Retrospectives and perspectives on plant conservation in Australasia

Australasian Plant Conservation wrote to members of the plant conservation community, inviting short contributions on the themes:

"What were you doing in 1991 and what are you doing now? How things have changed in the past 30 years." and/or *"What are the past, current and emerging issues for plant (or biodiversity) conservation in Australia (or Australasia)?*

The following short articles are arranged in no particular order and encompass reflections and wisdom. They demonstrate how things have changed – and that some things stay the same Reading through these contributions I was overwhelmed by the breadth of experience and expertise contributing to the cause of plant conservation in Australasia. While we may not always be proud of Australia's biodiversity conservation track record, there is hope for the future.

Heidi Zimmer
APC Editor

Heidi with *Telopea oreades* at Waratah Flat in Far East Gippsland, Victoria in 1993. Photo: John Zimmer

Stephen Bell

School of Environmental and Life Sciences, University of Newcastle

Eastcoast Flora Survey

One important future issue for plant conservation is how we manage rare and threatened taxa. We need to transition management of these entities from the species- to the landscape-level. Threatened species inevitably form part of a network with other biodiversity and abiotic elements of their habitat, and often focusing management on a single species also requires maintaining pollinator and dispersal networks, and habitat disturbance patterns. Current management strategies for some species are sometimes too focused and fail to also address the needs of co-occurring species and their habitat requirements. For example, are appropriate nesting sites for insect pollinators being retained in the immediate area of the target plant species? Is the low abundance of senescing adult plants of a soil-stored seed species related to a long absence of fire, and should we be concerned with no new recruitment? Is the abundance of terrestrial orchids found along the sides of bushland roads threatened by or because of the irregular ground disturbance created by maintenance? We also need to reintroduce and champion the concept of rarely seen species. There are numerous species that are rarely encountered in natural systems, but these should not be considered threatened because they are rare. Threatened species legislation is peppered with wide-ranging, likely well-conserved rarely seen species, but not all of these are subject to real and active threats. Before listing a species represented by few records, we should research its ecology and likely population size and accept the reality that some species are just rarely seen.

***Pterostylis chaetophora* (Vulnerable) colonising road edges in Columbey National Park. Photo: Stephen Bell**

Tony Auld

Australian Network for Plant Conservation
NSW Department of Planning Industry and Environment
Centre for Ecosystem Science, University of New South Wales
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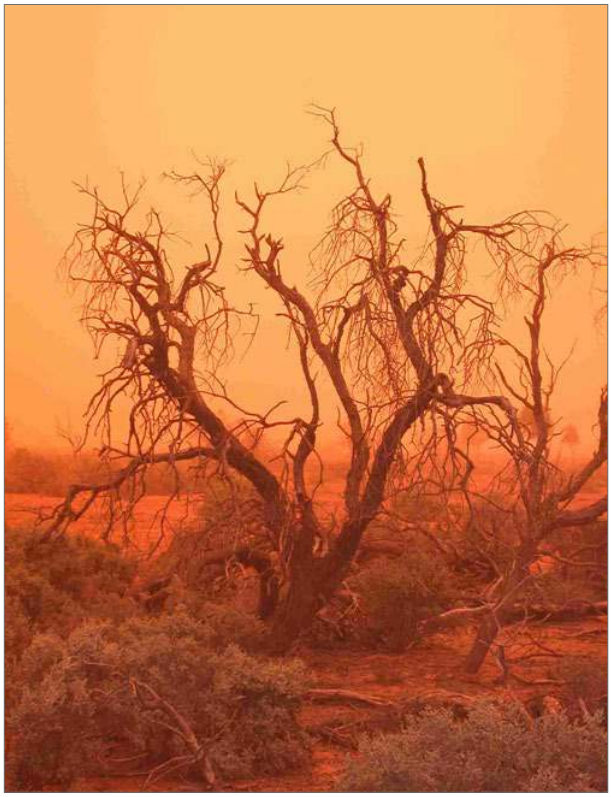
University of Wollongong

Back in the early 1990s, I was actively involved with the NSW National Parks and Wildlife Service working on plant and ecosystem conservation in fire prone systems, investigating the lack of ongoing regeneration of a number of long-lived arid trees and working with a national team looking at the identification of threatened flora. Several colleagues and myself were just formulating concepts around thresholds of tolerance of plant species to high fire frequency and what fire management was required to minimise adverse impacts.

30 years later, a warming climate has brought new threats and exacerbated the existing ones. The fire threshold work has been embedded in NSW fire management planning for over a decade and is now seeing the consideration of updates to incorporate thresholds of impact that relate to other components of the fire regime (severity and season). Threatened species listing is based on best practice international guidelines that have been adopted across Australia (IUCN Red List species criteria), while some jurisdictions have also adopted IUCN Red List for ecosystems criteria.



Dead *Acacia carneorum* in dust storm in 2008. Photo: Tony Auld

Sadly, some things haven't really changed; clearing and loss of species habitats continues at too high a rate leading to more species becoming candidates for listing as threatened; while regeneration in many arid trees has not improved and domestic and feral grazers, drought and a warming climate bring the likelihood of decline and loss of a number of these keystone species. The conservation of plants remains relatively poorly funded compared to that of many vertebrates.

