To thin or not to thin... Dealing with dense eucalypt stands

Prioritising restoration in Kalimantan

A road map for science into policy

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

Welcome to the Mapotron
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Decision Point

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On the point

‘Field of dreams’

American (film) version: An Iowa corn farmer, hearing voices, interprets them as a command to build a baseball diamond in his fields; he does, and the Chicago Black Sox come.

Australian (farm) version: An Australian wheat/sheep farmer looks out across the landscape and hears no voices (no birdsong, no frog croak, no bat call) and interprets this as a command that she needs to restore natural values into this landscape. She does and, over time, the voices return (a far better reward than a team of baseball players turning up).

What did she do? Well, there are heaps of things she could have considered, several of which are discussed in this issue of Decision Point. She thinned a patch of native regrowth up in the far south corner to enable the native understorey to take off (see page 6). She thought long and hard about which new pasture species she was introducing to her property (see page 4) to avoid future weed infestations. She applied for funding to sow native trees into a few of her clapped out paddocks and investigated what she might do to the patch of box gum grassy woodland to sustain its natural values (see page 14). She considered where she would get the best return (biodiversity outcomes) given she had limited resources (time, money and spare land) – well, that’s a theme behind most EDG research (see pages 8 and 15).

And then, not only did nature’s voices begin speaking again, but she realised her efforts to restore native vegetation had also added considerable resale value to her property (see page 3 – private benefits of native veg on private land).

What’s happening in your ‘field of dreams.’ Could a little environmental decision science help you reach that dream a little faster.

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Jane Catford with Don Driscoll in a dense sward of canary grass. This species is a known invasive plant but new varieties are still being developed for pasture. Jane and Don discuss how we can guard against releasing these future environmental weeds. (Photo by Stuart Hay)
Private benefits of native vegetation on private land

In many parts of the world, natural vegetation has been cleared to allow agricultural production. To ensure a long-term flow of ecosystem services without compromising agricultural activities, restoring the environment requires a balance between public and private benefits and costs. Information about private benefits generated by environmental assets can be utilized to identify conservation opportunities on private lands, evaluate environmental projects, and design effective policy instruments.

Maksym Polyakov and colleagues estimated the private benefits of native vegetation on rural properties in Victoria using a spatio-temporal hedonic model. They estimated the marginal value of native vegetation on private land and examine how it varies with the extent of vegetation on a property and across a range of property types and sizes.

Private benefits of native vegetation are greater per unit area on small and medium-sized properties and smaller on large production-oriented farms. Native vegetation exhibits diminishing marginal benefits as its proportion of a property increases. The current extent of native vegetation cover is lower than the extent that would maximize the amenity value to many landowners.

Given this, there is scope for improved targeting of investment in the study region by incorporating private benefits of environmental projects into environmental planning processes. Landowners with high marginal private benefits from revegetation would be more willing to participate in a revegetation program. Targeting these landowners would likely provide higher value for money because such projects could be implemented at lower public cost.

http://ajea.oxfordjournals.org/content/97/1/299

Surveys that take randomness into account

The survey of plant and animal populations is central to undertaking field ecology. However, detection is never perfect, so the absence of a species cannot be determined with complete certainty. Methods developed to account for imperfect detectability during surveys do not yet account for stochastic (random) variation in detectability over time or space. When each survey entails a fixed cost that is not spent searching (eg, time required to travel to the site), stochastic detection rates result in a trade-off between the number of surveys and the length of each survey when surveying a single site.

Alana Moore and colleagues at the University of Melbourne have developed a model that addresses this trade-off and use it to determine the number of surveys that: 1) maximizes the expected probability of detection over the entire survey period; and 2) is most likely to achieve a minimally-acceptable probability of detection. They illustrate the applicability of their approach using three practical examples (minimum survey effort protocols, number of frog surveys per season, and number of quadrats per site to detect a plant species) and then test their model’s predictions using data from experimental plant surveys.

They found that when maximizing the expected probability of detection, the optimal survey design is most sensitive to the coefficient of variation in the rate of detection and the ratio of the search budget to the travel cost. When maximizing the likelihood of achieving a particular probability of detection, the optimal survey design is most sensitive to the required probability of detection, the expected number of detections if the budget were spent only on searching, and the expected number of detections that are missed due to travel costs. They found that accounting for stochasticity in detection rates is likely to be particularly important for designing surveys when detection rates are low. Their model provides a framework to do this.

http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0153995

“Landowners with high marginal private benefits from revegetation would be more willing to participate in a revegetation program.”

“Open access to conservation science

Conservation science is a crisis discipline in which the results of scientific enquiry must be made available quickly to those implementing management. Richard Fuller and colleagues assessed the extent to which scientific research published since the year 2000 in 20 conservation science journals is publicly available.

They found that of the 19,207 papers published, less than 10% (1,667) are freely downloadable from an official repository. Moreover, only less than 5% (938) meet the standard definition of open access in which material can be freely reused providing attribution to the authors is given. This compares poorly with a comparable set of 20 evolutionary biology journals, where over 30% of papers are freely downloadable. Seventeen of the 20 conservation journals offer an open access option, but fewer than 5% of the papers are available through open access. The cost of accessing the full body of conservation science runs into tens of thousands of dollars per year for institutional subscribers, and many conservation practitioners cannot access pay-per-view science through their workplace. However, important initiatives such as Research4Life are making science available to organizations in developing countries.

The researchers urge authors of conservation science to pay for open access on a per-article basis or to choose publication in open access journals, taking care to ensure the license allows reuse for any purpose (providing attribution is given). Currently, it would cost $51 million to make all conservation science published since 2000 freely available by paying the open access fees currently levied to authors. Publishers of conservation journals might consider more cost-effective models for open access and conservation-oriented organizations running journals could consider a broader range of options for open access to non members such as sponsorship of open access via membership fees.


