

DECISION POINT

Connecting conservation policy
makers, researchers and practitioners

Issue #90 / July 2015



Celebrating NERP Environmental Decisions



Saving frogs as our cities grow



Stopping new pasture varieties becoming weeds



Summer scholars build policy bridges

Decision Point

Decision Point is the monthly magazine of the Environmental Decisions Group (EDG). It presents news and views on environmental decision making, biodiversity, conservation planning and monitoring. See the back cover for more info on the EDG. *Decision Point* is available free from <http://www.decision-point.com.au/>

Plus

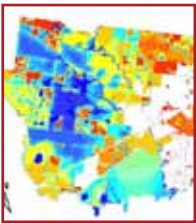
Why NERP and NERP ED are great investments
Robust decisions under great uncertainty
Planning for biodiversity in the urban fringe
Connecting science and management

DECISION POINT

Celebrating the NERP Environmental Decisions Hub

Issue #90 / July 2015

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On the point

NERP ED Hub: 2011-2015

The Environmental Decisions Hub (ED Hub) of the National Environmental Research Program was formally established in July 2011 and finished in June 2015. After all the progress reports (we produced one every six months for the Commonwealth Department of the Environment), workshops (we ran over 30 formal workshops and many more smaller informal meetings), scientific papers (we published well over 250 peer-reviewed papers, books and book chapters), presentations, press releases and forty issues of Decision Point – what more is there to say?

While all our activity, outputs and impacts have been minutely detailed in our various communications I think it's fair to summarise by saying that the ED Hub has been an excellent investment by the Australian Government Department of the Environment. Not only has it produced a solid body of science that has influenced policy, investments and actions on the ground, it has also deepened and enriched the engagement between conservation researchers and decision makers across Australia.

In terms of producing influential science, our engagement and interaction with the Australian Government Department of the Environment, our primary stakeholder, has been stronger than ever and the fruits of our research effort appear to making a real difference to environmental decision making in Australia. That success is based on four pillars: development of our relationship with the Australian Government Department of the Environment (ably assisted by the good people of the Department's Science Partnerships Section) both at a whole-centre level and through individual relationships; the maturation of our decision science (which is itself strongly influenced by the needs of government); the consistency, quality and popularity of Decision Point; and our greatest legacy - the growing body of talented and dedicated early-career researchers.

Highlights for me in terms of engagement and collaboration have included our decisions workshops with Parks Australia, the innovative Summer Scholars program, transforming views about monitoring and resource allocation, the big Think Tank we ran back in year one and our collaborations surrounding the offsets calculator. Notes on all of these things, and many more, appear in this special issue of Decision Point celebrating the work of the ED Hub.

*Hugh Possingham
Director
NERP Environmental Decisions Hub*

DECISION POINT

Decision Point is the monthly magazine of the Environmental Decision Group (EDG). The EDG is a network of conservation researchers working on the science of effective decision making to better conserve biodiversity. Our members are largely based at the University of Queensland, ANU, the University of Melbourne, the University of Western Australia, RMIT and CSIRO. **Decision Point** is edited by David Salt.

Decision Point is available free from: <http://www.decision-point.com.au/>

Think Tank A Go Go

How do you effectively share ideas across the two cultures of research and policy? In 2012 the NERP Environmental Decisions Hub tried something different. Rather than cram in as many research presentations as possible, we sought to minimise the presentations to maximise the time for discussion. And rather than simply sell what we were already doing, we put the emphasis on listening to what policy people from the Department of Environment felt were issues of concern.

As the event took shape it became known as the 'Think Tank', and its primary aim was to create a space for sharing knowledge and expertise while brokering partnerships that will hopefully mature into working collaborations.

The Think Tank ran over two and a half days in mid December. It consisted of eight sessions, or themes, being run two at a time. Most of these themes included projects where NERP-ED researchers had recently made substantial progress. They also represented areas in which the Department of the Environment had a current interest.

"We're not saying we've discovered the magical formula with our think-tank approach," observed Hugh Possingham, NERP ED's Director. "However, during the two and half days in which it ran, the Think Tank generated an amazing number of ideas and leads for future research projects; to my mind, more so than happens at more traditional conferences.

"Our researchers also took away important insights on what's valued by policy makers and, I believe, the policy makers similarly walked away with a better idea on where our science can strengthen their policy development.

"The Think Tank approach is one that we'll definitely be attempting to repeat and refine in the years ahead."

An offsets calculator

The Environment Protection and Biodiversity Conservation (EPBC) Act is the Australian Government's key piece of environmental legislation. It regulates impacts on matters of national environmental significance, such as nationally threatened species and world heritage areas as well as actions that involve the Commonwealth.

Developed following broad consultation, the 'EPBC Act environmental offsets policy' was released in October 2012. The policy sets out the principles for effective offsetting for those protected matters regulated under national environmental law. The policy was developed with a number of explicit aims, including improving the environmental outcomes that EPBC Act offsets deliver and providing greater certainty and transparency around regulatory decision making. One of the key priorities arising from the policy development process was the development of a transparent offsets guide (or calculator) that would give effect to the policy principles when assessing biodiversity offsets.

The final EPBC Act Offsets assessment guide emerged through a collaborative effort between Environment staff and researchers in the NERP ED Hub. The offsets assessment guide provides a tool for evaluating whether offsets for impacts on nationally threatened species and ecological communities are adequate. It is the first tool in operation in any jurisdiction worldwide that explicitly and transparently accounts for additionality, uncertainty, and time lags in calculating an offset requirement.

Reference

Miller KL, JA Trezise, S Kraus, K Dripps, MC Evans, P Gibbons, HP Possingham & M Maron (2015). The development of the Australian environmental offsets policy: from theory to practice. *Environmental Conservation* DOI: <http://dx.doi.org/10.1017/S037689291400040X>



At the end of 2012, Department of the Environment staff and NERP-ED researchers shared ideas, issues and opportunities for collaboration over two and a half days at the ANU in what became known as the Think Tank.

Summer research across the divide

How can science better engage with policy? It's an enduring, seemingly intractable problem. Both sides – scientists and policy people – want a better more productive engagement but all too often it fails to happen. NERP ED wondered if we couldn't throw a bit of light on this issue by getting undergraduate summer students to work on different policy areas within the Department of the Environment at the end of each year (over the summer break). With the help of the Science Partnerships Section (managers of the NERP Program), opportunities were identified in the Department of the Environment with NERP ED identifying and then mentoring summer scholars to work on the challenges.

At the end of 2012 the summer scholars were Anabel Lusk (from Canterbury University, NZ) and Prudence Roberts (from Macquarie University). They set out to better understand this thing called science-informed policy. Anabel looked at the science of how we measure the impact of invasive species while Prudence looked at how science fed into development approval on cassowary habitat.

Their investigations were so well received by the Department of the Environment that the scheme continued with new students in the summer periods of 2012/13 and 2013/14.



Anabel (centre) presents her findings to a group at the Department of the Environment. Prudence is on her left with the Director of the Science Partnerships Section, Dave Johnson, on her right. Anabel made the point that there appears to be little incentive to share information between the science and policy sectors.

Leveraging NERP

Reflections on investing in research and the NERP ED Hub

By Hugh Possingham (Director, NERP ED)

In recent years we have claimed that the investment by the Australian Government Department of the Environment in environmental research in Australian universities through the CERF and NERP have generated considerable leverage (see the box on acronyms if you're uncertain about these names). We have every expectation that our new NESP Threatened Species Recovery Hub will be every bit as effective in terms of return in investment.

In the mid-term review of our first hub (the Applied Environmental Decision Analysis Hub funded by CERF), leverage was documented as about five fold. How did we calculate this? Here is how you might go about calculating leverage in a fairly generic fashion. In so doing I'll also give you an estimate of the cost of getting research to the point of the initial essential output – publications.

