Australasian Plant Conservation

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The role of community groups in rare orchid monitoring in the West Australian wheatbelt

Monitoring a nutrient manipulation experiment to restore grassy box-gum woodlands

Monitoring for climate driven floristic shift in Australian subtropical rainforest

Could crowdsourcing be used to detect and monitor invasives?

Mitigating the effects of forest eucalypt dieback associated with psyllids and bell miners in World Heritage Areas

And much much more …

SPECIAL THEME: MONITORING AND COMMUNITY INVOLVEMENT

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Australasian Plant Conservation is a forum for information exchange for all those involved in plant conservation: please use it to share your work with others. Articles, information snippets, details of new publications or research, and diary dates are welcome. **The deadline for the June–August 2012 issue is Friday 11 May 2012.** The theme for the issue is **Bushland Restoration**. General articles are also very welcome. Specific examples of effective monitoring and general articles are also very welcome. Please contact Selga Harrington if you are intending to submit an article: selga.harrington@gmail.com.

Authors are encouraged to submit images with articles or information. Please submit images as clear prints, slides, drawings, or in electronic format. Electronic images need to be at least 300 dpi resolution, submitted in at least the size that they are to be published, in tif, jpg or gif format. Guidelines for authors are at: http://www.anpc.asn.au/anpc/pdffiles/APCGuideContrib.pdf.

Please send articles, no more than 1200 words, as a MS Word file (2000 compatible) by email to: selga.harrington@gmail.com.

Front cover: *Caladenia graniticola.* Photo: Mark Brundrett. From article by Mark C. Brundrett: *The role of community groups in rare orchid monitoring in the West Australian wheatbelt*

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From the editor

Selga Harrington

Parsons Brinckerhoff

Welcome, readers, to the autumn edition of Australasian Plant Conservation! Due to an overwhelming response to our call for articles for the summer edition of APC on the theme of "monitoring and plant conservation", we have produced a second edition of APC investigating monitoring. This is clearly a hot topic of great interest!

In this edition, the focus is on community involvement in monitoring projects. The articles highlight the importance of volunteers and the general community in rehabilitation, monitoring and data collection. The articles demonstrate how projects have worked towards their conservation goals by engaging a diverse range of volunteers and specialist interest groups including the local community, orchid enthusiasts, conservation groups, Indigenous community groups and GreenCorps.

This issue includes a range of monitoring projects with community involvement, from targeted suveys for threatened orchids in WA; to monitoring the effects of rehabilitation techniques for grassy ecosystems including the use of sugar application to shift the nutrient balance in favour of native species; to members of the public providing biodiversity data to the Atlas of Living Australia.

Also included in this issue are examples of monitoring threatened species populations such as the Bago Leek Orchid which is known only from two locations; and, the effects of fire on Button Wrinklewort of the grasslands and grassy woodlands of southeastern Australia.

Two larger-scale monitoring projects included in this issue look at vegetation changes in some of our World Heritage Areas. These projects investigate the impacts of Bell Miners in the Blue Mountains and Gondwana Rainforests of Australia; and, long-term climate-driven changes in the vegetation of the Gondwana Rainforests of Lamington National Park in Queensland.

Following the themed articles, is an article on predictive habitat modelling for the threatened Leafless Tongue Orchid. This provides some specific information on the likely habitats of this cryptic species across its range from southeast Queensland to Gippsland in Victoria and will improve the way native habitats are managed and assist in the assessment of potential development impacts on this species.

The issue concludes with our regular features: Report from New Zealand Plant Conservation Network; a book review, Information Resources and Useful Websites, Research Roundup and upcoming conferences and workshops.

Hopefully this edition will inspire you, provide some good ideas on how to monitor your own threatened species populations, rehabilitation works or vegetetation communities and provide some thoughts on how to engage the community to help you achieve your conservation goals. Happy reading!

The role of community groups in rare orchid monitoring in the West Australian wheatbelt

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Introduction

The Wheatbelt Orchid Rescue (WOR) project is a Lotterywest funded collaboration between the West Australian Native Orchid Study and Conservation Group (WANOSCG), the University of Western Australia (UWA), the Friends of Kings Park and the Western Australian Department of Environment and Conservation (DEC).

The West Australian wheatbelt is 154,000 km^2 area in the southwest botanical province that has a highly cleared and fragmented landscape with many rare species, which makes recovery actions for rare plants difficult.

The project selected five of the rarest orchids in the WA wheatbelt. These are listed as Threatened flora and ranked as Critically Endangered in Western Australia. Threats to these orchids include grazing, rising saline groundwater, firebreak maintenance, small population size and poor recruitment (Brundrett 2011). The main objective of this project was to gather knowledge required for sustainable management of Critically Endangered orchids in the WA wheatbelt and undertake recovery actions. Specific objectives were to:

- provide an accurate estimate of the population sizes of these orchids
- identify the size of their habitats
- identify potential new habitats
- evaluate population viability and threats.

Volunteers from the WA Native Orchid Study and Conservation group helped conduct surveys at Dragon Rocks Nature Reserve in September 2008. Photo: Mark Brundrett

Rare orchid monitoring

The WOR project coordinated surveys by orchid enthusiasts from the WANOSCG in collaboration with flora conservation staff from DEC. Volunteers and members of local wheatbelt community groups helped search for rare orchids in large areas of potentially suitable habitat. Data presented below also includes small-scale surveys by the author and DEC staff from 2007 to 2010. Population numbers and site names for each orchid follow designation in Interim Recovery Plans.

To monitor populations, teams of searchers spread out to thoroughly cover potential habitat areas. Numbers of flowering plants and leaves that occurred within 5 m of a GPS coordinate were counted, along with grazing intensity data and photo monitoring images. This information was used to map Core Habitat areas for each orchid to facilitate effective management, especially for fire. This data was presented at a Recovery Team Meeting at Narrogin in 2011 and published online by the University of Western Australia (Brundrett 2011).

The Granite Spider Orchid

In Sept 2008 about 30 WANOSCG volunteers participated in a survey of known and likely habitats for the Granite Spider Orchid (*Caladenia graniticola*) in Dragon Rocks Nature Reserve, one of the largest reserves in south western WA (32,000 ha). This orchid primarily occurs next to large granite rocks, so target areas were selected using Landsat satellite imagery. A three day survey found more than 300 granite spider orchids, about 10 times more than had been known to occur in this reserve (Table 1). Volunteers, who were very good at orchid spotting and identification, greatly expanded the size of habitat areas. These habitats were in good condition, except for some canopy decline in sheoaks, but this seemed to favor the orchids, perhaps due increased light levels and grazing protected by fallen branches.

The Ballerina Orchid

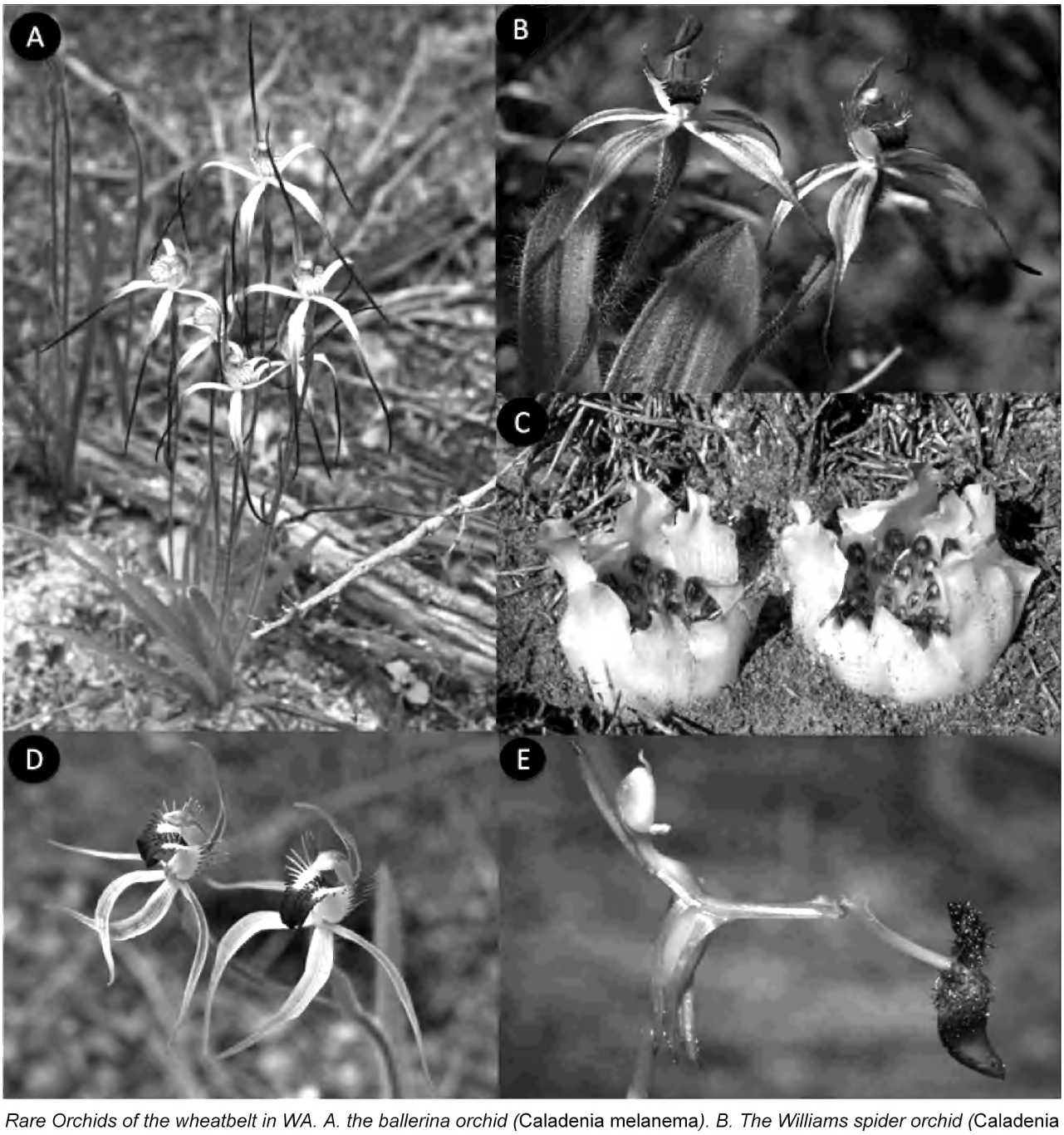
Monitoring of known populations resulted in a greatly revised estimate of total population size for the Ballerina Orchid (*Caladenia melanema*) (Table 2) and several new populations were discovered by enthusiastic volunteers (especially Margaret Petrides). However, most individuals of this species were restricted to one Critical Habitat area 3 x 1 km, comprising narrow strips of *Melaleuca*

lateriflora woodland between salt lakes and over half of these plants occur in one small 150 x 80 m patch (Table 2). The main immediate threat was grazing of seeds and flowers, which was addressed by fencing. In 2009 and 2010, many plants also showed signs of drought stress due to record low winter and spring rainfall and this prevented much seed set. Satellite imagery comparisons suggest that the canopy of shrubs under which the Ballerina Orchid grows has substantially declined in cover over the past 20 years (www.landmonitor.wa.gov.au). This is probably due to salinity, which is considered to be a major threat in all areas where the ballerina orchid occurs.

Other Orchids

Additional monitoring with volunteer support targeted the William's Spider Orchid (*Caladenia williamsiae*), previously estimated to consist of only 150 individuals, we counted over 450 plants in 2010. However, most of these (426) are confined to a very narrow area within a single nature reserve, with over 90% of William's Spider Orchids occuring within 2 ha.

Another survey in 2007 confirmed that most plants of the Lonely Hammer Orchid (*Drakaea isolata*) occur within 10 ha, but the total population size has remained fairly



*Rare Orchids of the wheatbelt in WA. A. the ballerina orchid (*Caladenia melanema*). B. The Williams spider orchid (*Caladenia williamsiae*). C. The western underground orchid (*Rhizanthella gardneri*). D. The granite spider orchid (*Caladenia graniticola*). E. The lonely hammer orchid (*Drakaea isolata*). Photos: Mark Brundrett*

constant for several decades at approximately 300 plants. The largest groups of this clonal orchid had 50 leaves and if each group of leaves is considered one individual then the population size for the Lonely Hammer Orchid is less than 50 individuals. This population is threatened by saline soils encroaching from a nearby saltlake.

