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Part A

BACKGROUND

This first part of this report includes a background to the 'Mainland Island approach', a summary of how mainland restoration projects were selected and descriptions of each of the six projects.

1. The initiation of mainland restoration projects

Six mainland restoration projects were initiated during 1995 and 1996 when Departmental funds were specifically allocated for mainland restoration. Because no policies or strategies were in place the particular reasons for these projects being established is unclear. Two main reasons were probably behind the creation of a mainland restoration funding pool. Firstly, there were increasing calls for conservation management to be undertaken *in situ*, to be directed at different levels of biological organisation—including genes, species and ecosystems, and for components of native biodiversity to be restored where this was appropriate and achievable. Secondly, there was growing awareness amongst conservation practitioners that restoration goals may be achievable at mainland sites, as well as at offshore islands. In view of statutory requirements and international obligations it could be asked why it has taken so long for New Zealand conservation management agencies to take up the challenge of managing ecosystems, including at mainland sites. To understand why ecological restoration goals for management have only been promoted relatively recently, a brief examination of the history of conservation management in New Zealand is required.

1.1 DECLINING NATIVE BIODIVERSITY

The history of human involvement in New Zealand ecosystems is both recent and dramatic. Although it was the last major landmass apart from Antarctica to be colonised by humans, the impacts of settlement have been catastrophic for the indigenous biota. In a little over 1000 years a predominantly forested landscape has been converted to one dominated by introduced grasses, conifers and built environments. Native vegetation has been almost completely cleared from more fertile lowland regions such as the Waikato Basin and the Canterbury Plains. In the North Island few natural vegetation sequences extend below 400 metres above sea level (Ogden 1995). Apart from forests, 90% of freshwater wetlands and tussocklands present in 1840 have also been lost (Atkinson 1994). Remaining vegetation sequences at lowland sites are highly fragmented, typically occurring as small fragments in production landscapes. Apart from habitat loss and fragmentation, hunting of native animals has also contributed to biodiversity loss. Eleven species of moa (Dinornidae) were hunted to extinction prior to European colonisation, and several species of whales pushed to the brink of extinction by early in the 20th century.

The introduction of over 30 species of terrestrial mammals also resulted in significant ecological impacts. Browsing goats (*Capra hircus*), deer (*Cervus* spp.) and brushtail possums (*Trichosurus vulpecula*) modified plant communities and competed with native animals for food and shelter. Singly or in combination exotic mammals are now recognised as significant agents of native biodiversity decline, with their impacts adding to the on-going environmental stresses caused by habitat loss and fragmentation. Three endemic plant species are presumed to have gone extinct since European colonisation (Atkinson & Cameron 1993). Of the frog fauna 43 per cent, and of the birds over 40 per cent have gone extinct since human colonisation (Mansfield & Towns 1997). These extinctions led the well-known American ecologist Jared Diamond to comment that 'New Zealand no longer has an avifauna, just the wreckage of one.' (Diamond 1984). While little information is available about the conservation status of lower plants and invertebrates, it is estimated that over 1000 taxa of native plants and animals are now threatened with extinction (Anon. 1997a). Introduced predators including rodents (*Rattus* spp.), mustelids (Mustelidae) and cats (*Felis catus*) have contributed directly or indirectly to the extinction of native animals already under pressure from habitat loss and hunting. In addition to the impacts of introduced mammals, a growing number of exotic plants are now recognised as weeds; they are an increasing focus for conservation management programmes undertaken by the Department of Conservation (Owen 1998). It is in this background of landscape modification, habitat loss and fragmentation, and extinctions that conservation activities have been initiated.

1.2 RESPONDING TO BIODIVERSITY LOSS

Reserves have been established in New Zealand for over 100 years. National Parks and other reserves were largely created to protect scenic and historic values rather than important ecological attributes. Notable exceptions were the establishment of Nature Reserves on Resolution, Secretary, Kapiti, Little Barrier and the sub-Antarctic islands which have prescribed nature protection goals. It was not until nearly 100 years of further massive habitat destruction had taken place that a network of Ecological Areas was created by the New Zealand Forest Service in the 1970s to protect important biological communities in publicly-owned forests on the New Zealand mainland. This initiative was followed in the early 1980s by the Protected Natural Areas Programme supported by the Department of Lands and Survey (Kelly & Park 1986) which was aimed at preserving fragments of New Zealand's natural ecosystems on lands of all tenures. Such reserves were created in a national setting of continued land development and increasingly fragmented natural areas. It was not until the passing of the Conservation Act and the establishment of DOC in 1987 that opportunities were created for a more unified approach to protecting biological diversity on public lands.

Building on the far-sighted but unsuccessful efforts of Richard Henry late last century in transferring kakapo *(Strigops habroptilus)* and kiwi (*Apteryx* spp.) to the predator-free Resolution Island Nature Reserve, New Zealand wildlife managers have achieved some significant successes in averting further extinctions and recovering threatened species. These successes have come from a realisation that reserve creation may not, by itself, be enough to prevent further declines and extinctions. The translocation of threatened species to 'safe' offshore islands where habitats are less modified and predators absent has been used increasingly as a conservation management tool (Clout & Saunders 1995). In the last 30 years, in particular, translocation success rates have improved markedly (Lovegrove & Veitch 1994). A number of species recovery plans now include objectives to translocate species in order to establish new populations on offshore islands where critical pests are absent.

The successful removal of a range of pest mammals from a growing number of islands has provided a further dimension to the recovery of threatened species. Conservation outcomes from the eradication of pest mammals has led to recognition of the impacts of these pests on native species, and that managing these impacts is central to effective biodiversity conservation in New Zealand. Building on the opportunities created by removing populations of pest mammals projects aimed at restoring island ecosystems have recently been advanced (Mansfield & Towns 1997).

1.3 CONSERVING MAINLAND BIODIVERSITY

Notwithstanding the ecological importance of offshore islands and the significant conservation management opportunities they offer, islands represent only a small fraction of the total New Zealand environment. Important ecosystems such as fertile lowland plains, terraces and swamps are virtually absent from offshore islands. Conservation programmes aimed at these and other ecosystems can only be undertaken at mainland sites (Meurk & Blaschke 1990).

On the New Zealand mainland where terrestrial pest mammals are able to re-colonise relatively easily, eradication is generally not feasible but recent advances in controlling herbivorous mammals have been made. Policy changes for the control of Himalayan thar (*Hemitragus jemlahicus*), for example, have moved from ineffectual 'clean-ups of problem animals' in high-density areas, to more focused and consistent control in areas prioritised for their conservation values (Miers 1985). Such policy changes directed at achieving important nature conservation goals heralded the introduction of a more strategic approach to pest control generally. Similarly, the recognition that irregular possum control operations did not necessarily result in vegetation recovery has led to the application of more intensive and frequent control operations at some sites. Planned approaches aimed at minimising the impacts of browsing mammals at prioritised conservation sites are now applied by DOC for brushtail possums, goats and tahr (Parkes 1996). In addition a national deer plan is currently being refined (Anon. 1997b). The development and application of improved control techniques, such as aerial hunting of goats and deer and the aerial distribution of toxic baits to reduce possum populations in remote areas, have also contributed to the attainment of important habitat protection objectives.

1.4 MAPARA AND THE 'MAINLAND ISLAND' APPROACH

Located in the northern King Country, the Mapara Wildlife Management Reserve is a 1400 hectare fragment of cut-over conifer forest in an essentially pastoral landscape (Fig.1). A feature of the reserve is the presence of a relictual population of the endangered wattlebird, the North Island kokako (*Callaeas cinerea wilsoni*). In the late 1980s a project was initiated with the aims of investigating the cause of decline and increasing the kokako population within the reserve (Saunders 1990). Recently-developed pest control techniques applied in the reserve involved more intensive management regimes than was normally the case in control operations. A range of pest species including possums, rodents, mustelids and ungulates were initially targeted for control. The Mapara project formed part of an 8-year adaptive management programme involving two treatment areas and one non-treatment area in similarly sized forest fragments containing kokako in the central North Island (Innes et al. 1999).

