INFFER: Investment Framework For Environmental Resources

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Abstract

Publicly funded environmental organizations use a variety of methods and approaches to develop and prioritize projects. Often these processes are not comprehensive, in the sense of considering all relevant information, and project ranking procedures are often inconsistent with well-established economic theory. Typically, organizations have difficulty comparing the relative merits of projects for different types of environmental assets, of different funding scales or of different time scales. Often, the choice of policy mechanism or delivery mechanism is somewhat arbitrary, and not necessarily the most effective. The Investment Framework For Environmental Resources (INFFER) was developed as a theoretically rigorous but simple and practical tool to address these issues. It focuses on achieving the most valuable environmental outcomes for the available budget. It is relevant to projects where the aim is to protect or enhance specific identified natural assets. It is designed to be comprehensive in its requirements for information and treatment of alternative policy mechanisms, and yet be as simple as possible to use. Through a structured and guided process, users collect and integrate information including: a specific and measurable goal for the asset(s), on-ground actions or management changes that will achieve the goal, behavioural responses by private individuals affected by the project, various risks to the success of the project, costs of the project, and important information gaps. The information is used in a framework that guides the selection of policy mechanisms, and the calculation of a Benefit: Cost Index to assist in the comparison of alternative projects. INFFER is has been used or trialled by 19 regional natural resource management bodies in four Australian states, and has influenced policy makers at state and national levels. Examples of outcomes from the use of INFFER are described. The principles underpinning INFFER are broadly applicable, so the framework is expected to be valuable in other institutional and bio-physical environments.

Keywords: economics, environment, natural resource management, integrated assessment, policy, decision support

Introduction

In recent decades in developed countries, there has been a substantial growth in the number and scale of policy programs intended to mitigate environmental degradation and protect natural resources. Examples include the Conservation Reserve Program, the Environmental Quality Incentive Reserve Program, and the Conservation Security Program in the United States of America; the Rural Development Regulation in the European Union; the National Farm Stewardship Program in Canada; and the Natural Heritage Trust in Australia.

Many tools, models and frameworks have been developed to assist with the spatial targeting and prioritisation of environmental investments. They include Conservation Action Planning (http://conserveonline.org/workspaces/cbdgateway/cap/index.html [accessed 13 January 2010]),
ATS (Hajkowicz and McDonald, 2006), MULBO (Meyer and Grabaum, 2008), and studies by Antle and Valdivia (2006), Ferraro (2004), Khanna et al. (2003), Watanabe et al. (2006), Wilson et al. (2007), Yang et al. (2005), amongst many others. There also exist many papers and reports concerning the selection of policy mechanisms for environmental programs (e.g., Aidt and Dutta, 2004; Bruneau, 2004; Hodge, 2000; Jensen and Vestergaard, 2003; Richards, 2000; Weitzman, 2002).

This paper describes a new framework, the Investment Framework For Environmental Resources (INFFER), that has been developed to fill a gap in the suite of existing tools. In particular we required a framework with the following combination of characteristics:

(a). It considers both the selection of policy mechanisms and project prioritization in an integrated way.

(b). In prioritising projects, it uses a comprehensive set of relevant information. Many existing tools and analyses are not comprehensive in this sense. For example, they may include biophysical scientific considerations, but omit important social or economic considerations (e.g., reviews by Brooks et al. (2006) and Redford et al. (2003) show that economics is usually omitted from analyses for conservation prioritisation).

(c). In providing guidance on policy mechanism choice, it considers a comprehensive set of possible mechanisms. Many existing papers and reports consider only a subset of the relevant mechanisms. For example, they may focus on incentive-based mechanisms, but exclude extension or technology development (e.g., Aidt and Dutta, 2004; Bruneau, 2004).

(d). It can be applied to different types of environmental assets. Many existing tools are focused only on a particular type of asset, such as water resources (e.g., AusRivas - see http://ausrivas.canberra.edu.au/index.html [accessed 13 January 2010], Newham et al., 2004) or biodiversity (e.g., Wilson et al., 2007).

(e). It is able to compare the cost effectiveness of projects across different types of environmental assets and projects of different spatial and temporal scales.

(f). It supports the development of projects that are internally consistent, meaning that the project activities are consistent with the project goal and the project budget.

(g). It is as easy to use as possible, while still meeting the above requirements. The intent is that it be usable by environmental managers who are not specialists in modeling, economics or technical analysis. Many existing tools have high requirements for technical expertise from their users. Ease of use is an essential feature to promote widespread use of such a tool (Pannell and Roberts, 2009).