There were surveys for the Western Underground Orchid (*Rhizanthella gardneri*) from 2008 to 2010 with help from WANOSCG volunteers. This unique orchid is very hard to find in the wild due to its subterranean habit and in some cases it took 20 volunteers several hours to find one flowering plant, but in another site we found over 20 plants in an hour. Since it is not possible to count individuals of the underground orchid without damaging their habitat, our approach was to map suitable habitat areas. This spatial data was used to define the boundary of a proposed nature reserve to protect the largest population of the western underground orchid near Munglinup.

Table 1. Summary of 2008 data for 3 populations of the Granite Spider Orchid (Caladenia graniticola) in Dragon Rocks Nature Reserve with estimated habitat area and number of GPS points covering plants within a 5 m radius.

Population	Plants	Flowers	GPS points	Habitat area
3	47	30	19	800 x 200 m
4	36	28	4	15 x 5 m
5	217	115	30	100 x 100 m
Total	**300**	**173**	**50**	**~18 ha**

*Table 2. Survey data (2009) for the Ballerina Orchid (*Caladenia melanoma*) from 6 subpopulations within its main population.*

Subpopulation	1a	1c	1d	1e	1f	1g	Total
Flowering Plants	483	19		82	15	106	705
Non-flowering	536	31		162	71	132	932
Grazed	258	31		51	48	244	632
Total	**1287**	**81**	**4**	**295**	**134**	**482**	**2269**

Conclusions

The WOR project increased community group involvement in orchid conservation both for rural residents who live near rare orchids and orchid enthusiasts who travelled to attend rare orchid surveys. From the community group perspective, a key outcome was the opportunity to see and photograph some of the rarest and most iconic orchids, while contributing to knowledge about them. Increasing community group involvement and interest resulted in the discovery of several new populations of rare orchids. Managing rare flora requires a compromise to be established between keeping Threatened plant locations secret and harnessing the volunteers required for surveys. The WOR project determined that, at least in very large reserves, effective monitoring of orchid populations required substantial volunteer assistance by people who are experienced at orchid spotting and identification.

Measuring trends in population size over time is difficult due to variations in flowering caused by rainfall and differences in survey intensity, but it was established that the Granite Spider Orchid population 5 and the Ballerina Orchid had increased substantially in numbers, while populations of other orchids seem to be stable. However, all the orchids monitored are still extremely rare and restricted to small habitat areas.

It was concluded that maps of orchid habitats need to occur at several overlapping spatial scales:

- Critical Habitat areas, defined as all areas with suitable occupied or unoccupied habitat.
- Core Habitat areas, the most essential area for survival of the species with the highest concentrations of and/or the majority of currently known individuals in a population. Multiple habitat areas, if defined, are ranked in order of importance.
- Patches with very dense concentrations of individuals within habit areas.

This approach allows resources to be targeted to where they are needed most, namely core habitat areas which have the highest priority for protective or remedial actions (e.g. fencing to suppress grazing, weed management, or fire exclusion areas).

Perhaps of greatest concern for these rare species should be the very small habitat areas and their long-term viability if climate change continues to alter rainfall patterns in the eastern wheatbelt, which is already close to the limit of orchid distribution in WA (orchids are most abundant and diverse in higher rainfall areas near the southwest coast). Severe drought which occurred in WA in 2009 and 2010 substantially reduced orchid emergence and reproduction, but the long-term impacts of declining rainfall need to be evaluated by further monitoring.

Acknowledgements

This research would not have been possible without important contributions by DEC staff, especially Andrew Brown, Erica Shedley, Marie Edgley and Kris Brooks. Thanks also to the many WANOSCG volunteers, especially Margaret Petrides, Wayne Merritt, Ray Grant, John Ewing and Etienne Delannoy, as well as Grahm Behn (DEC) and wheatbelt community group volunteers; Judy Williams, Jocelyn Ward, Lucy Skipsey, Ruth Kirchner, Pam Goodman and most especially Ann and Barry Rick.

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Could crowdsourcing be used to detect and monitor invasives?

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Can members of the community use new technology to help Australia track pests and diseases? After all, imported red fire ants, a significant pest, were first detected in Australia by domestic gardeners who noticed their aggressive stinging and swarming behaviour. We all know of amateur naturalists and photographers, farmers, landholders and others who spend time observing, photographing and recording animals and plants. Could this valuable information, gathered by vast untapped human resources across Australia, be utilised in a coordinated way to monitor invasive species?

The Atlas of Living Australia

Enter the Atlas of Living Australia (the Atlas). The Atlas (www.ala.org.au) has been funded by the Australian Government as a national repository for information on all species found in Australia: plants, animals, fungi and bacteria.

The data in the Atlas comes from a huge variety of sources - museums, herbaria, botanic gardens, national specimen collections, state government databases, NGOs (eg BirdLife Australia), consultants, DNA barcode libraries, community groups and individual citizens.

On crowdsourcing

Crowdsourcing refers to outsourcing problem solving to a network of people, or the crowd. Allowing people to provide data to an organisation like the Atlas does not of itself constitute crowdsourcing. Crowdsourcing is as much about engaging with a network of people as it is about the issue or the tools used to engage: the crowd engages with the issue and uses the tool to record that engagement. But a good tool will make engagement easier and more interesting, as is shown by the rise of social networking sites.

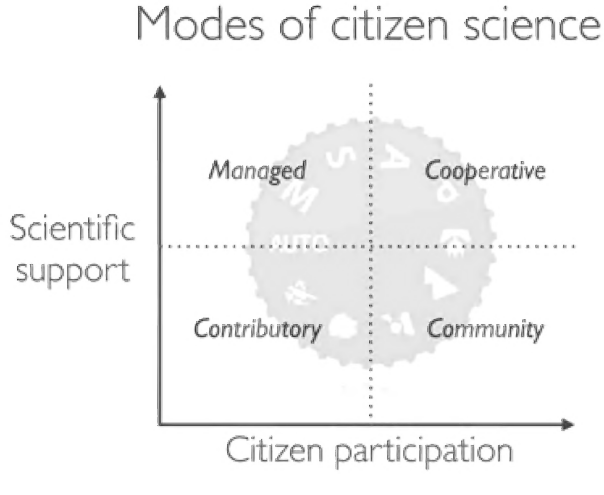
All over the world, researchers in fields as diverse as astronomy, cancer research, biodiversity and the search for extraterrestrials have discovered the power of crowdsourcing to engage with motivated individuals and groups to collect and/or analyse data for their research projects.

And there's an interesting twist starting to emerge: citizen driven research. Through crowdsourcing, not necessarily facilitated by computers, community groups are approaching researchers, offering crowdsourced data and asking the researchers to study the phenomenon represented by those data. This is especially so when researchers find it difficult to obtain funding and/or are not interested in the issues that the community wants researched, like some diseases that only affect a very small percentage of the population. Maybe the scientific paradigm is changing, perhaps becoming more democratic in some ways.

The Atlas and crowdsourcing

The geographic spread of Australian biodiversity provides a challenge in collecting data. Australia is a huge country and information about biodiversity in many areas has gaps; gaps that local people can help to fill. So, we see a valuable role for crowdsourcing; for encouraging landholders, NGOs, community groups, consultants and other interested individuals to provide data on the state and distribution of Australia's biodiversity, including invasive species.

To facilitate crowdsourcing, the Atlas offers data collectors two main mechanisms to capture, aggregate, analyse, model and map their data, free of charge. Firstly non-scientists and scientists alike have been able to enter their sightings and photos of species directly into the Atlas for some time now. All data provided to the Atlas, irrespective of its source, undergoes a series of data quality checks, eg to identify outliers and correct misspellings of species names. Results are annotated on each sighting record. This allows Atlas users to easily check the provenance, and quality, of all records in the Atlas to assess their 'fitness for use'.



How the relative level of scientific and community involvement offers a simple model for understanding the relative contribution of each group to crowdsourced research projects.

For example, a researcher may decide to include records contributed by an annual BirdLife Australia survey, but not include records contributed by a primary school student.

Secondly, the Atlas has a software suite—FieldData—that provides a dedicated web portal as a focal point for community groups and researchers for recording observations of plants, animals and other living things. These sightings can be ad hoc, entered as and when desired by users, or based on organised surveys. Data entered into FieldData is instantly displayed on a map so users can compare their sightings with those of other users of the portal. As with the Atlas site itself, photos can also be uploaded, a capability that is especially useful for species identification; where the photo can be viewed by more experienced community members or experts to help with identification.

The Atlas and invasives

So how could the Atlas be used to detect and monitor invasives? Imagine this scenario…

A keen ecologist and Bushcare member — let's call her Liz — notices an unfamiliar weed starting to appear in her neighbourhood. Liz mentions this to her Bushcare group and does some research—she thinks the weed may be known but newly arrived in her area.

For her own interest, Liz looks up the weed species in the Atlas, checks the distribution records for it and generates a map of its recorded distribution. There are no records of the weed in her neighbourhood. So Liz starts adding her sightings of the weed to the Atlas and encourages her colleagues and Bushcare members to do the same, which they do. They all then contact similar groups and interested individuals in the surrounding area to encourage them to register sightings of the weed on the Atlas site.

Slowly, the 'crowd' engages with the spread of the weed and, using the Atlas as an enabling tool, the number of sightings of the weed increases reflecting the increasing and known distribution of the weed. Within a year the weed sightings are widespread but with an inconsistent distribution. Liz decides to investigate further. Back in the Atlas, Liz pulls up all the sightings of the weeds and maps their distribution. Liz works her way through the environmental layers available in the Atlas's spatial portal looking for some correlations. Finally she discovers that the weed is only found in areas with particular rainfall, temperature and soil characteristics.

She reports these findings to the relevant state government agency that can now use this information to monitor and assess the spread of the weed, and decide whether it needs to monitor and/or control the weed and its spread.

Conclusion

Crowdsourcing is expected to continue to reinforce its role in providing valuable, credible and quality data for research. The Atlas will continue to support crowdsourcing activities intended to inform our understanding and management of Australian biodiversity.

Monitoring a nutrient manipulation experiment to restore grassy box-gum woodlands

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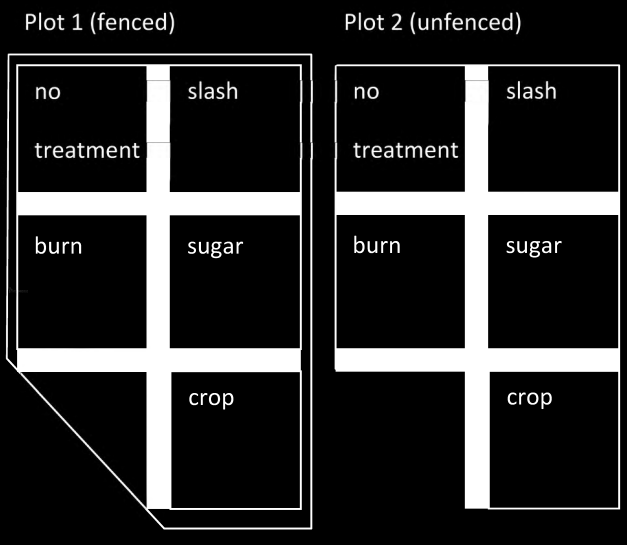
Weeds and the Nutrient Hypothesis

Exotic grasses and other weeds have wrought the most profound environmental change throughout The Pinnacle Nature Reserve in the ACT and similar degraded grassy box-gum woodlands in south-east Australia. These weeds are a threat to woodland flora and fauna as they cover the majority of the 138 ha Reserve, and exclude most native plants. Traditional weeding methods cannot defeat this weed menace and new techniques are demanded.

Recent research suggests that removing nutrients from the soil may tip the balance back in favour of native species. In small scale experiments, nutrients have been reduced by addition of sugar or activated carbon (Kulmatiski and Beard 2006; Prober et al. 2005), and this resulted in reduced cover of exotics and increased cover of native species. However, adding sugar is very expensive and requires reapplication every few months. It is not really suited to restoring large areas of degraded grassy woodland (Rawlings et al. 2010). However, adding sugar can provide important insight into the potentially limiting role of nutrients, and therefore the benefits expected if nutrients can be reduced using some other, cheaper method.


Plot 1 (fenced)
Plot 2 (unfenced)
no treatment
slash
burn
sugar
crop
no treatment
slash
burn
sugar
crop

of 2011 we accumulated 243 hours of effort to complete the surveys and slash the plots.

In addition to the plant surveys we also monitor soil nutrients, including total and available phosphorus and nitrogen. We took samples before implementing any treatments, and will take another sample at the end of the project.

