

THE BOTANIC GARDENer

The magazine for botanic garden professionals

ISSUE
47

MARCH
2017



Theme: Managing Risk

ISSN 1446-2044 | www.bganzt.org.au



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COVER: Spear Lily *Doryanthes
palmeri* George Pentland
Botanic Gardens, Frankston.
Photo credit: Paula Murphy

Unlike the more familiar Gynea
Lily *Doryanthes excelsa*, the
Doryanthes palmeri stalk
droops rather than stands
upright due to the weight
of the flowers.

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The theme of the July 2017 issue is ***Managing Social Media***. The deadline for contributions is Friday 26 May 2017. Please contact the Secretariat (secretariat@bganz.org.au) if you are intending to submit an article or have a contribution to other sections.

President's view

John Sandham, BGANZ President



John Sandham

Looking forward to welcoming you all to Adelaide!

Ever wondered how botanic gardens can adapt to the ever-changing environment we live in? With constantly shifting attitudes in our communities, how do we ensure our survival and maintain a vibrant and caring presence? How can we ensure proper connection with our public and foster their engagement? How can we ensure world class horticulture within our institutions, along with the vital continuation of internal and external education? How do we inspire and attract younger generations, friends and volunteers and gain their vital support?

How do we safeguard our commitment to botany, science and conservation? How do we ensure the preservation of endangered species in the wild and in our gardens? Sometimes I think botanic gardens are endangered species themselves. I do know that we need to invest in our staff and volunteers so we can all face these challenges together and attract passionate and supportive networks. These matters underlie our theme for our 8th BGANZ Congress, *Preservation: Exploring and Adapting*.

Please join us in Adelaide from 22-25 October 2017 to discuss these and other significant issues with like-minded professionals. The BGANZ Council has been extremely helpful in putting together an exciting program. All of us at the Botanic Gardens of South Australia are looking forward to hosting you 'at our place'.

We will also be holding our AGM at the Congress and welcome new people to join Council. Many of the current members will have served their term by then so we need new vibrant additions to lead BGANZ into the future. Please consider the opportunity to contribute your knowledge and expertise and help make a difference in the botanic garden world.

You can find the appropriate information via our own BGANZ webpage where you can also find out about the keynote speakers, field trips and social program we are planning. You can also register online and submit abstracts. Lastly remember to put your name down for the BGANZ awards as well as apply for grants to assist your travel and participation in the 8th Congress in Adelaide in October. So put the dates in your diary and prepare for a wonderful four days in South Australia.

Editorial insights

Janelle Hatherly, Managing Editor



Janelle Hatherly

This amazing picture represents 'a new way of seeing'. It reminds me of The Blue Marble pictures of the [Earth](#). **Look at the size of the person at the foot of the tree** – imagine standing there – there is no way we mere mortals could truly appreciate this giant sequoia located in the Giant Forest of Sequoia National Park in California. Until now ...



National Geographic worked with a skilful team of scientists and photographers to take 126 photos to show it all. It's been known as The President since 1923 and we can only imagine what it has stood witness to over its 3,200 years of life! If like me this story fascinates you, just Google it or read more [here](#).

I reproduce it here by way of drawing your attention to the themes for this year's three issues of the BGer. They are:

- Managing Risk
- Managing Social Media
- Managing Change

Interviewing Corrie Pitzer for this issue opened my eyes to the need for 'safe risk taking' and to the advances in OH&S thinking and best practice. I'm sure the three men in this photo were appropriately trained and knew what they were in for!

A friend recently emailed me this link and I noticed it originates from a National Geographic project in 2012. That's over five years ago and yet through social media the poignancy of this majestic living creation still engages and stimulates.

How effective are your organisation's social media communications? Are botanic gardens being strategic in their use of Twitter, Facebook, Instagram etc or are they just adding to the 'noise in

the ether'? If you're doing it well, or have something to share on the challenges of adopting new technologies please consider contributing to our July issue.

The last theme for this year, Managing Change, will effectively be highlights from our 8th BGANZ Congress, *Preservation: Exploring and Adapting*. It's all about 'new ways of seeing' our jobs, our changing world and those aspects which have stood the test of time and served us well ... like the heritage trees and living collections that define botanic gardens.

Outstanding in the field

Janelle Hatherly interviews

Corrie Pitzer, Principal and CEO of SAFEmap International, a global safety consultancy

Thanks for agreeing to do this interview, Corrie. You've worked in risk management for the resources industry for over 30 years and so have witnessed the evolution of safety culture in what is considered to be one of the most dangerous workplaces.

I'm particularly interested to learn how contemporary perspectives on OH&S might assist botanic garden professionals in their strategic planning.



Corrie Pitzer

Let's start with a brief description of your professional background and your position as a specialist in strategic safety management.

My educational background is in industrial psychology (bachelor and honours degrees) and in business management (honours and masters degrees) with a focus on human and risk management. I also completed a postgraduate qualification in education.

Career-wise, I progressed from the human resources field, as regional human resources and training manager for a large multinational company to group safety manager for Billiton (now BHPBilliton) until 1992, when I started SAFEmap. For Billiton, I developed several key strategic safety interventions for a workforce of about 120,000 at the time, comprising 65 mines, plants and smelters. Two initiatives, a safety review and a safety performance process, are still key processes in SAFEmap, now significantly refined and improved.

As Principal of SAFEmap I consult to several primary resource companies, largely in leadership and strategic safety development for oil and gas mines, as well as aviation and power-generating utilities. As CEO, I also oversee the activities of our offices in Canada, USA, South America, Australia and South Africa.

Historically, when did the focus on developing a safer work culture become part of organisational strategic planning?

Prior to 1988 the safety profile in most industries was low and organisations were reactive in their approach to accidents and incidents. Safety was generally an afterthought and compliance to legislation was the primary driver.

Then the Piper Alpha disaster happened in the North Sea where Occidental Petroleum's oil platform caught fire and 167 men burnt to death. Under the auspices of the United Kingdom Health and Safety Executive (HSE) a global enquiry was held and the panel, led by Lord Cullen, found some incredible things.

This created a huge shift in thinking and opened up a whole new field of study. A more proactive and risk-based approach was taken to safety. The UK leads (and, along with Holland, still leads) the world in safety management and research into organisational error. By that I mean catastrophic events that have complex causation and have a massive impact on the organisation.

Six months prior to the Piper Alpha disaster, its owner had won a competition that assessed Piper Alpha as the safest operating oil rig in the North Sea. Every disaster after that was assessed and the research opened up new perspectives on organisational practices.

This was a career defining time for me. I wrote a paper about this in 1995 when I compared the Piper Alpha disaster to the explosion of the Space Shuttle Challenger and the Moura Mine disaster in Australia 1994. The similarities in those three disasters were eye-opening.

And just recently I published a paper with Professor Sydney Dekker at Griffith University about the so-called 'seven delusions of near-zero organisations'. These are organisations considered leaders in safety with extremely high safety performances such as BP, DuPont, Transocean etc. who, prior to experiencing major disasters, boasted 'several years without a single injury'.

The biggest disservice companies can do to safety is to praise achievement of accident-free environments. Dealing in terms of 'we're so safe!' shuts down organisational transparency which is essential in proactive risk management.



Piper Alpha on fire shortly after the second explosion.

Photo: https://en.wikipedia.org/wiki/Piper_Alpha

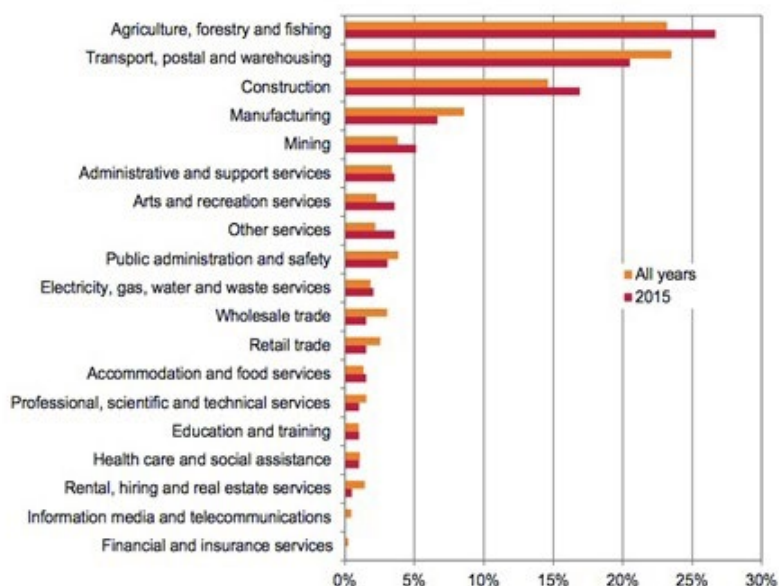
What impact did this research have on the workplace and how did organisations respond in practice?

It had a significant impact on most industries around the world in the sense that safety was brought top of mind. They elevated safety to the highest level of reporting structures in the organisation. Company directors realised the huge exposure they could have at safety events and that this resonated with attitudinal changes in society.

The death rate in Australian mines – in fact around the world – were huge in the 1980s and as time went on communities became more aware of these statistics and the mental impact of these dangerous environments started society questioning practices within the resource industry itself. The companies responded extremely well. So much so that I can say, without any reservation, that today the mining industry is more advanced in its safety practices and philosophies than many other industries out there.

I've worked in them all.

The mining industry deals with risk levels many times higher than any other industry yet they have maturity in their safety practices. With mining, the North American mining industry is some years behind the Australian mining industry in their thinking and the Australia mining industry is on par or leading the European/UK thinking in safety. But the utilities industry (gas and power) is still way behind the mining industry in their thinking.



Worker fatalities: proportion by industry of employer, all years (2003 to 2015 combined) and 2015

How do you explain human error, critical incidents and accidents?

This goes to the real fundamentals in thinking in safety. For centuries we've been blaming the human operator for accidents because they are involved in the accident. Unfortunately around the world to this day this is the incorrect and outdated mindset that is driving safety:

'That the human being is the fallible operator and that human error is to blame. If we can eliminate human error then we solve the safety problem. It's complex in cause but if we eliminates this we'll get there.'

I contend you'll never get there because you cannot eliminate human nature. Let me give you an example.

What do you see? If you said a coffee cup with a spoon in it, you made the same kind of mistake that killed 167 men on the Alpha Piper oil platform. You saw what you expected to see. This is a natural human response.

The fire started on Piper Alpha at 10 o'clock at night. They sent out a mayday to all the other rigs that were connected to them. They then shut down production and lost radio contact. All the other oil rigs continued to produce oil and this fuelled a small fire into a massive fire that caused gas pipes to explode. And when challenged at the Cullen enquiry as to why they didn't stop production (because they *knew* there was a fire), their answer was because they assumed Piper Alpha would get the fire under control.



What is this a picture of?

[Making assumptions is a powerful feature of the human mind.]

They made an assumption that Piper Alpha, like all oil rigs, was fitted with a highly advanced water deluge system and that any fire would be extinguished in seconds or minutes. The systems had never failed to do that in the past. What was unknown to them was that the Piper Alpha manager has scuba divers in the water the day before doing repair work and had the water deluge system switched off. And when the shift changed they failed to put it back on automatic.

Everyone saw what they expected to see – the fire was going to be extinguished. This is as logical as you seeing a spoon in the coffee cup. This is human error.

The definition of human 'error' is fallacious. In fact it is the foundation of human nature. Making assumptions is a powerful feature of the human mind. It is strength that we can conclude things without detailed information. This will occasionally fail when circumstances, impossible to predict, come into play. As long as we continue to blame the human being we will continue to chase the wrong causation.



It is a reasonable assumption if you said 'a cup with a spoon in it'.

If we continue to spend money on programs to eliminate human error we will continue to fail. Safety money should be spent on designing systems about leadership and culture in the organisation. Humans respond to culture, perceptions of their leaders and the systems they are subjected to.

Accidents are not unexpected events of the failure of people. Accidents are the normal reaction of normal people to random circumstances which are impossible to predict. However, we do have the capability to be proactive in looking at our risk exposures and to build resilience in our organisations.

Resilience engineering is a new concept evolving in safety. I've just been reading a fascinating book about this philosophy called *Antifragile: things that gain from disorder* by Nassim Taleb. In it he shows how the banking sector that caused the recent financial crisis started drifting into failure by normalising deviations. When things began to look fine this started a shut down in organisational transparency.

What is the current state of thinking on commitment to safety and risk management?

This is a difficult question to answer because different industries have different levels of risk and thinking. One big stream of current thinking says technology will be our answer and will save the day. We're so smart we can already build driverless cars which will eliminate the human being, their errors and the issue of human failure altogether. In my opinion, driverless cars will remain a pipedream and never reach market because the philosophical focus is still on the human being.

Consider this analogy: You're driving a car and suddenly two children appear in front of you. If you swerve to the left you go over a cliff and die, if you swerve to the right you will hit a truck and be killed. What do you do? The typical human response is to drive over the cliff but a driverless car, built to protect you at all costs, will run over the children. This response will never be acceptable. If manufacturers factor altruism into their driverless car design no-one will buy a 'car designed to kill you'. We can't solve this complex dilemma with technology.



