THE BOTANIC GARDEN

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THE BOTANIC GARDEN
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PRESIDENT'S VIEW

Changing behaviour

Philip Moors

Sub-tropical warmth and lush vegetation provided the backdrop for the recent highly successful BGANZ Congress in Mackay on the central Queensland coast. Our hosts were the Mackay Regional Botanic Garden and the Mackay Regional Council, and they ensured that the 125 or so participants were very well cared for. The Congress theme of 'Plan(e)t priority: regional reality' produced stimulating presentations on botanic gardens and climate change, population growth, sustainability, collections management, regional gardens and related subjects. The conference was the first to be held in the newly-opened Mackay Entertainment and Convention Centre and we enjoyed its excellent facilities, not to mention mouth-watering catering! Field trips to the Mackay Regional Botanic Garden and Eungella National Park were very popular, and the developments achieved and planned at the Garden were most impressive. Opened in 2003, the Garden focuses on displays of regional flora in landscaped settings beside a billabong of the Pioneer River.

I am most appreciative of all the organising and planning done by our local hosts, led by Helen Paulsen and Dale Arvidsson, and by Samantha Morris from conference organiser Wombat Creative. The Congress was generously sponsored by Mackay Regional Council, Replas Ltd, TerraCottem©, Horticultural Training Pty Ltd, and the South West Institute of TAFE.

The Congress program included a workshop session on the current and future directions of BGANZ. The discussions included information arising from the initial analysis of responses to the recent web-based survey of members and non-members (thank you to everybody who responded!). Workshop participants raised a number of ideas for future action which Council will be considering, together with receiving further results from the survey. Several workshop suggestions are already being acted on – for example, setting up members-only special interest discussion groups on the BGANZ website (a databasing group is under way) and having a members-only section of the website containing copies of garden documents such as master plans, water management plans, living collections policies, and education plans. These can then be used or modified by other gardens without the need to 're-invent' wholly new documents.

Our botanic gardens – whatever their size or location - are in challenging times due to resourcing pressures, impacts of climate change (both to the gardens and our communities), population growth, and the need to demonstrate relevance to government and community priorities. All of us have useful roles to play in meeting these challenges, both by exemplifying the regional reality of the Congress theme and by collaborating through BGANZ and internationally through BGCI. 'Changing behaviour' should be our focus – changing our own behaviour in how we sustainably manage our gardens, in making this the key purpose of our educational and visitor programs, and changing our community's behaviour in order to mitigate climate change and live more sustainably.

BGANZ Council 2009-2011

The two-year terms of appointment of Councillors expired at the BGANZ Annual General Meeting in Mackay, and I am grateful for the contributions all Councillors have made to BGANZ's progress since 2007. Two Councillors have retired – Trevor Christensen (South Australia) and Helen Paulsen (Queensland) – and I warmly thank them for everything that they have done for BGANZ during the two terms each has served on Council.

Under the BGANZ Constitution, Council comprises representatives elected or appointed by the four Regional Groups, gardens in other States, and the Council of Heads of Australian Botanic Gardens (CHABG). In accordance with constitutional provisions, these various representatives have now been finalised for the incoming Council and Council has subsequently elected office-holders for the next two years. I welcome new Councillors Dale Arvidsson (Queensland; Mackay Regional Botanic Garden), Michael Anlezark (South Australia; Australian Arid Lands Botanic Garden) and Tim Entwisle (CHABG; Botanic Gardens Trust, Sydney); Mark Webb has retired as one of the two CHABG representatives, but remains as the Western Australian representative.

Council and Office-holders for 2009-2011 are:

President - Philip Moors
Vice-President New Zealand - Alan Matchett
Vice-President Australia - Tim Entwisle
Secretary/Treasurer and Public Officer - Anne Duncan

Councillors

- Gary Fry (Northern Territory)
- Mark Webb (Western Australia)
- Michael Anlezark (South Australia)
- Mark Fountain (Tasmania)
- Annette Zealley (Victoria)
- Paul Scannell (New South Wales)
- Dale Arvidsson (Queensland)
- David Sole (New Zealand)

Your Council looks forward with enthusiasm to serving BGANZ and its membership over the next two years.

BGANZ Congress 2011

The Congress in 2011 will be hosted by the Alice Springs Desert Park, and preliminary planning has already started. The conference will be a joint meeting with the Australasian Regional Association of Zoological Parks and Aquaria (ARAZPA), the first time this has occurred. This event has been organised in recognition of the many areas of common interest between botanic gardens and zoos.

BGANZ CONGRESS 2009 IN MACKAY

BGANZ Goes Tropical!

Helen Paulsen

Warm temperatures, sunny days and mild evenings typified the conditions for the setting of the fourth Biennial BGANZ Congress held recently in the tropical city of Mackay, North Queensland. One hundred and seventeen delegates attended a packed two days of keynotes addresses and plenary sessions themed on Plan(e)t Priority: Regional Reality. Speakers presented information on the status of the bioregions in the future of Climate Change and investigated the already visible impacts of this upon botanic gardens within Australia and New Zealand.

The conservation of species through ex-situ preservation and the collections held within botanic gardens were identified as an important role for the gardens and also supported the goals of Botanic Gardens Conservation International Global Strategy for Plant Conservation. Many Australian and New Zealand botanic gardens are working on identifying species that have shrinking habitats as a result of global warming, and are therefore threatened in their current locations. Further work and partnerships are required to preserve these vulnerable species in suitable locations.

Delegates were challenged to consider the effect of a growing global population and the impact that this will have on food production capabilities as well as the reduction in agricultural land through residential infrastructure. Man's impact on nature has been influencing flora and fauna for centuries, however the added pressure of global warming has the potential to accelerate the consequences upon our environment. Botanic gardens have a role in ensuring that species are not lost as a consequence of this expansion.

The question of having a National Collection initiative for Australia presented delegates with options for longevity of collections housed within Botanic Gardens. The role that regional gardens undertake in preservation of regional species should not be undervalued as Australia and New Zealand gardens are generally located in diverse climatic locales.

How gardens present their research and information to visitors was explored through workshop and speaker presentations. An interactive workshop further discussed the roles and content of visitor services programs to school groups and other visitor groups. The provision of interpretation and guided interactive programs to the public continues to be a vital role of the botanic gardens throughout Australia and New Zealand. Quality of visitor services has been researched through the University of South Australia in conjunction with some of the botanic gardens who were represented at the congress. Engagement and learning were the two main areas that visitors to our gardens have the greatest interactive response when surveyed. Quality of food outlets also contributes to the patronage to gardens, where quality food equates to increased patronage.

Play facilities in botanic gardens attract parents and children to our gardens. Through interactive play environments the children explore various environments and have the opportunity to touch and smell plants from the local areas. The children are the future of Botanic Gardens and gardens continue to have a vital role in educating the future generations in the importance of plants to human existence.

Bendigo Botanic Gardens have completed a master plan that was available in CD format for delegates to take with them and provide comment to Bendigo in the near future. The master plan will give direction for future collections and will support funding applications in the future. There is a growing awareness of the importance of a Master Plan to guide development and for financial planning the operations and construction programs.
Poster presentations in the main hall and trade displays enhanced the meal breaks where networking and one-on-one interactions dominated. Displays focused upon the works within the gardens on display and the proposed expansion projects and future directions of some of the gardens. Delegates had opportunity to discuss the future of their gardens during the meal breaks and at nominated meeting times.

