Making the Best Choices for Conservation

MAY 2001

Department of Conservation
Te Papa Atawhai

Produced by
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Department of Conservation
PO Box 10 420
Wellington, New Zealand

May 2001
ISBN 0-478-22100-2

The Department of Conservation (DOC) is developing a new technique that seeks to measure conservation achievement, in terms of changes to the overall natural value on conservation land in New Zealand. If successful, this technique promises to improve conservation work by making it more cost-effective, transparent and accountable.

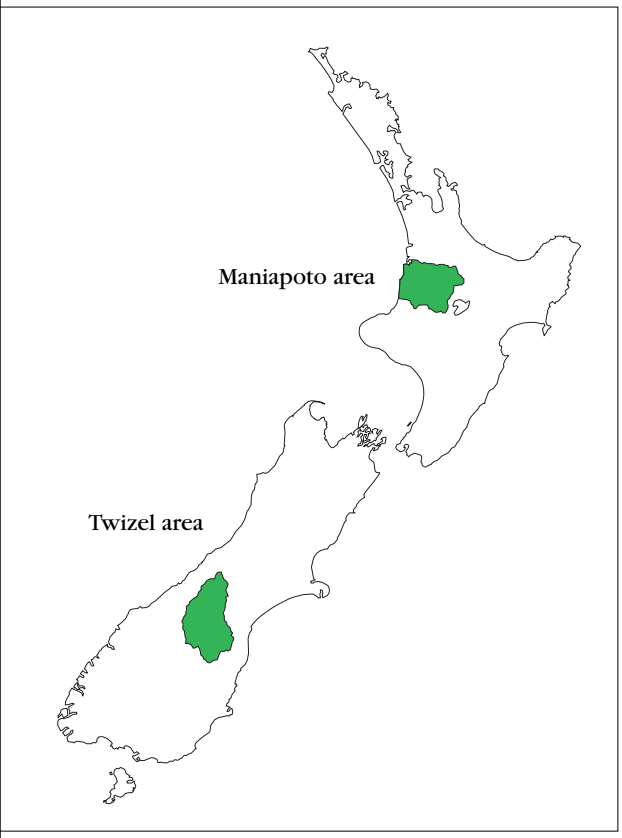
THE CHALLENGE OF IMPROVING CONSERVATION MANAGEMENT

New Zealand is home to such a diverse range of native plants, animals, invertebrates and natural environments that the challenge of conservation is often boiled down to 'caring for New Zealand's natural heritage'. Yet, precisely because the country's natural world is so diverse, it can be difficult to articulate just what differences DOC is making to this 'natural heritage'.

At present, we can simply monitor a forest reserve after possum control to see for ourselves the recovery of birdlife and the regrowth of vegetation. We can also measure changes at an individual species level, such as by monitoring kokako nesting success or a series of mistletoe plants before and after possum control. But a forest is made up of more than just kokako and mistletoe. It is also made up of soil, waterways, nutrient cycles, invertebrates, birds, weeds and trees. Measurement of the overall value of the possum control will need to recognise changes to the site as a whole. It also needs to recognise the value of the site in relation to the network of other conservation lands throughout New Zealand. Benefits to a large forest reserve that contains endemic species, for example, will be of greater value than the same benefits to a site that is small and ordinary. (Endemic means native to a specific region only, not occurring naturally anywhere else in the world). The newly developed technique for measuring conservation achievement takes all these aspects into consideration.

PROGRESS TO DATE

Since the mid-90s, DOC has been investigating ways to ensure its conservation management is as effective as possible. The aim has been to formulate a decision-making procedure that would allow DOC to prioritise its conservation management activities so that, among the many competing demands, effort is directed to those areas that have the greatest overall benefit to New Zealand's natural heritage. This decision-making process might be used in the same way as DOC's Visitor Asset Management System, which guides the management of visitor services and facilities throughout New Zealand. By 1999, DOC's Science and Research Unit had developed a theoretical model that laid the foundations for such a process. Called the 'Measuring Conservation Achievement' (MCA) model, it was peer reviewed by experts from Landcare Research, the Ministry for the Environment and DOC, and found to be scientifically robust. That means, it was judged to have significant predictive value.



