Fire in the foothills

Fire regimes and environmental gradients shape forest wildlife

In this issue
Restore or protect to best benefit marine ecosystems?
Selecting properties for a conservation revolving fund
Encouraging long-term stewardship of private land
Learning about adaptive management
Inside this issue

Orangutans (and science) in trouble ....................... 3
Trade-offs on land and sea .................................. 4
‘Biodiversity’ down, economics up .......................... 5
Fire in the foothills .............................................. 6
Selecting properties for revolving funds .................... 8
Long-term stewardship on private land .................... 10
Learning about adaptive management ..................... 12
What difference does CEED make? ....................... 16
Decision Point en Español launched at ICCB .......... 18
Networking for conservation in Colombia ............. 19
CEED News ....................................................... 20

On the point

3, 2, 1… Impact!

I remember seeing a venerable old professor being introduced to the audience by his host with the statement ‘need I say more about Professor X than he has an H-index of 85!’ (and the host didn’t say anything more, that was the entire intro). Well, Professor X didn’t look pleased at all; his worth had been compressed into a single number, his many accomplishments summarised by a solitary impact index.

Truth be said, few people ever reach the lofty heights of the 80s when it comes to H-indexes (a measure of the quantity and quality of a scientist’s publications, see page 17 for an explanation of how it works) but to use it by itself to summarise person’s accomplishments is a bit dehumanising. For surely how we achieve something is just as important as the achievement itself? Or, maybe not. Maybe the ‘number’ generated by the achievement, and how it fits into the index that measures something’s value, is all that’s important in our digitised, count-it-or-ignore-it world?

Measuring impact can be a fraught exercise. No matter how you approach it, you’re guaranteed to leave out something that someone else regards as important. Measuring someone’s impact is hard, measuring a network of someone’s is even harder. And that is the task that CEED has set itself as it enters its final year of ARC funding. Tas Thamo, Tammie Harold and Dave Pannell at UWA are leading the exercise and developing a framework to measure CEED’s impact (see page 16). But it’s more than just assessing CEED. The hope is this framework will be of value to other Centres of Excellence, indeed research networks everywhere, in engaging with their impact in all its diverse forms.

Of course, you only have to look at the climate-change debate to see that the ‘impact’ of science doesn’t tightly correlate with policy change (ie, high impact science doesn’t necessarily lead to rapid shifts in policy). And now the same seems to apply to the science on orangutan conservation (see page 3). Good robust (CEED) science is telling us orangutan populations are in trouble. However, for many stakeholders looking to develop the tropical forests that provide habitat to orangutans, this is an inconvenient truth (and to be denied).

So what is our ‘impact’ here. High on the science side, low on the policy side (in the short term, anyway). But our engagement with the researchers and managers with an interest in orangutan conservation is generating knowledge, skills and contacts (sometimes described as human and social capital) which will persist and hopefully strengthen into the future. Impact, if these aspects are factored in, takes on new dimensions.

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Decision Point is the free bimonthly magazine of the ARC Centre of Excellence for Environmental Decisions (CEED). CEED 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 and RMIT University.

Editor David Salt
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Our cover A fern glade in the foothill forests of Victoria 15 months after a fire passed through. What’s the connection between fire, management and wildlife in such situations? Find out on page 6. (Photo by Steve Leonard)
Orangutans (and science) in trouble

Will the orangutan be saved?

By Kerrie Wilson (Director, CEED) and Erik Meijaard (Co-Director of Borneo Futures)

Recently we published the first ever population trend analysis of the Bornean orangutan showing that the species has declined at a rate of 25% over the past 10 years. This rate of decline was sufficient for the IUCN to elevate the conservation status of this species to Critically Endangered last year. Dr Truly Santika, an Indonesian statistician and CEED researcher at UQ, led the paper published in *Scientific Reports*.

The study used advanced modelling techniques that allowed the combination of different survey methods (including helicopter surveys, traditional ground surveys, and interviews with local communities). This new approach enabled, for the first time, for the population trend of the species to be determined over its entire range. The study was conducted by a group of some 50 Indonesian, Malaysian, and international researchers, with the results building upon over two decades of collaborative research on the species, its habitats, and the perceptions of key stakeholders involved in its conservation management.

Ostensibly, our study should be a wake-up call for the orangutan conservation community and the Indonesian and Malaysian governments who have committed to saving the species. Indeed, every year some US$30-40 million is invested by governmental and non-governmental organisations to halt the decline of wild populations.

Has the new knowledge and updated endangerment status of the species led fundamentally rethinking of orangutan conservation strategies? Unfortunately, the answer is no. Indeed, the government response has been to cherry pick evidence that flies in the face of the best science.

Despite the early satisfaction that we have now an accurate measure of the population status and increased attention on this adaptable, yet slow breeding species the Indonesian government recently announced that orangutan populations in both Borneo and Sumatra have increased over the past 10 years and that the IUCN status change from Endangered to Critically Endangered was misguided!

These conclusions were drawn from a recent Population and Habitat Viability Assessment concluding that 10 years ago there were some 50,000 orangutans and now there are some 70,000. Unfortunately, the estimate of 10 years ago was likely very wrong. Such conclusions ignore the evidence of a reduction in population density of 50%, deny that several thousand orangutans are killed annually, and turn a blind eye to the extensive deforestation that has occurred.

What’s more, in a time when world news is dominated by terrorism, polarizing politics and historic hurricanes, the plight of the orangutan seems to have been forgotten. So far, Greenpeace has been the only organisation to push back on the government’s conclusions.

This indicates that despite quality (peer-reviewed) science telling us orangutans are in trouble, the government is not accepting this message. It means that the biggest threats to orangutans of habitat loss and killing will likely not be effectively addressed, and the focus of rescues and rehabilitation will likely continue.

The academic research community is increasingly called on to measure its impact and to up-skill our researchers to improve their science translation skills. This experience shows that all the obstacles to up-take also needs attention in impact evaluations to ensure all barriers are transparent – including those that are out of the researchers’ control.

**Key messages:**

For many threatened species the rate and drivers of population decline are difficult to assess accurately

We applied novel methods for integrating field and interview survey data for the Critically Endangered Bornean orangutan

Our analysis revealed that Bornean orangutan populations have declined at a rate of 25% over the last 10 years

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Santika T, M Ancrenaz, KA Wilson, E Meijaard et al (2017). First integrative trend analysis for a great ape species in Borneo. *Scientific Reports* 7, [http://www.nature.com/articles/s41598-017-04435-9](http://www.nature.com/articles/s41598-017-04435-9)
Trade-offs on land and sea

Should we restore or protect, on land or in the sea, to best benefit marine ecosystems?

By Megan Saunders (University of Queensland)

Coastal ecosystems like seagrass, coral and mangroves occupy the narrow fringe of sea between the land and the deep ocean. As such they provide easy access to the marine world – they are shallow, close to shore, and relatively calm places compared to the open ocean. These same features also make coastal ecosystems vulnerable to human activities – activities occurring both on land and in the ocean. Consequently, these ecosystems pose a number of challenges to managers.

