

AEDA News
Issue 4 (Friday, 13 July 2007)

AEDA News is a fortnightly email for members of the Applied Environmental Decision Analysis CERF Hub.

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1. Deal with it: Making decisions and dealing with uncertainty? (from the Deputy Director)

Dealing with uncertainty is always a challenge when making decisions, and it's central to most decision-making processes. Brendan Wintle, AEDA's Deputy Director, discusses uncertainty and AEDA's role in helping decision-makers deal with it.

There's always an extra level of precision or an extra source of information you can obtain in order to make a better decision. However, you need to keep in mind that information is expensive to collect and can take a lot of time to gather. Sometimes you have to wait years to obtain extra information and decisions can't always wait that long. Doing nothing while information is collected is a decision in itself that may be highly suboptimal, especially if environments are degrading or populations are in rapid decline.

One difficult question is how much information do you need to make a good decision and is it worth collecting extra information that costs time and resources to obtain? Are you going to make a substantially better decision if you've got that extra information at hand?

One of the things we'd like to do in AEDA is to develop approaches to quantifying the difference in the quality of the decisions that you'll make with different amounts of investment in collecting or compiling information. Using decision theory approaches, we can explicitly trade-off the cost of the extra information against the cost of the errors that might be made because we don't have the highest possibly quality of information.

For example, if you were trying to predict where in an agricultural landscape you should do a restoration activity it would be great if you could have a very good map of where all the individual paddock trees are because many ecologists have demonstrated the importance of having these remnants in the landscape. Of course, collecting this information is extremely difficult because you need spatial information at a really high resolution. This is generally very expensive and time consuming to compile, so there's an overhead cost to the extra precision.

To address the question of how much information is enough, we need to ask how bad a decision would I make based on intuition or poor data alone compared to if I had the better quality data. This can be quite difficult to do without using a formal decision theory. Because formal decision theory is not particularly that easy to implement for non-trivial problems, we (AEDA) would like to develop some sensible rules of thumb that can be applied by non-technical people to a range of characteristic problems. Rules of thumb might be used to help people decide when they need more data or when (and how) they should make a decision with available information.

So, that's the first aspect of this – assessing the value of information and putting that in terms of the quality of decisions. The other issue is how we should deal with uncertainty in decision making.

We can make better decisions by improving the information we have, but we can also make better, more robust decisions by explicitly incorporating the uncertainties that are inherent in the decision-making process or the uncertainties that arise because we don't have perfect information.

For example, rather than wait ten years while we figure out the best methods of restoration (and the best places to do it), we may be better off making restoration decisions now using the best available information. This is especially the case where an extra ten years may see further decline in habitat quality, and perhaps a local loss of species.

In order to make the best decision under uncertainty, we need a decision protocol that explicitly incorporates the uncertainty. One way to deal with uncertainty in decision making is to ask the question; "how wrong can I be about the performance of my restoration strategy and still achieve a satisfactory outcome (e.g. amount of successful restoration, or number of species extant at some time in the future)". Asking the question in this way allows you to use a formal decision theory to explore the consequences of being wrong due to the uncertainties you face and make a decision that is robust to those uncertainties. If you can make a robust decision without having to spend time and money collecting extra information, then that's a good outcome.

So, let's consider another example: say there's a call for creating a management plan for an endangered bird species, but one scientist stands up and says 'we simply don't know enough; we need more information before deciding anything'. What's an appropriate response?

Again, we want to compare the value of acting now based on the information we have against the value of acting later after spending time and money collecting more information. Part of the consideration is the lost opportunity in delay and opportunity cost of spending money collecting data rather than acting.

To analyse this problem, we need to consider the sorts of errors that you could make if you made the decision now without the extra information and the cost of those errors both financially and in terms of probability of persistence of the species. This would then be compared with the probability that the bird would decline to some irretrievable level if we don't act for say five years until we've actually got the information. This is risk trading; which amounts to making decisions in the face of uncertainty.

Using a formal decision theory allows you to deal with such problems in a coherent way. There is substantial evidence to suggest that humans are often unreliable when it comes to assessing risks, so using a formal decision process helps reduce the instances of nonsensical risk assessment and decisions. Making decisions in a structured way also increases transparency and accountability and, in some instances, can help reconcile competing political and personal agendas when decisions are made in groups.

One of the major goals of AEDA is to build decision-making protocols that help decision makers to deal with uncertainty in a coherent and systematic way. There is some excellent preliminary work in this area by AEDA members and others, and some papers with specific examples. Now we want to generalise those protocols and apply them to a series of emblematic case studies, in collaboration with agencies and other conservation and NRM bodies. We aim to develop approaches that are sufficiently accessible so that they can be adopted by people with limited experience in mathematics and decision theory.

(Some useful references and some of our preliminary work on decisions-making under uncertainty will soon be posted on the AEDA website [currently under construction]).