Sponsors displayed product, distributed brochures and booklets as well as samples to the delegates. Gold sponsor - Replas Industries provided a recycled tree guard as a prize to delegates who visited their display and entered the draw. Toowoomba Botanic Gardens representatives were excited to include this in their take-home luggage. Silver sponsor TerraCottem distributed samples, and many informative discussions were held regarding the benefits of this soil conditioner at the TerraCottem display. Ongoing training courses were set up and will no doubt be useful to many gardens and horticulture staff from the representative organisations at the congress. Horticulture Training Pty Ltd were also sponsors of the congress. They supply specialist horticulture study delivery in the workplace and have been involved with the training of many botanic gardens staff in Queensland over recent years.

Along with any memorable congress attendance is the venue and support facilities, including the food. I can confidently say that there was not one delegate who did not leave more than satisfied with the food on offer throughout the congress. The congress dinner on the Saturday night served up the final dessert in fine style - chocolate mouse encased in dark chocolate mounds with coloured white chocolate orchid flowers adorning the centre piece. The inspiration for this dessert came from the Mackay Regional Botanic Gardens Visitor Complex which is modeled upon an orchid flower layout for its design. The recently opened Mackay Entertainment and Convention Centre (MECC for short) was the venue for the congress proceedings. This congress was the first congress, conference or convention style event held in the new venue, and proved that the staff, facilities and program all worked without major hitch. The Mackay Regional Council is proud to have been able to offer this venue for the congress along with other sponsorship support for the event.

Throughout the congress the wonderful support and efforts of the Mackay Regional Botanic Gardens Friends Association members provided a colourful and vital role in hosting Garden walks, attending sessions and providing timekeeper duties and also arranging the decorations for the venue. The floral displays on the break-out tables and the main dinner displays were provided by Ann Douglas with flowers and plant material native to the Mackay Region. The displays added a touch of regional reality to the congress and were most decorative. The Garden Friends worked tirelessly in the months prior to the congress undertaking planting and support to the Botanic Gardens staff to prepare the gardens for the visitors to the city and the congress delegates.

On behalf of Dale Arvidsson, Maya Harrison, Muriel Green, Simone Minnican and myself, thank you to all who made the journey to our fair city, those who assisted behind the scenes and the staff at the MECC, and we hope to see you again when you visit our wonderful and rich region.

Field Trip to Eungella National Park, Sunday 11 October 2009

Alan Matchett, Team Leader / Curator, Dunedin Botanic Garden

It was a fine sunny morning when Helen Paulsen gave the thumbs up to make tracks to the extremities of her regional priorities and into the wilds of Eungella National Park some 1.5 hrs distant. Travelling up the expansive Pioneer River Valley Helen gave an informative account of the local sugar industry, farming practices and interesting insights into lifestyles and the favourite watering holes of the locals.

top left **Helen as our tour guide**
above **The author/ photographer**
Credit B. Wimmer

As we made the steep ascent up the narrow and winding road the fragile nature of the soils exposed at the roadside cuttings and ravaged by the seasonal downpours was plainly evident, as were effects of deforestation and marginal land use practices on nearby hills. At this point the sight of the gracefully arching fronds of Cyathea cooperi on the cooler gully faces was a pleasantly familiar sight.

Coming from New Zealand I was eagerly awaiting the sight of prime dairy country as was alluded to by Helen and further embellished by a roadside sign claiming this as "Cattle Country" while at the same time advertising a local "bull sale". Thoughts of green grass and cows quickly passed as we entered the Broken River section of the Eungella National Park. With the bus parked and a few final words of wisdom from Helen it was a rush to the platypus viewing platform alongside the Broken River. As luck would have it any platypus there may have been were already well tucked up in their stream side burrows. Such shyness was not shared by the multitude of turtles gathered for our pleasure. However, a lone water dragon much less certain of our intentions quickly sought refuge from our searching eyes.

Before moving on to the forest walk Paul Harris of the Queensland Park Service welcomed us to the land of the Birragubba, a vast landscape encompassing the Eungella National Park and ranging in altitude from 120m to 1300m. Disappointed that the Parks ambassadors had eluded us Paul's offer of a close encounter with the Parks 'special purpose' platypus was politely turned down in favour of savouring the experience for the real thing - well one that was actually alive ……thanks for the kind thought Paul.

After a quick top up with fluids the party covered the last 100m to the start of the Discovery Walk to be warmly greeted and escorted into the forest by members of the Mackay branch of the Society for Growing Australian Plants. A table of the group's library books provided for our perusal attracted a lot of attention and valuable point of reference for those of us not familiar with the local vegetation. Furthermore a souvenir booklet 'Complex Notophyll Vine Forest and Climate Change' was specially prepared for participating BGANZ congress members. This is a wonderfully prepared publication giving an excellent account of the forest vegetation encountered along the margins of the Broken River Discovery Walk.

This was my first experience of a subtropical rainforest, and what was immediately noticeable to me was just how dry it was. Granted with such distinct seasonal rain events exacerbated by what is an extended dry season with no rain of any consequence since May, the thought of a dry rain forest - while intriguing - was disturbing. This has become the trend in recent years, and as explained is bound to have a long lasting effect on this increasingly fragile environment. With an annual rain fall of around 1980mm this is very different for example to the temperate rainforests of the Fiords and West Coast of New Zealand's South Island where rainfall ranges from 3 to 8m annually. But unlike in the Eungella this is likely to increase even more. However, we were assured that when rain does come to the Eungella the effects of the 80mm per hour downpours soon alters any notions of drought very quickly.

Not only was the forest floor in the National Park crunchy and dry (and potentially a huge fire risk), the same effect was visually noticeable in the canopy 35 – 40 m above. Giant hanging wads of elk-horn and birds nest fern were clearly under stress. Other evidence could be seen where these large organic masses had shrunk and contracted so much losing their ' supporting grip' on host tree trunks and fallen to the forest floor taking all and sundry with them.

This introduction to the rainforest vegetation, while quite different in terms of what many of us were familiar with, still had a familiar look to it particularly the vertical stratification profile. There was the rich diversity of ground covers such the ferns including the black stem maiden hair and sedges such as Carex spp. The sub-canopy included emergent palms like the numerous Livistonia australis and smaller shrubs like the Shute harbour Gardenia. It guided my view finally to the towering canopy of the Tulip oak and Red Cedar. The presence of huge twisting lianes climbing skywards and the epiphytes and perching plants completed the picture of this incredible vegetation type.

Without the expertise of our hosts the rainforest would likely have remained a mystery to me, and I am sure I speak on behalf of all BGANZ members present on the Discovery Walk tour we are much the richer for it. The knowledge and passion for the unique Eungella rainforest was obvious. Grant, Irene and the rest of the team, thank you so much for sharing your knowledge with us.

BGANZ members on field trip to the Eungella Ranges

Networking results from the Congress

Gary Fry

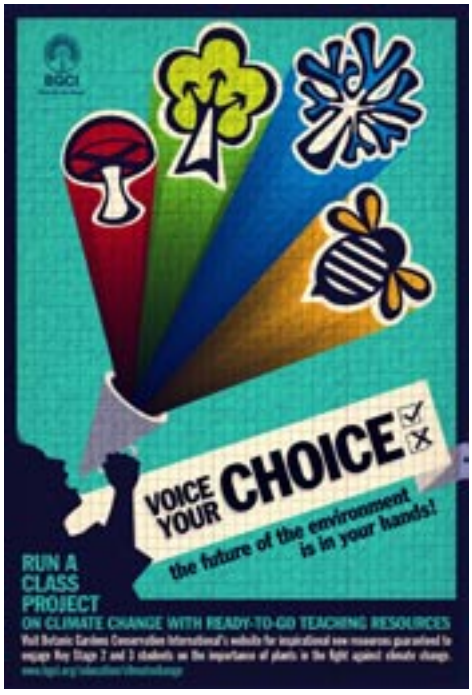
Some of the people involved and interested in plant records met at the Mackay Congress. There was a brief discussion about setting up a web site that will be available by invitation only. Initially, we expect that the website will be about sharing information about plant records, procedures and standards. It might be that a garden has a procedure for mapping plants of which they are proud, and which works well. That garden may be willing to share that procedure. The website will have a series of links to useful sites. It may well have information from other records management groups which might inspire and guide. Sarah White and Tom Myers have commenced discussions and will be working with a some other people who expressed interest in being involved at a high level - Rob Smith, Andrea Dennis, John Sandham, Sabine Glissman-Gough, and Yvonne Etherington. A detailed article will be published in the next newsletter. In the meantime, please register your interest with Sarah.White@nt.gov.au. The Desert Park has offered to convene this group until the next Congress in Alice Springs in 2011.