The central North Island adaptive management programme has been important for several reasons. Firstly it showed that populations of critical pests such as possums and ship rats (*Rattus rattus*) could be reduced and maintained at very low levels long enough for a kokako population to respond. Secondly, significant increases in kokako chick output and adult density could be attributed to the pest control applied. Thirdly, the application of an adaptive management approach allowed for scientifically robust conclusions to be reached. Research results indicated not only the importance of predation as a factor limiting kokako survival, but also the upper population levels of critical pests which may need to be maintained in order to enhance kokako populations. Such information is extremely important to managers in planning species recovery projects at mainland sites. Research at Mapara is currently focused on determining the minimum management effort required to sustain a kokako population in the reserve. While the Mapara project continues to be focused on kokako recovery, observations of other ecological responses to intensive pest control including changes in forest composition, structure and phenology, increased invertebrate community diversity and increases in the numbers of forest birds counted, led to a recognition that wider ecological benefits may result from management aimed at enhancing the kokako population here. A strategic plan for the reserve includes a provision to 'sustain indigenous biodiversity and key endemic species' in addition to objectives focused on the kokako population alone (Bradfield 1996).

This adaptive management programme represents an important advance in conservation management in New Zealand in that activities were directed at understanding and addressing agents of decline such as predation and competition by exotic mammals. The focus on managing ecological threats, rather than protecting individual birds or their nests, constituted a small, but important step towards an ecosystem focus for conservation management.

A key consideration in selecting the Mapara forest as a site where a kokako recovery project could be undertaken was that it was isolated from other kokako populations by surrounding pasture land. Because kokako are poor fliers and have relatively limited powers of dispersal, this isolation meant that there was likely to be little, if any, migration of individual kokako to or from the reserve. Working with a closed population presented important advantages in measuring changes in kokako abundance and in relating these changes to the management applied. The advantages in dealing with closed (discrete) populations have been central to successful species recovery projects undertaken on offshore islands. For some other animals in the Mapara forest with better dispersal abilities, however, pasture land surrounding the reserve did not constitute a barrier to their movements. Native birds such as kereru, the native pigeon (*Hemiphaga novaeseelandiae*) and karearea, the New Zealand falcon (*Falco novaeseelandiae*) have frequently been observed flying between the reserve and other areas. Some pest mammals such as possums, goats and stoats (*Mustela erminea*) also move in and out of the reserve and use non-forested habitats. For these and other animals the Mapara forest is not an 'island' in that they are not confined within its boundaries.

Apart from the presence of an isolated kokako population the Mapara reserve was also seen as analagous with an island in that there were clear boundaries within which management could be focused. Furthermore, once pest densities had been reduced in the reserve overall, control operations could be concentrated at identified points along the forest boundary where pests were likely to re-colonise.

Notwithstanding their value as visual boundaries, and advantages in limiting pest immigration, the borders of habitat fragments are nevertheless not true boundaries, and habitat fragments are not true 'islands' in a biogeographic sense. Many of the species being managed move beyond the boundaries of these sites and 'external' influences from the surrounding landscape mean that the management of small fragments as discrete units is problematic.

Following promotion of the approach taken at Mapara as 'island management, mainland style' (Saunders 1990) the terms 'Mainland Island' or 'Mainland Habitat Island' (Norton 1993) have been used increasingly in departmental communications and by the news media. 'Mainland Islands' are referred to in departmental publications such as the annual performance report to the Minister of Conservation (Anon. 1997c) and the Strategic Business Plan (Anon. 1998a).

Use of the term 'Mainland Island' by departmental staff in internal communications has no doubt had an influence on its continued use within and beyond DOC. Similarly, reference to 'Mainland Islands' in departmental publications and in public forums such as meetings, conferences and in news releases has most likely generated a level of currency for the term in some circles. This does not mean, however, that there is widespread recognition and acceptance of the term. Several community relations specialists in Conservancies have expressed misgivings about the value of the term as an advocacy tool. The view has been expressed that there is potential for confusion about the use of the word 'island' for sites which are not bounded by water. Furthermore, many people are not aware of the significance of islands as conservation management sites in New Zealand.

The initial concept of mainland islands represented by the Mapara project has been superseded by projects which have ecosystem-focused restoration goals and which may be undertaken within large ecosystem fragments where any similarity with offshore islands is not obvious. While the term 'Mainland Island' has been appropriate in reflecting the emergence of intensive conservation management projects at clearly bounded mainland sites, the term will have less relevance as control programmes continue, or to others where management boundaries are not so obvious. The term 'Mainland Restoration' better reflects the nature and goals of these projects, and may be a more appropriate generic term. Whatever generic term the Department uses for these projects, it is important that individual project names should have relevance to local communities and other stakeholders and reflect local history and community perceptions.

While there is growing awareness of wider ecological benefits resulting from pest control undertaken within the Mapara reserve, on-going management continues to be focused on the kokako population. It can be anticipated that as the project evolves, goals which incorporate wider ecosystem-focused parameters will emerge. Given the significant benefits which have already come from this project as a result of its focus on kokako, however, it is likely that Mapara will continue to be funded as a species recovery project for the foreseeable future.

Despite its continued focus on the recovery of a single species, the Mapara project was an important forerunner to ecosystem-focused mainland restoration projects. Apart from indicating that enhancement of a wider range of ecological attributes may result from management aimed at individual species, perhaps the most important legacy of the Mapara project to date has been its demonstration that the control of critical pests to very low levels is not only necessary, but is also achievable at mainland sites provided management is consistently focused in areas with defined boundaries. It is the scope and intensity of pest control undertaken within defined areas which are contiguous with other lands, rather than surrounded by water, which underpins the mainland island concept. A number of other projects have been initiated in the North Island in particular, focused on kokako and other species. Intensive poisoning and trapping regimes are being applied in patches of forest, and monitoring programmes established which are similar to those applied at Mapara.

Other projects were also important in paving the way for the initiation of mainland restoration projects. Research in the Eglinton Valley in Fiordland, for example, which led to a predictive model based on an observed relationship between beech (*Nothofagus* spp.) seeding, house mouse (*Mus musculus*) population irruptions and stoat predation of forest birds (O'Donnell & Phillipson 1996) led to important advances in the recovery of forest birds vulnerable to stoat predation. Intensive predator control and associated research in the braided river and grassland systems of the McKenzie Basin as part of Project River Recovery (Brown & Sanders 1999, Cook & Maloney 1999) also contributed to an understanding of the need for, and challenges associated with effective pest control at mainland sites.

The cumulative effect of conservation outcomes from offshore islands and a few mainland sites where intensive pest control was undertaken was that support was given to the creation of a mainland restoration funding pool by the Department in 1995.

2. Project selection

2.1 SELECTION PROCESS

Following the allocation of additional departmental funds for expenditure on threatened species management in the 1995/96 financial year, a funding pool for 'mainland restoration', among others, was created. Proposals for the initiation of mainland restoration projects were sought from Conservancies by the Director, Species Protection. A small group of departmental specialists evaluated and prioritised bids according to specified criteria. Following a 'reality check' with Conservancies, recommendations from this group were then considered at a meeting of representatives of each of the specialist threatened species groups which was convened by the Director, Species Protection in June 1995. A list of recommended allocations for new threatened species projects was subsequently submitted to the Department's Executive Management Team for approval.

Five mainland restoration projects were initiated using these funds in the 1995/96 financial year at Trounson Kauri Park (Northland Conservancy), northern Te Urewera National Park (then East Coast Conservancy), Boundary Stream Scenic Reserve (then Hawke's Bay Conservancy), Paengaroa Scenic Reserve (Wanganui Conservancy) and the South Branch of the Hurunui River headwaters (Canterbury Conservancy). Funds were also allocated for further investigation and refinement of a project proposal at Rotoiti within Nelson Lakes National Park (Nelson/Marlborough Conservancy) for operational funding in the following (1996/97) year.

With the announcement of an additional 3-year 'Green Package' funding pool to start in the 1996/97 financial year, a 3-day workshop was held in Wellington in February 1996 with the purpose of resolving mainland restoration goals, objectives and standards. While there was extensive discussion on a range of issues, little was resolved at this meeting. In retrospect this was probably an early indication of the complexity of issues needing to be addressed.

