these trees is complete.

While we're out planting new trees and encouraging the restoration of our expanding woodland areas, we hope visitors can also reflect and admire the enormous cultural value of retaining these old majestic remnants.





Nursery of Australian plants

Jim Whyte Senior Horticulturist (propagation).

Jim's love of native plants came from travelling around Australia and growing up in the water catchment area of The Oaks, bush walking, collecting and germinating Telopea seed. From there he joined the Australian Botanic Garden, and now he propagates for a living. Paradise for him!

As you may imagine, we have a large and diverse living collection of plants from across Australia housed in our nursery. Many people over the past 25 years have contributed to establishing and maintaining this collection; and yes, it's a handful to curate. The nursery of the Australian Botanic Garden covers approximately three hectares with one hectare of dedicated shade house plus a propagation building, two small glass houses, each split for additional climate control, a 'tube house' for establishing young plants and four poly houses that help production plants through our harsh winter.

The majority of our collection is 'wild sourced' i.e. collected from natural habitat; and consequently can be quite difficult to maintain. Australian plants in cultivation can be unreliable as they have evolved in a specific climate, aspect and soil type and while some adapt readily, others take more work. Unlike a 'regular' nursery that propagates and grows plants known to be successful, we are growing plants often unknown in horticulture and with limited knowledge of the propagation or growing conditions they prefer. While we have become much better at this over the years we still have many challenges to solve. Individual groups of plants may have a significant value attached either due to their rare status, because they form part of a bigger research project, or simply because of the expense required to re-collect; and, of course, there is

quite a lot of emotional attachment from those involved in collecting, propagating, growing and 're-propagating' individual plants over the years.

As a collection based nursery, we strive to maintain a continuous stream of plants to the Garden staff who request specific



Polyhouses are used to aid production and extend available growing season.

species suited to their garden themes. At times it seems never ending; and effectively it is. Figures vary but we generally propagate around 10 to 15,000 plants per year, including annuals, perennials and various trees, shrubs and groundcovers. Propagation techniques rely on seeds, cuttings, grafting and tissue culture. The nursery links closely with our research, seed bank and collection team, maintaining or finding homes for research plants or seed germination trials.

Grevilleas are amongst the most iconic Australian species and we are proud to house a large collection, many of which have been provided by the NSW Grevillea Study Group as well as our own collection. I have a great passion for grafting grevilleas that are difficult to cultivate, for display in the Banksia and the Connections Gardens, using rootstocks that readily thrive on our local clay soils. This season we have had great success with *Grevillea spinosa*, *G. acrobotrya*, *G. cheilocarpa*, *G. involuocrata* and *G. fistulosa*. These were planted in March and April this year and should be doing well by the time this goes to print.

We also have a commercial plant production unit which promotes the flora of NSW through contract growing of specialist native plants, usually for regeneration or commercial landscaping projects.

We also release selected native plants into the wholesale nursery market under the Royal Botanic Gardens "Collections" logo. Our aim is to reduce bush picking and support plant conservation objectives of private and government organisations by providing specialist 'provenanced' plant material i.e. where the precise origin of the plant material is recorded. Raising awareness of the conservation research role of the Royal Botanic Gardens & Domain Trust through retail plant labelling to the plant buying public is another positive outcome. We partner with a number of licensed growers who propagate plants for distribution to Queensland, ACT, South Australia, Victoria, Western Australia and NSW. You can identify these plants by the Trust logo on the tag and know you're supporting genuine plant conservation.

The first commercial plant release was in 2001, *Actinotus helianthi* 'Starbright' that coincided with the Centenary of Federation. It continues to be a popular variety of flannel flower in NSW and is now available in limited numbers across Australia.

Another of our successful releases is the non-climbing *Hardenbergia* cultivars 'Carpet Royale' and 'Flat White'.

The newest addition to the collection is the rare and endangered NSW species of *Prostanthera densa* called 'Mint Velvet'.





We have a number of plants in the pipeline that we hope to release to the retail market. All our plant releases aim to not only provide access to unique plants but also raise awareness of the threats posed to the fragile habitats in which they live



'Starbright' flannel flowers, overwintering in polyhouses



Hardenbergia 'Flat White'.



Nursery plants being 'hardened off' ready for planting.

Plant Records: the difference between a garden and a Botanic Garden

Tracey Armstrong, Gardens Information Officer

A garden is planted for pleasure.

A Botanic Garden is planted for pleasure and education, both now and in the future.

Long after the record keepers are compost, the records they kept will be used to investigate, inform, enlighten and remind those who follow.

It is useful for every garden, small or large, to record the basic facts as stock management information i.e. to know where plants came from, when and where they were planted, when they flowered and fruited, when they died and the cause of death. If you're a home propagator, then recording propagation date, kind of material, quality of material, treatment used, success rate etc will, over time, improve your technique and will inevitably improve the quality and quantity of your output. Relying on your memory is chancy at best and a complete waste of time and plant material at worst.

A Botanic Garden records all this information as well as much, much more. We record the field collection information including collectors' names, locality, lats and longs, altitude, habitat, associated species, soils and geology, landform and plant description. All this information underpins our collections. It allows our scientists, and other researchers, a one-stop shop to investigate taxonomy, biochemistry, ethnobotany, botanical history, plant conservation and many other disciplines.

For example, imagine working on the taxonomy of *Eucalyptus*. In the early days this could involve months or years of field work, travelling around the country collecting material – a very time-consuming and expensive exercise. Now a researcher can contact botanic gardens and ask them what species they hold. They will then only have to target selected species for field collection.

Imagine you wanted to illustrate a book on *Eucalyptus* with photos or paintings, or draw distribution maps for them; or test how variable the DNA of species are within distributions; or what colour dyes the foliage and flowers produce; or sample populations for biochemical analysis for medicine or oils.

It's all so much easier when wild-sourced living material can be found in your own Botanic Garden with accurate records attached.



Picking Favourites

Lesley Neuhold, Horticulturist

Asking a horticulturist to pick a favourite plant is a lot like asking a child in a lolly shop to pick just one lolly. There are just too many to choose from. However, after much agonising, staff of the Garden have managed to select a few of our favourite Australian native plants to share.