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2. Acknowledging AEDA funding

If you're producing a publication that has in some way come about through funding provided by AEDA (i.e., a paper resulting from an AEDA-funded workshop), you should where possible acknowledge the CERF funding. The Department of Environment and Water Resources, the source of our CERF funding, has requested the following wording:

'This work has been supported by the Applied Environmental Decision Analysis research hub which is funded by the Commonwealth Environment Research Facilities (CERF) programme, an Australian Government initiative which promotes world class, public good research.'

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3. Info gaps on biodiversity research (a new report from DEWR)

The Commonwealth Department of Environment and Water Resources (DEWR) has recently posted on the web a report that provides a critical assessment of research and information needs for implementing the 2004–2007 National Biodiversity and Climate Change Action Plan.

In Australia and globally, there is a growing list of recent changes in species' distributions, abundances and lifecycles that are highly likely to be due to climate change. Similarly, many experimental studies demonstrate that a variety of biological responses to climatic and atmospheric change (including changes in carbon dioxide concentration, and radiation, temperature and rainfall regimes) are likely to occur in the future. However, there are considerable limitations in our ability to:

- measure and predict specific impacts (i.e. the net result of various impacts on given species or in given locations, including rates of ecological change)
- determine the best approaches to managing biodiversity as climate changes
- provide effective information for managers and policy makers.

This report identifies the research needed to fill information gaps to protect Australia's biodiversity from the impact of climate change. It aims to inform the prioritisation of research within the Australian Government. It also aims to help government and private research agencies align their research activities on biodiversity and climate change with management requirements.

The issues discussed in this report have been drawn from a workshop on 'Research needs and information gaps for the implementation of the key objectives of the National Biodiversity and Climate Change Action Plan', hosted by the then Australian Government Department of the Environment and Heritage and the CSIRO in June 2005.

You can download the report from:

<http://www.environment.gov.au/biodiversity/publications/biodiversity-climate-priorities.html>

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4. Motivating change in catchments (a CSIRO report on reveg design and incentives)

CSIRO has just released a practical handbook for catchment managers to assess if an incentive program for biodiversity enhancement is appropriate in their catchment. The handbook is called *Motivating Change in the Catchment: A Guide to Revegetation Design and Incentives for Catchment Management Bodies*,

"This practical and easy to read handbook encourages catchment managers to assess environmental problems confronting their regions and to consider if revegetation is the appropriate remedy," says Dr Wendy Proctor from CSIRO Land and Water (and one of the report's authors).

"If so, the handbook encourages managers to consider various forms of incentives available to them to encourage landowners to provide effective revegetation strategies."

A range of incentive schemes that support revegetation and other conservation management actions on private and public land have been developed in recent years. The handbook provides a thorough overview of the various incentives, including stewardship payments, auctions and suasive instruments.

"Different types of incentives work better for different purposes, different contextual situations and different communities," says Dr Proctor.

"As it is important to get a good understanding of the type of community that will be involved in the scheme, we have included a community assessment survey to assist catchment managers to tailor appropriate incentives. This is backed up by a range of principles to test if the chosen scheme is suitable for the purpose."

There is a growing awareness that farming systems do not always fit with landscape needs, and may cause dryland salinity, poor water quality, a loss of native fish, and threats to biodiversity and native habitat. Reintroducing trees and other vegetation is often an important part of what needs to be done to address these problems and protect farming systems.

To increase both uptake and cooperation when the scheme is implemented, the handbook provides suggestions for including key stakeholders and the community in the decision making process.

The Handbook was prepared by the CSIRO and the Queensland Department of Natural Resources and Mines, and funded by the Australian Government Department of the Environment and Water Resources.

A copy of the report can be found at
www.csiro.au/resources/MotivatingChange

Further Information: Wendy.Proctor@csiro.au

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5. Decisions in the news (competing interests and marine reserves)

Editor's note: AEDA is about developing science for environmental decision making but it's always worth remembering that identifying trade-offs and reaching decisions are essentially social processes in which science is usually just one consideration. Here's a story from The Age that highlights some of the competing interests around the decision to proclaim a network of marine reserves off south-east Australia (announced last week). Environment Minister Malcolm Turnbull comments: "It is a balancing process. Not everyone gets what they want."

For more information on the Commonwealth marine reserves in the south-east marine region see <http://www.environment.gov.au/coasts/mpa/southeast/index.html>

Roughy justice: over fishing's net effect

Andrew Darby, July 6, 2007, The Age

Vast areas of the seabeds off south-eastern Australia have been locked into marine reserves as the Federal Government sets a template for protecting ocean life around the country.

Environment Minister Malcolm Turnbull said the world's first network of temperate, deep-sea marine reserves, covering 226,000 square kilometres, struck a balance between fishing industry demands and calls for greater biodiversity protection.

But the Australian Conservation Foundation said it was a disappointing sign that inshore areas with more abundant marine life would miss out on protection as more marine reserves were rolled out. The foundation said the reserves' area was heavily skewed towards the continental shelf slope and little-known abyssal plain beyond.

