Abstract
Public understanding of conservation is flawed in New Zealand and the level of threat to species and ecosystems is poorly understood. Pursuit of conservation goals is costly. We invest resources and effort to maintain specific species and return ecosystems to a former state by investing resources and effort. Selection of conservation projects needs to be based upon good understanding of their expected outcomes and projected costs. Efforts to conserve ecosystems should be evaluated to determine the effectiveness and efficiency of those actions. Practical, low cost evaluation techniques exist and can inform society about ecosystem conservation programmes. A New Zealand conservvision is for conservation decisions made by small groups of experts, based on estimated cost and projected outcomes that will conserve the dynamic nature of ecosystems.
1. Introduction
Conservation often evokes dedicated effort from many people, both employees and volunteers. We strive to achieve success, often in the face of massive challenges. Our conservation activities are more likely to be successful if some key criteria are met. These include: there is reasonable understanding of the current conservation situation, conservation objectives are well defined and achievable, and there is sufficient knowledge available of ways to move towards desired outcomes. The resources available for conservation are often scarce, and our choices will usually have both financial costs and opportunity costs. Greater conservation progress may be achievable if the costs of conservation programmes and projects are estimated and considered when choosing objectives and strategies. Given the existence of opportunity costs in conservation it is important to complete outcome evaluations to determine the success and cost effectiveness of conservation efforts. In this paper I review how New Zealand rates on those points and propose changes that could improve conservation performance. I conclude with a vision of conservation management that addresses these issues.

2. Public understanding of nature and biodiversity conservation
It is arguable that New Zealanders have flawed understanding of the current state of native species and ecosystems, and of the effectiveness of New Zealand conservation activities. Four nationwide surveys of New Zealand adults (Hughey et al., 2001, 2002, 2004, 2006) have asked respondents about their perceptions of the New Zealand environment, the quality of environmental management and causes of damage to the environment. In three of those studies we have asked if New Zealand is ‘clean and green’ (Hughey et al., 2002, 2004, 2006). Figure 1 illustrates that New Zealanders judge that we live in a clean and green land.

Figure 1. New Zealand’s environment is ‘clean and green.’ Source: Hughey et al., 2006.
Four nationwide surveys of 2000 New Zealand adults (Hughey et al., 2001, 2002, 2004, 2006) have asked respondents to provide ratings of the quality of eleven aspects of the New Zealand environment (air, groundwater, rivers and lakes, marine fisheries, soils, ...), native land and freshwater plants and animals, forests and bush. We also asked respondents how the New Zealand environment rates compared to other countries. Respondents consistently state that New Zealand species, bush and forest are in good or very good state. Respondents also state that the New Zealand environment is in a better condition than is the environment in other developed countries.

Figure 2 clearly indicates that New Zealanders rate highly the state of native land freshwater plants and animals, and native bush and forests. Those ratings can be compared to biophysical data and to rankings for New Zealand compared to other countries. In 2006 New Zealand had 2788 species that are considered threatened in some way, an increase of 416 over the 2002 count and approximately three percent of the estimated total number of New Zealand species.

New Zealand has 155 species on the IUCN Red Data List and is about 40th on that league table (IUCN). An international rating of New Zealand nature and biodiversity is provided by Esty et al. 2004 in a study of environmental sustainability. This study reports on 21 main indicators such as air quality, water quality, eco-efficiency (each calculated using several variables), and includes an indicator for biodiversity. While New Zealand rates and 14th overall, and scores highly compared to other nations on water quantity and quality, New Zealand is 146th amongst the 146 nations evaluated on biodiversity. The biodiversity measure is comprised of: percentage of a country’s territory in threatened ecoregions (New Zealand 67.34); threatened bird species as a
percentage of known breeding bird species in each country (New Zealand 42.00); threatened mammal species as percentage of known mammal species in each country (New Zealand 80.00); threatened amphibian species as percentage of known breeding amphibian species in each country (New Zealand 100.00); score between 0 and 1 with large values corresponding to high levels of species abundance and small values reflecting low levels of species abundance (New Zealand 0.52).