Photo: Tracey Armstrong

Stenocarpus sinuatus – The ‘Firewheel Tree’: Definitely my favourite plant, reminding me of home. Originally from Queensland, for several years I lived in the far north and later in the south-east. I grew to love rainforest areas, where the air is still and so much cooler than the coast.

The firewheel tree has an amazing flower, indicative of its common name. Spiralling deep ruby red spokes remind me of its *Grevillea* cousins and contrast with glossy, dark green lobed leaves. It is an amazing tree, especially when mature and towering.

Caz McCallum, Director, the Australian Botanic Garden, Mount Annan

Telopea aspera – ‘Gibraltar Range Waratah’: This Waratah is little known and little grown. It has a most attractive bright red flower with a white dusted centre and unusually rigid leaves with a textured lime green vein structure that is particularly attractive. It grows in the Gibraltar Range NP in northern NSW.

Daniel Bishop, Manager Horticulture

Commersonia bartramia – ‘Brown Kurrajong’: It’s a beautiful tree with masses of cream flowers in summer followed by lime green bristly fruit. It reminds me of the summer holidays when I was growing up on the far north coast of NSW.

Tracey Armstrong, Gardens Information Officer



Telopea spp. Photo: Cathy Offord

Telopea speciosissima – ‘Waratah’: For me they symbolise the Australian flora – beautiful, unique and tricky to grow.

Dr Catherine A. Offord, Principal Research Scientist

Eucalyptus pilularis – ‘Blackbutt’: This is a widespread species and can dominate the vegetation in some areas. Very old and large specimens are fantastic

trees with a grand structure and often have a stocking of bark at the base that has been blackened by bushfires. This contrasts with the silver and cream of the bark of the upper trunk and branches. This tree also reminds me of the south coast of NSW where in some areas it lines the roadsides

Graeme Errington, Seedbank Officer, Rainforest Project

Leucochrysum graminifolium – ‘Pagoda Rock Daisy’: It is small and I like little plants. The flowers are paper daisies so they last a while on the plant. When not in flower it looks like a grass tussock but a lovely bright green. It is only found in a small area of the Newnes Plateau so it is relatively rare and grows on interesting rock pagoda outcrops.

Lotte von Richter, Technical Officer, Research

Grevillea spinosa – Largely, as it has frustrated the heck out of me trying to graft it. But, now I have cracked the code! Absolutely the heaviest nectar producer I have come across.

James Whyte, Senior Horticulturist, Propagation

Brachychiton bidwillii – ‘Dwarf Kurrajong’: The grafted form. Because it is a small tree, less than 4 metres, that flowers bright red every year without fail. It makes a good mini avenue planting.

Grant Burrell, Senior Horticulturist, Theme Gardens

Buckinghamia celsissima – ‘Ivory Curl Flower’: Because of its large glossy leaves and perfumed grevillea like flowers. It’s the perfect small shade tree for suburban blocks.

Mark Viler, Senior Horticulturist, Commercial Production



Backhousia citriodora – ‘Lemon Myrtle’: Because of its smell. I also like its natural form/shape and overall appearance. It is very showy when flowering. It is quite easy to grow which helps as well.

Jarryd Kelly, Horticulturist, Greenkeeper

Lophostemon confertus – ‘Brush Box’: I have always had a fascination for Brush Box. In the wild they tend to grow quite tall and have a spectacular trunk. In the urban environment (in a park situation) they will form this large domed canopy of deep green foliage, that from a distance, stands out from the other surrounding trees. They also have a spectacular display of white/yellow starfish shaped flowers.

Geoff Goodwin, Senior Horticulturist, Arboriculture

Xerochrysum bracteatum cvs – ‘Strawflowers’: They flower for most of year, have a huge range of different flower colours and are easy to propagate.

Genevieve Duggan, Horticulturist

Gmelina leichhardtii – ‘White Beech’: A very attractive rainforest tree, uncommon in the Illawarra where its southern limit is; very elusive and hard to find in the bush; but when the sun shines through the canopy, its leaves glow a bright green and stand out from the rest of the canopy; always a joy to come across. It also produces a mass of white and purple flowers followed by clusters of beautiful purple fruit. A spectacular specimen tree for a larger garden or property.

Natalie Karbowski, Horticulturist



Xerochrysum bracteatum “Diamond Head”. Photo: Tracey Armstrong

Pimelea spectabilis – ‘Bunjong’: This grafted plant never fails to impress anyone who visits the Garden. The flowers are profuse and true to name – ‘spectacular’. This is one of the most rewarding plants to grow.

Lesley Neuhold, Horticulturist



Photo: Tracey Armstrong

Seedbanking at the Australian Botanic Garden – taking plant conservation to the next level

Peter Cuneo – Manager, Natural Heritage

The NSW Seedbank, located at ABGMA has always been at the centre of horticulture and conservation activity. The seed collection held at the Royal Botanic Garden, Sydney was moved to Mount Annan in 1986, and since that time an active seed collecting program from wild locations throughout Australia has been an essential part of developing this large and ambitious Garden. With the NSW Seedbank operations now fully integrated into the new Australian PlantBank, the seedbank still actively supports the development of the living collection throughout ABGMA and other RBG sites. Just like the ABGMA landscape and Garden, the role of the seedbank program has continually evolved, and now as the nucleus of PlantBank, it plays a lead role in the conservation of NSW threatened species.

This successful role has been built on the conservation partnerships established over several decades which commenced with NPWS recovery planning for iconic species like the Wollemi Pine (WP). That WP project, and others, drove the developing focus on ex-situ conservation at ABGMA and demonstrated the great strength of having seed collectors, horticulturists and seed scientists working side by side to deliver a flagship project.

This important ex situ seed conservation role was recognised in the NSW Biodiversity Strategy, and was further developed through our international partnership with RBG Kew’s Millennium Seed Bank Project (MSBP) from 2003. The partnership provided a substantial six year funding injection to support a statewide seed collecting program and enhancement to the seed research program. Over 1,400 new wild seed collections were made during this time and are now held at both PlantBank and the Millennium Seed Bank as a risk management strategy. The MSBP has also been active in other Australian states, and this significant investment has created a national network of native seedbanks of which PlantBank is a leading partner. Seed collections from Australia played a key role in the global MSBP reaching its first phase target of 10% of the world’s flora now held in conservation storage (~22,000 species).