Another approach is a shift to risk-based thinking. Organisations are starting to realise that even though they have risk management processes in place they are not really risk-focused. They still wait for accidents to happen and then react by solving the associated problems.

Organisations should establish and foster a 'learning culture' which supports risk-taking behaviour.

However because advances in legislation driving compliance include some risk-based thinking the next step for these organisations is to establish and foster a 'learning culture' which supports risk-taking behaviour. This will necessitate transparent, supportive and blame-free work practices which encourage and support employees to take the right risks at the right times and to do so competently.

The focus must be on competency. Employees will need training to deal constructively with risks, identify and judge them. And with a supportive environment they can make mistakes, learn and constantly improve their repertoire of risk skills.

How does organisational culture affect human behaviour?

One of the most fundamental needs of the human being, as a social being, is the need to fit in. All organisations, no matter how small, have a unique set of forces, demands and prescriptions (culture) that influence the behaviour of people within them. The influence is not a rational, one-way process. The collective behaviours of people define the culture and the culture defines the behaviours in a complex and dynamic way.

Culture lives in the perceptions people have of their leadership. In my consultancy work we start with measuring existing perceptions and then work first with management and then all levels within the organisation to develop a new culture model with a shift in focus: risk culture as against safety culture. The difference is important – the way in which an organisation views risk is inherently a value-defining angle and fundamentally defines the organisation.

The biggest disservice companies can do to safety is to praise achievement of accident-free environments.

If we talk about a safety culture, we inherently define risk as threat only. Defining culture in risk terms also allows for a more broad view of risk as a potential opportunity as well.

What advice can you offer to the botanic gardens world regarding risk management?

Risk for a botanic garden is different from a deep underground mine or for an oil rig. I visit botanic gardens with my wife Rosemary (nee Murray) who works in cultural institutions and I see a very safe, protected and guided environment with infrastructure compliant to public liability legislation. There's little need for such organisations to engage in risky behaviour to deliver good business.

However if, like me, you consider the primary role of botanic gardens is to bring nature to people then you have to provide visitors with more opportunities than passive observation. To engage them interactively means providing them with opportunities to explore and discover the 'thrill' of engagement and personal achievement. The experience shouldn't be diminished by an avoidance of risk. If you really want people to be able to go out there and fully experience your environment then you need to 'sell risk safely'.

There's a lot of discussion these days about how to give children enough opportunities to take physical risks in their free play. Adventure-oriented playgrounds offer more challenging playground equipment which encourages kids to safely test their limits. Here they can get a true thrill, from steep slides to high-flying swings to long zip lines. This proactive risk-focused approach ensures that the infrastructure is safe and sound with ready access to safe play guidelines.

If children make errors of judgement then they learn from their mistakes and develop skills they didn't have before. There's actually an interesting movement that started in New Zealand schools where all the rules were taken out of the playground.

Children were allowed to ride their bikes, play with bricks and sticks, or however they liked. This approach actually decreased the accident rates in school yards.

The issue with 'too safe' is that it takes away skill-building and competence that are normally developed with exposure to risk. Risk-taking behaviour is the 'heart and soul' of innovation. We want employees to constantly seek new and better ways to do even the most mundane of organisational tasks. If an employee eliminates a small step from a task, s/he is adding value to the business, and the sum of all small values added by all employees creates what the Japanese call 'kaizen'.



Rosemary (and Corrie taking the photo) on a guided walk at Huntington Botanic Garden in Los Angeles.



Photo: nationalpost.com/news

Where does the future hold with respect to balancing risk and innovation?

We are currently living in a world of constant turbulence and disruption. Unfortunately society is responding by becoming risk averse, avoiding accidents and change at all costs, apportioning blame and doling out huge penalties. This is killing transparency and I suspect we are going to experience more and more catastrophic events.

Safety rules (where you have to do the job the same way every time, all the time, because this has been determined to be the safest way with the least chance for an accident to occur in a specific task) is rigid thinking. This is contrary to how we innovate and this is killing business. Innovation happens bottom-up with individuals on the shop floor pushing boundaries, trying different approaches, succeeding and failing.

Resilience engineering is a relatively new approach in business. This new model builds informal networks within organisations to test risk in a safe way. For example, Netflix has an innovative approach to their biggest business risk – exposure to software hacking. They now employ hackers who deliberately hack into their systems from within the company while their engineers constantly develop more resilient software.

We're now using this concept in safety management. In this situation, change becomes the norm and this transparent approach builds organisational resilience. This is providing a powerful new framework for competing and winning in a world of constant turbulence and disruption.



Corrie speaking at the British Columbia Forestry Safety Conference 2016.

How different are perspectives on safety in the home (personally) and at work (professionally)?

People act in a far safer way at work than they do at home because legislation makes company directors stringent about safety. I come across many companies where it is mandatory to hold the rail when walking on stairs. In some cases this is taken so far as to record behaviour and if employees transgress they are fined and after three times they lose their job. This bizarre behaviour is exactly why we lose the focus on the real and systemic issues within organisations.

In the home we act on common sense (i.e. risk competence) which means we have minor accidents, learn from them and build resilience.

Botanic news: from home and abroad

Adelaide wins 2016 National Landscape Architecture Award

The 2016 National Landscape Architecture Awards were announced by the Australian Institute of Landscape Architecture (AILA) on Thursday 27 October in Canberra. The ceremony, held at the National Arboretum Canberra, was the first major event at AILA's 2016 *Festival of Landscape Architecture: Not In My Backyard*. From 157 entries, 40 projects were recognised in eleven new categories. Click [here](#) for the full list which includes Adelaide Botanic Garden's First Creek Wetland.



BGCI's news

BGCI has recently appointed Helen Miller as Head of Education and Vocational Training. Helen leads BGCI's public engagement activities including *LearnToEngage* – a new modular blended learning course for botanic garden educators, *BigPicnic* – BGCI's Horizon 2020 project focussed on public dialogue around food security and BGCI's International Congresses on Education in Botanic Gardens. Helen will also take an overview of the vocational training offered by BGCI.



Helen Miller

BGCI has also recently launched *ThreatSearch*, the most comprehensive database of conservation assessments of plants.

[Go to Search](#) to

- search over 242,000 conservation assessments, representing over 150,000 taxa,
- find out if a plant has a global or regional conservation assessment, and
- find out if a plant is considered threatened.

Australia Day medals and other awards

Australia Day medals (OAM) of the Order of Australia in the general division were awarded to two botanic garden volunteers this year. Our congratulations go to Alex Smart for his enormous contribution to the Australian Garden at Royal Botanic Gardens Victoria, Cranbourne Gardens (click [here](#) for more information) and to Mary Peden from Brisbane's botanic gardens for service to botanical organisations and to philanthropy.

In addition Wollongong Botanic Garden Friends Florilegium Artists were awarded the City Arts and Cultural achievement award for their threatened species paintings. Members include Helen Moon, Sandra l'Anson, Lee To, Janet Barlow, Heather Trott and Dawn McCrae have donated 23 original botanic artworks to Wollongong Botanic Garden.



Wollongong resident Clarence Slockee (well-known to BGANZ members since he worked as Aboriginal Education Officer at the Royal Botanic Garden Sydney) was also awarded the Lord Mayors Special Achievement Award for his contribution to Indigenous culture and Education. Congratulations Clarence!

A botanic garden for Chinchilla in Queensland ... and Delaware USA

The Western Downs Regional Council seems committed to developing a botanic garden for Chinchilla. The Chinchilla Botanical Gardens project is proposed to be located adjacent to the Chinchilla Historical Museum and Visitor Information Centre, within walking distance of the town's CBD. The strongly supported development will provide a safe and versatile space that will add to Chinchilla's beauty, heritage, and liveability well into the future.

According to their website they have committed \$300,000 towards a master plan and are conducting feasibility studies and community consultation. (Click [here](#) for more information.)

And if you're interested there's also a new botanic garden planned for Delaware USA. [Source](#)

Staff movements

Our friend and colleague **Sharon Willoughby** from the Royal Botanic Gardens Victoria Cranbourne Gardens and (until recently) Chair of BGEN, is leaving RBGV to embark on an exciting adventure in the UK. In March 2017 Sharon will commence in a new role and her 'dream job' as Head of Interpretation RBG Kew.

Sharon has worked for 18 years at the Royal Botanic Gardens Victoria and has led many significant projects including the interpretation planning and delivery for Stages 1&2 of the award-winning Australian Garden project at Cranbourne Gardens.

Sharon has established herself as an international contributor in the field of interpretation, communicating and fostering the role that botanic gardens play for social inclusion and community engagement. She will be greatly missed by her team and colleagues. Sharon would love to stay in touch. Her email address is swilloster@gmail.com

Best wishes Sharon from all in BGANZ, and thank you for your leadership, particularly your recent work with BGEN.

BGANZ would also like to thank **Maya Harrison** for all her work with BGEN and BGANZQ. Maya has recently left the Mackay Regional Botanic Gardens and we wish her well.

Australian National Botanic Gardens opens new bushland nature walk

The Australian Government has committed \$5 million to help the Australian National Botanic Gardens fulfil Stage One of its 20-year vision. The 2.2km new bushland nature trail through the gardens' Black Mountain Bushland Precinct was also constructed with assistance from the ACT Government's Tourism Demand Driver Infrastructure Program.



From left – Anthony Burton (track designer), Craig Cosgrove (ANBG Project Mgr), Dr Judy West (Executive Director ANBG), Ian Hill (Executive Director, Visit Canberra), Darren Stewart (Makin Trax), Rosemary Purdie (Friends of Black Mountain).

New nursery for the Mackay Regional Botanic Gardens

After 13 years of operation, Mackay Regional Botanic Gardens will finally build its own plant nursery. The botanic gardens received more than \$745,000 in state government funding to put towards the construction of an operations centre and nursery in the Meadowlands precinct. [Source](#)

Read rare old publications on biodiversity for free

According to Dr Nigel Taylor Singapore Botanic Gardens' director, 22 volumes from their library treasures will be added to the Smithsonian's global online initiative Biodiversity Heritage Library. [Read more.](#)

Natural history and botanical libraries from around the world are uploading digitised copies of biodiversity-related literature in their collections. They have been scanned and are published at www.biodiversitylibrary.org.

Bioblitz starts in Caribbean botanic gardens

The Royal Botanic Gardens of Trinidad and Tabago was chosen as the base camp for the Trinidad and Tobago's Bioblitz as it is a good location to survey and, more importantly, interact with the public. [Source](#)



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Kew Gardens to raise rent for the first time in its history

Considering that it is famed for its gardens, it's easy to forget that Kew Gardens has all sorts of buildings within the estate. The famous Palm House, Orangery and Pagoda are probably the first which spring to mind, but there are several other plant and ornamental houses also in the grounds.

What is less well known is that there are a number of other, smaller buildings which are suitable for use as private homes – and many of them have lain unused for years.

That is all changing now, however, as Kew has undergone a program of refurbishing and converting several of these buildings to let them out. [Source](#)

One dead and four injured at botanic gardens

[The Strait Times](#) reported that a huge heritage tembusu tree in the Palm Valley of the Singapore Botanic Gardens (SBG) fell at 4.30pm on Saturday 11 February 2017. It landed on a 38-year-old woman from India, killing her and injuring her husband, their two children and a 26-year-old Singaporean.

The tembusu tree was more than 270 years old, predating the establishment of the Gardens, which was founded in 1859 and became Singapore's first World Heritage Site in 2015.

As an SBG heritage tree, it was inspected twice a year and was deemed healthy last September.



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Pollinating great ideas

The Power of Flowers

Mary Lou Pavlovic, Artist

I'm Mary Lou, an artist who lives in Mittagong New South Wales. I first began incorporating flowers into my sculptures after a trip to Bali in 2008. Everywhere on the streets of Ubud, a Balinese inland town, large bowls of water are painstakingly decorated with tropical flowers by the local people. I was completely taken with these and found the flower arrangements very beautiful.

This simple floral idea inspired me onto a whole new artistic trajectory. I began creating abstract sculptures with flowers floating and suspended in water clear resin. I was fortunate to receive a research fellowship for a PhD in Visual Arts through Monash University to explore how beauty can be associated with progressive thinking and made most of my sculptures in Bali.

My sculpture *Bali on a Blue Day* draws influence from the bowls of water decorated with flowers around the streets of Ubud, Bali. I was very struck by the beauty of Bali on a blue day and called my work this, as when I cast that large block of resin, it had a wonderful blue colour.



Bali on a Blue Day 2015, 50cm wide x 100cm high x 45cm deep materials: resin, flowers, wood, acrylic paint and electric lamp.



Mary Lou Pavlovic



Examples of Bali urban art.

Anyone who has been to Bali will be familiar with the Balinese sacred fabric, the Kain Poleng, (square textile) which is composed of black white and grey checks. For Balinese Hindus the black signifies evil, the white good and the grey balance. The Balinese Hindus strive for balance in life. This checked fabric is everywhere in the public environment of Bali, wrapped around trees, around statues and worn by village security members as a sarong.