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Reference


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Perversity in the pasture
Guarding against new pasture varieties becoming tomorrow’s environmental disasters

By Don Driscoll (Australian National University) and Jane Catford (University of Melbourne)

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.

Consider African lovegrass. It was used to ‘improve pasture’ in Australia for almost 100 years, but is now declared a weed in four Australian states and the ACT. It has been of little value in pastures, poses a substantial fire risk and threatens a range of native species. Similarly, Gamba grass was widely promoted in northern Australia by the cattle industry and government. It is now listed as a Weed of National Significance. Gamba grass increases fire intensity five-fold, which transforms native woodlands into exotic-dominated grassland and increases the cost of fire management by an order of magnitude.

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 ongoing loss of our natural heritage.

New varieties of trouble

So, we’ve learnt our lesson, right? The problem of deliberately introduced plant species going rogue is both well known and well documented. Consider the box on ‘inviting trouble’ (it’s based on a survey published over twenty years ago).

Well, as incredible as it seems, we don’t seem to be learning at all. Agribusinesses still develop and promote new varieties of species that are known invasive weeds.

Our global survey of pasture plants (Driscoll et al., 2014; Driscoll & Catford, 2014) revealed 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.

Although these weed species already occur throughout much of Australia, the environmental risk escalates when new varieties of those species are released. They may belong to the same species, but these varieties can be quite distinct from their parents – just think of the differences among dog varieties like Chihuahuas, Dalmatians and wolves. The impacts of new pasture varieties in the environment can be substantial.

Weeds by design

New varieties can be created by cross-breeding different varieties or different species. Another trick to create better performing plants is to manipulate the symbiotic bacteria and fungi that live inside the plants. Engineering plants in any of these ways can lead to varieties with higher reproduction, higher growth rates, better resistance to disease and higher tolerance of environmental extremes. Unfortunately (but perhaps not surprisingly), these are the same characteristics associated with invasive species. New varieties of pasture plants are bred to grow great pasture, but at the same time, they are inadvertently bred to be super-weeds.

Once these souped-up plants have been bred, they are matched to the environments in which they are most likely to succeed. To make matters worse, because of the nature of pasture production, these new varieties will likely be planted widely across the landscape. Combined with new weedy characteristics, environmental-matching and widespread planting means that pasture plants can spread very easily, rendering nearby native vegetation extremely vulnerable to invasion. Because new pasture varieties can be planted very quickly over massive areas, it will be very expensive to try to control invasion once a weed has got away and the problem noticed. Pre-emptive action makes sense.

Under the radar

Australia has world-leading biosecurity. However, risks from new pasture varieties are not considered by current regulations. At the moment, Australia only considers the weed risk of new exotic species that may be imported. Exotic species that are already present in Australia are not assessed but are permitted ongoing entry, even if they are known to cause harm. This is a major flaw in our system: it suggests that if a species is already here, the damage, if any, is done, and ongoing use is a reasonable course of action. New varieties of these permitted exotic species can be developed, released and spread widely across Australia’s pastoral areas, without any scrutiny of their potential to (1) become new weeds, (2) increase the impacts of existing weeds or (3) spread into new areas.

In a nutshell, Australia already has an enormous weed burden that is destroying 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.
Feed or weed? See the video

The latest block buster from the Don Driscoll production house, who could forget *The matrix in ecology* and *Cannibal Horses of Australian Alps*, tells the compelling story of how pasture varieties are taking over the world.

Check it out for yourself

http://youtu.be/lMz1Pxtmo1c

But – there are solutions.

1. **Account for full environmental, social and economic benefits of new varieties**
   A key problem to address is the widespread conflict within government, where one section of government lists pasture plants as a threatening process (eg, see *Victoria’s list of threatening processes*), and other parts promote invasive pasture plants for use by the livestock industry (eg, *tall wheat grass*). This conflict reflects a lack of integration across sections of government, with different motivations and cultures in primary industry sectors compared with environment sectors. Analyses that account for social, environmental and economic costs and benefits may be one mechanism that would help promote integration across these sectors. Multi-criteria approaches to weighing up costs and benefits are already well developed and enable both monetary and non-monetary values to be transparently included in decision-making. Traditional economic analysis is not up to this challenge because it discounts future impacts, and struggles to consider non-monetary values like species and the amenity value of biodiversity.

2. **A list of prohibited and permitted species based on varieties.**
   This would enable distinctions to be made between varieties of pasture species that are benign and those that are invasive.

3. **Apply weed risk assessment to new varieties.**
   Government could expand its world-leading weed risk assessment protocols to apply them to new varieties that are proposed for either import or release after development within the country.

4. **Monitor new varieties and respond rapidly if they become invasive.**
   A program to monitor new varieties that are released and, if they become invasive, to rapidly respond to eliminate the threat. (And who would pay for this? We suggest that government needs to implement a polluter-pays scheme.)

This last point about who should pay is critical. The likely reason that agribusiness and government agricultural departments don’t consider the weed risk of their products is that they are not held accountable for the environmental damage their products cause, or the cost of managing invasive pasture species. A polluter-pays system might include industry-wide levies, insurance and bonds; mechanisms that are already widely used in Australia.

**Getting business on board**

While government must play a lead role, the solutions are not up to government alone. Agribusiness could take up opportunities to integrate weed risk assessment into their development programs, with the aim of developing varieties with low weed risk. The former Future Farms Cooperative Research Centre pioneered this approach, proving that development for agriculture can work together with environmental responsibility.

Agribusiness could also tap into environmentally-aware markets by developing a weed-free certification scheme for their products, and the same potential exists for certified farm products. Farmers could also contribute to improving stewardship of their land by refusing to buy new pasture varieties that have a high weed risk.