David Eldridge

School of Biological, Earth and Environmental Sciences,
University of NSW, Sydney

In 1991 I had been working with the NSW Soil Conservation Service for just over a decade, had spent a year in North Africa with the World Bank, and had just started a PhD. A federal government grant allowed me to start a four-year study of the ecology and management of biocrusts (cryptogams). This work took me all over the world, to Maralinga to investigate how biocrusts could stabilise nuclear waste dumps, and to run landholder (and ANPC) workshops all around Australia. The early '90s was a period of personal freedom, when governments placed more emphasis on science and scientific freedom, allowing us to pursue research agendas that we believed were important. Without this freedom, substantial ecological research would never have happened.
We were also trusted to engage with the media, unlike today when everything is managed. I had stints on Totally Wild and Burke's Backyard, and a trip to the Great Victoria Desert to record Australia All Over. Senior managers in my agency allowed me to work in a university environment, which was beneficial to everyone. A major legacy of those working in the late '80s and early '90s was that we amassed a huge repository of ecological data. With new statistical methods, and faster computers, we are only now realising the true economic and ecological value of these large datasets that tell us so much about the health of Australia's ecosystems nearly half a century ago.

Assessing the impacts of shrub removal on erosion at 'Bloodwood' north-west of Bourke early 1992. Photo: David Robson

Emma Bodley

Auckland Botanic Gardens

In 1991, I was only a baby smelling flowers and crawling around our home garden but by 1992 I had my first connection with Auckland Botanic Gardens. I explored the camellia garden with my cousin and had a photo outside the library/visitor centre (Fig. 1). Little did my mum know, that one day that would be my office and a place where I found my dream job. Throughout my childhood I was exposed to nature and the environment with holidays to natural areas and offshore islands and naturally I picked subjects at school and university that focused on environmental and ecological topics. I have now been working at Auckland Botanic Gardens for almost 8 years and I am involved in threatened plant recovery projects, seed collection and propagation research aiming to conserve plants of Auckland and eventually return them to the wild (Fig. 2). Working at a botanic garden is a fantastic place to advocate for the plight of threatened plants and empower our visitors to do the same, as well as value plants in their everyday lives. Plants are used to solve many of our challenges like bioremediation and water filtration, but we still need to overcome plant blindness to propel plant conservation forward and make the strides that animal conservation has made. It's time to be bold and ambitious with plant conservation and give plants the funding, governance and appreciation they deserve.

Figure 1. Emma, aged 2, visiting Auckland Botanic Gardens and hanging outside the visitors centre and library. Photo: D. Bodley

Margaret Byrne

Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions, Western Australia.

Plant conservation – 30 years of genetics and genomics

Population genetics has provided significant understanding and knowledge to inform plant conservation over many years, and conservation genetics is now well integrated into plant conservation practices. Genetic studies have demonstrated many unexpected insights into our Australian plants that are critical to inform conservation. Genetic diversity and differentiation is fundamental to managing rare and threatened species, particularly in fragmented landscapes and in an ancient flora. Genetics is integral to planning translocations and restoration, resolving species complexes and identifying cryptic species, understanding gene flow and population connectivity, identifying clonality and hybridity, determining mating systems to understand population dynamics, and understanding evolutionary history.

Figure 2. Working at Auckland Botanic Gardens on the conservation of *Pimelea eremitica,* a threatened species found in the northern part of New Zealand. Photo: R. Stanley

Genetics studies have contributed to conservation of many eucalypt species through understanding hybridisation, clonality, mating system, gene flow and adaptation, and identifying cryptic species. Photo: Margaret Byrne

The advances of genomics in recent years mean we now have even greater power in genetic data to inform conservation actions. In addition, this greater power provides opportunities to investigate areas we couldn't do effectively previously, such as adaptation to climate change, which is critical to develop strategies for responding to changing conditions, and understanding effects of inbreeding depression and dynamics of small populations.

In 1991 applications of genetics in plant conservation in Australia were just beginning to be understood. In the 30 years since then we have seen great advances in the sophistication of molecular techniques and in the expansion of applications to plant conservation (Byrne 2018). Now in 2021 we are routinely applying genomics techniques to our plant conservation challenges. You can access much more information on genomics and applications to conservation in the book *Conservation and the Genomics of Populations* (Allendorf *et al.* 2022) that is being published by Oxford University Press very soon. It clearly articulates the fantastic opportunities for applying genomics to plant conservation.

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Peter Bridgewater

Institute of Applied Ecology, University of Canberra

Four future challenges

30 years goes quickly. ANPC predates the Convention on Biological Diversity by a year. And reaches its 30th as the UN declares a Decade of Ecosystem Restoration. So, what of the next 30 years? Extinction will continue to be an issue. And sometimes species' traits cloud our understanding of a species' conservation needs. To take an animal example, *Pseudomys novaehollandiae* (New Holland Mouse), was "extinct" for 100 years, being rediscovered in the 1960s. Now it is well- known across the southeast and Tasmania, but its habitat choices are fickle and fire-related, making our knowledge uncertain. The accompanying photo of *Reedia spathacea*, a curious Cyperaceae from extreme Southwest WA, is listed as critically endangered, although we do not really know *how* critically.