Native bush and forest covers 23% of the terrestrial land area of New Zealand, a massive reduction from an estimated 85% of the land area a millennia ago. OECD (2007) note that a net loss occurred of nearly 175 km² of indigenous habitat between 1996 and 2002. The state of native bush and forests and other habitats is very often degraded or under threat from introduced species including rats, possums, numerous invasive plant species. Considerable effort and expenditures on controlling these threats are clearly succeeding in some areas, but the state of our bush and forests is mixed and the public’s rating of their state seems sanguine.

The conclusion – New Zealand public have an overly complacent view of native bush and forests and do not recognise how threatened are New Zealand plant and animal species.

3. Information

“It is hard to imagine what a world of perfect information would be like.” Joseph Stiglitz (2002)

It is noticeable that the views of the New Zealand public on the state of the environment are closely correlated with biophysical data for many parts of the New Zealand environment. The most striking exception to this is the divergence between public perceptions and the state of native plant and animal species. For example, their understanding of the state of New Zealand lakes, rivers, streams and groundwater and the factors that cause low water quality in lowland rivers and lakes seem well grounded (Cullen et al., 2006). Given those generally well informed views, it’s worth asking why the New Zealand public has such a rosy view of the state of biodiversity?

Most of us have limited direct information available to us on the state of our environment and are dependent on secondary sources to enable us to form a view on such topics. We asked respondents to our 2006 survey about their sources of information and the reliability of those sources of information.

- ‘What are your main sources of environmental information?’ – respondents were asked to rank their top three sources.
- ‘How reliable are the following sources of environmental information?’

Figures 3 and 4 summarise their responses. Newspapers and television were the most important sources of environmental information for most people (Figure 3).

Reliability was assessed on a five-point Likert scale, anchored by very reliable (1) and very unreliable (5).
Figure 3. Main sources of environmental information. Source Hughey et al. 2006.

Figure 4. Reliability of environmental information sources: Source Hughey et al., 2006.
The ranked order of the average response from most to least reliable for seven information sources is shown in Table 1.

**Table 1. Ranking of reliability of information sources.**

<table>
<thead>
<tr>
<th>Information Source</th>
<th>Average Response</th>
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<tbody>
<tr>
<td>Scientists</td>
<td>1.83 = Most reliable</td>
</tr>
<tr>
<td>Government departments</td>
<td>2.23</td>
</tr>
<tr>
<td>Lobby groups</td>
<td>2.46</td>
</tr>
<tr>
<td>Inter-governmental organisations</td>
<td>2.51</td>
</tr>
<tr>
<td>Regional councils</td>
<td>2.52</td>
</tr>
<tr>
<td>The media</td>
<td>2.93</td>
</tr>
<tr>
<td>Businesses</td>
<td>3.38 = Least reliable</td>
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Scientific sources of information are seen as being very reliable, lobby groups are judged to be more reliable than regional councils and inter-governmental organisations, but business has an overall negative rating.

Does reliance on mass media for major source of information explain why the public are poorly informed on the state of New Zealand native plant and animal species? Mass media are unlikely to be the real culprits. More likely it is the absence of information on the overall state of New Zealand’s biodiversity, and trends in the state together with a continual supply of good news stories that delude the public. The OECD 2007 recently commented on this in their report on New Zealand environment.

*In the absence of data on ecosystem condition and trends, conservation objectives continue to be defined in terms of agency outputs rather than performance outcomes.* OECD, 2007, p.5.

Publicly available data on New Zealand ecosystem conditions and trends would be valuable to decision makers in the public sector and NGOs who focus on conservation of species and ecosystems. But, equally importantly, it would provide a more rigorous basis for the public to understand what the state of species and ecosystems is, to understand the scale of the conservation challenges faced and to assess progress towards conservation goals.