In our Australian context, the development of INFFER was motivated by concerns about existing national environmental programs, particularly the National Action Plan for Salinity and Water Quality (NAP - www.napswq.gov.au [accessed 13 January 2010]), and the Natural Heritage Trust (NHT - www.nht.gov.au [accessed 13 January 2010]). In common with many programs internationally, the budgets for these programs were small relative to the scales of the problems they were intended to address. This, combined with spatial heterogeneity in the occurrence and severity of those problems (McPeak, 2003; Brooks et al., 2006), meant that targeting of investments to well-chosen high-priority areas and issues was required for the programs to operate cost effectively (a similar point having been noted in the European context by the European Court of Auditors, 2006, and argued more generally by Polasky, 2008). Unfortunately, the quality of targeting and prioritisation in the programs was low, with inadequate use of technical information, inadequate use of socio-economic information, poor integration of information for decision making, and poor selection of policy mechanisms (Auditor General, 2004, 2008; Chartres et al., 2004; Hajkowicz, 2008; Pannell and Roberts, 2010; Parliament of the Commonwealth of Australia, 2004; The Senate, 2006; Sinclair Knight Merz, 2006). This partly reflected that responsibility for some decision making was devolved to local bodies that lacked capacity for technical analysis and integrated planning (e.g. see Seymour et al., 2008), but even at state and national government levels we perceived a need for better decision making and prioritisation.

The paper proceeds as follows. The next section outlines the origins and development of
INFFER. This is followed by a detailed description of the framework, and then by an overview of its current application in Australia, including examples of project assessments. We outline a number of benefits and challenges that have emerged, before discussing future directions for the framework, and drawing conclusions from the project.

Origins and development of INFFER

INFFER had its origins in the Salinity Investment Framework III (SIF3), which was specifically focused on the problem of dryland salinity (Ridley and Pannell, 2005; Roberts and Pannell, 2009). Salinity was the subject of a major national program, the NAP, from 2001 to 2008. Perceived weaknesses in the investment decisions of that program were a key reason for the development of a salinity-specific framework (Pannell, 2001; Pannell and Roberts, 2010).

SIF3 was successfully piloted with two regional natural resource management (NRM) bodies, the North Central Catchment Management Authority in Victoria and the South Coast Natural Resource Management in Western Australia (Pannell et al., 2008; Roberts and Pannell, 2009) and had some influence on thinking about national and state government policy for natural resource management (Pannell and Roberts, 2009). The regional NRM bodies that we worked with were very positive about SIF3, but requested that we develop a broader framework, suitable for use with a wide range of environmental threats.

A preliminary version of INFFER was completed in early 2008. It was immediately put into effect by the North Central Catchment Management Authority. We participated in and observed their use of the framework. Our observations and their feedback led to a large number of improvements. Over time, more users adopted or trialled the framework (see below) and we continued to adapt and improve it in response to feedback.

The development and subsequent adoption of INFFER has been assisted by a number of important characteristics of the project. It has been an inter-disciplinary project, involving economic, social, biological and physical sciences. Team members have been from different disciplines, from different organizations in different sectors (university and government) and in different states (Western Australia and Victoria), with strong networks in research, extension, policy and on-ground environmental management. There has been a strong focus on communication and participation throughout, including extensive engagement with environmental managers and environmental policy makers.

Description of INFFER

In the introduction we described the required general characteristics of the framework (combines asset prioritisation with policy mechanism choice; uses a comprehensive set of relevant criteria; considers a comprehensive set of policy mechanisms; applies to different types of environmental assets and different spatial and temporal scales; assesses cost-effectiveness of intervention; easy to use). The identification of these characteristics was strongly based on our experience in collaborating with regional NRM bodies in piloting SIF3. The matter of ease of use was particularly important (Roberts and Pannell, 2009), as reinforced by the observation that, internationally, there is low usage of many decision tools intended to support decisions about environmental investment.

Related to this, through working with users, we sought to understand the contexts within which the framework would be used, and adapted it accordingly. For example, it needed to be able to draw in and integrate detailed technical information, or simpler information based on local knowledge or expert opinion if this was the best available. As well as technical and economic information, preferences of the community were important to users, and the process needed to be able to encompass a process of community consultation. It needed to be highly structured and guided, and to be actively supported by training and an accessible support service. The process also needed to recognize the constraints of time and resources available for analysis of priorities, such that it was not realistic or efficient to conduct detailed assessments for every possible investment opportunity. Rather the INFFER process starts with simple assessment of a long list of environmental assets, and becomes more detailed as the list is winnowed down to the most attractive options.