The final network for the south-eastern reserves, announced yesterday in Hobart, is closely tailored to draft areas released in 2006, with minor changes following complaints from fishing communities, particularly in Tasmania. There are several large areas around the Victorian and southern NSW coastline, all of them multiple-use zones where some fishing will still be allowed. However, Mr. Turnbull said 75 per cent of total reserves were closed to fishing.

The oil and gas industry will still be able to exploit about one-third of the network that has been declared special purpose zones, mostly in the deep.

Mr. Turnbull pointed to spectacular undersea features inside the boundaries, including mountains and canyons, and unique marine species. "It is a balancing process," he said. "Not everyone gets what they want."

But in a test of the reserves' biodiversity strength, the Cascade Seamounts south of Tasmania missed out on protection. It is one of the remaining strongholds of the over-exploited, century-old table fish, orange roughy. Tasmanian Fishing Industry Council chief executive Neil Stump said with the Cascade orange roughy stocks in the best condition of all, there was potential to continue fishing, and Mr. Turnbull said 80 per cent of seamounts in the region had been protected.

But ACF marine campaigner Chris Smyth said there was a lack of rigorous science behind the reserves decision.

The World Parks Congress in 2003 set a global benchmark of protecting 20 per cent of each marine bio-region, and Australia should be aiming for that in the further national reserves expected to follow around the whole coastline, Mr. Smyth said.

"But much of this south-east area is in the abyssal plain. That's worth protecting, but ... they are avoiding areas of high biodiversity, where of course the fishing is."

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6. New publications by AEDA members

John K. Stranlund and Yakov Ben-Haim,
Price-based vs. quantity-based environmental regulation under Knightian uncertainty: An info-gap robust satisfying perspective, *Journal of Environmental Management*. In Press, Corrected Proof, Available online 28 March 2007

Felton A, Hennessey BA, Felton AM, Lindenmayer DB, (2007) Birds surveyed in the harvested and unharvested areas of a reduced-impact logged forestry concession, located in the lowland subtropical humid forests of the Department of Santa Cruz, Bolivia.
<<http://www.checklist.org.br/getpdf?SL014-06>> *Check List* 3(1):43-50.

Gibbons P, Lindenmayer DB (2007) Offsets for land clearing: No net loss or the tail wagging the dog? *Ecological Management and Restoration* 8(1):26-31.

Lindenmayer DB, Cunningham RB, Weekes A (2007) A study of the foraging ecology of the White-throated Treecreeper (*Cormobates eucophaeus*) *Emu*, Vol. 107 No. 2 Pages 135 – 142, 2007

Lindenmayer DB, Fischer J, Felton A, Montague-Drake R, Manning AD, Simberloff D, Youngentob K, Saunders D, Wilson D, Felton AM, Blackmore C, Lowe A, Bond S, Munro N, Elliott CP (2007) The complementarity of single-species and ecosystem-oriented research in conservation research, *Oikos* 2007 116:7 1220

Taylor AC, Tyndale-Biscoe H, Lindenmayer DB (2007) Unexpected persistence on habitat islands: genetic signatures reveal dispersal of a eucalypt-dependent marsupial through a hostile pine matrix, *Molecular Ecology* 16 (13), 2655-2666.

Have you published an article or book recently that other AEDA members might be interested in? If you have, please send us the information so we can list it in the next issue of AEDA news.

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7. Picture this (A plea for Pics from AEDAites)

Some day, hopefully soon, AEDA will have a website and maybe a set of information sheets setting out the important research being done by the good scientists of AEDA. As these things develop it'd help our job no end if we could present some quality images to support our words. It's true; a good picture is worth a thousand words. Unfortunately, it's also true that coming up with a good picture can prove a real challenge when so much of your science is sophisticated and conceptual.

People sitting at computers, technical tables, equations, graphs and maps may reflect the type of activities that AEDA is involved in but they don't convey the spirit of why we're engaged in these pursuits.

So, what I'm hoping some clever AEDAites might be able to do is send me images that scream (or maybe simply suggest) 'monitoring', 'prioritisation and spatial planning' or 'environmental decision making'. Or failing that, send me your ideas and we'll see what we can cook up. If you're attending a workshop, consider what image might spell out the theme you're discussing (and that's not a pic of a group of people talking). If you're out in the field, is there some visual cue around you worth capturing. If you're in front of your computer and you think your latest analysis shows something special, what image might help convince someone outside of your field of this?

Producing relevant and clever images is not an easy task (and you're all busy people), but it's a worthy challenge. You're applying your best efforts to improve conservation through science-based decision making. Communication is a critical part of that process and visual images can sometimes make all the difference.

David Salt
Knowledge Broker, AEDA

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That ends issue 4 of AEDA News.

If you have news or views relating to AEDA or of interest to AEDA members, please send it to David Salt, dsalt@cres.anu.edu.au

(Please note that David Salt works Wednesday to Friday.)

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