PhD students as an investment

PhD students are the backbone of many applied environmental research projects. Almost all of our PhD students come with a PhD scholarship worth about \$24,000. Funds from the Australian Government Department of the Environment provide a top-up to around \$30,000. This attracts better students and enables them to focus on their project without the distraction of earning money from other activities.

Universities normally provide some research funds, while Department of the Environment funds will often match that – let's say \$5,000 each. Students have a supervisory team of two or three academics and their net contribution will be about 4% of an academic – which is worth \$6,000 per annum of salary. Hence the total salary and research costs per annum are \$36,000 and \$10,000 respectively. These attract overheads (see the box 'on on-costs and overheads') of 60% and 10% respectively making a total cost of around \$67,000 per annum.

Bottom line: leverage for PhD students is typically 1:6 - \$11,000 becomes \$67,000.

At this point it is worth trying to work out the cost of getting a piece of research to the point of publication. A very good PhD student will produce about three papers over four years. If their cost is \$67,000 per annum then the rough cost of a paper is $\$67,000 \times \frac{4}{3} = \$90,000$.

Postdocs

Postdoctoral researchers, on face value, do not provide the efficiency of PhD students. They are typically twice as productive but they cost about \$100,000 per annum (including on-costs). Adding in overheads, this means they cost about \$160,000 for salary (\$100,000 from the grant and \$60,000 from the university). If we add some expenses of \$18,000 per annum, shared about 50-50, then add 10% overheads on those expenses, the full cost of a postdoc is \$180,000 per annum – leverage of about 1:2. However, most of our postdocs are co-funded from other sources, so the final leverage for postdocs is between 1:2 and 1:4.

Bottom line: leverage for postdoc researchers is typically 1:3 with high variability from project to project.

“We have every expectation that our new NESP Threatened Species Recovery Hub will be every bit as effective in terms of return in investment.”

On on-costs and overheads

On-costs and overheads can cause confusion. In the Australian university sector, on-costs are direct costs that universities pay to employ their staff. Super-annuation is the biggest component of on-costs. On-costs typically run at 28% on top of the base salary. Overheads is the estimate of the additional costs to a university of employing staff. They range from 60% to 90% for salaries, depending on whom you are talking to, and 10% for equipment/travel/consumables etc. Hence, if you employ someone with a salary of \$78,000 then the actual cost is $\$78,000 \times 1.28 = \$102,400$. The cost, taking into account 'overheads', is a minimum of $\$102,400 \times 1.6 = \$163,840$.

It is interesting, again, to try to work out the cost of getting a piece of research to the point of publication. A very good postdoc will produce about two papers per year. If their full cost is \$180,000 per annum this means the rough cost of a paper is, again, around \$90,000.

Another calculation

Another way of getting a ballpark on the leverage of Commonwealth funds is to consider the number of papers written per year and note that the net full cost of a paper is about \$90,000. The latest count of NERP ED papers is about 100 per year. This represented \$9 million of output for an investment of around \$3 million per annum – leverage of 1:4, which lies somewhere between the postdoc and PhD calculations. This apparent consistency makes me happy.

Punch-line: We estimate that for every dollar invested by the Australian Government Department of the Environment in environmental research in our hubs, about \$4 is actually spent on research (taking into account the full cost of research) – a leverage of 1:4.

This is a remarkable level of leverage. Similar results emerge from funded week-long workshops, which usually produce one or two papers. Our style of quantitative impact-oriented research has been especially efficient because it often uses existing data.

I end by noting the high efficiency of PhD students as investment although, as expected, the time it takes to deliver an outcome, and the uncertainty of the outcome, makes postdocs a better investment in many cases. ●

Acronym timeline

- CERF: Commonwealth Environment Research Facilities Program
- AEDA: Applied Environmental Decision Analysis hub. The AEDA hub was funded by CERF from 2007-2010.
- NERP: National Environmental Research Program
- NERP ED: NERP Environmental Decisions Hub. NERP ED was funded from 2011-2015.
- NESP: National Environmental Science Programme
- TSR: Threatened Species Recovery Hub. NESP TSR is funded from 2015-2021.

Lessons from CERF & NERP

Transdisciplinary research, involving close collaboration between researchers and the users of research, has been a feature of environmental problem solving for several decades, often spurred by the need to find negotiated outcomes to intractable problems. In 2005, the Australian Government allocated funding through its environment portfolio for public good research, which resulted in consecutive four-year programmes (Commonwealth Environmental Research Facilities, CERF; and National Environmental Research Program, NERP). In April 2014, representatives of the funders, researchers and research users associated with these programmes met to reflect on eight years of experience with these collaborative research models.

This structured reflection concluded that successful multi-institutional transdisciplinary research is necessarily a joint enterprise between funding agencies, researchers and the end users of research. The design and governance of research programmes need to explicitly recognise shared accountabilities among the participants, while respecting the different perspectives of each group.

Experience shows that traditional incentive systems for academic researchers, current trends in public sector management, and loose organisation of many end users, work against sustained transdisciplinary research on intractable problems, which require

continuity and adaptive learning by all three parties. The likelihood of research influencing and improving environmental policy and management is maximised when researchers, funders and research users have shared goals; there is sufficient continuity of personnel to build trust and sustain dialogue throughout the research process from issue scoping to application of findings; and there is sufficient flexibility in the funding, structure and operation of transdisciplinary research initiatives to enable the enterprise to assimilate and respond to new knowledge and situations. 🍌

Reference

Campbell CA, EC Lefroy, S Caddy-Retalic, N Bax, PJ Doherty, MM Douglas, D Johnson, HP Possingham, A Specht, D Tarte & J West (2015). Designing environmental research for impact. *Science of the total environment* doi:10.1016/j.scitotenv.2014.11.089 <http://www.sciencedirect.com/science/article/pii/S0048969714016830>

“Successful multi-institutional transdisciplinary research is necessarily a joint enterprise between funding agencies, researchers and the end users of research.”

Strength in diversity

An excerpt from Campbell et al, 2015.

The ability of the five NERP hubs to respond to the needs and interests of their research users meant that they evolved subtly different structures and modus operandi. Three had a strong and extensive geographic focus: the Tropical Ecosystems Hub focused on the Great Barrier Reef, its rainforest hinterland and the Torres Strait; the Marine Biodiversity Hub focused on Australia’s marine territory; and the Northern Australian Biodiversity Hub focused on Northern Australian aquatic and terrestrial systems. These foci largely determined their research users and stakeholder groups, and resulted in a combination of bottom-up self-organisation around specific research issues and top-down coordination to resource and deliver large, complex research programmes.

The Environmental Decisions hub worked in partnership with a wide range of research users in the public and private sectors across the country, identifying discrete research topics through focused workshops after which small teams worked with end users on projects of varying duration from several months to several years.

The Landscapes and Policy hub identified several regions as case studies, with biophysical and social researchers working in interdependent teams on questions defined by the management agencies in each region.

While the NERP hubs were all selected against the same national prospectus and funded by the same government agency against the same overall objectives, guidelines and accountability measures, it is notable that each developed in quite different ways. All now have distinct and markedly different identities and modus operandi, yet the recent evaluation found each to be effective against both hub and programme level objectives. This suggests that there is no single ‘magic bullet’ formula for designing a successful collaborative applied environmental research programme. Rather, programme design, management structure and research practice should respond to the specific ecosystem/issue, mix of stakeholders and end users and the nature of their knowledge needs, cognizant of the history of research investment in that context. 🍌



National Environmental Research Program

An independent evaluation of NERP

Excerpt from NERP mid term evaluation (2014)

- This evaluation found that the program has been effective in meeting its objective in several key areas, most notably in
- informing national park planning and operations, and also
- across several high profile Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) responsibilities.
- The survey undertaken as part of the evaluation identified that a significant proportion of end-users, both in the
- Environment portfolio and other stakeholders, consider that the following have been the three major achievements from the NERP:
 - improved capacity of decision-makers, policy developers and environmental managers to connect with researchers and make the most of research outputs;
 - improved capacity of researchers to meet environmental decision-makers’ needs; and
 - improved knowledge of biodiversity or the functioning of ecosystems. 🍌

Reference

Spencer C, P McVay & S Sheridan (2014). *Evaluation of the National Environmental Research Program (NERP)*. <http://www.environment.gov.au/science/nerp/publications/evaluation-nerp>

Stopping new pasture varieties becoming tomorrow's weeds

Hundreds of the invasive plant species that now inflict major environmental and economic damage in Australia were originally developed and distributed as pasture species. What a perverse outcome. What's worse, we don't seem to have learnt from these mistakes.