Although we focus on the weed threat from new pasture varieties, the risk posed by industry-driven spread of exotic plants is not confined to the livestock sector. The same risks, and likely solutions, apply to other industries including bioenergy, carbon-sequestration, forestry and horticulture. With this array of industries releasing new varieties of plants, many of which are already invasive weeds, now is the time for governments to provide industry with appropriate incentives to consider the weed risk of their products.

As our tropical savannahs succumb to Gamba-grass fires, as our arid woodlands vanish under buffel-grass wastelands, and as native species vanish from the few remaining box-gum woodlands degraded by introduced pasture plants, it seems like common sense to stop making these kinds of problems worse.

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**Reference**

http://www.pnas.org/content/111/46/16622

http://dx.doi.org/10.1038/516037e

**Inviting trouble – when will we learn?**

Back in 1994, ecologist Mark Lonsdale surveyed the history of exotic pasture introductions in northern Australia to compare the rate of introduction of useful species with that of weeds. Between 1947 and 1985, 463 exotic grasses and legumes were intentionally introduced into the region, the grasses predominantly from Africa, and the legumes from Central and South America. Of these, only 21 (5%) came to be recommended as useful, while 60 (13%) became listed as weeds. Seventeen of the useful plants were in fact also weeds, leaving only 4 species (<1%) that were useful without causing weed problems. They were far outnumbered by the 43 species (9%) that were weeds but had no recorded use.

**Reference**

Stands of dense woody regrowth are increasing in extent across Australia and around the world, and that raises many questions on how they should be managed. What's their value and should we leave them alone or actively thin them?

Dense woody regrowth commonly pops up on cleared land where there has been some change in land use, usually a reduction in grazing pressure. In some places, this regrowth is considered a bad outcome. In parts of Europe, for example, the grasslands that may have been grazed for centuries are considered valuable for biodiversity in their own right (see the box on valuing woody regrowth). In Australia, on the other hand, woody regrowth is often considered a good outcome for biodiversity as it represents a transition back to the pre-cleared vegetation state. However, it is common for these regrowth stands to be much denser than undisturbed forest. They are often structurally simplistic with a high density of similar sized stems (see the main image on this page). These stems grow more slowly than in natural systems due to competition for resources. And this competition also suppresses the understorey vegetation, which was the focus of our research.

In Victoria, there is an increasing call for management of dense eucalypt stands on both private and public land. The most commonly cited management option is thinning – cutting down a proportion of stems and applying herbicide to prevent regrowth. The theory is that the release from competition should make the remaining stems grow faster, larger, and broader, as well allowing the recovery of understorey vegetation.

Self-thinning does occur in these systems and, given enough time, dense stands are generally expected to improve in quality. However, this is far slower than with active intervention. At the most basic level, the questions for managers then are: How bad is a dense stand for biodiversity and what is the benefit of thinning? But perhaps more importantly, we need to ask whether thickets pose a problem that warrants major investment from government. At what scale would thickets need to be a dominant form to cause concern for those species, and communities, and at what scale is the treatment cost effective?

We sought answers to these questions using data from two separate field projects conducted in box-ironbark woodlands and forests in central Victoria, where we evaluated the vegetation structure of dense regrowth stands of eucalypts, and the effect of thinning management (Jones et al., 2015). In order to determine what density of stems and cover of understorey ‘should’ be expected in natural systems, we evaluated our results in relation to published benchmarks of stem density and understorey vegetation cover (Gibbons et al., 2010).

We found that stands with stem density greater than benchmark levels suppress native understorey vegetation cover below its benchmark levels. Thinning stems can restore native understorey vegetation (richness and cover) in the short term, providing the soil seedbank has not been removed and there is no excessive grazing. This is the desired outcome from thinning, but the catch is that BOTH native and exotic species can recover following thinning.

In places that were weedy prior to the dense stand forming, or are adjacent to highly weedy areas, thinning could result in producing a negative outcome for a native understorey. Land tenure and environmental factors also influence the response of stands to thinning treatments and should be considered before thinning is applied.

“Thinning is a viable option but it’s not a silver bullet. It will not produce desired outcomes for all sites.”
For example, sites on freehold land, which typically indicates a history of dryland agriculture, had lower species richness and fewer native shrub counts than Crown land. Crown land, on the other hand, was less likely to have been grazed, cleared or otherwise intensively managed. The increase in cover and richness of exotic species and decrease in native shrub counts at sites adjacent to a road reflects a land use history of disturbance without intensive grazing, but one still prone to exotic species invasion.

So, to thin or not to thin? That is the question – but what’s the answer? Excessively dense stands (more than benchmark) are bad news for understorey vegetation. Given that dense stands tend to stay dense for a very long time without intervention, management may be a valuable activity. Thinning is a viable option but it’s not a silver bullet. It will not produce desired outcomes for all sites.

Of course, whether a land manager should thin or not isn’t only determined by the expected ecological outcome at the scale of a site. It also depends on how much it costs. Many questions remain about the cost-effectiveness of thinning for managing dense stands, both because the uncertainties have not been resolved and the objectives aren’t clear.

With limited resources to manage conservation problems, being confident that thinning can improve habitat characteristics is not enough to justify a campaign of publicly funded thinning of dense woody regrowth. A better understanding of how and when dense woody regrowth develops, and how it is distributed spatially would help to consider the merit of thinning proposals alongside other options to improve biodiversity conservation at larger scales.

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References


Mention Indonesia and images of soaring rainforests and orangutans come to mind. But the reality is quite different. Over 63% of Indonesia’s forest estate is currently deforested or degraded (that’s around 83 million hectares), and many of its iconic species such as the orangutan and proboscis monkeys are endangered. And the deforestation marches on. In 2012 Indonesia broke the record for clearing tropical forest. The choking haze from burning forest and peatland has blanketed South East Asia many times in recent years, and awareness of the economic and health hazards associated with this is growing.