The overarching threat of climate change, has added a new dimension to the conservation of biodiversity and the role of the seedbank. Wild collected native seed will be a key resource over the next few decades



Seed collections within the PlantBank seed vault. Photo: Simone Cottrell

and there will be increasing emphasis on using seed collections for ecological restoration. The location of PlantBank in western Sydney, a region of high vegetation loss and endangered bushland, makes it ideally situated to play an active conservation and restoration role for local Cumberland Plain vegetation, which now features in the PlantBank landscape.

With over 10,000 seed collections now held at PlantBank, representing over 5,000 Australian species, the seed collection is nationally significant. Safeguarding NSW threatened species will continue to be an important focus for the seed collecting and research program, with 45% of our threatened plants now held in the seed vault. The large seed storage capacity of PlantBank makes it ideally placed to hold 'back up' seed collections from across Australia and, potentially, the Asia/Pacific region.

For visitors to ABGMA, a visit to PlantBank is also an opportunity to see this important conservation work in action. No longer behind closed doors, visitors can now experience the 'journey of the seed' first hand at our PlantBank visitor exhibition area. We look forward to welcoming you!

The Australian PlantBank: a new era in plant science for the Sydney Royal Botanic Gardens

Catherine A. Offord – Cathy is a Principal Research Scientist and manages conservation and horticultural research at the Australian Botanic Garden Mount Annan

John Siemon – John is the Project Manager for the Australian PlantBank. He manages the facility and scientific infrastructure

The Sydney Royal Botanic Gardens (RBG), established in 1816, is the oldest scientific institution in Australia. From its earliest days, the RBG scientifically evaluated and sent Australian plants to institutions around the world as living plants, seeds or herbarium specimens. In many cases, this process involved the collection and storage of seeds or other propagation material and the discovery of how best to grow, and, in the case of seeds, to store plant material for future use.

Over time, the RBG has evolved as a scientific institution. Our science still relies on the collections, living and herbarium, and the expertise of staff at maintaining them and extracting meaningful information. Modern botanic gardens incorporate a range of scientific disciplines. At RBG we conduct research on botany, horticulture, genetics, ecology and pathology of Australian plants. With the establishment of the Australian Botanic Garden, Mount Annan (ABGMA) in the late 1980s, scientific studies were expanded into germplasm conservation, through seeds, tissue culture and living collections.

While we have always had a small but active seed bank, recent developments in seed storage technology across the globe have resulted in a new era of understanding. This has been fully embraced in the newly opened development at ABGMA in the form of the Australian PlantBank.



The Australian PlantBank is a building incorporating the NSW Seedbank, tissue culture and cryogenic facilities, with research laboratories, alongside educational facilities. The concept integrates germplasm conservation activities under one roof, adjacent to the intensive





activities of the existing Mount Annan nursery, and the surrounding extensive botanical collections. The building also interfaces with the critically endangered Cumberland Plain Woodland and provides opportunities to study the ecology and restoration of this diminishing community.

Interpreting the plight of plants

The central core of the building is a public space, offering the scientific experience and understanding to visitors to the Garden. The visitor experience begins when you walk underneath the reflective roof of the entrance emerging into the light and walking past a series of 26 horticultural beds that feature woodland species. Each bed has interpretation that works at a number of levels, from introducing newcomers to Australian plants, to school students and plant buffs who want more information. Granite blocks on the wall carry messages about the importance of biodiversity and the ways in which we can help conserve species. Standing back from the wall, you can see large letters forming the words PLANET PLANT. Black lines in the path link the landscaped beds, up the walls and into the laboratories forming a subtle connection of purpose reflected in the interpretative signage.

Inside out building design

The building has been designed to bring the outside in and the inside out. The reflective surface of the building mirrors the woodland in the distance on the outside and from the inside, trees are framed and vistas revealed at every window. Even the external mirrored surfaces are randomly placed to reflect the trees in the woodland.

The building has been designed to be sustainable, incorporating passive design and smart technologies to minimise energy use and decrease maintenance. Being close to the woodland, the building is constructed with fire-resistant materials.

All of the public areas and meeting rooms are named after local plants, including the Telopea gallery, the Acacia theatre (seats up to 150) and the Eucalyptus and Livistona meeting rooms.

Visitor experience – physical and virtual

Once inside the front doors, the visitor progresses along the main gallery, past the laboratories. The laboratories are arranged and interpretive signage is designed so that the visitor can see through the various layers of activity and gain an appreciation of the science within. The labs are designed so that there is minimal impact from the viewing on the scientists and they are happy to be observed whilst going about their work.

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President: Neville Page

Email: president@nativeplants-canberra.asn.au

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Website: www.nativeplants-canberra.asn.au

Society For Growing Australian Plants (Queensland Region) Inc.

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Secretary: Beth McRobert PO Box 586 Fortitude Valley QLD 4006

Email: secretary@sgapqld.org.au Website: www.sgapqld.org.au

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President: John Murphy Email president@australianplantssa.asn.au

Secretary: Ms Ali ben Kahn, PO Box 304, Unley, SA 5061.

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President: Eddy Wajon

Secretary: Kerry Smith, PO Box 519 Floreat WA 6014.

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There is an app available for download that adds a digital dimension to the experience. Other web-based resources are being added, such as a Climate Watch trial that goes through the woodland and to which people can add their observations about the flowering times of the species there.

Educational programs are delivered in the Persoonia Learning Laboratory, which features ‘connected classroom’ facilities that can link a class to another anywhere in the world with similar equipment.

The Seed Vault – a significant resource

Behind the seed processing laboratory is the Seed Vault. The vault is purpose-built of thick concrete to withstand four hours of fire or other potential disasters. Within the vault is the drying room (runs at 15% relative humidity and 15°C) that is necessary to get seeds to the required low moisture content to be stored in the freezer. There are a number of storage chambers within the vault. Most of our collections are held in the -20°C store. At the time of writing, over 40% of NSW plant species are held in the store with more species and multiple accessions of species being added progressively. These collections are used for a wide variety of scientific purposes by our scientists and others from around the world. There is also a large cool store for species used in on-site restoration, particularly native grass establishment and erosion control following African olive removal and other (mainly) onsite restoration projects. All new collections coming into the seedbank are germination tested and



Inspiring a new generation of plant lovers. Photo: Simone Cottrell



The Australian PlantBank: an integrated conservation science facility. Photo: Simone Cottrell

the results are made available on the Seed Information Database (SID – Kew) or on the Atlas of Living Australia (ALA).