During 1999/2000, the theoretical model was put to the test over DOC's Twizel management area in South Canterbury to see whether it could be applied in practice, to assess the cost-effectiveness of different conservation management activities. This application was very promising. It identified many ways in which more effective conservation management could be undertaken in the area. In fact, implementation of the report's findings would more than double conservation output of the Twizel Area Office for the same current expenditure. This increase in output would be worth more than $1 million.

In September 2000, DOC began a second more detailed field trial of the model in the Maniapoto Area of the Waikato, due to be completed in 2001.

DOC aims to progressively test both the theoretical MCA model, and its application to conservation management, over coming years. This will include trialling the model over the conservation management activities of the Canterbury Conservancy in late 2001 and undertaking research aimed at finding better ways to supply the input information needed for the MCA process. If it proves practical, DOC will look to progressively implement this approach throughout its conservation management activities.

If successful, the new method will allow DOC to:

- become smarter conservation managers by making management decisions that have the best overall conservation gains.
- quantify to central Government and funding agencies the changes DOC is achieving, and what it might be able to do with further funds.
- make the outcomes of conservation management more tangible to DOC's associates and to the public.

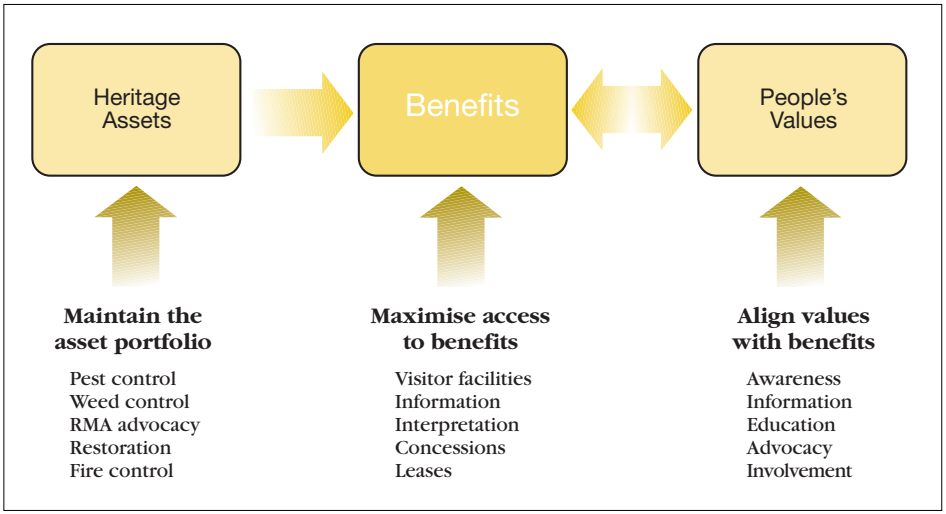
The model should also help determine whether we are achieving the New Zealand Biodiversity Strategy goal of 'turning the tide' in the decline of New Zealand's biodiversity, and would be available for use in the Ministry for the Environment's Environmental Performance Indicators Programme for the implementation and reporting of biodiversity indicators.

Finally, it could be adopted for use by other agencies with natural heritage responsibilities, such as regional councils and other Government departments.

Measuring Conservation Achievement – Defining the Department of Conservation's business

The public tends to think that the business of conservation is the management of native species. After all, this is the component of conservation work that invariably makes the news. DOC runs kakapo and kiwi recovery programmes, for example, and much of its work is species-focused. Yet, in reality, DOC only tracks the condition of a few species. The condition and status of most species is not known, even for a bird as notable as the kea. Additionally, many others remain undescribed, such as small invertebrates and deep-sea fauna.