Business planning priorities for the 1996/97 financial year were to consolidate existing projects, including additional infrastucture costs in some cases. A small group of departmental specialists was again assembled to evaluate bids and recommend priorities for funding to a 'meshing group' convened by the Director, Species Protection. In line with recommendations made the previous year, and following further investigation and refinements to an earlier proposal, the 'Honeydew beech forest' restoration project at Rotoiti was funded.

In December 1996 a decision was promulgated by the Director, Species Protection that no new mainland restoration projects would be funded in the 1997/98 financial year pending an evaluation of their performance. Priority was again given to consolidating existing projects. Bids were evaluated by a group of three Head Office and Conservancy specialists. In addition, funds were allocated to the establishment of a technical coordination position, and to the preparation of proceedings of the February workshop. It was proposed that an early task for the Technical Coordinator would be to evaluate progress at existing projects, and to recommend future activities and priorities. The position of Mainland Island Ecologist (Technical Coordinator) was filled in July 1997.

During the 1997/98 year plans, reports and technical information relating to activities and results from restoration projects were gathered by the Technical Coordinator in order to review progress and to recommend future actions. As part of this process information from mainland restoration projects was used in March 1998 to trial a cost-utility project evaluation model. This model is being promoted as a basis for determining the merit of individual conservation projects. Its development and refinement continues (Stephens 1999) in association with initiatives to develop a more integrated decision making framework and priority setting system for the Department.

In April 1998 the Regional General Manager (Northern) proposed a process and framework for developing project selection criteria, including for mainland restoration. This process involved an initial focus on mainland restoration projects whereby criteria would be developed in consultation with project staff, DOC's Science and Research Unit and other restoration specialists. It was proposed that these criteria would be subsequently evaluated more widely against other conservation projects prior to being formerly adopted.

A recommendation was made to General Managers by the Technical Co-ordinator that while existing projects should be maintained, the decision not to initiate any new projects should stand for the 1998/99 financial year. Although the Department's recently-approved Strategic Business Plan identified an intention to establish further restoration projects, this recommendation reflected a need for further time to evaluate existing projects, and to develop strategic directions.

2.2 SELECTION CRITERIA

Criteria for selecting mainland restoration projects were developed by Species Protection Division staff at Head Office. These criteria were based on suggestions arising from a meeting of conservancy Protection Managers in April 1995. Five general criteria were applied: project quality, biotic characteristics, project benefits, project risks and anticipated financial return. A selection table with accompanying instructions was prepared to guide the assessment group's evaluation of project proposals (Appendix 1). The development of criteria and a consultative process for ranking project bids was an important initiative. The following evaluation of the criteria, however, indicates that they did not adequately reflect differences between a focus on species recovery and ecological restoration.

Assessed sequentially, highest priority was given to 'project quality', with 'anticipated financial return' being the lowest. The project quality criterion included consideration of soundness, practicality and achievability of objectives and the appropriateness of methods, as well as cost-effectiveness of the proposed methodology and the scientific rigour of any experimental element of proposed projects. While practicality and achievability are important, it is questionable whether they should be primary considerations. Rather, achievability would more appropriately be considered after benefits had been assessed.

In relation to the second ranked criterion, ‘biotic characteristics’, three questions were to be answered in descending order of weighting. Firstly, ‘Is it a unique biotic assemblage?’; secondly, ‘Is it one of the few remaining examples of an ecosystem once more widespread, or does it form part of a continuous ecological or altitudinal sequence?’; and thirdly, ‘Is it a stronghold or important site for Category A and B plants/animals?’ (these categories are used in the Department’s species priority setting system, Tisdall 1994).

In effect greatest weighting was probably given by assessors to the presence of Category A and B species because all biotic assemblages are unique and it would be difficult to separate proposals based on this criterion. The second factor relating to ecosystems and ecological associations is similarly undefined since most habitats would fit one or other of ‘One of the few remaining examples of an ecosystem once more widespread’ or ‘Form(s) part of a continuous ecological or altitudinal sequence’. By default then, greatest weighting is likely to have been given in evaluations of biotic characteristics using these criteria to the presence (‘a stronghold or important site’) of threatened species (i.e. Category A and B plants/animals).

A species focus for selecting these projects can also be inferred from the‘benefits’ criterion. Benefits were first assessed according to the level of benefit to Category A and B threatened species, then by the level of benefit to other (threatened and non-threatened) species, and finally, by (anticipated) benefits from technique development elsewhere. Furthermore, whilst benefits to species from intensive management at these sites may have been relatively easy to predict, benefits from technique development were probably more difficult to rate highly, based on the proposals submitted.

While perceived risks were to be assessed under four headings (operational risk, outcome risk, adverse effects, public reaction) it is unlikely that assessors would have had sufficient information to objectively evaluate these specific risks. It is also likely that there was some duplication in assessing risks under this criterion, and under the highest weighting (project quality). A comment included in the associated instruction sheet that ‘Risk has not been included as a criteria for sorting the projects into the six (biotic characteristics) categories because many of the highly successful projects that have occurred in New Zealand have been high risk’, probably served to lower the weighting of this criterion amongst assessors, and suggests that relatively little weight was given to assessments of risks in overall evaluations.

The criterion with the lowest weighting involved a mix of anticipated levels of return, project costs and advocacy opportunities. Since each of these factors is quite different it is unclear how assessors determined a single score. It is not clear how a level of return was assessed. Again, a species focus may have been emphasised since the most obvious ‘returns’ may have been those associated with population enhancement and species recovery. While project costs could be compared based on project proposals, subsequent review has shown that allocations through this process were not necessarily the only funds committed to these projects (see Project Costs section). Down-scaling a proposal during the selection process on the basis that its anticipated initial costs were higher than another similar proposal may not have resulted in the cheapest project being chosen. Evaluating the advocacy opportunities of these proposals probably constituted the greatest challenge for assessors. The variable results achieved to date indicate the problems in setting advocacy objectives, and measuring performance (see Public Awareness and Community Participation section).

A review of these selection criteria was undertaken by the Hawke's Bay Conservancy Advisory Scientist in March 1996. This review included some suggested changes to existing criteria and recommended some additional ones. Suggestions included incorporating biotic characteristics in a re-defined 'conservation context' criterion, broadening consideration of project benefits to include those associated with ecosystem restoration, public awareness and historical and cultural attributes, and the application of more objective measures for evaluating costs and benefits. Additional recommended criteria included 'Concept fit'. 'Complementation/newness' and 'Showcase potential'. This review also recommended a revised order and weighting of selection criteria, which were presented in tables. While this review was not available for consideration by the evaluation group for the 1997/98 business planning round, it was forwarded to the Technical Co-ordinator on his appointment in July 1997.

The assessment group which evaluated bids for refinements to existing mainland restoration projects in the 1997/98 business planning round used modified criteria from those used in the previous 2 years (Appendices 2 and 3). Criteria, in order of weighting, were as follows:

- 'An existing mainland island project?' Since a decision had been made that no new mainland restoration projects were to be initiated pending a review, this question had an obvious priority.
- 'Project quality.' Factors were identical to those used in previous years.
- 'Urgency.' This was a new criterion with three categories; urgent, important but could be delayed, and useful but not urgent. The relevance of urgency in relation to project bids for ecological restoration could be questioned. Urgency in conservation decision making is typically associated with preventing further extinctions. Although there are scenarios where urgency would be a relevant consideration, its proposed use as a selection criterion here is probably a further reflection of an underpinning focus on threatened species recovery.
- 'Benefits.' Factors were identical to those used in previous years.
- 'Risks.' Factors were identical to those used in previous years.
- 'Level of return' including benefits and anticipated costs, and advocacy opportunities was not used as a selection criterion in the 1997/98 process.

Since no new projects were being considered for the 1997/98 financial year, and bids for refinements to existing projects were not sent to the group, no additional funds were allocated based on assessors' recommendations in the 1997/98 planning round.