The Balinese often place beautiful offerings made of flowers where the Kain Poleng is placed. And so I thought this work reflected the beauty and familiarity of Bali, it plays on a geometric grid against an organic composition of flowers. This kind of tension is often seen in Balinese landscape and architectural design – a play of opposing elements – again fundamental to the Balinese Hindu religion, where opposing forces are joined to become one.

My flower and resin works have been collected by the City of Port Phillip Council in Melbourne. In 2015 they purchased a work I created with the Balinese carver Ketut Suaka. I made long poles filled with resin and flowers and he attached his carvings of flowers to the ends of these. These were on show as part of the Council's new purchases exhibition in December last year. In 2015, my flower and resin works were featured in an exhibition, *Australian Artists and Bali, 1930s to Now* at McClelland Sculpture Park and Gallery Victoria.



My flower and resin works have been collected by the City of Port Phillip Council in Melbourne.

Once I completed my PhD, the need to earn a living became a priority. Not really wanting to leave my studio, I began making smaller craft works still based on the idea of flowers suspended in a non-toxic clear resin.



I began experimenting with bangles, candle holders and fridge magnets featuring flowers embedded in resin. I used Australian native flowers, gum leaves and nuts I found around my home.

I collect flowers and leaves on my daily walks around Mittagong. The cockatoos here are very good at throwing pine cones, gum nuts and acorns onto the ground for my use! I also now source my daisies from Victorian farms in the summer.

I particularly enjoy working with small native daisies, *Ixodia* species, as they come in a range of sizes that suit the different sizes of my bangles and are very tough and durable. Being a naturally white flower I found I could easily dye them different colours with food dyes – I simply stick their stems in diluted red and yellow food colouring and then let nature do the rest.

Generally after I have picked and dried all the flowers, I work on batches of forty bangles at a time, pouring the resin and setting the flowers. With the embedding-in-resin process I have found that some flowers lose their colours fast in the resin while some will stay intact. Any plants that have a high liquid content are difficult to embed in resin. The bangles take me about two weeks to finish. There are many reworkings with touching ups and polishing until I'm happy with the finished results.



The concept of artworks in bangles really resonates with me. I loved the idea of a band of flowers worn around the hand – like the floral wrist corsages worn at weddings and other festivities – but now immortalised in resin as an art form. The floral bangles also made me think of childhood games of creating jewellery with flowers and other gifts of nature. I love the fact that each bangle is unique as it's impossible to perfectly replicate each design.



I still visit Bali regularly to be stimulated by the people and the environment but also get pleasure spending time in the serenity of botanic gardens closer to home. I thought it would be wonderful if my art dedicated to nature could be associated with botanic garden shops. Each plant in a garden is unique and I thought visitors might like to take home mementos that are also 'real' and original – not mass-produced copies. I would love to connect my work with any conservation or special collections and am currently researching where these might be.



I have worked with the Royal Botanic Garden in Sydney, the Blue Mountains Botanic Gardens at Mt Tomah and the Australian Botanic Garden at Mt Annan. Soon the Australian Botanic Gardens in Canberra will display my work, as will the botanic gardens in Singapore.

I'm so grateful that working with real flowers in this creative way is becoming my day job!

The hort. section

Compiled by **Brad Creme**,
Curator, Bendigo Botanic Gardens



Brad Creme

First word

This section of the magazine is an opportunity for horticulturalists to highlight their work in curating and developing living collections throughout botanic gardens in Australia and New Zealand. We can learn from each other's site-specific knowledge and practices.

Our guest horticulturist this issue is Lindy Harris who shares her insights into managing and maintaining the living collections at Karwarra Australian Native Botanic Garden www.yarraranges.vic.gov.au/Karwarra. Thanks Lindy!

If your garden has a special collection and you want to share stories about your horticultural challenges and successes, please drop me a line at b.creme@Bendigo.vic.gov.au and we'll take it from there.

Karwarra Australian Native Botanic Garden



KANBG Curator Lindy Harris

Karwarra Australian Native Botanic Garden's mission statement is:

To use Australian native plants in a beautiful garden that inspires and educates.

The name 'Karwarra' is said to be a derivation of the Aboriginal word meaning 'place of wildflowers'.

Karwarra Australian Native Botanic Garden (KANBG) is located at Kalorama in the Dandenong Ranges approximately 42kms from Melbourne's CBD. It is dedicated to growing Australian native plants.

The Dandenong Ranges attract many overseas, local and interstate visitors. Access to KANBG is through the Kalorama Memorial Reserve from Mt Dandenong Tourist Road. The reserve itself sits on a saddle and so our car park, garden entry, buildings, retail plant nursery and part of the gardens sit on relatively flat land in full or lightly filtered sun. The garden drops away at the

rear of the main building, faces eastward with paths and garden beds meandering under established indigenous Messmate Stringybark, Mountain Grey Gum and Blackwood Wattle. The soils at Karwarra are deep, volcanic, well-drained, aren't naturally nutrient-rich and are often dry under the now mature indigenous tree canopy.

History

May Moon, a pioneering conservationist and one of the founding members of the 'Save The Dandenongs League',

along with then Shire of Lillydale Councillor Maurice (Maurie) Seymour were members of the Mt Dandenong and District Horticultural Society (MDDHS). The MDDHS was founded in 1936 and while it is likely most members were immersed in exotic plants, in the 1960s Society members May and Maurice discussed the concept of creating an Australian plant garden in the Dandenong Ranges.

MDDHS members embraced the idea as this would serve the dual purpose of creating an appreciation of Australian plants while allowing the MDDHS to have a permanent home for their meetings and flower shows which had always been held in a tiny rented hall nearby. Once the decision was made, members set about locating a suitable site for the garden.

In 1969 Lillydale Shire Council (now Yarra Ranges Council) leased them five acres of land adjoining the Kalorama Memorial Reserve and members set about fencing and creating the garden on what was then a weed-infested site. They also fundraised tirelessly for the building that remains an important part of the garden today and functions as a community meeting space and art exhibition space.

The garden was officially opened in 1971 and was run entirely by MDDHS members. For some years the style and design of the garden varied as it was influenced by changes in fashion and the tastes of various people including landscapers. Between 1978 and 1984 the gifted local designer Kath Deery created a naturalistic design that continues to inform the garden today.

How Kath came to design the garden is a lovely story of serendipity. At her own large property in East Ringwood, Kath had created a much admired Australian native garden under a canopy of established indigenous eucalypts. Although never a member, Kath knew members of the Australian Plants Society, formerly the Maroondah Group of The Society for Growing Australian Plants (SGAP) who told her about Karwarra Garden. She attended an Open Day at Karwarra held by the MDDHS.



Entry to Karwarra Garden.

THE HORT. SECTION

In conversation with MDDHS members, she offered assistance in redesigning the garden and this offer was accepted. Kath offered her services at no cost and did much of the planting herself with some additional assistance from Maroondah (SGAP) members, MDDHS members and other volunteers.

Kath's design consists of irregularly-shaped garden beds of varying sizes surrounded by meandering paths. An emphasis on smaller-growing plants placed in drifts formed attractive landscapes, encouraging visitors to wander slowly and to look at the plants intimately. Kath took into account how plants looked together, mindful though of the importance of grouping plants of similar light and water requirements.

Her design was not just a collection of plants. Consideration was given to how the plants would grow, their shape, flowering colour and flowering season. Part of Kath Deery's design included a series of natural-looking ponds and runnels arranged down part of the slope behind the building and linked to the 'borrowed' Silvan Dam in the distance. A rockery just below the ponds was created by the renowned Ellis (Rocky) Stones and remains an important and fitting feature in the lower garden.



Creating the ponds in early days.

Kath's design was not just a collection of plants. Consideration was given to how the plants would grow, their shape, flowering colour and flowering season.

Kath was exclusively in charge of the garden design and the plant selection, a task she undertook with great knowledge, conviction, intuition and flair. She did not draw up plans, instead selecting plants from specialist plant nurseries and then arranging the plants onsite while still in their pots until they reflected exactly the picture she had in mind. Having said that, Kath was a pragmatist and if a plant wasn't performing where she had placed it, she would either pull it out or transplant it.

We have a list of her early plantings compiled after planting but there is no reference to where each plant was located in the garden. This would have been helpful for us when replanting.

Some of her original plants do remain in the garden and we have photographs that allow us to identify some of what was planted, particularly around the ponds. While we do not wish to slavishly adhere to Kath's planting suite, we recognise that it is her design flair, plant selection and sensitive placement that gave and continues to give Karwarra its unique place in the history of Australian garden design, particularly in a public garden context.

By 1989 Mt Dandenong and District Horticultural Society handed the responsibility for the garden to Yarra Ranges Council and the Council appointed Karwarra's first full-time gardener. The garden now has two full-time staff members. An Advisory Committee made up of MDDHS members, community members, Friends of Karwarra Garden representatives and the Karwarra's Curator meet monthly to guide the decisions regarding the garden.

The Council supported the creation of a Master Plan and Landscape Architect John Patrick Pty Ltd, after detailed consultation with the community and other stakeholders, completed the Master Plan document in 2006. This plan has guided the direction of the garden over time. A new garden entry and improved (but sensitively done) path work allowing all-abilities-access were features of this plan and have been successfully completed.

Aims of Karwarra Garden

Over time there have been many discussions as to what the aims of the garden should be – now and into the future. These are:

1. To display the diversity of Australian plants in a landscaped setting.
2. To promote the use of Australian plants in horticulture through education.
3. To encourage visitors to take away landscaping ideas from Karwarra Garden and try them out in their own garden.
4. To showcase plants that will perform well in the shaded, mountain environment.
5. To encourage the garden to sustain an ecological balance by maintaining a section of indigenous bushland and providing for the needs of the local fauna.
6. To encourage research of groups of Australian plants by holding botanical collections.
7. To trial new species to horticulture and experiment to find their preferred growing conditions.
8. To conserve and preserve species which have become rare in their natural habitat.
9. To promote Karwarra Garden as an important tourist facility in the region.
10. To provide tourists from overseas with the opportunity to see a broad range of wildflowers in one place.

Practicalities

We are often asked whether we have an irrigation system in the garden. Other than an above ground drip system, installed during the establishment of an Australian Rainforest section at the lower part of the garden some years ago, we do not, nor do we intend to install one at this stage. There are a number of reasons for this:

- In the past, supplementary watering was unnecessary at Karwarra given the reliably high rainfall of the Dandenongs. While reduced rainfall and higher temperatures due to climate change will continue to impact on the garden, in practical terms, the root system of the established indigenous eucalypts create physical barriers to the installation of sub-surface irrigation infrastructure. Besides, additional irrigation would only result in healthier eucalypts and not necessarily benefit those plants growing under their canopy.
- The slope of the garden, combined with the meandering paths, irregularly-shaped garden beds and the weak and variable water pressure in the Dandenongs also make installing a permanent irrigation system problematic.
- In addition we are keen for Karwarra to be a practical demonstration of how to integrate garden and 'home' in an environmentally sensitive way. We see being able to show visitors that you can garden satisfactorily without having to irrigate or hand water regularly as an important message. The main Karwarra building is typical in size of many domestic homes and the garden environment directly surrounding the building serves as example of how they might integrate their own home and garden in an environmentally thoughtful way.
- As much as possible plants are selected and located according to site and aspect and we try to limit the use of potable water, instead capturing rainwater from the roof to recharge tanks and ponds as required. Water tanks are used to flush our toilets and switch automatically to mains water when the tank is low. Solar panels recharge a battery and run the pump circulating water around the Kath Deery ponds. Water overflow from ponds is directed to various ephemeral and meandering water courses that slowly channel water to soak gardens beds and finally enter the ponds in the fernery area at the bottom of the garden.
- We do acknowledge that these strategies depend on there being sufficient rainfall. Even with sensible plant choices and planning for the changes in climate, we all recognise that protecting the plants in botanic garden collections is a huge responsibility. We cannot afford to risk important collections by taking extreme, short-term water-saving measures.
- Given the issues and limitations of permanent irrigation at Karwarra we have to hand water all very young plants. We usually use a metal probe attachment to maximize water penetration to subsurface soil and we do occasionally use sprinklers. We also recognise that we can incorporate these labour intensive strategies because Karwarra is a relatively small botanic garden.

Our plant collections

In the mid 1990s a waratah collection and a boronia collection were developed and registered with the plant trust Garden Plant Conservation Association of Australia (GPCAA). We continue to manage and expand these collections to this day.

Our collections also include plants from the Rutaceae (citrus) family such as *Leionema*, *Philotheca*, *Eriostemon*, *Correa*, *Asterolasia*, *Chorilaena*, *Zieria*, *Acradenia*, *Crowea*, *Diplolaena* and *Boronia*.

Other significant collections include mostly small-growing representatives from the Sterculiaceae (Malvaceae) family with an emphasis on *Thomasia* and *Lasiopetalum*.

Many of the plants from these families occur naturally as understorey plants and so generally do well at Karwarra, allowing visitors to see plants growing successfully under established trees. Anyone who has worked in a retail native or exotic plant nursery will know how often gardeners arrive, desperately seeking plants that might be grown successfully in shady, dry sites.