This means that, while the preservation of native species may be conservation's ultimate aim, it would be hard to measure or define conservation work simply against the results DOC is known to have with native species. Instead, contemporary ecological thinking, as expressed in the 1993 Convention on Biological Diversity and the New Zealand Biodiversity Strategy, puts a focus on natural habitats and ecosystems as a means of conserving species. In other words, maintaining a full range of natural habitats and ecosystems is seen as a means of sustaining populations of native species. This approach assumes that a healthy site will contain the full range of species we want to preserve, even if we do not know their exact condition.



(And, of course, this approach does not preclude that a number of species will continue to require individual species recovery plans and management *ex situ* in the short term.)

If conservation is viewed as an asset management business, the assets DOC manages are best thought of as natural habitats and ecosystems, rather than just the species contained within them. The MCA approach follows this thinking. It suggests that, if we can measure the condition of natural habitats and ecosystems, then we can keep tabs on the overall condition of New Zealand's biodiversity.

Measuring Conservation Achievement – How does it work?

At the heart of the MCA approach is the development of a way of assessing the condition of natural habitats and ecosystems – which it measures as 'natural character'.

'Natural character' represents the degree to which the original pre-human condition of a habitat or ecosystem remains, and is measured on a scale from 0 to 1. For example, an ecosystem may be assigned a value of 0.2, which simply means that 20% of its 'natural character' remains. The use of 'natural character' as a measure of biodiversity condition is based, in turn, on the fact that where natural habitats or ecosystems are most modified, or have the least 'natural character', there tends to be less remaining native biodiversity.

A forested national park, for example, may only be modified by introduced pests like possums and rats, and so will retain much of its native biodiversity. But a working farm, which is intensively modified by vegetation clearance, wetland drainage and the introduction of pests and weeds, will only retain a few scraps of its original biodiversity, such as grass grubs, pukeko and harrier hawks.

The MCA approach quantifies five attributes of natural character. This makes use of the wealth of ecological monitoring and scientific information that New Zealand has gathered over recent times, and draws on the judgement and experience of local staff. These attributes are:

- **Plant and animal removal**. The intensity of disturbances, as indicated by the amount of biota removal through hunting, fishing, logging, fire and land clearance.

- **Pest pressure**. The level of consumption pressure on native plants, animals and invertebrates as indicated by the variety and abundance of introduced animal pests.
- **Weed pressure**. The level of competition pressure on native plants as indicated by the percentage cover of introduced plants.
- **Resource modification**. The intensity of disturbances, as indicated by the amount of change to natural hydrology, nutrient, substrate, light and temperature regimes from land use activities, roading and urban development.
- **Fragmentation**. The change in the natural character of the surrounding landscape associated with ecosystem fragmentation, loss of connectivity and edge effects.

Plant and animal removal can be estimated by comparing the present biotic cover of a site against what it was thought to have had historically. Intact, pest-free native forest has had little disturbance, and may be assigned a value of 1.0, whereas urban areas have had extensive disturbance, and may be assigned a very low value of 0.01. Similarly, pest pressure is quantified by determining which introduced animal pests are present at a site, and in what abundance, and then estimating each pest species' impact on plants, animals and invertebrates respectively on a scale from 0 to 1.This information is amalgamated into a single figure of pest (consumption) pressure for that site. After all five attributes of natural character are quantified, an overall 'natural character' value can be generated on a scale between 0 and 1. In other words, by incorporating a whole range of historic, geographic and ecological information, the MCA approach is able to generate a detailed comparative measure of the degree to which a site has been modified in a way that could not be achieved by any intuitive means.

Measuring Conservation Achievement – Applications of the theory

There is an immediate benefit of being able to measure the 'natural character' of a site, as a surrogate for the condition of an ecosystem and the species that reside there. It means that we can then go on to determine the 'biodiversity status' of any particular site we are interested in.

This can be done by measuring natural character against the area of the site in question. Obviously, site area is important to recognise because the larger an area is, the more biodiversity it is likely to sustain. This can be most simply expressed as the average natural character of the site.