**4. Cost and expenditure information**

Setting achievable goals is a fundamental requirement for success in any endeavour. Achieving the goals chosen requires committing resources to deliver actions. Nature conservation is big business in New Zealand and in many other countries. Global expenditures on nature reserves are estimated to total US$6 billion annually. Those expenditures have been described as insufficient to adequately conserve nature. Additional expenditure of $16.6 billion per annum is estimated to be necessary to provide and maintain a broadly representative system of nature reserves (James et al., 1999). In New Zealand, only 2-3% of the total land administered by the Department of Conservation is in its intensively managed areas (Green and Clarkson 2005).

Given the magnitude of the nature conservation challenges faced in New Zealand, choice of goals needs to be based upon good understanding of the projected costs of achieving the goals. Information on the projected costs of conservation programmes would seem to be essential to gain sufficient funding as it provides funding agencies with a reasoned understanding of the level of commitment required. Applications for
funding that lack specific and detailed cost information can be more easily dismissed or underfunded, whereas applications that include such information must demand more serious attention. Cost estimates are also required for forecasting the effects of different policy goals, and for cost-effectiveness analyses. That type of information is crucial for efforts to achieve greater effectiveness and efficiency in use of conservation resources.

Surprisingly, expenditure data on nature conservation and cost estimates for public sector conservation projects are elusive in New Zealand. New Zealand is unusual in not requiring costs to be estimated for species recovery plans (reference). Threatened species recovery plans rarely include costing of the planned activities. The New Zealand Biodiversity Strategy explains the grave situation species face and the actions required to halt or reverse the decline in biodiversity, but does not provide projections of the cost of those actions. Reports from practitioners such as the New Zealand Conservation Management Group (2004) provide information on actions taken, changes in population size, but do not mention costs. It’s reasonable to ask why is cost not routinely estimated for biodiversity projects?

Some reasons for the absence of cost information include: it requires the use of further resources to assemble the information if it is not routinely available, it is subject to risk and uncertainty, and it can create expectations of funding that may not be available. A more basic reason may simply be that the importance of cost is not recognized by conservation managers or policy makers. Whatever the reasons, the absence of cost and expenditure data limits our ability to make informed decisions, is likely to lead to poor conservation decisions and less conservation progress than might be made with the resources available.

4.1 Opportunity costs and financial costs

Why should we be concerned about conservation cost effectiveness, surely we just get more money? University of Edinburgh seminar attendee, November 2000.

Conservation often requires making hard choices because the resources available are limited and the conservation challenges are immense. It seems sensible to consider the expected costs of the options before we make choices. In a world where there is limited ‘money’ available a decision to fund one species programme is likely to limit the resources available to conserve another species.

The selection of one particularly high cost species’ programme may limit the resources available to a number of low cost species programmes. This point is strikingly evident in the research of Emma Moran who obtained estimates of the cost of 11 single species programmes for 2003-2011 and of the expected expenditure on each of the species. ‘Cost’ in this research is defined as the amount of money required in order to accomplish a particular purpose (Brown, 1993: 521); ‘funding’ is the amount of money set aside for a particular purpose; and, ‘expenditure’ is the amount of money actually used for that purpose (Brown, 1993: 1042 and 886).

The Present Value (PV) of estimated total costs of the 11 single species programmes for 2003 - 2012 indicate the huge range in costs of management of species (Figure 5). The variations in the costs of programmes are striking: the PV of total costs for the ten year period covers a large range, from under $12,000 for the Stephens Island ground beetle program to over $9 million for the North Island kokako program. The large range in the PV of total costs means that the higher cost programs account for the majority of the costs of threatened species management over the timeframe: the six highest cost
programs account for 92 percent of the costs over all 11 programs. The variation in costs is also reflected in the difference between the median PV of total cost of just over $1.6 million and the average PV of total cost of around $3 million for the ten year period.

Figure 5. Present Value of estimated costs of NZ species programmes 2003-2012. Source, Moran et al.

Those projected costs can be compared with estimated expenditures on the 11 species over the same time period (Figure 6).
The data on estimated expenditures for each species were provided by their respective species’ manager. There are startling differences between species in their projected expenditure to cost ratio for 2003-2012.