We began monitoring in spring 2010 and with the exception of burning, we began our treatments in 2011. Burning will begin in autumn 2012 if the grass dries out enough. Our spring 2010 data revealed there were no significant differences between our treatments. We can therefore be confident that any effects that emerge over the coming years are caused by our treatments and not by some inadvertent confounding factor. We will continue to monitor the flora annually for three years; a timeframe over which we hope to see some response to our treatments.

Volunteers work together to identify plants and record the data in a quadrat within a fenced area at The Pinnacle Nature Reserve. Photo: Don Driscoll

Conclusions

Implementing a community-based experiment requires four elements to be successful:

1. a project leader with expertise in experimental design, analysis and field methods, or with access to advice in these matters and the ability to learn quickly
2. a group of committed volunteers willing to get down on hands and knees to survey plants
3. a cooperative and engaged park management agency, and
4. a successful grant application.

If you have the first three, the fourth is not that hard to achieve.

Sugar sprinkling at The Pinnacle. We apply a total of 250 kg of sugar every four months to our experimental quadrats, at a rate of 0.5 kg/m^2, to test if if nutrient management favours native species. Photo:Correa Driscoll

Our community-based park-care group hope that our experiment can help us to discover if nutrient manipulation will reduce exotic grass cover and increase natives. Our group, and many others that work in grassy box-gum woodlands need this information so that we can restore extensive degraded areas of this critically endangered ecological community. By undertaking detailed species-level monitoring we expect that we will be able to understand the full range of responses to our treatments. With these insights, we will be able to make informed decisions based on whether the benefits of particular treatments outweigh the costs.

We will then be able to work towards the restoration of our Reserve knowing that our volunteer effort is targeted in the most effective way to get the best restoration results.

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The Threatened Crimson Spider Orchid, Albury NSW

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Threats to Crimson Spider Orchid

While I conduct the threatened species surveys for our Crimson Spider Orchid (*Caladenia concolor*), I am amazed at the natural beauty that surrounds us, but also aware of how fragile its existence is. Land clearing, trail bikes and 4WDs, deliberately lit fires, firewood and bush rock collection, 12 years of drought and cattle breaking through fences all add to our concern for the treasures our woodlands hold. Grazing of the single leaf by native marsupials, like eastern grey kangaroos, swamp wallabies and possums as well as digging up by birds and echidnas also threaten these exotic treasures that survive in our harsh bush landscapes. Indeed, threatened species surveys can be threatening to the plants themselves, as some of us monitoring and researching them trample around sites compacting the soil and reducing associated vegetation cover.

We have tragic, historic records showing that ladies used to win prizes at our local show in the 1940's with armfuls of these beautiful orchids.

Our box gum woodland is an endangered ecological community in NSW and is nationally listed as critically endangered. It consists of a variety of gum trees as overstorey, with a complex understorey of grasses, herbs and forbs, including our Crimson Spider Orchid,. With only 80 – 90 known Crimson Spider Orchid plants left in the world, having the privilege of looking after our population of 18 plants, leaves us with a big responsibility, if we are to ensure any remain for our kids to discover later in their lives.

Habitat and ecology

The Crimson Spider Orchid exists in shallow topsoils in granite ridge hillsides, along with the other 43 known species of orchids in our region. Scientists and keen amateurs have been trying to propagate these large spider orchids for over 20 years unsuccessfully and we are continuing to gather information and conduct research on them with the NSW Office of Environment & Heritage, Albury Botanic Gardens staff and the Victorian Multi Species Recovery Team.

The Crimson Spider Orchid has a mycorrhizal fungi associate and a specific pollinator, a thynnid wasp, that add to the dilemma we face. The mycorrhizal fungi is essential as it penetrates the minute seed coat to assist in germination. The male thynnid wasp pseudocopulates with the flower, lured by the pheromone exuded by the orchid imitating the female wasp pheromone. They are a mystery and may lend credence to the opinion in many circles, that the Crimson Spider Orchid is so dependent on other organisms, that arguably they may be approaching natural extinction.

The Orchid only replaces its own tuber each season, so division is impossible. Seed will only grow within 25 mm of an adult plant and it appears that adult plants may have a life span of between 10 and 15 years. Deflasking the orchid seedlings, from the environmental safety of a flask into a potting medium in standard orchid nursery conditions, has been the downfall of many laboratory attempts thus far, so scientists continue to research new methods.

Indeed, we are about to attempt trials on the Crimson Spider Orchid using encapsulation, a process of combining both seed and its associated mycorrhizal fungi together. Dr. Karen Somerville from Mt Annan Botanic Gardens, Sydney, NSW, will attempt to utilise this method for encapsulating both seed and fungi together in alginate beads (known as encapsulation–dehydration), which may reduce failures during deflasking.

In trials conducted with *Diuris* and *Pterostylis* species, encapsulated beads transferred directly from in vitro culture to potting mix, resulted in the establishment of at least one seedling, and production of a healthy tuberoid, when transferred near the commencement of the natural growing season. The encapsulation–dehydration method may have a practical application for use in ex situ conservation of other terrestrial orchids, as well as their mycorrhizal fungi (Sommerville et al, 2008).

Protection and survey of the local population

One of 90 known Crimson Spider Orchid plants left in the world (Photo: Dr. Robert Fleming)

So what do we do to protect them, while we are awaiting the scientists opinions and decisions?

Sixteen years ago we were approached by local enthusiasts alerting us to the fact that this species was under threat from wayward cattle grazing. We gathered as much departmental help as possible to establish what could be done to protect them in the short term, while we went about establishing a recovery plan. Their identification was essential and they were classified as separate to a similar, common species found elsewhere in south east Australia. They were only known from two viable sites and one non-viable site at a popular tourist spot. Luckily 40 plants were discovered at a new site some 200 km away in 2004, to bring the total to 80-90.

On a local scale, we enlisted the help of our indigenous Wiradjuri community and sought funding from various organisations to assist with fencing off the area to cattle grazing. The Wiradjuri community have been essential to the success of the program so far, by enabling further survey works to be conducted hand in hand with indigenous heritage surveys and fencing construction and repair, to reduce illegal vehicle damage in our woodlands.

In 2000, we were ably assisted during our surveys, by GreenCorps volunteers from California on an exchange program. This survey consisted of line searches, walking shoulder to shoulder, standing on rocks, leaves and twigs wherever possible to minimise trampling. Within 20 metres of our first line search, 19 year old Angela Butler from Los Angeles had found a new plant. It was an enormous moment for the whole group, as no new plants had been found during the previous 3 years of surveys.

The local community were invited to assist us with a Community Biodiversity Survey, which we undertook in 2003, to get a record of what was out there so we could manage our woodlands more appropriately. Over 100 experts and volunteers participated and during this survey, volunteers (Emmo Willinck and his daughter Bela, as well as Michael McFarland), found two new plants.. These successes were counter balanced by the fact we appeared to have two known adult plants not re-surface for the third year in a row, which normally means they have reached their end. The population is monitored in this way six times per year with an extra three to five trips for hand pollination for seed. Small stepping stone rocks have now been set up to minimise trampling. We continue to monitor and research these amazing plants and the stunning bushland they inhabit.

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Mitigating the effects of forest eucalypt dieback associated with psyllids and bell miners in World Heritage Areas

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Dieback and decline

Dieback is a widespread problem affecting individual trees, woodlands and forests across Australia. Dieback refers to the deterioration in the health of the tree crown from which recovery can occur. Progressive, gradual deterioration in overall tree vigour leading to premature death is known as decline. Both can occur as the result of interacting biotic and abiotic factors producing a series of stress-response events. Causes have been attributed to drought, pathogens, herbivory, ecological feedbacks, and altered land management especially in relation to fire and grazing (Heatwole and Lowman 1986, Close et al. 2009).

Forest eucalypt dieback associated with psyllids and bell miners

In eastern Australia, eucalypt dieback associated with psyllids and bell miners, known as bell miner associated dieback (BMAD), is a serious issue. Large areas of forest from Victoria to southern Queensland, on both public and private land are under threat. The detrimental impacts include loss of habitat, biodiversity, and forest productivity, as well as altered ecological processes, all of which threaten the integrity of these iconic eucalypt ecosystems. In NSW BMAD is recognised as a Key Threatening Process under the *Threatened Species Conservation Act 1995*

(http://www.environment.nsw.gov.au/determinations/bellminerfd.htm).

Forest eucalypt dieback associated with psyllids and bell miners is a complex ecological problem with many interacting factors (Wardell-Johnson et al. 2005). Psyllids are a group of sap sucking, lerp forming, foliage invertebrates. Psyllid outbreaks may occur in response to nutrient enriched new growth (due to tree stress or high soil nutrients), climatic factors, or predator and parasitoid interactions (Paine and Hanlon 2010, Stone et al. 2010).

Bell Miners feed on the lerp (the sugary coating on the nymphal psyllid) but often do not eat the psyllid, allowing the psyllid population to remain unchecked. Bell miners are aggressively territorial, fending off other bird species that would otherwise predate on the psyllids. Bell miners require a specific habitat and forest structure for nesting, including a relatively dense midstorey 2 – 5 m in height (Stone 2005). In disturbed forests, the invasive weed of national significance *Lantana camara* often provides these conditions. In many forests the interactions between psyllids and bell miners leads to crown dieback, evident through canopy thinning and branch death, and can ultimately result in tree death.

World Heritage Areas under threat

BMAD is threatening the eucalypt communities in the Gondwana Rainforests of Australia and Greater Blue Mountains World Heritage Areas (WHAs). The Gondwana Rainforests of Australia extends from the central coast of NSW to south-eastern Queensland and the Greater Blue Mountains Area lies west of Sydney in NSW. These WHAs are of special conservation significance recognised internationally for their outstanding universal values (http://www.environment.gov.au/heritage/places/world/index.html).

The project

The project 'Mitigating the effects of Bell Miner Associated Dieback' is funded under the Commonwealth Government's Caring for Our Country grants scheme. This project aims to address the threat of BMAD to the Gondwana Rainforests and Greater Blue Mountains WHAs. This will be achieved through undertaking actions to treat and prevent BMAD in combination with research, monitoring and spatial analysis, to better understand the process and occurrence of eucalypt dieback throughout the WHAs.

The project consists of two major components. The first component focuses on the threat of BMAD by answering fundamental questions such as:

- How much eucalypt forest in these WHAs is affected or at risk?
- Which type of forests are affected or at risk?
- Where are these affected forests located?
- How badly affected are they?

The answers to these questions will enhance our understanding of the issue and help prioritise areas for management. Qualitative questionaries to land managers and aerial photo interpretation of high-resolution digital aerial imagery with ground validation will be used to address these questions. Repeating the mapping and questionnaires in the future will help to assess changes in dieback over time.

The second component utilises adaptive management to answer the questions:

- How can we prevent and treat BMAD?
- Which of these options work and which don't?
- What is the most appropriate management in different situations and places?

Symptoms of bell miner associated dieback: tree death at Border Loop, Border Ranges National Park.

Symptoms of bell miner associated dieback: crown thinning and branch death of eucalypts at Wallaby Creek, Tooloom National Park.

The main management method being trialled is bell miner habitat modification by weed control or fire, along with limited psyllid control through tree injection with insecticide. Where lantana occurs, weed control removes the dense midstorey and allows a more open forest structure to establish and native composition to be restored (Yeates and Schooler 2011, Somerville et al. 2011). Fire also modifies forest structure, and is often more effective at the landscape scale. Fire alters ecosystem process such as nutrient cycling, as well as creating a large disturbance event from which succession in many different parts of the ecosystem can occur. These may also be important factors for mitigating dieback.

Treated sites will be surveyed before treatment and then monitored annually following treatment for 2-5 years. Surveys of fixed quadrats across different sites and landscape positions will allow an assessment of changes in bell miner and psyllid populations, and any improvement in tree health. The data will also be used to look for patterns that may indicate which forests and species are affected or susceptible and at risk.

Summary

This project is applying the principles of adaptive management to address the issue of BMAD. We are identifying long-term options to mitigate dieback and restore forest health. In other areas we are attempting to prevent the deterioration of forest health into a state of dieback by actively identifying forests that are susceptible and at risk, and implementing proactive management. Management tools include the use of fire, weed control, and invertebrate control that aim to modify bell miner habitat and reduce bell miner numbers, or reduce psyllid abundance. Fire may also re-instate ecological processes, such as nutrient cycling, which help to maintain healthy forests. The outcomes of this project will assist with prioritising areas for management, identifying which management tools should be applied, and build our knowledge on the process of eucalypt dieback and the key elements that are important for the maintenance of forest health.