Agricultural weeds cost Australia an estimated \$4 billion every year, and the environmental damage is thought to be of a similar magnitude. Introducing these pasture species was a big mistake that Australians will continue to pay for indefinitely. We face increased fire risks, increased management and weed control costs, as well as threats to our natural heritage.

Don Driscoll and Jane Catford undertook a global survey of pasture plants (Driscoll et al., 2014) revealing that over 90% of plant species developed and sold by agribusinesses are weeds somewhere in the world, and on average 30% are weeds in the country in which they are promoted. In Australia, species promoted by agribusiness include orchard-grass (*Dactylis glomerata*), canary-grass (*Phalaris* species), tall fescue (*Schedonorus arundinaceus*), and sub-terranean clover (*Trifolium subterraneum*). These species are all recognised weeds in Australia, weeds that degrade native communities such as threatened box-gum woodlands.

In a nutshell, Australia already has an enormous weed burden that is threatening our natural heritage, increasing fire risk, and multiplying the costs of land management. Unregulated development and release of new varieties of existing weeds will make the weed problem worse, potentially a lot worse. 🌱

See [Decision Point #86](#) for the complete story

Making robust decisions on willows in the face of uncertainty

How much should we invest in *learning* as opposed to *doing* when it comes to conservation management in the face of great uncertainty? A common response to this vexed issue is simply to ignore the issue – we make the best decision that we can based on what we know (or don't know) and trust our intuition. A better way is to apply a framework of structured decision making (SDM) to identify robust management strategies. How does this work? Consider how we applied this approach to develop a long-term management strategy for the invasive gray willow up on the Bogong High Plains. The stakes are high with the prospect of this very invasive willow taking over an endangered alpine ecosystem. There is great uncertainty surrounding the available options and, looking into the future, this is compounded by a changing climate and shifting fire regimes.

Structured decision making involves working with key stakeholders involved in a problem to create an agreed framework around the decisions they need to make. The process we use involves setting a context, agreeing on objectives, listing the various available options to meet these objectives and devising ways to compare the costs and benefits of those options.

When working through the willow problem it emerged that the key decision to be made was the proportion of resources to allocate to: (a) the control of existing populations of willow in alpine bogs, (b) control of sub-alpine source populations, and (c) the acquisition

See [Decision Point #67](#) for the complete story

The researchers recommend:

1. **Account for full environmental, social and economic benefits of new varieties.**
2. **A list of prohibited and permitted species based on varieties.**
3. **Apply weed risk assessment to new varieties.**
4. **Monitor new varieties and respond rapidly if they become invasive.**

Reference

Driscoll DD, JA Catford, JN Barney, PE Hulme, Inderjit, TG Martin, A Pauchard, P Pysek, DM Richardson, S Riley & V Visser (2014). New pasture plants intensify invasive species risk. *PNAS* 111: 6622–16627, doi: 10.1073/pnas.1409347111 <http://www.pnas.org/content/111/46/16622>



Jane Catford with Don Driscoll in dense sward of canary grass. This species is a known invasive plant but new varieties are still being developed for pasture. (Photo by Stuart Hay)

of better information about willows that may serve as sources of colonists in the future.

Unless budgets increased substantially, investing in research or adaptive management to learn about the system and resolve key uncertainties (fire frequency, willow seed dispersal distance, bog vegetation recovery rate) would not improve our ability to manage the system. If budgets did increase substantially, learning about willow seed dispersal distance would contribute the most to improving management. 🌱

Reference

Moore JL & MC Runge (2012). Combining Structured Decision Making and Value-of-Information Analyses to Identify Robust Management Strategies. *Conservation Biology* 2: 810–820.



Willow control in Victoria's alpine country. (Photo by Joslin Moore)

Burning questions for black cockatoos

The gregarious Carnaby's cockatoo are such a common sight in Perth that it is easy to forget they are endangered, and that the urban and agricultural expansion of south-western Australia has removed the bulk of their habitat. How we manage their remaining habitat will have important consequences for the species' survival.

To understand how fire influences food availability in the banksia woodlands the cockatoos depend upon, Leonie Valentine and Richard Hobbs examined how time-since-fire influences plant and cone densities of the two dominant native woodland food species (*Banksia attenuata* and *Banksia menziesii*). They then estimated the number of Carnaby's cockatoo that would be supported in different post-fire aged banksia woodlands (Valentine et al 2014).

They compared tree density and cone productivity of dominant banksias across 44 sites of varying post-fire aged vegetation. The number of Carnaby's cockatoos that could be supported in banksia woodlands was estimated using the bird's energetic requirements and seed energy content, and accounting for some aspects of their foraging ecology.

Banksia attenuata produced more cones at sites aged 10–30 years since fire in both survey years, while cone productivity for *B. menziesii* was highest in very old sites (>35 years since fire) in one year only. The researchers predicted that higher numbers of Carnaby's cockatoos would be supported in vegetation aged between 14–30 years since fire, peaking in vegetation aged 20–25 years.

The current distribution of post-fire aged vegetation within this area (>60% burnt within the last 7 years) is predicted to support around 2,725 Carnaby's cockatoos, representing 25–35% of the estimated birds reliant on the area. Their results indicate that food resources are

influenced by time since fire. Therefore, if optimising food resources was an objective, the availability of food may be manipulated by altering burning patterns. Importantly, this would involve retaining greater areas of woodland burned with less frequency. 🌿

Reference

Valentine LE, R Fisher, BA Wilson, T Sonneman, WD Stock, PA Fleming & RJ Hobbs (2014). Time since fire influences food resources for an endangered species, Carnaby's cockatoo, in a fire-prone landscape. *Biological Conservation* 175: 1–9.



Carnaby's cockatoos feed on the seeds of a variety of native and introduced plant species and on insect larvae. Plants include kwongan heath plants such as banksias, dryandra, hakea, grevillea and also marri seeds. New research suggests fire management may make an important contribution to sustaining the cockatoo's food sources. (Photo by Leonie Valentine)

See [Decision Point #84](#) for the complete story

Climate shift for eucalypts

How will eucalypts cope with climate change? Nathalie Butt recently led the first comprehensive investigation into the vulnerability of eucalypt distributions to climate change across Australia. The investigation revealed that overall, eucalypt species in the central desert and open woodland regions will be the most affected, losing 40% of their climate space under the extreme climate scenario. The least affected species, in eastern Australia, are likely to lose 20% of their climate space under the extreme scenario.

As well as the climate threat faced by the trees themselves, cascading impacts on eucalypt-dependent species and communities will be far-reaching. And that applies to the ecosystem services and landscape-scale bio-climate processes that eucalypt communities contribute to.

In terms of conservation planning, the results are also significant. Restoration efforts in particular may have to be reframed. Where areas set aside for restoration are currently climatically marginal, and in future will be no longer climatically suitable, the prospects of restoring such areas must be questioned. Establishing trees in such landscapes is extremely difficult and entails financial risk. 🌿

Reference

Butt N, LJ Pollock & CA McAlprine (2013). Eucalypts face increasing climate stress. *Ecology and Evolution*. 3: 5011–5022.