INFFER is intended to be used for investment in projects that have a clear focus on protecting or enhancing specific natural resource assets. It is not intended for assessment of projects with a
focus on general education, awareness raising, capacity building or research that is untargeted to specific assets. However, these types of actions can be included in projects that aim to protect or enhance particular assets, and indeed may be crucial components of these projects.

Characteristics of project plans developed for environmental investment

Plans developed using INFFER have the following characteristics:

• They make transparent all of the assumptions and data used to assess the project.

• They are based around specified environmental and natural-resource assets.

• They are focused on, and assessed in relation to, the achievement of ultimate outcomes for those assets (such as improvement in their condition) rather than on activities or outputs.

• They include a goal for each environmental asset that is “SMART” (specific, measurable, achievable, relevant and time-bound).

• They are internally consistent: the on-ground actions specified would achieve the goal; the policy mechanisms and delivery mechanisms specified would result in the required on-ground actions; and the costs specified are consistent with the policy and delivery mechanisms.

Structuring the process around specific assets assists users to maintain a focus on the achievement of environmental outcomes.

Process

The project web site, www.inffer.org, describes the INFFER process in greater detail (as well as providing materials about other aspects of the Framework discussed below). INFFER can be used for development and assessment of individual projects, or it can be used to select the highest priorities from a long list of potential projects. In the latter case, the process proceeds as follows:

Step 1: A list of significant natural assets that are candidates for investment is prepared. These assets can be drawn from existing documents or lists, from community workshops, from relevant experts, or from analytical processes, such as systematic conservation planning. At the regional level, the list commonly includes 100 to 300 significant assets.

Step 2: Using a simplified set of criteria, the list of significant assets is filtered down to around 20-40 assets. Our suggested approach (which most regions to date have used) is to identify assets of high significance, with high current or predicted future damage, or the set of criteria can be tailored by the organisation implementing INFFER to cater for their preferences or needs. Then the filtered list is further reduced using a “Pre-assessment Checklist”. Assets may be culled at this point because they are not spatially explicit, because a specific, measurable time-bound goal cannot be formulated, or because an initial assessment indicates that the project would not be cost-effective.

Step 3: Using the INFFER Project Assessment Form, develop an internally consistent project for each asset on the reduced list. This process draws together readily available information, consisting of desktop review of publications and reports, and consultation with the community and with relevant experts. Information required at step 3 includes: asset significance, threats, project goal, works and actions, time lags, effectiveness of works, private adoption of actions, delivery mechanisms and costs. Using this information, apply the Public: Private Benefits Framework to help select policy mechanisms, and calculate a Benefit: Cost Index to be used in project ranking. The output from step 3 is a Project Assessment Report which includes: the Benefit: Cost Index, risk factors (practice change, technical feasibility, socio-politics, long-term funding), spin-offs, quality of information and key information gaps.

Step 4: Select a short list of priority assets/projects based on the information in the Project Assessment Report and other relevant considerations.
Step 5: Develop investment plans or proposals for external funding (depending on whether INFFER is being used to allocate an internal budget or to develop and assess projects for external funding).

Step 6: Implement those projects that receive funding. In many cases, the first stage of a project should consist of a detailed feasibility investment, involving targeted collection of additional information to strengthen the assessment done in step 3.

Step 7: Monitor, evaluate and adaptively manage projects. After feasibility assessment, and at regular intervals thereafter (say every two years), the data in the original Project Assessment Form for each funded project should be updated to reflect lessons learned, progress towards outcomes, and any new data or analysis that has become available. At this point, managers should consider whether the original design of the project is still suitable, and whether the project should remain a priority.

Information requirements

Information required to complete the Project Assessment Form for an asset is as follows:

• An assessment of the natural asset’s overall significance, importance, utility or value;

• The main threatening processes that are reducing, or may reduce, the asset’s significance or value;

• A goal for the asset that is “SMART”;

• The on-ground works or changes in management that are required to achieve the goal;

• The predicted effectiveness of those works, represented as the predicted difference in asset value with and without the works and management changes;

• The likely time lag until a current intervention would generate a substantial part of its benefits. The lag could be because the biological or physical response to an intervention takes time, or because the intervention is preventing damage that would not have occurred until some time in the future;

• Various risks: of technical failure, of landholders adopting adverse practices despite efforts to prevent this, other socio-political risks, and risks of not obtaining required long-term funding beyond the current project;

• Potential positive and negative spin-offs effects from the works or management changes;

• The adoptability of the proposed works or management changes by relevant land or water managers, including the likely extent of adoption under different policy scenarios;

• Legal approvals required;

• A set of actions or interventions to be undertaken by the environmental management body to lead to the adoption of the proposed works or management changes by relevant land or water managers. This may include mechanisms such as stewardship payments, conservation tenders, regulation, education, training, awareness raising, research and development, or direct implementation of works;

• Costs of the project, and the need for ongoing costs beyond the current project; and

• Key knowledge gaps in each area.

