

DECISION POINT

Connecting conservation policy
makers, researchers and practitioners

Issue #60 / June 2012

Acting fast avoids extinction

The parrot hangs on
but we've lost the bat



**Tracking homicidal,
mango-loving jungle birds**



**Celebrating the lessons of
Landscape Logic**



**The value of swimming
with sharks**

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

Wrestling with the economics of biodiversity
Sawfish in hypothetical markets
The saga of the parrot & the development application
EDG blogs on

DECISION POINT

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Our cover: Orange bellied parrots on King Island, captured on 'film' by Glenn Ehmke. For the story of this photo, see page 16. For the story of this species, see page 6.

On the Point

In the spirit of collaboration

Which group has the key to making effective decisions on conservation? Is it the ecologists and mathematical modellers (tags that many EDG researchers wear) with their powerful algorithms and extensive databases? Or maybe it's the economists or other social scientists with their insights on human and market behaviour? Or is it down to the doers – the NRM managers and/or designers of policy? Or the activists and NGOs dedicated to saving nature?

Of course, the answer is 'all of the above' (and more besides). It's encouraging that, these days, most people wanting to make a difference in the realm of conservation acknowledge that it's a complex challenge requiring inputs from all quarters. And it's in this spirit of multi-disciplinary collaboration that I commend this issue of *Decision Point* to you. Each story speaks to some aspect of collaborative effort and cross disciplinary networking.

To begin with, economic methods working in partnership with ecological approaches to decision making gets a strong run in this issue with an editorial on TEEB (p4), an economic evaluation of shark tourism justifying shark sanctuaries in Palau (p11), and non-market valuations of sawfish supporting conservation efforts in the Kimberley (p10).

The sawfish work was actually an output of the Environmental Economics CERF Hub, a 'cousin' to AEDA (EDG's precursor, though the researchers in this story are now part of the EDG). Another cousin CERF was Landscape Logic which partnered AEDA in several investigations integrating science with landscape management. On page 14, Landscape Logic's Director, Ted Lefroy, describes a new book that reflects on the legacy of that Hub.

And Hamish Campbell tells the story of how cutting-edge tracking technology combined with solid conservation planning is providing new ways forward for the conservation of cassowaries (p12).

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DECISION POINT

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

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

Short accounts of papers (old and new) coming out of the EDG. If you would like copies of any of these papers please visit:

<http://www.edg.org.au/edg-communication/edg-peer-reviewed.html>



Measuring invasibility

The outcome of human-mediated introductions is affected by the invasiveness of species and invasibility of ecosystems. Research has primarily focused on invasive species; ecosystem invasibility has received much less attention.

A prerequisite for characterizing invasibility is the ability to compare levels of invasion across ecosystems. In this paper, the researchers aim to identify the best way to quantify the level of invasion by non-native animals and plants by reviewing the advantages and disadvantages of different metrics. They explore how interpretation and choice of these measures can depend on the objective of a study or management intervention. Based on this review, they recommend two invasion indices and illustrate their use by applying them to two case studies.

Relative alien species richness and relative alien species abundance indicate the contribution that alien species make to a community. They are easy to measure, can be applied to various taxa, are independent of scale and are comparable across regions and ecosystems, and historical data are often available. The relationship between relative alien richness and abundance can indicate the presence of dominant alien species and the trajectory of invasion over time, and can highlight ecosystems and sites that are heavily invaded or especially susceptible to invasion.

Establishing standard, transparent ways to define and quantify invasion level will facilitate meaningful comparisons among studies, ecosystem types and regions. It is essential for progress in ecology and will help guide ecosystem restoration and management. 🍷

More info: Jane Catford catfordj@unimelb.edu.au

Reference

Catford JA, PA Vesk, DM Richardson & P Pyšek (2012). Quantifying levels of biological invasion: towards the objective classification of invaded and invulnerable ecosystems. *Global Change Biology* 18:44-62.

The value of reveg for birds

The researchers in this study examined the conservation value of different kinds of revegetation through a comparative study of birds in 193 sites surveyed over ten years in four growth types located in semi-cleared agricultural areas of south-eastern Australia. These growth types were resprout regrowth, seedling regrowth, plantings, and old growth. Their investigation produced several key findings: (1) Marked differences in the bird assemblages of plantings, resprout regrowth, seedling regrowth, and old growth. (2) Differences in the number of species detected significantly more often in the different growth types; 29 species for plantings, 25 for seedling regrowth, 20 for resprout regrowth, and 15 for old growth. (3) Many bird species of conservation concern were significantly more often recorded in resprout regrowth, seedling regrowth or plantings but no species of conservation concern were recorded most often in old growth.

They suggest that differences in bird occurrence among different growth types are likely to be strongly associated with growth-type differences in stand structural complexity. Their findings suggest a range of vegetation growth types are likely to be required in a given farmland area to support the diverse array of bird species that have the potential to occur in Australian temperate woodland ecosystems. These results also highlight the inherent conservation value of regrowth woodland and suggest that current policies which allow it to be cleared or thinned need to be carefully re-examined. 🍷

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Reference

Lindenmayer DB, AR Northrop-Mackie, R Montague-Drake, M Crane, D Michael, S Okada & P Gibbons (2012). Not All Kinds of Revegetation Are Created Equal: Revegetation Type Influences Bird Assemblages in Threatened Australian Woodland Ecosystems. *PLoS ONE* 7: doi:10.1371/journal.pone.0034527

Using state-and-transition models in adaptive management

Adaptive Management (AM) is widely advocated as an approach to dealing with uncertainty in natural resource management as it provides an explicit framework for motivating, designing and interpreting the results of monitoring. One of the major factors impeding implementation is the failure to use appropriate process models; a core element of AM. Process models represent beliefs about the properties and dynamics of an ecological system and ecosystem responses to management. Quantitative models of ecosystem response help resolve ambiguity about the efficacy of management and facilitate iterative updating of knowledge using monitoring data.

This study reports on the use of a state-and-transition model (STM) in the Adaptive Management of native woodland vegetation in south-eastern Australia. The STM is implemented as a Bayesian network, making it simple to communicate and update with new data as they arise.

Application of the model is demonstrated using case-study and simulation data. The researchers show how the model may be used to predict the probability of achieving desirable state transitions at restoration sites and how monitoring of those sites can be used to update the model (learn) and adapt (review restoration strategies).

After just one monitoring/learning cycle, 7 years after the first investments, they found that updated models predict markedly different transition probabilities compared with initial models based on expert opinion. This has strong implications for the apparent cost-efficiency of restoration strategies. The STM approach provides a sound theoretical basis for restoration decisions, while the Bayesian network implementation provides a workable framework for using the STM adaptively. 🍷

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Reference

Rumpff L, DH Duncan, PA Vesk, DA Keith & B Wintle (2010). State-and-transition modelling for Adaptive Management of native woodlands. *Biological Conservation* 144: 1224-1236.