When it comes to getting the best outcomes for these coastal marine ecosystems, should we be investing limited conservation budgets in actions on the land or in the ocean? Conventional wisdom is that the most effective conservation actions to benefit coastal marine ecosystems involve the implementation of marine protected areas, or alternatively, a reduction of land-based threats. Active marine restoration, on the other hand, is typically considered a low priority option. This is due, in part, to high costs and low success rates.

To help managers better understand the trade-offs, we developed a model that compared restoration to protection, on either the land or in the ocean. The aim is to maximise extent of coastal marine ecosystems. We based the model on seagrass meadows and adjacent catchments in Southeast Queensland.

In our model, the riparian vegetation in the landscape, the presence or absence of which is a major determinant of sediment erosion to the coast in the region, is divided into four categories – intact and protected, intact and unprotected, cleared, or in restoring condition. This is based on work by Hugh Possingham and colleagues (Possingham et al, 2015). In our analysis we extended the approach to include the adjacent seascape, which in our case study consisted of seagrass meadows.

The marine ecosystem was divided into the same four categories, with a fifth category for areas of the ocean which are unsuitable for seagrasses due to low light conditions. The area of ocean that is too murky to support seagrass changes in each time-step as a function of the proportion of the landscape that is cleared, and thus a source of eroded sediments to the ocean, vs intact riparian habitats, which protect against erosion.

Surprisingly, we found that despite its high cost and low feasibility (see Decision Point #95) direct active marine restoration can be the most cost-effective approach to maximising extent of marine ecosystems over decadal time-scales. This assumes that there is suitable habitat available for restoration (defined as planting seagrass transplants); clearly, if suitable habitat does not exist, for example due to poor water quality, then other actions would take priority.

There is substantial uncertainty in our understanding of the dynamics of complex linked land-sea ecosystems, several assumptions underpinning our model, and a large degree

Key messages:

- We developed a model that compared restoration to protection, on either the land or in the ocean, to maximise the extent of coastal marine ecosystems
- We found that direct active marine restoration can be the most cost-effective approach over decadal time-scales
- The optimal decision will vary in different social-ecological contexts. We provide some rules of thumb to help with decisions.
of uncertainty exists in some of the model parameters. Further, geomorphological and ecological conditions vary geographically. The model can in theory be applied to other regions, but it is not straightforward to parameterise. Therefore we used the model to investigate how uncertainty in key parameters affects our decision making.

We discovered that the optimal decision will vary in different social-ecological contexts, but some basic information can guide optimal investments to counteract land and ocean based stressors:

1. marine restoration should be prioritised if the rates of marine ecosystem decline and expansion are similar and low;
2. marine protection should take precedence if the rate of marine ecosystem decline is high, or if the adjacent catchment is relatively intact and has a low rate of vegetation decline;
3. land-based actions are optimal when the ratio of marine ecosystem expansion to decline is >1.4, with terrestrial restoration typically the most cost effective; and
4. land protection should be prioritised if the catchment is relatively intact, but the rate of vegetation decline is high.

These rules-of-thumb illustrate how cost-effective conservation outcomes for connected land-ocean systems can proceed without complex modelling.

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References


‘Biodiversity’ down, ‘ecosystem services’ up

Does what we say reflect what we think?

CEED researchers have found that the term ‘biodiversity’ is less prevalent in conservation policy discourse these days.

In an effort to learn about how biodiversity conservation has been framed in recent years, Alex Kusmanoff and colleagues at RMIT University analysed the text of media releases by the Australian Government environment portfolio and the Australian Conservation Foundation over a ten year period (from 2003 – 2014). They found that there has been a decrease in the use of the term ‘biodiversity’ and an increase in the use of economic language, including regular use of ‘ecosystem services’ concepts.

In contrast, over the same time period, ‘biodiversity’ has increased in use within scientific literature.

What does this mean for biodiversity conservation? There is concern that consistent framing of biodiversity in economic terms (such as ecosystem services) will promote the value of biodiversity as a resource over its intrinsic value.

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Reference


A satellite image of the Burdekin River flood plume in 2008 spreading from the coast out into the Great Barrier Reef lagoon. When prioritising investments, incorporating the connections between land and sea is important. (Image by NASA)

The Great Barrier Reef is a centre of biodiversity much valued by most Australians. Increasingly, however, that value is being framed in economic terms. Deloitte Access Economics, for example, recently priced the Reef’s economic, social and icon value as being worth $56 billion dollars. And, while economic framings are on the increase, the term ‘biodiversity’ itself is on the decrease (consider the badging of the 2010 IYB below). RMIT researchers wonder if this has consequences for biodiversity conservation. (Photo of the GBR by K Connors, Morguefile).
‘Foothill forests’ cover approximately 7.5 million ha in the state of Victoria (see Figure 1). They are a priority for fire management, containing significant biodiversity and posing risks of fires to people and property. But how do you manage a major natural disturbance like fire when they are occur across a broad-scale environmental gradient like foothill forests?

Foothill forests in Victoria encompass broad-scale gradients of temperature, rainfall, and vegetation type. Along these gradients, fires create mosaics of vegetation with different disturbance histories relating to the time between fires, fire type and spatial pattern in the landscape.

In a new study published in the journal *Ecosphere*, we brought together data from six major studies (bringing together more than 600 biodiversity survey sites) to provide a more complete picture of the links between biodiversity, fire regimes and environmental gradients in foothill forests (Kelly et al, 2017).

(Above) A typical scene in the foothill forests of Victoria. In the morning mist this patch of woodland doesn’t look particularly fire prone but the blackened trunks, open canopy and epicormics buds (leaves sprouting from the main tree stem) suggest a major fire has passed through here recently. Indeed, this image was captured some 15 months after large wildfires seared parts of central Victoria. The foothill forests cover a wide range of environmental conditions. How do you manage for fire in such situations? (Photo by Steve Leonard)

Fire regimes and environmental gradients shape the distribution of forest wildlife

By Luke Kelly (University of Melbourne), Angie Haslem (La Trobe University) and Steve Leonard (La Trobe University)

Figure 1: Extent of foothill forest vegetation in Victoria and (right) fire history of foothill forest. (From Kelly et al, 2017)
Key messages:

Important insights can be gained by modeling how fire regimes, not just fire events, influence biota in forests.

Management of fire regimes needs to be complemented by an understanding of the underlying environmental gradients and key elements of habitat structure that influence resource availability for plants and animals.

We aimed to advance fire ecology by quantifying species responses to recurrent fires, by modeling species responses to a greater range of fire regimes and environmental gradients, and by comparing species–environment relationships between multiple taxonomic groups in one ecosystem.

Species distribution modelling of 32 bird species (493 sites), three small mammal species (175 sites) and 77 vascular plant species (615 sites) showed that common to animals and plants was a strong influence of broad temperature and rainfall gradients. For example, a suite of species was closely associated with high rainfall (eg, silver wattle, Tasman flax lily, yellow-faced honeysuckle), whereas others were associated with low rainfall (eg, small grass tree, white-eared honeysuckle).