REPORTS

News from BGCI

Belinda Hawkins

Our education for climate change portal went live last month. It contains a brilliant, ready-to-go, professionally designed teaching activity called 'Voice your Choice'. The idea is that classes split into 4 groups – for younger children either bees, algae, fungi or trees, for older children either Brazil wood, banana bat, Rosy periwinkle or sphagnum moss - each group makes a case for the survival of their group or species above all the others, a vote and debate follows and the children create ballot papers, badges and cases for support. The idea of course is that we need all species to form a functioning ecosystem: every species matters, especially in light of climate change. Within the portal there are also 8 other new teaching activities, drawn from case studies from our Plants and climate change: which future? report. These take the form of investigations and games, all illustrating aspects of climate change. For example, 'Where have all the fish gone?' looks at why there are no fish left in the Akosombo Dam in Ghana and asks; what has this got to do with plants? The activity '*Talking graphs*' encourages children to consider energy consumption in different countries and '*Alpine plants in trouble*' looks at where can alpine plants can go as the climate changes. The portal also a generic plants and climate change Powerpoint presentation, details of the Fairchild Challenge BGCI option (which sees children designing a front cover for a London band's new single, called '*Footprints*'), a climate change botanic garden tour which enables you to create a climate change trail in your garden and links to lots of other climate change education resources.



Happily, we've been able to translate Voice your Choice and 4 of the new teaching activities into Spanish and Chinese (Mandarin). This means that the resources are available in three of the most spoken languages in the world and we very much hope they will be picked up and distributed widely. The Spanish and Chinese portals, with all the resources available to download for free, are being launched in Taiwan on 17th November – to coincide with the 2nd Meeting of the South East Asia Botanic Garden Network. Douglas Gibbs from BGCI will launch the portals before the important meeting for this fledgling network gets underway.

Also in the Asia Pacific region, the new International Certificate in Botanic Garden Management in the Asia Pacific Region is due to run on 5 - 20th March 2010, at Singapore Botanic Gardens. This new two-week training course covers major present-day themes of practical conservation work at botanic gardens. It is designed to help representatives from the Asia Pacific region involved in botanic garden and arboretum management (in particular horticultural staff and mid-level managers) refresh their existing skills, understand global environmental policy, explore new ideas and engage with botanic garden experts from around the world. The course is run by BGCI, Botanic Gardens of Australia and New Zealand (BGANZ) and Singapore Botanic Gardens.

Next time we'll be able to report back from BGCI's 7th International Congress on Education in Botanic Gardens, happening on 1 - 6 November 2009 in Durban, South Africa. By then preparations will also be well underway for the 4th Global Botanic Gardens Congress (4GBGC), being held in Ireland, June 13-18, 2010.

Lastly, since this issue is on water management you might like to download Issue 4.2: Making waves for water conservation - of Roots, our bi-annual education review. This issue was all about water conservation and the intimate and complex relationship between plants and water. Healthy and diverse plant cover is essential in maintaining viable watersheds, streams and lakes. They hold soil in place, control stream flows and filter sediments from water. Wetlands, among the most productive ecosystems on Earth, provide habitats for a very wide range of plants and animals and are important breeding and nursery areas for fish, birds and invertebrates. They also act as a buffer zone between landscapes. Yet the destruction of wetlands and forests is an all too familiar story and a major cause of increased flooding and lack of fresh water. Global climate change is likely to amplify the range and impact of both flooding and drought. Botanic gardens are in ideal positions to raise awareness about these issues so this issue of Roots highlighted some of the valuable work they are doing.

WATER MANAGEMENT

Water conservation initiatives of the Royal Botanic Gardens Melbourne

Peter Symes

Background

The availability of water for urban landscapes is under increasing threat, whether from regulation, social-political views, population demand or the impacts of climate change. Most Australian cities have imposed severe water restrictions at some stage within the last decade. Melbourne is currently on stringent restrictions and approaching critical water shortages after a decade of unprecedented below average rainfall conditions. It was through strategic planning that RBG Melbourne began its water management journey in 1993, well before the current water crisis now experienced in Victoria. The Gardens became recognised as a leader in urban landscape management. Public recognition of RBG Melbourne's achievements was highlighted by the Savewater awards with the RBG winning Garden and Design Construction categories in 2003, 2004 and reaching the finalist shortlist in 2003 (Efficiency in Government) and the Garden Management category in 2005 and 2006. RBG Melbourne is believed to be the first Australian Botanic Garden to develop irrigation management plans to guide efficient water use. These plans have been resourced by local government agencies and other Botanic Gardens in developing efficient irrigation practices (Devin Riles pers. comm. 2008, Irrigation Specialist, Denver Botanic Gardens, USA).

The picturesque landscape of the Royal Botanic Gardens Melbourne covers over 38 hectares of managed land. Over 50,000 individual plants are cultivated in the living collections representing a diverse 12,000 taxa from a variety of habitats and geographical locations around the world. Considerable benefits are provided to the community with the Gardens enjoying over 1.6 million visitors during 2007-08 which was a 14% increase from 2006-07.

RBG Melbourne's intrinsic diversity of plants, environments, soils, landscapes and functional activities presented both stimulating challenges and opportunities for adopting appropriate strategies to improve water use efficiency.

Strategies to improve water use efficiency

Strategy 1 – Upgrade delivery infrastructure

Past landscape irrigation practices revolved around the daytime use of an inefficient manually operated hose and sprinkler system. Water losses to evaporation are highest during the day and these are exacerbated by more exposure to wind. Another significant issue was that up to 70% of Curator's time was estimated to be spent on just shifting sprinklers.

Following extensive hydraulic modelling and soils surveys, the installation of an automatic irrigation system (AIS) was completed during 1993-1994 at a cost of over AUD $1.3 million. Careful attention was give to installation techniques such as directional boring to ensure minimal disruption to the mature landscape, particularly the health of existing trees. Today the PC centrally-controlled system comprises of 18 satellite controllers, 480 stations, 6,800 sprinklers, 4 flow sensors, 16 soil moisture sensors and over 40 kilometres of pipework. In consideration of the past historical difficulties to effectively irrigate the living collections, the completion of the AIS was a very significant milestone for the Gardens.

Upgrading of delivery infrastructure is a continuing process. For example, sprinklers are progressively replaced with more efficient models and most existing spray systems have been retrofitted with rotating, multi-stream sprinklers that have improved uniformity characteristics.

Strategy 2 – Focus on professional development

In 1995, water management training and subsequent development of irrigation scheduling methodologies was facilitated by Burnley Campus, The University of Melbourne. This training initiated an improvement in understanding soil hydrology, plant water use and climatic factors at a time when the knowledge of urban water management was very limited.

Following the training there was an immediate improvement in water use efficiency of about 230%. Commitment to professional development and the practice of applied science cannot be over emphasised. For example, the total cost of the training programs in Melbourne gardens is estimated to be less than AUD$5,000, while RBG employees have helped deliver water savings since that time of about AUD$1.4 million. This is an astute investment by any measure. Water management development programs are continued to ensure that employees are provided with the current scientific information and skills to inform horticultural judgement. The present reputation of RBG Melbourne as an efficient water user in the community and its continuing development of water management strategy can be primarily attributed to the early development of employee expertise in water management.