Ambitious goals

But there is hope. Indonesia’s new presidency has ambitious plans to stop forest and peatland destruction in concert with reforesting 2 million hectares of degraded land annually. This also acknowledges the goals of the former presidency to reduce carbon emissions by up to 41% by 2020, with much effort directed to reducing emissions from deforestation and forest degradation.

Alongside these new national policies are a series of bilateral agreements with other countries. The $1 billion Norway-Indonesia agreement, for example, has encouraged a moratorium on clearing primary forests and peatland. Numerous other countries, including Australia, have supported similar conservation and restoration efforts. Wealthy philanthropists have also become involved through ventures such as privately funded ecosystem restoration concessions (ERCs) such as Harapan Rainforest by Prince Charles or Bill Clinton’s support of the Katingan Project, which was featured in Harrison Ford’s documentary Years of Living Dangerously.

These goals, agreements and initiatives are inspiring and critical first steps. However, it is increasingly clear that while talking the talk is easy, implementation is not without challenges. Almost 40% of primary forest loss in recent years was in areas that were meant to restrict or prohibit clearing, including peatlands. The capacity to repair degraded forests through the national forest restoration program is limited to 300,000 and 500,000 hectares annually. Furthermore, the ‘Forest Estate’ provides important sources of livelihoods for both indigenous and trans-migrant families. Added to this there are competing development goals – for oil palm, timber plantations, and energy production – spurred by industry, international demand, and Indonesia’s economic growth targets.

Understanding trade-offs

This is where CEED researchers have become involved, lending our expertise at clearly defining and solving land use problems with multiple objectives and constraints.

CEED PhD student and Indonesian national, Sugeng Budiharta and his colleagues have tackled the difficult problem of prioritising reforestation efforts, given the goals of sequestering carbon and restoring biodiversity. They identified 400,000 hectares of highly degraded lowland forest in East Kalimantan, for which reforestation was cost-effective (Budiharta et al., 2014). This research reveals degraded areas that should not be converted to other land uses, such as palm oil. Instead these areas could be the focus of privately funded ecosystem restoration concessions (ERCs) and contribute to the government target of creating 2.5 million hectares of ERC (currently only 397,000 hectares of ERC licenses have been granted).
An adult male orangutan in a Kalimantan oil-palm plantation, now an endangered species. (Photo by Nardiyono)

Down in Central Kalimantan, Liz Law and her colleagues were faced with a similar problem. Their study region, the Ex-Mega Rice Project area, covers several major peatlands in lowland forest, over 60% of which have been deforested or degraded. Despite the area being a major source of carbon emissions, common metrics used to prioritize forest carbon projects often overlooked this region, as they focused on the more easily measurable and visible above-ground carbon.

By modeling carbon across the region, CEED researchers were able to show that proxies of above-ground carbon had no correlation to metrics of total carbon emissions, or the potential for carbon emission reductions in this region (Law et al., 2014).

Unintended outcomes

Furthermore, restoration projects in this region of Central Kalimantan have focused on carbon and biodiversity, yet have met and often been stymied by the challenges of trying to simultaneously support local livelihoods, and resist the increasing pressure of oil palm development. Liz and colleagues quantified and mapped ecosystem service values, assessed their spatial interactions, and evaluated the potential provision of ecosystem services under future land-use scenarios (Law et al., 2015). They found that implementation of existing land-use plans has the potential to improve total ecosystem service provision, but identify a number of significant inefficiencies, trade-offs, and unintended outcomes that may arise. For example, the potential development of existing palm oil concessions over one-third of the region may shift smallholder agriculture into marginal, low-productivity regions and substantially impact carbon and biodiversity outcomes.

While improved management of the large conservation zones planned for the region may enhance the protection of carbon stocks, not all biodiversity features will be represented, and these zones will likely be expensive to restore and difficult to enforce, particularly against ongoing illegal timber harvesting and the push to develop both oil palm and smallholder agricultural production. This study highlights how ecosystem service analyses can be structured to better inform policy, planning, and management in globally significant but data-poor regions.

All of these articles have been published open access and are part of an international collaboration between CEED researchers and other members of the Borneo Futures Initiative http://www.borneofutures.org/.

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Spreading the word

Environmental decision science is all about understanding the trade-offs between options in an effort to maximise environmental outcomes. While ‘decision science’ is as old as the hills, environmental decision science is a relatively young discipline. As a discipline, we’re beginning to build our profile in Australia and the developed world but our science has possibly its greatest potential in the developing world where the tension between economic growth, resource depletion and conservation is high. Therefore it’s important to spread the word about research such as these Kalimantan studies.

This research has been highlighted in both The Jakarta Globe and the environment web site Mongabay, receiving over 16 thousand facebook likes, and 170 re-tweets. It may not have every Indonesian citizen talking about land use and the trade-offs between multiple objectives, but it’s a start.
Welcome to the Mapotron
New open-source software to bring together spatially explicit information

By Jutta Beher and Jeff Hanson (University of Queensland)

Conservation planning is all about being spatially explicit. Species, ecosystems, people, threats and management activities are the basic components in any conservation plan and they are all distributed across the landscape in varying degrees. A good conservation plan contains information about the distribution of these components with a framework to help managers decide how to apply their limited resources for the best result (i.e., which management actions where for the best conservation outcomes).

There’s a lot of spatially explicit information out there on these various components but, unfortunately, that information often never comes together. That’s because it’s held by different people in different places for different purposes in different ways. Often, people have the knowledge about the locations of species or ecosystems, for example, but they don’t know where to deliver it. Or the information may not be in the form of ‘useable’ spatial data (it might be scrawls in the margin of a birdwatchers notebook). Or the person doing a citizen science survey may have no access or knowledge of GIS software. Or maybe spatially explicit data does exist but it’s in a format created differently from another user and the two data sets can’t easily be merged.