The Project Assessment Form is available at www.inffer.org. The approach adopted is designed to be comprehensive in the inclusion of categories of information that are relevant to the prioritisation decision, but to use a simple approach within each category, at least within the desktop phase of the process (step 3 above). For example, the impact of each major threatening
process is represented as one of four categories: low (0 to 25% loss of asset value), medium (26 to 50%), high (51 to 75%) or very high (76 to 100%). Similarly, the time lag until the majority of benefits from the current project is represented as 0-10 years, 11 to 30 years, 31 to 50 years, or more than 50 years.

There are several reasons for using this simple approach. We recognize that very precise information will be unavailable for many of the categories of information, particularly at the desktop assessment stage. Given that the program budget is relatively small (compared to the level that would be required to manage the problems comprehensively), a precise ranking of investment is unnecessary. Rather, we seek a short list of potentially outstanding projects. The simpler approach is easier for users. This is important – even with the simplified approach, a number of users find the task difficult. Pannell (2009b) shows that small to moderate errors in the data used to rank projects are likely to have only a small negative impacts on the overall net benefits from the program’s investment. And finally, if the project is selected for funding, our recommended approach is to commence the project with a more comprehensive feasibility assessment, including field work, modeling and community consultation, where needed, so any errors introduced by the simple approach used at this earlier stage can be corrected.

Notwithstanding the simplifications in this approach, it is important that all of the requested information is provided. Some users are tempted to omit elements that they find difficult to complete, but Pannell (2009b) shows that omitting important variables from the metric used to rank projects is likely to have a large negative impact on the overall net benefits from the program’s investment.

Public: private benefits framework

Where the proposed project involves changes in behaviour of private individuals (e.g. changes in land use by farmers), INFFER employs the Public: Private Benefits Framework of Pannell (2008, 2009a) to provide guidance about the choice of policy mechanisms. We consider this a very important element of INFFER as previous national programs have often involved poor choices of policy mechanisms.

The Public: Private Benefits Framework establishes current land management as a benchmark, and examines the public (or external) and private (or internal) net benefits of changes sought by a project. Depending on the levels of these benefits, and on the basis of a set of principles and assumptions, it recommends a policy mechanism that will be most cost-effective for a particular project. Options are positive incentives, negative incentives, extension, technology change and no action. These categories include a range of more specific mechanism options, as described by Pannell (2008, 2009a).

Figure 1 illustrates the version of the Framework that is used within INFFER, based on an assumption that any investment should generate a benefit: cost ratio of at least 2. The INFFER Instruction Manual provides detailed guidance on how to use the information collected on the Project Assessment Form to locate a project within the graph shown in Figure 1.
Figure 1. Public: Private Benefits Framework as used in INFFER (source: Pannell, 2009).

Cost-effectiveness index

To assist with the prioritisation of projects, a Benefit: Cost Index (BCI) is calculated as follows.

\[
\text{BCI} = \frac{V \times W \times F \times A \times B \times P \times G \times DF_B(L) \times 20}{C + PV(M)}
\]

where

- \(V\) = significance (or value) of the asset (score out of 100, or non-market valuation)
- \(W\) = multiplier for proportional impact of works on asset value
- \(F\) = multiplier for technical feasibility risk (probability that the project will not fail due to problems with technical feasibility)
- \(A\) = multiplier for adoption of changed management by private landholders (proportion of adoption level required to achieve goal)
- \(B\) = multiplier for risk of adoption of adverse practices (probability that the project will not fail due to adverse adoption)
- \(P\) = probability that socio-political factors will not derail the project, and that required changes will occur in other institutions
- \(G\) = probability that essential funding subsequent to this project will be forthcoming (e.g. this project may be the first phase in a longer project, or ongoing payments to landholder may be needed to retain the benefits generated by this project).
- \(DF_B\) = discount factor for benefits (proportion), depending on \(L\)
- \(L\) = time lag until the majority of anticipated benefits from the project occur (years)
- \(C\) = short-term cost of current project ($ million in total, over the three-to-five-year life of project)
- \(PV\) = present value function to convert future costs and benefits to equivalent present-day values
\[ M = \text{annual cost of maintaining outcomes (}$\text{million per year, beyond the immediate project).}\]

A feature of the BCI is that it allows cost effectiveness to be compared across projects of different scales (spatial, temporal or budgetary) and across different types of natural resource assets (e.g. rivers, wetlands, threatened species, agricultural soils). A higher BCI is preferred, irrespective of project scale or asset type.