Shifting gums: Large scale shifts in climate space under both moderate and extreme scenarios. Tree climate regions were broadly based on the Bureau of Meteorology climate classification, as above. The arrows indicate the overall direction and magnitude of climate space shift for the four general climate regions.

See [Decision Point #72](#) for the complete story

Saving reptiles on Christmas Island

Christmas Island is truly like nowhere else in the world, but the island's highly endemic fauna is under pressure. Four species of mammal have gone extinct since human settlement, including the presumed recent loss in 2012 of the endemic pipistrelle bat. And it's not just the mammals that have suffered. Since 1980, Christmas Island has also witnessed catastrophic declines in reptile numbers, with five of the six native reptiles currently on the verge of extinction. Taken together, this is believed to be one of the largest reptile decline problems that Australia has ever faced.

The causes of these reptile declines are unknown, but the accidental introduction of invasive species has had devastating effects on many Christmas Island animals. Park managers suspect that the reptile declines have resulted from combined pressures from a range of invasive species, including cats, rats and yellow crazy ants. Two other highly invasive species: the Indian wolf snake (*Lycodon capucinus*) and the giant centipede (*Scolopendra subspinipes*), have filled the island's vacant ecological niche of 'small-reptile predator' with potentially devastating consequences for the endemic reptiles of Christmas Island which have no experience with such predators.

Melissa Wynn's research on Christmas Island aims to identify key threatening processes acting upon the endangered, endemic reptiles and develop ways to effectively target our investment in management to support future reintroductions and mitigate the risk of further decline in the Christmas Island giant gecko. This research strengthens existing links between EDG scientists and



Melissa Wynn gets up close with a destructive invader: the giant centipede. The centipede preys on small reptiles and is believed to be contributing to the decline of Christmas Island's native lizards.

Parks Australia building on collaborations on Christmas Island and in other Commonwealth national parks.

Currently Melissa is working with experts from around the country to identify all the potential threats causing reptile declines on Christmas Island and to model the costs, benefits and constraints of all available management actions. These models will form a decision framework, identifying what new information would be of most value to inform research priorities in the field. 🍎

See [Decision Point #83](#) for the complete story

Planning for biodiversity in the urban fringe

Biodiversity near and within urban areas brings many benefits but its maintenance involves complex trade-offs between competing land uses. NERP ED researchers recently demonstrated how these trade-offs can be better described to facilitate more transparent, efficient and democratically derived urban planning. They used reserve design tools in a novel way to identify priority development sites. The approach is based on a synthesis of ecological, social and economic data. Then trade-offs between biodiversity conservation and other key development objectives were quantified. Other key development objectives included transport planning, flood risk and food production. And they demonstrated how all this can be done using a case study of changes in land use across the City of Wyndham, a local government west of Melbourne.

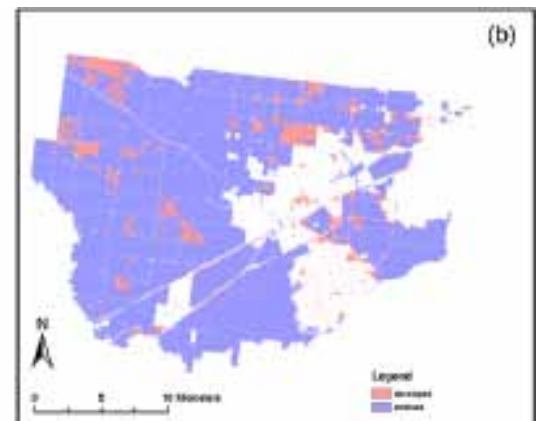
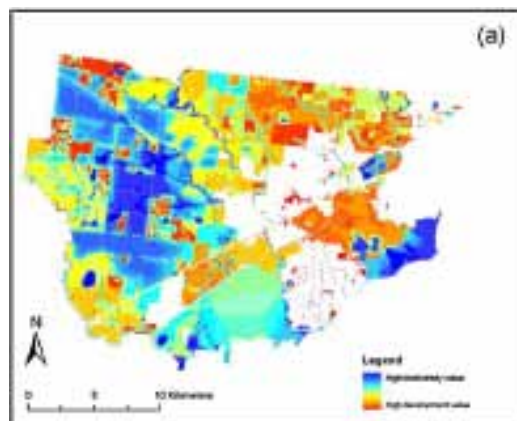
The process involved gathering data, identifying and weighting key values according to stakeholder preference, and modelling to produce visual representations of possible scenarios that have been optimised according to the chosen values. 🍎

Reference

Bekessy SA, M White, A Gordon, A Moilanen, MA McCarthy & BA Wintle (2012). Transparent planning for biodiversity and development in the urban fringe. *Landscape and Urban Planning* 108: 140-149.

See [Decision Point #68](#) for the complete story

A map of the study area showing its biodiversity value (a). (b) shows areas representing the lowest ranked 10% of the landscape in terms of biodiversity value. If biodiversity was your only consideration when it came to development then the areas in pink are places you would develop.



Citizen science and the value of protected areas

Long-term monitoring data are critical for determining whether protected areas are able to achieve their objectives. The problem is that, in most cases, these long-term data 'officially' do not exist. The good news is that even though 'official' data sets collected by scientists often don't exist, 'unofficial' observations made by keen 'amateur' naturalists are sometimes readily available. Can these citizen-science records shed any light on the effectiveness of protected areas? Megan Barnes and colleagues examined the value of bird lists in assessing impact in Australia's Wet Tropics and found they can make a real contribution (Barnes et al., 2015).

The aim of Megan's analysis was to evaluate the contribution of protected areas to the conservation of endemic birds. She did this by comparing abundance and trends in birds within and outside of protected areas in the Australian Wet Tropics in Queensland. The data used were non-standardised volunteer collected bird surveys (bird lists) and the approach they used involved List Length Analysis. Similar to other studies, they estimated trends in species populations with a Bayesian logistic regression to infer bird presence from bird lists.

Her analysis targeted 21 bird focal species. Overall, she found that 18 of these have been stable since 1998. Sixteen were more likely to be found within the Wet Tropic protected areas, two were more likely to be recorded outside, and three showed little difference. Except for one endemic species, there was no difference in trends in prevalence between protected and unprotected areas. These results suggest that for the majority of species, protected areas may contain better habitat than unprotected areas, but birds inside protected areas are not significantly better off through time, as long as forest outside protected areas remains intact.

These findings have direct implications for the monitoring and management of the Wet Tropics World Heritage Area and other

See [Decision Point #83](#) for the complete story

Connecting science and management (at Booderee)

Management of national parks is mainly based on the experience of resource managers and not directly on new scientific knowledge and evidence. And yet there are many advantages to connecting management with research on the ground. David Lindenmayer demonstrates this value by describing the development of a strong and enduring partnership between scientific research and resource management in Booderee National Park (BNP), a coastal reserve next to Jervis Bay on the south coast of NSW. The partnership has focussed on three key issues within Booderee: the impacts of fire on native biota, the response of vertebrates to feral animal control and the control of Bitou bush.

In regards to fire, a new understanding of the relationships between bird persistence and recovery following fire (derived from empirical research) has resulted in a change from uniform prescribed burning of entire compartments of native vegetation to patchy fires across a maximum proportion of a given compartment.