Tissue culture and beyond

Not all species have seeds that can be dried and stored in the freezer. Species from rainforests and mesic environments often have seeds that lose viability when dried. Many of these species are held as garden plants in the ABGMA collections and we are researching the systematic storage of plants in tissue culture and in cryogenic storage at $<-180^{\circ}\text{C}$ in liquid nitrogen. We have a 'green wall' on display featuring tissue cultures of species that range from horticultural cultivars of flannel flowers, to orchids requiring a fungus to grow, and rare and threatened rainforest species. It's all about diversity.

The focal point of the building interior is the 'Diversity Wall'. There are 44 separate displays, cabinets full of interesting seeds, drawers with specially illustrated books and illustrated panels dealing with topics such as adaption, species and vegetation loss. Some displays are playful, such as the children's drawer that shows scats produced by animals and what seeds they contain, to a drawer full of gravestones representing every plant species known to have gone extinct in NSW in the past 150 years. The display is playfully linked by an acrostic i.e. words that flow together representing the concepts of plant diversity and its importance to our world.

The Rainforest Conservation Project

Graeme Errington

Technical Officer, Rainforest Conservation Project – Graeme collects seeds of rainforest species and assesses their germination and seed storage behaviour.

Karen D. Sommerville

Scientific Officer, Rainforest Conservation Project – Karen investigates alternative conservation measures for species that cannot be conserved in standard seedbanks.

Catherine A. Offord

Principal Research Scientist – Cathy manages germplasm conservation research for the Royal Botanic Gardens and Domain Trust

Rainforests under threat

More than 50% of Australia's plant biodiversity is contained within rainforest communities that cover only 0.3% of the land area. In NSW, approximately 30% of the pre-European extent of rainforests has been cleared, but some communities have suffered greater disturbance than others. For example, less than 1% remains of the nationally endangered Lowland Sub-tropical Rainforest community. Many of the remaining rainforest areas have previously been subjected to logging and continue to suffer from associated issues such as fragmentation and the invasion of exotic species such as weeds and myrtle rust. These, and other factors, have a significant effect on natural ecological processes including seed production, dispersal and recruitment.



Within these threatened rainforest communities are a number of species that have the additional problems of low population numbers, limited distribution or extreme sensitivity to a particular threat. Species that are badly affected by myrtle rust, for example, are under considerable stress. This fungus, which was first detected in 2010, has now spread from the central coast of NSW to Victoria and far North

Anetholea anista with myrtle rust damage.
Photo: G.Errington





Queensland. Myrtle rust has had a dramatic effect on some Myrtaceae species, such as *Rhodamnia rubescens* and *Rhodomyrtus psidioides*, both of which suffer defoliation and reduced flower and seed production following infection. This sensitivity may have profound effects on the long-term survival of the species. These and other rainforest species require urgent conservation actions that may include ex situ options such as seedbanking.

There has been very little seedbanking of rainforest seeds to date as there has been limited knowledge of their response to storage and an expectation that many species would be intolerant of conventional seedbanking techniques.

The Rainforest Conservation Project is therefore focussed on collecting and assessing the storage potential of seeds from Australian rainforest species, storing those seeds that are suitable for seedbanking and looking for alternative conservation measures for those that are not.

Collecting rainforest seeds

Australian PlantBank staff have extensive experience collecting seeds from dryland communities. The protocols for ensuring good quality collections from such communities are well-developed (see Offord & Meagher 2009). One of our challenges now is to understand the differences between collecting seeds from rainforest habitats and collecting from dryland areas and to develop protocols to suit. Some of these differences are advantageous to the collection process and others have a negative impact on the quality of the collections and the time required to obtain them.

Asynchronous ripening (ripening of fruit spread over an extended period of time), for example, is a feature of a number of rainforest species and this feature creates a wide window of opportunity for seed collection.

In addition to the increased opportunities for collection from individual species that asynchronous ripening allows, there tends to be a spread of different rainforest species ripening throughout the year. The upside of this is that we can make seed collection trips at any time of the year rather than being confined to collecting in summer and early autumn. The downside is the limited number of seeds that may be available at any one time.

A particular difficulty encountered in collecting seed from rainforest areas is that some species occur only as individuals spread widely across the landscape rather than in closely clustered populations. This greatly increases the effort required to obtain a seed collection of reasonable size and genetic diversity.



Stephania japonica var. *discolour* with fruits of varying maturity.
Photo: G. Errington

Seedbanking: dryland versus rainforest seeds

For many species, the length of time a seed can be held in storage can be maximised by a combination of drying and storage at low temperatures. Most conservation seedbanks dry seeds to around 5% moisture content and then store them at -20° C. Drying reduces the chance of ice crystals forming and damaging cell structure during freezing, while storage at -20° C increases the length of time the seed can remain viable by slowing down the ageing process. The majority of species from dryland communities, such as *Acacia* and *Eucalyptus* species for example, produce seeds that readily tolerate this drying and freezing process. Many rainforest species, however, produce large seeds with thin seed coats (such as those from the genera *Endiandra* and *Neimeyera*) that do not tolerate drying, or produce seeds that tolerate some drying but not freezing.



To date, there has been relatively little work done on understanding the seed storage behaviour of Australian rainforest seeds, i.e. understanding how well they tolerate drying and freezing. Tolerance of drying can be assessed most effectively by comparing the germination percentage of fresh seeds to that of seeds dried to around 5% moisture content. Any significant

Endiandra entrorsa (Dorrigo Plum) has large seeds that cannot be dried. Photo: G. Errington





decline in germination after drying indicates that a species is desiccation sensitive and not suited to seedbanking.

Tolerance of freezing can be assessed by comparing the germination percentage of seeds that have been frozen and thawed with the germination percentage prior to freezing. Any significant decline in germination after freezing again indicates that a species is not suited to seedbanking. This is common in seeds with a high oil content (e.g. *Macadamia ternifolia*) as damage to the seed can occur due to structural changes in the oils during freezing.

