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## Efficient investment of conservation funds: are “mainland islands” delivering conservation bang with the public buck?

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**Abstract:** Mainland habitat ‘islands’, a relatively new concept, is promoted as a way to arrest the ongoing decline, and eventually enhance New Zealand’s indigenous biodiversity. Mainland islands aim to restore fully functioning biotic communities with a predominance of indigenous species through active intervention. Assessment of New Zealand current mainland island projects on the triple-bottom line of ecological, social, and economic costs and benefits demonstrates a net gain. By achieving multiple social and environmental goals within an adaptive, integrated management framework, the mainland island projects are delivering substantial value with conservation funds. Further benefits for conservation may be derived by extending social goals and integrating limited economic goals within the mainland island framework. An expansion of the mainland island concept is recommended.

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**Keywords:** mainland islands, ecological restoration, sustainable development.

## Introduction

"Are the most important conservation targets being achieved by doing the highest priority work to the standard necessary and using the public's funds as efficiently as possible?"

– Nick Smith, Minister of Conservation (1996-99) in "Restoring the Dawn Chorus"

The modern tenets of good governance, transparency and accountability, have been entering New Zealand's democratic frameworks, organizations and legislation for some years now. The Department of Conservation (DOC), like most of our organizational structures, has worked to increase the accountability and transparency of its activities (DOC 1998a) -- and consequently, made possible attempts to answer the conservation minister's question. The Department of Conservation has a wide range of responsibilities that currently encompass ecological management, recreation, historical preservation, conservation advocacy and public awareness and coastal and marine protection (DOC 1998a). Ecological management constitutes approximately 55 percent (1997/98 figures) of DOC funds; invested in animal pest and weed control, threatened species recovery programmes, improving ecological knowledge, extending marine protection, assisting with the protection of biodiversity on private land, the restoration of offshore islands and restoration of mainland 'island' ecosystems. This last element, the restoration of mainland habitat 'islands', is a relatively new concept promoted as a way to arrest the ongoing decline, and eventually enhance our indigenous biodiversity.

The first practical demonstration of comprehensive habitat restoration on mainland New Zealand began at Mapara in 1989 (Saunders 1990). The project targeted an array of pests, including domestic stock, feral goats, possums, ship rats and mustelids, within an isolated 1400 hectare forest block dramatically reducing pest density. A strict scientific management design, including control areas and switching treatments, as well as careful monitoring of outcomes clearly demonstrated successful recovery of Kokako populations in response to management (Innes et al. 1999). Subsequent calls for the same approach to be applied to further ecological areas (Norton 1993) led to the establishment, in 1995 and 1996, of six mainland island projects, with core areas of intensive management covering a little over 10,000 hectares (Saunders 2000; Saunders & Norton 1999). Although the first 'official' mainland islands have only been operating for six years, considerable research has been undertaken and a number of successes have been documented. On the other hand, the restoration projects have involved considerable expense (Saunders 2000) and several challenges remain unresolved (Saunders & Norton 1999). Therefore, it is prudent to assess whether the six mainland island projects are cost-effectively meeting the highest priority conservation targets, to the desired standard -- and more importantly, is the mainland island concept still a good way to invest further conservation funds.

We begin by clarifying the most important threats and opportunities for New Zealand conservation, followed by an explanation of the way in which the Department of Conservation has attempted to confront these issues head-on by implementing the mainland island concept. We then assess the mainland island projects on the triple-bottom line of ecological, social, and economic benefits and opportunity costs (Bennet & James 1998). Finally, we discuss how the mainland island programme can deliver additional conservation value.

## Issues in New Zealand conservation

### **Decline of indigenous biodiversity**

Mainland islands are a direct response to the decline of New Zealand's indigenous biodiversity, regarded as our 'most pervasive environmental issue' (MfE 2000). Current decline is driven by predation, herbivory and competition from introduced pest species (Craig et al. 2000). Introduced pests disrupt ecosystem function and suppress recruitment of some indigenous species. Feral goats (*Capra hircus*), deer (*Cervus spp.*) and brushtail possums (*Tichosurus vulpecula*) disrupt forest regeneration (Saunders & Norton 1999) and, in the case of possums, kill mature trees. Invasive plants and weeds such as Old Man's Beard (*Clematis vitalba*), wilding pines (*Pinus radiata*) and *Tradescantia fluminensis* are also altering the composition of our indigenous ecosystems. Native birds are predated by rats (*Rattus spp.*), mustelids, and possum (Innes et al. 1999).