Editor's note: LibbyRumpff wrote about this innovative study in *Decision Point* #47 (see http://ceed.edu.au/wp-content/uploads/2011/03/DPoint_47.pdf). We've repeated a summary of it here as it's a great example of the collaboration between AEDA (the precursor of EDG) and Landscape Logic, both of which were CERF Hubs. Landscape Logic has just launched a book celebrating its work. See the story on page 14.

Capturing biodiversity value

The difficulty in valuing biodiversity according to the 'TEEB approach' has at least been partly circumvented by the 'EDG approach' – where biodiversity value is more often defined in ecological rather than economic terms. This doesn't mean that non-ecological values cannot be 'captured'. Indeed, the tools and approaches developed by members of the EDG have strong foundations in economics and mathematics. For example, consider:

The Marxan family of software has been used by hundreds of people around the world to assist in developing spatial plans for the conservation of biodiversity which minimizes overall cost.

See the Marxan issue of *Decision Point*

http://www.aeda.edu.au/docs/Newsletters/DPoint_Marxan_special.pdf

INFFER (Investment Framework For Environmental Resources) incorporates the logic of cost-benefit analysis within a framework that allows land managers to prioritise projects to address environmental issues.

See *Decision Point* #55

http://ceed.edu.au/wp-content/uploads/2011/11/DPoint_55.pdf

PPP (Project Prioritisation Protocol) draws upon the principles of traditional cost-efficiency analysis to prioritise investment in threatened species management.

See *Decision Point* #29

http://www.aeda.edu.au/docs/Newsletters/DPoint_29.pdf

to actually *do* with the information generated by the valuation. In contrast, the approach taken by many in the conservation planning community is to take the ecological value as a given, and then develop methods and tools to best allocate scarce resources.

Hugh Possingham, EDG's Director, sums up the difference in the 'EDG' approach from the 'TEEB' approach in a report he wrote back in 2001 on the 'business of biodiversity' (see http://www.wentworthgroup.org/docs/The_business_of_biodiversity.pdf) in which he says: "How to value biodiversity, and how much time and money to spend protecting it, are important questions that are not discussed here [this is generally the TEEB approach]. Instead I assume that external forces fix the amount of time and money invested in biodiversity conservation. Given this economic constraint, the question remains: how should our available time and money be spent to best effect and most efficiently?" [this is generally the EDG approach]

The differences in part relate to different perspectives on what is 'biodiversity'. Valuing ecosystem services is one thing, but how can biodiversity be considered within this framework? Although TEEB suggests that biodiversity should be considered for its insurance value and because it confers 'resilience', quantifying this value from an economic valuation perspective is rather complex. Based on what I heard at the TEEB conference, biodiversity appeared to be considered analogous to ecosystem services – which isn't necessarily true. The EDG approach tends to value biodiversity in ecological rather than economic terms. (See the box on capturing biodiversity value.)

What could EDG learn from TEEB?

While most of what EDG does could be regarded as 'TEEBish' – with much of the differences being simply in language and framing – I think there is a good opportunity for EDG researchers to learn from the TEEB community (and vice versa).

The work of TEEB is receiving support from a number of different fora and at multiple scales of governance, so there is a need for conservation researchers to understand how this might change the

status quo for biodiversity conservation – particularly given that biodiversity is so fundamentally different to ecosystem services in mega diverse countries such as Australia.

EDG researchers may want to consider how economic valuation could be useful in the context of environmental decision making, and where it may (or may not) be appropriate. Economic valuation can provide an avenue for capturing a greater plurality of values within a decision framework, and when incorporated alongside more standard biodiversity metrics can assist in analyzing trade-offs between alternative policy objectives.

More generally, it can be useful to consider how economic principles might provide additional insights to our research. For example, economists and policymakers are particularly concerned with the distribution of costs and benefits across different stakeholders, whereas conservation planning has so far focused primarily on efficiency. Equity is increasingly being considered within conservation planning (and facilitated by the development of new tools, such as Marxan with Zones) but is not yet mainstreamed within the field.

For TEEB, there has so far been an overwhelming emphasis on valuing ecosystem services based on human preference methodologies, so I think there is scope for more work on approaches which better capture the multiple values from biodiversity – for example by quantifying benefit from an ecological rather than anthropocentric perspective (such as the number of species affected, or the area of habitat impacted, or the increased probability of preventing extinction of a species). How to best integrate such information into a framework that can be used to assist decision making is another question - formulating and solving such problems is a key focus of the EDG's research. As TEEB moves into its next phase, there lies an opportunity for EDG researchers to engage and form part of the burgeoning TEEB network that is connecting economists, ecologists, policymakers and professionals from a range of fields around the world. 🍷

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The TEEB Conference: <http://www.teeb-conference-2012.ufz.de/>

EDG at the TEEB conference

Megan Evans presented the initial findings of a project which is investigating the economic potential of restoring native vegetation within agricultural areas in Queensland, in the context of a carbon market. Her research suggests there is an opportunity for significant carbon abatement through the management of regrowth vegetation, providing economic benefits in addition to achieving positive conservation outcomes for biodiversity.

Liz Law presented her research on integrating ecosystem service valuation and conservation planning for multiple objectives in Borneo, an example of how the ecosystem service concept can be utilised in spatial planning to both aid in the definition of land use planning targets and analysing policy options with regards to potential trade-offs between environmental and economic objectives.

Azusa Makino presented her research on integrating cost information within systematic conservation planning in the TEEB and the Marine Environment conference theme. She discussed the importance of cost-efficiency for marine reserve design and how to best utilize ecosystem services and economic cost data within the decision-support tool, Marxan.



Acting fast avoids extinction

The parrot hangs on but we've lost the bat

By Tara Martin (EDG, CSIRO)

Failure to act quickly on evidence of rapid population decline has led to the first mammal extinction in Australia in the last 50 years, the Christmas Island pipistrelle (*Pipistrellus murrayi*). The fate of another iconic species, the migratory orange-bellied parrot (*Neophema chrysogaster*), monitored intensively for over 20 years, hangs in the balance.

To understand what led to the bat's demise in one case and (hopefully) the recovery of a parrot in another, we analysed the decision process underlying the management of both species. Based on this, we've come up with recommendations for minimizing species extinction worldwide:

- 1) Informed, empowered, and responsive governance and leadership is essential;
- 2) Processes that ensure institutional accountability must be in place, and;
- 3) Decisions must be made whilst there is an opportunity to act.

The bottom line is that, unless responsive and accountable institutional processes are in place, decisions will be delayed and extinctions will occur.