In our research we have been collecting information on monitoring activities from a range of conservation researchers. We collected this info using online surveys. Part of what we needed to know was the locations of places where they did their monitoring activities, and the data needed to be spatially explicit. Even though we were dealing with experts, we experienced all of the issues we describe above; that is the information we were bringing together had so many differences it was proving very challenging to bring together.

Points, lines and polygons

Different monitoring activities may be best represented using different types of spatially explicit data. For instance, the location of monitoring programs that involve visits to specific sites could be represented using point longitude-latitude coordinates. On the other hand, this format would be inappropriate for studies that use large transect-based methods, where it would be better to use a series of lines to indicate location of the monitoring activities. However, neither of these data types would be appropriate for indicating the location for monitoring activities that took place over a spatial area, and in such cases closed shapes (polygons) might be more appropriate.

So, what we needed was a platform that anyone could use to generate point, line, and polygon data. We also needed people to be able to associate extra information with the spatial data they generate, such as what animal was monitored at each place and how intensive the monitoring was at each place. Most importantly, this platform needed to be easy to use so that survey respondents unfamiliar with geographic information systems (GIS) would be able to use this platform with minimal or no training.

The ideal platform would also integrate seamlessly into the survey, and streamline some of the data processing for us. We wanted the survey respondents to be able to draw points, lines, and polygons on maps that appear inside the same web-page as the other survey questions. We didn’t want to complicate the process by having respondents install extra programs or open up another web-page and manually send the data to us by email. Finally, we also needed the platform to store and pre-process the survey data to streamline the data collection process, such as associating the respondents name with the data they generate and exporting it in common GIS data formats for analysis.

That was our wish list. However, when we tried to find open-source software that met these criteria there was nothing available. So, we created our own!

Introducing the Mapotron

What we created is a software package called Mapotron. It’s an interactive platform that allows people to pass on their spatial information directly to the person that wants to use it, while avoiding extensive editing, or technical difficulties. While we created it initially for our survey, it quickly became apparent that this is a resource that many people will find useful for a variety of purposes.

Why it is special? Well, for starters, it’s open source. This means that everyone can use it for free for non-commercial uses, everyone can see the source code, and everyone can modify it for their own purposes, or contribute new features to improve the software for all users.

And, because Mapotron is hosted online, neither survey makers nor respondents need to download any software to use it. It is fully accessible through web-browsers (though we’d recommend you run it using Google Chrome).

Mapotron is easy to use. Individuals familiar with Google Earth or Google Maps should feel comfortable using it, and it also comes with extensive help documentation.

And Mapotron is fast. It is powered by the NECTAR cloud system.

Who might find it useful?

Mapotron could be a useful tool for anyone collecting information that includes locations from many people. For example, citizen science projects usually requires people to note where they have seen a particular species? Mapotron enables this information to be collected without complicated descriptions of the locations.

Other potential uses include:

- Science or management bodies who want to back up existing data with local observations
- Collating information from indigenous communities
- Any project that seeks to engage with the community.

The strength of Mapotron is that it simplifies the communication of spatial knowledge to such an extent that anyone can do it. You don’t have to bring in expertise to draw that information on a map and afterwards digitize it. People can directly draw in the web browser.

Mapotron is now a working app but we believe it holds enormous potential for use in a range of projects and databases. It can be integrated into any existing websites of data repositories or websites of agencies who have an interest in collating observational information. NRM bodies or scientists may benefit from this tool for any engagement with stakeholders or impacted communities.

There is even work underway to include the Mapotron into the way we use and apply Marxan.

We hope we’ve whetted your appetite. If you have any interest in bringing together spatial information (past, present or future), why not check Mapotron out for yourself. You can find it at http://marxan.net/shinyapps.html

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Mapotron is now a working app but we believe it holds enormous potential for use in a range of projects and databases. It can be integrated into any existing websites of data repositories or websites of agencies who have an interest in collating observational information. NRM bodies or scientists may benefit from this tool for any engagement with stakeholders or impacted communities.

There is even work underway to include the Mapotron into the way we use and apply Marxan.

We hope we’ve whetted your appetite. If you have any interest in bringing together spatial information (past, present or future), why not check Mapotron out for yourself. You can find it at http://marxan.net/shinyapps.html

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Mapotron: an interactive web-app for spatial data

Expert knowledge on biodiversity and management actions is a critical component of conservation science. Mapotron is a new digital platform that allows researchers to generate and communicate spatially explicit data—without needing to use a full blown geographic information system (GIS) or having to convert between different formats. It seamlessly embeds into online surveys, allowing researchers to elicit spatial data from hundreds of participants with minimal effort. Pictured below is a screen grab of Mapotron listing several of its many features. Check it out yourself to discover its full potential.

http://marxan.net/shinyapps.html

1. Drawing tools
Generate points, lines, polygons, rectangles, and circles by clicking on these buttons.

2. Add labels
Right click on a feature and type into the textbox to add a label to your data.

3. Download
Download the data to your computer.

4. Share
Email the download link for your data to another person.

5. Create pop-up boxes
Add vector data to the basemap to guide your respondents with pop-up information.

6. Integrate with online surveys
Create fields in the attribute table of the generated data via a link to modified questions in your online survey (Java code). Provide name and email address details so that Mapotron knows the name of the respondent and who the data is for. This way the respondents don’t have to fill in these details, and Mapotron can automatically save the data when the respondent finishes the survey. (For other examples: https://github.com/paleo13/mapotron/tree/master/examples)

“There’s a lot of spatially explicit information out there but, unfortunately, that information often never comes together. That’s because it’s held by different people in different places for different purposes in different ways. That’s why we created Mapotron.”
A roadmap for science into policy

The what, who, how and where of making a difference

By Sue Pillans (University of Queensland)

The starting line: Before embarking on this journey you need to ask yourself why you want policy makers to use your science? What is motivating you to engage with policy makers and why do you care if your science is adopted or not? These are fundamental questions to ask before you head down this path.