2.3 PROJECT SELECTION—DISCUSSION

A process involving the development of weighted criteria and assessment by technical specialists was employed to select mainland restoration projects. Selection criteria were only used to choose mainland restoration projects as part of business planning for the 1995/96 financial year. Five projects were chosen, with 'seed funds' also being allocated for the refinement of a sixth proposal. A decision in December 1996 not to initiate any further mainland restoration projects pending an evaluation of existing ones meant that selection criteria in the 1997/98 and 1998/99 business planning rounds were only used, in effect, to evaluate proposals for consolidation and refinement to existing projects. It is not clear what influence the assessment group recommendations had on decisions concerning existing projects.

While the development and refinement of selection criteria and the application of a consultative process was useful, the value of the criteria was reduced by their lack of emphasis on ecological restoration goals. This was probably due to the inherent complexity of ecosystems, and the related challenges in setting ecological restoration goals compared with those for species recovery. The lack of any precedents in selecting mainland restoration projects and evaluating their success probably also contributed to this problem.

The task of setting appropriate selection criteria was made more difficult by the absence of any policy on the overall goals of ecological restoration, or guidelines on how restoration projects differ from other conservation activities. The decision not to fund any further projects and to initiate a review of existing ones after only 2 years is an indication of both, a recognition of the important challenges involved in ecological restoration, and a lack of strategic direction. That changes were made to selection criteria is a further indication of a lack of clarity on the overall goal for mainland restoration. An important implication of the changes made to criteria used in the 1997/98 business round was the removal of any consideration of biotic assemblages and ecological associations from the assessment process. This meant that the application of the modified criteria would inevitably result in emphasis being placed on species recovery, rather than on biotic assemblages or ecological associations and processes.

In addition to a lack of strategic direction, the absence of any objective process for selecting ecosystems to which restoration activities would be directed was also problematic. Criticisms have been expressed that these projects (and departmental conservation management programmes generally) are inappropriately confined to tall forests, rather than to a more representative array of remaining ecosystems. The decision that no further projects would be undertaken in central North Island podocarp/broadleaf-type forests until the Northern Te Urewera project moved out of its experimental phase, suggests that limits were being placed on management in particular ecosystem types—although no formal strategy existed upon which such decisions could properly be based.

An important test of the value of the selection criteria would come from an evaluation of progress made in relation to them. Results presented in this review indicate that while important progress has been made with respect to some specific criteria such as enhancing populations of threatened species, developing new techniques, and promoting stakeholder involvement, achievements have yet to be interpreted at most projects in relation to wider ecological parameters such as biological assemblages, or ecological processes.

Based on an assessment of the selection criteria used in the 1995/96 business planning round, it is concluded that they were chosen primarily for their potential to enhance populations of native forest species at particular sites. Other factors including the presence of unique biotic assemblages or important ecological associations, and criteria involving project quality, anticipated benefits, risks and costs were more difficult to assess and are likely to have had less influence on funding decisions. Off-site benefits such as the development of techniques which may be applied more widely, and advocacy were similarly difficult to prioritise and probably also had little influence on decisions taken.

Although island biogeographic principles were not used in the selection of existing mainland restoration projects, the apparent isolation of 'habitat fragment'-type projects such as the Trounson, Boundary Stream and Paengaroa reserves makes it tempting to select further projects and manage them according to these principles. There has been considerable debate about the application of island biogeographic principles to reserve selection—the so-called SLOSS, or 'single large or several small' debate (Simberloff & Abele 1976, Gilpin & Diamond 1980). Most debate has focused on the use of the equilibrium model (MacArthur & Wilson 1967) to promote the conservation of single large reserves, rather than several small ones of equivalent total area. Key principles underpinning this model are that species diversity declines as habitat isolation increases, and as habitat area decreases. Because habitat fragments have more permeable boundaries than true islands surrounded by water, these principles do not necessarily apply. As a result of pest invasions, for example, species richness may not necessarily decline in small habitat fragments as predicted by island biogeographic theory. Furthermore, land use changes in surrounding areas mean the landscape context is more changeable than for true islands.

Noss & Cooperrider (1994) suggested six empirical generalisations relating to species conservation in reserves;

- Species well distributed across their native range are less susceptible to extinction than species confined to small proportions of their range.
- Large blocks of habitat containing large populations of a targeted species are superior to small blocks of habitat containing small populations.
- Blocks of habitat close together are better than blocks far apart.
- Habitat in contiguous blocks is better than fragmented habitats.
- Interconnected blocks of habitat are better than isolated blocks, and dispersing individuals travel more easily through habitat resembling that preferred by the species in question.
- Blocks of habitat that are roadless or otherwise inaccessible to humans are better than roaded and accessible habitat blocks.

It has been suggested that these guidelines have proven to be extremely robust and are among the best supported generalisations that conservation biology has to offer (Wilcove & Murphy 1991). While they may provide a useful guide it has been concluded that the effects of habitat fragmentation are complex and it is unlikely that simple principles, or universal rules could be applied (Spellerberg & Sawyer 1999).

In reality, island biogeographic principles, reserve design and the SLOSS debate may be relatively minor considerations in selecting conservation management sites. It will be important to manage biodiversity in small fragments as well as in large habitat complexes if a representative sample of New Zealand's remaining biodiversity is to be protected. This will require an understanding of the biological consequences of fragmentation and the development of policies and management procedures which reflect the differences between managing true islands, large habitat complexes and smaller fragments within modified landscapes. Criteria for selecting management sites in fragmented landscapes, in particular, will be critical (Noss & Harris 1986, Saunders et al.1991). An important challenge in a New Zealand context will be to develop criteria, perhaps based on those of Noss & Cooperrider (1994), so that priorities for conservation management may be set in a variety of landscapes with different levels of fragmentation. That is, rather than selecting reserves *per se*, management areas will be chosen according to a range of parameters which, in addition to biogeographic features such as size, shape and proximity to other fragments, may also include the defensibility of boundaries against pest migration, the suite of pests present, land uses in the catchment and community support.

Any strategic approach to effectively conserving representative New Zealand ecosystems should involve experimental management at sites chosen according to various biological, geographical, social, financial and logistical considerations. Provided objectives were pursued to gain strong inferences from the management applied at different places (for example, in different ecosystems, fragmented or contiguous, large or small, lowland or upland, accessible or remote), important advances in our ability to manage ecosystems can be anticipated. The development of 'landscape ecology' (Noss & Cooperrider 1994) will be crucial to developing our understanding of important processes and interactions within such habitats, and between fragments and their surrounding landscapes.

2.4 PROJECT SELECTION—KEY POINTS

Criteria were developed and a selection process established for prioritising Conservancy bids for mainland restoration funds.

Although criteria covered a range of factors including ecosystem attributes, emphasis was given to the potential of these projects to recover threatened species.

It was decided in December 1996 that no further mainland restoration projects would be initiated pending a review of the success of existing ones.