It is possible to conserve all the species with which we now live. But not necessarily in the "wild", given the continuing diminution of wildness (note lack of -er after the d). The flexibility in ANPC using *ex-situ* to *in-situ* conservation approaches to repairing existing ecosystems under pressure from global changes, is its strength. Like community-based Landcare, ANPC is the only way forward for plant conservation – governments simply can't cope!

Four challenges loom large for the future – how to

- Deal with increasing plant diseases (think Myrtle Rust, *Phytophthora*).
- Improve our knowledge of species distribution and ecology.
- Embrace ecological novelty (see APC **24(4)**: 27-28).
- Forge better links with Aboriginal and local knowledge.

Fix these and the future of Australia's plant biodiversity is assured.

***Reedia spathacea*, a critically endangered Cyperaceae, (with a slightly younger author), D'Entrecasteaux National Park Western Australia. Photo: Ian D. Cresswell**

David Coates

In 1991, as a research scientist in the then Department of Conservation and Land Management in Western Australia, I attended the inaugural ANPC Conference "Protective Custody? *Ex situ* Plant Conservation in Australasia". At that time my research and plant conservation activities focussed on *in situ* conservation dealing with a range of threatening processes including habitat loss and *Phytophthora* dieback. The conference opened my eyes to the value of *ex situ* conservation and the possibility of establishing populations of threatened plants through translocations. It was also becoming increasingly clear, with the local extinction of a number of threatened plants due to *Phytophthora* dieback, that *ex situ* conservation approaches were needed. In 1993, with assistance from Maurice McDonald, the threatened plant seed bank was established in the department. Anne Cochrane subsequently joined as Manager with Andrew Crawford recently taking over from Anne. A few years later Leonie Monks joined the Department to establish a program focussing on translocations of threatened plants which, combined with the newly established seedbank, paved the way for the integration of *ex situ* and *in situ* approaches across the agency that exists today. At the same time my research has continued to focus on the use of genetics in assessing and managing small declining plant populations, and more recently translocations. The move, over the last 30yrs, from allozymes to DNA based markers culminating in the current technical and analytical tools of genomics has revolutionised the use of genetics in conservation.

***Banksia brownii* was one of the first threatened species in WA to be targeted for seed collection in 1987 prior to the local extinction of the east Stirling montane populations due to *Phytophthora* dieback. These seed collections have subsequently been used in translocations and genetic studies. Photo: Dave Coates**

We now have unprecedented resolution of patterns of genetic variation within populations and species to assist in a range of activities such as translocations, small population management and ecological restoration.

Bob Debus

It was one of the great pleasures of my professional life to have held responsibility for the Ministerial portfolio that included the great scientific and cultural institutions of the State of New South Wales for the second quarter of the 30-year history of the Australian Network for Plant Conservation.

That was a time, in the early 2000s, when early rounds of uncommonly severe bushfires and problems of dieback were causing some sections of the general public to better understand what botanists and other scientists were already so acutely aware of – the climate was changing and a growing proportion of endemic species were potentially at risk. Now the awareness is greater but the threats have rapidly become worse – and the crisis of changing climate and the crisis of biodiversity are understood to be closely intertwined.

The move away from fossil fuel is critical for the achievement of necessary emissions reduction in the next thirty years but it is unlikely on its own to be enough. We also need so called 'natural solutions' for the reduction of atmospheric carbon. The preservation and restoration of our unique and increasingly vulnerable Australian ecosystems is necessary for the indispensable contribution it can make to the abatement of climate change.

That kind of conservation work can only be effective at the necessary scale if scientists and practitioners use the best available research and collaborate across jurisdictions and disciplines exactly in the manner that ANPC has been set up to promote.

So on the occasion of its thirtieth anniversary ANPC and the community practitioners and world class scientists who make up its membership are more important than they have ever been at any previous time in its history.

Photo: Bob Debus

Mark Brundrett

Biological Sciences, the University of Western Australia (UWA)
and the West Australian Herbarium

30 years of research on conservation and restoration in WA

In 1991 I was studying mycorrhizas in natural habitats and mines in Kakadu, while based at UWA. I arrived there two years earlier to work with a highly respected team led by Profs. Lyn Abbott and Alan Robson after finishing my PhD in Canada. Subsequent projects included a CSIRO-China collaboration on eucalypt plantations, managing rare wheatbelt orchids with community groups and banksia woodland restoration. I developed efficient methods for detecting mycorrhizal fungi, restoring habitats and propagating orchids. I also wrote an orchid guide that explains their ecology.

I am now a volunteer researcher on orchid pollination, genetics, conservation and taxonomy. This includes a genetic study of the *Thelymitra variegata* group led by Drs. Katharina Nargara and Lars Nauheimer (Australian Tropical Herbarium) and Mark Clements and Heidi Zimmer (National Herbarium). My research also includes resolving the global importance of mycorrhizal associations and plant traits such as fire responses.