Fire interacted with these environmental gradients and shaped species distributions. We built on previous work by showing that interactions between fire, climate and vegetation type influence the distributions of plants and animals: species can have different responses to fire along broad rainfall and temperature gradients (eg, narrow-leaved wattle and Australian king parrot).

Most fire ecology studies model the effects of fire on plants and animals by using time since the most recent fire. Our results underscore the important insights that can be gained by modelling how fire regimes, not just fire events, influence biota in forests. Inter-fire interval (ie, the average number of years between successive fires at each site) was the most influential component of the fire regime on both plants and animals. For example, the occurrence of vascular plants such as messmate and prickly currant bush was associated with longer inter-fire intervals, in addition to gradients in local vegetation types.

Multiple characteristics of fire regimes influenced the distribution of forest species. Time since fire also influenced vertebrates, particularly bird abundance, more than plants. Of species that responded to time since fire, most were associated with older fire ages (eg, rose robin, golden whistler, yellow-faced honeysucker). The insectivorous flame robin was one of few vertebrate species that was most likely to occur in recently burnt vegetation.

As predicted, animals closely associated with direct measures of habitat structure, such as tree diameter and leaf litter, were those most strongly influenced by fire regimes. Species distribution models including habitat structure had a moderately higher model fit and predictive ability than those using fire regime variables. For example, the flame robin was more likely to occur in open areas. It is likely that resources that are available in the more open understory of recently burnt forests drive this species’ relationship with time since fire.

Foothill forests are dominated by trees that rapidly recover from wildfires and, on the whole, our results show that common plant and animal species in foothill forests are likely to be tolerant of wide variation in fire regimes. However, although many plants and animals in these forests are resilient to variation in current fire regimes, the potential for large wildfires at shorter intervals, associated with a warmer and more extreme climate, warrants attention from both scientists and land managers.

Managing fire for biodiversity conservation is becoming increasingly important in forests worldwide. Our work in the foothill forest ecosystem in southeastern Australia usefully illustrates several points applicable to other forest areas with high biodiversity, flammable vegetation, and that are experiencing growing use of prescribed burning.

First, our study shows that understanding fire regimes, not just fire events, is important for managing plants and animals in forests. We recommend that forest managers go beyond simple measures of fire events and develop strategic objectives for plants and animals based on fire regimes.

Second, fire regimes in forests need to be understood and managed in the context of environmental gradients, even within a single forest type. Variation along environmental gradients is linked to biodiversity and influences management options and the effectiveness of fire suppression and prescribed burning.

Finally, it is necessary to complement management of fire regimes with understanding of the key elements of habitat structure that influence resource availability for plants and animals. Species relationships with fire regimes may be easier to translate into management plans, but this approach risks missing key habitat components on which taxa depend.

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Reference


The flame robin (*Petroica phoenicea*) is an insectivore that feeds from open ground. Statistical analysis showed that it was one of few vertebrate species more likely to occur in recently burnt vegetation. (Photo by Rohan Clarke)
Acquiring private land with significant conservation value (in order to then protect it) can be a powerful way to permanently protect important species and ecosystems. But this approach can be expensive, particularly in areas where land values are high. An alternative to buying the land and making it a reserve is to enter into permanent agreements with private landholders (such as conservation covenants or easements, see Decision Point #97), that restrict both current and future landowners from conducting activities that would be harmful to their land’s ecological value. In recent years some conservation organisations have developed an innovative approach that integrates targeted land acquisition with permanent conservation agreements, drawing on the use of a revolving fund.

A revolving fund is a pool of money that conservation organisations can use to acquire land with high conservation value as it becomes available for purchase. The organisation then ‘on-sells’ the land to conservation-minded owners, with a condition that the new owners enter into a conservation covenant or easement. Owners of existing land can’t be ‘forced’ to enter a conservation agreement, but anyone wanting to purchase these revolving-fund blocks need to agree to enter a covenant as a condition of buying the land.

The proceeds from the sale are then used to purchase, protect and on-sell additional properties, incrementally increasing the amount of protected private land. It’s a great way to buy and conserve land that needs protecting, whilst also being able to recover costs and then go out and do it all again.

Key messages:

- The effectiveness of a conservation revolving fund for land acquisition relies upon selecting the right properties
- Whilst conservation factors are important, financial and social factors are also highly influential, with a major determinant being whether the property can be on-sold within a reasonable timeframe, and at a price that replenishes the fund
- To facilitate the on-sale process, often selected properties include the potential for the construction of a dwelling

ABOVE: Much private land holds considerable conservation value. Purchasing land and locking it up in a reserve is an expensive option. Encouraging owners to sign up to conservation contracts can be more cost effective. Revolving funds provide a unique, self-replenishing approach to make this happen. (Photo by Mat Hardy)
The beauty of the revolving-fund approach is that it is potentially self-sustaining. However, the effectiveness of this approach is based upon selecting the right properties. In a general sense, a ‘good’ property shouldn’t cost too much to purchase, should possess features of high conservation value, and should be desirable enough to new buyers, even with the requirement of entering into conservation covenant. If these conditions aren’t met then the revolving fund might start shrinking or be less effective in delivering worthwhile conservation outcomes.

But how do these general requirements translate into specific day-to-day decision-making for the various revolving funds currently in operation? The approach must be working, as almost 146,000 hectares have been protected to date. But until our study, no-one had explored the various factors that influence the property selection decisions being made.

To remedy this, we conducted semi-structured interviews with managers from each of the five major revolving funds in Australia to explore how they go about choosing properties. We asked them about the factors they currently consider when buying properties for this scheme, and how these factors are integrated into their decision-making.

Pulling out the common themes from the managers’ responses, we found that whilst conservation factors are of course important, there are also a number of financial and social factors in the mix, with a major determinant being whether the property can be on-sold within a reasonable timeframe, and at a price that replenishes the fund. This makes sense if you’re trying to turnover properties and protect as much important land as possible.

But we also uncovered just how tricky these decisions can be. Managers are faced with clear trade-offs between conservation, financial, amenity and other factors. An example is the need for managers to make sure there is room on the land for the new owners to build a house if they wish to, without compromising the ecological integrity of the property. The study identified a number of ways that managers work through these trade-offs, and mitigate the risks of using revolving funds to conserve private land.

Managers clearly have a huge wealth of on-ground experience in making the revolving fund approach work. In our recent paper in Conservation Biology, we have documented some of their knowledge in order to help others who are either currently running, or considering setting up a private land conservation revolving fund (Hardy et al, 2017).

Based on the commonalities between programs, we suggest there is scope for further development of shared learning and an opportunity for an adaptive approach to property selection decisions. Working together, we believe managers can better navigate the challenges of revolving fund property selection. In so doing, we are confident they will be able to better manage the trade-offs, risks and challenges that arise from this promising new approach to private land conservation.