The above parameters are quantified using information collected using the Project Assessment Form. Detailed guidance is provided to users regarding the specification of the above parameter values. To simplify the process, a number of specific assumptions are made, including that the real discount rate is 5%, and that maintenance costs are borne for 20 years beyond the end of the current project. These assumptions could be varied if necessary.

The Benefit: Cost Index is closely related to a Benefit:Cost Ratio, a tool routinely used by economists (e.g. Mishan and Quah, 2007). Indeed, if a valuation study is conducted to provide an equivalent dollar value for the asset in good condition, then the Benefit: Cost Index in fact provides a Benefit:Cost Ratio for the project. In working with regional NRM bodies, our preferred approach (for reasons of simplicity and user acceptance) is to score the value of the asset relative to an arbitrarily selected reference environmental asset (an asset of high national significance). The reference asset has a V score of 100, and other assets are scored relative to that, with guidance provided in the Instruction Manual. This score incorporates both market and non-market aspects of the asset.

Using this latter approach, the resulting BCI value does not have a simple interpretation – it is measured relative to the reference asset. However, this is sufficient to allow useful comparisons or rankings of projects. If it is assumed that the total value of the reference asset which is $2 billion, then the BCI value required for a project to break even is 1.0.

Appreciating that factors beyond a straightforward rational approach to decision making are often relevant to environmental decision makers (Kørnøv and Thissen, 2000; Wood and Becker, 2005), we warn users against the mechanistic application of the BCI. As noted earlier, it is not intended that projects will be ranked precisely. The BCI should be treated as an important input to the prioritisation decision, but not used prescriptively.

The BCI is structured in a particular way to address cost effectiveness. This distinguishes INFFER from a Multi-Criteria Analysis approach (e.g. Hajkowicz and McDonald, 2006), in which criteria are usually combined linearly, and so cannot accurately quantify cost effectiveness. Pannell (2009b) shows that this is important, as poor project assessment metrics can greatly reduce the benefits of public investment in projects.

**Handling uncertainty**

Knowledge gaps and uncertainty are common in environmental investment analysis. INFFER deals with them in several ways.

The Project Assessment Form asks users to note key knowledge gaps in each area of the form. The quality of information in each section of the Form is also elicited and reported to decision makers. If knowledge gaps mean that a sound decision cannot be made, the process leads users towards either investing in additional research, or reducing the priority of investment in works.

The process results in specific requirements for information being recognized, allowing research effort to be targeted to issues that have a greater potential to contribute to decision making. It provides a vehicle for research results to be used appropriately.

Although INFFER step 3 involves collation and integration of the best available existing information, we recommend that funded projects should often commence with a feasibility phase, in which additional field work, technical analysis or consultation is done if necessary.

Key risks are handled explicitly as probabilities. For example, the Form asks users to specify the probability that the project will fail due to problems with technical feasibility, socio-political issues, or lack of future funding. It also requires information for risks related to adoption of new practices.
Training and support

The philosophy behind INFFER training and support is to empower users to be able to complete INFFER analyses themselves. We have found this to be an extremely important aspect of the project, especially given the low existing capacities of many regional NRM bodies in relation to rigorous planning and prioritisation processes (Seymour et al., 2008). The project team currently includes 1.4 full-time-equivalent staff responsible for training and supporting users of INFFER (with additional input from the project leaders, Pannell and Roberts). Their activities include running training workshops with potential users, existing users and decision makers within their organizations; being proactive in contacting users to provide support; providing feedback on draft Project Assessment Forms; and providing a telephone help-desk service to users. We have noted a very strong correlation between the extent to which users access these support services and the quality of the project assessments that they perform. There is detailed documentation of INFFER on the project web site, including an extensive page of frequently asked questions and specialists have prepared materials to be used for accredited training of INFFER users. Nevertheless, our experience has been that no matter how good our written support materials are, many users require interactive support. This observation is consistent with reviews of rational approaches to environmental decision making (Kørnøv and Thissen, 2000; Wood and Becker, 2005), which have concluded that cognitive limitations often contribute to decision makers deviating from the rational path. In our discussions with policy organizations about the implications of adopting INFFER, we emphasise the importance of the provision of training and support to users.