Examples of plants sampled for the *Thelymitra variegata* Genomics for Australian Plants project. Photos: Mark Brundrett

My top seven emerging issues for plant conservation in WA are:

1. Ecosystem restoration is very difficult and often fails to recreate specific plant communities.
2. Mycorrhizal fungi take decades to recover in new habitats.
3. Rare orchid monitoring needs to include vital statistics such as pollination measured in fixed areas.
4. Orchids can have very low rates of pollination, especially in large groups.
5. Rare orchids face increasing threats and diminishing resources for their recovery.
6. Volunteers make major contributions but need better support and coordination.
7. Many orchid taxa are very similar to others and their identification can be inconsistent.

Rachael Gallagher

Hawkesbury Institute for the Environment,
Western Sydney University

In 1991, I'd just started at high school and founded the 'Environment Club' with my first group of like-minded plant enthusiasts. The most important development in conservation since this time has surely been the explosion of resources now available to scientists (amateur and professional) for understanding the Australian flora. In this time, we've digitised the information from millions of herbarium specimens, created major bioinformatics platforms to deliver datasets and information to any user, sequenced the genomes of thousands of species, and catalogued over a million observations of Australian plant traits. We can now take on continental scale analyses which would have been truly incredible to Banks and Solander.

With this in mind, I believe the greatest current and emerging challenge for plant conservation is how to fully integrate this wealth of data into threat assessment, management and monitoring. Despite having access to these vast resources, we need people – in permanent and valued positions in government, industry and academia – with the skills to turn data into knowledge. Crises such as the 2019–2020 bushfire season demonstrated how we can mobilise resources on the traits and geographic ranges of species alongside threat mapping to assess plants and ecosystems systematically across Australia. Given the hyper-diversity of our national flora (some 26,000 species) and the vast scales of our landscapes, the task of systematically assessing and ultimately protecting plants in Australia is immense. We need to invest in people – not just infrastructure – to prevent plant species being overlooked in the national conversation around threatened species and conservation.

Training the next generation of Australian plant scientists (L-R: Matthew Alfonzetti, Sophie Moore and Ruby Stephens working hard on a drizzly day in the field at Strickland State Forest in Narara, NSW). Photos: Rachael Gallagher

Andrew Crawford

Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions, Western Australia

When the ANPC was established in 1991 I was undertaking an undergraduate degree in Horticultural Science. More significantly, I would be returning for my third season of commercial seed collecting. This balance of academic knowledge and practical seed collecting skills would stand me in good stead for my future career. Fast forward ten years and I started working for the then Department of Conservation and Land Management (now the Department of Biodiversity, Conservation and Attractions) at Western Australia's conservation seed bank, the Threatened Flora Seed Centre (TFSC), which now forms part of the Western Australian Seed Centre. I was employed to undertake seed conservation work as part of the Millennium Seed Bank Project (MSBP), a global effort to conserve seed led by the Royal Botanic Gardens, Kew. When I started, there were few conservation seed banks in Australia. Thanks largely to the MSBP, every Australian state and territory now has a conservation seed bank. With so many agencies across Australia involved with the MSBP, the Australian Seed Conservation and Research (AuSCaR) network was formed. This network has matured into the Australian Seed Bank Partnership (ASBP) which has strong ties to the ANPC and has been closely involved with ANPC projects such as the revision of the Germplasm Guidelines. These guidelines have aided in the improvement of the standard of seed banks across Australia so the collections they hold are no longer just seed, but high quality, representative seed samples that are actively being used to recover threatened species.

Andrew seed collecting in Fitzgerald River National Park. Photo: Andrew Crawford

Dr Paul Gibson-Roy

Restoration Ecologist

In 1991 I was studying environmental horticulture at Burnley College (Melbourne University). This set me on a path focused on the restoration of grassland and grassy woodlands. At that time the main issue regarding this vegetation was characterising their extensive decline and lobbying for legislation changes to ensure the protection of what remained. Little credence was given to the notion they could be reconstructed through ecological restoration. However, given that in Australia's highly cleared arable landscapes there is often little native vegetation left to conserve, over ensuing years small groups of people began to seriously investigate techniques and approaches that might make their return through restoration possible. Now, 30-years on the great achievement of those groups is that they have provided numerous small-scale (1 ha +) demonstrations that species and functionally rich grassy communities can in fact be restored (and maintained in those states). Sadly, 30-years on, the countering great disappointment is that conservation-focussed legislation has failed to prevent their continuing loss. There has been little support from governments or their agencies to develop policy, programs or sector capacity that would see their restoration occur at landscape scale (at the same time decades-long support of simplistic tree and shrub plantings continues). On reflection I rejoice grasslands and grassy woodlands do not have to disappear – as a society we have the knowledge and capacity to restore them to the extent we see fit. Also on reflection, I bemoan that we have failed to make this happen.

Mark Ooi

Centre for Ecosystem Science
School of Biological, Earth and Environmental Sciences
University of NSW, Sydney

In the 1990s, I was completing a new degree course at the University of Wollongong, a Bachelor of Environmental Science, and also travelling and surfing as much as I could. At the time, the idea of focusing a degree on the environment and conservation, was relatively novel – even the term 'biodiversity' was only just beginning to gain traction after the United Nations Earth Summit in Rio in 1992.