In New Zealand, approximately 800 indigenous species are listed as acutely and chronically threatened. Despite annual expenditures of NZ $106.5 million on management of natural heritage, 92 percent of these species do not receive enough help and 77 percent have no programme specifically targeting their recovery (Department of Conservation, 2004). It is clear that there are very real opportunity costs flowing from decisions to allocate resources to conservation of any species. For ‘high cost’ species their opportunity cost may mean few or no resources are available for many ‘low cost’ species and a quickened pace towards critical status.

### 4.2 Total cost to recover a species

Present Value (PV) of costs over one decade do not tell the complete story about the magnitude of species recovery costs as the recovery rate of each species play a major role in determining PV of total recovery cost. Emma Moran has estimated for 11 species the PV of total recovery cost as shown in Figure 7.

![Figure 7. Projected total costs of single species from 2003-](image)

There are remarkable differences between species in their total recovery costs and the time it will take to move from the threatened species list. Information of this type is not readily available, hence quantifiable goal setting and monitoring against those goals is absent.
5. Evaluation of performance

When it comes to evaluating the success of its interventions, the field of ecosystem protection and biodiversity conservation lags behind most other policy fields. Ferraro and Pattanayak, 2006, 482.

It is disappointing that so little evaluation occurs of nature conservation activities. The failure to apply evaluation tools in nature conservation decision-making can result in errors in project selection, wasted use of scarce resources, and lower levels of conservation than may be achievable from the limited resources available.

Evaluation requires effort, and expenditure. Conservationists may wonder if the resources used for evaluation would be better used directly for conservation, but evaluation can lead to greater conservation outcomes. One example of the payoff from inclusion of economic factors in decision-making is provided by Ando et al., (1998) who demonstrate that when pursuing a target of providing habitat for 453 endangered species, consideration of both economic and ecologic factors, can achieve the target at one sixth of the cost if solely ecologic factors are considered.

Evaluation may sometimes seem dauntingly difficult, perhaps because it so rarely occurs in conservation or because relevant information is not readily available. A recent paper considered this problem and concluded ‘It was not possible to find an unbiased, objective metric for measuring effort put forth in recovery actions and to track relative success. At this time, in fact, many recovery management actions cannot be determined to be successful or unsuccessful’ (Abbitt & Scott 2001: 1281).

Economists argue that evaluation is both possible and essential.

If any progress is to be made in stemming the global decline of biodiversity, the field of conservation policy must adopt state-of-the-art program evaluation methods to determine what works and when. Ferraro and Pattanayak, 2006: 482.

State-of-the-art for Ferraro and Pattanayak (2007) requires comparison of actual outcomes fro intervention to a counterfactual provided from population viability analyses. That is a possible way to proceed but it requires significant analyst skill and time to complete PVA studies. Alternatives methods can be sought, and they need not be especially sophisticated or costly to improve on the current situation. The Millennium Ecosystem Assessment (2005, Policy Responses) includes the following comment... ‘Few well-designed empirical analyses assess even the most common biodiversity conservation measures.’

Evaluation of conservation projects is possible and I have worked with colleagues at developing and applying evaluation methods to conservation including Cost Effectiveness Analysis (CEA) and Cost Utility Analysis (CUA). The latter technique we have applied to single species and multi-species projects in New Zealand, Australia, Cameroon (Cullen et al. 2001, 2003, 2005) The CUA approach requires obtaining information from project managers on expenditure for each project over a specified time period, on the species threat classification status over the time period and on its counterfactual – what its threat classification status would have been in the absence of the project. The latter type of information may seem difficult to obtain but our experience has been that obtaining expenditure information is much more problematic in New Zealand. Our objective is to be able to measure the contribution of intervention
to improving species’ conservation status as measured by the numbers of COPY produced during the study period, and to calculate present value of expenditure per COPY. Table 2 illustrates results from evaluation of some New Zealand single species projects.