Applications of INFFER

There are 56 regional NRM bodies in Australia (http://www.nrm.gov.au/nrm/region.html [accessed 15 January 2010]). Of these, 19 regions in four states have used or trialled INFFER (as of January 2010): all six regional bodies in the state of Western Australia, seven of the 10 bodies in Victoria, five of 13 bodies in New South Wales and one of the 14 bodies in Queensland. Most of these regional bodies have trialled its use with a limited number of natural resource assets. Two have chosen to fully adopt INFFER, using it to guide their overall planning and prioritisation processes.

To illustrate the impacts of using INFFER for one regional natural resource management body, Table 1 records the effects of INFFER analysis on investment decisions for five environmental assets in the North Central region of Victoria. Table 2 shows the parameter values obtained from the Projects Assessment Forms completed for these assets, and the corresponding BCIs, which influenced the changes noted in Table 1.

Table 1. Impact of INFFER on investment decisions by the North Central Catchment Management Authority, Victoria, Australia, for selected high-value assets.

<table>
<thead>
<tr>
<th>Asset name</th>
<th>Investment prior to INFFER</th>
<th>Investment change due to INFFER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoca river reach 7</td>
<td>The project was funded solely from the North Central River Health program which focused on river bed and bank protection and remediation through fencing, revegetation and payments to farmers to install off-stream watering for livestock. Works were targeted at sites where landholders were interested in participating.</td>
<td>INFFER highlighted a lack of evidence to support a narrow focus on the river bed and banks. The project had a relatively low Benefit: Cost Index, reinforcing the need for more detailed analysis prior to investment. Research was initiated to strategically identify the major sources of sediment and nutrient inputs into the Avoca river.</td>
</tr>
<tr>
<td>York Plains wetlands</td>
<td>The project was funded from the North Central dryland program and was solely focused on salinity mitigation for the wetlands. A number of studies were commission to document the value (cultural, flora and fauna studies)</td>
<td>The focus changed from only targeting salinity to better including protection of biodiversity value. This included obtaining funding to implement enduring land use change mechanisms and funding for riparian and vegetation</td>
</tr>
</tbody>
</table>

Table 2. Parameter values obtained from the Projects Assessment Forms completed for selected assets, and the corresponding BCIs, which influenced the changes noted in Table 1.
and investigate the threats (water quality modelling) facing this asset. restoration plus cultural heritage protection.

Eleven Nationally endangered orchids

Maintenance funding was allocated on an annual basis across a range of threatened species of which these were only a segment. The available funding was then allocated on a proportional basis across all species without regard for the level of investment required to improve species conservation status.

INFER identified actual investment required for improving conservation outcomes for the 11 species. This larger level of funding has been allocated over a three year investment cycle.

Loddon river reaches 1-8

The project is one of 10 five-year large scale river restoration projects that were identified through a state initiative. The project’s major focus is on ground work for riparian bed and bank protection to maximise river health outcomes for investment.

The project is still funded under the same funding initiative. There was no change in investment as a result of INFER but the environmental managers have increased confidence that the project is cost-effective.

Brush- tailed phascogale

This project was developed for the 2009/10 Investment Plan and was unfunded prior to INFER. INFER was used as the key tool for project scoping and development.

The project was successful in obtaining $1.4 million over 3 years following application of INFER. INFER was fundamental in underpinning assessment of technical feasibility and likely adoption of changed land management practices.

Table 2: Underpinning parameters for INFER analysis conducted on assets in North Central Victoria. (See the Benefit: Cost Index section for explanations of the variables.)