Research has also demonstrated the value of feral animal control showing it substantially increases populations of some animals such as the common brushtail possum, the long-nosed bandicoot and the eastern bristlebird. On this basis, an intensified approach to feral animal control in BNP is now well established as a key and ongoing conservation activity recognised formally within the official management plan for the reserve. 🍎

See [Decision Point #67](#) for the complete story



Bird lists compiled by 'citizens' may inform the effectiveness of our reserve networks. (Photo by Dirk Hovorka)

landscape-scale management approaches. Since there is no marginal benefit of protected areas, their results potentially reflect the effectiveness of landscape management. Maintaining intact rainforest may be enough to ensure the conservation of viable populations of range-restricted birds in the Queensland wet tropics in the medium term! The researchers recommend targeting more systematic monitoring towards species with high uncertainty, small sample size, indicated declines and differences between protected and unprotected areas. These include the golden bowerbird, fernwren, Atherton scrubwren, and satin bowerbird. 🍎

Reference

Barnes M, JK Szabo, WK Morris & H Possingham (2015). Evaluating protected area effectiveness using bird lists in the Australian Wet Tropics. *Diversity and Distributions* 21: 368–378.

Reference

Lindenmayer DB, C MacGregor, N Dexter, M Fortescue & P Cochrane (2013). Booderee National Park Management: Connecting science and management. *Ecological Management & Restoration* 14: 2–10. doi:10.1111/emr.12027
<http://onlinelibrary.wiley.com/doi/10.1111/emr.12027/full>



Booderee National Park Project Officer Nick Dexter (foreground) discusses Bitou bush control with scientists and managers during a science workshop in the park. The science/management relationship that has been cultivated at Booderee has made an important contribution to conservation outcomes in the coastal reserve.

Managing the impacts of urban development on old trees

How green is my backyard? Three quarters of Australia's population lives in urban areas so for most of us our 'backyard' is an urban space. And most of our urban spaces aren't that wildlife friendly. In a study undertaken by Darren Le Roux and colleagues in Canberra (Le Roux et al., 2014), urban green space supported fewer mature trees, tree hollows, dead trees, logs, shrubs and litter than adjacent nature reserves. Each of these features represents important habitat for native species of birds, bats and invertebrates. As long as these habitat resources are absent from our urban green spaces, then so too will much of our native wildlife. What's more, this wildlife will be pushed out of our growing urban areas.

As an example, iconic old eucalypts that are scattered through Australia's suburbs (most of which pre-date European settlement) provide many habitat resources for native wildlife, including hollows where birds, bats and possums nest or roost; large volumes of nectar that support many of our invertebrates, birds and mammals; large dead branches that fall to the ground and large ribbons or slabs of peeling bark under which many unique invertebrates live (and which subsequently support many birds and lizards). In fact, the researchers found that a third of all native bird species in Canberra ONLY use large, mature eucalypts over 150 years old.

In contrast to conventional thinking that connectivity is critical for wildlife, they found that isolated large trees in urban areas support more species and individuals of birds than equivalent large trees in intact areas such as nature reserves. That is, removing a large tree in an urban area is more detrimental to biodiversity than removing a large tree from a nature reserve!

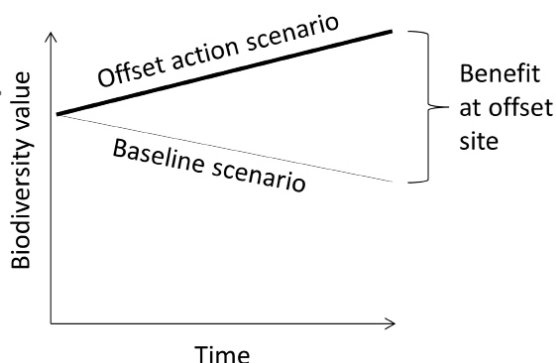
However, large old eucalypts have a bad reputation in urban areas: they have dropped their limbs on cars, houses and even people; they can have an expansive root system that destroy footpaths and drains; they block solar access; and they can represent a hazard in areas with high bushfire risk.

See [Decision Point #82](#) for the complete story

Calculating the benefit

Calculating the real benefit of a conservation action by comparing losses and gains isn't only relevant to the way we do offsets, it applies equally to conservation planning and agri-environment schemes. NERP ED recently reviewed the literature on conservation policy in the three areas of offsets, conservation planning and agri-environment schemes (Maron et al., 2013). They found that the approaches used to calculate conservation benefit often involved assumptions about the alternative scenario that were not explicit, demonstrably wrong or both. Based on this, they believe that assumptions about how conservation value changes over time in the alternative scenario can often be substantially refined, and that making these assumptions explicit by calculating directly the expected difference between the two scenarios is likely to improve the quality of conservation decision-making.

Biodiversity benefit gained at an offset site is the difference between the scenario with the offset action and the baseline scenario (modified from Maron et al. 2013).



Over two-thirds of the mature eucalypts at this site (left) were removed for this section of the new suburb of Gungahlin in Canberra (right) (Source: Google Earth).

Large eucalypts are therefore often removed to make way for new suburbs. And where eucalypts are planted in suburbs, they are rarely permitted to get to an age when they provide suitable habitat (eg, tree hollows) for many native species. For example, in the suburbs of Canberra, planted eucalypts are generally permitted to reach 60-80 years of age before they are removed.

Establishing more trees, extending the standing life of existing trees and increasing the rate at which eucalypts develop habitat features—will reduce the rate at which large, old eucalypts will decline in urban green spaces, no feasible combination of these will totally reverse a decline in large old eucalypts in Canberra's suburbs. Can we offset this loss in some other way? What about the use of nest boxes? The researchers are currently examining these issues. 🍷

Reference

Le Roux DS, K Ikin, DB Lindenmayer, W Blanchard, AD Manning & P Gibbons (2014). Reduced availability of habitat structures in urban landscapes: Implications for policy and practice. *Landscape and Urban Planning* 125: 57-64.

Consider agri-environment schemes where governments give out money to landholders to do environmental works. The increasing popularity of market-based instruments for the delivery of such funding has led to a proliferation of benefit metrics for comparison of competing bids for funding. These metrics, or utility functions, are derived through a variety of approaches and are intended to represent the benefit being purchased for a given investment in private land conservation, often in order to compare the cost-effectiveness of competing investment options. The researchers examined recent (since 2000) agri-environment schemes that used a quantitative metric of benefit to compare competing bids for funding. They found that rather than calculating conservation benefit as the difference between the 'with investment' scenario and the alternative scenario, the difference between the current value and the estimated future value of a site (with investment) was often used. In effect, this reflects a naive assumption that the alternative scenario for a site is one of no change from its current state. 🍷

Reference

Maron M, JR Rhodes & P Gibbons (2013). Calculating the benefit of conservation actions. *Conservation Letters* doi: 10.1111/conl.12007

See [Decision Point #69](#) for the complete story

Good environmental decisions and strong metrics

Good environmental decision making is information-intensive. Environmental managers invest a lot in monitoring and research to collect information, but often take a rough-and-ready approach to combining that information into a form that is useful for decision making. Does this matter? Does it make a difference to environmental outcomes to use a theoretically sound decision metric, compared with a weak decision metric? That was the question David Pannell and Fiona Gibson set out to answer by comparing environmental outcomes generated by these two approaches.

What they found, in short, was that it does matter which decision metric you use. Indeed, it can make an enormous difference. As a consequence, many decision metrics used by environmental managers result in us missing out on very large environmental benefits.

A common approach used by environmental managers to score the projects they have to choose between is to define a set of variables believed to correlate with projects' benefits and costs, and combine them into a formula or metric so that projects can be compared. Numerical values or scores are assigned to each potential project and these scores are used to rank the projects.

There are many different ways the various benefits and costs of a project could be combined and there are thousands of different decision metrics in practice around the world. Unfortunately, many (if not most) of these decision metrics have problems in the way they determine the value of the project. Commonly used decision metrics have a range of weaknesses, including adding variables that should be multiplied, omitting important variables related to environmental benefits, omitting project costs, or subtracting costs rather than dividing by them.