The Christmas Island pipistrelle

The Christmas Island pipistrelle was a tiny (3.5g) insect-eating bat. It was endemic to Christmas Island, an Australian External Territory located 1500 km north west of Australia in the Indian Ocean.

Plotting a time-line of events we can trace the decisions and research that led to the bats extinction (Figure 1). When first described in 1900, the bat was considered widespread and abundant and subsequent observations suggest it remained common until 1984.

From 1994 onwards, monitoring revealed a consistent and rapid decline in population size until its extinction in 2009. The question asked now, is how did we manage to monitor a species to extinction?

Continued on page 7

An increasingly uncommon sight, orange-bellied parrots out in the field. Concerns were being raised over the orange-bellied parrot's decline back in 1917. By 1981 it was on the the brink of extinction. (Image by Glenn Ehmke. See page 16 for the story behind this image.)

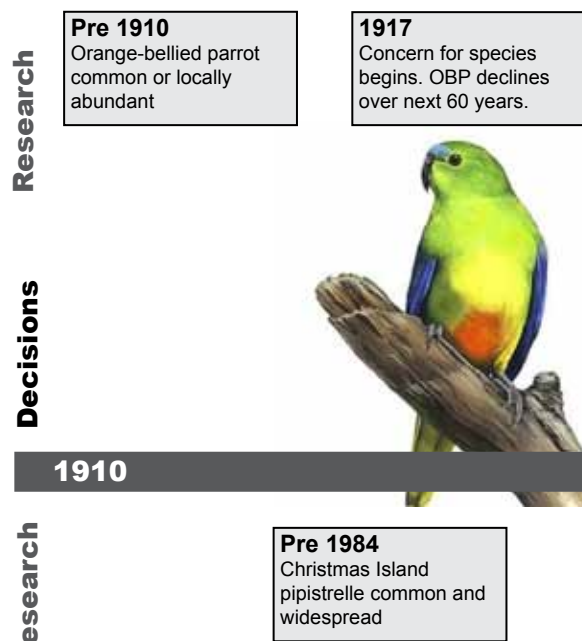


Figure 1: Time-line showing key research findings and management decisions relating to the conservation management of the orange-bellied parrot (above the line) and Christmas Island pipistrelle (below the line). The pipistrelle is now extinct whereas the orange-bellied parrot still exists a viable captive population of over 170 individuals. Boxes in pink denote the final series of actions that led to species extinction or preservation. (Modified after Martin et al, 2012.)

“Unless responsive and accountable institutional processes are in place, decisions will be delayed and extinctions will occur.”

Published in 2004, the main aim of the Christmas Island Pipistrelle Recovery Plan was to monitor the population, and determine the underlying threatening process causing its decline. Research into the possible threats revealed a complex web of potential factors with no single factor being able to explain the species decline. Even today, the precise cause of the decline remains unknown but it was likely the result of a complex cascade of negative impacts due to the colonisation of the bat's habitat by a suite of invasive species, including the giant centipede, common wolf snake, yellow crazy ant and black rat. Disease is another possible contributing cause.

By 2006, it was clear that trying to save the species in the wild was not going to succeed on its own. Key researchers and professional bodies, including the Australian Mammal Association and Australasian Bat Association, called on the Federal Minister of Environment to intervene and commence a captive breeding program. Over the next three years these pleas continued, but to no avail.

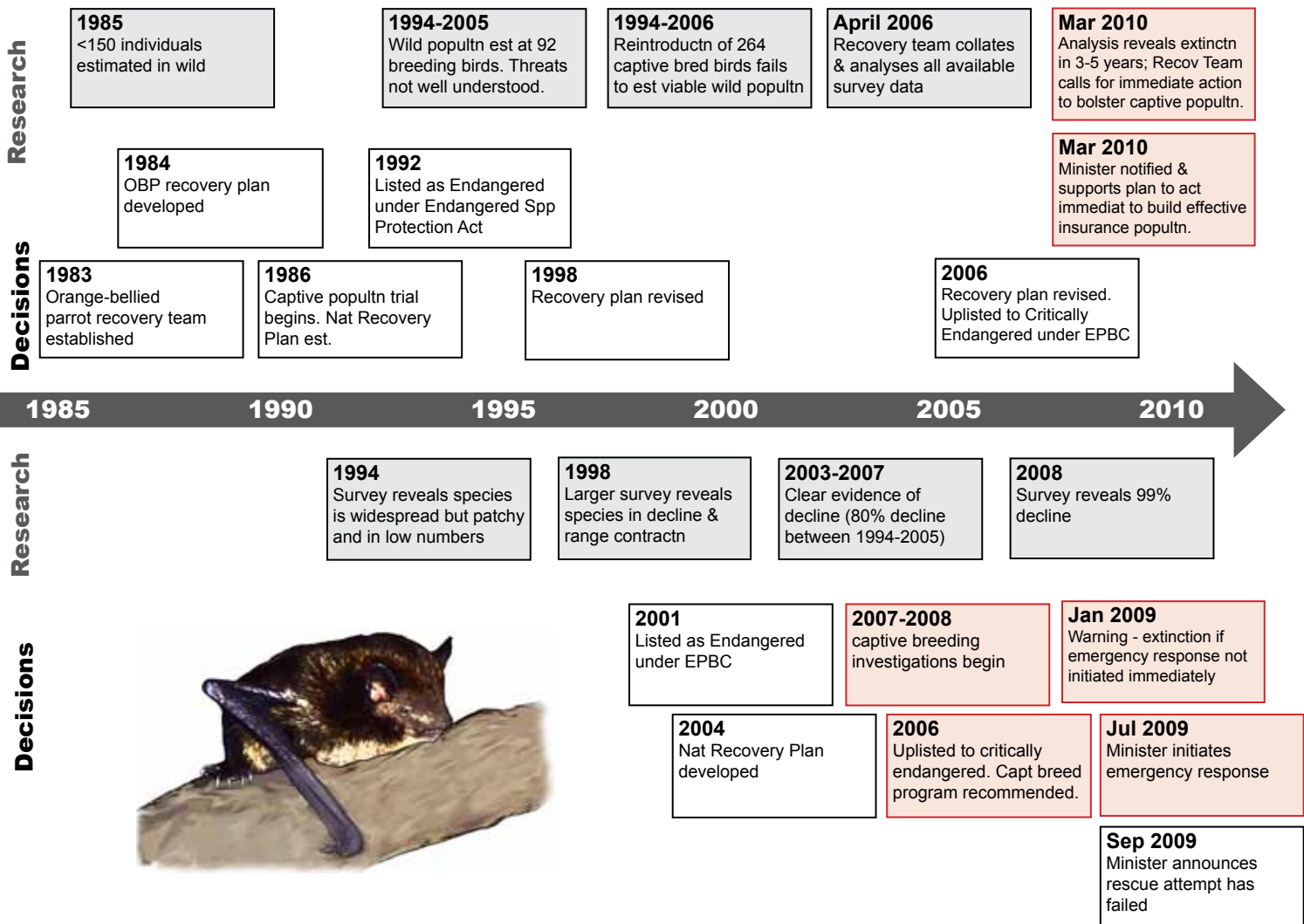
Meanwhile, monitoring in 2008 revealed a 99% decline in the population size from 1994. Finally, after further warnings in January



From 1994 onwards, monitoring revealed a consistent and rapid decline in the population of the Christmas Island pipistrelle. It went extinct in 2009. The question asked now, is how did we manage to monitor a species to extinction? (Image by Lindy Lumsden)

2009 that the species would disappear if urgent action was not taken to capture the last few remaining bats and commence a captive breeding program, the Minister gave the green light in July 2009. Two months later the Minister announced that the rescue attempt had failed.