If you would like your science to inform policy you first must know a bit about the world of policy. Based on my experiences working with State, Commonwealth and international governments and my background as a marine scientist I have outlined a series of basic steps, a roadmap if you like, to help with your journey. Of course, there is no set route for engaging with policy makers or informing public policy. The way to engage and inform will be dependent upon a number of factors including the jurisdiction, policy priorities, organisational structures, personalities, timing and how ‘political’ the environmental policy/issue is.

This is a challenging space for both policy makers and researchers but there are many out there that have bridged the gap and the steps below may help you to move in the right direction.

1. Prepare for the road ahead – govt priorities

To inform and influence policy, researchers need to spend time learning about the public policy that relates to their area of research. This may seem obvious but it’s a critical step that is often overlooked as being boring or time consuming. This is not a criticism but a reality as in most cases the KPIs of researchers and academics is to publish their work in high impact peer-reviewed papers, which does not align with how policy is developed or implemented. Again, this highlights the motivations around why you want your science to inform policy.

An understanding of what the government’s priorities and policies as they relate to your research area can be found relatively easily through internet searches looking for key documentation such as: election commitments, strategic plans, research and development strategies and so forth. Each jurisdiction will be slightly different in how they share and communicate their information but for the most part the strategic priorities of governments can be found as public records on the World Wide Web. Thinking more broadly than directly related policy areas will also help to give context to government decision-making processes. For example, economic policy imperatives often affect the uptake or acceptance of environmental science and research.

Understanding the constraints of government is also another important element of this journey. For example, fixing a deteriorating State budget and overhauling national health and education systems may mean that other things fall by the wayside. Understanding the priorities of the government of the day will allow you as researchers to have a better understanding of why some things are considered priorities, and others are not.

So, the first step to informing and influencing public policy is to prepare for your journey and see how your research aligns, supports or differs from the governments policy, noting the scale and diversity of public sectors in Australia. As a starting point a useful guide to the Public Sectors in Australia can be found at: http://www.governanceinstitute.com.au/knowledge-resources/public-sector-governance-library/guide-to-the-public-sectors-in-australia/

“Throughout your journey it is important to ask yourselves if you want to make the time and effort to inform public policy.”

2. Pick up passengers – engage with policy makers

Once you have an understanding of the policy priorities relating to your research, the next stop on your journey is to find out who to engage with in government. This can be a bit tricky as departmental structures and staff have a tendency to change regularly at all levels. Organisational charts and contact lists for government departments are usually accessible through the internet, however getting to the right policy makers in the relevant business areas will take some time and effort. Some of the larger departments have call centres, which can put you in touch with the relevant units and staff.

Another way of finding out who is to ask your colleagues who they engage with in the government and ask for an introduction or accompany them to relevant meetings and workshops. Building a collegiate network within your own research group will help to provide consistent and regular advice to policy makers. Keeping an eye open for government-led seminar series and information sessions regarding public policy consultation processes will also expose you to the staff leading these initiatives. Building a network with stakeholders who already have a direct relationship with the Government, such as lobby groups, industry associations, NRM groups etc, is yet another mechanism to engage. These groups can end up ‘championing’ your research with the government.

Taking passengers on the journey with you will help to build relationships and networks with key government staff. Keeping in mind that you need to be in the drivers seat if you want your research to be known by the Government and used to inform public policy.

3. Pack for the journey – tailor your communication

Once you have found out the ‘who’ in Government you can start to have conversations about your research, but how? It is important to engage early and regularly with government staff, as the policy cycle has many triggers, one of which is timing. All too often researchers become aware of an environmental policy change or announcement and immediately send their published papers through to the government. Whilst peer-reviewed published papers are an excellent evidence-base for governments, immediate uptake of published studies is not practical. Similarly, just because something is published does not necessarily mean that everyone agrees with the findings and/or recommendations.

A more effective way for researchers to engage is to share your research on a regular basis with policy makers (as early on in your research as possible), build a relationship with staff and be accessible to decision-makers. It is also important to be mindful of the language barrier between science and policy. This is where knowledge brokers or translators come in handy as well as finding ‘champions’ of your research in the Government that can translate your research into ‘organisational’ speak.

When communicating your research keep your science messaging simple, avoid jargon and don’t drown people in facts and figures. Data is extremely important to share with policy makers to help them make informed and evidence-based decisions, but decision makers are rarely scientists so you need to be able to tell a story that they understand. Packaging up your scientific advice in the form of tools, management actions, simple graphics and scenarios are useful ways to inform policy makers. Researchers should also focus on some solutions if possible, not a better definition of a problem.

In developing your advice keep in mind that the criteria policy and decision-makers commonly use to develop public policy includes the social, economic, cultural and biophysical. Remember that policy-
Stages of the policy cycle:

1. Policy study
2. Issue identification
3. Policy analysis

4. Ask for directions – understand public policy

Once you have an understanding of the government’s priorities and you have identified who in the government you can discuss and share your research with it’s a good next step to know about how the policy you have identified will need to communicate the science as well. So packing well for your journey is a must!

5. Be ready for road works - policy is political

The make up and operations of governments in Australia has changed dramatically over the past 5-10 years as we see a rapid and dramatic change to a more ‘streamlined’ Public Service. The main role of governments is to provide service delivery to the public, make rules, collect tax, manage Government finances, develop policies and enforce laws and regulations. As a democracy we, the public, vote in the ruling party to Government where public policy is then debated by politicians and created and implemented by public servants. So public policy is political and as such is influenced by political processes, where decisions are often not informed by evidence or research.