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Monitoring the effects of fire on the Button Wrinklewort (*Rutidosis leptorrhynchoides*)

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Introduction

The Button Wrinklewort (*Rutidosis leptorrhynchoides*) is a perennial forb native to *Themeda triandra* grasslands and grassy woodlands in south eastern Australia. Since European settlement, loss of habitat and overgrazing have contributed to a decline in the population; the species is now listed as endangered and is limited to a number of small populations in the ACT and western Victoria (Scarlett & Parsons, 1990). There is some evidence to suggest that fire could be an important tool in Button Wrinklewort conservation. Many of the remnant populations are found in areas which are frequently burnt (such as railway reserves), and in areas where this burning has ceased, populations have suffered declines (Scarlett &

Parsons, 1990). Further, research has shown large gaps between grass swards to be of critical importance for Button Wrinklewort recruitment and survival, and fire has been recommended as a way of maintaining these gaps (Morgan, 1997). However, there are concerns that burning may damage Button Wrinklewort plants and encourage weed growth, and current management guidelines recommend that remaining populations should be protected from fire (ACT Government, 1998). In this study we monitored the effects of an autumn burn on a large population of Button Wrinkleworts in order to improve knowledge of the direct and indirect relationships and inform management practices.

The endangered Rutidosis leptorrhynchoides *in flower. Photo: M. Fagg*

Methods

The study was carried out in Stirling Park, Yarralumla, ACT, where the National Capital Authority (NCA) intended to undertake prescribed burns as part of their fire hazard management plan. In order to measure the effect of fire, a transect method was used to estimate percentage cover of Button Wrinkleworts and covariates (including St John's Wort, Chilean Needle Grass, Plantain and other weeds, native grass, bare ground, litter and shade) before and after the fire. The change in percentage cover at each transect was averaged across the burned plots (n=12) and compared with control plots in an adjacent area (n=12).

Transects were 5 metres in length, marked with fire proof stakes and placed in areas where there was at least one Button Wrinklewort present. Percentage cover was estimated by recording the species or covariates (mentioned above) present at 10 cm intervals along the transect (presence was recorded if any part of the plant intersected a vertical line perpendicular to the tape measure at that point).

Pre-burn data were collected in April 2011. Post-burn data were collected in September 2011, following the control burn carried out by the NCA in May. The same transect method was used to quantify the fire intensity immediately after burning. At 10 cm intervals along the transects the intensity was classified as either not burnt (no evidence of burning), lightly burnt (some leaf litter remaining) or heavily burnt (all/most leaf litter reduced to ash).

Results

Analysis of the baseline data collected before the burn showed that the treatment and control transects were comparable, with almost identical Button Wrinklewort distributions and few significant differences in mean densities of other covariates (Student's t-test). Cover of St John's Wort, Plantain and total weeds were negatively correlated with cover of Button Wrinklewort (REML correlation).

The fire intensity was extremely variable and patchy; five of the twelve transects were more than 90% unburnt. As a result, in the analysis the treatment transects were further classified as 'lightly burnt' (<10% burnt, n=5) and 'heavily burnt' (>10% burnt, n=7).

The change in percentage cover was compared between treatment and control plots. There was a slight but non-significant trend for Button Wrinklewort cover to decrease in both the control and treatment plots. The trend was stronger in the heavily burnt plots but still was not significantly different from the control.

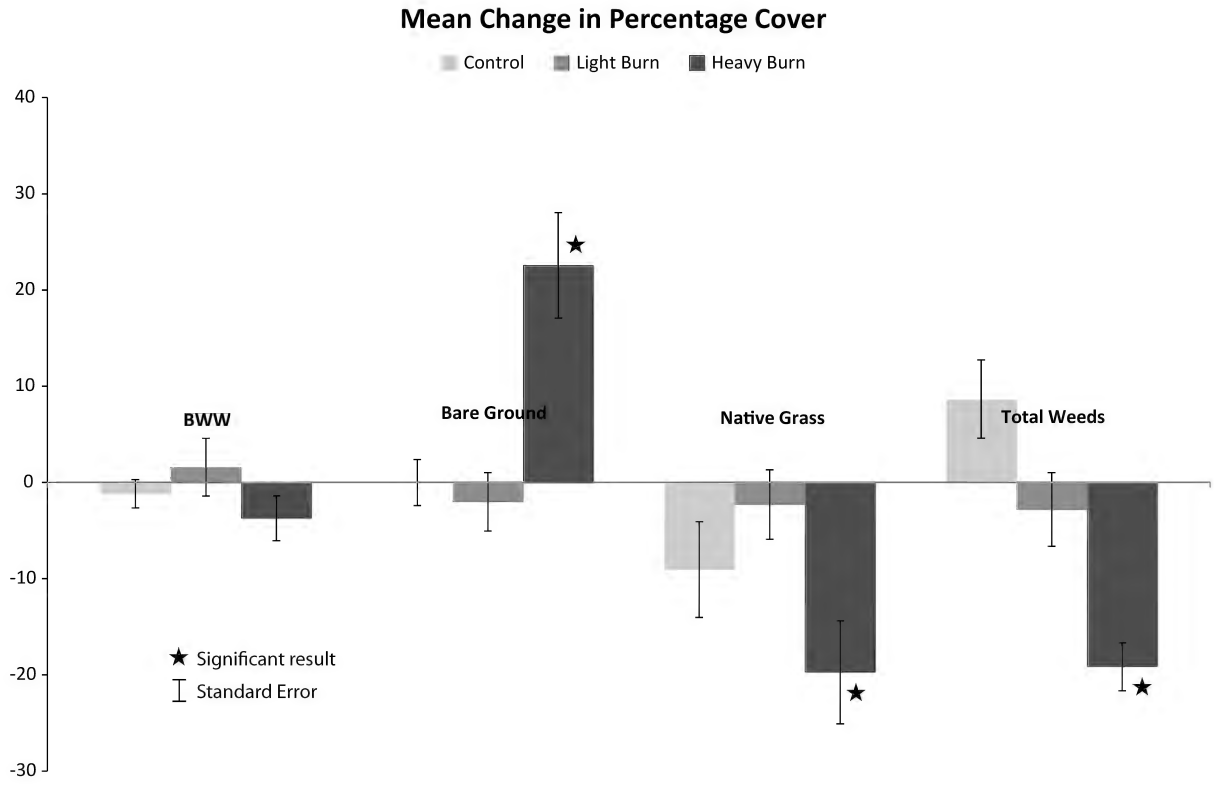
The seven heavily burnt plots experienced a significant increase in bare ground (+23%) when compared with the lightly burnt and control plots. While native grass cover decreased in all treatments there was a significantly greater decrease in the burnt plots (-20%) and there was no difference between the control and lightly burnt plots. Finally, there was a significant decrease in Plantain (-13%), Chilean Needle Grass (-3%) and total weed cover (-19%) in the heavily burnt plots, compared to the control plots.

Discussion

Contrary to the concern that fire may cause mortality in adult Button Wrinklewort plants, there was no evidence of mortality as a result of the fire treatment. Following the fire, Button Wrinkleworts were observed to regenerate from basal buds despite complete removal of all above-ground material, even in the most heavily burnt patches. This indicates that the Button Wrinklewort is able to tolerate quite an intense burn without significant losses.

The Button Wrinklewort is an inter-tussock forb, and usually grows in areas where the grass does not form a dense canopy (Scarlett & Parsons, 1990). A study by Morgan (1997) found that the Button Wrinklewort is highly gap-sensitive, with seedling emergence and survival as well as growth rate and flower production dependent on gaps greater than 30cm wide. While the present study did not look specifically at the size of inter-tussock gaps, the observed increase in bare ground and decrease in native grass cover following fire treatment may create gaps that increase germination and survival in the following year.

Studies have shown that unburnt or grazed sites tend to have a greater proportion of exotic species than regularly burnt areas (Stuwe & Parsons, 1977; Morgan & Lunt 1999). The present study found that the fire treatment resulted in a significant decrease in total weed cover in heavily burnt



Mean change in percentage cover by treatment. While there was no difference in the change in Button Wrinklewort cover between treatments, significant differences were found for bare ground, native grass and total weed cover. In all cases, the heavily burnt plots were significantly different from the lightly burnt and control plots which did not differ significantly from each other.

plots (-19%) while the controls experienced an increase of more than 8%. Herbaceous exotics such as Plantain compete with the Button Wrinklewort to occupy the same inter-tussock spaces, while Chilean Needle Grass forms dense swards that exclude inter-tussock species. Both species are considered to be particularly problematic in Stirling Park and this reduction in cover is likely to be beneficial for the Button Wrinklewort and other native species.

Conclusion

Within the short time-frame of this study, the fire treatment had no direct effect on Button Wrinklewort abundance. However, it did affect covariates such as bare ground, weeds and native grass cover that may indirectly benefit the Button Wrinklewort in the longer term by reducing competition and forming gaps that are important for germination and survival.

We recommend that fire be considered as a management strategy in Button Wrinklewort populations along with current management practices, and that further monitoring of these sites as well as additional burning trials should be carried out to assess the long-term effects including flower and seed production, recruitment, and recurrence of competitors.

Acknowledgements

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Monitoring for climate driven floristic shift in Australian subtropical rainforest

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Background

The potential impacts of climate change on subtropical rainforest vegetation communities are being studied in south east Queensland by monitoring along an altitudinal gradient. This transect forms part of a larger international survey project known as IBISCA: Investigating the biodiversity of soil and canopy arthropods. IBISCA originated in Panama in 2003 as a collaborative project between a group of 40 scientists from more than 20 countries, including Australia. Following the success of the Panama study, IBISCA-style collaborative surveys have also been conducted in Vanuatu (2006) and France (2008-2010).

In 2006, the IBISCA survey protocol was applied to the subtropical rainforests of Lamington National Park in south east Queensland. This study revolved around the establishment of an altitudinal transect ranging from 300 m to 1100 m above sea level, whereby adjacent altitudes could serve as surrogates for different climates. Such a study design has provided a unique research environment in which to study the potential impacts of a changing climate at a single point in time, as well as establishing a permanent baseline transect which can be tracked over time. Soil and canopy arthropods were intensively studied over several years and although I will focus on the vegetation results here, the results from all IBISCA Qld studies, including the vegetation studies, have recently been published in a special volume of the Memoirs of the Queensland Museum (Burwell *et al.* 2011).

Study location and methods

The IBISCA Queensland transect was established in the West Canungra Creek catchment of Lamington National Park in 2006. The transect consisted of vegetation plots established at each of five altitudes: 300 m, 500 m, 700 m, 900 m and 1100 m above sea level. As such, the transect traversed a steep moisture and temperature gradient where the low altitude plots experience generally hotter and drier conditions than the cooler and moister high altitude plots. Each adjacent altitude surveyed also represented approximately 1°C change in mean annual temperature. All plots were established on basalt derived soils with a similar aspect, a minimum of 50 m from a major water course and with no recent disturbance, in order to remove as much non-climate related variation as possible.

At each altitude, four permanently marked 20 x 20 m plots were established with star pickets and all trees ≥5 cm diameter at breast height (dbh) tagged. Diameter was measured at 1.3 m from the ground on the uphill side of the trunk and tree tags nailed in 10 cm above this. Where vines or epiphytes obstructed measurement, these were gently lifted and the tape passed underneath. All other vascular plants on the site, including tree seedlings, were identified and given a score for cover.

The study and what we found

In establishing the altitudinal transect at Lamington National Park, we were looking for early evidence of climate related floristic shift, or turnover in the vegetation community, as has been identified elsewhere in the world in similar studies. In particular, we were looking for a stepwise, upslope movement of tree species where seedlings were found growing upslope from their parent trees. Such a pattern may be an indication of the upslope movement of cool, moist environmental envelopes as is predicted to occur under warming and drying climate change scenarios. In order to do this, we compared the established and juvenile tree communities recorded at different altitudes. An 'established' tree was defined as one with a stem of ≥5 cm (dbh), and a 'juvenile' tree was one with a stem below this dbh cut-off, but capable of reaching this size class. The presence or absence of species in each of these groups was compared at each altitude by using the Bray-Curtis dissimilarity metric.

Our results did not, as it turns out, reveal a stepwise upslope movement of seedlings, but instead a pattern which was quite unexpected (Laidlaw *et al.* 2011). At the two highest altitudes, 900 m and 1100 m, the established and juvenile tree communities were quite similar, suggesting that the tree communities are largely reproducing themselves *in situ* at these sites. At altitudes of 700 m and below, however, a strong division was found between the established and juvenile tree communities, regardless of what altitude they were growing at. This result suggests that at mid to low altitudes at Lamington National Park, the recruiting tree community was not reflecting the composition of the canopy, and a floristic shift may be occurring.