Not all are easy to grow but so many are. *Thomasia* and *Lasiopetalum* particularly are still under-represented in nurseries and yet are well-suited to domestic gardens, particularly in a shady site. It helps also that many of these plants have appealing flowers and interesting or decorative and sometimes aromatic foliage.



Left to right: *Thomasia bracteata*, *Chorilaena quercifolia* (the red flowering form)



Left to right: *Zieria citriodora*, *Thomasia sarotes*

Victorian threatened species collections

Including a Victorian rare & threatened (R&T) species collection is a high priority and a sad but necessary part of Karwarra's ongoing commitment to conservation and education.

The guidelines for this collection are that they first should reasonably suit the environment at Karwarra. We would politely refuse plant material that was unlikely to thrive here. Why waste valuable plant material *and* make the poor things suffer even more?

Consideration of their weed potential is also important. This sounds counter-intuitive to the notion of what a threatened species is but of course we know that a plant that is naturally localised and vulnerable can misbehave in a different location.

Among our collection are plants such as Tall Astelia *Astelia australiana* and White Star Bush *Asterolasia asteriscophora* subsp. *albiflora*, both of which occur within the Yarra Ranges area.

While our primary focus is on Victorian R&T species we sometimes include threatened species from other states, particularly species that naturally occur on the south-eastern Australian coastal fringe. That is, provided we think they will grow and they aren't going to grow too large!

We have a number of mature *Brachychiton* species as larger representatives of the Sterculiaceae (Malvaceae) family and while we are a small garden and can't afford to add larger trees without careful consideration we have made a recent exception. We planted the critically-endangered Ormeau Bottle Tree *Brachychiton* sp. 'Ormeau' to replace a very large and mischievously weedy Lilly Pilly.

Our once extensive boronia collection had almost disappeared over time due to drought, senescence and other factors. As part of a rejuvenation of the garden some seven or so years ago, we propagated important surviving boronia plants and staged the removal of self-seeded or superfluous plants. This allowed us to reclaim garden beds and space to recreate as much as possible to Kath's original vision.



Lasiopetalum shulzenii (Portland form)



Grevillea williamsonii

One of life's little ironies is that we had to remove Chef's Cap Correa *Correa baeuerlenii* (itself listed as vulnerable) as it was one of the plants that had wholly overtaken large garden beds to the detriment of other plants. We still have happy but well-pruned specimens of it in the garden.

Indigenous collection

A sizable section of the garden at Karwarra includes a regenerated area of natural indigenous bushland. Twelve naturally occurring species of terrestrial orchids have been documented in this bushland with five species flourishing naturally throughout the ornamental garden beds and soft-fall paths.

Record keeping

Good record keeping has long been a part of Karwarra garden. Initially all plantings are carefully listed on Excel spreadsheets and then the data is transferred to an Access data base. The Excel spreadsheets and Access database include an extensive range of fields including information as to where a plant was sourced or purchased, the name of the wholesale grower (if obvious by label) and provenance if known. Plant location within the garden is also listed. Small, robust metal tags are discretely placed next to each plant in the garden with basic information but we do not have accession numbers at this point in time.

Particular note is made on the data base as to whether there are restrictions on propagation and sale or distribution of plants such as threatened status, PBR (plant breeders' rights) and protected trademark names. We try to limit the inclusion of hybrids in the garden but make exceptions, especially with smaller plants such as those boronias in the GPCAA collections.

We propagate *from the garden for the garden* but also propagate for sale in our small retail plant nursery. We share plant material with other botanic gardens, organisations and individuals doing research and bona fide collectors. There are various other fields that we diligently use to document our collection but I won't expand on those now.

Yarra Ranges Council and Councillors continue to support KANBG, appreciating not only the value of the garden to locals of and visitors to the Yarra Ranges but also its wider importance as a special living collection. Put simply, Karwarra's mission statement could just as easily be 'Inspiration, relaxation, conservation & education' which is really what botanic gardens are all about. We hope you come and see what we are up to.

The science section

Compiled by **Brett Summerell**, Director,
Science and Conservation, Botanic Gardens &
Centennial Parklands



Brett Summerell

First word

In this section of the magazine we highlight some of the academic research happening both in Australia and internationally of relevance to botanic gardens. Those of us who work in botanical and conservation research hope to make our science more accessible to the community at large and what follows will help you communicate this core function in your work too.

If you have science information for inclusion in future issues please drop me a line at brett.summerell@rbgsyd.nsw.gov.au

Evolution of truffle fungi in Australia

In Australia we have a great diversity of truffle fungi – fungi that produce fruiting bodies underground (hypogeous) or barely emergent. Many of these fungi form very important mycorrhizal associations with a number of plant species right across Australia. This is thought to be an evolutionary adaptation to the increased aridity of large parts of Australia.

This has resulted in mutually beneficial relationships with a number of small marsupials that dig up the truffles, consume them and consequently disperse the fungal spores in their scats. In a new paper published in *Australian Systematic Botany* Elizabeth Sheedy (at the National Museum of Natural Sciences, Tsukuba, Japan) and colleagues (at Uppsala University, Sweden, the Royal Botanic Gardens Victoria, the West Australian Herbarium and the University of Tennessee) have constructed molecular phylogenies of a large number of truffle fungi as well as groups that produce mushrooms and truffle-like fruiting bodies.



Mesophellia truffles, found along Australia's east coast, are a tasty food for native marsupials.
Photo: Teresa Lebel, Royal Botanic Gardens Victoria

This information was then used to construct molecular clock models which support an increased rate of this form of adaptation in Australia during the Oligocene and Miocene (between 34 and 13 million years ago). Although the rate of evolution of these types of fungi is shown to have increased in Australia after separation from Antarctica (i.e. as the continent became more arid), the timing also overlaps with the rapid evolution and radiation of potential mycorrhizal plant associates and the emergence of specialised mycophagous marsupials that could disperse them.

A complex relationship between the fungus, the plant associate and the marsupial disperser have all combined over that period to allow the radiation of these fungi into diverse habitats.

Herbarium specimens as tools to assess the impact of large herbivores on plant species

More and more researchers are coming up with innovative ways to use herbarium collections to answer interesting ecological questions. In a paper by Marie-Pierre Beauvais and colleagues in the journal *Botany* leaf size in nearly 700 herbarium specimens of White Trillium *Trillium grandiflorum* were compared with field populations of the same plant. Both had been ungrazed and grazed by White-tailed Deer. White-tailed Deer have been increasing in numbers and over grazing is thought to be placing the plant species at risk.

White-tailed Deer have been increasing in numbers and over grazing is thought to be placing the plant species at risk.



Their data showed that large animal herbivory skews leaf size to a smaller size when compared with both herbarium specimens and with ungrazed populations. This is likely to lead to reduced flowering and seed set and to render the species less resilient.

The use of herbarium specimens provided a temporal component to the spatial data and allowed an assessment of a longer time period than could be achieved by standard ecological sampling. The authors noted 'these rich data sets (herbarium specimens) are seriously jeopardised by the downtrend in specimen collecting'.

Orchids and deception – this time the other way round

Generally when we think of deception and mimicry relating to orchid pollination it is with respect to resemblance of orchid flowers to their insect pollinators. An insect is enticed to pseudocopulate with a particular orchid species because its flower resembles that particular insect's mate.

Insects, of course have also evolved in myriad ways and there are some species of insects that mimic orchid flowers in order to enhance their own existence. Orchid mantises are an interesting example of this. These spectacular insects from South-east Asia are amazing creatures. They resemble orchid blooms and fool prey into believing they are the flowers. Interestingly, in many mantis species the female is substantially larger than the male and more closely resembles a flower in size as well as appearance.

Research by Gavin Svenson and colleagues at the Cleveland Museum of Natural History and published in *Scientific Reports* has mapped the evolutionary history of these insects and has demonstrated that large size in females has evolved over time to allow predation on larger pollinators of the orchid flowers. This was coupled with more and more elaborate colour and morphology, not necessarily to completely mimic the flower but still to entice the pollinator to visit (with fatal results for the pollinator!).

It was still beneficial for the male to remain small as this allowed it ease of movement and dispersal so that it was able to mate with as many females as possible. The female mantis was not driven by this need and hence the evolutionary drive to increase in size and become more substantial predators. Check out these amazing animals on <http://channel.nationalgeographic.com/wild/worlds-deadliest/videos/deadly-disguised-orchids/>.

Some genetic variability finally discovered in the Wollemi Pine

The Wollemi Pine *Wollemia nobilis* is undoubtedly one of the most amazing botanical discoveries of the last 50 years. Research to date had been unsuccessful in demonstrating any genetic variability using a variety of molecular tools and techniques.

Based on this, it was assumed that the trees population had headed down a severe genetic bottleneck and was completely inbred. This has significant consequences for its survival and how it might adapt to threatening processes such as the introduction of *Phytophthora* root rot pathogens about 12 years ago.

Now, in a new paper by Abigail Greenfield, Hannah McPherson, Tony Auld, Sven Delaney, Cathy Offord, Marlien van der Merwe, Jia-Yee S. Yap and Maurizio Rossetto in *Australian Journal of Botany*, techniques involving next generation sequencing of the chloroplast genome of the population of Wollemi Pines have detected small amounts of genetic variability.

The implications of this discovery for the conservation of the Wollemi Pine are still to be determined. Plants contain DNA in their nuclei and in the chloroplast; the chloroplast DNA is smaller but still contains substantial amounts of genetic information. Future research will need to look at the potential of individual trees to respond differently to threats like diseases but new techniques that allow the exploration of gene products such as resistance chemicals offers some potential for exploring this.



A Wollemi Pine growing in the wild.
Photo: Jaime Plaza

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Managing safety at botanic gardens – a safety practitioner's perspective

Col Finnie, Director, fini:OHS

Introduction

Like all industries, there are some unique challenges that present themselves when looking at managing safety at botanic gardens, and in horticulture generally. These challenges can be seen as obstacles to getting good safety outcomes, but that is losing an opportunity. Most challenges can be used as catalysts to excel in safety.

Here are a few of the key 'challenges' I've noticed:

1. Money – or lack of it;
2. Entrenched ideas about what is or isn't safe;
3. The public space/workplace dynamic.

How much will that cost?

Yep, investing in safety has costs, but creativity, smart thinking and wise investments readily produce outcomes well in excess of the initial outlay. A little known big study of European companies on safety cost benefit delivered a very solid finding: for every dollar spent on safety, the total benefit returned was twice as much. Obviously there is a limit to that return, but the survey looked at day-to-day safety expenditure. And a large part of the benefits is the simple fact that good safety invariably brings efficiency gains.¹

I would go so far as to say that if the efficiency gain isn't obvious when considering a safety improvement, you need to look harder at what options were considered. If there is no efficiency gain then it's likely that the best options haven't been looked at.

['You think safety is expensive? Try an accident!']

¹ The return on prevention Calculating-the-costs-and-benefits-of-investments-in-occupational-safety-and-health-in-companies, published by ISSA, 2012.

And then there is the quote from a petrochemical executive, 'You think safety is expensive? Try an accident!' Every major incident, particularly if an injury is involved means a mad scramble to fix the problem, usually without time to reflect on too many options. It has to be fixed and fixed fast. That sort of management response is a big threat to the first point about getting maximum efficiency. Or at the very least means money needs to be spent outside normal budget deliberations – always a problem when funding is tight.

Entrenched ideas about safety

The challenge here is that horticulture seems to attract people passionate about their work. For them, getting the job done prevails, and sometimes this can be at the cost of being done as safely as reasonably possible. It doesn't have to be that way. Capture the passion for the work. Throw out dogmatic safety thinking and lock the safety solution finding in step with the passion to get the job done. Typically this will mean holding solution-finding workshops with the staff who are dealing with specific safety issues day-to-day.

Do a quick tally of the number of years your staff have accumulated their skills – for any larger botanic gardens that will quickly tote up to 100+ years. Your safety specialist (or person who has to manage safety) should be exploiting that amount of knowledge with creative, supportive and positive guidance to extract the best, most effective solutions.

[A quick tally of the number of years your staff have accumulated their skills could quickly tote up to 100+ years!]

Get staff to 'own' the solutions in one degree or another and they will be much more inclined to be part of successful implementation. And whatever you do, be 'fair dinkum' about the solutions. This isn't an issue exclusive to horticulture, it happens everywhere.

Staff who are exposed to risks and get the impression that management is not serious about solutions will not take long to 'twig' that safety talk is nothing but talk; that's the best way to blow apart any hope of genuine safety performance improvements. Hold safety meetings when you say you will. If you can't afford a particular solution, say so, and ask for other options that will fit the budget. Encourage creative thinking and act on those as quickly as possible. Always allocate a deadline for implementation. Deadlines get missed; it's the nature of them! Make sure everyone knows why a deadline was missed, and set another, quickly.

Putting together an adequate amount of written safety material can be a substantial OH&S cost – so you will want to get maximum 'bang for your buck' with that material. Do you have a substantial bunch of safety documentation, safe work procedures and the like? How often do staff refer to them? If they aren't referring to them at least every now and then ask why.