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Reference


Aussie revolving funds in nutshell

As of June 2016 there are five major revolving fund programs in Australia. They are operated by the Nature Conservation Trust of NSW, the Queensland Trust for Nature, the Nature Foundation SA, the Tasmanian Land Conservancy, and the Trust for Nature (Victoria). Collectively they have $29 million of revolving fund capital, purchased and on-sold 155 properties and established conservation agreements on around 146,000 hectares.

Give me a home among the gum trees. Many people place a high value on living with natural ecosystems. (Image: the Smiths Lake House by sandberg schoffel architects)
Changing human behavior is fundamental to the success of conservation programs. Fostering an ethic of ‘stewardship’ on private land is one form of behavior change increasingly being sought to protect key biodiversity areas. When planning private land conservation (PLC) initiatives, multiple incentives are employed to attract landowners into short-term and long-term conservation contracts. These different incentives are used to entice different types of landowners. They also cater to the different motivations or drivers landowners have for participating. Given the long-term horizons for biodiversity conservation, we were curious to discover which incentives contribute to long-term stewardship. Long-term outcomes are important given uncertain political support for conservation initiatives across many local- and national-level governments.

More than just dollars and cents
Long-term stewardship of private lands: the importance of nonfinancial incentives
By Matthew Selinske (RMIT University)

Through our research we sought to understand how programs and their incentives contributed to participation and the continued management of lands for biodiversity. We interviewed 113 landowners across three different program types and contexts:
- the Biodiversity Stewardship Program, a long- and short-term conservation contract program in the Western Cape of South Africa;
- the Greenfleet biodiverse carbon-offset program in Victoria, Australia; and
- EcoTender, a reverse auction and covenancing program run by the Victorian State Government.

Why do people participate in private land conservation?
We found that across the three studied programs, landowners had a pre-existing stewardship ethic that forms the basis of an environmental identity (this finding is supported by

Recognition of stewardship efforts, such as this BSP sign, are another important ingredient for ensuring program satisfaction. (Photo by Matthew Selinske)

BSP landowner surveying their privately protected area near Paarl, South Africa. (Photo by Matthew Selinske)

ABOVE: BSP landowner looking out over recently burned fynbos near Elgin, South Africa. (Photo by Matthew Selinske)
previous research). Financial incentives may help in increasing participation by reducing barriers to uptake and to pay for management projects, but for participants across these three programs, financial incentives were not a main driver to participation. We found over 90% of respondents participate because they care about their land and desire to restore and protect it (often in perpetuity). The mechanism that protects the land (eg, via a covenant or easement) becomes a main incentive to join. As one EcoTender participant put it: “Because [the restoration is] something I would have done anyway but I think the real bait for me was the covenant. If I did all this [work] and after I've gone somebody buys the land and knocks it all over, what's the point [of restoration]?”

What drives continued participation and management?
When we asked what drives continued participation, again common themes emerged among the three programs. We found that satisfaction with the program was overwhelmingly dependent on continued delivery of management support and a perceived efficacy of program participation.

In the Biodiversity Stewardship Program, those that were dissatisfied felt that they had ‘held up their end of the bargain’ but CapeNature (the implementing agency) had not; its input had amounted to very few visits by an extension officer. Across all three programs, landowners wanted more extension support to help build their capacity in managing their land, supporting their sense of self-efficacy, which is vital to behavior change. In both the Victorian programs, the advice and assistance provided to landowners through property visits from extension officers was ranked as an important aspect of the program, but happened informally as there was not a formalized role for extension support.

Networks of connection
Landowners also wanted to be connected to other landowners to share ideas and provide support for each other. Engagement with like-minded landowners is key to continued reinforcement of stewardship ethic and adaptive management. Programs unable to support landowners with continued extension visits would be wise to facilitate and build landowner networks, to pass management information through and establish communities of support.

As with most conservation initiatives, our research suggests we should be looking towards longer-term impacts and forecast changes that may change biodiversity benefits. In the private landowner context, this is fundamental. Simply signing landowners up to conservation contracts isn’t sufficient. Consideration of what drives landowners to continue participation in conservation activities is needed. We argue that financial incentives may be instrumental for uptake, but not suitable as the backbone of a program for long-term conservation. We recommend embracing multiple approaches to PLC with an awareness of what capacities landowners need to continue to make the right decisions for biodiversity.

This work has impacted the thinking of South African conservation planning, which has chosen to delay additional enrolment until all current land owners can be properly supported with extension support.

To learn more about our PLC research, please see our recent entries on the RMIT conservation science blog https://icsrg.info/

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What is stewardship?
The definition of ‘stewardship’ varies from place to place, person to person. In a general sense it relates to people taking responsibility for the many values of a landscape, usually with an aim of ensuring those values persist for subsequent generations.

The South African Biodiversity Stewardship Program sets out its vision of stewardship like this:

- To ensure that privately owned areas with high biodiversity value receive secure conservation status and are linked to a network of other conservation areas in the landscape.
- To ensure that landowners who commit their property to a stewardship option, will enjoy tangible benefits for their conservation actions.
- To expand biodiversity conservation by encouraging commitment to, and implementation of, good biodiversity management practice, on privately owned land, in such a way that the private landowner becomes an empowered decision maker.

http://www.capenature.co.za/care-for-nature/stewardship/

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What is stewardship?
Learning about adaptive management

Good decisions produce results AND help you learn

By Michael Bode (James Cook University)

The world’s ecosystems and species face a wide range of threats. Managers have a range of things they could try – ‘interventions’ – but they are often uncertain how the system will respond to any particular intervention. They are also often uncertain about which of the many threats is the most important to address. While additional research could allow us to work out which actions work and which don’t, we rarely have the time or the money to do all the research required for a ‘perfectly’ informed decision. We need to act now, in the face of all that we don’t know.

Key messages:

- Ecosystems are poorly understood, but often require immediate management action
- Adaptive management allows action to be taken immediately, and also helps learning
- Though commonly cited, true adaptive management is rarely applied
- Changing management because of ongoing monitoring at management sites is not adaptive management
- Adaptive management requires long funding time-frames, a high tolerance for risk, and institutional and management flexibility (factors that are rarely found in conservation).

Above: Fishery managers constantly have to deal with the challenge of making decisions on allowable catch quotas with incomplete information. Adaptive management is one pathway to meet this challenge. (Photo by Megan Saunders)

The harvesting of marine ecosystems (fishing) illustrates this dilemma well. Species targeted by commercial fisheries have both economic and conservation value. Managers have to regulate these fisheries to ensure the persistence of the harvested species, while also allowing vital economic activity to continue. The appropriate limitations on catch will depend on the dynamics of the ecosystem, but there are many unknowns. Managers are uncertain about how fast the population recovers from low abundance; about the strength of density-dependent feedbacks; about interactions between harvested species and other parts of the ecosystem.