This application means that DOC would be able to compare with each other the status of different natural habitats, ecosystems or land management units, such as national parks and reserves.

The MCA approach has a second benefit: if we wanted to know the overall 'biodiversity status' of all conservation lands in New Zealand, we could simply work out the average natural character of all land units managed for conservation purposes. This 'biodiversity status' would not recognise how well the full variety and diversity of New Zealand's biodiversity is represented on conservation lands, but it would provide a useful index for monitoring the country's overall progress towards its conservation goals. This information is desperately needed in New Zealand, particularly at a political and policy level. The theme of the New Zealand Biodiversity Strategy, for example, is to 'turn the tide' in the decline of New Zealand's native biodiversity.

Yet, while the New Zealand Government adopted this goal in February 2000, no single concrete measure has yet been available to express the condition of New Zealand's biodiversity. Instead, we have relied on indicators, such as the decline in forest cover in New Zealand or the decline in the numbers of surviving terrestrial vertebrate species, to illustrate the problem.

A third benefit of the MCA approach is that DOC can demonstrate the difference its activities are making to New Zealand's natural heritage. This can be done by comparing the overall biodiversity status (at a national, conservancy or local level) with and without DOC's management. This would make the MCA approach a vital tool in ensuring DOC is as transparent and accountable to Government, its associates and the public as it could possibly be. It also means it would be possible to illustrate what difference DOC could be making to New Zealand's natural heritage at differing levels of funding.

'Smart Conservation Management' – Applying the MCA approach to conservation work

The original aim of the MCA project was to find a way of ensuring that DOC's conservation management was as effective as possible. This can be achieved by applying the MCA approach to discrete projects to determine what effect they will have on natural heritage against a range of criteria such as the cost of the projects. This approach, which is still under development, is known as 'Smart Conservation Management' (SCM). When DOC undertakes a conservation management activity, it aims to either improve, or to lessen the rate of decline of, a site's 'natural character'. It may also look to increase the area of the site, by planting native vegetation as part of an ecological restoration programme or by removing an introduced weed species.

According to the MCA approach, then, the test of a conservation management activity is the degree to which it will change the value of a site. This is measured as the size of a project's outcome, which can be found by comparing the difference in site value with and without management. This can be expressed as:

Project Outcome = Site Value*With Management* **– Site Value***Without Management*

The concept of 'site value' used in this application is broader than that of 'site status'. Not only has it a measure of its 'natural character', it also incorporates the important considerations as to how large, distinctive and important the site is.

Obviously a large site, which has more potential as a home for indigenous biodiversity, will have more value than a small site. A site that has a high degree of endemism, or which is distinctive relative to other ecosystem types in New Zealand, will have more value than a site of little distinctiveness. And a site that represents the most important remaining example of its ecosystem type will also have more value than an unimportant site. Finally, a nearly pristine site will have more value in terms of our natural heritage than a highly modified site.

Accordingly, site value is expressed as:

Site Value = Size$^{0.4}$ x Distinctiveness x Importance x Natural Character

The rate at which sensitive species are lost with diminishing habitat area is recognised by measuring the size of the habitat to the power of 0.4; the measures of 'distinctiveness' and 'importance' are expressed on a scale of 0 to 1, based on models generated using knowledge of New Zealand's existing environment and land cover.

Smart Conservation Management – Assigning project merit and cost-effectiveness

Just how worthy a project is of implementation does not depend simply on its 'project outcome', or how much it contributes to New Zealand's natural heritage. We also need to balance this against the project's urgency and feasibility.

Firstly, a restoration project that can deliver its outcomes in one year will have more to recommend it than a project that can deliver the same outcome in ten years. And a project that counters a threat which is fast-acting, such as wetland drainage, will have more to recommend it than a project that counters a slow threat, such as the spread of some weed and pest species. The desirability of getting outcomes sooner rather than later is measured as the Net Present Value (NPV) of an outcome. This can be expressed as:

NPV *Project Outcome* **= Project Outcome x $e^{-d\,t}$**

(where e is the exponential function, d is the current discount rate (10%) and t is time in years until the outcome happens).