The researchers estimated the environmental losses resulting from each of these weaknesses. They found that poor metrics resulted in environmental losses of up to 80% – not much better than completely random uninformed project selection. The most costly errors omitted information about environmental values, project costs or the effectiveness of management actions. Using a weighted-additive decision metric for variables that should be multiplied is another costly error commonly made in real-world decision metrics. They found that omitting information about



Which environmental project should get priority? In making these decisions it's important to use a strong metric.

project costs or the effectiveness of management actions, or using a weighted-additive decision metric (that should be multiplied) can reduce potential environmental benefits by 30 to 50%.

They also demonstrated that the quality of the decision metric makes a much bigger difference to environmental outcomes than the quality of the information used within it.

So, your choice of metric matters. Simply choosing a logical metric can improve environmental outcomes more than even obtaining substantial increases in environmental budgets. Of course, getting a bigger slice of the budget will help, but it is critical to ensure that any money is spent wisely by using a good metric. 🍎

Reference

Pannell DJ (2013). *Ranking environmental projects*. Working paper 1312, School of Agricultural and Resource Economics, UWA. Crawley, WA. <http://ageconsearch.umn.edu/handle/156482>

Pannell DJ & FL Gibson (2014). *Testing metrics to prioritise environmental projects*. Working Paper 1401, School of Agricultural and Resource Economics, UWA. Crawley, WA. <http://ageconsearch.umn.edu/handle/163211>

See [Decision Point #82](#) for the complete story

Dealing with non-detections in biological surveys

Our big brains struggle to coherently combine probabilities. It's something that's been noted time and again in studies on how doctors interpret a medical diagnosis but it's a basic problem whenever we are presented information with several points of uncertainty. And this is a big problem commonly encountered in environmental management whenever we have imperfect detection.

Techniques to estimate the chance of not observing a species if it is in fact present (false absence) have been around in ecology for some time. But often we're interested in the probability a species is present in circumstances where it is not detected. This is especially the case in environmental impact assessments, where failure to detect a population of a threatened species (a false absence) can have dire consequences.

It's easy to be duped into mistakenly thinking a simple reworking of conventional techniques will give you the answer. Psychologists even have a name for this mistake – the inverse probability fallacy.

The alternative to relying on our intuition is using Bayes Theorem. Brendan Wintle and colleagues have re-jigged Bayes Theorem for the specific setting of repeat survey visits with imperfect detection.

Applying their approach suggests that if the species you're after is especially cryptic such that you're unlikely to detect it in any one visit, but the habitat is ideal, you need to revisit the site many times. If the habitat is poor and the species is easy to detect, a lesser effort is required.

It's a curious thing that epidemiologists and psychologists, who have known how to approach and solve these kinds of problems for decades, have had limited success in getting doctors and vets to think straight. It'd be no bad thing if we could begin to routinely use Bayes theorem or logic trees to avoid similar blunders in environmental management. 🍎

Reference

Wintle BA, TV Walshe, KM Parris, & MA McCarthy (2012). Designing occupancy surveys and interpreting non-detection when observations are imperfect. *Diversity and Distributions*. 18: 417–424.

See [Decision Point #57](#) for the complete story

Halting cane toads in WA

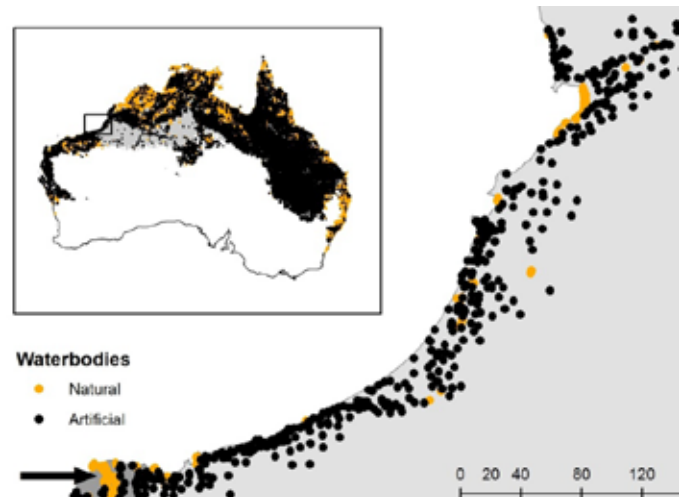
Cane toads have reached the Kimberley and there is no sign that their conquest is nearing completion. Their relentless advance across the Top End makes it seem like they are invincible, but we believe that by exploiting the toads' inability to retain water, we might be able to control its spread. Few, if any toads can survive more than 10 days without water in the dry season.

So, in very dry regions, we may be able to halt their spread by excluding them from permanent water sources. If we manage lots of water sources in the same area (eg, by fencing natural water bodies, or minimising leaks in tank and trough systems that provide water to cattle), we might be able to create a waterless barrier or 'firebreak' in the landscape that toads can't penetrate.

Now this sounds ambitious – where could we manage all permanent water bodies to create a waterless firebreak? Well it just so happens that toads will need to march south towards the Pilbara through an arid corridor where permanent natural water is in short supply. Artificial water points and natural springs dot the corridor, forming a thin strip of suitable toad habitat along the coast. The combination of landscape and climate makes this corridor a potential bottleneck (or choke point) in which to create a barrier. 🍌

Reference

Tingley R, BL Phillips, M Letnic, GP Brown, R Shine & SJE Baird (2013). Identifying optimal barriers to halt the invasion of cane toads *Rhinella marina* in arid Australia. *Journal of Applied Ecology* 50: 129-137.



Natural and artificial water bodies in the study area. The scale bar is in kilometres.

See [Decision Point #82](#) for the complete story

Urban expansion, climate change & frog habitat

Who'd be a frog in the suburbs? Not only do they have to contend with habitat loss, fragmentation and degradation, now there's climate change, too. Joab Wilson and colleagues have tried to better understand the separate impacts that climate change and urbanisation might be having on frogs. Of course, the two processes are overlapping and interacting. A frog's ability to migrate to more suitable habitats in response to increasing temperatures (connected to climate change) may be reduced in more fragmented landscapes (connected to urbanisation). However, given the large uncertainties surrounding climatic predictions at the scale of cities and the unpredictable nature of ecological communities, it will be challenging to accurately predict how species may respond to future climatic events.

Our study produced a series of best- to worst-case climate and urbanisation scenarios for the suitability of pond habitat for the spotted marsh frog in the urban fringe of Melbourne. It's expected that ponds will become less suitable as habitat as they become increasingly dry under the climate change scenarios. However, we wanted to see what this might mean under different development pathways in the suburbs.

We found that pond habitats in the Merri Creek catchment are likely to become less suitable for amphibians under both climate and urbanisation scenarios. An increasingly warm and dry climate is likely to provide less standing water for species to be able to breed and for tadpoles to develop.

An important finding to note, however, is that in the short term it's urban development that poses the much greater risk, making ponds significantly less suitable for the species to persist. And that

gives us something that lies within our power to do something about. Our ability to control the effects of urban development on the habitats provided by the Merri Creek corridor is something we can engage with at the local and regional scale whereas mitigating climate change requires concerted effort at all scales.

When you consider how much attention is being given to climate change while so little is being given to the impacts of urban expansion, it could be we are ignoring the elephant in the room. 🍌

Reference

Wilson JN, S Bekessy, KM Parris, A Gordon, GW Heard & BA Wintle (2012). Impacts of climate change and urban development on the spotted marsh frog (*Limnodynastes tasmaniensis*). *Austral Ecology*. DOI: 10.1111/j.1442-9993.2012.02365.x



Urban development in the Merri Creek catchment is likely to carry a heavy impact for amphibians.

See [Decision Point #63](#) for the complete story

A call to better protect Antarctic biodiversity

The 'last wilderness on Earth' requires a better system of protected areas according to NERP ED researcher Justine Shaw. That wilderness, of course, is Antarctica.