Given enough time, research could answer these unknowns. However, fishing – with or without regulations – will continue in the meantime. Managers are therefore faced with an intractable problem. Decisions need to be made immediately, but good decisions require additional information.

The theory of adaptive management, and the set of analytic tools that surround it, offer a path between these two common and contrasting demands. Adaptive management is often called ‘learning by doing’. It recommends, as its name suggests, that managers act experimentally, undertaking the conservation action that they believe will both deliver benefits and information. They watch the ecosystem respond to their actions, and then measure the consequences to better understand how the system operates – to ‘learn’ as they do.
However, adaptive management is a little more complicated than just trying something to see if an action works. This approach is sometimes held up as adaptive management, and is often colloquially referred to as 'suck-it-and-see'. This, however, is not a good representation of what adaptive management is about.

True adaptive management involves making an explicit prediction about how the system being managed will respond to a particular action, using multiple competing models of how the systems works. It ideally involves trialling multiple actions and comparing the results of these different 'experiments'. It’s about learning about the system and then applying these lessons to subsequent management iterations, learning more with every iteration. It’s about undertaking a formal mathematical analysis of the problem in order to better understand how best to proceed.

The characteristics of adaptive management

The main aim of adaptive management in conservation is to identify and undertake actions that will deliver conservation benefits, but will also reduce our uncertainty about ecosystem dynamics. Management actions therefore have dual consequences, with explicit and implicit value to managers. Actions deliver explicit benefits when they achieve management goals. They also deliver implicit benefits when they help managers learn, because better information improves future decisions.

Achieving today’s management goals is obviously the most important, since it delivers immediate and direct benefits. Learning is ‘less’ valuable, since the benefits it offers will only occur in the future (and will therefore be time-discounted), and may be relatively small if the reduction of uncertainty is marginal.

Simple experimental management takes a passive stance towards learning. A manager undertakes the action that they believe is most likely to deliver benefits, and they then learn by observing the outcomes of this best-practice management. This is sometimes referred to as passive adaptive management.

Active adaptive management, by contrast, recommends a strategic approach to learning. The value of each action is a combination of its expected beneficial outcomes, and also the future learning that could be gained. This combination makes adaptive managers more likely to choose actions that they actually think might be suboptimal, to verify those beliefs. It can even encourage them to undertake actions that they know to be terrible, if the resulting collapse and recovery will help them to rapidly learn about the ecosystem dynamics.

These facts can be distilled into a series of features that must be present for a project to be considered formal adaptive management. These are:

1. The identification of goals for management (which are developed in collaboration with stakeholder groups).
2. The specification of multiple management actions that could potentially achieve these management goals.
3. A dynamic model (or models) that predicts how the system will change in response to management interventions, coupled with a statistical process for interpreting outcomes when they are observed. This model should be dynamic and stochastic, and the variation will be only partly predictable.
4. The implementation of at least one of the identified management actions, coupled with a monitoring program that observes how the system responds to the intervention.
5. A statistical updating of the system model(s) following the post-intervention responses, and a consequent change in management actions if this is recommended by the model. This process should be iterative, with reassessment of the system model and management intervention following monitoring, followed by a new phase of management.

A clear and succinct definition of adaptive management can be found in a guide on the topic published by the US Government (Williams et al. (2009)): “Adaptive management is a systematic approach for improving resource management by learning from management outcomes.” Learning is important but in a decision framing that importance is determined by how much it improves the decisions we make. It is never undertaken for its own sake.
Limitations to adaptive management

Adaptive management is a popular idea in conservation, and has been widely recommended in the applied science literature. Its popularity has reached the point where the term is routinely included in policy documents and legislation (eg, the Marine Life Protection Act in California). However, in the vast majority of cases, closer scrutiny reveals that these programs are not implementing adaptive management as has been described here.

Instead, decision-makers are using the term to describe management programs that are coupled with ongoing monitoring, and where the managers are uncertain about which intervention will be most effective. Most lack conceptual models of the system dynamics against which management outcomes can be compared. Thus, while they might be ‘adaptive’ in the broadest sense of the word (in that the management will ‘adapt’ as new information comes to hand), their approach to resolving management uncertainty is heuristic and informal. Consequently, these forms of pseudo-adaptive management are likely to be inefficient or ineffective. They are better described as reactive management, or ‘trial-and-error’ management.

Adaptive management is often incorrectly applied because the term has become so broadly interpreted. However, even in those rare occasions where formal adaptive management has been applied, the approach has a low success rate. Reviews have attributed these failures to three primary issues:

1. inadequate or absent funding was made available for the monitoring step, which is essential for assessing the outcomes of actions;

2. decision-makers are often unwilling to admit their uncertainty, or to experimentally undertake management actions that they believe to be suboptimal; and

3. the scientific leadership, and the financial and political capital required to update a complex, adaptive program of management is rarely available on the necessary time-frames. It should be noted that each of these issues is institutional, rather than technical. In the latter case, researchers have pointed out an inherent contradiction in the implementation of adaptive management: the technical and scientific skills required to design and execute a complex experimental management plan are rarely found alongside the logistical and political acumen needed to execute such a plan in a difficult political environment.

Because none of these limitations are technical or scientific, they can’t be addressed through better mathematical methods or decision-support tools. In broad terms, each of these constraints speaks to the inherent challenges of managing complex, stochastic ecosystems that evolve on timescales that are vastly longer than political – or even scientific – attention spans.

Adaptive management requires scientists and managers to transparently admit how little they understand about the systems they study. They must then seek funding to experimentally manage these systems over very long timescales, during which time they will have to consistently cite their own ignorance as a rationale for (potentially unpalatable) experimental management. Finally, they are required to maintain attention and focus on this problem for long periods, during which time they may be able to draw few useful conclusions.

Successful applications of adaptive management

Despite these constraints, adaptive management can be successful, even at extensive spatial and temporal scales, and in socio-ecological systems that include large numbers of stakeholders with disparate values and goals. As evidence, there are a small number of well-documented examples where the application of formal adaptive management has delivered management benefits.

The best-known example is of waterfowl management in the United States, which has been managed with a formal adaptive management program for the past three decades. Other examples include the management of Glen Canyon, on the Colorado River, USA, and the restoration of sand-mined ecosystems in Australia.

Although each of these success stories applied the same formal adaptive management techniques, each case-study is also deeply idiosyncratic. In each example, managers found unique ways to address a series of difficult social, fiscal and political constraints. The examples therefore provide lessons, but not necessarily broad solutions, to the factors that are considered the greatest obstacles to successful adaptive management.

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References


An illustrative example

In its application, adaptive management is a process of dynamical optimisation under uncertainty. Its mathematical formulation explicitly describes the uncertainty associated with key system parameters. The problem dynamics include (1) a model of how each action is expected to change the objective function, and (2) a model of how observations of the outcome alter our understanding of the system dynamics – how we learn. Dynamical optimisation tools (eg, SDP, optimal control) are used to consider sequences of decisions, looking forward in time.