If you have a serious injury the local safety inspector will soon find out if the relevant procedures are little more than dust-gatherers. Good written safety procedures need to be living documents. It would be rare for any given procedures to remain fully relevant for more than a year. And every document can be improved. Again, the best solution is to encourage ownership by getting ideas from staff on what needs to change. A serious injury is a bad catalyst for bringing your safety stuff up to date. Treat your written material like any other business asset: if it's not maintained it quickly loses value.

Workplace or public space, which prevails in safety thinking?

This one is a 'lay down misere', particularly in the context of the close relationship between safety and efficiency. The temptation is always going to be to minimise disrupting things like pedestrian flow and access to parts of your garden. But the simple fact is only construction site standards are acceptable when it comes to work site barriers for that front-end loader, backhoe or arborist work.

This means a simple strip of tape is not sufficient – an actual barrier is essential. And then there is that variable that all horticulturists working in public areas have experienced: the sometimes unfathomable inability of some members of the public to see the danger they are putting themselves into. This reinforces the need for proper substantial barriers.

Some key risk management strategies that need to be considered:

- It's unreasonable and often impossible for an operator of a big bit of machinery to be fully aware of every place the machinery is about to move into at every moment. There has to be areas that an operator can do his/her work with a reasonable assumption no one will be in the space. That means giving the operator reasonable confidence that the public are not easily able to get into the operation area. But it also means that everyone else working on the site needs to be super aware of people movements, and acting as 'spotters' for the machine operator.
- It's often impractical in botanic gardens to put up the sort of cyclone fence barriers seen at construction sites. Orange plastic netting can be a good substitute. And that brings the very practical issue of how you keep the stuff fully supported and doing its job, particularly if there is some wind about. At the Royal Botanic Gardens Victoria (RBGV) we identified work site barriers as an issue that had to be resolved. We held a few workshop sessions and found this suitable solution.

Previously plastic bollards with the heavy rubber base were used to support the plastic netting. This usually resulted in the netting falling over in the smallest breeze. The solution was to use pig-tail stakes and lashing to produce a strong anchor system for the netting. Portable bollards were then only needed to keep the netting vertical (plus the bollards had their own anchoring effect). See the photos below for some examples of effective barriers and more explanation of how the problem was resolved at RBGV.

- Another important risk management factor is that the barrier solutions illustrated above is a good example of smart investment utilising staff engagement and expertise. The RBGV invested my time and the time of one of the more experienced staff members (who just happened to be a Health and Safety Representative). My role was to ensure compliance matters were addressed (i.e. ensuring a genuinely effective barrier) and the other staff member brought a practical sense of what staff would find easy and quick to erect.
- Sometimes there 's a need to barricade off very large areas, and that's when orange netting can be a problem. In those situations it might be adequate to use bollards and hazard strip tape, particularly when the public thoroughfare is over 20 metres from where mobile equipment is being used. I recommend using double runs of yellow and black hazard strip tape (i.e. two separate runs of tape). However if this method is used it is important to be even more diligent about other staff acting as spotters when front end loaders and other large machines are operating inside the barrier.



Here the pig-tail stake provides the anchoring tension. The plastic bollard is simply keeping the netting vertical and transferring that anchor tension to the netting. If more tension is needed just add more stakes.



The set up here is barricading a wide thoroughfare. Note how the bollards keep the netting vertical, but also transfer anchoring tension produced by the pig-tail stakes. This system does not collapse readily in a wind.



This configuration exploits all the elements of the wider barriers, but is a quick, effective and more elegant use of the pig-tail stakes. Most importantly it is still a genuine barrier.

- If you have roads for public vehicle access in your gardens there's a possibility it is a public road (in the statutory sense). This means you will need to use the recommended guidance on barriers and signage required by your local work safety regulator. In Victoria there is an excellent Code of Practice called 'Worksite safety – traffic management'. It's quite thorough and benefits from a bunch of clear diagrams of recommended barrier/distance/signage configurations.
- Focus on the most dangerous work first. This is always going to be where large machinery is being used and arborist work is being done. Get this right before working on other less high risk barrier problems. This is a good general principle to use for all risk management situations: get the big problems solved first, don't fall into the trap of only taking on the quick and easy to solve problems. The lure of dealing with the quick easy-to-fix stuff is a common problem faced in all workplaces, so don't fall into the trap.

[Get big problems solved first, don't fall into the trap of only taking on the quick and easy to solve problems.]

- Finally there's the workplace public space challenge of visual elements and signage related to danger. There is enough to say here to fill a whole article, so here are a few tips covering the main areas:
 - Use yellow and black hazard strip tape, in preference to the increasingly common red and white tape. Yellow and black is more recognisable as a warning colour combination. (From my teaching OHS in China recently I came to realise the red and white tape we see a lot used on construction sites here is probably due to the fact that red and white is used in China – hence the cheap supply of that sort of tape.) However, even in China yellow and black tape is used in higher risk situations.
- And all tapes are not equal. Buy the better quality double-sided print tape. It's more durable and can be used multiple times.
- Signage is a big issue. But signage should always be treated as a supplement to smart barricade placement and management of public access to a work site, rather than placing a lot of emphasis on signs for risk control.

As a rule of thumb, a court is unlikely to pay any attention to the quality of your signage if an injury occurs because your site management and barriers were inadequate. That said, smart signage is a big help. Think hard about sensible signage and placement, it can be a temptation to just 'whack-it-up' without carefully considering the efficacy of the signs. Defer to using graphics-only signs versus graphics combined with text. While the latter might be good for locals, it might not be the most suitable signage for visitors to your garden who don't have English as a first language.

Smart safety

In closing I'd like to reiterate an earlier point: safety has to be a part of embedded day-to-day culture and involve management in a meaningful way. Good safety solutions will invariably bring solid savings in the long term. Working out smart safety solutions is not as easy as is often stated; all that nonsense about

'safety is just about common sense etc' is just guff. Smart safety is a problem-solving exercise using and

building on your staff's experience and skills. Fortunately like all project management, there is always a good solution if you think hard enough. And the bonus is that your gardens will be more efficient when you have smart safety as your primary goal.



A simple 'double run' tape barrier using higher impact yellow and black hazard strip tape.



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Dinosaurs in the gardens!

Natasha Salt, Special Projects Officer, **Micheline Newton**, Visitor Services Manager, and **Julia Watson** Senior Gardener Education and Partnerships, Auckland Botanic Gardens

Did this heading get your attention? It certainly got the attention of Aucklanders this summer. We recently hosted *Dinosaurs in the Gardens (DitG)*, a three month event that attracted over 33,000 registrations across ten weekends. The event was hugely successful for us, and we learnt a lot along the way.

Dinosaurs capture the imagination and intrigue both young and old, providing us with a fantastic platform to highlight the ancient plants in our Gondwana Arboretum. This collection consists of plants connected to the ancient flora of Gondwana, grouped according to modern geographical distribution. *DitG* was an opportunity to bring our Gondwana Arboretum to life and engage families with this unique garden collection.

The event included a large display in our visitor centre of dinosaur statues, fossils, Gondwana plants and interactive stations. There was also a trail for kids that led them through the garden to our Gondwana forest, highlighting garden links to the dinosaur era along the way, including a stop to see a plesiosaur in the lake.

This event was run in partnership with Eventosaurus, a newly established New Zealand-based company. Eventosaurus imported large dinosaur statues for the display, plus animatronic dinosaurs for weekend *Dinosaur Encounters* that proved to be the main attraction of the event. Running three times a day every Saturday and Sunday between November to February, the encounters were extremely popular, presenting new challenges to us as a 'host' partner.



Simple but eye-catching branding was created to promote the event.



Part of the large display in the Visitor Centre.

Eventosaurus provided a team to manage the weekend events, including professional actors to run the shows and staff to run merchandising and activities. Despite our staff not running the encounters directly, having thousands of extra visitors on site and a new partnership model to work within, we had 'a lot of learnings' around risk management and health and safety.

Eventosaurus had run pilots of *Dinosaur Encounters* at local shopping centres to test-run the encounters and gauge public interest. It became immediately obvious that interest was huge and we would need to manage visitor numbers. We used a free website, Eventbrite, to list our *Dinosaur Encounters* and encouraged the public to register their attendance. They were not required to bring a ticket but registration enabled us to create a false sense of restriction, and limit visitor numbers to 1,000 per session (i.e. 3,000 registrations per day). To service the increase in car parking requirements at encounter times we opened extra event parking on another section of the site managed by security.

The pilot tests also provided invaluable information on how children and adults responded to lifelike dinosaurs walking around. We quickly realised that crowd management was necessary to protect the actors in the dinosaur suits and to reduce risk of injury from excited kids clambering to touch the dinosaurs which might cause them to fall over.

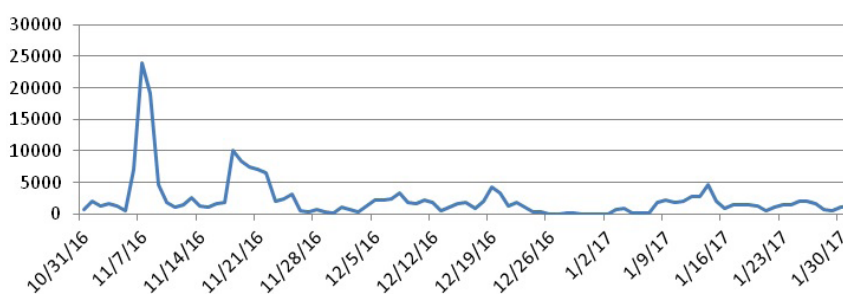
We primarily marketed the events through social media and free Auckland Council channels, with very minimal paid advertising. Thanks to some clever teaser videos and an enthusiastic following of family-friendly websites and bloggers, the event took on a life of its own. When registrations opened, we took more than 6,500 registrations in the first 24 hours. Social media and word of mouth marketing were by far the strongest factors driving awareness of the event. Over the course of the three months, our total page 'likes' on Facebook increased by 26%.



Dinosaur Encounters were designed to be friendly and fun, with children getting a chance to pat a dinosaur.

Running pilot programs is a great way to test-run an event and gauge public interest.

Facebook Daily Reach of page posts:
The number of people who saw any of our page posts



Facebook was an excellent avenue for promoting *DitG*. Note the spikes in page views in November when we first launched our teaser dinosaur videos.

Why run an event of this size and nature?

Comparing the risk factors associated with this event against the potential benefits informed our decision to proceed. We weighed up the financial risks and people resources required to deliver a quality visitor experience, manage reputational risk and protect our infrastructure.

As a botanic garden we have developed clear plant collection guidelines and marketing plans that direct our day-to-day operations and engagement activities to ensure alignment and effective use of our limited resources.

The Gondwana Arboretum is a distinctive feature of our garden, and one we have always wanted to showcase to visitors ... but hadn't quite determined how. Engaging people with plants is one of our key objectives, and hosting *DitG* in the Gondwana Arboretum was the perfect opportunity to achieve this objective and to tell the stories of these important plants.

A partnership approach enabled us to run an event of this size.

Another key reason for running this event was to test a partnership approach where our staff were not totally responsible for the full event. The team at Eventosaurus ran all of the *Dinosaur Encounters* on weekends and arranged all of the dinosaur statues, fossils and equipment. It was this partnership approach that made it possible for us to host an event of this size, without straining our staff resources and budget.

In tandem with this event we initiated an interpretation project, to put signage into our Gondwana Arboretum. This is one of our most extensive collections on site in terms of its footprint. The summer event enabled us to see how public received the information and gave us a clearer insight into how to pitch more permanent information on signage.

We used imagery, information and graphic design elements that were developed for *DitG* in our new interpretation, thereby maximising the use of the graphic design costs and research involved. We found that running projects in parallel proved to be efficient and effective use of resources. We also shared various design elements and resources with the Wellington Botanic Gardens, who will host the dinosaurs in their gardens during Easter.



A plesiosaur in our lake (part of the kid's dinosaur trail) attracted a lot of attention!

Running a safe event

In partnership with Eventosaurus we drew up an event plan that included the project scope, indoor and outdoor activities, health and safety requirements and key contacts. This was provided to all staff and the Eventosaurus team. It was important that everyone involved understood all the risks and controls put in place, how to manage them and how to respond to any issues that arose.

Risk management for the *Dinosaur Encounters* were addressed pre-event by directly emailing registered attendees tips on planning their visit to ensure they had a great time. Crowd control was managed by restricting numbers and using infrastructure to provide a clear space for the dinosaurs and the Dino Ranger (an actor hired to narrate the *Dinosaur Encounters*). To reduce the risk of children being scared of the dinosaurs, the Dino Ranger warmed up the crowd with sounds and roaring competitions and delivered a script that ran through health and safety advice for parents and caregivers.

Eventosaurus managed the safety of its performers. All were given a copy of the event plan and general health and safety and they managed direct risks to their team either performing or working in the Dino Zone (a separate pay-for-entry area with additional dinosaurs and entertainment after each session). For example the dinosaur suits could be prone to overheating the artists. To mitigate this, Eventosaurus considered the duration of the show (each session was only 20 minutes long) and the time of day (early or late to avoid the midday sun). Huge logs were arranged in the event site to keep dinosaurs and crowds separated and the Dino Ranger ensured the crowd stayed behind the logs.