### **Limitations to conservation**

Comprehensive legal protection has not halted the decline in biodiversity on the mainland (Saunders & Norton 1999). Pest management capacity is insufficient to control pests over the majority of the mainland (Saunders & Norton 1999). The complex ecological interactions between pests and indigenous species are still revealing unexpected surprises; recent discoveries demonstrated that possums predate Kokako (*Callaeas cinerea*) nests (Innes et al. 1999). Some aspects of our ecosystems are almost unknown; the impact of pests, such as the common wasp (*Vespula vulgaris*), on indigenous invertebrates is still poorly understood (Moller 1999). There is widespread public support for biodiversity conservation and our natural heritage. However, the importance of public conservation awareness continues to increase. Public education and conservation advocacy remains essential to ensure continued public support and funding (DOC 1998a).

## **The goals of conservation**

The goals of conservation are set out in the New Zealand Biodiversity Strategy (MfE 2000), part of commitments made under the International Convention of Biological Diversity. One goal of the strategy is to 'maintain and restore a full range of remaining natural habitats and ecosystems to a healthy functioning state'; emphasis is on in-situ conservation, an ecosystem focus and representativeness. A further goal is to 'enhance community and individual understanding about biodiversity, and inform, motivate and support widespread and coordinated community action to conserve and sustainably use biodiversity'; emphasis is on both the preservation and sustainable use of conservation resources to provide direct social benefit.

## **Meeting conservation needs with mainland islands**

### **Key components of mainland islands**

Mainland islands aim to restore fully functioning biotic communities with a predominance of indigenous species through active intervention (Saunders 2000). Active intervention involves the intensive control of pests within geographically distinct managed areas. Native species recovery, residual pest levels and some ecosystem attributes are monitored to benchmark success. Close cooperation with the local community is a principle of the mainland island concept. Enlisting the support and co-operation of adjacent landowners, local residents and the wider community was emphasised at Mapara (Saunders 1990). Public advocacy for conservation is also an important component of several 'official' mainland island projects (DOC 1998b). The application of a science-based approach is used to reduce uncertainty. Manipulative experiments, used in conjunction with basic research offer the opportunity to gain reliable ecosystem knowledge and make strong inference about results (Saunders 2000).

### **Advantages over traditional approaches**

Species-specific recovery programmes, such as the Takahe (*Porphyrio mantelli*) protection programme, have been important in rescuing several 'bottom of the cliff' species but it is not possible to manage each endangered taxon individually (Saunders & Norton 1999). The mainland island programmes recognize the importance of adopting management goals focused on ecological functions, in addition to structural ecosystem components such as plants and animals. Wider, more profound conservation benefits derive from this approach (Saunders & Norton 1999).

Island transfers remove species from the mainland to off-shore islands where their safety can be more easily assured. The mainland island approach, by resisting species loss and

ecosystem degradation in situ, allows the public to become more closely involved in restoration.

Basic ecological research, when conducted without direct reference to management needs may not be directly applied by conservation managers. Management without a strict scientific basis may fail without the causes of failure being identifiable (Walters & Westoby 1986). Significant benefits are being derived from combining research and management activities in mainland islands. A culture of collaboration is developing between researchers, conservation managers and stakeholders (Saunders 2000). Research results are applied immediately; studies on the effects of *Vespulid* wasps in the Rotoiti mainland island has had an immediate affect on control regimes (Saunders 2000).

Large-scale pest management attempts to reduce pest numbers over large areas, inevitably spreading effort thinly on the ground (Saunders & Norton 1999). The mainland island concept sets low pest densities, rather than area, as the target of pest control. This approach ensures that desired ecological outcomes are achieved, albeit over a smaller area.

### **Limitations of mainland islands**

Even though they have a high profile, there has been remarkably little criticism of the mainland island approach to conservation in the literature; an indication of the degree to which the projects are accepted by the ecological community. However, pursuing mainland island restoration projects does involve some incidental costs.