These dynamics are most easily illustrated with a simple example. Imagine a manager attempting to conserve a threatened species. Two management actions are available to her. The first action is the current best-practice, and its probability of success is known with complete confidence. The alternative action has never been applied before, and so it is unclear whether it is better or worse than the current best-practice action. If successful, each action would deliver the same benefit to the species, and the only issue is therefore whether the new action is better or worse than the current best-practice.

If the manager were only making a single, one-off management decision, then the appropriate choice would be to implement the best-practice action, since it has demonstrated track-record of success and, without subsequent actions, there is no value to learning about the alternative.

However, if she intends to continue managing for multiple time-steps, there may be value in exploring the alternative action, since there is some probability (shaded in blue in Fig 1) that the alternative action is superior. We have therefore set up a simple adaptive management problem. Managers have two actions available to them. They need to take actions immediately, but they don’t know everything they would like to know about the system – specifically, whether the alternative management action is better or worse than the best-practice action. They therefore consider taking actions that will offer both information and benefit. Below, we explore these ideas by formulating and solving this problem as a simple, two-step adaptive management project.

In the first time-step, the manager could undertake the best-practice action, and we can easily calculate the expected value of this choice. In time-step 1, this action will deliver a known expected benefit of $p_1$ (blue line in Fig 1), since the probability of success is known with (almost complete) certainty. The manager will then make the same decision in the second time-step: with no subsequent actions there is no benefit to exploring the alternative action, and the optimal choice will therefore be to again undertake the best-practice action. Starting with the best-practice action therefore has an expected benefit of $B_1 = 2p_1$, (without time-discounting).

Alternatively, the manager could undertake the alternative action in the first time-step, observe the outcome, and learn about its success rate before making her second decision. Given we’ve never seen the alternative in action, we start with a uniform belief in its success rate. Perhaps it is always successful ($p_2 = 1$); perhaps it never works ($p_2 = 0$). We can capture this belief with a uniform distribution, which we describe using the beta function $f(p_2) = \frac{1}{1.1}$ (the solid red line in Fig 1).

In the first time-step, the expected benefit of the alternative action will reflect the manager’s informed-but-uncertain belief distribution in the method’s success rate. Given our belief distribution, this probability is $p_2 = 1/2$. The manager’s actions in the second time-step will reflect the outcome of this first attempt.

On the one hand, if the action was unsuccessful (with probability $1 - p_2 = 1/2$), she will have learned a pessimistic lesson about the alternative action.

Specifically, her new belief about the action can be described by the beta distribution $B(1,2)$ (the dashed red line in Fig 1). From the properties of the beta distribution, the expected benefit of taking the alternative action in the second time-step would then be $p_2 = 1/3$. On the other hand, if the action was unsuccessful, the expected benefit of taking the alternative action in the second time-step would be $p_2 = 2/3$ (dotted red line in Fig 1).

We note first that, if the probability of the best-practice action is lower than 1/3 then the manager will automatically take the alternative action in both time-steps, since the expected outcome will always be higher. Second, we note that if the best-practice action has a probability of success higher than 2/3, there is no point to learning about the alternative action, since even a successful application would still leave the best-practice action a superior choice. Learning in this case cannot alter the management decision, and there is therefore no value to this information.

Following this adaptive approach, we can predict that the expected benefit of taking the alternative action in the first timestep is:

$$B_1 = p_1 + p_2 + (1-p_2)p_2 = 1.083$$

This equation implies that an adaptive manager faces 1 of 5 scenarios (Fig 3): $p_2 < 1/3$ (red shaded area in Fig 2); in this case, the manager will undertake the alternative action in both time-steps. Even if the alternative action fails in the first application, it is still expected to outperform the best-practice action. $p_2 > 1/3$ (blue shaded area in Fig 2); in this case, the manager will never attempt the alternative action. Even if it were successful in the first application, its expected performance will still be lower than the best-practice action. Note that in this case, we are aware of the substantial probability that the alternative action is superior to the best-practice action. However, the adaptive management analysis indicates that there are too few learning opportunities for management to resolve the question.

$1/3 < p_2 < 1/2$ (green shaded area in Fig 2); In this case, the manager suspects that the alternative action will be the better option, but will keep an open mind. In the first timestep they take the alternative action, and make their second decision after observing its performance.

$1/2 < p_2 < 0.555$ (green shaded area in Fig 2): Based on the current information, the manager believes that the best-practice action is superior to the alternative action. Nonetheless, they will undertake the alternative action in the first time-step, because the value of learning about its true performance outweighs the short-term loss of expected benefits.

$0.555 < p_2 < 2/3$ (yellow shaded area in Fig 2): In this situation, the manager is sufficiently confident about the superior performance of the best-practice action that they are not willing to learn about the alternative action. This is despite the very real possibility (perhaps as high as 45%) that the alternative action is superior. The value of obtaining this information is just not high enough to justify its short-term costs.

This problem is a conservation realisation of the ‘one-armed bandit’ problem, first solved by economists in the 1950s, and famous for its application to clinical trials of medical interventions. There are a range of methods available for calculating or approximating the optimal solution in more complex contexts, and all agree that the best way forward is a mixture of exploitation and exploration. Exploration involves the application of the action that we currently believe to be superior (action 1, in Fig 1); exploration requires the judicious use of uncertain actions that may (or may not) turn out to be superior than the current best practice (action 2; Figure 1).

The optimal balance of exploitation and exploration will depend on a suite of factors, including the amount of uncertainty associated with each action, the length of the management horizon (i.e., are we planning to manage for 2 years, or 200 years?), and the broader applicability of the actions.

![Figure 1](image1.png)

**Fig 1:** Belief distributions of the adaptive manager in our simple example. The solid blue line indicates that the manager’s belief distribution in the success rate of the best-practice action centres around 0.85, and has very low uncertainty. The solid red line indicates the manager’s deep uncertainty about the performance of the new, alternative action. The shaded blue region is the probability that the best-practice action is superior; the shaded red region is the probability that the alternative action is better. The two red lines show what the manager’s belief distribution would look like if her first attempt to apply the alternative action yielded a success (dotted line, showing a stronger belief in its success), or a failure (dashed line, reflecting the evidence of its failure).

![Figure 2](image2.png)

**Figure 2:** Optimal adaptive management approach to the simple management problem. The x-axis shows the manager’s belief in the performance of the best-practice action (the value of 0.55 reflects the situation in Fig 1). The blue line shows $B_1$, the benefit that the manager can expect if she starts by applying the best-practice action in the first timestep. The red line shows $B_2$, the benefit she can expect if she starts with the alternative action. The optimal adaptive management decision for a given belief in the best-practice action is determined by the higher of the two lines.
What difference do we make?

Evaluating CEED’s impact

By Tammie Harold (University of Western Australia)

What is CEED’s impact?

If CEED was an academic its impact might be summarised by its publication record. To date, CEED research has produced more than 800 journal publications over the last six years. One in every 28 journal papers are considered ‘highly-cited,’ meaning they have received enough citations to place them in the top 1% of their respective fields. Collectively, these publications have an H-index of 45 (see the box on the H-index).