Of course, such one-off surveys highlight the lack of long-term information known about forests in their 'normal' state. It is possible we had simply stumbled upon a normal pattern in these forests which has just not been recorded before. The timing of the 2006 survey coincided with

an extended period of drought where the death of some seedlings could be expected, but why was this pattern not found along the length of the transect? We suggest a possible reason is that sites at higher altitudes are regularly exposed to fog and cloud, even during droughts, which may help to mitigate the worst effects of dry weather on the understorey. We know that cloud and fog can constitute significant moisture inputs in montane forests (Hutley *et al*. 1997), and that one of the many predicted impacts of climate warming is that the elevation of cloud formation may rise. In the case of Lamington National Park, it is possible that in the future, cloud may no longer make regular contact with the vegetation at the highest altitudes, dramatically reducing the amount of moisture available during drought.

Araucarian notophyll *vine forest surveyed at 500 m altitude in Lamington National Park, south east Queensland. Photo: Melinda Laidlaw*

Conclusions and further work

Vitally, the results of the 2006 survey have allowed us to make predictions about what we may find the next time this site is resurveyed. For example, for the sites which sit at the base of the current cloud cap (approximately 900 m above sea level) we can predict an increase in the Bray-Curtis dissimilarity between established and juvenile tree communities should the base of the cloud cap rise and the mitigating effects of cloud during drought be reduced. Only ongoing monitoring of this and other similar transects established along environmental gradients will reveal if the floristic shifts identified are intermittent, or the start of a long term compositional change in Australia's subtropical rainforests. The first of many resurveys of the vegetation of the IBISCA Queensland transect is currently underway and we look forward to seeing how the forest has changed following two La Niña events.

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Monitoring the Bago Leek Orchid (*Prasophyllum bagoensis*)

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Orchid ecology

Orchids are fascinating plants. They are great indicators of health as they require so many things to work at once to maintain a population.

Firstly, they require the right micro-organisms living in the soil to facilitate nutrient absorption. The habitat needs to be suitable for those micro-organisms so any major change in landuse or environmental conditions can impact the organism thereby impacting on the orchid. For example, if there is a change in leaf litter drop or a change in the grazing regime, the micro-organism can suffer thereby impacting upon the orchid.

Secondly, the orchid requires the right pollinator to be present be it a bee, wasp or maybe a moth. The habitat requirements for the pollinator must also be right so, for example, if the site in under-scrubbed, the other food resources for the pollinator may disappear thereby reducing the population of the pollinator and the orchid's reproductive capabilities.

And of course, you need the right sort of habitat for the orchid too! So as you can imagine, orchids only really thrive in undisturbed environments and are highly susceptible to minor changes. For example, in a wet year, the orchid may flower more or less in line with how the micro-organisms in the soil cope with the increased moisture. It is this finicky nature which makes orchids particularly hard to monitor as any change in numbers from year to year may be due to natural environmental factors or may be a sign that the population is in trouble.

Monitoring the Bago Leek Orchid

The Bago Leek Orchid (*Prasophyllum bagoensis*) is listed as an endangered species under the NSW *Threatened Species Conservation Act* and occurs in sub-alpine grassy wetlands on private and State Forest lands near Tumbarumba, approximately 100 km south west of Canberra. It flowers in Spring or early Summer, which in the sub-alpine zone occurs some time in December or January. It grows in wet grasslands dominated by Tussock Grass (*Poa labillardieri*), Fine-leaved Snow Grass (*Poa clivicola*) and Snow Grass (*Poa sieberiana*) bordered by Snow Gum (*Eucalyptus pauciflora*) Woodlands (Office of Environment and Heritage, 2012).

Past censuses of the species has found that numbers of this orchid fluctuate seasonally from 20-80 plants (NSW Scientific Committee, 2004). Office of Environment and Heritage staff have been trying to keep an eye on this species since 2000 when the orchid was first collected and it is now known to occur on two properties in the Southern Tablelands of NSW, one of which is a State Forest lease and the other of which is on private property protected under a binding Conservation Agreement. A targeted survey was undertaken on the Conservation Agreement to determine if *Prasophyllum bagoensis* was present after it's location on the State Forest lease. Mapping of the area should be consulted to determine if other areas of suitable wet tussock grassland at similar elevations exist which could be targeted in future surveys to determine if more populations of this species exist.

I have had the pleasure of visiting the population on the private property three times in the last few years to monitor this orchid. The first time was back in 2008 in January when we found an abundance of orchids flowering. We walked around the site (the area of suitable habitat on the property concerned is only about 1 km square) recording all the *Prasophyllum* plants we saw and taking detailed measurements to confirm our identification. Measurements taken included the height, number of flowers, size and shape of petals as well as documenting the colour variations. There appeared to be four different species of *Prasophyllum* as well as Golden Moths (*Diuris monticola*) flowering and the grassy wetland was covered in an abundance of daisies. We recorded around 150 *Prasophyllum* orchids, 20 to 30 of which were the Bago Leek Orchid.

When I visited the property in December 2011, things were a little different. There were only two different *Prasophyllum* species flowering, one of which was *P. bagoensis*. Furthermore, we found only seven *P. bagoensis* plants and one of another species of *Prasophyllum*. The Golden Moths were also present but not in the numbers we had seen back in 2008. We visited again in January 2012 and found as little as 10 *Prasophyllum* plants in full flower with only three being *Prasophyllum bagoensis*. We did find spent *Prasophyllum* flower heads but there was no way to tell which species they were.

Possible causes of the population fluctuations and future monitoring

So what caused this difference in flowering abundance? Maybe it was indeed related to rainfall and moisture levels. The first visit in 2008 was undertaken in a year when drought was, and had been prevalent, for many years while the second visit in 2011 was undertaken in a wet year. It is possible that the Bago Leek Orchid likes the moist habitat found within the tussock grassland but does not like it too wet and hence flowers better in dry years.

This summer has also been noted as one of the coldest on record for nearby Canberra, which has impacted on the

The endangered Bago Leek Orchid was first collected in 2000 and is only known to occur on two properties in the Southern Tablelands of NSW. Photo: Maya Beretta

growth of many plants. Maybe it is the unseasonably cool weather which has resulted in a poor show of flowers for this and other species of orchid?

The site had been heavily grazed then de-stocked when the current owner purchased the site. Many improvements in the health of the flowlines through the wetland had been recorded during the second visit and grass tussocks were much denser. It is possible that the Bago Leek Orchid grows better with less competition from grasses which would explain why numbers of the species are less now that the disturbances of grazing have been removed for a longer period of time. The site is in better condition than when the owner bought it but there appear to be less orchids now than when the site was heavily grazed. Do these orchids thrive in areas with a degree of disturbance?

Well, the truth is that it is all speculation. These questions can only be answered with long term, annual monitoring not only of the Bago Leek Orchid numbers but also comparing this information to weather patterns and activities on the site over time.

Ideally, monitoring of this species should be undertaken annually with two site visits to both properties in December and January of each year. Areas of suitable habitat should be walked and a census of *Prasophyllum* species undertaken. Evidence of disturbance and the density of groundcover should be recorded as well during these visits to enable comparisons between disturbance, grass density and flowering abundance to be made. Furthermore, other areas of suitable habitat in the region should be surveyed to determine if other populations of this species exist and these could also be added to the monitoring program. And even with regular monitoring, questions may still remain, especially with a family of plants which is as complex as the Orchids.

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Vehicle access controls monitored through photopoints

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Monitoring the vulnerable Sand Ixodia

Douglas Point Conservation Park was declared a National Park and Wildlife Reserve back in 1997 to protect an important population of the Sand Ixodia (*Ixodia achillaeoides* subsp. *arenicola*). This spectacular coastal plant is a nationally Vulnerable plant species and occurs in south west Victoria and the south east of South Australia. The only protected reserve where this species occurs naturally is the Douglas Point Conservation Park some 30 km south west of Mt Gambier. This park was declared to protect this species but also other flora and fauna species including the Rufous bristlebird (*Dasyornis broadbenti*).

Off-road vehicles were considered the greatest threat in the reserve with past use being totally uncontrolled and impacts to the Sand Ixodia population being the motivation for proclamation. A local volunteer group (Mt Gambier Friends of Parks Group) set upon a project to improve the plight of this fabulous but fragile coastal park and *Ixodia* species.

In 1998, the enthusiastic volunteers went into action and constructed low cost fencing and barriers, and parking bays to help keep vehicles to defined tracks and away from eroded areas, cliff tops, and the Sand Ixodia population. The going was tough, digging post holes by hand in calcrete/flint topped ridges and cliff tops but all was worth it in the end. Towards the end of 1998 all was complete. Now time to sit back and watch. Monitoring was considered an integral component of this project and photopoints were the option chosen. The aims of the photopoints were to:

- maintain records on the regeneration of the Ixodia population on the trig point
- provide the group with photopoint monitoring experience
- record changes in vegetation structure and regrowth in areas where access control works had been undertaken.

A series of 12 photopoints were set up in 1998 where vehicle control works had been undertaken. Each site

was marked with two small wooden stakes to ensure they blended in with the environment. One was the sight peg and the other the photographers standing point. Each point was logged into a GPS for ease of finding again and a form was filled out noting any features or changes to the site since the last visit. Changes included vegetation growth and increased track use and less vehicle damage from driving off-track. The frequency of the monitoring started out as annual then once every two years and is now once every three years.

Results

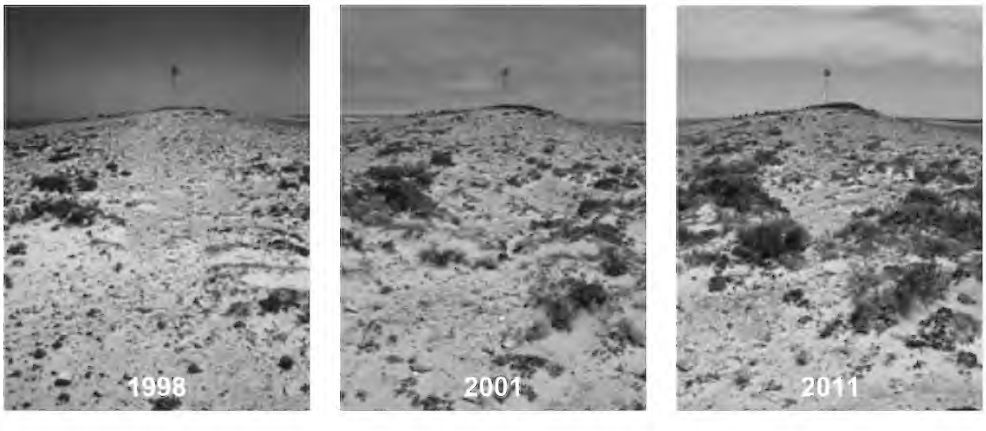
The photopoints have created a fantastic historic record of the condition of the reserve at a given point in time allowing us and future land managers to compare how the park and specific locations throughout the park have changed (positively or negatively) after our actions. We would not change anything to our methods only that finding the small pegs have been difficult once sand begins accumulating and vegetation grows. Most of the sites have shown only gradual change (improvements in vegetation growth) with others showing damage to vegetation and highlighting park user preference to old tracks. This is the first time our photos have been used to show case how well photopoints can work.

For the Sand Ixodia, despite the extremely harsh conditions including a rocky shallow soil our photos (without counting plants) show that the population has increased both in numbers and overall plant size. The original access track has grown back well preventing any further impacts by vehicles to this site. Project successful!!

In 2008, the Department for Environment and Natural Resources staff set up more formal plant monitoring protocols (transect/quadrats) using our photopoints as a guide to more accurately document changes to the population at this site.

Sand Ixodia is a nationally Vulnerable plant species, occuring in south west Victoria and the south east of South Australia. The only protected reserve where this species occurs naturally is the Douglas Point Conservation Park some 30 km south west of Mt Gambier. (Photo: Bryan Haywood)

Photo monitoring clearly shows that the original access track has grown back well preventing any further impacts by vehicles to this site. Project successful!!



A gradual improvement in the Sand Ixodia population growing in a very harsh environment.

Introduction of Pellitory into revegetated coastal dunes to attract the Yellow Admiral Butterfly, City of Stirling, Western Australia

Georgina Lambert and Sheldon Pritchard

Stirling Natural Environment CoastCare. http://stirlingnaturalenvironmentcoastcare.myclub.org.au/. Email: georgina20@iinet.net.au

Introduction

This project was started in 2010 by volunteers of Stirling Natural Environment Coastcare (SNEC).