Screening rainforest species for seed storage behaviour is complicated by two additional factors:

1. Seeds of some species are dormant (not ready to germinate), and we have to overcome this dormancy in order to further test the seeds.
2. Seeds that tolerate both desiccation and freezing can still be short-lived in storage under standard seedbanking conditions (e.g. *Grevillea robusta* and *Alphitonia excelsa*). Seeds in this category can be identified by conducting a rapid aging experiment (Merritt et al. 2014).

Alternative conservation techniques

There may be as many as 50% of rainforest species that produce desiccation sensitive seeds. For these species, and for those that do not produce seed at all, seedbanking is not a viable option. Alternative conservation techniques for such species include living collections (actively growing in gardens, pots or tissue culture) and cryopreservation. Living collections require a considerable amount of space and maintenance time so these are chiefly being used as an intermediate step to generate material for cryopreservation.

Cryopreservation involves the storage of tissue in liquid nitrogen (or its vapour) at temperatures as low as -196°C . Cryopreservation requires careful preparation of the material to be stored to ensure the cells are not damaged during freezing or subsequent thawing. The techniques and materials used in this preparation process vary among species and the type of tissue conserved. Considerable research can be required to determine the best methods to use. Though techniques for preserving some horticultural and crop plants are now well developed, little work has been done on developing methods for eastern Australian native species, particularly those from rainforest regions. These species will be a major focus of research under the Rainforest Conservation Project for the next five years. Cryopreservation will also play an essential role in conserving material from non-seed producing rainforest plants (such



Sub-tropical rainforest in the Illawarra
(Image: G. Errington)

as ferns and mosses) and for conserving organisms that form symbiotic relationships with plants (such as the mycorrhizal fungi of orchids).

Hope for the future

Ex situ conservation is not a substitute for conserving plants in the wild, but it does provide effective insurance against extinction by ensuring a source of material for reintroduction is available should it ever become necessary. Ex situ collections also provide a source of material for research into the biology of threatened species, for propagation to reduce pressure from wild collecting, and for education of the general public. Our hope for the Rainforest Conservation Project is to develop collections and carry out research that contribute to the understanding and continued survival of rainforest species in Australia and around the world.

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I'm here, now where am I? Your visit to the Australian Botanic Garden

Daniel Bishop, Manager Horticulture

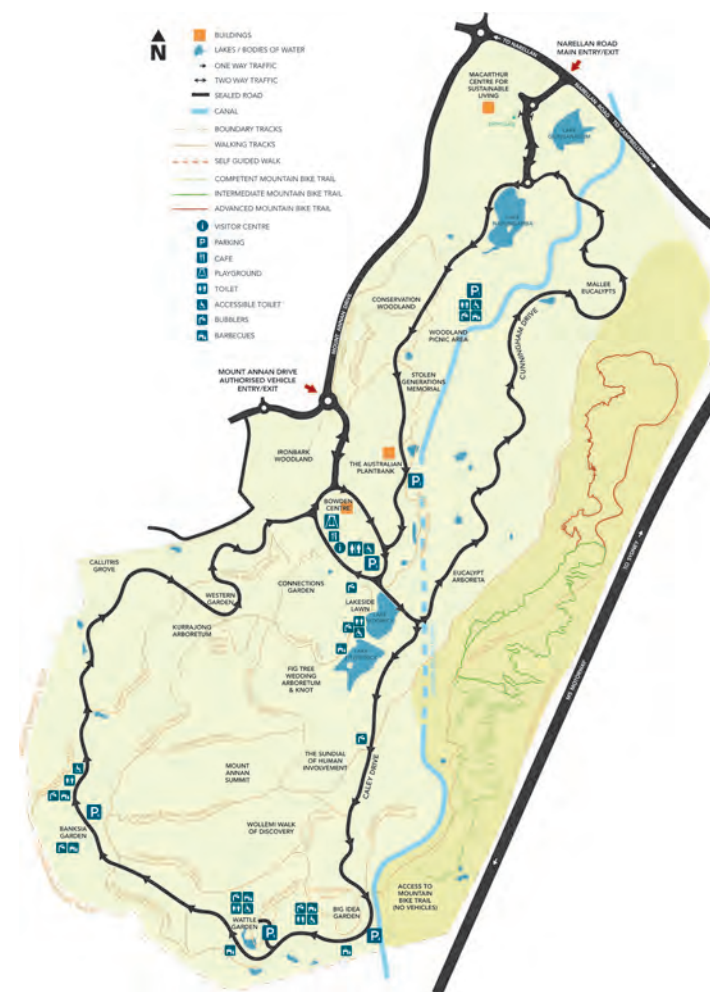
Dan has worked with the Trust for over 25 years and seen plenty of growth along with many changes since first working with staff at the Australian Botanic Garden in 1993.

For a moment, imagine life without plants...breathe...relax a little... now enjoy our living landscape. With the new entry to the Garden from Narellan Road the journey starts the moment you drive through the new gates into our young hoop pine avenue; enjoy a view across Lake Nadungamba, the pastoral majesty of grand old ironbarks and drive slowly into our most important fragment of Cumberland Plain Woodland. You've entered a botanic garden unlike any other.

The transition from the outside world into and beyond our Woodland is an experience to be savoured, while the arrival of PlantBank is perhaps a reminder that these diminishing landscapes should not be taken for granted. Within the stark architecture are modern research, seed storage and interactive learning facilities where visitors are welcome to see the science of plant conservation in action.

Travelling around our site in a vehicle can confuse some. Our Garden involves landscape scaled patterns. The central precinct, named Yandel'ora, a place of meeting between peoples, remains the key destination. We encourage people to take advantage of the new orientation zone being established near the central car park (P3).

In many ways a botanic garden remains a work in progress, always growing and evolving. In that spirit, the botanic heart of the original design for Mount Annan, the Terrace Garden, has been renamed and modified over the past several years into a display that seeks to connect visitors to the original theme - the evolution of Australian *Plants through Time* and themes reflecting the function of plants in our lives: *Plants and Wildlife*, *Plants in Habitat* and *Plants for People*. In redesigning pathways, installing water features and improving access through the garden, the *Connections Garden* has demonstrated the ability of gardens to adapt to major change. Although not without pain, the redesign has permitted more flexibility for horticultural staff in the successful presentation of our diverse collection. Hopefully as we continue to develop and establish these new themes, we will provide a more engaging canvas with which to tell our stories.