But real-world impact (or the knowledge transfer and application of CEED’s many outputs) is much harder to pin down than a simple publication index. CEED has dissected 87 of its most iconic research projects, and 58 of these engaged over 100 end-users and stakeholders based in government or industry positions.

The wide scope and sheer volume of CEED research makes evaluating its impact a considerable task. What’s more, there are unique challenges in evaluating the impacts of environmental sciences, particularly due to the lag time between the results being made available, to contributing to a policy change, and then further, to being able to measure the difference the change has made to our society.

In the second half of June, David Pannell from UWA and CEED’s Director Kerrie Wilson convened a workshop in Perth with CEED Chief Investigators and external reviewers to discuss the impact that CEED-funded research has had (and continues to have) on our world.

“One of the things we’ve been trying to thrash out is whether CEED has had an effect that is ‘greater than the sum of its parts’. That is, what extra might have been gained from the ARC funding CEED as a centre, compared to if they had instead individually given funding to each CI.”

Ram Pandit gives an overview of his research project that valued the access to protected areas in Nepal to demonstrate the range and depth of CEED impact.

Richard Hobbs shares an experience of achieving substantial impact with research on restoration management.

Richard Hobbs shares an experience of achieving substantial impact with research on restoration management.

will change, the extent of that change, the importance of the change, and the time lags involved. Our work evaluating CEED’s impact will, we hope, demonstrate a process and contribute to a better understanding of the various drivers at play.

The working group attempting to develop a framework to measure CEED’s impact: from left (front row): Sarah Bekessy, Dave Pannell, Tas Thamo, Tammie Harold, Eve Macdonald-Madden; (middle row): Kerrie Wilson, Jonathan Rhodes, Richard Hobbs, Margaret Byrne; (back row): Tony Peacock, Alistar Robertson, Vanessa Adams and Kathy Avent.
“We are starting to build evidence that CEED has achieved more impact in environmental decision making than would have been possible by the sum of all the individual, smaller research centres that make it up.”

Part of the process will involve interviewing a cross section of stakeholders involved in CEED’s research. These professionals will be asked about their perspectives, views, and other forms of evidence to support CEED’s claims of impact.

Ideas that are being explored in this evaluation include the adoption of CEED-inspired terminology, a change in mindset within an organisation in terms of raising awareness of environmental decision making tools, methods and approaches, and the extent to which CEED research has contributed to policy change, the prioritisation of funding or the establishment of programs.

“We are starting to build evidence that CEED has achieved more impact in environmental decision making than would have been possible by the sum of all the individual, smaller research projects led by a group of individuals working in isolation,” observes Kerrie Wilson.

“This is partly due to the networks and collaborations that have been formed as a result of CEED. As such, the evaluation will also look into how CEED contributed to the effectiveness of postgraduate research training programs, research communication, and the career development of researchers.

“And, on top of this, if CEED can demonstrate a process by which an environmental research network can effectively demonstrate its own impact, well that will be one more important legacy we leave behind.”

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Would you be happy with an H-index of 45?

Does an academic who produces 200 papers have twice the impact of another academic who only produces 100? What if someone had only published 5 papers but each one was cited 1,000 times in other papers (whereas each of the 200 papers published by the first academic had only each been cited in one other paper)? Citations, of course, are one measure of the influence of your research; the more times you are cited the greater your influence. Sometimes it’s suggested that the number of papers you publish is an indication of quantity whereas the number of times each paper is cited is an indicator of quality.

Which is more important (quantity or quality)? The answer (as it always is in science), is it depends. It depends on what the papers were about (whether they solved something deemed important), how the research was done and how many people used the results. Impact is a very relative thing.

Measuring the impact of research has been a long running challenge and there have been many efforts to produce publication indexes to reflect the impact of individual researchers. Indexes are needed* because raw publication data can be quite misleading. Numbers of papers and numbers of citations per paper are the two key bits of information but how to combine them in a simple and meaningful way has always been tricky.

One the most common indexes used these days is the H-index (first suggested by the physicist Jorge Hirsch in 2005). A scholar with an index of \( h \) has published \( h \) papers each of which has been cited in other papers at least \( h \) times. For example, a researcher who has published 20 papers would need each of them to be cited 20 times to score an H-index of 20. If this researcher was then to publish a 21st paper, she (or he) would not increase their H-index until all 21 had been cited 21 times.

The H-index reflects both the number of publications and the number of citations per publication. And while it is relatively easy for a competent academic to reach an index of 10 (10 papers cited at least 10 times), it becomes increasingly difficult to increase your H-index the higher you get.

An H-index of 45 (45 papers cited at least 45 times) would be excellent for a high achieving mid-career academic. Having said that, it’s impossible to compare an individual’s track record to a research network like CEED. The complexity surrounding the concept of ‘impact’ for a network of researchers is enormous, which helps explain why no universal index exists to reflect such impact.

*As a side note, CEED has done a bit of research on what are the ingredients of an effective index (see Decision Point #56) and the related idea of how to build a strong prioritisation metric (see Decision Point #82).
**Decision Point en Español launched in Colombia**

A Spanish-speaking magazine for a Spanish-speaking audience

As announced in the July issue of *Decision Point*, *Decision Point en Español* is now available. Our Spanish cousin got its official launch at the ICCB 2017 (the International Congress for Conservation Biology) run this year in Cartagena – in Spanish-speaking Colombia.

CEED researchers ran a workshop at the conference on the theme of conservation in the Spanish-speaking world. At the workshop, CEED’s Director Kerrie Wilson officially launched the latest issue of *Decision Point en Español*, and was joined by the magazine’s editors Eduardo Gallo Cajiao and Duan Biggs. The audience hailed from many different countries including Chile, Costa Rica, Peru and Colombia.

*Decision Point en Español* launched in Colombia

A Spanish-speaking magazine for a Spanish-speaking audience

*Decision Point en Español* was very well received, with many conservation researchers keen to subscribe and contribute articles. Copies of the latest issue were given to NGO staff, academics, and staff from government agencies.

ICCB is one of the world’s most important conferences on conservation biology, attracting over 2000 delegates from around the planet. And CEED had a strong presence at the 2017 event, with 33 presentations involving CEED students, staff and alumni. They spoke on a wide range of topics including sessions on conservation planning in post-conflict Colombia, indicators of collapse for ecosystem risk assessments, crowdfunding conservation, the future of conservation technology, red listing human behaviours that impact global biodiversity, a synthesis of coral reef restoration efforts, acquisition strategies for revolving conservation funds, and the governance of biodiversity offsetting.

If you are interested in *Decision Point en Español*, you can download free copies from the Decision Point website (where you can also read any individual article online).


Maria Martinez-Harms (left) and Rebecca Ruting showcase the English and the Spanish versions of *Decision Point* on the CEED booth at ICCB 2017.