Across Australasia, members of the nettle family Urticaceae provide food for the Yellow Admiral butterfly larvae, *Vanessa itea*, Family Nymphalidae. These species form a broken continuum, across temperate Australia, her islands, to Tasmania and New Zealand (Braby, 2000). One cosmopolitan link is Pellitory (*Parietaria debilis*) (Powell 1993).

In southwestern Australia (WA), Powell (1993) confirms that the most utilised larval food plant is Pellitory (*Parietaria debilis*). Other known species are reported to be the native nettles *Urtica incisa* and *Parietaria cardiostegia*, also, introduced *Parietaria judaica*, *Soleirolia soleirolii* and Stinging Nettle (*Urtica urens*). SNEC was not interested to introduce more problematic weed species into the coastal bushland, besides, Stinging Nettle causes unpleasant dermatitis.

Compared to our spectacular flora, especially when in spring flower, Pellitory plants are unimpressive. They grow to 40 cm height, prefer semi-shaded damp areas, under the shelter of larger bushes, on calcareous soils. Easily mistaken for weeds, and often smothered by weeds, the unknowing would pass them over as an insignificant component of the bushland. Environmental degradation continues to limit the natural distribution of Pellitory and so, in turn, diminishes the local breeding potential of *Vanessa itea*.

Two healthy larvae have almost defoliated this plant (Photo: Sheldon Pritchard)

Also, as Pellitory is an Annual, with an eight month seed-to-seed lifespan, April/May to November/December, the butterflies must breed and oviposit on healthy plants, between June and early October to ensure that they get sufficient food before seed set and the plants' demise as the heat of summer arrives.

Within the City of Stirling, there is one natural stand of Pellitory on a coastal dune north of Scarborough; and two planted sites along a bushland path (Powell, pers. com. 2009). Despite growing in Trigg Bushland Reserve, a Bush Forever Protection Site, they are poorly protected (Western Australian Planning Commission, 2000).

Methods

Seed source

Seeds of Pellitory were sourced from Robert Powell's bush garden and we followed his procedures for seed sorting and counting. His original plant and seed stock came from Rottnest and Garden Islands, some 20 km offshore from the cities of Perth and Fremantle. Coates & Hamley (1994), in their population dynamics study, confirmed there would be no significant genetic deterioration nor variation in resultant mainland generations if their seed source was of island provenance.

Garden projects

We grew Pellitory in our gardens as an important side project (SNEC 2010/2011). This gave us the opportunity to observe more closely stages in the Yellow Admiral's lifecycle. In the most successful garden with the largest population of Yellow Admirals, additional Pellitory had to be transplanted to supplement the food supply.

Coastal dune sites

Seven sites were chosen along 6.5 km of coastline, selected to match Pellitory's natural requirements. All were 1 m^2 in area and coordinates recorded using a GPS. Each site was broadcast with 1000 Pellitory seeds/m^2 in April 2010. Sites were visited fortnightly to weed, count plants and check their growth, defoliation, flowering and seed production status. Larval behaviour was also observed, using an extendable hand mirror followed up by photography.

A newly emerged Yellow Admiral Butterfly clinging to its pupal case (Photo: Sheldon Pritchard)

Results

A significant hail storm at the end of March 2010 moistened the soil sufficiently to warrant starting the project early, by mid-April. This heralded one of WA's driest winters on record and germination followed suit with fewer than five plants germinating at five of the sites. These sites were abandoned. Better germination occurred at the two remaining sites (sites W1 and W2), located some 5 m inside a fenced and signposted 'Dune Conservation Area'.

In June 2010, 40 and 25 plants had germinated in sites W1 and W2 respectively. Both sites were covered for 7 days in August 2010 to protect from local spraying of *Oxalis pes-caprae* with Metsulfuron Methyl 0.2g/15L + Pulse®. Pellitory survived, some stressed.

Between 7 and 15 September 2010, five to six larvae and 17 -23 larvae were observed at sites W1 and W2 respectively. As they grew, the larvae varied in size with one, in late September, large enough to pupate. Had there been several layings or were some larvae undersized due to insufficient food? The plants were defoliated but continued to form leaf and flower.

Mid afternoon on the 20 September 2010 near Site W2, there hovered a Willy Wagtail (*Rhipidura leucophrys*), King's Skink (*Egernia kingii*) and a Bobtail (*Tiliqua rugosa*), all predators of small animals and insects. By 8 pm there was total disappearance of larvae. Did our activities this day alert these predators to their tucker? Did the largest larva move away to pupate deep inside the Acacia cyclops bush?

By November 2010, the Pellitory lifecycle was complete. Extra seed stock for 2011 was sourced from our gardens and in June 2011 the project recommenced. Welcome winter rains continued through to early December 2011. The soil seed bank germinated, yielding in excess of 500 plants per site over an expanded 2 m^2 area. An additional 250 seeds were sown over the sites.

In August 2011, the environs around both sites were sprayed for *Oxalis pes-caprae* with Metsulfuron Methyl 0.2g/15L + Pulse®. Sites were not protected – a serious oversight. Within the month between 75% and 95% Pellitory plants had died. Surviving weakened Pellitory could not support the resident larvae. The project was stopped.

Conclusions

In 2010, the initial Pellitory populations at sites W1 and W2, survived an unusually dry winter but, more intriguing, they were sufficient to attract breeding Yellow Admiral butterflies. We are encouraged to believe that Yellow Admirals might now make annual visitations to these sites. SNEC's efforts to rehabilitate the coastal vegetation are steadily revitalizing local biological processes, and, though disappointed to lose the vulnerable larvae to probable predation, perhaps a natural food link has been added to the evolving coastal biota.

It is important to learn that herbaceous annuals, like Pellitory, seem highly vulnerable to Metsulfuron Methyl spray. To protect plants, they must be covered for five to seven days during and after spraying.

This project has been a steep learning curve establishing Pellitory; and we are yet to observe Yellow Admiral visitations on the dunes. We have gleaned, thus far, a basic understanding of the intimacy between a now, not so insignificant plant species, and the Yellow Admiral butterfly. This is just one of a myriad of intraspecific relationships that could develop within our local coastal dune plant communities.

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SNEC's 2010/2011 A butterfly story with Christmas Cheer. *Christmas & New Year Newsletter* pp. 2-3. http://www.stirlingnaturalenvironmentcoastcare.myclub.org.au/.

Acknowledgements

We sincerely thank the City of Stirling and the SNEC Committee for permission to carry out this project. Robert Powell, WA mentor for so many Friends' Pellitory projects, guided us through 2010 and interpreted the lifecycle of *Vanessa itea*. Vanda Longman permitted us to collect another seed source from her garden. Sheldon Pritchard patiently photographed interesting stages in the butterfly's lifecycle; and all praise to those seven SNEC volunteers who bravely undertook to grow Pellitory in their gardens!

Habitat of the Leafless Tongue Orchid (*Cryptostylis hunteriana*) throughout its known Australian distribution

Claire de Lacey, Stephen Bell[A], Steven Chamberlain and Karl Bossard

[A]Corresponding author. Email: sajbell@bigpond.com

Rationale

Targeted surveys to detect rare or cryptic plant species and their likely habitats are an important technique; however, they are expensive and time consuming, and sometimes don't provide much useful information, especially where the threatened plant species in question has a wide distribution. Furthermore, the current rate of habitat loss for these plant species is sketchy or unknown; like many rare and cryptic species the Leafless Tongue Orchid is often overlooked in surveys. This project set out to improve our understanding of what conditions and habitats the Leafless Tongue Orchid prefers, and so improve the way we manage native habitats and assess development to help protect and conserve them.

Description of the Leafless Tongue Orchid

The Leafless Tongue Orchid (*Cryptostylis hunteriana*) is a leafless saprophyte; only when in its reproductive phase (November to February in New South Wales and Victoria, June to August in Queensland) does it appear above ground. The species is listed as Vulnerable in NSW and at Commonwealth level. The principal threat to the species is disruption or loss of natural habitat through development pressures in coastal regions (NSW DECC 2005a). Lack of knowledge on preferred habitat can place species at risk in areas undergoing rapid and intensive development.

Prior to this study, papers on its regional occurrence had been published (e.g. Bell 2001; Clarke et al. 2004), but there was no comprehensive, range-wide treatment.

Methods

All known records of the Leafless Tongue Orchid were extracted from state and Commonwealth databases (and other verifiable sources) across its entire range: in all, 108 sites were surveyed. At each site, full floristic data were collected within a 0.4 ha (20 x 20 m) quadrat; additional data recorded included vegetation structure, soil types, aspect and cover-abundance for all plant species.

These data were then analysed: species recorded in plots from this and other surveys were transformed to simple presence/ absence format to allow data from all surveys (regardless of how cover-abundance scores were rated) to be used in the analysis. Two statistical analysis routines in PRIMER (Clarke and Gorley, 2006) were used: the first elucidated apparent vegetation communities in which the Leafless Tongue Orchid occurred; the other - performed on the combined dataset - produced diagnostic species lists for each vegetation type generated. Maximum entropy modelling software (*MaxEnt:* Phillips et al. 2006) was used to model the distribution of the Leafless Tongue Orchid using landscape variables (e.g. climate, substrate, terrain datasets) to ascertain correlations within the current distribution. The derived vegetation communities, combined with *MaxEnt* outputs, allowed the species' potential distribution and those habitats where it was most likely to occur to be mapped across its range.

Results

The locations of the 108 known sites visited, areas of potential habitat and the most likely habitats for the Leafless Tongue Orchid, were mapped throughout the species' entire range.

Substantial populations of the Leafless Tongue Orchid occur: between Jervis Bay and Batemans Bay (NSW South Coast); near Lake Macquarie and Nelson Bay (NSW Central Coast); and East Gippsland in Victoria. Scattered records occur in south-east Queensland, the Gibraltar Range area and at Nowendoc (NSW Northern Tablelands), near Eden, (NSW South Coast) and in the Blue Mountains.

Existing authoritative texts stated the Leafless Tongue Orchid was known to occur in wet-heath on sandy soils in coastal districts; however, this research suggests it occurs in a much wider range of habitats, as outlined below.

NSW Northern Tablelands

- New England Blackbutt Grassy Forest and New England Blackbutt Shrubby Forest
- Large-fruited Blackbutt/ Strawberry Gum Woodland.

NSW Central Coast

- Scribbly Gum/ Bloodwood/ Apple Woodland
- Bloodwood/ Apple/ Mahogany/ Peppermint Forest
- Grey Gum/ Bloodwood/ Stringybark Forest (Georges River)
- Dwarf Apple/ Banksia Scrub (North Sydney).

NSW South Coast

- Banksia/ Hakea Wet Heath
- Banksia/ Hakea Dry Scrub-heath
- Peppermint/ Bloodwood/ Stringybark/ Silver-top Ash Forest
- Bloodwood/ Scribbly Gum/ Silver-top Ash Forest
- Silver-top Ash/ Yertchuck/ Spotted Gum Forest
- **Woollybutt/ Bangalay/ Stringybark/ Rough-bark Apple Forest (Eden)
- **Spotted Gum/ Woollybutt/ Paperbark Forest
- **Coachwood/ Lilly Pilly/ Bangalay Rainforest

South East Queensland

- Banksia/ Mahogany Wallum Heath

East Gippsland (Vic)

- Grasstree Wet Heath
- Yertchuck/ Stringybark Woodland.

The species was found to occur at elevations from 10m asl in South East Queensland to over 1200m in the NSW Northern Tablelands, on various soils derived from basalt, sedimentary geologies and Quaternary sands. Protected populations of the Leafless Tongue Orchid are known from various National Parks (e.g. Gibraltar Range, Tomaree, Wallarah, Ku-ring-gai, Jervis Bay, Murramurrang, Ben Boyd [NSW] and Croajingolong [Vic]).

Limitations

Data

Ten of the 18 defined habitat types are based on single samples only: the authenticity of these records is not doubted, but their occurrences in otherwise unreported habitats pose questions about habitat variations associated with this species. Records in 3 of these groups (prefixed ** in the list above) are additionally uncertain because of location data accuracy. These groups should be treated with less confidence than the other defined groups.

The Leafless Tongue Orchid is a leafless saprophyte which is only detectable when in flower (November to February in New South Wales and Victoria, June to August in Queensland). Photo: Stephen Bell

Use

Modelling and habitat profiles are useful for estimating the probability of threatened cryptic plant species occurring; however, unknown populations could occur that have not been predicted because their habitat was not represented in the sample data. Outlier populations, particularly those at the limit of a species' range, are important in enabling species to adapt to future habitat alterations (e.g. as an effect of climate change). Given the foregoing, and the necessarily limited nature of this study, defining potential habitat for the Leafless Tongue Orchid should not rely totally on our research: an area's suitability as potential habitat for the Leafless Tongue Orchid should be determined using our research along with additional tools, such as the scientific literature and local knowledge.