As I was grappling my way through courses, taking in Rob Whelan's lectures on fire ecology and trying to understand the concepts behind biological diversity and conservation management, I think the rest of society was on a similar path. There seemed to be a shift towards a global effort to clean up the environment. As an example, at that same Rio Earth Summit in 1992, they also established the Climate Change Convention, a treaty established to encourage research into human impacts on the climate and ways to mitigate developing threats.

A wonderful 12-year-old roadside grassland restoration in SW-Victoria featuring beautiful and rare native wildflowers. Photo: Chris Findlay

Thirty years on, after forays into other work and lots of travel, I am now an academic at UNSW, researching fire, climate change and plant ecology, and giving the occasional fire ecology lecture. I think that a key indicator of how things have changed is that nearly every university now has conservation and ecology as a core part of their science curriculum and a regular intake of keen students. But in other ways, change has been slow, and we are still struggling with ways to address global issues like climate change.

Mark on an ecology field trip to Kioloa, NSW in 1991. Photo: Rob Whelan

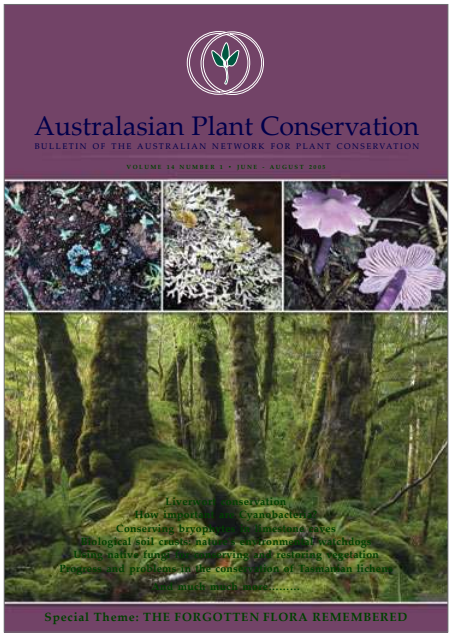
At a prescribed burn in the Noosa region in 2019. Photo: Justin Collette

Tom May

Royal Botanic Gardens Victoria

My involvement with ANPC began in 1999 when I ran a workshop on fungi at the 4th National Conference in Albury-Wodonga. As participants sat around looking at fungi photos, I remember being struck by the thought that some had never had the chance to share their interest in fungi with like-minded people. I'd helped to start Fungimap a few years earlier, as a mapping scheme, but my experience at the workshop emphasised the need to link people as well as collect data. Fungimap went on to hold successful national and regional events, and fungal study groups have sprung up across Australia.

From 2006 to 2008 I edited *Australasian Plant Conservation*. I enjoyed being in touch with contributors from all around Australia, sharing successes and challenges in plant conservation. Personal highlights were special issues such as "The forgotten flora remembered" and helping organise the 2007 ANPC Forum on soil biota "What lies beneath".



Cover of "The forgotten flora remembered" special issue of APC, 2005.

Lately, I've been thinking about how we tackle conservation of groups such as algae, bryophytes and fungi. For too long, these critical components of the biota have been put at the back of the queue, due to perceptions of a lack of knowledge and people. This "serial" approach reinforces the lack of resources and stifles progress. A better strategy is to work on all biota, in parallel, in ways appropriate to the state of knowledge. After all, ecosystems are complex interactions among numerous species. As an example, I'd like to see "spore banks" to complement seed banks as a key measure for *ex situ* conservation of fungi — and something to get started on now, rather than waiting until all plants are banked.

Suzanne Prober

Land and Water, CSIRO, Floreat, WA

In August 1991 I stopped outside a country cemetery near Young in New South Wales and noticed a field of golden yam daisies (*Microseris walteri*) and buttercups (*Ranunculus pachycarpus*) blooming in the early morning sunlight. I'd been searching for more than a year for a site like this, living evidence of the pre-European plant diversity and composition in the widespread White box (*Eucalyptus albens*) woodlands of south-eastern Australia. A closer look revealed a diversity of species rarely found within the agricultural landscapes outside this ungrazed sanctuary. Over the next two years I visited nearly every cemetery on the NSW western slopes, as well as many Travelling Stock Reserves, roadsides and back paddocks, to piece together the ecological story of these woodlands.

Since then I've been fortunate to have been involved in an inspiring wave of commitment to the conservation of temperate eucalypt woodlands in agricultural landscapes, including a burgeoning of ecological research, the listing of these woodlands as a threatened ecological community, growing engagement with First Nations people, and the development of new policies for their conservation. The latter include Conservation Management Networks, revegetation and fencing programs, the birth of Australia's regional NRM system, and Australia's first Environmental Stewardship Program.

I'm still involved in research in these woodlands today, unlocking the secrets that help us understand how to restore and manage them. Alongside this I've had the pleasure to work in Australia's largest remaining temperate eucalypt woodlands, the Great Western Woodlands in south-western Australia, where intact woodlands stretch from horizon to horizon. But I've also seen the immense scars created by increasing landscape-scale, intense fires in these woodlands in recent years, an early taste of the climate change impacts we can expect in ecosystems around the world. This looming threat has led to another of my research foci – rethinking nature conservation in a changing climate and helping biodiversity adapt.