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Acting fast avoids extinctions

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The orange-bellied parrot

Estimates from the 1800s to early 1910s suggest the migratory orange-bellied parrot was common across its breeding range in Tasmania and its wintering range in southern Victoria and South Australia. By 1917, concerns were being raised over the parrot's decline and a survey across the species' entire range in 1981 confirmed it was on the brink of extinction (Figure 1).

Responding to the decline, a multi-agency, multi-government recovery team, was established in 1983. This was one of the first such bodies established in Australia, and it included members from universities and non-government organisations.

In 1986, the first trial captive breeding population was established. By 2009, around 170 birds were in captivity. In April 2009, the Orange-bellied Parrot Recovery Team expressed concern about the state of the species in the wild and commenced collating and analysing all available monitoring data.

In March 2010, on reviewing the analysis, it became evident that the species would become extinct in the wild within three to five years unless drastic action was taken. The recovery team decided that immediate action was required to bolster the captive population into an effective insurance population. Implementation of this decision, including the capture of two new juvenile founders, got under way within one day.



In March 2010 it became evident that the species would become extinct in the wild within three to five years unless drastic action was taken. The recovery team decided that immediate action was required to bolster the captive population into an effective insurance population. Implementation of this decision got under way within one day! (Image by John Harrison)

“Central to the outcomes for both the Christmas Island pipistrelle and the orange-bellied parrot was the difference in governance and leadership between the two cases.”

Within three weeks, the recovery team had drafted an action plan to augment the existing captive breeding program to form an insurance population based on an increased number of founders.

In addition to being endorsed and supported by the relevant State Environment Ministers, the Federal Environment Minister was notified and the Commonwealth committed further resources in response to the recovery team's proposed actions.

During the 2010-2011 breeding season a further 21 juveniles were taken into captivity to increase genetic diversity, enhancing the possibility of future conservation options, including population augmentation and reintroduction once threats are managed.

The decision process

Management of endangered species is a process of decision-making. The decision process can be conceived as a sequence of decision functions that precede and follow rule-making or norm-setting (Table 1).

Examining these cases in the context of these decision functions reveals some clear differences. In both cases, the intelligence or information on species decline was obtained and delivered to decision makers and recommendations for action were promoted. The divergence in the decision process occurred in the functions of prescription, invocation and application.

The orange-bellied parrot had a champion in the form of an active recovery team to guide species management and ensure

Decision Functions	Definition	Christmas Island Pipistrelle	Orange-bellied Parrot
Intelligence	Obtaining, processing and delivering information to decision makers	✓	✓
Promotion	Recommending and mobilising support for alternative policies	✓	✓
Prescription	Turning policies into actions	✗	✓
Invocation	Implementing actions in a timely manner	✗	✓
Application	Implemented actions in the manner in which they were prescribed	✗	✓
Appraisal	Assessing whether prescriptions achieved goal	✓	On-going
Termination	Cancelling or updating the prescription	✓	On-going

Table 1. Assessment of which decision functions were carried out in the case of the Christmas Island pipistrelle and orange-bellied parrot.

recommendations were turned into action (prescription, Table 1). The recovery team included the necessary expertise as well as members of relevant government agencies and non-government organisations. The recovery team was informed, had a history of credible action and advice, and was willing to respond. These recommendations were based on the best available science, were invoked as intended and applied quickly enough to avoid foregoing opportunities.

With the Christmas Island pipistrelle, the information conveyed by credible researchers, professional bodies such as the Australasian Bat Society, the Australian Mammal Society, and even of the statutory Threatened Species Scientific Committee, did not lead to a decision until it was too late.

Leadership has emerged as a critical component of endangered species recovery, underpinning conservation program success. Good leadership can ensure the decision process is carried through, in other words, that policies are turned into actions and actions are implemented in a timely and appropriate manner.

From these sobering accounts of species decline, loss and decision-making, the following recommendations emerge:

1. Informed, empowered, and responsive governance and leadership is essential.

Governance is the physical exercise of determining influence, and for endangered species where legislation provides for their conservation, government is the instrument that does this. Leadership is the ability to inspire and mobilise others to achieve purposeful change and is a component of governance.

Central to the outcomes for both the Christmas Island pipistrelle and the orange-bellied parrot was the difference in governance and leadership between the two cases. While knowledge about the parlous state of the pipistrelle was available, as were expert recommendations to act, these individuals had no authority to make decisions, nor was there an effective leader to champion the urgent need to act. The result was that a decision to act was not taken. The internal decisions that resulted in no action were not transparently available and there was no consistent body with expert and public membership involved in guiding decisions.

In the case of the orange-bellied parrot, the authority to make informed management recommendations resided in a single body the Orange-bellied Parrot Recovery Team. The recovery team was recognised by the States and Commonwealth, contained all the necessary expertise on the parrot's biology, ecology, threats and management. The recovery team took responsibility for collating and analysing information, adaptively determining actions, coordinating activity and advising the community and governments of the actions that were required. As the team had broad representation from interested parties including NGO's and community members, any failure to act would have drawn a public response. This collective authority provided governments with confidence to make decisions based on biological evidence and on evidence that there was scientific, jurisdictional and community support. The recovery team model also provided an opportunity to generate an ongoing commitment of resources to enable responsiveness including leveraging urgent investments of additional resources. We identify the existence of an effective leadership body - the Orange-bellied Parrot Recovery Team - as a central ingredient in the persistence of the species.

2. Processes that ensure institutional accountability must be in place.

In both cases, monitoring indicated that population declines continued despite action to abate some identified threats. As a result, only two options remained: do nothing or establish captive insurance populations. Both recovery plans included objectives and

actions to monitor and undertake research to better understand the cause of the declines, but only the parrot's recovery plan contained specific actions that should be undertaken as a result of this monitoring and research.