Conclusion

Given the rate of species extinction and habitat loss in Australia, there is an urgent need for land managers and consent authorities to understand preferred habitat for rare species, especially cryptic species. The default assumption in most environmental impact assessments is that a species will be detected during surveys if it is present or, where not recorded, that the site represents low quality habitat for the species. However, a growing body of evidence recognises that this is not the case, either because an observer fails to detect species that are present at a site, or the plants' habits make it impossible to detect most of the time. Predictive modelling of potential habitat allows land managers to be better informed on the locations in which cryptic and rare species are likely to occur.

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Acknowledgements

We thank the NSW Environmental Trust for funding this project. For their invaluable assistance we also thank: The Australasian Native Orchid Society (especially Alan Stephenson) and Michael Smith at Shoalhaven City Council; also the numerous state agency staff, orchid enthusiasts and conservation volunteers for field records or assistance. The supply of data from State and Federal government databases is also appreciated.

Further Information

For full details of the study, including the results of predictive mapping, please contact the NSW Environmental Trust. A detailed paper submitted to the ecology journal Cunninghamia will be published in the near future following peer review.

*The threatened and cryptic Leafless Tongue Orchid (*Cryptostylis hunteriana*) is often overlooked in surveys. Photo: Alan Stephenson*

Report from New Zealand Plant Conservation Network

Kerry Gillbanks

Email: kerry.gillbanks@aucklandcouncil.govt.nz

New Zealand Threat Classification System

The New Zealand Indigenous Vascular Plant Panel will be meeting in late April/early May to review the threat listing of New Zealand indigenous vascular plants. The Department of Conservation developed the Threat Classification System to assess the status of any plant, animal or fungus that has a wild population established in New Zealand. Information is gathered from the entire community of relevant scientific and conservation experts in the country.

Progress is monitored through three indicators; extinct species, status of threatened species and the status of at risk species. Extinct species is measured through trends in the number of indigenous species that are extinct. Status of threatened species and of at risk species are measured through trends in – the number of species in each category, the number of species in each category under active management and the demographic response to management at population level for selected species as case studies.

The system is reviewed approximately every three years.

Molloy, J., Bell, B., Clout, M., de Lange, P., Gibbs, G., Given, D., Norton, D., Smith, N., Stephens, T. (2002) Classifying species according to threat of extinction. A system for New Zealand. *Threatened species occasional publication* 22:26.

New Zealand's Favourite Plant for 2011

A native Bamboo Rush, *Sporadanthus ferrugineus,* found growing only in the Waikato region of the North Island was voted as the Network's favourite native plant for 2011 in our annual ' Vote for your Favourite Native Plant'. Past winners have been the Chatham Island forget-me-not, *Myosotidium hortensium,* Cook's scurvy grass, *Lepidium oleraceum* and pingao, *Ficinia spiralis*. What will it be this year? Voting opens at the end of the year.

Network Updates

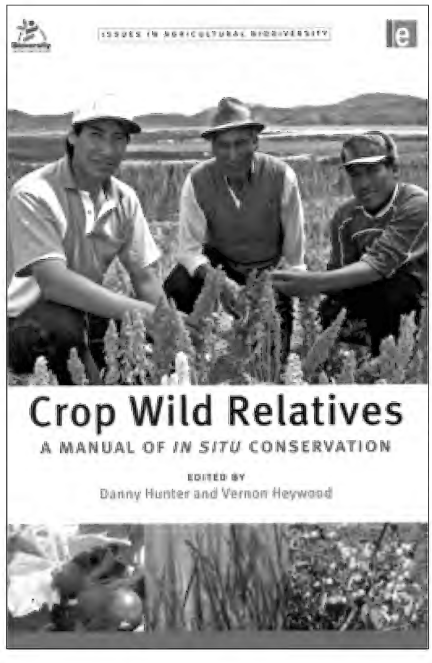
Keep an eye out for details of our upcoming conference being held in Auckland at the end of this year.

Visit www.nzpcn.org.nz for more information.

Book reviews

Crop wild relatives. A manual of *in situ* conservation

Edited by D. Hunter and V. Heywood
Earthscan, February 2011, 352 pages
Paperback ISBN: 9781849711791, AU $ 72.00
Available from http://www.cropwildrelatives.org/resources/in_situ_conservation_manual.html



Our dependence on biodiversity is increasingly recognised, and one of the essential services provided by biodiversity is the provision of food and fibre. Global crop production is dominated by very few species, and within those species in any one year, a small number of varieties are grown over very extensive areas. At the same time old varieties are being lost and, until recently, very little attention had been given to conservation of the wild progenitors and other related species of crops. The main strategy employed for conservation has been the establishment, *ex situ* of secure storage of propagation material, either seed or vegetative (including tissue culture samples). This strategy is also recognised as being important for conservation of plant species in general, and substantial investments are being made in Australia and overseas in the construction of genebank facilities.

Important, and indeed essential, as genebanks are the Biodiversity Convention gives priority to *in situ* conservation. Not only are there philosophical grounds for such an approach, there are strong practical reasons. We live in a rapidly changing world, and climate change is only one of the threats to biodiversity. Material retained in genebanks conserves genetic resources adapted to the environment at, or more probably, before the time of collection. Conservation *in situ* provides the opportunity for evolution and selection of new genetic variation better adapted to changed environments.

In recent years niche markets have developed a far greater diversity of foodstuffs. Local supermarkets now regularly have a range of tropical fruits of which we were previously unaware, and 'exotic' grains like quinoa feature in recipes and on shop shelves while heritage varieties of fruit appear at farmers' markets and specialist fruiterers. It is likely that many more species will feature in the future, but it is unlikely that new global staples will emerge. The majority of humans will remain dependent on the same limited number of species which has sustained population expansion over the past two centuries. Feeding a much larger population, on less, or lower quality land, into the future will require substantial 'improvement' of those core species, be it through conventional breeding or genetic engineering and is likely to require input from wild relatives.

The Global Environment Facility and the United Nations Environment Programme have provided substantial funding for the project – *In situ* conservation of crop wild relatives through enhanced information management and field application. The volume under review is one of the outcomes of the project. The project involved five partner countries: Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan. This draws to attention how many of the field and orchard crops of western agriculture derive from origins in the Middle East and Central Asia, and how many potentially invaluable genetic resources are at risk in these regions.

Australia, so far, has contributed few new crops to world agriculture (macadamias excepted), but eucalypts are major forestry trees in many parts of the world. Interest in bush-tucker may lead to domestication of new crops. As part of our responsibility for all biodiversity in the continent we need to be aware of our obligations to retain and utilise the potential of possible crop plants.

A major component of the manual deals with community education, and ownership of knowledge and the benefits derived from it. Building community partnerships are an important component of conservation in Australia, and while there have been many successes we can still learn from the experiences of others.

This very interesting volume deserves to be widely read, and while perhaps not something individuals will rush out to buy, should certainly be on the shelves of as many libraries as possible.

Review by Paul Adam
School of BEES, University of NSW

Information Resources and Useful Websites

Draft national wildlife corridors plan

www.environment.gov.au/wildlife-corridors

The Federal Government has released the Draft National Wildlife Corridors Plan aims, providing the government a proposed strategy to restore and manage ecological connections in the Australian landscape. The plan aimed to restore native wildlife and rebuild ecological functions in the landscape, including the long-term retention of natural stores of carbon.

Norman Wettenhall Foundation

www.nwf.org.au

The Norman Wettenhall Foundation is an environment group and philanthropic trust that focusses on supporting biodiversity conservation projects around Australia. They particularly look for innovative and collaborative flora and fauna programs involving research, monitoring and recording data, training, community education, and sustainable land management. For more information on grants go to our website www.nwf.org.au and check out the guidelines and closing dates. You can email Beth on beth@nwf.org.au with any queries.

Australian weed identification on-line tool

www.business.qld.gov.au/agriculture/land-management/weed-identification-tool.html

The Lucid team at the University of Queensland – now based in the Queensland Alliance for Agriculture and Food Innovation (QAAFI) – have been involved in the development of weed identification tools for the past 10 years. The key to Environmental Weeds of Australia, previously only distributed as a DVD, is now available for free online, courtesy of Biosecurity Queensland. This interactive identification and information resource for over 1000 invasive plants is an invaluable resource for all those involved with research, training and management of environmental weeds in Australia, especially State and local weed control officers, Bushcare and Landcare volunteers.

Biological control of weeds in Australia

Edited by M. Julien and R. McFadyen
CSIRO publishing, March 2012, 648 pages with colour photographs and illustrations
Hardback, ISBN 978064309993, $180.00

Biological control of weeds has been practised for over 100 years and Australia has been a leader in this weed management technique. The classical example of control of prickly pears in Australia by the cactus moth *Cactoblastis cactorum,* which was imported from the Americas, helped to set the future for biocontrol of weeds in many countries. This book reviews biological control of weeds in Australia to 2011, covering over 90 weed species and a multitude of biological control agents and potential agents.

Weeds of northern Australia

by Nicholas Smith
Environment Centre of the Northern Territory, $25

This field guide features 150 species weeds and will help you identify high priority weeds threatening Northern Australia. For more information and to download a couple example pages, to get a feel for the field guide, visit http://www.ecnt.org/weeds-field-guide

Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects

www.rta.nsw.gov.au/environment/biodiversity/index.html

Biodiversity Guidelines - Protecting and managing biodiversity on RTA projects has been released by NSW Roads & Maritime Services (RMS - formerly the Roads & Traffic Authority, RTA).

These Guidelines are intended for use by RMS staff and contractors, but provide a valuable template for other public- and private sector utilities providers in all States (and should be used by the conservation sector to get such organisations to lift their game!).

Formatted as ten guides, they cover:

Guide 1: Pre-clearing process

Guide 2: Exclusion zones

Guide 3: Re-establishment of native vegetation

Guide 4: Clearing of vegetation and removal of bushrock

Guide 5: Re-use of woody debris and bushrock

Guide 6: Weed management

Guide 7: Pathogen management

Guide 8: Nest boxes

Guide 9: Fauna handling

Guide 10: Aquatic habitats and riparian zones

Information Resources and Useful Websites (cont.)

Myrtle Rust Information Resources

Key Myrtle Rust documents are now centrally available on the new Commonwealth website http://myrtlerust.net.au. These include:

- The national Plan for Transition to Management of Myrtle Rust (version 1, Nov. 2011), outlining current Commonwealth-funded projects.
- Myrtle Rust Forest Industry Issues Paper (Forest and Wood Products Australia) - dated 'June 2011' but apparently only released in December. This paper attempts to assess the likely impact on commercial forestry in Australia, and contains the only (so far) public post-mortem on the initial 2010-11 response effort.
- Management Plan for Myrtle Rust on the [NSW] National Parks Estate (Oct. 2011, NSW Office of Environment and Heritage).

An updated Management Plan for the greenlife sector has just been released by Nursery & Garden Industry Australia. The Australian Nursery Industry Myrtle Rust (*Uredo rangelii*) Management Plan 2012 is available at http://www.ngia.com.au/Section?Action=View&Section_id=527 and updates host lists, plant interstate movement controls, and fungicide treatments. This remains by far the most comprehensive guide for everybody in the plant growing and distribution sectors.

State websites: Key websites in the states of occurrence are:

Queensland: www.dpi.qld.gov.au/4790_19788.htm

New South Wales: www.dpi.nsw.gov.au/biosecurity/plant/myrtle-rust

Victoria: www.dpi.vic.gov.au/forestry/pests-diseases-weeds/diseases/myrtle-rust

Domestic quarantine provisions are in place – see www.quarantinedomestic.gov.au/myrtle-rust.html for links.

A Way Through: The Life of Rick Farley

by Nicholas Brown and Susan Boden
New South Books, February 2012
Paperback, 432 pages, ISBN 9781921410857, $39.95

Rick Farley was one of the architects of the national Landcare program, which created a wholly new level of dialogue and engagement between the farm sector and the conservation sector. He was one of the all too rare creative and honest free-thinkers on Australian natural resource management – among many other things. His death in 2006 left us much poorer in the debates over water, land use, and rural conservation. Andrew Campbell recently posted a good review of the biography at The Conversation (http://theconversation.edu.au/what-happened-to-brave-leaders-a-look-at-the-life-of-rick-farley-5376) .