Secondly, we need to recognise the feasibility of a project by identifying those risk factors that may contribute to the failure of the project – such as operational, political and legal risk.

Ultimately, then, each proposed project must be assigned a value of 'project merit'. This gives a clear indication of what benefits the

project is likely to deliver in terms of New Zealand's natural heritage, discounted against the urgency and feasibility of achieving that result. This can be expressed as:

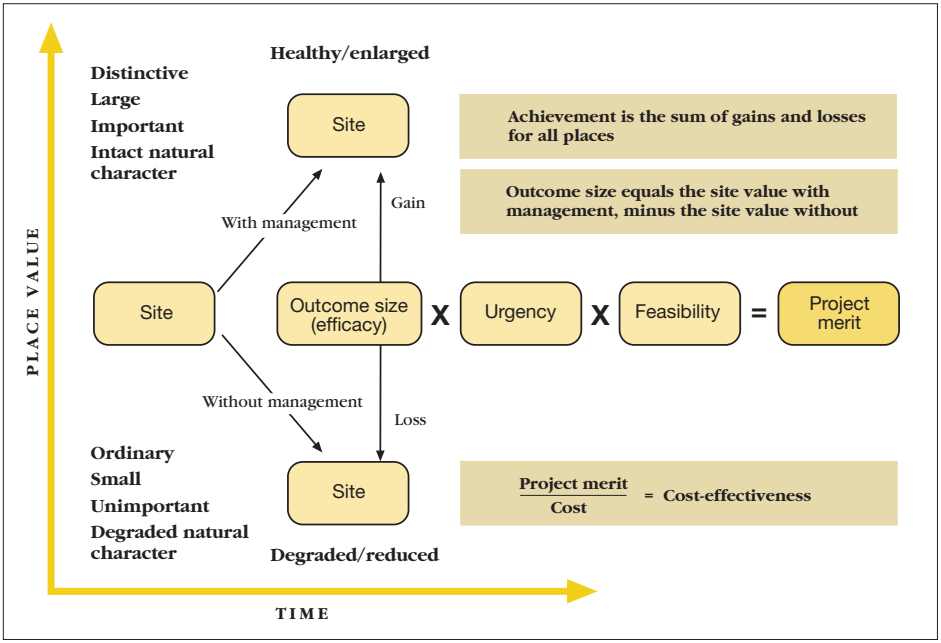
Project Merit = NPV *Project Outcome* x Project Feasibility

The final step in the MCA approach is to assess the 'project merit' against the cost of the project. Obviously, if two projects have the same merit, the one that costs less is likely to be preferred.

This is the measure of cost-effectiveness, which will make DOC's work as transparent, effective and accountable as it can possibly be. This can be expressed as:

Project Cost-Effectiveness = Project Merit/Project Cost

MODEL OF PROJECT MERIT



Smart Conservation Management – What it will not do

Smart Conservation Management offers an excellent way to determine the cost-effectiveness of a conservation project to implement, and to compare competing project proposals and project designs against each other. If adopted, SCM would be used as a tool for well-informed decision-making. It would also be used to make DOC's work more transparent and accountable to central Government, funding providers, and the public. However, it does not mean that DOC would do 'conservation by numbers' in the future. As always, the final decision as to what projects are implemented depends on more than just cost-efficiency considerations.