Dinosaur Rangers kept the actors safe and the crowd too. Note the large logs on the ground to separate visitors from dinosaurs.



A subtle change to our logo was a fun way of embracing the dinosaur event.

Eventosaurus's team had first aid training, were well-briefed on how to manage lost children and always had radio transmitters on them for communication. Dogs are allowed on site at Auckland Botanic Gardens providing another risk consideration. The event area itself was an on-leash area, but we made the area a no-dog zone during *Dinosaur Encounters*. We ensured all staff were aware of this and confident to talk to visitors about it.

It was important to tell people how to behave and to manage expectations before they arrive. We used the pre-event emails to cover off what we expected to be the major pain points and questions such as the potential scariness of the event, traffic and parking options.

It's important to tell people how to behave and to manage expectations before they arrive.

Risk management for static displays

The visits by dinosaurs to shopping centres during the pre-event pilot indicated that we needed to restrict access to the static dinosaur displays to prevent damage. Visitor safety was managed by ensuring the dinosaur statues were secure and out of reach, also reducing financial risk due to dinosaur damage. We opportunistically used the need to separate kids from the dinosaurs to surround the statues with Gondwana era plants.

To ensure visitors could engage with the display, we looked for opportunities for low risk interactive engagement. This included providing a 'feel a fossil' display, forest and dinosaur sounds, a simple fossil dig and a colouring competition. These fun and distracting activities helped prevent damage from some of the more hands-on kids!

Eventosaurus took out public liability insurance to cover the outdoor experience, while our insurance covered the indoor infrastructure. We undertook to service any small costs resulting from damage.



Fencing off and surrounding models with plants helped protect them from damage.

Turning ideas into reality

Teamwork is a vital aspect of any major event. *DitG* required external teams (graphic designers, Eventosaurus, security) and internal teams (visitor services, field and asset teams, Auckland Council internal support) working together to make it happen. Communicating every step of the way kept everyone informed and feeling up-to-date with information.

Staff were updated on a weekly basis on how the event was going, and weekend staff were briefed on details and expectations before each *Dinosaur Encounters* weekend. Ongoing feedback allowed us to change delivery to match use or visitor needs, and improve our engagement opportunities throughout the event duration.

Key learnings

- Don't think operationally immediately as you might squash the dream. First discuss the ideas on a big scale (a gigantasaurus scale!) and then look at the logistics and deliverables through a more realistic lens.
- Allow a long lead in time for large new projects. From initial discussion to implementation we took 11 months to prepare for *DitG*.
- Cater to families. Families are a key audience of botanic gardens. Running an event of this nature provided fantastic experiences that will stay with families who will long associate our garden with positive memories.
- Some of our biggest successes came from the little (and cheap) things. Repurposing a large case used to transport the model dinosaurs into a 'selfies cage' was one of the most popular attractions in the visitor centre!
- Safety and security is vital. Ensure your visitors feel safe at large-scale events by implementing comprehensive health and safety training with staff and partners, and by enlisting specialised staff when necessary. For example our security company worked on traffic management and crowd control.
- Allocate time to address risks proactively as well as reactively during the event. This ensures health and safety management provide a supportive but fun experience for visitors.

Conclusion

After running a large event, it's good to ask 'would we do it again?' In the case of *DitG* the answer is a resounding yes! The event was well aligned with our objectives, and partnering with Eventosaurus made the event possible.

Botanic gardens are fantastic sites for hosting large public events. However it is a balancing act to weigh up the benefits to the site and the commitment of resources required to run large events.

Outcomes achieved by the event include:

- A valuable and effective ongoing collaborative relationship with Eventosaurus,
- Alignment of the event with key objectives and engagement priorities (i.e. Gondwana arboretum interpretation),

- Key plant messaging – increased community awareness of the Gondwana continent and the trees descended from that era (50% of visitors said they learned something about the ABG),
- Increased engagement through social media activity (Facebook likes increased by 26%; website hits increased by 45% on same period last year, with a 148% increase on event pages) and use of simple inexpensive interactive engagement elements,
- Increased visitation, especially by families and young children who now see ABG as a fun place to visit,
- Growing our returning visitors – 72% indicated they were likely/extremely likely to return to the Gardens after *DitG* finished,
- Increased public profile of both ABG and the Gondwana Arboretum
- Multidisciplinary approach – the ability to use a wider team of skills to develop all aspects of the exhibition.



WEBSITE

106,000 more page views than same time last year.

148% increase in views of Event section (85% of event views were for *DitG*).



FACEBOOK

26% increase in total Facebook likes since 1 Nov 2016.

34,707 – our largest organic post reach ever.

50,230 – largest reach using paid FB promotion.



VISITORS

33,353 people registered to attend a *DitG* session. This does not include walk-ups.

54% had either never visited the Gardens or only visited a few times in their lives.

72% of visitors were likely/extremely likely to return to the Gardens after *DitG* finished.

50% learnt something about the Gardens while visiting for *DitG*.

The numbers

If you are considering running a large event of a similar nature, we would be very happy to share our learnings, documentation and planning processes. Please get in touch with Julia Watson: julia.watson@aucklandcouncil.govt.nz. If you are interested in hosting *Dinosaurs in the Gardens* please contact Laurence Taylor: l.taylor@eventosaurus.co.nz.

Safeguarding the living collection

Greg Bourke, Curator Manager, Blue Mountains Botanic Garden

When I commenced in the role of Curator Manager at the Blue Mountains Botanic Garden Mount Tomah (BMBG), one of the first questions I asked the staff was 'What are the most significant plants in the living collection?' which was shortly followed by 'What processes do we have in place to ensure these significant plants are safeguarded against acts of God?' The latter question was one that few were able to answer convincingly. The truth was, while we housed many significant specimens in the living collection, few were backed up.

What processes do we have in place to ensure our significant plants are safeguarded against acts of God?

Staff at the BMBG have long been aware of the risk that our collection poses to surrounding areas. There is a strict weed risk assessment and monitoring process in place but as I delved deeper into the protection of the living collection the more concerned about it I became. Some of the rarities were backed up as potted specimens in our nursery but as all were subjected to the same watering system and on the same site, this wasn't something I considered good enough.

Others like the Wollemi Pine were offered greater protection with many clones split across the three estates of the Botanic Gardens & Centennial Parklands and a program in place to store genetic material for the future in both tissue culture and seed in the state-of-the-art Australian PlantBank.

In October 2013 a large fire broke out near Mount Tomah burning over 140,000 acres of Blue Mountains bushland at times threatening the garden. This event reinforced the need to have a disaster recovery plan. Our land and infrastructure were insured but not our most valuable asset, the plants.

Over the years I'm sure you've all heard of cases of plant theft from botanic gardens – also about cases of ring barking and other acts of vandalism, particularly in parks and gardens in Victoria. While these are certainly of concern at our botanic garden, of greater concern to me are fire, climate change, pests and disease.

In 2016 I was fortunate to win a scholarship from the Foundation and Friends of the Botanic Gardens. This took me to the UK to look at some of the botanic gardens there, in particular their management systems including collections management. What I found was that their living collections are in many ways no better than ours. Like us, some species were offered greater protection than others which didn't necessarily reflect the conservation status of the species.

**[I found other living collections are in many ways
no better safeguarded than ours.]**

So what have we done? Once our list of rare species was created, we looked at a number of criteria to decide which species we could and should act on first. Opportunistic collection of seed has seen a few species make it into the Australian PlantBank at the Australian Botanic Garden but given the risk of hybridisation, cuttings has been the focus for many species. This has given us some quick wins.

The Dwarf Mountain Pine *Phaerosphaera fitzgeraldii* is one species that we've had good success with. The species is endemic to the Blue Mountains with just 760 plants left in the wild. Growing to little more than 1m tall, this species looks great in a bonsai pot so may be appealing to the broader public. Consequently the Growing Friends team together with Senior Horticulturist Damien Vella have propagated a few hundred so we can make them available in our plant sales area. Plants will also be made available to botanic gardens in the BGANZ network.



The Dwarf Mountain Pine in safe hands.

Abies nebrodensis is listed as critically endangered on the IUCN Red List. Only 30 mature specimens are left in the wild and BMBG houses one of the few in Australia. Cuttings have been taken which will be distributed to gardens of similar climate in the BGANZ network.

Rhododendron kanehirai is extinct in the wild. Although it has been cultivated for many centuries (Lu, S.Y. & Pan, F.J. 1998) only four plants are in botanic garden collections with BMBG being the only institution known to house this species in Australia. This species has proven easy to propagate and will also be made available to other botanic gardens.

Betula chichibuensis is only known from a single location in Japan with a population of less than 50 (possibly as few as 21) mature individuals. Listed as critically endangered on the IUCN Red List this species is considered one of the more basal taxa in the genus. Currently we only have one small plant but a few cuttings have been taken.

Whilst there is still much work to be done to ensure we manage risks to the living collection, I'm confident that we're moving in the right direction. I look forward to sharing material with members of the BGANZ network and beyond as we continue to improve collections management at the Blue Mountains Botanic Garden Mount Tomah.



Rhododendron kanehirai sadly extinct in the wild.



The beautiful foliage of *Betula chichibuensis*.

Would you like to join the BGer Editorial Committee?

BGANZ is looking for emerging and seasoned 'botanic gardeners' (in any discipline) who would like to be involved with the publication of THE BOTANIC GARDENER – an e-magazine produced three times a year.

This is a great opportunity to develop your networking, writing and editing skills as well as contribute to the success of our professional organisation. Training will be provided and this is not a very time-consuming commitment.

Anyone interested should contact Janelle Hatherly, Managing Editor, directly on janelle.hatherly@bigpond.com



Providing opportunities for 'free play' for children

Sam Crosby, Coordinator Education Services, Australian Botanic Garden Mount Annan and Centennial Parklands

Introduction

People often share their stories of childhood play experiences with me. It is not a random act. These are stories shared as part of a professional development training program or presentation for adult educators. It is one that I deliver on nature pedagogy and play as an educator for the Australian Botanic Garden Mount Annan. (ABGMA)

As people recall their childhood adventures they spill tales of trees climbed, knees scraped, cubbies built and free range play. All are shared with passion, a cheeky grin and animated movements. This is usually before a drop in expression ... and I wait for it: 'kids these days don't get out enough.' And it's true. They really don't.

According to Nature Play WA, Australian children spend less time outside than our maximum security prisoners and only one in three children under the age of 12 have climbed a tree.

These statistics and an increasing amount of press coverage and academic research point towards a worrying trend. Our children are less active, have declining literacy and cognitive abilities (such as problem solving, critical and imaginative thinking). They are less resilient and above all have a growing disconnect from the natural world, a phenomenon which even has a title these days. It is known as 'nature deficit disorder'.

An increase in screen time, over-scheduled weekdays and weekends, a real lack of access to places to play and adult fear of risk and injury, all contribute to this decline. This is leading many cultural organisations that engage with children to try to make up for this loss of a 'free range' childhood and aim to bring back some of these adventurous experiences.



Building cubbies helps to engage the imagination and develop a sense of place.
Photo: Sharon Robertson

What botanic gardens can provide

Botanic gardens can and do provide these opportunities for free play experiences here in Australia. Whether it be in the Ian Potter Children's Garden in Melbourne or via the *Bush Kindergartens* operating out of the Royal Botanic Garden at Cranbourne. At ABGMA we are not only providing training opportunities for other educators in this field, but we have recently developed a nature play area and deliver our own regular facilitated nature play programs.

These include a weekly Bush Play group for children aged 2½ – 5 years as well as holiday programs for older children such as the *Big Garden Bushrangers* and *Kids vs Wild* with a 'free play' underpinning.

With facilitated programs delivered by expert garden educators, the parental fears that often limit children's access to nature play dissolve. Although not a truly 'free play' nature experience like the ones shared by myself and other adults, but during these programs our garden educators make a deliberate point of allowing children the opportunity to choose their own adventure.

With little adult influence, they are given time to explore and play freely. Our educators adopt a different role to most parents and educators. Rather than hovering and directing children's play (in the role of the 'helicopter' archetype), we see our role more like 'hummingbirds'. We fly in to give advice or provide help with solving a problem when it's needed, and then fly out once the play is back on track and in flow.

It works well, because these experiences then transfer to family life. Children become eager to share their experiences with parents and bring them back to the place where they discovered a magic tree, saw a strange lizard or made the coolest cubby. And parents become comfortable with the idea of stepping back.

The nature play programs at ABGMA are extremely popular with many repeat bookings as parents increasingly realise the value of these experiences. Put simply, if they want smart, happy and healthy kids, nature play is a great tool.



Places to hide and play (away from the direct influence of adults) help kids to become resilient and be great problem solvers. Photo: Sharon Robertson



Physical challenges help with child development and create risk benefit. Photo: Sharon Robertson

Aside from the developmental benefits for children, there are also short and long term benefits for botanic gardens. In the short-term, this may mean an increase in revenue raised from nature play programs, or higher visitation and money spent at the visitor shop or café. In the long-term what these programs do is help to create emotional connection to place and a sense of awe and wonder for the natural world.