By being aware of the likelihood of ‘road works’ along the way it will help researchers to become flexible and adaptable to a changing political (and policy) landscape. The most recent and most obvious example of this can be seen in the way some governments across Australia have made swift policy changes regarding climate change. In some cases major policies have completely ignored or avoided any reference to our changing climate. Policy is political, so be prepared for speed bumps.

The finishing line: Throughout your journey it is important to ask yourselves if you want to make the time and effort to inform public policy. From my experience policy-makers can be quite demanding of researchers time and effort, dependent upon the urgency and level of controversy of the public policy issue at hand.

Having a strategy to engage with policy-makers about your research so you avoid becoming just a random passenger from time to time is important, as is keeping in mind the time, effort and energy this pathway can consume. For those researchers fortunate enough to have a project plan/budget you may like to allocate 2-5% of your time and resources to a ‘policy-making engagement’ function or workshop, for example.

The steps outlined here are just a guide, and like any roadmap it is up to you which direction you take and how many stops you make along the way. You can choose to take the wheel and take the road less travelled or you can pick up a few passengers along the way, take the scenic route and enjoy the ride!

Whichever route you decide on, I’d be interested in hearing about any lessons you pick up on the way. 🎉

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Learning from agri-environment programs in Australia
A NERP workshop, (Mt Stromlo, Canberra, November 2014)

By Dean Ansell (ANU), Fiona Gibson (UWA) and David Salt (ANU)

Do our agricultural landscapes hold the key to protecting our declining biodiversity? If they do, how would it be done? And who would pay? Would it be the landowner or the general public (via the government)? These might sound like simple questions but when you consider some of the factors at play it quickly becomes apparent we’re dealing with very complex issues (consider our boxed case study stories).

Australia, like many other countries, is spending increasing amounts of money on conservation outcomes in agricultural landscapes. And, just as in other countries, we haven’t got much to show for the investment (though the problem of declining biodiversity just gets worse).

A story of two agri-environment schemes

To illustrate the complexity behind designing agri-environment schemes, consider these two simple situations, both examples of efforts to protect biodiversity on farm land. The first involves a run-down paddock on which the landowner has removed his sheep and sown a mixture of native trees and shrubs. In exchange for a ‘stewardship’ payment of $50 per hectare per year, the farmer agrees to keep his sheep out of the paddock for five years. He gets half the payment at the beginning and the rest at the end of the 5 years, at which time grazing stock are permitted back into the paddock.

By this time the native vegetation should have developed enough to be able to cope with the reintroduction of grazing. Indeed, the presence of trees and shrubs will provide the grazing animals with valuable shelter. (See the image below on the left.)

The second situation involves a farmer agreeing to remove grazing sheep from a patch of box gum grassy woodland – an ecosystem now listed as threatened in Australia. The farmer is allowed to let his/her sheep into the woodland in short bursts – pulsed grazing – whereas previously the woodland experienced set stocking in which a certain number of animals were always there. The landowner also agreed not to fertilise the woodland. For these actions the government is prepared to pay the farmer over $200 per hectare per year, and the farmer has entered into a contract that will run for 15 years. (See the image below, right.)

Late last year ecologists, economists and social scientists (largely from NERP ED) and practitioners came together at Mt Stromlo in Canberra to share their experience on what we’ve learnt from agri-environment programs to date, what are the gaps in our knowledge and where should we be moving in the future. Representatives from the Department of the Environment and Agriculture were also present to contribute a little policy reality to the discussions.

The main output of the workshop will be a book presenting short and engaging discussions from each of the workshop participants. The book should be available in the coming months.

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The first situation describes a process of restoration, with the aim of returning native vegetation to land that once supported it. It’s about improving the natural value of degraded land. The second is more about the preservation or conservation of an existing ecosystem. It’s about sustaining the health and resilience of land with high natural values. Both schemes are happening in production landscapes and the land under each scheme is expected to continue to provide agricultural outputs into the future.

- Which approach is better, restoration or conservation?
- Where do we get the best value for money? (Why should one farmer be paid four times the amount the other farmer receives? Do we receive four times the return? Do we derive four times the natural value?)
- Why should the government pay for a scheme which benefits the farmer (in the case of new trees providing shelter for stock)?
- Why does the restoration scheme only run for five years when the conservation project goes for 15?

Of course there are many answers to each of these questions and it often depends who you ask. “Which is better?”, for example, would most likely get different answers from ecologists, economists, farmers and policy makers. Which simply underscores the complexity surrounding the operation of these schemes.

On the third day of the workshop a field trip was organised in which workshopers visited two agri-environment schemes near Canberra. The first involved a scheme called Whole of Paddock Rehabilitation (WoPR) in which whole paddocks are directed seeded with native vegetation. In the picture above, Graham Fifield from Greening Australia (the NGO who developed the scheme in partnership with farmers) describes how WoPR works to workshopers. They are standing in a five year old WoPR plot.

The second scheme visited was an Environmental Stewardship Program site. In this situation, a farmer agrees to remove grazing sheep from a patch of box gum grassy woodland and to not fertilise. The picture above shows workshopers standing on the woodland site listening to the property’s manager explain how it works.
Allocating funds among restoration actions

A NERP* Workshop, (Bris, Sept 2014)

By Luke Shoo (University of Queensland)

*This was a joint workshop between the NERP Tropical Ecosystems Hub and the NERP Environmental Decisions Hubs.

A major emerging task for biodiversity conservation is to ‘scale-up’ the restoration of degraded land from the local patch to the scale of the landscape (regional). This poses significant challenges for prioritising investments, most notably because: (a) restoring native vegetation involves considerable uncertainty and time lags over at least several decades; and (b) restoration typically involves a range of different potential actions, each with its own costs, time frame and likelihood of success.