Focusing on priority areas of intensive management may leave the majority of the conservation estate neglected or ineffectively managed by poorly funded conservancies and regional councils (Craig et al. 2000). Three points suggest there is little merit in this idea. First, a wide range of legislation, including the National Parks Act (1980), the new National Pest Management strategy and most regional pest management plans require public authorities and the private sector to exterminate introduced plants and animals as far as possible. Second, the Animal Health Board, regional councils, community groups and individual farmers control possums and feral deer to limit the spread of bovine tuberculosis (Tb) to cattle (Hartley 1997). Third and finally, experience gained from intensive pest management at mainland island projects is already helping to increase the efficiency and reduce the costs of pest control outside the restoration projects (DOC 2000).

The intensive use of poison to control pests in mainland islands is an area for concern. There is some risk to none target species; aerial poisoning operations with 1080 carrot-bait have been shown to affect North Island robin populations (Powlesland et al. 1999). Rat

poisoning operations in Mapara and Kaharoa forest in the North island stoats showed an increase in predation pressure on birds after rat populations declined (Murphy et al. 1998). Other poison risks include accumulation of toxins in the environment and public wariness of poisons (Craig et al. 2000; Hartley 1997; PCE 1994). In spite of these concerns, there is widespread agreement that the benefits of intensive poison use outweigh the costs. Furthermore, intensive pest control may be interspersed with periods of minimal management (Saunders 2000).

Unlike off-shore islands, reinvasion by pests is inevitable in most mainland islands. The presence of natural features that define geographical boundaries reduce the threat of reinvasion. The Rotoiti mainland island is bordered by Lake Rotoiti, the rocky tops of the St Arnaud, farmland and a small river thereby enhancing its definition as an 'island' (DOC 1998b). Trounson, Boundary Stream and Paengaroa mainland islands are all forest remnants surrounded by pastureland (Saunders & Norton 1999). Nevertheless, only projects such as the Karori sanctuary surrounded by a predator proof fence (Lynch 1995) or fenced peninsula mainland islands (Saunders & Norton 1999) have a realistic chance of eradicating pests. Mainland islands may therefore be required to maintain pest control in perpetuity, greatly increasing the long-term costs of the projects.

## Are mainland islands a good way to invest in conservation?

### **Assessing conservation value of mainland islands**

By what standard do we hold mainland island projects accountable? Environmental advocates are demanding that business and industry balance environmental and social equity as well as financial equity (Bennet & James 1998). Therefore, it seems reasonable to expect that the sustainability of conservation management be judged on the same, triple bottom line, basis (Hartley 1997).

### **Environmental equity**

Mainland islands are still relatively new concepts in conservation yet they are already delivering strong positive environmental outcomes. The Rotoiti mainland island strategic plan chose as a goal, 'The restoration of beech forest with emphasis on the honeydew cycle' (DOC 1998b). Baseline Kaka (*Nestor meridionalis septentrionalis*) research near Lake Rotoiti showed just 2 successful nesting attempts out of 20 monitored over an 11-year period; only 4 young fledged. Three years after the implementation of the Rotoiti Nature Recovery Project, 10 of 12 monitored nesting attempts had been successful, fledging 30 young (Moorhouse 2000). The ability to control pests to low numbers within the Rotoiti mainland island passed its most challenging test over the 2000/01 summer after a second

successive beech masting year caused pest numbers to explode (DOC 2001). In the Te Urewera mainland island, ecosystem function indicators such as red mistletoe (*Peraxilla tetrapetala*) and foliar browse index are beginning to show positive responses to pest control in the core areas (DOC 2000). Survival rates for kiwi chicks of 73% have shown that stoat control is effective. Less intensive monitoring regimes also suggest strong responses from a host of other bird species including Kaka, Keruru (*Hemiphaga novaeseelandiae*) and North Island Robin.

In addition to the positive environmental outcomes of mainland islands, there is an environmental opportunity cost incurred in not expanding the mainland island program over further, representative areas. The recent discovery of the rare mistletoe species *Alepis flavida* in the Otamatuna core of the Te Urewera mainland island demonstrates that, without active management, some cryptic species may be lost from parts of New Zealand without their existence being recognized (DOC 2000).