You can leave your car for a time and explore all the possibilities surrounding Yandel'ora. Several walking tracks, including extended walks through the Connections Garden, Lakeside and Ironbark Woodland, provide walking opportunities to return to PlantBank. Young children will enjoy burning energy within our playground while parents and carers can casually dine within sight at Melaleuca Café. Beyond the Fruit Loop garden is the Bowden Centre where meetings, workshops and learning occur within delicate woodland surrounds.

If you're in the mood for more active pursuits or planning a picnic you may have already headed out along Caley Drive toward several themed picnic gardens. Our *Theme Gardens* have also changed with us over the past 25 years. Our bottlebrush collection has been incorporated



into a garden of *Big Ideas*, helping home gardeners learn more about the versatility of native plant cultivars; how you can recycle almost anything; and demonstrating how to use Australian plants in your own particular garden style. Don't be put off by the crowded car park; it's the take-off point for our popular mountain bike track. There are plenty of facilities, picnic tables and barbecues to share.

Our largest and most enduring theme garden, *Wattle*, remains popular with larger groups and those who require easy access to facilities. A real delight as we leave winter behind, the brilliance of mass flowering in July and August belies the diversity of *Acacia* species throughout the year with their interesting bark features and intriguing leaf modifications.

On a summer day, nowhere is more pleasing than the *Banksia Garden*. The cool rainforest gully and shade from the remnant canopy provide welcome respite. Proteaceae, perhaps the most universally acclaimed genus, displays such an array of colour, texture and flower form. Evolution has indeed taught this group how to adapt to a variety of extreme conditions, all without losing a sense of humour. Over recent years we have expanded the opportunity to display dry western species through the construction of hundreds of meters of dry stone walls. It's taken dozens of public walling courses to build this landscape feature with well over three hundred people directly contributing. As dry stone walls regularly stand for hundreds of years, they will remain a symbol of how the community is helping to shape this Garden.

Your meandering journey will take you past the Tuscany inspired *Callitris* arboretum and a fascinating array of *Brachychiton* species including flame trees, kurrajongs and bottle trees, before you arrive back at Yandel'ora Circuit. From there, exit signs will guide you past Lake Sedgwick again, onto Cunningham Drive and out to the Narellan Road exit. This northern route is where you're most likely to see our resident macropods and in late afternoon or cool misty days you'll often see Eastern grey kangaroos, wallaroos and an occasional swamp wallaby browsing the grassland, unperturbed by passing vehicles. Eucalypt arboreta line this road as recovering woodland remnants remind you that the final shape of this Garden is still emerging.

After 25 years we are coming to terms with what creates this Garden's unique character. Open space, big skies, informal displays full of botanic wonder and a comfortable place to relax; woodlands that are real bush; room to stretch your legs or ride a bike; or somewhere to just sit and observe the stillness. The Australian Botanic Garden offers such opportunities and we welcome visitors to join in this journey with us.

What's The Big Idea?

Helen Byfield-Fleming Centre Coordinator of Macarthur Centre for Sustainable Living

The Australian Botanic Garden and Macarthur Centre for Sustainable Living are leading the way in the demonstration of sustainable garden and building design.

In 2004, the Royal Botanic Gardens & Domain Trust (the Trust) joined forces with CERES Macarthur, an environmentally committed group of Macarthur residents with the support of local councils and MACROC (Macarthur Regional Organisation of Councils), to form a new company called the Macarthur Centre for Sustainable Living Limited (MCSL).

The Macarthur Centre for Sustainable Living is a not-for-profit, community-focused organisation that aspires to be a world-class educational facility and model for the promotion of sustainable technology and practices in homes, urban precincts and businesses. Built with funding from the Australian Government's Sustainable Regions Program, the Centre demonstrates the best in environmental building design and construction as well as a range of organic vegetable and ornamental garden initiatives supported by a dynamic community volunteer base.



Recycled brick, concrete, railway sleepers and a plastic container; great ideas for your garden!





The Centre conducts community educational programs and projects that build social capacity and empower individuals to embrace sustainable lifestyles in very real and practical ways. A new structure utilising contemporary energy efficient technology and sustainable materials, as well as the retro-fitting an older onsite 1970s home that once served as a ranger cottage for the Botanic Garden, have provided the Centre with opportunities to display alternative energy production, waste-water recycling, water and energy efficiency and waste avoidance (reduce, recycle, reuse!) in both building styles. So there are no excuses people!

MCSL's host, the Australian Botanic Garden, showcases a large range of native plants presented as botanically themed collections. Besides the Banksia and Wattle themes is the intriguingly titled *Big Ideas Garden* that has emerged from an earlier bottlebrush dominated garden to focus the display on accessible native plants and home gardening ideas. With much of the botanic garden's collection being of 'wild sourced' plant material, it was always difficult when visitors sought information on where to purchase these interesting looking plants. Wild sourced means collected (under a scientific licence) from the bush, so the plants are unavailable in garden centres. To address this interest, the Big Ideas Garden now displays as many cultivars and hybrid native species as possible, demonstrating nursery available native plants to grow with tips on how to establish a truly sustainable design.

The goal of both facilities is to show people how to save money, time and the planet - all in a day's work. Both demonstrate how to link practical modern living with clever garden ideas and sustainable methods such as worm farming, composting, vegetable and seedling propagation and planting, chook care, native plant growing, water wise gardening, recycling and mulching. Hopefully these initiatives will inspire the community to embrace our environmental messages after they see how easy it is to be effective in the home and out in the garden!

The Big Ideas Garden is open every day of the year, except Christmas Day, from 10am to 5pm. MCSL is open to the public from 9:30am to 3:30pm Monday to Friday. For special activities and more information about the Centre, check out www.mcsl.org.au. We encourage you to make the short detour next time you're in the neighborhood. Get involved! Who knows what you may discover or what you could share with others?

Inspiring botanical experiences

Belinda Howell, Manager, Marketing and Visitor Centre

Belinda has been at the Australian Botanic Garden, Mount Annan for almost four years. As a local to the area, she enjoyed watching the Garden develop into the impressive botanic garden it is today and felt privileged to be involved in the Garden's 25th anniversary celebrations last year.