Recovery plans must specify or include requirements to generate triggers to transform monitoring into action and institutions must be accountable for ensuring these actions are carried out. Monitoring of declining populations without the intention to decide between different management options will only document extinction.

Monitoring should be undertaken within an adaptive management framework, whereby explicitly stated actions will be taken when certain events occur. This is known as state-dependent decision-making.

3. Decisions must be made whilst there is opportunity to act.

Delaying decisions removes opportunities to act and runs the risk that a species may go extinct. The orange-bellied parrot would almost certainly have followed the Christmas Island pipistrelle to extinction if the decision to augment the captive population had not been made and acted upon immediately. In the case of the pipistrelle, failure to act immediately on the 2006 information about its critical decline likely contributed to its extinction three years later. Failure of key functions in the decision process concerning the pipistrelle resulted in slow decision-making. Such delayed decision-making has been cited as a key contributor to the failure of endangered species recovery programs.

We are only too aware that insufficient conservation resources exist to manage all endangered species and, without greater investment, difficult decisions about how to allocate resources between species must be made. It is conceivable, in the case of the Christmas Island pipistrelle, that the appropriate decision was to do nothing because of a perceived low likelihood of success relative to the cost of management and limited resources that could be better allocated elsewhere. Instead no decision was apparent. In the case of the orange-bellied parrot, a timely decision to augment the captive-bred population has avoided extinction, at least for now.

What is clear from this analysis is that stemming the global loss of biodiversity through recovery planning will require brave, effective governance, leadership and decision-making in the face of uncertainty. Informed responsive governance has many faces from a single empowered agency to delegation to a multi-organisation recovery team.

Finally, monitoring must be linked to decisions, institutions must be accountable for these decisions and decisions to act must be made before critical opportunities, and species, are lost forever. 📌

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Author's note: Many people and institutions made this research possible and these are outlined in Martin et al, 2012. However, I would like to pay particular thanks to the assistance of Mark Holdsworth and Stephen Harris.

Reference

Martin TG, S Nally, A Burbidge, S Arnall, ST Garnett, MW Hayward, LF Lumsden, P Menkhorst, E McDonald-Madden & HP Possingham (2012). Acting fast helps avoid extinction. *Conservation Letters* DOI: 10.1111/j.1755-263X.2012.00239.x

“Management of endangered species is a process of decision-making.”

The business of swimming with sharks

A shark in the water is worth (way) more than two fins in a soup

By Caroline Mitchell (University of Western Australia)

In 2009 the government of Palau created a shark sanctuary in its surrounding waters. This was in recognition of the perceived importance of the shark diving industry to the economy of the small Indo-Pacific nation. But just how much value comes from diving with sharks? And how does this compare with other more traditional uses such as harvesting sharks for meat and fins? To answer these questions a team of researchers from the University of Western Australia conducted a socio-economic analysis of the shark diving industry. EDG researcher, David Pannell, was part of that team.

The team's brief was to determine the economic benefits that had flowed to Palau as a result of shark-diving tourism. Their research highlights how economic incentives can potentially drive the implementation of measures that support wildlife conservation (Vianna et al. 2012). At the community level the researchers showed that preserving the sharks is actually in the best interest of the fishers who used to harvest the species for their meat and fins.

Four main stakeholders in the shark diving business were identified by the researchers and asked to complete onsite questionnaires. Dive tourists comprised the largest of these groups. They were asked a series of questions about their spending on the islands, their motivation for choosing to go to Palau and their shark diving experiences. Dive operators and dive guides provided information on tourist numbers and their expenditures as well as the nature and number of sharks and the most popular diving sites.

In addition, face-to-face interviews were conducted with local fishers and the owner of the fish market. Information elicited from them included their income from fishing, details of fishing activities and techniques and their views on shark preservation. The survey data, together with government statistics, was integrated into an economic model, which produced some interesting results:

- There is an estimated population of 100 sharks in the popular dive sites off Palau, the most prevalent species being the grey reef shark and the white tip shark. Approximately 8,600 visitors to Palau per year dive with these sharks generating US\$18 million per year to the country's economy.
- These same 100 sharks would have a 'one off' value of US\$10,800 if caught and sold for consumption. This represents a mere 0.006% of their value as a non- consumptive item over 16 years (a conservative estimate of their lifespan).

“100 sharks in the popular dive sites off Palau generate US\$18 million per year to the country's economy. These same 100 sharks would have a 'one off' value of US\$10,800 if caught and sold for consumption.”

- Local fishers earn more by selling fish to restaurants catering to the shark-diving tourist market than they could earn by harvesting the sharks. The estimated additional annual income to fishers from selling to restaurants specifically for consumption by shark divers is US\$1200 per year.
- Although the majority of tourists visiting the islands were unaware of the shark sanctuary (surprisingly only 29% of tourists intend to dive), for many respondents, the existence of the sanctuary was given as a positive factor influencing decisions to return to Palau for further shark diving.
- The revenue from the shark diving industry is distributed to many sectors of the economy, thereby benefiting the community as a whole. It accounts for approximately 8% of the GDP of the country.

Clearly, shark diving can be a lucrative business, and the government of Palau felt the results are a strong vindication of its sanctuary policy. This research provides important evidence for the establishment of more marine protected areas and grounds for better protection for sharks, which in many places around the world are in crisis.

It looks like there are many sound reasons why swimming with sharks should be encouraged!

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Reference

Vianna GMS, MG Meekan, DJ Pannell, SP Marsh & JJ Meeuwig (2012). Socio-economic value and community benefits from shark-diving tourism in Palau: A sustainable use of reef shark populations. *Biological Conservation* 145: 267–277.

In 2005, it was estimated that approximately 500,000 divers were engaged in shark-diving activities worldwide. An increasing range of opportunities for this type of tourism are available, including cage diving, shark feeding and drift diving with reef and oceanic sharks. Shark-diving tourism can be found in more than 40 countries with new destinations and target species being established rapidly. (Image by Gabriel Vianna, the lead author on the paper featured here.)



Tracking homicidal, mango-loving jungle birds

Good data and effective decisions on cassowary conservation

By Hamish Campbell (School of biological Sciences, University of Queensland)

Having survived eons of environmental change, the southern cassowary of northern Queensland (*Casuarius casuarius johnsonii*) is now in crisis. What's more, everyone is at odds on how to fix the problem. New research involving satellite tracking and conservation planning, however, is suggesting a way forward.

The problem for the southern cassowary is that its rainforest home has been reduced to a patch-work within a sea of human-dominated landscapes. People are more than happy to subsidise the cassowaries' diet, but birds become aggressive once they associate humans with food, and these birds possess the means to inflict serious damage to humans. Tempting cassowaries into human-frequented areas also exposes them to dogs and traffic – their biggest killers.