**Eduardo Gallo Cajiao presents Julia Miranda, the Director of the National Parks Service of Colombia, with a copy of *Decision Point en Español*. Julia commented that this type of science magazine would be very valuable to their management agency but these types of resources were rarely available.**

**Duan Biggs discusses the latest issue of *Decision Point en Español* at its launch at ICCB 2017.**

**Kerrie Wilson was one of 33 CEED presenters speaking at ICCB 2017. Here she is discussing the trade-offs between conservation and development goals.**
In July, we travelled to the colourful city of Cartagena in Colombia to attend the Society for Conservation Biology’s biannual International Congress for Conservation Biology (ICCB) conference. “Insights for sustaining life on Earth” was the theme for this year’s conference, with an emphasis on how to better manage social-ecological systems. This year, the conference was attended by over 1,400 people from 71 different countries which ranged from conservation practitioners, policy-makers, academics and researchers.

For PhD students who are still novices at international conferences, we found ICCB to be an amazing source of information and great experience. This conference opened our eyes to the conservation issues being faced around the world, and the wide variety of different approaches to conservation being applied. Though there was a huge variety of talks and issues, there were a couple of themes we noticed that kept resurfacing throughout the five days of the conference and really stuck with us.

As the conference was held in Colombia, it wasn’t surprising that a major theme at ICCB was conservation within this corner of the world. It was fascinating to hear about the conservation challenges and opportunities faced in Colombia and other Latin American countries (though as a Colombian native, many of these issues were well known to Felipe). Many talks focused on the increasing threats biodiversity faces within Latin America, such as deforestation, mining, and the illegal wildlife trade.

A major theme was conservation in areas of conflict, such as conservation in post-FARC Colombia. Felipe led a workshop at the conference that focused on identifying new opportunities for biodiversity conservation in Colombia’s post-peace agreement era. The workshop started as an initiative of Colombians doing their PhD in Australia, and was partially funded by CEED. The workshop provided participants, including experts from different NGOs, academic and government institutions, with the opportunity to identify potential projects and research questions around accounting for conflict risks in conservation decision-making, while promoting the design of conservation strategies with positive socio-economic impacts.

Conflict between and within countries can put stress on the environment through resource extraction, and can restrict the reach and effectiveness of conservation programs. However, when conflicts are resolved deforestation often increases, which threatens the biodiversity within these regions. However areas that were previously too dangerous to enter also open up for potential conservation projects.

The workshop also discussed the importance of filling the gap between science and policy to promote conservation in post-conflict scenarios, as well as opportunities to do large scale land use planning in the country. The workshop was a great opportunity to grow Felipe’s professional network and learn about cutting-edge research being conducted within this research field.

This and other themes (including the growth of social science and technology in conservation science) presented throughout the ICCB conference suggest that conservation research is moving towards more global, collaborative and interdisciplinary approaches. This has huge potential for the success of conservation projects across the world.

Attending this conference gave us insights into not only the direction that conservation research is heading, but also into the reality faced by conservationists around the world. It was a week full of new ideas, great conversations, and amazing Colombian wildlife and food! If you ever have the opportunity to attend an ICCB conference in the future, we would definitely recommend it.

Note: Marie Dade and Felipe Suarez are PhD scholars in the Rhodes Conservation Research Group at the University of Queensland. This story is an edited excerpt from a blog Marie wrote about the ICCB experience. To read the full blog see https://rhodesconservation.com/2017/09/16/conferences-conservation-and-colombia-iccb-recap/
**Academic conferences need environmental policies**

CEED researchers are passionate about trying to reduce our environmental impacts. A team of our researchers have recently published a correspondence piece in *Nature Ecology & Evolution* asking why so few academic conferences seem to have taken actions to reduce their environmental impact. The team consisted of Matthew Holden, Nathalie Butt, Alienor Chauvenet, Michaela Plein, Martin Stringer and Iadine Chadès.

They found that, from a selection of 116 conferences from a range of disciplines and countries, only 9% advertised actions that reduced the environmental impact of the conference, with even fewer (4%) offering options for carbon offsetting.

The ecological disciplines led the way in attempting to reduce the environmental impact of their conferences (and so you would hope), but sustainability paradoxically lags behind (see Figure 1).

**Reference**


![Figure 1: Frequency of advertised sustainable practices](http://www.ceed.edu.au/)

**Grades and UNEP**

Two UQ CEED graduates are off to work conserving the great apes of Africa and Asia. Emily Massingham and Dylan Jones recently headed over to Nairobi to commence a six-month internship with the Great Apes Survival Partnership (GRASP). GRASP is a UN Environment Programme initiative committed to ensuring the long-term survival of chimpanzees, gorillas, bonobos, and orangutans and their habitats in Africa and Asia.

CEED’s Director Kerrie Wilson said GRASP’s approaches to conservation were similar to CEED’s, and grounded in collaborative science with an objective of understanding the broader context in which these issues persisted.

“We’re excited that two graduates with experience in CEED’s approach to conservation, are going on to work with the only species program within the UN family,” says Wilson. “While they will be focusing on great ape conservation, they will be part of the larger wildlife unit and will be involved in the complex discussion on issues affecting the habitat and survival of endangered species, from habitat loss to illegal trade.”

For more info on GRASP, visit [http://www.un-grasp.org/](http://www.un-grasp.org/)

**Bide your time**

Conservation gain could be obtained by identifying efficiencies across time, according to Gwen Iacona. Iacona, a CEED Postdoctoral Research Fellow at UQ, used mathematical modelling to demonstrate that because of the different rates of change in economic and ecological systems, waiting, and using the time to improve the conservation capacity of the organisation, provided better conservation outcomes than simply spending available money immediately (Iacona et al, 2017).

“We tested this idea using data on forest restoration to counteract bird extinctions in Australia and Paraguay,” says Iacona. “We found that in both cases more species could be protected and extinctions could be halted faster when the available money for restoration was leveraged by investing it, before spending it on projects.

“This result opens up a new dimension in conservation planning because it demonstrates that conservation gains can be obtained by looking for efficiencies in time and not just in space as has been the traditional strategy.”

Iacona said that every year more species were being driven to extinction by the combined pressures of habitat destruction, invasive species and climate change. These ongoing losses had created a crisis culture in conservation, where project funds were spent as soon as they are received. This new research challenged that orthodoxy and demonstrated how strategic delays could improve efficiency.

“Waiting can allow agencies to leverage additional benefits from their funds through investment, capacity building, or monitoring and research,” explains Iacona. “With the right amount of delay, limited conservation resources can protect more species and surprisingly they can even do so in less time. Our results suggest that, in addition to their current focus on where to target resources, conservation managers should carefully choose when to spend these funds.”

**Reference**

Iacona GD, HP Possingham & M Bode (2017). Waiting can be an optimal conservation strategy, even in a crisis discipline. *PNAS*

[http://www.pnas.org/content/early/2017/09/07/170211114.abstract](http://www.pnas.org/content/early/2017/09/07/170211114.abstract)