Strategy 3 - Develop research and industry partnerships
One of the core values of the Gardens is the emphasis in the development of strong relationships with other organisations for mutual research outcomes. Applied science and industry expertise are vital foundations for continuous improvement.

University of Melbourne
Since 1995, RBG Melbourne and University of Melbourne continued on from those early training programs to develop a strong partnership in urban water management research and publication including technical presentations at various conferences. Currently, this partnership includes an industry partner - Sentek Pty Ltd an Australian manufacturer of soil moisture sensors in a project to examine landscape water use against inputs from soil moisture data, automatic weather station and human insight through horticultural judgement. Methodologies are currently being developed to assist in the management of complex landscapes under water scarce conditions and according to soil moisture stress indicators. A paper was presented at the Irrigation Australia national conference in May 2008 and further publications and workshops are planned in the future to support the improvement of urban water management.

Monash University
Monash University and RBG Melbourne are also engaged in a project to study rainfall interception by mature tree canopies in the urban landscape. Indicative results indicate interception losses (Xiao et al. 2000) of up to and over 60% of monthly rainfall. This is an important issue as there is some evidence that the nature of rainfall patterns in Melbourne is also changing to the extent that more rainfall will be intercepted (David Dunkerley pers. comm 2009, Associate Professor, School of Geography and Environmental Science, Monash University) notwithstanding any further impacts from climate change. With tree canopy coverage of over 60% across its landscape, the study of rainfall interception is very pertinent as an water management issue for RBG Melbourne.

The quality of existing water bodies is also a very important consideration when focussing on integrating site hydrology. The Water Studies Centre, Monash University and RBG Melbourne have been working together through quality student projects to build a knowledge base on the RBG Lakes System for improving water quality, ecosystem functioning and future capacity for water storage.

Irrigation Australia

RBG Melbourne has been a member of the peak industry body - Irrigation Australia (IAL) for about a decade. Since 2004, the Gardens have been the preferred host site of IAL in Melbourne for the delivery of irrigation efficiency training due to the added value of its water management experience and site diversity. Over ten workshops have been sponsored by the Gardens so far to extend the benefits of water management expertise into the wider community.

South East Water

Since 1999, RBG Melbourne has enjoyed a strong relationship with its water authority - South East Water Limited (SEWL) through delivery of water conservation information to the community, initially through the award-winning Water Conservation Garden. This collection was developed and is maintained by sponsorship from SEWL. Due to its track record in significant water conservation and heritage importance, RBG Melbourne has been allowed limited exemptions by SEWL from water restrictions since November 2002. SEWL regularly draw on the water management expertise of RBG Melbourne when examining urban water management in the broader sector.

Strategy 4 - Improve application efficiency

Improve sprinkler effectiveness

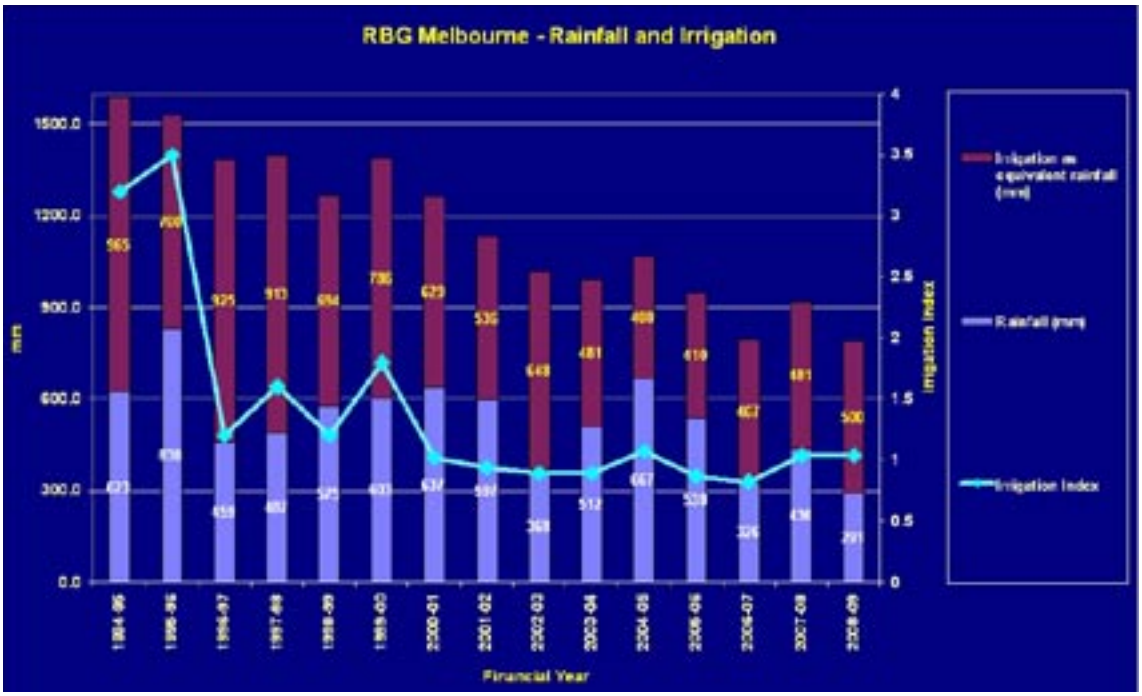
Interception of the sprinkler stream by foliage, branches and trunks of plants compromises effective delivery. Stream-type sprinklers are more effective and efficient than sprays in delivering water through shrubberies and were adopted widely across the landscape. Most spray-type sprinklers have been replaced with modern multi-stream types. These were found to be significantly more efficient when tested by horticultural employees. Some of the current difficulties are maintaining reasonable clearance around sprinklers through plant selection and judicious pruning to optimise sprinkler performance.

Optimising the use of rainfall

Attaining high levels of efficiency also involve making the best use of any rainfall. The effective use of a 10 mm rainfall event across RBG Melbourne results in a potential saving of 3.8 million litres (megalitres) of water or 3,800 tonnes or AUD$4,600 in today's costs. In early 1999, improvements to flow management and pressure resulted in an increase of the effective flow rate of the irrigation from 35 L/s to 50 L/s. Although available flow rate was increased by 43%, average irrigation water use decreased by about 40-50% during 1999-2007. The generation of high flow capacity through hydraulic efficiency provides much greater flexibility in scheduling as operators can afford to delay irrigation and increase the probability of harvesting additional rainfall.

Measure performance

Many performance measures proposed to determine water use efficiency are best suited to production agriculture and horticulture (turf-farms, floriculture) where the end product can be measured in quantity compared to the water used. Irrigation performance for ornamental landscapes is often subjectively measured in a qualitative manner as plant aesthetics and health are regarded as paramount. RBG adopted an irrigation management performance indicator called the Irrigation Index (Ii). This indicator accounts for climatic conditions and specific plant water use rates. It is calculated by dividing the volume of water actually applied to the site by the estimated requirement. For example, an irrigation index of 1.0 is the 'ideal' rating, while a result of 1.3 would possibly indicate a 30% oversupply. From 2000-2009, during severe drought conditions, irrigation indexes of 1 have been consistently achieved. In more recent years an irrigation/rainfall aggregate of <900mm per annum and less than 90 litres/visitor/year have also been set as benchmark targets to cater for climate change shift and increased visitation demands. Auditing of irrigation systems is also undertaken by specially trained staff to assess efficiency. Distribution Uniformity (DU) is a measurement of sprinkler uniformity. The RBG aims to maintain all sprinkler irrigated turf areas with a Distribution Uniformity (DU) value greater than 75%.