One management action has been to prohibit the deliberate feeding of cassowaries. Unfortunately, because the birds show a distinct preference for mangos, bananas and apples over their native cassowary plums and lilly pillies, the feeding ban is consistently flouted. Hefty fines have been enforced but this has only served to demonise wildlife rangers in the eyes of the local community.

Why bother?

Why should we invest in the conservation of cassowaries if much of their habitat is already gone? Well, cassowaries ingest the fruit of over 250 rainforest plants, thereby performing a seed dispersal service undertaken by a guild of birds and mammals in other



An adult female southern cassowary, wearing a GPS-based telemetry device.



UQ researchers and Queensland Parks & Wildlife Service rangers tag a female cassowary with a GPS-based device.

tropical rainforests. Without the cassowary, Queensland's remaining rainforests are likely to become significantly less diverse.

Cassowaries are also an important tourist attraction and the focus of community-driven conservation. The local district authority has even renamed itself the Cassowary Coast Council in acknowledgement of the bird's pulling power.

Despite all the interest in cassowaries, much of what is known is based upon hear-say and anecdotal observation. Management actions are currently being implemented for cassowaries with scarce, out-dated and incorrect base-line data, and there is virtually no follow-up monitoring.

Cassowary telemetry

Of course, tracking a ground bird through dense rainforest is no simple task. In an attempt to provide urgently needed data upon the social and environmental factors influencing bird distribution and abundance, I led a research project that attached GPS-based tracking devices to free-ranging birds. This allowed us to monitor the movements of these animals within the rainforest. The project involved scientists, vets and park rangers to catch and tag the

“We now have the tools and analytical techniques to answer questions about cassowary ecology not possible only a decade ago.”

birds, and then later conservation planners to use the collected information to formulate effective management strategies.

The cassowaries tagged in the study inhabited a reserve network consisting of Moresby Range National Park and Etty Bay Conservation Area. The GPS location data showed that whilst the birds held core home-ranges inside the boundaries of the protected area, they frequently left the park to visit agricultural land, tourist areas, and residential properties. In addition, some birds travelled up to 1 km outside the reserve to feed on an invasive weed known as the pond-apple (*Annona glabra*). After feeding on them, the cassowaries then transport the seeds back into the rainforest and deposit them in a healthy dollop of fertiliser.

Having cassowaries shuttle back and forth between the parks and surrounding human-landscape is bad for both the birds and the rainforest. Pond-apple is rapidly spreading in the reserve and cassowaries are turning up dead or injured.

Spatial priorities

EDG researchers Matt Watts and Carissa Klein were called in to see if spatial prioritisation techniques could be used to improve the efficiency of the existing reserve network. The analysis prioritised parcels of land inside and outside the reserve (parcels were 50m² in size) based upon monetary value, the cost of rehabilitation and protection, and its importance to the cassowaries (derived from the telemetry data).

The results showed that the current reserve only encompassed approximately 50% of the cassowaries' home-ranges. While it would be desirable to enlarge the reserve to encompass all areas utilised by the cassowaries, this option isn't feasible as it would cost too much. Another option was to aim somewhere between a 'do nothing' approach and a 'protect 100% of their range' target. This third option would incorporate two management strategies:

- 1) Purchase and protect currently unprotected remnant rainforest adjacent to the reserve that was highly utilised by the cassowaries; and
- 2) Use targeted incentives to landowners in cleared-areas frequented by cassowaries to minimise threatening processes (Figure 1). These might include actions such as traffic calming, signage, road fencing, restriction of dog access, removal of exotic fruit plants, and the planting of native fruit plants.

This study represents an important step forward in our capacity to effectively manage for cassowaries. We now have the tools and analytical techniques to answer questions about cassowary ecology not possible only a decade ago.

Although the collection of GPS-based location data can be costly, once the ecological information is sufficiently robust it can be modelled throughout the cassowary's geographical range. Such systematic prioritisation of what are often costly management actions will be the most effective use of resources in the longer term. 🍎

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Reference

Campbell HA, RG Dwyer, S Fitzgibbons, CJ Klein, G Lauridsen, A McKeown, A Olsson, S Sullivan, ME Watts & DA Westcott (2012). Prioritising the protection of habitat utilised by southern cassowaries *Casuaris casuaris johnsonii*. *Endangered Species Research* 17: 53-61.

Editor's note: If you think tagging killer birds is exciting, check out [Decision Point #38](#) in which Hamish Campbell discusses the finer points of attaching tracking units to massive salt water crocodiles.

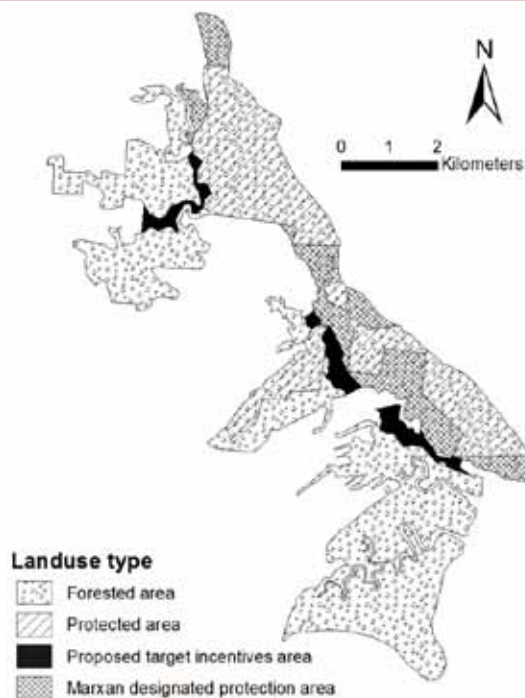


Figure 1. The results of the spatial prioritisation analysis showing current protection area network, proposed enlargement of the protected area, and the target incentives zone. This protected area network lies in the Etty Bay and Moresby Range region in northern Queensland.

An ancient ratite

The southern cassowary of Northern Queensland belongs to an ancient group of ratite birds. They diverged from the avian lineage so long ago that if you were to plot the evolutionary tree, they would sit on one branch whilst every other species of bird would sit on the other.

The cassowary is a large, colourful and flightless bird. The female is slightly larger than the male, weighing up to 75 kilograms and growing as tall as 170 centimetres. It has a helmet like structure on the top of its head, known as a casque and draping shiny black plumage but no tail. Its feathers differ from other birds as the quill splits in two. The naked skin around its neck is brilliant blue, with two red wattles hanging from the front. Each well-muscled leg has three toes, with the inside toe bearing a large dagger-shaped claw that can be used in defence. For such a large, striking bird, it blends remarkably well into rainforest.