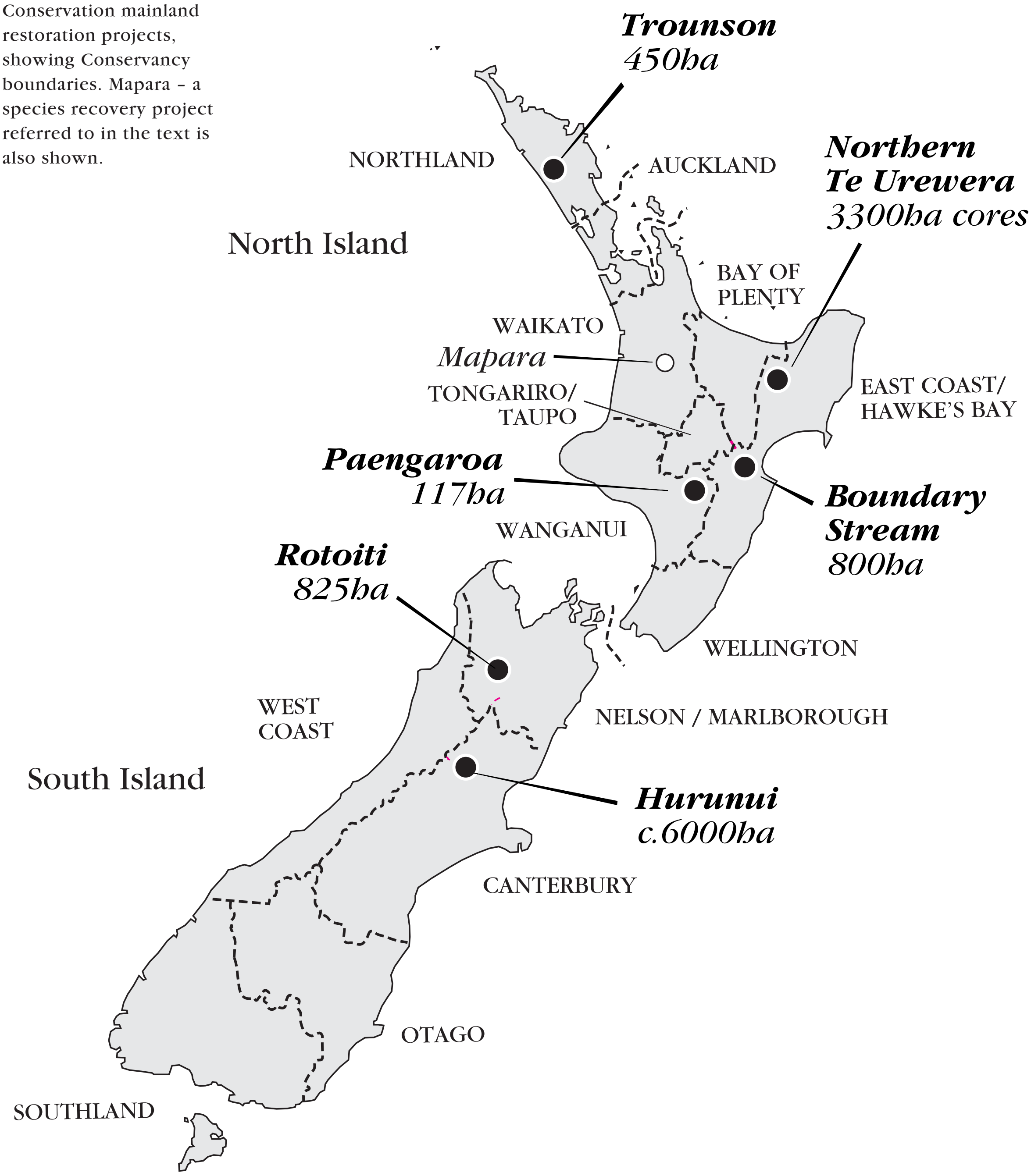
The absence of any policy or clear direction on the overall purpose of these projects meant that their selection in relation to ecological restoration goals was problematic, as was any review.

An additional problem was the lack of an objective process to select and prioritise ecosystems for management.

3. Site features

The following project descriptions are based on information supplied by project and Conservancy office staff. The six mainland restoration projects reviewed here are spread across five departmental Conservancies with four in the North Island and two in the South Island (Fig. 1).

Figure 1. Location of Department of Conservation mainland restoration projects, showing Conservancy boundaries. Mapara – a species recovery project referred to in the text is also shown.

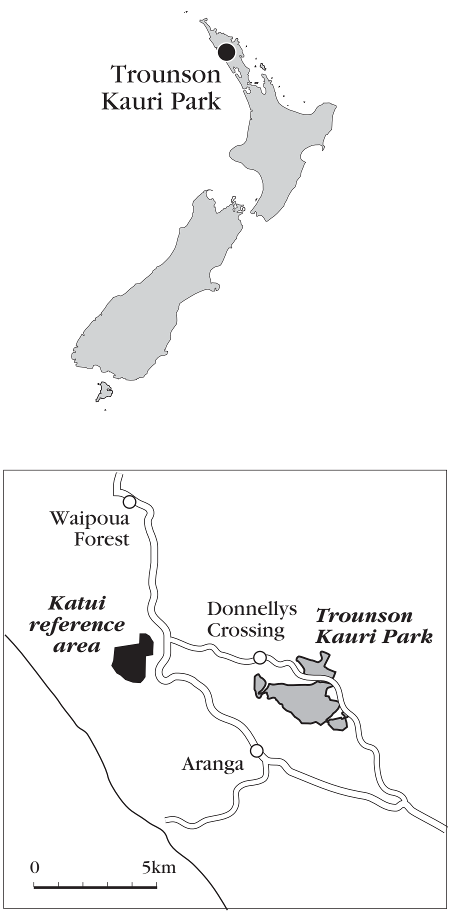


3.1 TROUNSON KAURI PARK ECOSYSTEM RESTORATION PROJECT

Situated south of Waipoua Forest in the upper Kaihu River valley in western Northland, the 586 hectare (ha) Trounson Kauri Park Scenic Reserve comprises 445 ha of forest, surrounded by pasture land which is leased for grazing (Fig. 2). The operational (treatment) area consists of four blocks: Main (294 ha), North (100 ha), East (26 ha) and West (25 ha). The North block is separated from the other blocks by a road. The East and West blocks are linked to the Main block by narrow forest corridors. The Waima River flows along the south-western boundary of the reserve. The Trounson reserve lies close to the small settlements of Donnellys Crossing and Kaihu Valley and is 36 kilometres (km) north of Dargaville township.

Topography in the Trounson reserve is flat to rolling with steeper gullies (Fig.3); altitude ranges from 150 to 300 metres above sea level (m a.s.l.).

The reserve is a remnant of 'old growth' mixed kauri, podocarp-hardwood forest and lies within the Western Northland Ecological Region. Mature kauri trees (*Agathis australis*) are common in parts of the reserve, dominating the ridge tops. Nine species of podocarp are also present such as kahikatea (*Dacrydium dacrydioides*) and totara (*Podocarpus totara*) as well as including monoao (*Halocarpus kirkii*), a species of very restricted distribution. Regenerating broadleaf forest forms a significant component of the reserve, with large taraire (*Beilschmiedia tarairi*) present. Several species of rare orchid are found in the reserve.



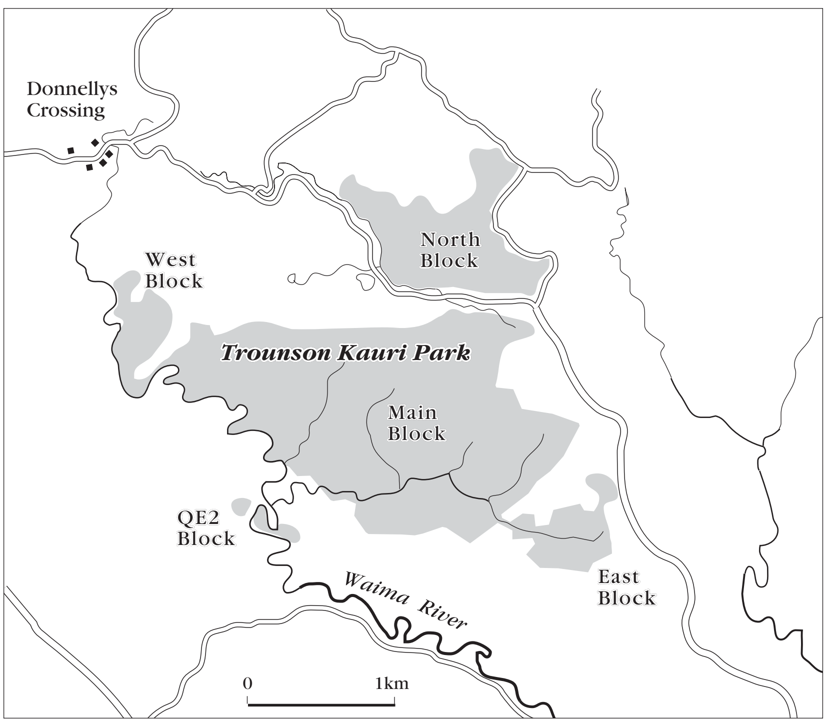


Figure 2. Trounson Kauri Park project area and the Katui Scenic Reserve reference area.