Strategy 5 - Adopt current technology

Automatic weather station

Horticultural staff initially relied on climatic information supplied by the Melbourne Bureau of Meteorology to guide irrigation scheduling. However this data was non representative of site conditions. In 1998, an automatic weather station (AWS) was installed in RBG Melbourne to provide climatic data to assist irrigation management, obtain records for BOM, and assist in the horticultural management of the site. A modified Penman-Monteith algorithm (FAO 1990). calculates the evapotranspiration rate (ETo) of a standard 'crop' from a wide range of climatic variables such as solar radiation, air temperature, wind speed and relative humidity.

Crop coefficients (Kc) (Allen et al. 1998; FAO 1990). are required as modifying values to adjust ETo and calculate evapotranspiration of distinct plant types or landscape zones. Up to four specific landscape irrigation schedules (High X, High, Medium and Low) based on distinct landscape coefficients K_L (Costello and Jones 2000) are applied to both garden and turf areas (Connellan G and Symes P 2006). It has been the Garden's experience that weather-based irrigation scheduling can be successfully applied to maintain the health of highly diverse plant collections and landscapes.

Soil moisture sensors

Sixteen tension-based 'Watermatic' soil moisture sensors are installed in turf areas across the Gardens and the data is directly feed back to the irrigation control system for monitoring. This system has the ability to cease irrigation upon reaching certain set-points in soil moisture.

Up to date and detailed knowledge of the extraction of soil moisture from the different soil layers in the garden beds at RBG Melbourne (RBGM) is proving to be extremely valuable in the water management of these gardens. In a collaborative project with Sentek Pty Ltd and the University of Melbourne, landscape soil moisture is being monitored by multi-sensor capacitance type probes (EnviroSCAN®), supplied by Sentek Pty. Ltd in selected garden beds. This information is continuously relayed at frequent intervals to a host website from where it can be viewed and analysed by the project partners.

Soil moisture sensing technology assists adaptive irrigation management in providing information on actual plant water use rates, rainfall effectiveness, drainage rates; the influences of mulch, overhead tree canopy and water repellent soil on soil hydrology.

Strategy 6 – Reduce water demand

Warm-season grasses

Due to physiological (C4 photosynthesis) and morphological adaptations (deeper rooting), warm-season grasses are more efficient users of water than cool-season species and can be managed to use up to 30% less water. Changing landscape turf composition from cool-season grasses to one dominated by warm-season species, either by management techniques or direct propagation, was one strategy to improve water use efficiency. A form of regulated deficit irrigation (RDI) is also applied to transition from a domination of cool-season grass to warm-season in early summer. This has been successfully managed to the extent that turf areas in the Gardens now use less water annually compared to garden beds.

Water sensitive urban design

The Water Conservation Garden and the Melbourne-indigenous flora collection developed at Long Island are key examples of proactive landscape planning to reduce water demand. Both areas are more adapted to Melbourne's climate, including seasonal dry periods. Long Island receives no supplementary irrigation and the Water Conservation Garden is watered at about 50% of other moderately irrigated garden areas. Guilfoyles Volcano is a landmark project currently in progress and combines a heritage water supply storage, xerophytic, climate-suitable plantscape, stormwater reuse, efficient irrigation and innovative water quality treatment using floating wetlands.

Strategy 7 - Diversify alternative water sources

The Gardens is currently planning the development of a stormwater harvesting system and improvement of Ornamental Lake water quality through recirculation, bioremediation and wetland development. About 50% of the funding has been provided for the construction of the AUD$2.2 million 'Working Wetlands' scheme through philanthropic donation, whilst the rest is being sought through government. Once constructed, the projected additional annual water volumes are considered to provide enough water to maintain the health of the Lake and some potential for irrigation reuse. For water supply security, additional sources of decentralised alternative water supplies are currently being sought, particularly those that do not rely on continued patterns of average rainfall. Current projections are suggesting a potential decrease in average rainfall for the Port Philip Catchment of Melbourne (where RBG Melbourne is situated) of up to 24% less by 2070 (DSE 2008).

<16 Working Wetlands Stage 2 General Layout Schematic>

Strategy 8 – Adapt to climate change

Plant selection methodologies are being applied to facilitate a transition to a landscape more suited to less water demand and greater heat tolerance over the next 50 years, whilst still maintaining the heritage style. Gardens policy has been developed and documented through the Masterplan Review and Living Collections policy. Regardless of whether alternative water sources can be identified, RBG Melbourne is still planning for the future on the basis of increasing average (up to 2.6 degrees Celsius by 2070) (DSE 2008). Whilst extremes in temperatures are also a threatening process for the landscape – in late January 2009, Melbourne experienced three consecutive days over 40 degrees Celsius which had a very significant impact on many of our living collections. These temperature issues are very difficult to mitigate unless significant adaptation to the planting palette occurs over time. In October 2008, the author completed a 4-week technical scholarship (funded by the Friends of RBG Melbourne) tour of South-west USA landscapes and botanic gardens to glean insights into implementing these adaptations.

Research is currently being done to try and establish comparative climates (homoclimes) with Melbourne using past long term averages and also for future projections as a guide for plant selection. One simple model that has been used is an Aridity Index (Gentilli 1971) that only requires access to monthly temperature and rainfall data which is relatively available around the world. Plant selection frameworks are also being developed concurrently with climatic comparisons.

Summary of strategies to improve water use efficiency

1. Upgrade delivery infrastructure
2. Focus on professional development
3. Develop research and industry partnerships
4. Improve application efficiency
5. Adopt current technology
6. Reduce water demand
7. Diversify alternative water sources
8. Adapt to climate change

The adoption of these strategies resulted in progressive water savings of 50-60% from 1994-95 to 2008-09 over a decade of drought conditions.

More Information

RBG Water Conservation Webpage
http://www.rbg.vic.gov.au/gardening_info/water_conservation

RBG Melbourne Urban Landscape Water Management Research Webpage
http://www.rbg.vic.gov.au/research_and_conservation/Urban_Landscape_Water_Management_Research

Irrigation Australia 2008 National Conference Paper
http://www.irrigation.org.au/assets/pages/75D132F4-1708-51EB-A6BCF9E277043C3E/19%20-%20Symes%20Paper.pdf

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Water Management Initiatives at Mount Annan Botanic Garden

Caz McCallum

Mount Annan Botanic Garden was chosen in the mid-1980s as the preferred site for a new Australian plant botanic garden by the Botanic Gardens Trust, Sydney for two key reasons: its undulating surface and rainfall half that of Sydney. In other words, it was expected a broad range of Australian species would grow happily within 65 kms of the parent garden in Sydney. The Garden opened October 2 1988.

Being such a big site, 416 hectares, original infrastructure costs were huge. This may have impacted on the decision to use asbestos fibre cement pipes for the main and branch water lines. Unfortunately, it was soon realized the soil of Mount Annan is reactive clay which expands when wet and cracks wide open when dry. As the in-ground pipes became more brittle over time, each wet or extended dry period caused soils to heave or separate. With no flexibility, the pipes cracked, split, broke and generally failed. This created the potential for large losses of water since breaks underground are often not obvious in clay for some time.

With two on-site plumbers, staff are very aware of water usage and best management practices, especially when summer temperatures soar. For garden beds, unfiltered irrigation water is sourced from an 1880s built canal that runs from Cataract (near the Illawarra Escarpment) to Prospect Dam, in Sydney's north west. Due to its age and sandstone construction, regular canal maintenance is scheduled, at which times potable water has to be used for irrigation. This is outside the Garden's control as is the amount of water to be stored in case of a fire emergency.