Table 2. Evaluation of single species programmes

<table>
<thead>
<tr>
<th>Species recovery programme</th>
<th>Present Value of Total Expenditure</th>
<th>PV Expenditure per COPY</th>
</tr>
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<tbody>
<tr>
<td>Brothers Island tuatara <em>Sphenodon guntheri</em></td>
<td>13 694</td>
<td>40 780</td>
</tr>
<tr>
<td>Cook Strait tuatara <em>Sphenodon punctatus</em></td>
<td>13 694</td>
<td>76 457</td>
</tr>
<tr>
<td>Campbell Island teal <em>Anas anas nesietis</em></td>
<td>39 940</td>
<td>103 178</td>
</tr>
<tr>
<td>Short tailed bat <em>Mystacina tuberculata</em></td>
<td>318 938</td>
<td>184 570</td>
</tr>
<tr>
<td>Yellow-eyed penguin <em>Megadyptes anipodes</em></td>
<td>603 013</td>
<td>305 344</td>
</tr>
<tr>
<td>Hector’s dolphin <em>Cephalorhynchus hectori</em></td>
<td>773 844</td>
<td>1 048 245</td>
</tr>
<tr>
<td>Black stilt <em>Himantopus novaezelandiae</em></td>
<td>2 441 822</td>
<td>1 077 724</td>
</tr>
<tr>
<td>Takahe <em>Porphyrio hochstetteri</em></td>
<td>3 278 178</td>
<td>2 327 560</td>
</tr>
</tbody>
</table>

Source: Cullen et al. 2001.

A 239 fold difference in costs of projects is impressive, and the 57 fold range in cost per COPY interesting. The results seem interesting and informative to us and we judge that this type of information could be useful to conservation decision makers.

The CUA approach that we have developed seems to offer a useful way to evaluate species conservation projects. It is practical to use as it makes modest demands for information collection, it has low cost to apply, and it has been adapted for use in other countries with differing threat classification systems. The CUA methodology is also being developed for application to ecosystem management (Hearnshaw et al. 2007).

There are several other evaluation methodologies used and proposed for conservation (Stephens et al, 200x; Ferraro and Pattanayak 2007; Hajkowicz 2007, Bandara and Tisdell 2005, Engerman et al. 2003) and we have reviewed the range of evaluation options (Hughey et al. 2002), but application of evaluation tools is as slow in New Zealand as it is elsewhere. Green and Clarkson (2005) provide a review of the first five years of the New Zealand Biodiversity Strategy, and comment that progress has been made since 2000 in ‘turning the tide’. However, they note that goal setting, monitoring and evaluation are areas where much more effort is required.

‘Linked to the overdue need to complete and implement a comprehensive system of environmental indicators and environmental performance standards is the importance of developing monitoring and reporting systems. ... The importance of monitoring and reporting systems has been obscured by one important shortcoming in the strategy - the very few time-linked and quantifiable targets that are set against which to measure progress.’ (Green and Clarkson 2005, 3)
These are timely comments and it is important that they are noted and acted upon if we are to make real, measured progress in biodiversity management.

6. An information-rich conserv-vision

This conference provides an opportunity to look forwards to consider what might be possible during the next 50 years. The current challenges are very large but trends such as accelerating climate change, continuing arrival of invasive species and escape of exotics, suggest the challenges will continue to increase. Meeting those challenges will require sustained commitment of resources over the next fifty years. There is no evidence of weakening of taxpayer willingness to fund conservation, but current support seems at least partly to be based upon public misunderstanding of the true state of New Zealand biodiversity. Maintaining public support for nature conservation might best be achieved if the public continue to have confidence that realistic goals are being pursued, resources are being used effectively, and real progress is being achieved.

My conserv-vision is that the following will become standard practice in the next five years.

- Conservation programme outcomes and their counterfactuals are projected.
- Conservation programmes are costed before decisions are taken.
- Quantifiable, time-linked conservation goals are chosen.
- Timely monitoring and reporting of conservation programme outcomes and costs.
- Evaluation of conservation programmes including comparison to counterfactuals.

Adoption of these practises will take us quite a way to overcoming the information deficits that decision makers and the public have too readily accepted. If the insights of Emma Moran, Amy Ando and others lead to smarter use of resources than occurs at present we may have considerably better conservation outcomes by 2050 than present trends suggest are likely.
References