Research Roundup

Compiled by Kirsten Cowley, Centre for Plant Biodiversity Research, Canberra.
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Special Issue: **Human-mediated introductions of Australian acacias – a global experiment in biogeography.** *Diversity and Distributions* Volume 17(5) (whole issue), pages 771–1075. September 2011.

Barbour, W. & Schlesinger, C. (2012). **Who's the boss? Post-colonialism, ecological research and conservation management on Australian indigenous lands.** *Ecological Management & Restoration* 13(1): 36-41.

Bauer, J.T. (2012). **Invasive species: "back-seat drivers" of ecosystem change?** *Biological Invasions.* DOI 10.1007/s10530-011-0165-x

Beale, R. (2008). **Special report: Review of Australian Quarantine and Biosecurity.** www.quarantinebiosecurityreview.gov.au

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Contributions to Research Roundup are welcome, and should be sent to Kirsten Cowley at the above email address using an email subject heading "APC Research Roundup" or similar. Their inclusion will be subject to available space.

Conferences and Workshops

4th National NRM Knowledge Conference

16-18 April 2012
Adelaide, SA

This conference will be an opportunity for planning, policy and on ground practitioners to share their relevant successes, experiences and learnings with their Australia-wide colleagues and to see and hear a lot of examples of how programs are being delivered by peers to achieve healthy and resilient landscapes inclusive of productive, cultural and natural systems. For more information visit http://www.aomevents.com/NRM2012

Fungi Festival 2012

26-30 April 2012
Hobart, Tasmania

Fungi Festival 2012 includes a Symposium on the Conservation and Management of Fungi (April 26-27) and weekend workshops and forays about fungi as well as a debate on the 'Eating wild fungi: fun or foolhardy'. Fungi Festival 2012 is organised by Fungimap and NRM South (Tasmania).

Further information: Blanche Higgins (Fungimap Coordinator) 03 9252 2374, fungimap@rbg.vic.gov.au. Booking forms are available on the Fungimap website http://www.rbg.vic.gov.au/fungimap

2nd National Conference on Practical Responses to Climate Change

1-3 May 2012
Canberra, ACT

The theme for 2012 is "Water and climate: policy implementation challenges". This conference will be an opportunity for policy makers, engineers, scientists, planners and academics to present, hear and debate the latest research and practice on water and climate policy implementation challenges in urban, catchment and coastal environments. Visit the conference website at www.climatechange2012.org for further information regarding conference themes.

NRM planning for resilience: Strategic regional planning to build resilient landscapes & communities

20-21 June 2012
Sydney, NSW

Resilience thinking offers an approach to environmental management that makes it possible to identify undesirable states in the landscape and determine landscape thresholds. Understanding this concept and how it can be applied at a regional level will enable landscapes and communities to absorb disturbance and maintain environmental, social and economic development.

NRM Planning for Resilience will bring together key players currently developing regional plans and policies to support climate change adaptation and sustainable regional development. Delegates will examine the linkages and competing demands across social, economic and environmental drivers. For more information visit http://nrmoutcomes.com/

Conferences and Workshops (cont.)

19th Australian Orchid Council Conference and Show

11 – 16 September 2012
Perth, WA

The Australian Orchid Conference, held every three years, will be held in Perth this year. For more information visit http://www.waorchids.iinet.net.au/19th_AOC_Conference.htm

Coast to Coast 2012 - *Living on the Edge*

17-21 September 2012
Brisbane, Queensland

Australia's bi-annual Coast to Coast Conference provided a forum for those with an interest in coastal, estuarine and marine matters to meet and to share knowledge and experiences in the areas of management, science, policy, governance, advocacy and other related topics. For more information visit http://www.coast2coastaustralia.com/

Government Sustainability Conference

18-19 September
Melbourne, Vic

The 2012 Government Sustainability Conference will provide local, state and federal government professionals and representatives of other public sector agencies with comprehensive analysis and advice about how to ingrain environmentally sustainable policies and practices within their organisations and the communities they serve. The conference will address environmental issues facing all levels of government, including:

- How to embed a culture of environmental sustainability within a government organisation.
- Implementation of leading-edge climate change strategies that encourage reduced emissions and prepare a government organisation for the risks posed by climate change.
- Community engagement in environmental initiatives.
- Encouraging sustainability in public sector infrastructure and the built environment.
- Efficient water management practices and waste minimisation.
- Green purchasing and procurement.
- Policy and regulation adherence.

Visit http://www.governmentsustainability.com.au for more information.

Oceania Section of the Society for Conservation Biology Regional meeting: People and Conservation in Land and Sea Country

21 – 23 September 2012
Darwin, NT

This regional conference on Conservation Biology in Oceania will focus on traditional land and sea management, by Indigenous people. This meeting will showcase Indigenous conservation management while highlighting the tools and knowledge now available to all conservation practitioners in caring for land and sea country For more information visit http://oscb2012.org/home

Australian Rangeland Society 17th Biennial Conference

23-27 September 2012
Kununurra, WA

This conference brings together managers, users and researchers of rangelands for discussion of 'hot topics' and current rangeland issues. The theme for the Conference is 'celebrating diversity: people, places, purpose'. Proposed topics for discussion include:

- strategic land and water use planning in northern Australia
- balancing pastoral, tourism, mining and conservation uses in the rangelands
- Indigenous land use and management
- latest techniques in grazing, biodiversity, fire and carbon management
- new science for rangeland management in a multiple use framework
- case studies in land restoration and land use change.

For more information visit http://www.austrangesoc.com.au/site/whatson_conference.php

Conferences and Workshops (cont.)

Australasian Systematic Botany Society Conference

23-28 September 2012
Perth, WA

The conference theme (Local knowledge, global delivery) is inspired by the recent, landmark decision to allow electronic publication of new taxa. Abstracts on biodiversity informatics, web-based collaborations, electronic publishing and eFloras are invited. Presentations on local endemism, pollination ecology and biodiversity threats such as climate change and plant pathogens are also encouraged.

The conference coincides with the height of spring flowering in the south-west of Western Australia and is also an excellent opportunity to visit the new Western Australian Herbarium, which has recently moved to a state of the art facility within the Western Australian Conservation Science Centre. Please visit http://www.asbs2012perth.com/ for further information.

18th Australasian Weeds Conference

8-11 October, 2012
Melbourne, Vic

The Conference will showcase recent advances in weed science, extension and policy across Australian and international communities and landscapes. The Conference will focus on 'Developing solutions to evolving weed problems'. For more information visit the conference website http://www.18awc.com

EIANZ Annual Conference

24 – 26 October 2012
Sydney, NSW

The Environment Institute of Austalia and New Zealand annual conference will be held in Sydney in October. For more information visit the conference website http://www.eianz.org/eventsplus/category/environment-institute-annual-conference

2012 ANPC Conference

30 October – 2 November 2012
Canberra, ACT

The ANPC marks its 21st year in 2012. To celebrate the occasion, the 9th ANPC National Conference will:

- review and highlight plant conservation achievements in Australia over the last two decades
- evaluate the strengths and weaknesses of our existing approaches to plant conservation
- highlight current major issues facing plant conservation in Australia
- identify plant conservation directions in Australia for the coming decades.

The overall conference theme is *plant conservation in Australia, achievement and future directions*. Sub-themes include:

- Threats
- Conservation policy
- Plant conservation strategies
- Vegetation, soil and water context
- Ecological restoration
- Role of the NGO sector.

The conference will include invited key note papers, contributed papers, posters and workshops, as well as field trips in the ACT region to examine on-ground plant conservation activities. Registration for the conference will open in mid May 2012. Further information available at http://www.anbg.gov.au/anpc/conferences/2012/themes.html.

Ecological Society of Australia Annual Conference Ecology: Fundamental Science of the Biosphere

3 – 7 December 2012
Melbourne, Vic

The theme for Ecological Society of Australia's 2012 annual conference is Ecology: Fundamental Science of the Biosphere. The aim is to "get back to basics" and focus on the scientific inquiry that underpins our discipline. Ecology is fundamentally important to the conservation and wise management of the Earth's natural resources. The outcomes of our work matter! It needs to be based on rigorous theory, survey, experimentation and modeling. For more information visit the conference website http://esa2012.org.au/index.asp?IntCatId=14

ICBB 2012 : International Conference on Biotechnology and Biodiversity

6-7 December, 2012
Perth, WA

The 8th International Conference on Biotechnology and Biodiversity aims to bring together leading academic scientists, researchers and scholars to exchange and share their experiences and research results about all aspects of Biotechnology and Biodiversity, and discuss the practical challenges encountered and the solutions adopted. For more information visit the conference website http://www.waset.org/conferences/2012/perth/icbb/

ANPC Corporate Members

ANPC gratefully acknowledges the support of the following corporate members

Albury Botanic Gardens, NSW

Australian National Botanic Gardens, ACT

Botanic Gardens of Adelaide, SA

Centre for Australian National Biodiversity & Research

Department of Environment and Conservation, WA

Department of Primary Industry, NSW

Heritage and Wildlife Division, Department of Sustainability, Environment, Water, Population and Communities

Mackay Regional Botanic Gardens, QLD

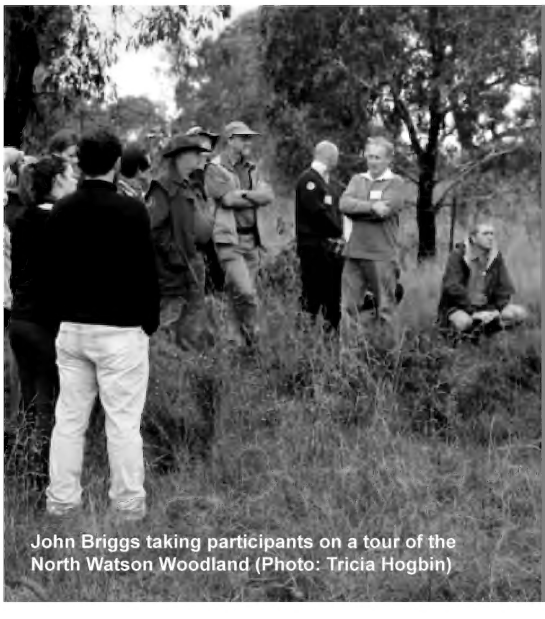
Murrumbidgee Catchment Management Authority

Royal Botanic Gardens Melbourne, VIC

Royal Tasmanian Botanical Gardens, TAS

Sydney Olympic Park Authority, NSW

University of Melbourne, Burnley Campus, VIC



John Briggs taking participants on a tour of the North Watson Woodland (Photo: Tricia Hogbin)

Seeking images of past ANPC activities

The ANPC has a new Flickr photo sharing page, at **www.flickr.com/photos/anpc**, where you can view pictures of ANPC activities and events.

2012 is ANPC's 21st anniversary and we'd like to collate photographs from the past 21 years.

Do you have any images of past ANPC activities that you are willing to share? If so, please email images, along with photographer name and a descriptive title, to anpc@anpc.asn.au.

ARE YOU SUBSCRIBED TO ANPC NEWS?

Keep up to date with the latest news about plant Conservation in Australia by subscribing to ANPC's email newsletter - ANPC News. Details of upcoming events, resources, funding opportunities, courses, and volunteering opportunities will be emailed to you every 2-4 weeks.

To subscribe, go to anpc.asn.au and click on the 'subscribe to ANPC News' link in the right hand column.

The ANPC welcomes contributions to ANPC News. Email your news to anpc@anpc.asn.au with "For ANPC News" in the subject line.
Please keep your news item concise (<250 words) and preferably provide a link that readers can click to for further information.

Australian Network for Plant Conservation Inc (ANPC)

9TH NATIONAL CONFERENCE

In partnership with the
Australian National Botanic Gardens
21 years collaborating for conservation

AUSTRALIAN NATIONAL BOTANIC GARDENS

Plant Conservation in Australia: Achievements and Future Directions

Celebrating the ANPC's 21st year, the conference will:

- review and highlight achievements over the last two decades;
- evaluate the strengths and weaknesses of existing approaches;
- highlight current major issues;
- identify directions for the coming decades.

Monday 29 October to Friday 2 November 2012
Canberra ACT

To keep informed about the conference subscribe to ANPC News – go to our website www.anpc.asn.au

Photos (top to bottom): *Dendrobium phalaenopsis; Anigozanthos manglesii; Epacris impressa; Telopea speciosissima; Eucalyptus globulus; Gossypium sturtianum; Wahlenbergia gloriosa; Swainsona formosa.* Photos: APII M.Fagg