### **Social equity**

One of the strengths of the mainland concept is the synergy of positive social outcomes alongside environmental benefits. Currently, there are few quantitative results of positive social outcomes though there is considerable anecdotal evidence. The Rotoiti mainland island has received almost unanimous support for its continuation (DOC 2001), a result of the success of the project and the strong community building approach taken. Strong support has enabled the Department of Conservation to announce that the area under pest control at Lake Rotoiti will increase from 825 hectares to over 1125 hectares for rats and over 4000 hectares for stoats (DOC 2001). Long terms plans are to extend the mainland island's pest control to an area of around 11,000 hectares in order to provide sufficient habitat for kiwi. Successful delivery on its advocacy and education goals and widespread public support provides strong evidence that the Rotoiti mainland island is providing conservation value.

### **Financial equity**

Whether the mainland island projects develop financial equity is more debatable than the previous two aspects. An economic analysis of the restoration projects must consider the economic benefits, the direct costs and the opportunity costs of diverting conservation funds from other uses.

Mainland island projects have initially involved high costs; \$165 per hectare of intensive pest management in 1998/99 (Saunders & Norton 1999). These costs are now declining and are likely to continue to decline in the future as the efficiencies of pest management increase. In the Te Urewera mainland island, contractors are tasked with the job of

controlling possums, deer and pig over a 16,000 hectare background area surrounding the four core management areas, using traps and cyanide (DOC 2000). Operations in 1999/2000 reduced possum densities to an average residual trap catch index (RTC) of 2.9% over this area at an average cost of \$33.50 per hectare. This approach has low financial risk because operations are performance based, less environmental risk than aerial poison operations and engenders strong local support by employing local people. There is an expectation that long-run costs will be reduced to \$11 per hectare and experience from these and other pest management experiments may reduce the financial costs of pest management over the rest of mainland New Zealand.

As mentioned previously, it is unlikely that neglect of pest control over the majority of the mainland will occur as a direct result of the expansion of the mainland island programme. However, there are alternate uses for funds spent on mainland islands and these represent costs as lost opportunities for conservation. Conservation funds could be invested to increase the capacity of national monitoring programmes such as the significant natural areas (SNA) programme or the protected natural areas (PNA) programme. These programmes identify and formally reserve representative areas of New Zealand. Though important, the trade-off between identifying significant areas, and comprehensively restoring and maintaining those areas, has been in favour of identification programmes (pers. obs.). Conservation funds could enable the purchase of high priority land for addition into the conservation estate, however additional conservation land could further strain the Department of Conservation's resources (David Norton, pers. comm.) Funds could be invested in additional basic ecological research. The mainland islands concept has proven to be an excellent framework within which to conduct ecological research while achieving conservation goals and ensuring the results of research reaches conservation managers; thus, it would be more appropriate to further integrate basic ecological research into mainland island projects. Conservation funds could be invested in species recovery programmes. There is considerable public support for species recovery programs, such as those for Takahe and Kakapo, and financial support from business; for example Project River Recovery (Hartley 1997). However, the importance of an ecosystem focus, even when restoration of specific species remains a goal, is already resulting in some species focused projects being integrated within mainland islands; for example Kaka, Kiwi and Kokako projects at Rotoiti and Te Urewera (DOC 2000; Moorhouse 2000).

The mainland island projects represent a different philosophical approach to allocating conservation funds. Rather than spreading the funds across the conservation estate and over many, single purpose projects, mainland islands funds are becoming frameworks within which multiple conservation aims including ecological research, species recovery and conservation advocacy can be achieved (pers. obs.).

## How can mainland islands deliver more value?

### **Building conservation capacity**

Current mainland islands can extend background management areas and add additional core areas in strategic locations. This model has been used successfully in the Te Urewera mainland island (DOC 2000) and is being used to extend the Rotoiti area (DOC 2001). The environmental and social benefits from the existing mainland island areas demonstrate that the creation of additional, 'official', mainland islands is a worthwhile investment for the Department of Conservation; particularly if future projects are chosen to encompass existing species recovery or ecological research programmes.