What the individual becomes

I grew up playing freely in Cumberland Woodland of South Western Sydney and now I spend my days educating others about it, at a botanic garden with a goal to conserve and protect it. I am sure my experience of developing a passion and connection with nature through free play as a child is not an isolated experience. I have no doubt that other staff and volunteers who work in botany, horticulture or environmental conservation will tell you that they too developed a connection to nature in their early formative years.

It can easily be forgotten that children engage with landscape, plants and other aspects of nature in a very different way to adults. This is why it is so important for botanic gardens to provide nature play experiences. While we, as grown-ups may be engaged by an expert sharing knowledge verbally, or being able to wander through a beautiful and important scientific collection, children need to be physically and emotionally engaged.

The pathway to botanic enlightenment begins with hands in the soil, dirt on the face, elevated from the bough of a tree or hidden in a shelter made from sticks. Kids need to be imagining and laughing with friends, taking risks alongside tall trees, observing the sounds of birds and insects buzzing in the breeze, away from the influence of adult ideas.

It is great to know that there is support and investment from botanic gardens throughout Australia and New Zealand to allow these experiences to grow in our children's lives. Without it, it will surely be that much harder to encourage the development of the next generation of botanists, horticulturalists and nature lovers. For those that might not choose a path in these fields, access to nature play also helps to ensure that the universal values that come from visiting and supporting botanic gardens continue. There may be a few leaves lost along the way but in the long term, I am sure it is well worth it.

If you are interested in developing competency in nature pedagogy and play, please contact the Education team for information about their training programs. Call 04 463 7969 or email us at School.excursions@rbgsyd.nsw.gov.au



Kids making a bower from sticks is part of developing ecological understanding.
Photo: Sharon Robertson

Managing risks at the Tasmanian Arboretum

phill Parsons, President of the Tasmanian Arboretum Inc.

I have mostly enjoyed working in horticulture over the past four decades and as President of The Tasmanian Arboretum I am mindful of the need to manage risk to our living collections so that plant survival and labour efforts aren't wasted.

The Tasmanian Arboretum tree park is being developed and maintained by voluntary workers for everyone's benefit. It is a not for profit community organisation providing a tourist attraction and a botanical institution for Northern Tasmania. Within 66 ha of parklands just 10 kilometres south of Devonport, we have the world's largest collection of Tasmanian living woody plants, Southern Hemisphere conifers and plants from northern hemisphere forests.

Where space and material have been available, the Tasmanian Arboretum has followed the accepted strategy of planting multiple species in several locations as far from each other as collection layout plans allow. Thus far our losses in this collection have been few.

Southern Hemisphere Conifer Collection

Losses of Pehuen or Monkey Puzzle Tree *Araucaria araucana* appeared to be due to dry conditions or perhaps from choosing the wrong site for the plant's needs but one that appeared to be reasonable from an aesthetic aspect. Where *Araucaria araucana* survived we added more in that dip in the ground. Now we have three ages represented. The earliest planting are now almost at the top of a south facing slope. The subsequent plantings to the first were part of our risk management strategy.

Last year some damage occurred to the tips of many of the *Wollemia nobilis* in the grove we planted in our Australian Collection, but not to the several others planted with a south facing aspect in our Gondwana Collection, some 140m distant and at 40m greater in altitude.

The cause of the damage is unknown but the trees in the grove had grown at three to four times faster than the lower group and the damage occurred in a particularly long period of low rainfall now being followed by a wet summer. Not all specimens in the grove appeared to be affected.



The two age classes of the *Araucaria araucana* planted in a dip.



The Wollemi Grove with solar pump providing water to the Australian Rainforest watering system in the foreground.



Wollemia nobilis tip damage and recovery.

Afrocarpus falcatus showed poor root development and so it was reproduced through cuttings. The year we planted out the cuttings had a cool dry growing season and our losses were all 12 planted. Fortunately we have a second specimen and a further round of cuttings has been taken. The plant showing poor root development has now died.

A new partnership with the Australian Rainforest

The Tasmanian Arboretum has recently partnered with the Australian National Botanic Gardens to expand our collection of Australian plants. Our focus is on plants growing at high altitudes along the east coast of mainland Australia. Thus we are taking a wider view of managing risk through ex-situ conservation. Before the partnership the Arboretum grew *Eucryphia wilkiei*, a species only found on Mt Bartle Frere (1633m) between 1200 and 1500m in altitude.

Our focus is on plants growing at high altitudes along the east coast of mainland Australia.

Some species with a distribution restricted to higher altitudes may not be represented in our collections. With the climate on a trajectory to temperatures greater than 2°C these plants will have a potentially reduced distributional range. Even those species already held in our living collections may find the temperature exceeds their tolerance range at that site.

We hope that by choosing to focus on plants tolerant of warmer climates, and at some risk, we can continue to fulfil Target 8 of the Global Strategy for Plant Conservation.

Crystal ball gazing informed by a little science

According to highly skilled climatologists there is no avoiding a global average temperature greater than that experienced in the time humans have depended on agriculture to support more complex forms of human activity (with its related population densities and alienation of natural systems).

Looking forward, all collection managers need to consider a future with a different climate. We can modify some environmental factors in the culture of plants, but holding ex-situ living collections of trees at the extremity of their tolerance range presents much greater cost and challenges than most of our budgets will cover.

[Looking forward, all collection managers need to consider a future with a different climate.]

The Tasmanian Arboretum's biogeographical layout had been a focus on the Palaeartic flora of the northern hemisphere region. In nature it is forecast that Palaeartic species will relocate pole ward or to an altitude where they can survive.

Although we hold very few plants from this flora we don't know which of these species may, or may not, tolerate the emerging climate at our arboretum.

Other plants might cease to produce seed but could last for some years as relicts, their rate of decline influenced by their tolerance of increased temperatures and changed rainfall patterns.

To manage that risk we are moving towards acquiring species distributed in warmer climates. However we are still limited to holding those species with a tolerance of our minimum temperature of -7°C with three frost free months and a rainfall low of 520mm this century.

The Tasmanian Arboretum Inc. is dedicated to the development of an arboretum of international standard. We cannot afford to neglect trees. They supply our physical needs for buildings, furniture, fibres, food and fuel. They are also essential worldwide for preservation of the environment, soil and water stability and the renewing of the air we breathe. They are also essential to supply our spiritual needs.

Oman Botanic Garden

Janelle Hatherly, Education and interpretation consultant

A national botanic garden – setting the vision

What an amazing country Oman is! The same size as Victoria with a population equal to that of Brisbane it is relatively easy to explore this Muslim country and become familiar with its rich centuries-old cultural heritage and natural diversity.

I have recently returned from a three-week holiday in Oman. My objective was to personally experience the major ecological habitats that make up this wonderful desert country and to reconnect with friends and colleagues of the Oman Botanic Garden (OBG) to see how work is progressing there to establish the first botanic garden in the country.

Oman's plant diversity and physical geography are on show everywhere and have not yet been totally obscured by urbanisation and industrialisation. That said, Oman is on the cusp of becoming a thriving 21st century modern society thanks to His Majesty Sultan Qaboos bin Said who came to power in 1970. Revered by all, and rightly so, Oman is beholden to this visionary leader for putting in place the planning, massive infrastructure and services needed to establish a healthy educated proud population and a resilient economy. Oman's economy is almost entirely reliant on oil revenue and is therefore susceptible to international trends.

**A prosperous Oman
reborn as a modern
State founded on
science, knowledge and
human endeavour.**

Oman's ultimate destination
as per his Majesty's historic
address on 23 July 1970



What makes Oman so special is that with only 50 years of modernisation, traditional family values and culture are still deeply rooted and widely practiced in contemporary society. From the outset of its modern renaissance, Oman has maintained an intense focus on education and is learning the best of the West and the rest of the world and adding this to its own rich Islamic and pre-Islamic heritage.

One of His Majesty's personal priorities is environmental sustainability and this includes the establishment of a national botanic garden. The site of the Oman Botanic Garden (approximately 430 hectares close to Muscat) was designated as a national protected area by Royal Decree in 2006. With a mission and vision to establish a facility to conserve the unique botanical and ethnobotanical heritage of the country it is intended to display Oman's plant species in exhibits that represent the different habitats of the country.

Starting from scratch

Once the intent, government endorsement and financial support were in place, strategic planning took place to:

- research, identify and document Oman's flora and habitats,
- collect and propagate a plant collection from scratch,
- imagine, develop and design public displays,
- build all the necessary infrastructure and visitor facilities, and most importantly,
- train staff in the various disciplines that make up contemporary botanic garden.

While it is not yet open to the public, the OBG is now at the point of realising something *very special*. To date:

The staff (around 80 and predominantly Omani) have obtained qualifications, undertaken on-the-job practical training and travelled abroad to study and improve their skills and understanding of best practices in a variety of disciplines including botany, horticulture, ethnobotany, education and landscape architecture.

Oman has a strong agricultural background yet the study of botany and horticulture and the concept of a botanic garden are relatively new. Staff have benefitted greatly from the opportunity to interact with other botanic garden(ers) and from working in environments that are different from Oman. The Oman Botanic Garden provides them with the ideal workplace to consolidate this academic knowledge with relevant practical experience.

For example, Ghudaina Al-Issaey earned her Bachelor of Science in Biotechnology and Environmental Sciences from Sultan Qaboos University in Oman (SQU) and went on to pursue her Master of Science in Biodiversity and Taxonomy of Plants at the University of Edinburgh in the UK. Ghudaina is a botanist at the OBG with a special interest in biogeography of Omani plants.



Ghudaina Al-Issaey in the field.
Photo: Ahmed Al-Shukaili



It was great to catch up again with OBG artist Laila Al Jahwari. Laila attended a master class with botanical illustrator Beverly Allen in Australia in 2013.

Abdulrahman Al Hinai is one of three ethnobotanists at the OBG. He has environmental science qualifications from SQU and has undertaken a month long internship at Missouri Botanic Gardens.

He is hugely passionate about his job and spends much of his time on field trips gathering and documenting local knowledge related to traditional plant uses. He says it is still not too late to learn age-old practices from traditional farmers and understands the importance of engaging the local community in social inclusion programs. Thanks to research like this, traditional varieties of wheat (for bread making) and crocuses (for saffron) have been discovered and will be conserved as part of OBG's living collection. Propagation tips and information on plant uses has also been meticulously recorded and spared from being lost.

Ismail Al-Rashdi, Senior Horticulture Specialist at OBG is a font of knowledge and experience when it comes to maintaining and propagating the wild plants of Oman. I was surprised to learn that 'the big stuff' – the baobabs, acacias, frankincense and other trees are relatively easy to grow in cultivation.

The plants (about 80% of Oman's 1300 native plant species) have been databased and are represented in the OBG's living collections, herbarium or seedbank.



Abdulrahman Al Hinai (centre) espouses the many virtues and uses of *Moringa peregrina* as well as the *Euphorbia riebeckii* beneath it to educator Mohammed Al Saidi and me. He also explains the falaj system of water allocation and staggered usage that has sustained village communities for centuries.



Ismail Al-Rashdi shows me a desert rose that has been rescued from a road construction site as well as the propagation and flowering of *Eulophia petersii*, one of only a handful of Oman's native orchids.



Dr Annette Patzelt oversees the development of OBG's herbarium.

Oman has been identified as one of the world's key 35 biodiversity hotspot areas that contain at least 1500 endemic species of vascular plants (> 0.5% of the world's total) and where at least 70% of the natural vegetation has been lost. Strategies are being put in place for ex-situ and in-situ conservation of the 78 strictly endemic species and 48 near-endemics. According to Scientific Director Dr Annette Patzelt, OBG is well on its way to establishing the largest collection of Arabian plant species anywhere in the world.

Annette has authored several books that make ideal field guides for the botanically-minded traveller like me and Senior Botanist Darach Lupton drew my attention to the latest update on OBG's plant collection in *SIBBALDIA: The Journal of Botanic Garden Horticulture*, No. 14 (pp 119-132). Click [here](#).

The nurseries have been significantly expanded over the last three years. Species diversity has increased and the number of each species rationalised so that exactly and only what is needed for display purposes (with 50% supplement for any attrition) is being propagated at this critical stage.

The nurseries have been significantly expanded over the last three years.

The on-site nursery area has doubled over the last three years and 1400 big trees have recently been planted in large planter boxes in advance of their final destination in the garden habitats and amenity areas. Two satellite nurseries have also been established in climate-appropriate locations at Jebel Akhdar (in the Northern Hajar Mountains) and Salalah (in the Southern Dhofar mountains) to propagate the wide range and huge numbers of plants needed for display.



Hanan Al Moqbali and Buthaina Al Rahaili of the OBG Propagation Team explain techniques to Salha Al Mahrouqi from Education and me. They also point out the Australian-invented bottom heating propagation mats.



The sign says 'tree for later translocation' – there's a sense that every plant needed for display is on its way to being collected or cultivated.



It's hard to photograph the extensive living plant collection.