Most of Antarctica is covered in ice, with less than 1% permanently ice-free. This ice-free land is where the majority of biodiversity occurs yet only 1.5% of these important areas belong to Antarctic Specially Protected Areas under the Antarctic Treaty System.

Although the Antarctic environment is less utilised and populated than others, activities permitted on the continent such as road and building construction, vehicle traffic and waste disposal are having substantial impacts on biodiversity.

What is required now is a systematic network designed to best conserve the biodiversity of Antarctica as a whole. Once a protected area is designated and human activity restricted, management efforts are relatively minimal compared to protected-area management requirements on other continents. And what we would gain would be a protected area network that everyone could truly be proud of. 🍷

Reference

Shaw JD, A Terauds, MJ Riddle, HP Possingham & SL Chown (2014). Antarctica's Protected Areas Are Inadequate, Unrepresentative, and at Risk. *PLoS Biol* 12(6): e1001888. doi:10.1371/journal.pbio.1001888



Only 1% of Antarctica is free from ice. These areas are critical to the conservation of Antarctic biodiversity but only 1.5% of this ice-free space is formally protected. (Photo by Aleks Terauds)

See [Decision Point #81](#) for the complete story

Strategies to bridge the implementation gap

There is a growing body of evidence to show that scientists often don't answer the questions most important to managers. It is also increasingly clear that while decision makers value scientific information they do not routinely use science even when it's available. There are many reasons for this divide between the science and practice of conservation, a separation that is often called the implementation gap. Within the conservation science community there are incentives for publishing research and attracting funding, but not for engaging with decision makers. Furthermore, what is interesting to scientists is not always what is needed by managers.



EDG researcher Phil Gibbons (on the right) talking about biodiversity offsets out in the field with a local government conservation manager. Researchers need to work with managers and decision makers as they do their science if they are to bridge the implementation divide.

Carly Cook and colleagues recently analysed ways of bridging this gap. They found that there are least three key challenges for those hoping to achieve boundary-spanning conservation science. First, scientific and management audiences can have contrasting perceptions about the salience of research. Second, the pursuit of scientific credibility can come at the cost of salience and the legitimacy of science in the eyes of decision makers. And third, different actors can have conflicting views about what constitutes legitimate information. The key to overcoming all three challenges is through meaningful collaboration between scientists and decision makers. To achieve this they nominate four approaches that have proved successful in a number of situations: boundary organisations (independent organisations that work at the nexus of science, policy, and practice and facilitate communication among them), research scientists working within management agencies, formal links between research-focused institutions and management agencies, and training programs for conservation professionals.

Breaking down the boundaries between different groups of conservation professionals, and different scientific disciplines, requires that these different groups be prepared to engage with one another and to challenge traditional models of knowledge production. While this may require some additional effort, there are many rewards for those willing to invest their time and energy. 🍷

Reference

Cook CN, MB Mascia, MW Schwartz, HP Possingham & RA Fuller (2013). Achieving conservation science that bridges the knowledge-action boundary. *Conservation Biology*, 27(4): 669-678.

See [Decision Point #73](#) for the complete story

Movement science and policy

The movement of organisms has a fundamental influence on the distribution of biodiversity and affects community structure and ecological phenomena such as reproduction, resource availability and species interactions. Anthropogenic disturbances and inappropriate management can disrupt these important processes, so movement information should be considered in conservation decisions.

A recent review indicated that there remains a dearth of information on species movement and its incorporation into policy. In light of this, NERP ED ran a workshop on the topic down at Mollymook (south coast of NSW) in September 2013. The broad aim was to identify the relevance of movement information to a range of government policy and management issues and develop a framework for managing uncertainty when making environmental decisions.

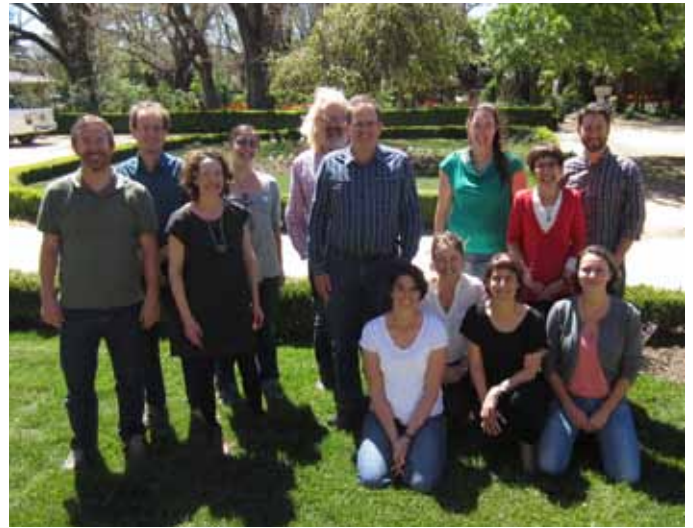
Participants split into two groups to address two key issues. The first group identified environmental decision-making domains where movement information is most relevant, with a view to providing advice to both sides of the policy-science interface on how to effectively share information. This group also identified emerging areas of biodiversity policy that might benefit from movement knowledge.

The second group developed a conceptual framework for managing the two types of uncertainty encountered within these decision-making domains: the relevance of movement to the environmental decision, and information on movement itself. During this process Department staff provided policy case studies and decision scenarios, which were extremely valuable in providing context so that researchers could ensure that the approaches taken were realistic and relevant.

It's hoped that the new collaborations arising from this workshop will enable movement science to better inform policy in a range of areas (for example in connectivity and restoration policy). 🍷



The 'Movement' crowd at Mollymook.



Participants of the Urban Biodiversity workshop.

Urban biodiversity

Our urban environments present unique challenges for biodiversity conservation. Tradeoffs between competing objectives are complex and vested interests high. Past planning decisions often leave lasting ecological and social legacies. Despite decades of research, key knowledge gaps remain around the processes that drive patterns of biodiversity and how they interact with social systems. Novel and sophisticated approaches are required to conserve biodiversity in urban systems.

In late 2013, representatives from NERP ED and the Department of the Environment took part in a workshop on urban biodiversity conservation and management. The workshop aimed to identify key objectives for urban biodiversity conservation in Australia, and investigate the role of decision science and new research approaches in this area.

Researchers considered questions such as: What are key research questions for urban biodiversity in Australia now and in the future? How do we make decisions about conservation actions in highly modified landscapes? What are appropriate objectives for urban biodiversity, and how can we measure conservation success in cities? Do current policies reflect these objectives?

The workshop was extremely productive and enjoyable – an amazing number of new ideas and research questions were raised and investigated, and the staff at the Carrington Inn in Bungendore (NSW) looked after us very well. Several papers are in the pipeline, so watch this space!! 🍷



Lessons shared on mixing carbon with biodiversity planting.

Carbon farming and biodiversity

Under the Carbon Farming Futures program, rural landholders have the potential to generate carbon credits through activities such as agroforestry, re-vegetation of land or changed agricultural practices. Each of these activities may have positive or negative effects beyond their intended mitigation of climate change (externalities or co-benefits). There are many, and often complex, costs and co-benefits that should be taken into account when assessing different carbon farming mitigation options.

This workshop, ran at The University of Western Australia in November 2013, brought together various players working on this issue from around Australia. We aimed to create valuable collaborations and produce useful research outputs. The workshop drew together ecologists, economists, social scientists, modellers, foresters, policy officers and carbon consultants; all sharing their insights on how farming for carbon and farming for biodiversity can be understood, measured and traded off. 🍷

Posing problems in the Park

Supercolonies of yellow crazy ants are threatening the forest ecosystems on Christmas Island. Can we predict where supercolonies are likely to form? Will these predictions lead to better targeted control effort?

The noxious bitou bush has invaded coastal ecosystems in Booderee National Park in Jervis Bay, NSW, and park managers are pouring significant resources into removing it. Does the pay-off from control justify this hefty allocation of resources or are we better off investing elsewhere?