<table>
<thead>
<tr>
<th>Asset name</th>
<th>V</th>
<th>W</th>
<th>F</th>
<th>A</th>
<th>B</th>
<th>P</th>
<th>G</th>
<th>L</th>
<th>C</th>
<th>M</th>
<th>BCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avoca river reach 7</td>
<td>6</td>
<td>0.25</td>
<td>0.88</td>
<td>0.7</td>
<td>1</td>
<td>0.98</td>
<td>0.5</td>
<td>15</td>
<td>1.56</td>
<td>0.1</td>
<td>1.7</td>
</tr>
<tr>
<td>York Plains wetlands</td>
<td>7</td>
<td>0.5</td>
<td>0.88</td>
<td>1</td>
<td>1</td>
<td>0.98</td>
<td>0.5</td>
<td>7</td>
<td>3.8</td>
<td>0.1</td>
<td>4.4</td>
</tr>
<tr>
<td>Eleven Nationally endangered orchids</td>
<td>5</td>
<td>0.5</td>
<td>0.93</td>
<td>1</td>
<td>1</td>
<td>0.85</td>
<td>0.5</td>
<td>5</td>
<td>0.42</td>
<td>0.043</td>
<td>17.6</td>
</tr>
<tr>
<td>Loddon river reaches 1-8</td>
<td>10</td>
<td>0.25</td>
<td>0.93</td>
<td>0.7</td>
<td>1</td>
<td>0.85</td>
<td>0.9</td>
<td>20</td>
<td>3.0</td>
<td>0.1</td>
<td>2.2</td>
</tr>
<tr>
<td>Brush- tailed phascogale</td>
<td>3</td>
<td>0.5</td>
<td>0.88</td>
<td>1</td>
<td>1</td>
<td>0.85</td>
<td>0.5</td>
<td>10</td>
<td>2.0</td>
<td>0.05</td>
<td>2.9</td>
</tr>
</tbody>
</table>

Policy impacts

At the state government level, there has been strong interest in the two states where we have had the strongest engagement and where policy direction was already towards an asset-based approach to environmental management (Western Australia and Victoria) and growing interest in two others (New South Wales and South Australia). The most significant policy outcome has been in Victoria where the state government has recently decided to embed INFER within state environmental investment decision processes.

*INFER will be utilised for the next five years or until an alternative is developed.

Actions

3.3.3 Utilise INFER and further develop other decision support tools for applying asset-based approaches to planning and investment for flagship areas and biolinks by the 2011/12 Victorian Investment Framework round.

3.3.4 Provide training and support in the application of INFER and other decision support tools by 2011* (Department of Sustainability and Environment, 2009).
The Australian Government has been extensively briefed about INFFER, and has given several positive signals about it. In a submission to a Senate Inquiry into Natural Resource management, the relevant government agencies (the Department of Agriculture, Fisheries and Forestry and the Department of the Environment, Water, Heritage and the Arts) wrote that:

“The departments are drawing on tools such as the Investment Framework for Environmental Resources (INFFER) to give maximum rigour and accountability to Caring for our Country funding decisions. ... The departments will be incorporating the key principles and processes from such tools into the development of outcomes, draft targets and the business plan and these should flow through to the assessment and funding recommendations. ... It is also proposed to incorporate a number of elements from INFFER and other ‘evidence-based’ decision making tools in the assessment of Caring for our Country funding proposals.” (Anonymous, 2008c, p. 15).

INFFER was the only planning tool recommended to applicants for government funding in the 2008-09 round of competitive funding under Caring for our Country (the main national NRM program).

Challenges in using INFFER

Although we have sought to make INFFER as simple as possible, users who have been used to much simpler and more partial planning approaches have needed a high level of training and support. Given the neglect of cost-effectiveness as a consideration in environmental planning and prioritisation in Australian NRM programs for decades, we have found that acceptance of INFFER requires more than training in its mechanics. It requires support for a change in mindset, and in some cases even a change in organizational culture. Users need to be persuaded that it is worthwhile investing the time and effort into a more comprehensive assessment.

Particular aspects which have caused difficulty for some users include: the specification of a “SMART” goal for the project; the specification of on-ground actions and management changes in sufficient detail to be able to judge whether they would achieve the goal and to be used to estimate costs of the project; and judgments about the likely adoption of those actions and management changes with or without policy mechanisms. Because INFFER focuses on the internal consistency of the information provided, some users have found that they needed to revise their responses in early parts of the Form after responding to later sections. For example, they may find that they have specified on-ground actions that are not sufficiently attractive to landholders to be adopted. Some users have reported that they initially find this circular process frustrating, although the difficulties decline with experience, and overall the focus on internal consistency is a strength of the Framework.

Perhaps due to the emphasis on community engagement in past Australian NRM programs, some users wish to define “the community” as one of their NRM assets. It can be difficult to convince some individuals that, while the community is central to the INFFER process and project implementation, it is illogical to treat it in the same sense as a wetland or river. We highlight three roles for the community in the process: to express values and preferences for different NRM assets, to provide local knowledge about assets and their management, and to help deliver works and management changes required to protect or enhance the asset. These are all incorporated in INFFER, without treating the community as being equivalent to a natural asset.