In this workshop we aimed to directly address the tension between minimizing shortfall risk (not achieving desired targets) and maximizing return on investment in the context of resource allocation for restoration. The ultimate goal of this work will be to establish a conceptual basis for resolving more complex situations including multiple types of actions and use this to inform investment decisions across a range of regional management contexts and different ecosystems.

We initially explored the problem with specific reference to rainforest restoration, for which relatively good relevant data and contextual information are available. This included recent investigations led by Carla Catterall (Griffith University) and Luke Shoo in a NERP Tropical Ecosystems project (12.2 – see http://www.nerptropical.edu.au/) which has provided valuable insights into time lags, and uncertainty of recovery for a range of vegetation characteristics between self-organised forest regrowth and biodiverse plantings, in the Australian wet tropics uplands.

To address the issues of restoration decision making and resource allocation, Shoo and Catterall together with Kerrie Wilson have established a research collaboration between two NERP hubs (Tropical Ecosystems and Environmental Decisions). The resultant workshop brought together a diverse range of experts from different institutions across Australia with knowledge of restoration ecology, conservation planning, structured decision making, financial planning, vegetation management and legislation and relevant government policy initiatives (eg, 20 Million Trees Programme, Carbon Farming Initiative). The workshop was attended by representatives of the University of Queensland, Griffith University, CSIRO, Queensland Government’s Department of Science, Information Technology, Innovation and the Arts and the Australian Government’s Department of the Environment.

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Dbvotes

Dbvotes is the EDG’s internal eNewsletter. It goes to members and associates of the EDG each week, and consists of small snippets of information relating to environmental decision making. They might be government documents, research articles, blogs or reports from other research groups. Here are six bytes from recent issues. If you would like to receive the Dbvotes eNewsletter, email David.Salt@anu.edu.au

1. LaP Hub launches ‘Life at Large’

Life at Large — an interactive web-based report collating all the research outputs from the Landscape and Policy NERP Hub. It showcases the responses from the hub’s 35 researchers from different disciplines to the question ‘How do we take a regional scale view of biodiversity conservation?’

http://www.lifelatlarge.edu.au/

2. Academy warns of climate risks to Australia

The Australian Academy of Science has released its latest update on the state of climate science, warning of the consequences for Australia if no action is taken to address human-induced climate change.


3. Wind & solar energy and nature conservation

This Future Brief from the European Commission focusses on how land-based ecosystems are affected by wind and solar photovoltaic (PV) development, and how win-win solutions which maximise both conservation and climate benefits may be developed.


4. GBR Long Term Sustainability Plan 2050

And Investment proposal on water quality, catchment and coastal repair by Great Barrier Reef Natural Resource Management Organisations.


5. World’s govs failing on protected areas

A new study has found that while governments are making progress in expanding Protected Area networks, these are failing to provide adequate coverage for nature.

Butchart et al. (2015) Shortfalls and solutions for meeting national and global conservation area targets, Conservation Letters

http://onlinelibrary.wiley.com/journal/10.1111/(ISSN)1755-263X/earlyview

6. Common Euro birds decline more rapidly than rarer species

The number of birds in Europe has fallen by more than 420 million between 1980 and 2009, new research has found. The study, which examined 144 bird species across 25 countries, found that 90% of the lost numbers were accounted for by common species, such as house sparrows.

Sleepers in the grass

In many far flung paddocks on private land in south east NSW stand star posts marking the location of a collection of rail sleepers, sheets of corrugated tin and roof tiles. These are survey stations set up by Geoff Kay and David Lindenmayer from the ANU. These little islands of artificial habitat are magnets for lizards, snakes, frogs and invertebrates. If there are any of these creatures in the surrounding landscape, they’ll more often than not turn up in these patches. These survey stations have been set up in locations where farmers are receiving Environmental Stewardship Program (ESP) payments from the Federal Government to monitor whether the ESP is making a difference to biodiversity (of course, each ESP monitoring station is matched to another control station outside of the area in the ESP). Geoff (on the left) is pictured here talking to Phil Gibbons and Emma Burns about how the monitoring works and what they hope to discover. The ESP is an agri-environment scheme, one of many being applied in Australian rural landscapes. A recent NERP workshop on agri-environment programs is seeking to distil key learnings on how such schemes operate, and how they can be improved. See our story on page 14.

What’s the point?

The mozzie decides

- There’s one in every crowd, the mozzie magnet, the person who claims that mosquitoes preferentially seek them out resulting in a disproportionate higher number of bites. Could there be any truth in this? According to researchers, mozzies choose their victims using a number of cues. Initially they are attracted to the carbon dioxide we breathe out. Body heat is important too. But once the mozzie gets closer, she (and it’s only the females that bite) responds to the smell of the victim’s skin. It’s believed blood type (particularly type O), pregnancy and beer drinking all make a person more attractive to mozzies (though results are known to vary for different species of mosquito). Lactic acid in sweat has also been shown to be a key mosquito attractant, but then there are up to 400 chemical compounds on the human skin that could also be playing a role in attracting the blood suckers.
- So, while it’s probably true that some people are more targeted than others, science is still a long way from providing any definitive answers as to why or what to do about it (other than a healthy application of insect repellent).
- More info: see Cameron Webb’s discussion of mozzie biting preferences at the Conversation.

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.

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Decision Point is the monthly magazine of the EDG.

The funding of the research presented in this issue of Decision Point, like most research, comes from multiple sources and is identified in the original papers on which the stories are based (references are provided in each story). In terms of CEED and NERP ED, the research on problematic pasture varieties (p4,5) was supported by NERP and CEED; the work on thinning dense eucalypt stands (p6,7) was supported by NERP and CEED; the studies on Kalimantan was supported by CEED; and the development of the Mapotron (p10,11) was supported by NERP.

To contact the EDG please visit our websites at: http://ceed.edu.au/ or http://www.nerpdecisions.edu.au/