Each day, we have the incredible opportunity to connect visitors with the wonderful world of plants. From joining a relaxing guided walk in the Connections Garden, hearing an interesting talk on plant conservation, getting hands-on at a workshop, to even riding a bike through an area cleared of African Olive, we aim to inspire the appreciation of plants and the natural environment.

The most recent addition to our visitors' experience is the Australian PlantBank volunteer guided tour program. PlantBank surprises, inspires and captivates. Our free volunteer guided tours take visitors on a journey of discovery of Australian plants and the important conservation work taking place at this internationally significant facility. Tours are offered on weekends at 11.00 am and 1.00 pm and on most weekdays, along with unique behind-the-scenes tours with a scientist for groups and special events.

Our dedicated team of volunteer guides also delivers fascinating general Garden tours. Visitors can discover the interesting history of the Garden and how it has been transformed from former farmland, into a site of excellence in horticulture, conservation, scientific research and education. These free tours leave from the Visitor Centre most days of the week and showcase seasonal flowering highlights.

For something particularly special, visitors can join an early evening 'Twilight Highlights' tour and enjoy the Garden at this dazzling time of day. Before watching the sunset from Sundial Hill, a highlight for visitors is spotting wallaroos that call the Garden home.

If early mornings are more your style, a 'Breakfast with the Birds' tour will delight and invigorate. What better way is there to start the day, than in the fresh air to the majestic sing-song of more than 180 species of birds?



A group enjoy a tour of the Australian PlantBank



From pre-school students to university students, the Garden offers a range of quality learning experiences. Students can even join a connected classroom lesson at PlantBank from anywhere around Australia, or even from another country using state-of-the art virtual excursion technology.

For younger visitors, we offer fun, interactive and engaging learning experiences. Whether it is dip-netting for creatures living in the lake, becoming a mini-scientist for the day, creating an amazing recycled masterpiece or experimenting behind the lens at a kids photo workshop, we aim to inspire botanical wonder.

Not only do we have sensational displays of annual plants – we have sensational annual events.

The much-loved NSW & ACT Girl Guides event has been held at the Garden since 2010. Established originally to mark the centenary of the Girl Guides movement, the event was so successful that it is now held annually. Around 800 eager girls descend on the Garden for a carefully-developed program of activities including tree planting, canoeing, bird spotting and worm-farming and composting workshops.

A foodies dream, the popular AnnanROMA Food and Wine festival showcases the burgeoning food and wine industry of the Macarthur region. As visitors taste their way around Lakeside, they can also take in the stunning views across the Garden, along with the smooth sounds



A feathered friend of the Garden. Photo taken by photography competition entrant Christopher DeJong.



Culinary delight, the AnnanROMA Food and Wine festival.



Girl Guides learning about what lives in the Lake. Photo: Girl Guides NSW & ACT

of the talented local performers that take to the stage. Guided tours of the Fruit Loop Garden add to the culinary experience on the day. This hidden treasure displays plants from across Australia that have been used by Australians, both past and present, as food, tools and medicines in contemporary Australian culture. Visitors can see and smell wonderful Australian plants used in the food industry such as *Backhousia citriodora*, *Citrus australasica* and *Davidsonia pruriens*.

For budding photographers, the Garden offers endless opportunities to capture gorgeous photos of flora, fauna, landscapes, sculpture and sunsets. The Garden's annual Budding Photographer competition has delivered many remarkable images that showcase the diversity and beauty of the Garden. From frogs and beetles, statuesque wallaroos, intricate patterns of leaves and bark, bright flowers in bloom, landscapes of rolling hills, to majestic birds in flight – this competition shows nature at its best. Culminating in a digital exhibition in the Visitor Centre, there are a range of categories on offer, including a category for young shutterbugs.

Speaking of creativity, the Garden offers a number of opportunities to find the artist within. Whether it is at a drawing class, sketching group or following a trail of sculptures, the Garden offers inspiration for any budding artist or blooming expert.

The Blue Tree strikes a strident note in the landscape. It has been transformed into a catalyst for discussion about the value of these natural features to the landscape. Even though the tree died some years ago, it still provides shelter, perches and potential nesting hollows for birds and other animals.

A beautiful sculptural piece, the Stolen Generations Memorial in the Woodland area is designed to take visitors on a journey of healing and reflection. The site was chosen by the Stolen Generations Committee and their story is told through the sculptural centrepiece.





Photo of the Blue Tree taken by Aribowo Wangsaputr, photography competition entrant 2013.

The most recent additions to the Garden's sculptural collection include 'Figures in the Landscape' and 'Bottlegrass' created by artists-in-residence in 2011 and 2012. Brochures on the sculpture trail are available from the Visitor Centre.

Getting active in the Garden is also recommended. Did you know that the Garden has 11km of competition standard mountain bike track? The track, much of it once covered with dense African Olive, provides a challenging and rewarding ride within a diverse botanical display. It also provides us with an opportunity to engage with new audiences and promote the important conservation work carried out in a botanic garden. Each year, we host a number of mountain biking races and events, including a popular and high-profile 24-hour race event.

Other active recreation opportunities available at Australia's largest botanic garden include orienteering, cycling, cross country events and a myriad of scenic trails and tracks for walking and jogging. The Garden provides a picturesque backdrop for other recreational experiences - from relaxed picnics, leisurely strolls, and bird spotting, to social gatherings and celebrations at venues around the Garden.

The Garden hosts a number of events that unite the local community, including the Campbelltown City Challenge Walk. The Garden makes an idyllic location for the thousands of keen walkers who annually register for this healthy lifestyle initiative. Participants can complete a 6 km or 12 km walk across a range of entry categories.

Ending the year in strong community spirit, the Garden provides a festive treat with all the trimmings – the Carols in the Garden. This event has a great line-up of entertainment and provides local youth



My favourite native plant is *Ptilotus exaltatus*. I love this photo titled 'Purple Fuzz' by 2010 competition entrant Andriana Stocko.

with an opportunity to showcase their talents on stage. Last year, improvements to the program were made to offer a more engaging event with a stronger environmental focus.