More info

http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=25986



Landscape Logic: Integrating Science for Landscape Management

You've seen the CERF, now read the book

By Ted Lefroy (Director, NERP Landscapes and Policy Hub)

There once was a CERF (Commonwealth Environment Research Facility) called *Landscape Logic*. It was a close cousin of AEDA (Applied Environmental Decision Analysis, another CERF Hub and the group that preceded the EDG). And AEDA and *Landscape Logic* had much in common, sharing some researchers and the overarching goal of better environmental decision making. Last month a book was launched that distilled many of the key lessons coming out of *Landscape Logic*. Professor Ted Lefroy, lead editor and Director of *Landscape Logic*, describes here the new text. [Note: Professor Lefroy is now the Director of the NERP Landscapes and Policy Hub and is still closely involved with the EDG and the NERP Environmental Decisions Hub. He sits on NERP ED's Steering Committee.]

'Can we detect the influence of public environmental programs on the condition of our natural resources?' It's a pretty basic question; one that I and a number of environmental researchers posed back in 2005. At the time, a series of national audits of Australia's environmental programs could find no evidence of public investment improving the condition of waterways, soils and native vegetation, despite major public programs investing more than \$4.2 billion in environmental repair over the last 20 years. If there's no evidence of improvement, how can we learn and invest more wisely? Or, why even bother investing at all?

The *Landscape Logic* Hub was set up to help us explore these issues. It brought together researchers from four Australian universities and CSIRO, and enabled us to work with environmental managers from three state agencies and six regional catchment management authorities. Funding for the enterprise came from the Commonwealth Environment Research Facility program, and the hub ran from 2006 till 2010.

The legacies of the *Landscape Logic* initiative are many and varied. In addition to the formal scientific papers and reports it produced, our activities led to many relationships being forged across the research/management and policy divide that will hopefully endure for many years to come. One of the Hub's legacy outputs is a book bringing together the key insights of what was discovered, and it's just been released. Unsurprisingly, the book is called *Landscape Logic*.

Landscape Logic describes how this collaboration of 42 researchers and environmental managers functioned. It describes what we found and what we learnt about the challenge of attributing cause to environmental change.

While public programs had been responsible for increases in the amount of vegetation, there was less evidence on improvement in vegetation condition and water quality. In many cases we demonstrated



Tim Cole and Regina Magierowski (from UTAS) assessing the ecological condition of the Great Forester River in Tasmania as part of *Landscape Logic*. You can read about this research in Allan JD, Yuan LL, Black P, Stockton T, Davies RH and Read SM (2011). *Investigating the relationships between environmental stressors and stream condition using Bayesian belief networks*. *Freshwater Biology* doi:10.1111/j.1365-2427.2011.02683.

that critical levels of intervention had not been reached, interventions were not sufficiently mature to have had any measurable impact or that monitoring had not been designed to match the spatial and temporal scales of the interventions. In many cases interventions lacked sufficiently clear objectives and metrics to ever be detectable.

In the process of discovering this, the collaboration generated new knowledge on disturbance thresholds in river condition, diagnosed sources of pollution in river systems, and developed new approaches for the application and uptake of state-and-transition and Bayesian network models for environmental management.

An important insight arising from the Hub's work was in understanding how people learn about their immediate environment, how social norms can determine what is and what is not acceptable behaviour, and how they are established and passed on. Knowing what needs to be done in a technical sense often turns out to be the simpler part of the challenge.

The *Landscape Logic* project confronted the question of establishing cause by using multiple lines of evidence to accommodate uncertainty and strengthen inferred relationships between large scale patterns and local processes.

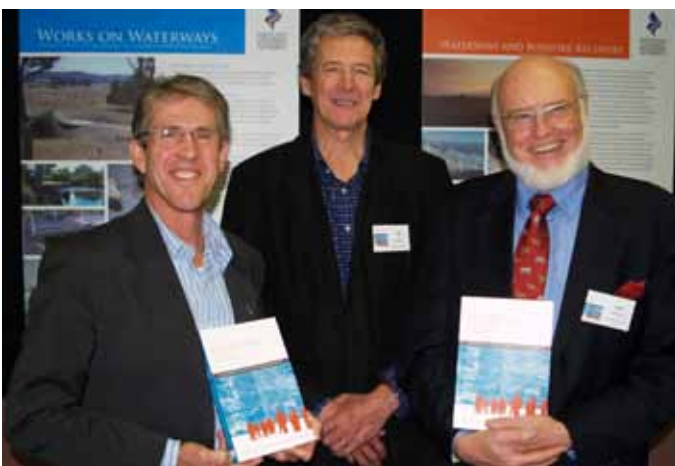
Patterns of environmental change can be detected from aerial photographs and satellite images. However it was interviews and surveys of long-time residents and workshops with landholders that enabled the research group to piece together changes at a local scale and understand when and how observed changes had occurred.

Landscape Logic the CERF hub ran for five years. *Landscape Logic* the book distils the essence of this unique venture and provides valuable lessons for environmental managers and policy makers. Read it and judge it for yourself.

More info: Ted Lefroy Ted.Lefroy@utas.edu.au

Reference

Lefroy T, A Curtis, A Jakeman & J McKee (Editors) (2012). *Landscape Logic: Integrating Science for Landscape Management*. CSIRO Publishing.
<http://www.publish.csiro.au/pid/6769.htm>



Professor Ted Lefroy (centre) with fellow *Landscape Logic* book editor Professor Allan Curtis (left) and Dr John Williams at the book launch at Charles Sturt University (Albury) last month.

Caught in the web

What a tangled web we sometimes weave

By David Salt (Editor, *Decision Point*)

Where do you get breaking news on the EDG?

When talking about EDG (and CEED and NERP ED) we tend to refer to the core or primary researchers that form the backbone of EDG. The EDG network consists of 26 core researchers (14 in common to both NERP ED and CEED) spread across five Australian universities and CSIRO. If that wasn't complicated by itself, each of these researchers maintains their own information web portal or websites. Sometimes these websites are 'official' university property; sometimes they are 'unofficial' self-maintained websites, usually set up through free web services like wordpress. Several researchers have both official and unofficial websites simultaneously. Some of these websites are updated frequently, some never. Some carry news stories that are hours old, others give you news that hasn't been updated in years.

All have links to other related websites and the interconnections between and across EDG nodes quickly becomes a tangled web. So, if you're a fly wanting to glean good intelligence on what the EDG is doing, where would you search? The first port of call, of course, is *Decision Point*. However, if you wanted to start knowing about breaking news and happenings from the source, then you need to begin navigating the tangled web and learn which threads contain gold and which don't. Here are a few starting points.

CEED News

This news page flags CEED awards, press releases and events.

<http://ceed.edu.au/media/>

NERP ED News

Not a news page as such, more of a home page with news feeds at the bottom

<http://www.nerpdecisions.edu.au/>

University of Queensland

Two of the groups that form part of the EDG crowd are the Wilson Lab and the Buckley Lab. Both profile papers as they get published.