Figure 3. Northern boundary, Trounson Kauri Park.

Several threatened animals are also found in the reserve including a dense population of North Island brown kiwi (*Apteryx australis*). Kauri snails (*Paryphanta busbyi busbyi*), banded kokopu (*Galaxias fasciatus*), pekapeka—the long-tailed bat (*Chalinolobus tuberculatus*), kukupa—the New Zealand pigeon and kakariki—the parakeet (*Cyanoramphus* sp.) are also present; other species with limited distributions are all present in substantial numbers within the reserve. Initiatives have recently been taken to re-introduce North Island kokako, Pateke—brown teal (*Anas chlorotis*) and toutouwai—North Island robin (*Petroica australis*) to the reserve.

The forest is effectively isolated from deer, goats and pigs (*Sus scrofa*) which are all increasing their ranges elsewhere in Northland. Good fences prevent stock access into the reserve. Pest mammals within the reserve include Australian brushtailed possum, ship rat, Norway rat (*Rattus norvegicus*), house mouse, cat, stoat, weasel (*Mustela nivalis vulgaris*) and ferret (*M. furo*). Dogs (*Canis familiaris*) have been found in the reserve on several occasions.

The 295 ha Katui Scenic Reserve, 6.5 km to the north-west, serves as a reference area for comparison with the intensively managed area[1]. It features regenerating mixed kauri-podocarp-hardwood forest and extends from 140 to 240 m a.s.l. with a mainly northerly aspect. This reserve lies on two ridges of gentle to moderate topography in the headwaters of the Muriwai Stream. The reserve lies just north of Maunganui Bluff and about 4 km north-west of the Trounson Kauri Park. The Katui reserve is composed of cut-over kauri-podocarp-hardwood forest dominated by taraire, kohekohe (*Dysoxylum spectabile*) and nikau (*Rhopalostylis sapida*). While few mature kauri remain, regenerating rickers

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[1] Whilst definitive in an experimental context, the term 'non-treatment area' is less helpful in that few areas in the vicinity of these projects have not been treated with some level of possum (and, perhaps, other pest) control. The term 'reference area' is suggested as a more appropriate term.

are common. Vegetation in the Katui reserve also differs from Trounson with the presence of canopy species such as puriri (*Vitex lucens*), kowhai (*Sophora microphylla*) and kawakawa (*Macropiper excelsum*). Its understorey has been heavily browsed by ungulates.

Katui supports moderately high numbers of possums and is generally in poor health. Both the Trounson and Katui reserves have underlying medium-well drained clay soils on a fine to medium grained basalt bedrock.

Other forest sites in Northland are also being used to compare trends in diurnal bird and kiwi populations in relation to different management regimes. Approximately 15,000 people visit the Trounson reserve annually, including school groups (both local and regional), as well as national and international tourists. A high number of volunteers—mainly students from overseas—contribute to research and management programmes in the park. Northland Polytechnic and Auckland University students also undertake research here. An interpretive boardwalk through part of the reserve attracts a large portion of the visitors. Guided evening walks along the boardwalk are conducted during the summer by a concessionnaire.

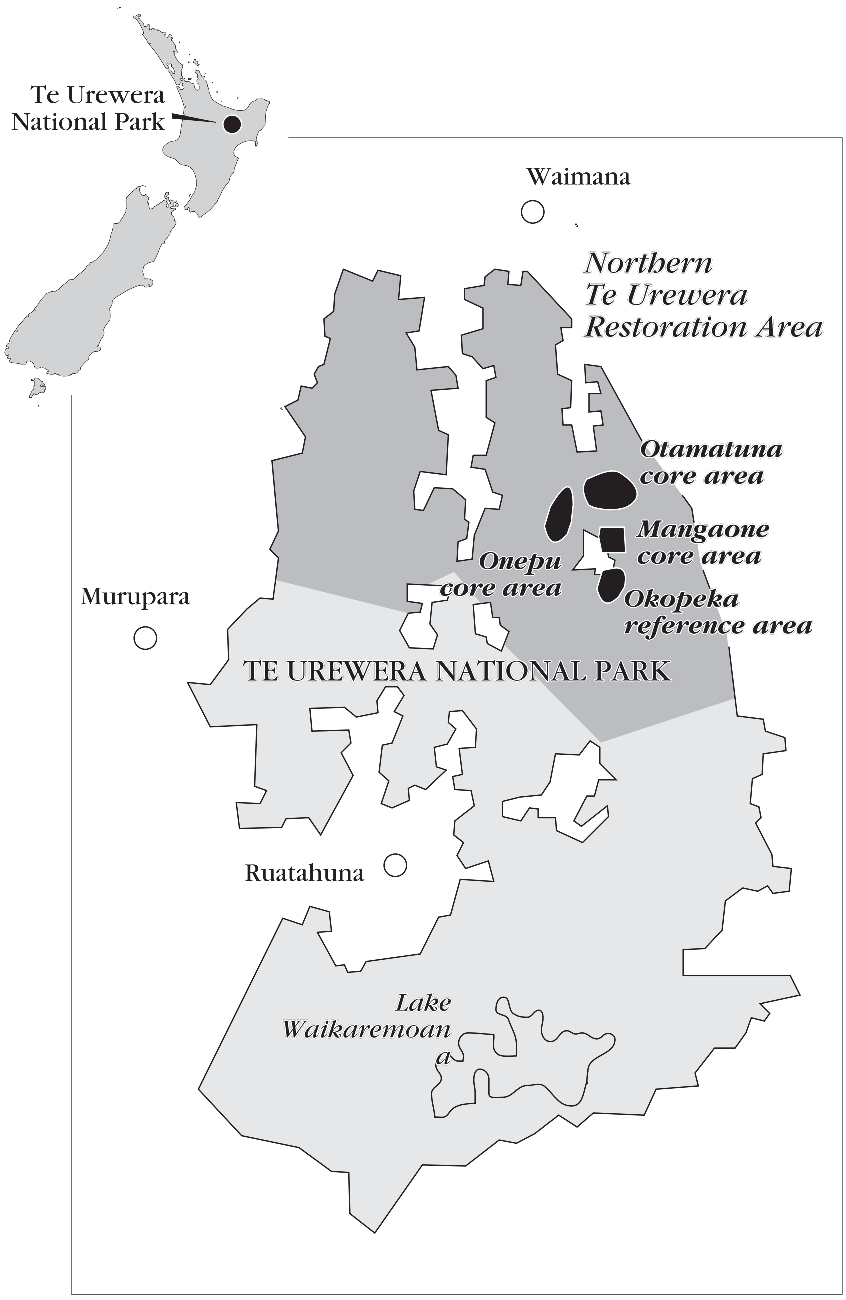
3.2 NORTHERN TE UREWERA ECOSYSTEM RESTORATION PROJECT

The Northern Te Urewera Ecosystem Restoration project lies in the middle reaches of the Tauranga (Waimana) River valley within Te Urewera National Park. The long-term goal of the project is to restore a 50,000 ha portion of the northern Te Urewera forest complex through intensive, integrated management to be achieved through a series of short-, medium- and long-term objectives. The project was initially focused in the Otamatuna 'core breeding' area where intensive management is being undertaken. Initially covering some 1300 ha, the core breeding area has been expanded so that about 2500 ha is currently under intensive multiple pest control. Less intensive possum control and monitoring is being undertaken over much of the remainder of the 50,000 ha. While not covered in this review, additional core breeding areas at Onepu and Mangaone—each covering about 400 ha (Fig. 4) are being developed—and others are being considered elsewhere in the block as part of a staged expansion programme.

A reference area covering about 550 ha in the Okopeka area 5 km to the south of the Otamatuna area is monitored to compare pest populations and some native species. Similar monitoring regimes are also in place in the Onepu and Mangaone core areas. The soils, topography and vegetation of the Okopeka area are very similar to the Otamatuna operational area, although a coastal influence is less obvious in Okopeka.