The existing mainland islands are not managed primarily for their strategic capacity building potential (Saunders 2000) but the lessons learned from the projects may be applied more widely. Exporting the knowledge gained from existing projects will allow future mainland islands to achieve similar outcomes with a smaller financial investment. Mainland islands have the potential to be the lego blocks of a much more extensive ecological restoration framework on mainland New Zealand.

### **Integrating economic and social values**

"The main response of the DOC to the ongoing declines in native ecosystems has been to concentrate management in areas where pests can be most easily eliminated or controlled. Thus ... limited resources and a protectionist philosophy may be leading to a division ... into priority areas of intensive management where the aim is to restore and maintain a largely pre-European biota, and the remainder" - (Craig et al. 2000, p67).

Extractive economic use within the intensively managed core areas of mainland islands is clearly undesirable; current mainland islands are lifeboats for our biodiversity. However, considerable opportunities exist to integrate sustainable economic use and additional social goals within larger mainland island areas in order to reduce the financial cost of the projects. Two recent, highly divisive, debates between preservation and use of New Zealand's natural resources illustrate the opportunities and difficulties. The Timberlands West Coast (TWC) resource consent application to sustainably harvest beech forest on the South island's west coast in 1999 involved plans for active ecosystem management through browser and predator control (Moller 1999). The mining application by GRD Macraes involved a call for the establishment of a 10,000 hectare mainland island to balance the ecological impact of mining in the Victoria Conservation Park (in press). If the

issues can be resolved, mainland island restoration projects may become a way to balance development interests with genuine benefits for conservation.

Already mainland islands are managed for multiple uses including public enjoyment, indigenous biodiversity outcomes and ecological research. Large mainland island framework areas, could combine multiple intensively managed core areas with many other uses yielding greater social and economic benefits. Examples could include eco-tourism, protection of catchment areas for urban water supplies, customary use of native wildlife, hunting and fishing, sustainable forestry, wind farms, carbon crops, some farming activities, gardening, the discovery of new types of drugs, and mining that leaves surface features largely intact or is accompanied by extensive rehabilitation of mined areas (Hartley 1997). The environmental balance to social and economic use of public land would be broad pest control regimes over much larger areas than is presently affordable.

There is international precedent for socio-economic integration within an ecological restoration project. The Guanacaste National Park (GNP) in Costa Rica is a 135,000 hectare regenerating dry forest (and a 70,000 hectare marine environment) based around a 10,600 hectare core remnant (Janzen 2000). Socio-economic integration at local, regional and national level is a key goal for this project. The GNP has 120 fulltime employees and a USD 1.6 million dollar annual operating budget in the local biodiversity, education, environmental service and eco-tourism industries. Such projects show that economic returns and ecological restoration do not always have to be mutually exclusive.

In New Zealand, maximising conservation benefit from our natural resources may be achieved by integrating a range of complementary land uses from preservation in intensively managed restoration core blocks, to reserved areas for recreation, to uses yielding economic returns. The mainland island concept can be the framework to enable this vision.

### **Striving for sustainable ecosystems**

There is little likelihood that conservation outcomes within mainland islands are possible without continuing investment in pest control, at least in the short to medium term. Continuing research to find ways to make our ecosystems sustainable long-term should be pursued. Options include, the development of biological pest control (Cowan 1999), establishment of markets for some exotic species to make pest control cost-neutral (PCE 1994), allowing sustainable economic use of some ecosystems in exchange for ecological management (Hartley 1997; Moller 1999) and possibly, the acceptance of some exotic species as part of our new ecological landscape.

## Conclusion

At present, the extent of conservation land that can be protected to the standard required to 'restore the dawn chorus' is a small fraction of the public estate. Pests are the major limiting factor in New Zealand conservation. The mainland island concept was developed to address decline of indigenous biodiversity. By achieving multiple social and environmental goals within an adaptive, integrated management framework, the mainland island projects are already proving to be a valuable long-term strategy.

Expanding the mainland island concept, encompassing some existing conservation functions within mainland islands and creating new mainland islands will bring additional conservation gains. The mainland island concept has enormous potential to deliver further conservation gains if capacity is increased. The lessons learned from mainland islands can be exported throughout New Zealand, on both public and private land. The integration of limited economic goals, in addition to existing social and environmental goals, would enable mainland islands to deliver even greater bang for the conservation buck.