Kerrie Wilson's lab – Wilson Conservation Ecology Lab

<http://wilsonconservationecology.com/>

Yvonne Buckley's lab – Buckley Plant Ecology Lab

<http://buckleyplantecologylab.wordpress.com/>

University of Melbourne

Most of the EDG people at Melbourne Uni are in the Quantitative & Applied Ecology Group (QAEG), located in the School of Botany.

<http://qaeco.com/>

University of Western Australia

EDG people at UWA are mainly in two research groups, David Pannell's CEEP and Richard Hobb's ERIE.

CEEP – Centre for Environmental Economics and Policy

<http://www.ceep.uwa.edu.au/>

ERIE – Ecosystem Restoration and Intervention Ecology

<http://www.erie-research.org/EDG.html>

The Australian National University

Most of the EDG people at ANU belong to the Conservation and Landscape Ecology Group. Last year that group had a stab at running a blog called CLEAR as blog (which hasn't posted anything now for several months, see the box: A bit on blogging).

<https://clearasblog.wordpress.com/>

A bit on blogging

Last year a group of us here at the ANU node of the EDG had a crack at setting up our own blog. We called it CLEAR as Blog (with CLEAR standing for Conservation, Landscape Ecology And Restoration). It started well, producing half-decent posts each fortnight on an array of topics, but soon other priorities took over and the blog has been silent now since Christmas. I've been wondering what it takes to blog successfully and as a starting point I've looked at the blogs around me, specifically those connected with members of the EDG. Here are three worth mentioning, each representing a somewhat different approach (which I've invented names for). Lessons I take out of these sites is that good blogs are dynamic blogs, dynamic blogs are regularly refreshed and to be engaging they need to contain personal insights. Good blogs don't have to be long and don't even have to be based on words. They take a bit of time to create but that investment can yield a high return.

The discussoblog

Discussoblogs offer short reflective discussions on themes of interest to a blogger and his/her audience. David Pannell's Pannell Discussions are a good example of this. David explained what his blog site was all about in his blog number 200* which came out at the end of last year (200 blogs! It would take our blog a century to reach this score at our current rate!):

"My main motivation for starting Pannell Discussions in 2004 was to communicate economic ideas, principles and theories to a wide audience, in a way that engages people and gets the ideas across clearly. I wanted people to see the relevance and interest of economics, and to dispel myths, misconceptions and misunderstandings about it. I also wanted to raise awareness about my research that might otherwise have sat relatively unread in academic journals.

"Seven years later, judging from the number of readers and the feedback I get, the site has achieved those objectives quite well. There are 600 subscribers, and the more popular articles get read by over 1000 people (or at least loaded onto their computer screens).

"I think the benefits have been greater than I anticipated. On the cost side, I aim to spend no more than an hour on each one, so it's not a big burden. And, anyway, I quite enjoy writing them."

More info: <http://www.pannelldiscussions.net/>

The diaroblog

Diaroblogs are more about reflecting on the blogger's immediate environment, what's they've been doing, what they think about this and how it connects to the other related things. Megan Evans, a member of the Wilson Lab at UQ, runs her own blog, 'economical ecology' which is more of a web diary or log of her own activities and reflections (which is closer to the origins of blog, short for 'web log') most of which are in the realm of conservation science.

More info: <http://economical-ecology.com/>

The birdoblog

I could have called this a pictoblog or captionblog but birdoblog sounds better. This is where the blog post is an image with an extended caption. An example is one of my favourite blogs, Natural Newstead. The subtitle of this elegant little blog is 'Observations of flora, fauna and landscape in central Victoria', and that's exactly what it is, though most of the pics and observations are about birds.

It's set up and largely produced by Geoff Park who is an extended member of EDG and an associate of David Pannell. Geoff lives in Newstead, just outside of Bendigo in Victoria, and his blog presents images that he (and sometimes colleagues of his) capture of the natural history in their neighbourhood. Posts are every few days, sometimes daily, and consist of an image with one or two paras discussing what we're looking at.

I subscribe to this site. They only take a few seconds to absorb, and they always take me away from the daily grind.

More info: <http://geoffpark.wordpress.com/>



Three birds in the bush

Editor's note: Our cover image is of three orange bellied parrots out in the 'bush'. Given that they are critically endangered (see the story on page 6), surely capturing an image like this doesn't happen every day. Indeed, when I first saw the pic I assumed it was a trick, that maybe this bush setting was actually in some massive cage. But it was no trick. The image was captured by passionate birdo and superb photographer Glenn Ehmke; and the birds are indeed out in the 'wild'.

"These three orange bellied parrots were on King Island on migration to the mainland in April 2008," Glenn explains. "They were sighted during a 'blitz' in 2008 in which around 30 volunteers from all around Australia came to the island to intensively survey for the parrots over 5 days. We found at least four previously unknown sites for the birds on the island including this one.

"These birds are 'day roosting' in African boxthorn, a declared noxious weed, but one of the few patches of woody vegetation of any kind on highly denuded King Island. Another reason they may choose to sit in boxthorn is the virtually perfect good colour match for their plumage." Glenn's photography also featured on our last cover (DP#59, a flock of godwits). If you'd like to see more of his exquisite images, check out his website.

More info: <http://glenne.zenfolio.com/>

What's the point?

A bird in the spotlight

Whether the orange-bellied parrot goes extinct or not, the public memory on this species will likely be dominated by the debates stirred up around development approvals. In the 1990s the proposed relocation of the Coode Island Chemical storage facility to a location near Point Wilson, Victoria, was jeopardised by the potential impacts upon orange-bellied parrot habitat. The Victorian premier described the species as a 'trumped-up corella'. A bit later the orange-bellied parrots were considered in the impact assessment for the Woolnorth wind farm on Tasmania's north-west coast. Possibly the most high-profile case occurred in 2006, when the potential threats to the orange-bellied parrot were cited as the key reason for the Commonwealth to reject the proposal to build a wind farm in eastern Victoria. The decision was later reversed. And earlier this year, the parrot was again being cited for delays to approving a boat marina on Victoria's Mornington Peninsula.

Source: http://en.wikipedia.org/wiki/Orange-bellied_Parrot and <http://www.theaustralian.com.au/news/health-science/rare-parrot-holds-up-marina/story-e6frq8y6-1226266213969>



ENVIRONMENTAL DECISIONS GROUP

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.

The EDG is jointly funded by the Australian Government's National Environmental Research Program and the Australian Research Council's Centre of Excellence program.

Decision Point is the monthly magazine of the EDG. It is available free at: <http://www.decision-point.com.au/> If you would like to contact *Decision Point*, see page 2.

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



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