The endangered white-throated wren in Kakadu National Park is believed to be sensitive to different forms of fire management. Can adaptive management provide rangers the information they need to discern the merit of alternative burning regimes?

These aren't hypothetical case studies dreamt up by researchers to test different modelling approaches; they are real life challenges currently being faced by the staff of Parks Australia. Maybe NERP's decision science can lend a hand.

In May of 2012, a group of NERP researchers met with representatives from Parks Australia at the University of Melbourne to share views, insights and research on monitoring, modelling and environmental decision making in general. The meeting was 'brokered' by NERP ED's Knowledge Broker, Terry Walshe, and the leader of Parks Australia's Biodiversity Science Team, Judy West.

Managers outlined a variety of current and emerging challenges they're dealing with, including the ant/bitou/wren dilemmas outlined above, while researchers discussed the pros and cons of different approaches to making sound environmental decisions.

"The value of such meetings goes beyond the issues that confront us today," says Terry Walshe. "There is enormous enthusiasm for collaborative work and I'm confident the body of research developed by NERP over recent years will provide accessible and durable solutions to the specific problems posed. But the real value of the workshop was the relationships between researchers and end-users that emerged. These links hold the promise of creative, well constructed solutions to the challenges that lie ahead.

"Parks Australia is dealing with a daunting set of challenges and new (often unforeseen) problems are arising all the time. The opportunity for applied research that makes a difference is abundantly evident.

"In a sense, Judy and I have contrived a flirtation between researchers seeking on-ground relevance and managers seeking clarity in decision-making. The hope is that the flirtation translates to a relationship of substance.*" 🌱

[*Editor's note: This story originally appeared in *Decision Point* #61 in mid 2012. We're happy to report that things have moved on considerably since then – in very positive ways with several ongoing and productive relationships.]



Parks' officers and NERP researchers develop a decision framework for assessing different management options concerning efforts to conserve an endangered lizard on Christmas Island.



Terry Walshe (standing) encourage those gathered at the Parks' workshop to consider their discussions (fruitful though they were) as but the first step in an ongoing relationship.

Management thresholds with Parks Victoria

- Whilst ecological research and monitoring can help define unfavourable ecosystem conditions; the question of when to implement a management action requires value judgements by decision-makers. Such judgements require decision-makers to subjectively trade-off competing objectives.
- NERP ED researchers worked with Parks Victoria to trial a structured decision making (SDM) process to explore where to set management thresholds for the intertidal brown alga, Neptune's necklace, at Port Phillip Heads Marine National Park. Neptune's necklace is an indicator of the condition of invertebrate and algal communities on Victoria's rocky intertidal reefs. Parks Victoria has identified that a key threat to intertidal reef communities is trampling by humans. While the condition of Neptune's necklace has remained relatively stable since 2004, Parks Victoria are concerned that human trampling may increase in the future and is likely to result in declining condition of intertidal reef communities. The challenge for Parks Victoria is this: If the condition of Neptune's necklace starts to decline in the future, at what point should a more intensive management strategy be implemented to minimise the impact of trampling? 🌱

Reference

- Addison PFE, K de Bie & L Rumpff (2015). Setting conservation management thresholds using a novel participatory modelling approach. *Conservation Biology*. DOI: 10.1111/cobi.12544.



NERP ED researchers worked with Parks Victoria to determine management thresholds relating to the condition of Neptune's necklace, a common seaweed of the intertidal zone.

Priority threat management in the Lake Eyre Basin

The Lake Eyre Basin in Central Australia is under pressure from multiple sources. Something needs to be done quickly but, as is often the case, environmental managers are operating under severe time and resource limitations, and are attempting to make decisions surrounded by enormous uncertainty. The threat that is really scaring environmental managers is the establishment and spread of exotic plants (as identified by the Lake Eyre Basin Rivers Assessment implementation plan).

Given that there are insufficient resources to manage all invasive plants across this vast area, information on the ecological cost-effectiveness of different management strategies is critical. To help assemble this information, 22 experts in weed management, policy making, community engagement, biodiversity and natural values were brought together to prioritise invasive plant management strategies across the Lake Eyre Basin. The project resulted from a collaboration between the Queensland University of Technology and CSIRO (involving several NERP ED researchers) and was funded as a NERP emerging priorities project.

The experts identified the key invasive plants species threatening the natural values of ecosystems across the bioregions of the Lake Eyre Basin. They estimated the level of investment required and the likely benefit gained per dollar for each strategy. The expected biodiversity benefit of each strategy was estimated as the reduction in area that an invasive plant species is likely to dominate over a 50-year period, where dominance was defined as more than 30% coverage at a site.

Twelve strategies to manage invasive plants were agreed upon by the experts at a four-day workshop held in Brisbane in May, 2013. The strategies focused primarily on ten weeds which were considered to have a high potential for broad, significant impacts on natural ecosystems in the next 50 years and for which feasible management strategies could be defined. The total cost of the 12 strategies over the next 50 years was estimated at \$1.7 billion. If implemented, it was estimated that these strategies would result in a reduction of invasive plant dominance by 17 million ha; representing a 32% reduction. That's an area covering roughly 14% of the Lake Eyre Basin.

The risks of not undertaking these management strategies include the likely conversion of 14% of the entire basin to weed domination, and a high likelihood of the mound springs ecosystems being lost.

The top five most cost-effective strategies for the entire Lake Eyre Basin were for the management of: 1) Parkinsonia, 2) Chinese apple, 3) Mesquite, 4) rubber vine and 5) bellyache bush. 🌱

Reference

Firn J, TG Martin, B Walters, J Hayes, S Nicol, I Chades & J Carwardine (2013). *Priority Threat Management of invasive plants species in the Lake Eyre Basin*. CSIRO Climate Adaptation Flagship Working paper No. 17 (CSIRO and QUT).



Endemic Mitchell grasslands are being converted to shrubland by the invasion of exotic invasive species like prickly acacia. (Photo by Jennifer Firn.)

Presentations galore

During the four years of the NERP Environmental Decisions Hub, environmental decision scientists regularly travelled to Canberra to give briefings and presentations to policy people and decision makers in the Department of the Environment. These ranged from one-on-one meetings, small groups and packed lecture theatres.

Pictured below is Professor Richard Hobbs addressing a packed house in the Department's 'Bunker' lecture theatre back in 2013. He was giving a lecture on the many challenges of ecological restoration at scale, a topic that the department is having to grapple with on a number of fronts (for example, the wildlife corridors and carbon sequestration initiatives). Richard is one of Australia's foremost experts on ecological restoration and a co-author of the recent Science paper on restoration at scale. What made this lecture noteworthy was that within days of that Science paper coming out, the Department of the Environment knew about it through its NERP program (via the Science Partnerships Section that manages NERP); Richard, being a key researcher with NERP ED, was asked if he might give a presentation to the Department, to which he agreed; and the lecture took place in weeks to a packed audience. "It's the fastest response from policy people I've ever had to a paper," quipped Richard before the lecture. Which all suggests that NERP is connecting real-time science to policy in ways that have rarely been done in the past. 🌱



NERP Environmental Decisions Hub



- The Environmental Decision Group (EDG) is a network of conservation researchers working on the science of effective decision making to better conserve biodiversity. Our members are largely based at the University of Queensland, the Australian National University, the University of Melbourne, the University of Western Australia, RMIT and CSIRO. *Decision Point* is the monthly magazine of the EDG.
- The EDG is jointly funded by the Australian Government's National Environmental Research Program and the Australian Research Council's Centre of Excellence program. This issue of *Decision Point* has been dedicated to celebrating the science and engagement of the NERP Environmental Decisions Hub.



National Environmental Research Program



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Australian National University



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