Dr Suzanne Prober and Dr Ian Lunt researching the restoration of the native ground layer in a white box woodland landscape, Murringo NSW. Image: Margaret Beemster

Brett Summerell

Director Research and Chief Botanist
Australian Institute of Botanical Science
Royal Botanic Gardens and Domain Trust, Sydney

In the past 30 years we have seen a revolution in the capacity of plant science to understand plants and ecosystems, and the threatening processes affecting them, at both a macro and microscale. Technological advances in computer modelling and analysis and in gene and genomic analysis allows us to now better understand not only the impacts on species, but also on the genetic diversity present in ecosystems and how to conserve them more effectively. The questions we can now address really have made it a wonderful time to do conservation science, and to provide answers to the most pressing problems affecting plant survival.

Brett at Mt Tomah Spur at the Blue Mountains Botanic Garden, Mt Tomah. Photo: Brett Summerell

Unfortunately, over that time we have seen and experienced an escalation in the negative impacts of humanity on the natural world. The impacts of climate change, land clearing and from my own research perspective, invasive species, continues to rise. Invasive plant diseases like *Phytophthora* root rot and myrtle rust have either become more recognised and prominent or introduced into Australia with devastating effects on the survival of at-risk species. The response needed to manage such problems is complex and multifaceted, but encouragingly we are starting to see action involving a diverse community of scientists and concerned individuals.

It would be easy to be despondent, as the task is immense, but I am continually heartened by the way in which this community continues to collaborate in the face of some resistance. The role of ANPC in co-ordinating and supporting these responses has been critical and we would be much poorer without their work over the past 30 years.

Angela T Moles

Evolution and Ecology Research Centre, University of NSW, Sydney

Conservation in a dynamic world

The last 30 years have seen a dramatic advance in understanding of how quickly ecosystems and their component species can change. Plant species' ranges are shifting poleward or uphill at an astonishing rate, and the timing of biological events such as flowering are advancing substantially (Fitter and Fitter 2002; Parmesan and Yohe 2003).

The shifting ranges of species, and the associated changes in interactions between taxa resulting from coexisting with a different suite of competing plants, pollinators, herbivores and pathogens (*e.g.,* Robbirt *et al.* 2014) likely impose strong selective pressures on our plant species. Which brings me to another advance: we have gone from thinking that evolution occurs over geological timeframes to having many examples of plants undergoing evolutionary change within years or decades (*e.g.,* Williams, Kendall and Levine 2016; Everingham *et al.* 2021; Figure 1).

All this change could be seen as good news, as it gives us hope that our beautiful native species and ecosystems will be able to adapt and shift to persist in the face of change. However, while we might celebrate the fact that our favourite threatened native species are able to survive climate change by moving upslope or poleward, we might simultaneously be dismayed when our favourite ecosystem is colonised by native species from warmer regions.

Much of our conservation policy in Australasia aims to keep ecosystems in a state as close as possible to their pre-European condition. However, this goal is becoming increasingly unattainable in the face of climate change, species' introductions and other anthropogenic pressures. It seems to me that we will be able to retain more of our native species and ecosystem function by allowing species to shift and communities to reassemble than by trying to hold back the tide. Managing ecosystems in flux is going to require changes in our approach and legislation that are almost as dramatic as the changes our species are facing.

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Figure 1. *Arctotheca populifolia* was introduced from South Africa to Australia in the 1930s. There are now substantial, heritable differences in morphology, phenology, physiology and reproductive biology between the Australian and South African populations (Brandenburger 2019).

Jen Silcock

School of Biological Sciences, Faculty of Science,
University of Queensland and Queensland Herbarum

October 1991. I was nearing the end of Grade 2 at Pittsworth State Primary School on the eastern Darling Downs, Queensland. Sitting in a hot country classroom, unaware of the rare and endangered grassland forbs quietly living their lives in small remnants amongst the agricultural fields and woodland hills that stretched beyond the edge of town. I would remain unaware for more than a decade, despite doing some local assignments for geography and being dragged around bushland reserves by my Landcare-ing dad.

October 2021. Sitting at my kitchen table in western Queensland, writing these reflections while my toddler sleeps. In the past 15 years, I've spent hundreds of hours exploring and researching those grassland remnants around my hometown. I now know that they harbour a remarkable suite of endangered plant species, and represent the last stronghold for some that have become extinct in southern states. My observations and repeat measurements clearly show that these remnants are slowly being eroded in a classic 'death by a thousand cuts' scenario. A bit of slashing here, some weedy grasses there and the odd spot of opportunistic grazing. Across the valley, some peri-urban expansion and a road-realignment.

This to me represents perhaps the major issue for plant conservation in Australia. Other big issues for plant conservation get a lot more airtime, for example myrtle rust and *Phytophthora*, and broadscale landclearing. However this insidious loss and degradation of small remnants in already fragmented agricultural and urban landscapes – through edge effects, the inertia of rampaging weeds, unwitting destruction, lack of care and protection – will perhaps result in the biggest long-term loss of species and examples of ecosystems in eastern and southern Australia.