Firstly, SCM does not recognise a variety of intangibles, such as Maori cultural and spiritual values; asssigning a value to these would be inappropriate. Secondly, SCM does not recognise that a conservation project with little merit in terms of natural heritage gains may still be worth implementing for other reasons. The project may offer new understandings, the development of new techniques, or the garnering of strong public support that will benefit conservation in future. Thirdly, DOC may be required to manage a particular species, such as kiwi or kakapo, as a discrete conservation outcome. In such a case, the achievement will be measured in the status of that species alone, rather than of natural heritage in general. Therefore a species-focused project could be implemented irrespective of its wider natural heritage outcomes. (Nevertheless, recovery of a species at a particular site will usually run roughly parallel to the recovery of the site's natural heritage in general.)

The decision as to when to make trade-offs in all three instances will continue to rely on good consultation and sound judgement within DOC and with its associates. SCM would not replace other forms of decision-making, such as face-to-face consultation, hui and business planning. Rather, it will be used within these practices as a planning and information tool.

SCM cannot yet be used to specify management actions in historic resources or visitor facilities management. It has been designed and tested only for the management of natural heritage.

Selecting sites

A key to making the MCA approach as useful as possible is its ability to define all conservation land into a continuum of 'sites' according to the outcome being sought. A 'site' can be defined at any scale, from the boundaries of a particular ecosystem to the legal boundaries of a conservation reserve or national park, or the area in which a project will have its outcomes.

A 'site' can also be a single area, or a collection of separate places, and would not necessarily accord with DOC's management boundaries. For example, in its application as Smart Conservation Management, DOC may want to measure the outcome of a particular project. Therefore, it will identify a 'project outcome site'. If it wants to determine the condition of an isolated reserve, then it will define the site as the legal boundaries of that reserve, and so on.

To achieve this variability in definition, the MCA approach uses 'environmental domains' as its foundation. The classification of environmental domains was undertaken by Landcare Research for the Ministry for the Environment; it defines land according to climate and landform variables that have been proven to account for much of the distribution pattern of canopy tree, fern and shrub species. These are derived from data describing soil type, slope, temperature, solar radiation, humidity and rainfall.

This environmental domain information is then overlaid with information on the 'biotic cover' of the land, drawn from the Land Cover Database. This recognises a range of cover classes, such as indigenous forest, planted forest, tussock, inland wetlands and urban development.

If, for example, 40 environmental domains and 12 different types of biotic cover are recognised in a region, then in theory up to 480 different ecosystems could be identified in the region.

Adding the 'natural character' information gathered through the MCA approach to this information layer helps measure how much a site contributes to what remains of any ecosystem type.

Where to from here

The successful development of the 'Measuring Conservation Achievement' model, and its application as 'Smart Conservation Management', relies on four factors:

- **Refinement of the MCA theoretical model.** More research is needed on how to measure 'natural character' values, such as the level of fragmentation and consumption pressure from introduced pests. Contract research is underway to improve these techniques.
- **More data**. In order to undertake SCM most effectively, we need more information on key threats, such as weed cover and pest abundance through New Zealand. Contract research is underway on ways of estimating from known data, and greater information sharing will be sought between Government agencies and research organisations.
- **Further testing and costing of SCM**. Before implementation, DOC needs to be sure that SCM is cost-efficient to implement, and that it will provide accurate and useful outcomes.
- **A Departmental 'fit'**. We need to have a database and related systems in place so that Biodiversity staff throughout DOC could easily use SCM. This would include, for example, the production of maps of pest abundance and weed cover for each of DOC's management areas. In addition, staff must be trained in, understand and support the SCM initiative to become smart conservation managers.

The MCA model shares the same vision as the Environmental Performance Indicators Programme developed by the Ministry for the Environment (MfE). Both aim to find a comprehensive way of measuring the state of natural heritage, and the pressures on it, throughout New Zealand. To this end, DOC will continue to work closely with MfE on the project. Both will also seek to promote partnerships with other agencies that have natural heritage responsibilities, or access to key data-thereby building capability across the public sector for more effective management of natural heritage.

Finally, it may be possible to extend the MCA technique into the freshwater and marine environments, so that their management can also benefit from these enhanced approaches.