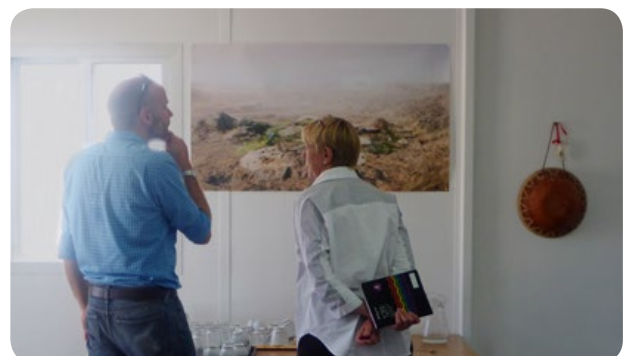
The Master Plan for the OBG has been reviewed and revised and the interpretive design and documentation phase for the 70-hectare public display area is nearing completion. In consultation with a large multi-disciplinary team of consultants including Arup, Grimshaw and Haley Sharpe Design (HSD) the whole OBG staff have been involved in numerous workshops and been on an amazing creative journey to work out – to the very last detail – the interpretation objectives, the landscape design and facility requirements before construction begins.

The whole staff is buoyant with anticipation and excitement. They have been consulted on every decision and are well on track to realise a world-class visitor experience (especially targeted at Omani locals). Everyone involved is 'on the same page' when it comes to what will be the final product and everyone is armed with the relevant information to play their part, whether it is researching and propagating the exact number and type of plants needed for the landscapes, developing exhibitions or documenting infrastructure elements.

Andrew Anderson, OBG's landscape architect tells me with great pride that there are about 10,000 individual construction drawings detailing technical specifications. Soon the construction tender will be let and it will be full steam ahead to transform the vision of a leader and the dreams of many into a reality.



OBG now looks like a construction site with sections pegged out, road works everywhere and signs of the location of built and natural elements.



Andrew Anderson outlining the key elements in the design concepts.

Imagining the finished product

Every botanic garden professional and committed voluntary pioneer who has been involved in developing a botanic garden from scratch understands that the gestation period is around 20 years. The genesis of the idea and its embryonic development are valued and savoured but the greatest pleasure comes with the birth and the final realisation of the vision. One thing is for certain, the OBG is set to be a world class cultural attraction and an integral part of Oman's contemporary renaissance.

The principal interpretation approach is to showcase the major habitats that make up this wonderful country in a 70-hectare public display area at the OBG. This will provide Omanis with a significant cultural attraction where they can relax with their families while they learn about the diverse ecosystems of the country.

Core messages have been developed to fully engage visitors with OBG's mission and vision. As they come to know Oman's natural habitats they will understand why their unique biodiversity must be valued and conserved. They will become familiar with research that is being undertaken – a growing body of knowledge they can actively contribute to. Their awareness about the importance of plants in Omani culture will be raised to the point that they'll be inspired to act to reduce the threatening processes that are putting many species at risk.

Modernisation is taking its toll on the natural environment of Oman and the OBG is already contributing significantly to a sustainable future. For example, OBG has recently published *Oman Plant Red Data Book* in which Dr Patzelt identifies the four categories of threat responsible for species decline in Oman. These are:

- Breakdown of traditional land management
- Development of human settlements and other non-agricultural land uses with a substantial footprint
- Human intrusion and disturbance
- Climate change.

A visit to the OBG in Muscat will also give international and local tourists insights into Oman's natural and cultural wonders which will be an incentive for them to venture further afield in this relatively small country.

The attractions

The greatest plant diversity exists in the mountainous regions of Oman – the Southern Mountains in the Dhofar region and in the Northern Hajar Mountains. These will be represented in two glasshouse biomes – the Southern Biome and Northern Biome (approx. 7500m² and 4500m² respectively). From the introductory information centre, visitors will be able to access these climate-controlled attractions by cable car and shaded walkways. By being refreshingly green as well as 'cool and dry' and 'wet and warm' spaces, the biomes will provide a welcome respite for locals and tourists all year round.

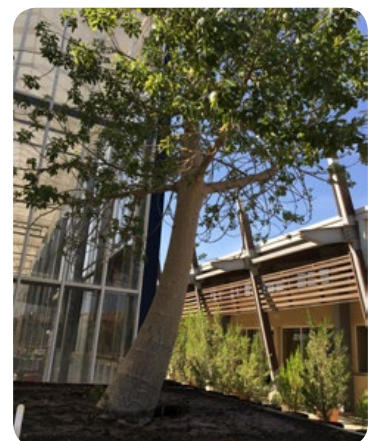
The Southern Biome will be particularly lush and will mirror the monsoonal season for an extended period of the year. The Dhofar Mountains and elevated coastal escarpments are different to anywhere else in the country with thick mists, waterfalls, fertile soil and rich woodland vegetation. Grazing cattle, goats and camels have created grassy slopes on the plateaus and banana, pawpaw and other tropical fruit plantations add a 'tropical' effect along the coast.

It's not surprising that around 70% of the total flora and the majority of the endemics are concentrated in Dhofar in Southern Oman. Specimens of as many of these as possible will be on display in the Southern Biome with

frankincense trees and its relatives, huge and endangered baobabs and the elephantine desert rose as signature living sculptures. Visitors can also look forward to seeing a 15 m waterfall along an escarpment.



Dry winter view of dense vegetation cover on the distant Dhofar ranges and a flowering *Delonix elata* in the foreground. The desert roses *Adenium obesum* were just starting to bloom.



Adansonia digitata in the wild and in cultivation at the OBG.

The Northern Biome will feature vegetation of the rugged Hajar Mountains that stretch 700 kms from the west to the east of northern Oman. These arid mountains are stunningly beautiful and rival the Grand Canyon in USA in scale and visual impact. It will be interesting to see how this will be theatrically portrayed in the Northern Biome.

The presence of large specimen trees (some hundreds of years old that have been rescued from road development sites) will help create the virtual reality. As visitors descend through the biome they'll encounter open woodland vegetation found at lower altitudes and the temperate fruits (pomegranates, almonds, apricots etc) and fragrant Damask roses that are cultivated on the plateau in the Jabal Akhdar range.



It's awesome discovering your first *Boswellia sacra* in the wild – and smelling its fragrant resin. For more than 2000 years frankincense was considered more precious than gold and frankincense from Dhofar is still considered to be the best in the world.



It was distressing to see herds of camels grazing on them!



Above 2000m the exposed, rocky slopes are dominated by gnarled juniper and olive trees. I was in Oman at the wrong time of the year to see verdant vertical terraces and loaded fruit trees in the mountain villages on Jebel Akhdar.



The Northern biome will lead into a natural outdoor display representing a typical wadi (valley with at least intermittent water) and its associated oasis settlement. Traditionally Omanis lived near natural water sources and springs and created a complex falaj irrigation system to enable them to grow all they needed in protected valleys or on terraced hillsides. Date palms (ubiquitous and with every part useable) are a distinctive feature of wadis at lower altitudes. They exist in villages such as these shown here, and in the Northern biome, ethnobotany as well as traditional Omani lifestyles will be showcased.

Other outdoor habitat displays will include:

- The gravel desert habitat that covers much of the coastal plains and the central inland areas in the north of the country. Consisting of a rocky substrate of limestone, sandstone and shale it has poor soil and is sparsely vegetated but bursts into bloom after the spring rains.
- Two different sand desert habitats are included. With rainfall less than 50 mm per year golden or white sands dominate the landscape and vegetation is sparse.



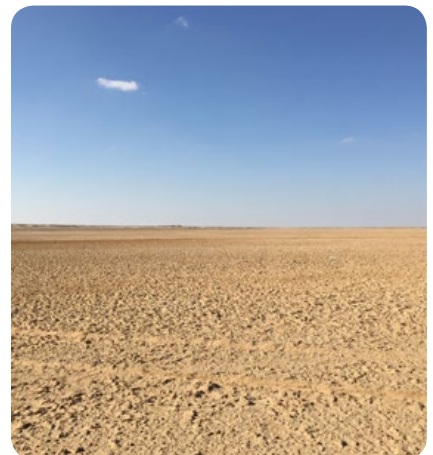
The picturesque villages of Balat Sayt and Misfat Al Abriyeen deep within the Hajar Mountains.



OBG's natural environment is an *Acacia tortilis* dominated gravel desert.



The central gravel desert is a clearly defined ecological unit of 40,000km². Irregular precipitation from fog allows for greater plant diversity.



Vast salt flats also occur in Oman. Most of this area is devoid of vegetation due to extraordinary salinity (sabkha). However plant growth is possible chiefly on miniature dunes, called nabkhas.



In sand deserts *Prosopis cineraria* is a familiar sight in wadi channels as are grasses and a few other hardy inhabitants.

The visitor experience

Oman has pleasant winter temperatures and during this time visitors to the OBG will be encouraged to explore the outdoor desert habitats areas, amenity spaces, three large natural play zones, a central events space and a demonstration garden as well as the two glass biomes. All plants on display will be geo-tagged and labelled, I'm told. All amenity areas of the garden will be landscaped using only the native plants of the country.

In summer outdoor temperatures can exceed 50 degrees making the outdoor experience less appealing. Yet in summertime, visitors will be able to comfortably experience these outdoor dry desert habitats from inside the Habitats Pavilion. With 360 degree views, 'interpretation plus' and engaging public programs visitors will augment this reality.

At the entrance there will also be a visitor centre with ticketing and information facilities, retail shop and refreshments.

Oman Botanic Garden is poised to become a regional leader in conservation, research and education. A large research centre and field studies centre is also under development on the site, including classrooms, an auditorium, laboratories, the seed bank, the herbarium, a library and other visitor services. The field studies centre will provide accommodation for visiting students and researchers.

For now, we just have to be patient and wait for this must-visit cultural destination to be completed. In the interim I can strongly recommend visiting Oman the country as a tourist destination. It's just perfect for nature lovers like us!

Botanic Gardens Reports

2nd Botanic Gardens Australia and New Zealand Open Day

The second Botanic Gardens Australia and New Zealand Open Day has been confirmed for 28 May 2017. Save the date in your diaries and let's make 2017's event bigger and better. With over 75 gardens and arboreta involved in the inaugural event, it is sure to be another great day to promote the value of BGANZ and the work we all do.

[Register your Garden today.](#)



BGANZ Council signs with SMSOnline sponsorship consultant

BGANZ President John Sandham said: 'Since its inception in 2004, BGANZ has operated on a moderate annual budget. BGANZ's growth will be greatly influenced by the level of financial resources it can achieve.

Our BGANZ Business Plan has increased financial resources as a major goal. To achieve this goal BGANZ Council has taken the exciting step to engage the services of SMSOnline, Sponsorship Consultants, with a deliberate aim to significantly increase BGANZ financial resources.'

A three day workshop will be held in Canberra 22-24 March and a BGANZ team, led by Peter Bryon, Manager Australian National Botanic Garden to work towards securing increased sponsorship over the next 12-18 months.

New BGANZ website nears completion

Brad Crème (Bendigo Botanic Gardens) has led a small BGANZ Web Development team to review the current BGANZ communications programs with a major focus on the BGANZ website.

Chromatix has been engaged to design and build the new BGANZ website. Chromatix is a leading web and communications. BGANZ hopes to launch the new BGANZ website in coming weeks.

BGANZ awards program 2017 – Don't miss out!

BGANZ members are entitled to apply and gain, if the judging panel decides, more than one award. For full details of the all awards application and selection process go to www.bganz.org.au

Calendar of conferences and events

8th BGANZ Congress 22-25 October 2017

The 8th BGANZ Congress will be hosted by Botanic Gardens of South Australia. This is the first BGANZ Congress to be held in Adelaide. All information including program, keynote speakers and registration details can [be found here](#).

6th SEA Botanic Gardens Network Conference 24-28 April 2017

The South East Asia conference to be held in Vietnam will include two main components: SEABG business meeting and a technical capacity building workshop. [Conference details](#).

Tropical Plant Identification Course 15-26 May 2017

This will be held in Kew Gardens in UK. Taught by Kew botanists, all with an in-depth knowledge of the plants and habitats of the tropics, the course will give participants an overview of 70 of the most commonly encountered tropical plant families, using morphological key 'spotting' characters. [More details](#).

APGA Annual Conference Hamilton Botanic Gardens, Ontario, Canada 19-23 June 2017

Please note: One BGANZ Member can receive a free APGA Conference Registration (Value; \$750 USD approx.)

BGCI's 6th Global Botanic Gardens Congress 26-30 June 2017

To be held in Geneva Switzerland. Information as it comes to hand on this and other international events as well as proceedings of past conferences can be found [here](#).

Australasian Botanic Gardens Volunteer Guides Conference 15-19 October 2017

This will be held in Canberra and hosted by The Australian National Botanic Gardens.
[For more information.](#)

Farm Health and Safety Conference 30 October – 1 November 2017

Farmsafe Australia holds a biennial Conference to bring people together to look at ways to reduce injury on Australian farms. The Conference aims to facilitate the exchange of information, research and innovation, with the desired outcome being to develop practical solutions for addressing farm safety. This year the 2017 Conference (to be held in Cairns) will look at Creating a resilient, safe and healthy agricultural community'. [Details here.](#)



www.bganz.org.au