I want my son to be able to experience the subtle beauty of Australia's only native thistle, *Rhaponticum australe*, and sit under a gnarled mountain coolabah at sunset and feel the magic of the downs – home to hundreds of generations of Giabal families – before agriculture razed their productive blacksoils. These remnants, like hundreds of others across Australia, will only survive if they have local champions to look out, advocate and care for them. Maybe school curricula that include introductions to local species, ecosystems and natural history are part of the solution.

Flowerhead of *Rhaponticum australe*, Australia's only native thistle, first collected by Mueller in 1854 but now considered extinct in Victoria and New South Wales. Photo: Don Butler

Mountain coolibah (*Eucalyptus orgadophila*) on hill behind Pittsworth township. Photo: Jen Silcock

Leonie Monks

Biodiversity and Conservation Science, Department of Biodiversity, Conservation and Attractions, Kensington, Western Australia.

In 1991 I started my tertiary education in a broad-based Bachelor of Science in Biology. As I progressed through my degree I increasingly focused on units about plants and conservation and eventually completed an honours and masters project in plant conservation. This interest in Australian plant conservation led to my current job as a Research Scientist with the WA Department of Biodiversity, Conservation and Attractions (DBCA), where my research focus is on improving the success of threatened plant translocations. When I started at DBCA (or CALM as it was known then) in the late 1990s, translocations were a relatively new idea, with only a limited number having been undertaken in Australia. These early translocations had often been conducted to mitigate for population loss due to development or had been undertaken on an ad hoc basis with little thought about the long-term prospects of the plants. Whilst mitigation-type translocations are still occurring, now more frequently translocations are undertaken to conserve and recover species as threats such as salinity, habitat degradation, diseases (*e.g.,* Myrtle Rust and *Phytophthora* dieback) and more recently climate change are increasing. With the increased translocation activity and with the publication of guidelines such as ANPC's Guidelines for Threatened Plants in Australia and the synthesis and publication of past translocation work (*e.g.,* Silcock *et al.* 2019) much has been learnt to improve success rates. Today, there is a much better understanding of the need to carefully plan and implement translocations to better contribute to the conservation of a species.

Leonie Monks at translocation site for *Chorizema humile*. Photo: Benson Todd/DBCA

Amelia J. Martyn Yenson

Australian Network for Plant Conservation
The Australian PlantBank, Australian Institute of Botanical Science, Australian Botanic Garden, Mount Annan NSW 2567, Australia

In 1991, I was thirteen and already enamoured with plants. My family went on picnics and bush walks in the Royal National Park and enjoyed David Attenborough documentaries and the new ABC show 'Gardening Australia'. Family holidays usually involved a trip to a bush block owned by the late Dr Surrey Jacobs, a family friend and botanist at the Royal Botanic Gardens, and his wife Betty. Further afield, we camped at the inland dams of NSW, including Keepit, Burrendong, Wyangala and Burrinjuck. The photo below was taken at Burrendong Arboretum on one such trip. I was aware of the greenhouse effect and global warming but much more interested in pretty plants especially Australian species, and their diversity of form, colour and scent.

Fast forward 30 years and I now have three children who recognise plants and enjoy bushwalks but have many interests of their own. They are more keenly aware of the world around them than I was at their age. They worry about their environmental future, particularly the decisions that adults are taking on their behalf. I often use examples from my work at ANPC and the Australian PlantBank to show them that many adults devote their lives to studying and protecting plants, habitats and their global future.

It is my privilege to work for ANPC and help amplify the reach of the important work happening in seed banks, botanic gardens and labs, as I learn more about restoration and translocation projects. Here's to a bright future for ANPC, promoting lifelong learning and collaboration in the challenging years ahead.

Amelia in the Fern Gully at Burrendong Arboretum, January 1992. Photo: Greg Martyn

Damian Wrigley

National Coordinator, Australian Seed Bank Partnership
National Focal Point, Global Strategy for Plant Conservation
Oceania Representative to the CITES Plants Committee

In 1991 I was 10 years old and visiting Kings Park and the Perth Zoo on weekends with friends. I dreamed of growing up to work with 'nature' and now I'm living that dream. I count myself lucky to be working with incredible people from all over the world to conserve native plants and their associated ecosystems.

For me the most pressing issues that plants have faced for a long time now are anthropogenic influences on the places they inhabit. Sadly, this now encompasses the entire planet. With rampant changes in land use, increased globalisation moving pollution, pests and disease to new areas and the increasingly serious impacts of climate change, plants more than ever need our help. Despite these pressures I have hope for the future. I see so much opportunity in the networks and partnerships we foster and maintain both in Australia and overseas. By making our knowledge and expertise available and working collaboratively to secure and share resources we can continue achieving positive outcomes together – far more than we could do working alone.