For more information

Measuring Conservation Achievement, by Theo Stephens. In: Biodiversity Now! edited by P. Blaschke and K. Green. Science & Research Unit, Department of Conservation, Wellington, 1998.

Conservation Achievement: The Twizel Area, by Theo Stephens, Derek Brown, and Norm Thornley. Department of Conservation, Wellington. Draft summary report, March 2001.

Tracking the Fate of New Zealand's Natural Heritage. Fact sheet from Science & Research Unit, Department of Conservation, Wellington 2001.

Does DOC make a difference?

Imagine you have $1 million to spend in any way you choose on conservation management. How would you best decide what to do at one particular site? Would you spend that money on possum control, on controlling old man's beard, on stoat control, or on a combination of all three? Imagine you have $1 million to spend on possum control, but you are free to select where the money is spent. How would you best decide at which site to control possums? Imagine, also, that you have $1 million to spend on conservation management, but that you could get an additional $1 million if you could show the benefits of that extra funding. Imagine, finally, that you are at a community forum and are being challenged as to what benefits conservation is bringing to the community. What good has that possum control been?

The Measuring Conservation Achievement approach, and its application as Smart Conservation Management, offers a way to help answer each of these questions. It could help decide what the most effective course of action is, and will help express in concrete terms what is being achieved.

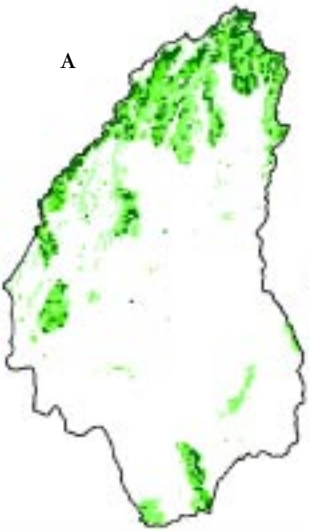
Interpreting the sets of Twizel maps:

A represents the change in natural character and **B** the cost ($); higher colour intensities indicate higher values.

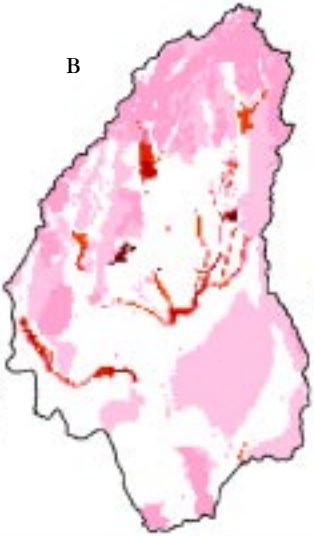
C illustrates the values from **A** divided by those from **B**; red indicates low, and green indicates high cost-effectiveness.

Cost-effectiveness of Current Management

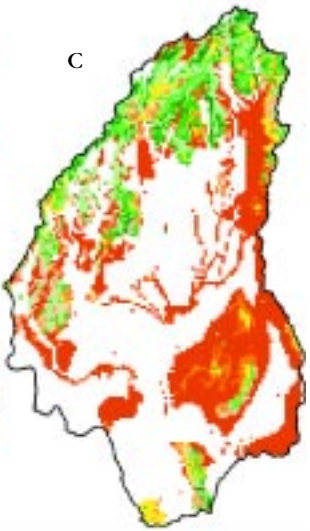
The difference we make…



Where we spend the money…



Cost-effectiveness…



The link between project cost information and the 'project outcome site' means that cost and cost-effectiveness data can be displayed spatially to reveal patterns over the landscape. Current management makes most difference in the high country but the greatest expenditure per km² is in lowland areas, particularly in the river beds. Consequently the most cost-efficient expenditure is in the high country. However, if the more cost-efficient conservation programme on the basis of MCA calculations were implemented, conservation efficiency would be much improved, particularly in the foothill country. This implies that there is significant under-investment in conservation of the foothill and basin areas.

Cost-effectiveness of Restructured Management

The difference we make… Where we spend the money… Cost-effectiveness…