## References

- Bennet, M., and P. James, editors. 1998. The Green Bottom Line: environmental accounting for management, current practice and future trends. Greenleaf Publishing Limited, Sheffield.
- Cowan, P. 1999. Vertebrate pests: impacts and future management. Proceedings of the Manaaki Whenua conference, 21-23 April, 1999, Wellington, New Zealand.
- Craig, J. L., S. Anderson, M. Clout, R. Creese, N. Mitchell, J. Ogden, M. Roberts, and G. Ussher. 2000. Conservation issues in New Zealand. *Ann. Rev. Ecol & Syst* **33**:61-78.
- DOC. 1998a. Restoring the dawn chorus: strategic business plan 1998-2002. Department of Conservation, Wellington.
- DOC. 1998b. Rotoiti Nature Recovery Project: St Arnaud's Honeydew Beech Mainland Island Strategic Plan. Department of Conservation, St Arnaud.
- DOC. 2000. Northern Te Urewera Ecosystem Restoration Project: Summary Annual Report. East Coast Hawke's Bay Conservancy, Department of Conservation, Gisbourne.
- DOC. 2001. Press release (Sep 3, 2001) : Rotoiti mainland island to expand.
- Hartley, P. 1997. Conservation strategies for New Zealand. New Zealand Business Roundtable, Wellington.
- Innes, J., R. Hay, I. Flux, P. Bradfield, H. Speed, and P. Jansen. 1999. Recovery of North Island kokako *Callaeas cinerea wilsoni* populations, by adaptive management. *Biological Conservation* **87**:201-214.
- Janzen, D. H. 2000. How to grow a wildland: the gardenification of nature. Pages 521-529 in P. H. Raven, and T. Williams, editors. *Nature and Human society*. National Academy Press, Washington D.C.
- Lynch, J. 1995. Back to the future: Karori - from reservoir to wildlife sanctuary. *Forest and Bird* **275**:12-19.
- MfE. 2000. The New Zealand Biodiversity Strategy: Our chance to turn the tide. Ministry for the Environment, Wellington.
- Moller, H. 1999. Sustainable Management of Beech Forests: Consequences for Biodiversity and New Zealand Conservation Management. Presented in Support of Resource Consent Application RC99/75, Ecosystems Consultants Ltd, P.O. Box 6161, Dunedin.
- Moorhouse, R. 2000. Kaka in the South Island. *Conscience*, Department of Conservation Newsletter **39**:5.
- Murphy, E. C., B. K. Clapperton, P. M. Bradfield, and H. J. Speed. 1998. Effects of rat-poisoning operations on abundance and diet of mustelids in New Zealand podocarp forests. *New Zealand Journal of Zoology* **25**:315-328.

- Norton, D. A. 1993. Mainland habitat islands : a vision for New Zealand nature conservation. West Coast Conservancy Technical Report Series No. 2. Department of Conservation, Hokitika.
- PCE. 1994. Possum Management in New Zealand. Office of the Parliamentary Commissioner for the Environment, Wellington.
- Powlesland, R. G., J. W. Knegtmans, and I. S. J. Marshall. 1999. Costs and benefits of aerial 1080 possum control operations using carrot baits to North Island robins (*Petroica australis longpipes*), Pureora Forest Park. NZ Journal of Ecology **23**:149-160.
- Saunders, A. 1990. Mapara: island management "mainland" style in D. R. Towns, C. H. Daugherty, and I. A. E. Atkinson, editors. Ecological restoration of New Zealand islands. New Zealand Department of Conservation, Wellington.
- Saunders, A. 2000. A review of Department of Conservation mainland restoration projects and recommendations for further action. Page 220. Department of Conservation, Wellington.
- Saunders, A., and D. A. Norton. 1999. Ecological restoration at Mainland Islands in New Zealand. Biological Conservation **99**:109-119.
- Walters, C. J., and M. Westoby 1986. Adaptive management of renewable resources. New York: Macmillan; London: Collier Macmillan.