We find that certain types of information are consistently lacking. This is particularly true of information about the impacts of particular management actions on environmental outcomes, and the behavioural responses of individuals to specific policy mechanisms. Concerns about the level and quality of information linking actions to outcomes have been expressed by other authors in Australia (e.g., Hajkowicz and McDonald, 2006, Hajkowicz, 2008) and internationally (e.g. Falconer and Saunders, 2002; Weinberg and Claassen, 2006).

For a some users, the challenges appear to have been too great. Some have been unable or unwilling to devote the time required to complete Project Assessment Forms to a good standard. In Victoria, at least, now that the state government has decided to embed INFFER within its decision process, we expect this reticence to reduce substantially. Our experience is that, in most cases, assessment of each asset takes two to five person days of work by experienced people,
but it can be as little as one day or as much as 10 days. We consider this level of effort to be a reasonable level of due diligence to be undertaken by bodies that are applying for large amounts of public funding, but some individuals who are used to receiving funds with much less work are not yet convinced. Nevertheless, there is a movement amongst Australian governments (state and national) to require investment proposals to be well considered, evidence-based and will achieve target outcomes, so we expect that there will be increasing pressure on regional NRM bodies to improve their decision making processes.

Where final funding decisions are made externally from the bodies which are applying INFFER, an issue is to ensure that all assessments are conducted to an acceptable standard. We have found that regional NRM bodies are concerned that assessments conducted by other bodies with which they have to compete for funding should be subject to review and quality assurance. This is clearly an issue that is not specific to INFFER, but for some bodies their use of INFFER seems to have brought the issue to the surface.

There are many other tools available that can make a contribution to planning and prioritisation of environmental and natural resource investments. We have sometimes faced confusion among potential users about what different tools provide, and some incorrect perceptions that other tools were similar to or in competition with INFFER. In many such cases, we find that the other tools in question can often be used in a complementary way with INFFER (e.g. by providing information to help complete the INFFER Project Assessment Form) but we have yet to find another tool that would replace INFFER, in the sense that it satisfies all of the criteria specified in the introduction of this paper. In a number of cases, we have worked with the developers of other tools to prepare brief papers outlining the relationship between the tools.

In the application of INFFER by regional NRM bodies, they have often been led toward substantial changes in their investment priorities. Given the neglect of a number of crucial issues in their past approaches to prioritisation, this is not surprising, but it does potentially raise political risks. We recognize that INFFER may recommend investments that conflict with existing political preferences, as indeed any rigorous assessment process may do. Changes in investment patterns may generate resistance from existing beneficiaries, be they land managers or government officers. Perhaps of most concern has been reticence by some government officials who expressed reservations about adopting INFFER because it would reveal the poor quality of previous investment decisions.

Future directions

The existing INFFER framework, documentation and training materials will continue to be revised and improved in response to experience and feedback from users. In the medium term, we aim to provide more specific guidance on the merits of different forms of environmental investment, based on the results of current modeling and research being supported by the project. This might take a form similar to the SIF3 framework (Ridley and Pannell, 2005), in which scientific and modeling results are embedded within the decision framework, or it might lead to separate documents or decision tools that would guide users of INFFER.

We are hoping for adoption of INFFER by additional regional natural resource management bodies and by governments. Uptake in Victoria is likely to be strongest in the short term and will require state government support for training and on-going support. Whilst we hope to see INFFER formally embedded in the institutional arrangements of other governments, we recognise that this is likely to take time.

There is large potential for INFFER to be used within the Australian Government’s Caring for Our Country’ program and this appears to be a motivation for regions outside Victoria to adopt INFFER. We will continue to work with the Australian Government to encourage and support their further use of INFFER.

The principles that underpin INFFER are general, so the tool should be relevant to any country where the government invests public funds in protection of natural assets. The strongest interest to date has come from Canada, and we look forward to building on initial discussions with potential collaborators in Japan, Italy, Ireland and New Zealand.

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References


European Court of Auditors, 2006. Information note by the European Court of Auditors on Special Report No 7/2006 concerning Rural Development Investments: do they effectively address the problems of rural areas? European Court of Auditors, Information Note ECA/06/20, Luxemburg.


Meyer, B.C. and Grabau, R., 2008. MULBO: Model Framework for multicriteria landscape assessment and optimization. A support systems for spatial land use decisions, Landscape...
In the context of environmental resources, investment frameworks play a crucial role in guiding strategic decision-making for land conservation. This section highlights key publications and research contributions from various authors, each addressing different aspects of environmental management and policy intervention.