Since entry fees were abolished in 2011, more visitors than ever are enjoying the experiences offered at the Australian Botanic Garden. I am very excited to see the Garden grow toward its future, and can imagine how wonderful this much-loved Garden will be when we celebrate its 50th anniversary. I hope to see you in the Garden soon!



2010 Budding Photographer competition winner James Mortimer with 'Sundial'





Painting your garden

Geoff Duggan Dip Hort, B.

L.Arch (Hons 1)

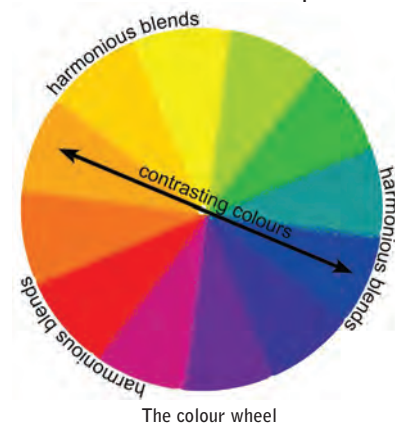
Geoff began working at the Australian Botanic Garden a year before it opened in 1987. His role in the Garden's development is hard and soft landscape design, project management, construction and infrastructure management.

Just like a painting, we can use colour in the Australian Botanic Garden to create harmony and dramatic effect. Using the colour wheel is a great way to begin exploring the use of colour and combinations. The primary colours blue, yellow and red can give a garden personality and connect directly with our emotions. With tints and shades of colours adjacent to each other on the colour wheel we can create harmony in our garden, while colours opposing each other create contrast.

There is a greater risk in using contrasting colours, as it can be more demanding on the eye and can be overwhelming.

It is best to use contrast sparingly to create particular focus points within the garden. An example of this might be to invite exploration or draw people through the landscape. The use of sculpture, furniture and architecture should also have careful consideration in the garden in terms of colour range.

In Australia we are fortunate to have an exciting palette of blue to choose from. Cool colours around the blue, green, mauve end of the spectrum are calming and soothing and also give depth and dimension. We are using examples of harmonious cool colour blends in the "Room with a View" garden at Lakeside. This includes the stunning blue of *Lechenaultia biloba* coupled with *Scaevola* spp, *Derwentia arenaria*, *Dampiera diversifolia*, *Brachyscome* spp and *Wahlenbergia stricta*.



In the warmer range, red, orange and yellows can combine to create intimacy and excitement. However too much red can be distracting against its contrasting leaf colour green. This can be offset a little by the use of white. The brilliant red of *Anigozanthos* can be complemented with the softer reds and pinks of *Croweas*, *Boronias* and *Chamelauceums* in our Central

Display gardens near the Garden Shop. Other reds can be found in the Big Idea Garden with many *Callistemon* species and of course the Grevillea Garden. Around Christmas is also a great time to see the spectacular reds and oranges of the Red Flowering Gum, *Corymbia ficifolia* at Lakeside.

In late winter the usually cool and shady Wattle Garden comes to life with vibrant gold and yellows of hundreds of different species of *Acacias*. These are complimented by other Fabaceae family members including *Dillwynia*, *Pultenaea* and *Goodia* spp.

Using contrast can be a little more adventurous. Some examples of



Above: Harmonious planting scheme
Left: *Wahlenbergia stricta*
Photos: Simone Cottrell





contrast are the striking gold and yellows of *Acacia* spp. combined with the vivid purple of *Hardenbergia violacea* used sparingly in the Wattle Garden. During spring the yellows and pinks of *Schoenia* and *Rhodanthe* spp. combine in mass displays to provide a great focal point in our large Central Display Gardens landscape. Also, the harmonious blues mentioned before are in stark contrast of the orange walls of the “Room with a View” sculpture. This is an example of using non plant related colour.

There are ways of to alleviate some of the dangers and pitfalls of a contrasting colour scheme. The use of grey foliage can help tone down too much contrast. In larger displays, a continual flow of grey foliage with its softening properties and mass can pull a design together, providing unity to the overall effect. Some grey foliage plants used in the Central Display gardens for this purpose are *Leucophyta brownii*,



Anigozanthos cultivars
Photo: Jaime Plaza



The Wattle Garden late Winter. Photo: Simone Cottrell

Eremophila glabra cvs, *Eremophila nivea*, *Westringia* cvs. Other grey foliage plants used also have the added advantage of spectacular flowers which can also enhance the display. Reds on *Swainsona formosa*, whites on *Actinotus helianthi* and the yellows on *Pycnosorus globosa*, *Acacia cultriformis* and *Chrysocephalum apiculatum* can all be seen in this garden helping to produce the desired effect.

While not strictly a colour, black can also be used to create a contrast or point of interest in the garden. We tried unsuccessfully many years ago to grow the black flowering *Kennedia nigricans* and *Macropidia fuliginosa*. It may be time to try again.

The focus on colour so far has used examples of mainly flowering annuals, perennials and shrubs. Many plants only have a relatively short flowering period, so it needs some careful research and planning in order to coordinate flowering times, not to mention the hard work in maintaining the garden.

Don't discount the value of fruits, foliage, bark, as sources of longer lasting colour in the garden. Consider the black trunks on *Eucalyptus sideroxylon* in contrast with the pale smooth trunks of the *Corymbia maculata* at the old entrance to the garden, especially after rain. There is also the bronze foliage of *Leptospermum petersonii* “Copperglow” and the pink fruits of the *Syzygium paniculatum* in the main car park gardens or the bright orange twisted seed pods of the *Pararchidendron*





Contrasting colours in Mass display of *Schoenia* and *Rhodanthe* spp. Photo: Jaime Plaza



Contrast on a smaller scale with *Scaevola* and *Helychrysum* sp. Photo: Jaime Plaza



Grey foliated *Leucophyta brownii* used in a contrasting colour scheme. Photo: Simone Cottrell



pruinosa in the Connections Garden.

While spring is our main flowering period, with a little exploring you will find something flowering somewhere in our diverse collection of Australian flora.

It is up to the individual as to whether they would like harmony or drama in the landscape. So, while you paint your garden, consider this, Are You a Picasso or Monet?

Trunk Colour on *Corymbia maculata*
Photo: Simone Cottrell