Unfiltered water is drawn from the on-site canal. Allen Powell

A Memorandum of Understanding was signed with Sydney Water in October 2006 and extended to the end of this year. Water meters were installed at no cost to the Garden in a range of locations. A diagnostic assessment of onsite water management provided the basis for developing current water practices and a practical action plan - to improve water management, measure progress and benchmark against other organisations.

The report identified about one third of the annual usage of potable water on the estate was lost through leaks and pipe breaks. Stage 1 of the ring main (asbestos pipes) replacement project commenced in 2007-08 with replacement of the first 2000 metres of the 5000 metre long southern ring main. Immediate water savings were experienced through a 66% reduction in the annual water consumption. The report also indicated other areas for improvement, to which Garden staff responded strongly.

In late 2008, the Garden's performance was reassessed by Sydney Water against its One-2-Five Star rating scale in the Every Drop Counts business program and independently audited to confirm Sydney Water's finding. As a result, this year Mount Annan Botanic Garden achieved the highest rating for water management of a NSW government organisation when awarded a 4 star rating i.e. for water management integrated into everyday business systems.

Replacing pipes was not the only method employed to achieve this result. Systems have been developed and simple techniques extended. Dripline irrigation is widely used. Rainwater tanks collect water from the rooftops of the two education buildings, Bottlebrush Classroom and the Bowden Centre. In the latter, rainwater is used for surrounding garden irrigation, toilet flushing, and underfloor heating. Nursery staff also employ a range of methods designed to control water waste and maximise watering efficiency, particularly through electronic controllers, bottom up watering and highly selective watering regimes.

And within the next two years, the total 5 kms of Southern Loop water mains which provide water for the theme garden areas, should be replaced with modern durable lines. Then the smaller branch lines replacement will commence.

Australian plant collections pose a problem when sourcing alternative water supplies. Because the purified by-products of the local sewerage treatment plant and the neighbouring waste recycling unit at Jacks Gully cannot be guaranteed of constant high quality, the Garden is definitely limited, for the moment, to reliance on unfiltered canal water or collectable rainwater. Reed beds for water purification may have a place in the future, as they have worked very well with grey water recycling at the Macarthur Centre for Sustainability. This facility is located within the Garden and represents a partnership of the Botanic Gardens Trust, local Councils and the community.

Yet despite challenges, Mount Annan Botanic Garden has still managed to achieve a 15% decrease in water use per annum over the past decade.

With predicted climate change, the Garden's plant collections will become even more valuable and water management therefore more critical, in the bid to reduce water use, provide high quality displays and educate our visitors. For this reason, the Big Idea theme garden has become more important as a teaching aid – with displays of simple water saving techniques, low water use plants suitable for the local area and creative use of recycled materials and water capture for flushing.

Challenged by it sheer size, in an era of tightening budgets, effective water management requires staff keep up to date with new technologies and aware of constraints on set goals. They are keen to advance our knowledge of more technical approaches, particularly in researching plant requirements in their place of origin and applying strictly measured seasonal water. The next decade will see Mount Annan Botanic Garden turn a corner in recorded water use management and even more strongly underpin horticulture with science.

Looks aren't everything.
Michael Anlezark

One of the biggest issues affecting many Australian botanic gardens (both urban and regional) now is just how much water is really necessary for our living collections. It is an issue that goes to the very core of the sustainability of these collections.

At The Australian Arid Lands Botanic Garden (AALBG) here in Port Augusta we have had to critically evaluate the amount of water used, the sustainability of this amount and also its source (the Murray River).

One of the questions we have been asked a lot at the AALBG is "If this is an arid botanic garden why do you have to water everything?" Once upon a time and not too long ago the answer would have been "so everything looks good and puts on good displays". Over the recent years we have had to seriously reassess this answer and have come to the realisation that it is no longer appropriate for us to think like this. It is also unreasonable for the public to be satisfied by such an answer. The fact is that in nature not everything looks great all the time and maybe there is wisdom in a more natural systems-based approach in our collections, particularly if it is just aesthetics that is dictating high water use.

In South Australia tight water restrictions have become a part of everyday life. Sprinklers have disappeared from domestic gardens together with thirsty plant species and also many lawns. The public is making garden sacrifices almost daily based on sustainability, and we are now all looking for alternatives and more efficient ways to keep our plant collections alive. I see it as our role and the role of all botanic gardens to lead by example and not by 'exemption'. At the AALBG we have looked at exactly how much water we use, how we can reduce this now and in the long term. We are also reconsidering our master plan and starting to identify and modify future projects to encompass any necessary water rationalisation.

Some parts of our collection are now being watered by rainfall alone and some sections are in the final stages of the removal of supplementary watering. Most future plantings and collections will be watered in their establishment phase only.

Considering that all plants collected for our arid zone IBRA based thematics are from areas of around 250mm annual rainfall or less, the annual rainfall of around 250mm in Port Augusta should suffice. I realise that we are fortunate in that we do not have to consider the excessive water requirements or management of collections of exotic or historical plants that are held in many other botanic gardens. Therefore we can invest all of our resources into managing the future and not the past.

One easy way we can promote our water conservation messages to our visitors in a manner that is relevant to them and in a way that they can take home, is through our 'AridSmart' Gardens.

This is a series of 6 gardens developed to inspire, using arid plant species in a variety of landscape styles from informal to formal including a Desert Garden and an Eremophila Courtyard Garden.

They include important water management messages from 'no water use, to low water use' and like our botanical collection some of these areas are designed to rely on rainfall alone, once established. Even establishing plants is done efficiently using centrally controlled sub surface in line dripper systems. Importantly, all of the plants featured in our AridSmart gardens are available for sale from our nursery (and all currently being labelled with our registered AridSmart brand).

The next step for us will be the same as for many Australians, and that will be the acceptance and use of treated waste water. The AALBG is just two years from this becoming a reality with a pipeline already at the fence line.

For now at the AALBG I would prefer that our Flinders Region, Great Victoria Desert Region and Central Ranges collections look more like the 'real thing' and not lush unsustainable examples of how some would like them to be. If that means some things look dead or straggly so be it. That's nature - let's work with it.

Water Kwatye
Scott Pullyblank

To understand water within the Alice Springs Desert Park a little background information is necessary.

The Alice Springs Desert Park is the first Biopark in Australia and one of the first in the world. It operates as a zoo, a botanic gardens and a cultural centre; paradoxically because it is all of these, it is none of these. It is a fully integrated environmental education facility that has a "habitat-based, story-driven" approach to interpretation that maximises its potential to help visitors respect, enjoy and look after Australian deserts.

The Desert Park is set out as various habitats and sub-habitats found within the arid region of central Australia. Elements of both botanical and zoological collections are strictly situated within their correct habitat and sub-habitat zones: Sand Country (red sand), Desert Rivers, Woodland and Mulga Woodland. People have been an integral part of these ecosystems for many thousands of years.

Without people the experience is far from complete. The Aboriginal culture of the Alice Springs area is part of the holistic experience that is the Alice Springs Desert Park [1].

Kwatye means water in Central Arrernte, the language of Mparntwe which includes Alice Springs. There are at least thirty-two different words for water in Arrernte thus illustrating how important knowledge of water is to people, especially to those people in arid regions. Water and life are synonymous whichever way you look at it. It has taken a recent series of droughts to remind some parts of the Australian community about this fact. Careful use of water is something that we take very seriously at the Alice Springs Desert Park.

Alice Springs has an average yearly rainfall of 286mm, however in 2001 741mm fell. The following year we had 198mm[2]. The average is skewed dramatically by the extremely wet years that seem to come every ten years or so. In between these events people often refer to years as drought years. In fact these are the more common climatic events and may be best referred to as dry. Alice Springs would therefore almost have a 'wet' and a 'dry' 'season' where the wet lasts for two or three years on average and the dry five or six years. Note that this is only wet when compared to the dry years. In a wet year the months with little or no rainfall are usually more common with most of the rain often falling within a few months. Summer rain is more common than winter rain.