Most of northern Te Urewera lies within the Waimana Ecological District which is predominantly in the lowland bioclimatic zone; it is made up of rolling to steep ridges underlain by greywacke with narrow terraces and alluvial fans on lower valley sides. The higher ridges are generally broad-crested with a zone of moderate and gently undulating topography 50 to 400 m wide. These gentler slopes have retained layers of volcanic ash of varying structures and

Figure 4. Northern Te Urewera Ecosystem Restoration Project showing core management areas and reference area within the proposed 50,000 hectare restoration area (dark grey shading).



composition, with yellow-brown pumice soils derived from these materials. Soils downslope are steepland variants of mixed ash/greywacke parent materials or skeletal greywacke soils. Altitude in the northern Te Urewera ranges from 150 m in the valley floors to more than 1000 m a.s.l. on the ridges. The Tauranga (Waimana) River follows a major geological fault, draining northwards into the Bay of Plenty.

The main vegetation type in both the core areas, and the Okopeka reference area, is rimu-rata/tawa-kamahi forest with localised red beech forest on ridge crests and restricted areas of podocarp forest on terraces and fans (Fig. 5). Several native plants typical of semi-coastal and lowland forest are present, including kiekie (*Freycinetia baueriana banksii*) and nikau. The vulnerable pirirangi—the red mistletoe (*Peraxilla terapetala*) is present on the Otamatuna ridge and elsewhere in the area. Other mistletoes may also be present. Another

Figure 5. Looking north from Otamatuna Ridge.

vulnerable species, *Myosotis* 'pottsiana' (a yet undescribed native forget-me-not) also occurs here.

Because of its large size, range and quality of habitats, northern Te Urewera contains a fauna assemblage that is as comprehensive and intact as any left on the New Zealand mainland. Nearly all indigenous birds present in North Island forests are represented here, including several threatened species including North Island brown kiwi, North Island kokako, whio—the blue duck (*Hymenolaimus malacorhynchos*), kakariki, North Island kaka (*Nestor meridionalis septentrionalis*), New Zealand falcon and bats are present. Occasional reports of North Island weka (*Gallirallus australis*) have also been recorded. A range of native fish are present in the rivers and streams in the area, including the threatened short-jawed kokopu (*Galaxias postvectis*). The as yet un-named Raukumara tusked weta is present in the area, as is the very rare and euphemistically named plant 'Xit'.

Tuhoe are the tangata whenua of northern Te Urewera and have lived in, and interacted with the area for many centuries. They have a particularly close relationship with Te Urewera: all the ridges, high points, streams, old habitation sites and waahi tapu are named. Tuhoe have never been alienated from Te Urewera and tangata whenua still live in enclaves of private land within the National Park and along the margins of the Tauranga (Waimana) and Ohinemataroa (Whakatane) Rivers. Tuhoe living in the area have never lost contact with the natural world of Tane and have great knowledge and understanding of the land with the plants and animals that inhabit it.

Local communities have a strong interest in Te Urewera, with many children being introduced to the area on school trips. The valleys are popular summer camping destinations and there are strong local tramping and hunting groups. Hunters in particular use the area extensively, with many former commercial deer and possum hunters living nearby.

3.3 BOUNDARY STREAM MAINLAND ISLAND PROJECT

The Boundary Stream Scenic Reserve is situated on the south-eastern flanks of the Maungaharuru Range, approximately 60 km north of Napier in northern Hawke's Bay (Fig. 6). The operational area consists of the entire Scenic Reserve (702 ha) plus a further 100 ha of contiguous privately-owned forest. Two reference areas are being monitored for comparative purposes; Cashes Bush Conservation Area and Thomas Bush which is part of the Opouahi Scenic Reserve.

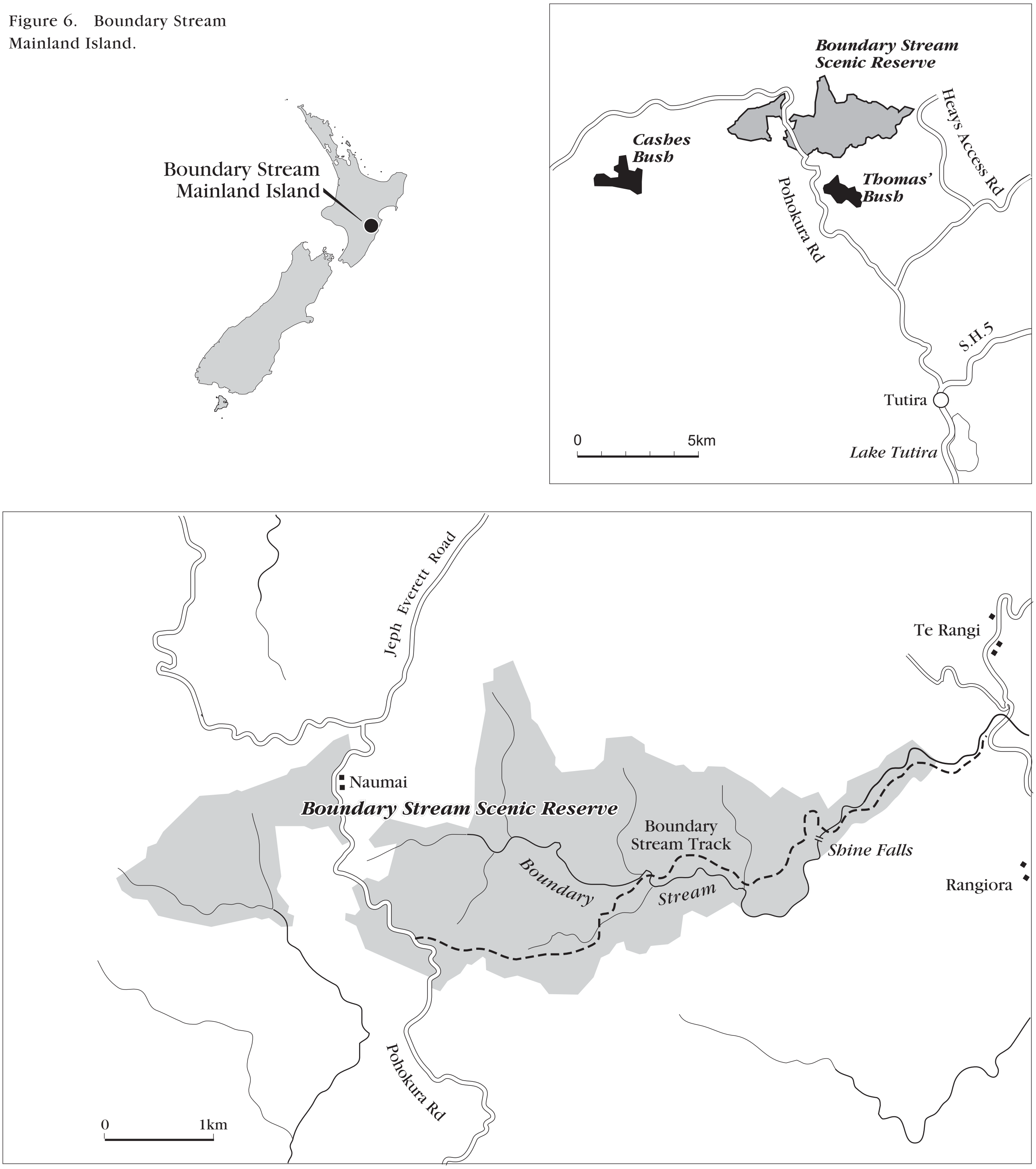


Figure 6. Boundary Stream Mainland Island.

Figure 7. Boundary Stream Scenic Reserve, looking west.

The Boundary Stream operational area is a large gully system featuring a complex topography of deep gorges, steep cliffs, numerous streams and several waterfalls—including the 58 m high Shine Falls. Altitude ranges from 300 to 1000 m a.s.l. The Boundary Stream Scenic Reserve constitutes the largest single example of primary and advanced secondary forest within protected areas in the Maungaharuru Ecological District (Fig. 7).