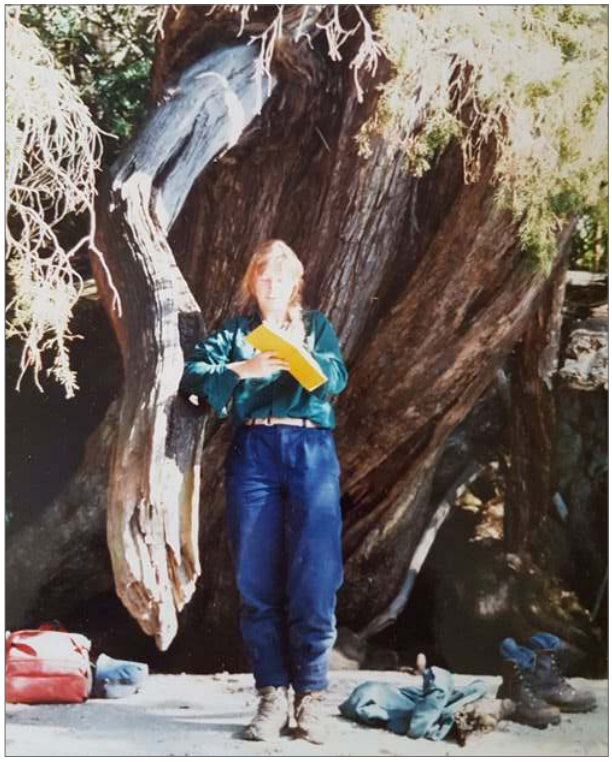
I want to offer a huge congratulations to the ANPC and all those who have contributed to the organisation over 30 years. Your work has been so influential and it is great to see that influence continue to flourish. Australia's lucky to have so many dedicated experts working towards a common goal of conserving our native plants and sharing that knowledge with our Australasian neighbours.

I think I've convinced at least one of my kids to pursue a career in plant conservation – it'll be his generation that needs to continue our work! Photo: Damien Wrigley

Alison Shapcott

University of the Sunshine Coast, Queensland

In 1991 I was working with the Tasmanian Parks Wildlife and Heritage employed under the National Rainforest Conservation Program and I had just published a technical report on the Population Biology and Genetic Variation of Huon Pine (*Lagarostrobos franklinii*) which was to later become part of my PhD (University of Tasmania). This was to be one of the earliest conservation genetics studies published in Australia, a field that blossomed over the next 30 years. Since that time I have continued to integrate strong field based population ecology with genetics to address conservation and restoration of Australian plants with nearly 40 species studied to date. The genetic markers have changed over time and the emergence of spatial analysis, modelling and mapping tools has revolutionised the study opportunities. Perhaps the biggest change has been the shift in focus from conservation to restoration.



Alison undertaking fieldwork, with Huon pine in background, about 30 years ago. Supplied: Alison Shapcott.

News from the Australian Seed Bank Partnership

Australasian Seed Science Conference 2021: *Linking seeds with needs; securing our future in a changing world*

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The Australasian Seed Science Conference 2021 was hosted by the Australian National Botanic Gardens, Canberra, as a global virtual event from 6th-10th September 2021 with 425 delegates from 34 countries. This international meeting followed on from the National Seed Science Forum of 2016 and presented the latest advances in seed science across the conservation and agricultural sectors. The conference was delivered across four key themes with two days of plenary and three days of workshops.

The Partnership would like to acknowledge the support of our partners and sponsors as well as our Organising and Scientific Committees, special guests and delegates for helping to make the conference an important opportunity for collaboration across the conservation and agricultural seed sectors in Australia and overseas.

Delegate 'photo' from the virtual Australasian Seed Science Conference 2021. Photo: ASBP

The Authors would also like to acknowledge the ASSC 2021 Scientific and Organising Committees for their efforts to synthesise the vast amount of information presented throughout the various conference sessions.

1. **Seed biology and evolutionary ecology –** *Unlocking the challenges of germination, dormancy and seed ecology in a changing world.*
2. **Seed sourcing and end-use –** *Considering genetic diversity, restoration and translocations as well as sector specific approaches to seed conservation and use.*
3. **Seed and gene bank management –** *The ins and outs of managing ex situ seed banks and gene banks and the methods for maximising seed quality and longevity.*
4. **Seeds in culture and society –** *Sharing stories and learning about historical, socio-cultural, and legal practices of seed conservation, use, exchange, and repatriation, including collaborations between traditional use, community, and ex situ seed banks and gene banks.*

Theme 1 – Seed Biology and Evolutionary Ecology

Our first theme for the conference was chaired by Prof. Adrienne Nicotra and welcomed 24 authors including the Keynote speaker Dr Si Chong Chen from the Millennium Seed Bank of the Royal Botanic Gardens, Kew. Dr Chen looked at biomass allocation across seed and diaspore functional components, presenting the findings from intraspecific and interspecific studies, improving the available knowledge of the variation of seed functional components. Dr Chen's findings suggest that smaller seeds invest proportionally more biomass in protective tissues than do larger seeds, a finding that agrees with traditional ideas that some small seeds may have advantages in physical defence. Studies such as this are important for improving our collective understanding of plant reproductive strategies.

The following 23 talks and posters in this theme demonstrated how the study of seed traits is contributing to our understanding of plants' reproductive strategies and how these are driving species distribution under