Naturally the salt pan, clay pan and gypsum pan within the Desert Park only carry water after rain events. What this means for those of us with horticultural interests in this 'arid zone' is that there is a need to have water at our disposal throughout the year and a need to be water conscious. This would now seem to be obvious given what most of the south, east and west of the country have been through in terms of drought. The paradox is that Alice Springs has access to large reserves of ground water [3 4]. The source of this water is underground in aquifers which are part of the Amadeus Basin. Most of the town's water comes from the Mereenie aquifer.

Whilst most of temperate Australia was, or still is, in drought, Alice Springs has been in one of its 'dry' periods; yet none of our households have experienced any restriction on water use at all.

Working with the local ecology of inland Australia has enhanced our efficiency. The plants within the arid zone can be roughly split into two types based on their adaptations to the desert environment: the re-sprouters will continue to 'grow' whilst conditions are suitable, but slow to a stand still or become dormant if conditions are not favourable. They re-sprout when conditions have improved sufficiently. Then there are the obligate seeders that grow quickly, set seed and die. The seed germinates when conditions are conducive i.e. after rain. It often does not take very much rain at the right time for this to happen. Grasses tend to grow after spring and summer rain and wildflowers after autumn and winter rain.

For the re-sprouters to grow from seed takes more rain, and rain over a longer period. These long rain events are not common and may occur decades apart. The few wet years each decade may not be enough for many species. Longer periods of good rainfall may be needed for recruitment. But generally, the parent plants are long lived. Some produce seed which will stay viable for many decades; others produce seed regularly. In either case seed is there 'ready to go' when conditions are suitable. Being long lived, there is no need for constant recruitment of individuals to the population.

The species can easily survive the long periods between the extremely wet years which are needed for seed to germinate and grow a root system capable of sustaining the plant through the dry times. For arid zone plants these conditions are not particularly harsh. Plant them in Sydney or Cairns and that would be harsh.

Despite the fact that the Desert Park grows plants from the arid zone, we need water to establish the re-sprouters and to display the obligate seeders (ephemerals). This may be rainfall, but is generally irrigation. The dry years (below average) exceed the wet years by almost two to one. It may not sound too dry when stated this way, however the pattern typically plays out as five to seven below average rainfall, or dry years, followed by one to three consecutive wet years, or above average rainfall. Bear in mind that the average rainfall is only 286mm. Clearly no matter what the biology of the species to be grown they need water to establish themselves and then to remain in an active state. In order to reveal some of the desert's secrets the Desert Park must present the ecosystems in their actively growing and flowering state. For the most part this also requires a constant source of water. To achieve this we have at least 60 kilometres of drip line and 60,000 drippers across 30ha. It is estimated that the rate of water use across the site is about 2 mega litres/ha/year.

Our water regime is designed to provide what we believe is maximum benefit for the lowest water output. Whilst his is obviously something of a balancing act, we have arrived at the following water schedule for our habitats:
- Once every two weeks
- 8 hours duration in summer (1st Oct to 31st March)
- 4 hours in winter (1st April to 30th Sept)

This watering regime provides deep water to promote root growth that will sustain the plants through our long hot summers. In situations where there has been a major plant out, we water daily for the first week then reduce to once a fortnight for four weeks until the plants go onto the regular schedule. Planting is most commonly carried out in autumn, with fewer plantings in spring.

The Desert Park does not undertake any new development lightly. If an increase in water use is involved an assessment of water usage versus benefit is made. In recent times we have finished one major new development and begun another.

Just over a year ago the Desert Park fenced part of the Mulga habitat we planted more than a decade ago. This exhibit, of a little more than four hectares, also houses animals appropriate to that habitat. Visitors can take a guided walk through this atmospheric area, offered each night, with magic sightings of inhabitants such Mala, Burrowing Bettong and Brush-tailed Bettong. Many of these species displayed within the Mulga Walk are sadly now extinct within the Northern Territory or have not been seen in the wild for many years. We have installed i20 Hunter popups controlled by electronic timers to support growth of local native plants which provide fresh grazing and browsing opportunities for these animals.

The second major new direction involves the development of a 'farm'. This will provide local indigenous food items for the majority of the animals in our collection. Our aim is to reduce, and eventually stop, the transportation of seed, fodder and vegetable matter from the coastal regions of Australia to the Desert Park. Growing our own produce will greatly reduce our carbon footprint and feeding natural food will potentially have both health and behavioural enrichment benefits for our animals.

There are costs in increased food preparation time, greater horticultural effort and in an increase in our water use. However, the major benefits of this project have been weighed against the negatives. One benefit is the community engagement. Visitors will have the chance to work off part of their carbon debt by volunteering in our farm. Local groups with at-risk youth are seeking involvement. Whilst there is an increased use of a finite resource, water, the environmental outcomes through education, and a significant decrease in the Desert Park's carbon footprint justify this use.

top Brush-tailed Bettong *Bettongia penicillata*, a critically endangered species, eating Native Cucumber Cucumis melo grown at Alice Springs Desert Park.
Photo Credit Pete Nunn, Alice Springs Desert Park 2009

above Native Cucumber *Cucumis melo* planted within the 'Farm' as a source of seed and fruit for animals at Alice Springs Desert Park.
Credit: Scott Pullyblank, Alice Springs Desert Park 2009

above right Bush Bananas *Marsdenia australis* a native species to be 'farmed' as a food source for animals at Alice Springs Desert Park. All but the very woody parts of the plant can be eaten: fruit, leaves, buds and roots.
Credit: Scott Pullyblank, Alice Springs Desert Park 2009

right Native Millet *Panicum decompositum* planted within the 'Farm' as a seed food source for animals at Alice Springs Desert Park.
Credit: Scott Pullyblank, Alice Springs Desert Park 2009

The farm site developed so far is just under 1.5 ha, and of course there is the potential to 'crop' some species from the rest of the botanic gardens which is the Desert Park site.

We aim to reduce our dependence on water in the farm by growing local plants although healthy produce will require regular watering, at least initially. The watering regime in this area is at present on a daily water schedule as plantings are new. After about four weeks even this area will revert to being watered once a fortnight as with the habitat zones.

Irrigation being tested before planting native grasses in the Alice Springs Desert Park Farm
Credit: Scott Pullyblank, Alice Springs Desert Park 2009

The system for delivering the water to the farm is based on the successful structure repeated across the Desert Park. An 80mm main leads to 50mm Bermad valves then to a 40 or 50 mm high density poly sub-main which in turn leads to 13 mm poly-pipe with micro-irrigation ending in 4l/hr drippers or i20 Hunter popups. Popups are only used where a solid cover is required such as in exhibits where animals will browse the subsequent growth or where a solid wildflower display is featured.

The Desert Park has a small desalination plant. The Alice Springs town water supply is 500ppm salt which is not ideal for growing the wildflowers that would naturally rely on winter or autumn rain events to germinate and grow. The desalination plant produces water that is 100ppm salts. Desalinated water is used sparingly as there is a cost both in energy and in water.

Using desalinated water allows the Desert Park to produce a spectacular annual display of wildflowers during our peak tourist season in winter and early spring. This is an event that would otherwise only occur with autumn and winter rain. Once again the benefits to the park of using water in this instance are carefully considered.

Annual wildflower dispaly at Alice Springs Desert Park
Photo Credit: Alice Springs Desert Park

The outcome from careful use of water in combination with good planning and dedicated staff has delivered the magnificent Alice Springs Desert Park as it can be seen today: a vibrant thriving Biopark immersing visitors in the living desert where one can experience the diversity and life of the central Australian arid regions.

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2009 Australian Government Bureau of Meteorology: Climate of Alice Springs. http://www.bom.gov.au/weather/nt/aliceSprings/climate.shtml October 2009

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2- 2007 Northern Territory Government Department of Natural Resources Environment the Arts and Sport Technical Fact Sheet Where does Alice Springs water come from ? http://www.nt.gov.au/nreta/publications/natres/pdf/AliceSpringsWaterResources.pdf

3- The Alice Springs Desert Park http://www.alicespringsdesertpark.com.au/

2007 Northern Territory Government Department of Natural Resources Environment the Arts and Sport NT Waterwise Central Australia http://www.nt.gov.au/nreta/water/wise/

Water conservation initiatives at Kings Park and Botanic Garden

Christina Mykytiuk

Kings Park and Botanic Garden is a 400 hectare reserve adjacent to the CBD of Perth Western Australia, managed by the Botanic Gardens and Parks Authority (BGPA). Two thirds of the area is remnant bushland but over 70 hectares of the site is irrigated parkland, including the 17 hectare Western Australian Botanic Garden.

Most of the irrigation uses ground water for which the BGPA has a strictly limited allocation with a few areas irrigated with mains water. In times of a growing focus on the need to conserve water, the BGPA has implemented a number of initiatives to improve its water use efficiency. This has required a delicate balance between introducing water efficiency measures and maintaining the high standard of amenity and presentation expected of what is now the most popular tourist destination in Western Australia. Kings Park and Botanic Garden welcomed over 6.5 million visitors in 2008/09, placing significant pressure on the site, particularly on the high profile turf areas.

A major water conservation initiative has been the assessment of irrigated turf areas according to their public profile and visitor usage and assignment of a 'watering priority' category of high, medium or low. Turf within each watering priority category receives a different watering regime based on a per cent replacement of water lost through evaporation.

In order to monitor the effectiveness of current watering regimes in turf areas, soil moisture monitoring is conducted through the use of lysimeters. Soil moisture readings are taken at a depth of 100mm at a series of key locations in high priority turf areas throughout the irrigation season. These readings enable adjustment of irrigation times to ensure that the soil moisture remains between the full and allowable deficit levels, thus avoiding both unnecessary application of water causing leaching and drought stressing the plants. The monitoring undertaken to date has indicated that the soil water content in these turf areas remained within the target range for more than 90% of the time. The highest priority turf areas have consistently remained within the industry benchmark of 57-60% replacement of evaporation (e-pan).

In some beds in the Botanic Garden (Figure 1) and some other garden areas, overhead irrigation has been replaced with sub-surface in line trickle irrigation resulting in considerable reductions in water use in those areas. Soil moisture readings are taken in some garden beds at varying depths up to 700mm, covering both underground trickle and overhead watering areas. The results of this monitoring continue to demonstrate that watering maintains soil water content at satisfactory levels without over watering.

Other water efficiency measures in progress include changing some key display beds from the use of exotic annuals to Western Australian native species, reducing the area of turf in the lowest profile areas and replacement with mulch and a reducing water regime over time, and the grouping of plants with similar water requirements and ecological origins where possible to maximise watering efficiency.

Western Australian Botanic Garden entry bed has sub-surface in line trickle irrigation as a water conservation measure. David Blumer, BGPA

Water Conservation at the Australian National Botanic Gardens

Frances Verrier

The Australian National Botanic Gardens (ANBG) cares for the national collection of Australian plants, and features a third of Australia's known plant species, with over 78,000 plants growing on site. The ANBG living collection currently receives all its water for irrigation from the ACT domestic water supply via an extensive electronic computer controlled irrigation system. In accordance with best practice in landscape irrigation, the amount of water applied to garden beds through irrigation is determined by the vegetation type, the actual rainfall and evaporation rates. At the ANBG about 50% replacement of net evaporation is generally applied, as per the industry standards for native vegetation.

After an exceptionally dry year in 2006 (350 mm of rainfall – almost half average), Canberra was facing the very real possibility of Tier Two, Stage 4 water restrictions, which would restrict the ANBG to the use on non-potable water only for irrigation. In response, the ANBG released its Water Management Strategy in July 2007, which has eight aims:

1. To separate potable water supply for buildings
2. To secure non-potable supply for irrigation
3. To establish an ANBG irrigation improvement program
4. To review living collection species selection
5. To modify landscaping within the ANBG to ensure maximum water efficiency and effectiveness of irrigation
6. To build staff capacity in irrigation management
7. To increase community awareness
8. To develop a research program to inform non-potable water, drought and CO2 tolerance of native plants as they relate to climate change.

Obtaining reliable sources of non-potable water is a priority for the ANBG, and a number of sources are preferred to ensure reliable supply. The ANBG has considered many options (including on-site dams, recycled sewerage and recycled stormwater). However, the most obvious and convenient source of non-potable water, with the best cost/benefit profile, is recycled water from Lake Burley Griffin. This helps the ACT meet its recycled stormwater targets, and is convenient and cheaper for the ANBG. While permanent access to lake water is administratively and legislatively complex, the National Capital Authority has agreed to the Director of National Parks temporarily abstracting up to 170Ml from the Lake. Impending legislative changes should make it possible to formalise this arrangement.

The ANBG is about to commence construction of a pipeline to access non-potable water from Lake Burley Griffin to the ANBG, subject to licensing, environmental and planning approvals. This project will also include construction of new potable water infrastructure on the ANBG site, In addition to seeking a non-potable water supply, the ANBG is already improving water efficiency through its *Irrigation Improvement Program.* This program includes the use of soil moisture indicators, changes to irrigation practices (timing, frequency, amount), on-site water capture and recycling, a reduction in irrigated garden beds and the installation of water meter flow monitors to alert of irregular or atypical water flows. In addition, older less efficient sprinkler heads have been replaced, drip irrigation has been installed, pressure-reducing valves have been modified to ensure sprinklers operate more efficiently, existing irrigation infrastructure has been audited to prevent double watering of older garden beds, and uniform nozzle sizes have been installed for consistent flow rates.

ITEMS OF INTEREST

Conferences, Courses and Events

BGANZ Queensland 2010 Conference
13-15 August 2010
Tondoon Botanic Gardens, Gladstone
Email: Merilynh@gcc.qld.gov.au

BGANZ – NSW 2010 Conference
'Where to now'
27-29 August 2010
Hunter Region Botanic Gardens
Email: info@portstephens.org.au

Safeguarding agriculture and the environment
Global Biosecurity 2010 Conference

28 February – 3 March 2010
Brisbane Qld
http://www.globalbiosecurity2010.com

International Certificate in Botanic Garden Management in the Asia Pacific Region
Asia Pacific botanic garden management: capacity building in critical times
5 - 20th March 2010
Singapore Botanic Garden
http://www.bgci.org/education/asiapacific

American Public Garden Association, 2010 APGA Annual Conference

June 1-5 2010
Atlanta, Georgia
http://www.publicgardens.org/web/2007/01/2007_apga_annual_conference.aspx

4th Global Botanic Gardens Congress
13-18 June 2010
National Botanic Gardens of Ireland
http://www.4gbgc.com/index.html

8th International Flora Malesiana Symposium
23-27 August 2010
Singapore Botanic Gardens
http://www.sbg.org/fm8

Seventh International Conference on En Environmental, Cultural, Economic and Social Sustainability
5 to 7 January 2011
University of Waikato, Hamilton, New Zealand
http://onsustainability.com/conference-2011/

XVIII International Botanical Congress
23-30 July 2011
Melbourne Vic
http://www.ibc2011.com

TO ALL READERS OF THE BOTANIC GARDEN

A VERY HAPPY CHRISTMAS
AND BEST WISHES FOR 2010