A broad mosaic of vegetation exists in the reserve, comprising 12 distinct types including mixed broadleaf, hardwood and podocarp species through to montane forest species. Notable features of the flora include regionally rare and threatened species of neinei (*Dracophyllum latifolium*) and yellow-flowered mistletoe (*Alepis flavida*), kakabeak (*Clianthus puniceus*), a species of Pimelea (*Pimelea aridula* 'Maungaharuru') endemic to the Ecological District, a diverse habitat sequence within an extensive altitudinal range which includes mature forest, scrub, bluff systems and swamp. The forest structure was still in relatively good condition before the start of this project even though it has been extensively modified by stock, red deer (*Cervus elaphus*), goats and possums and, to a limited extent, by past logging and burning.

One of the reference areas, Thomas Bush, lies approximately 1 km south of the Boundary Stream reserve. The two areas are separated by grazed pasture with some small bush pockets and pines. The Thomas Bush reserve covers an area of 87 ha and extends from 550 to 740 m a.s.l. Vegetation in the reserve is comparable with the middle and lower reaches of the Boundary Stream operational area.

The Cashes Bush reference area covers 187 ha. It lies about 4 km south-west of the Boundary Stream reserve. Situated on the western flank of the Maungaharuru Range just below the highest part of the range, Cashes Bush extends from 700 to 1100 m a.s.l. Vegetation here is comparable with the upper reaches of the Boundary Stream reserve.

Introduced mammal pests in these reserves include feral pigs, goats, red deer, possums, rodents, mustelids, hedgehogs and cats.

Rodents, mustelids, feral cats, dogs, pigs and possums have had impacts on the native fauna which once included weka, blue duck, numerous kiwi, kokako, saddleback (*Philesturnus carunculatus rufusater*) and various lizards. Native animals include a healthy and diverse invertebrate fauna—including the landsnail *Powelliphanta traversii* 'Maungaharuru') which is present in the Cashes Bush reference area. This species is endemic to the Ecological District. There is also a remnant North Island brown kiwi population, skink and gecko species and a comprehensive range of exotic and native forest birds representative of the Ecological District. North Island robins were re-introduced to the reserve in April 1998. The natural history of the general area has been well documented. The Boundary Stream reserve was incorporated in a DSIR (now Manaaki Whenua—Landcare Research Ltd) bird monitoring programme in 1987.

Situated within one hour's drive from Napier and Hastings (which have a combined population of about 100,000), the Boundary Stream Scenic Reserve is regularly visited—particularly the Shine Falls at the lower (north-eastern) end of the reserve where a public walking track is maintained. About 5000 people visit the reserve each year.

3.4 PAENGAROA RESERVE

The Paengaroa Mainland Island is a small forest remnant surrounded by farmland on the banks of the Hautapu River 10 km north-west of Taihape (Fig. 8). The total project area is 117 ha, comprising the 101 ha Paengaroa Scenic Reserve and an additional 16 ha of Conservation Area and Road Reserve. A small area of adjacent forest is not included in the operational area (Fig. 9). There is no reference site.

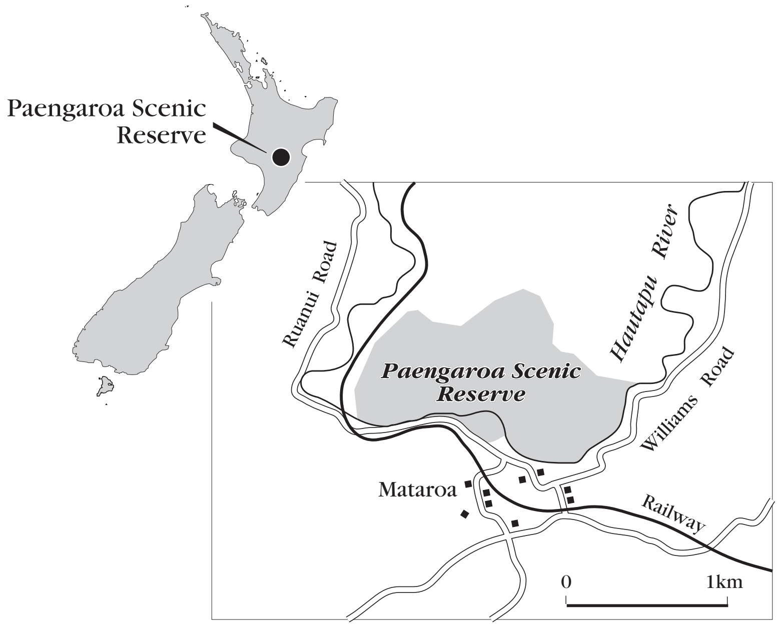


Figure 8. Paengaroa Reserve.

Figure 9. Overview of the Paengaroa Reserve (photo: Terralink).

The topography of the Paengaroa reserve consists of a narrow river terrace and hillslope with a southerly aspect. Altitude ranges from 520 to 706 m a.s.l. Soils are based on a mudstone parent rock with a lahar overlay. The project area lies within the Rangitikei Ecological District and features an unusually diverse range of divaricating shrubs and trees—including threatened species and others with localised distributions. The river terrace forest is podocarp/broad-leaved forest typical of this part of the Hautapu Valley. Approximately 230 indigenous plant species are recorded for the reserve.

The range of divaricating shrubs and trees with divaricating juvenile stages is probably the greatest for any place of comparable area in New Zealand. More than 30 divaricating species are known, including six species which are considered nationally threatened: *Coprosma obconica* ssp. *obconica*, *Coprosma wallii, Melicytus flexuosus, Olearia gardneri, Teucridium parvifolium, Pittosporum obcordatum*, as well as the mistletoe *Tupeia antartica*. For the climbing daisy *Brachyglottis sciadophila*, Paengaroa is one of only two North Island locations. A number of other plants in the reserve have restricted North Island distributions. Although the precise reasons are not clear, it is apparent that unique conditions at the reserve have led to these unusual species occurrences. While the mixture of higher plants within the reserve is particularly unusual, further investigations may well find similar uniqueness within lower plants and invertebrates here.

The reserve holds populations of miromiro—the tomtit (*Petroica macracephala*) and rifleman (*Acanthisitta chloris*), both of which are very uncommon in, or absent from other nearby forest remnants.

The small village of Mataroa lies adjacent to the reserve. Several local residents have expressed interest in management of the area. There is a relatively long history of interest in the area by botanists due to its unusual plant assemblages. Prior to its establishment as a mainland island, some common ivy (*Hedera helix*) control was carried out by botanical groups, the Royal Forest and Bird Protection Society and other conservation groups.

3.5 ROTOITI NATURE RECOVERY PROJECT

The Rotoiti Nature Recovery Project lies within the Nelson Lakes National Park. The operational area is an 825 ha portion of mixed honeydew beech forest on the slopes of the St Arnaud Range adjacent to Lake Rotoiti (Fig. 10). It is buffered on its western side by the lake, on its north-western side by developed farmland, and on the east by the rocky tops of the range (Fig. 11). To the south it is contiguous with the greater Nelson Lakes beech forest complex. Two reference areas are used; 'Lakehead', a 400 ha area of forest at the head of Lake Rotoiti; and Mt Misery, a 200 ha area on the south-eastern shores of Lake Rotoroa.

Altitude ranges from 680 m at the lake shore to about 1400 m a.s.l. at the tree line in the operational area. Lying just south-east of the Alpine Fault, the geology of the area consists of a greywacke base with glacial terraces on the lower slopes. The Lakehead reference area has a similar geology to the operational area, although there is more moraine material in the former. Vegetation is similar at all three sites (Rotoiti operational area, Lakehead, Mt Misery).

The Rotoiti project area is representative of the mixed honeydew beech forests of the Travers Ecological District. The forests here are transitional between the mixed beech-podocarp forests of north Westland and the drier beech forests of western Marlborough. The lower slopes in the area are dominated by red beech (*Nothofagus fusca*) and silver beech (*N. menziesii*) with mountain beech (*N. solandri* var. *cliffortoides*) and kanuka (*Kunzea ericoides*) at sites with poor drainage, and upper slopes by silver and mountain beech grading to pure mountain beech at the tree line.

A relatively diverse bird fauna is a feature of the large habitat complex, including kakariki, South Island kaka (*Nestor meridionalis*), weka and kea (*Nestor notabilis*). Long-tailed bats are also present. While no reptiles have yet

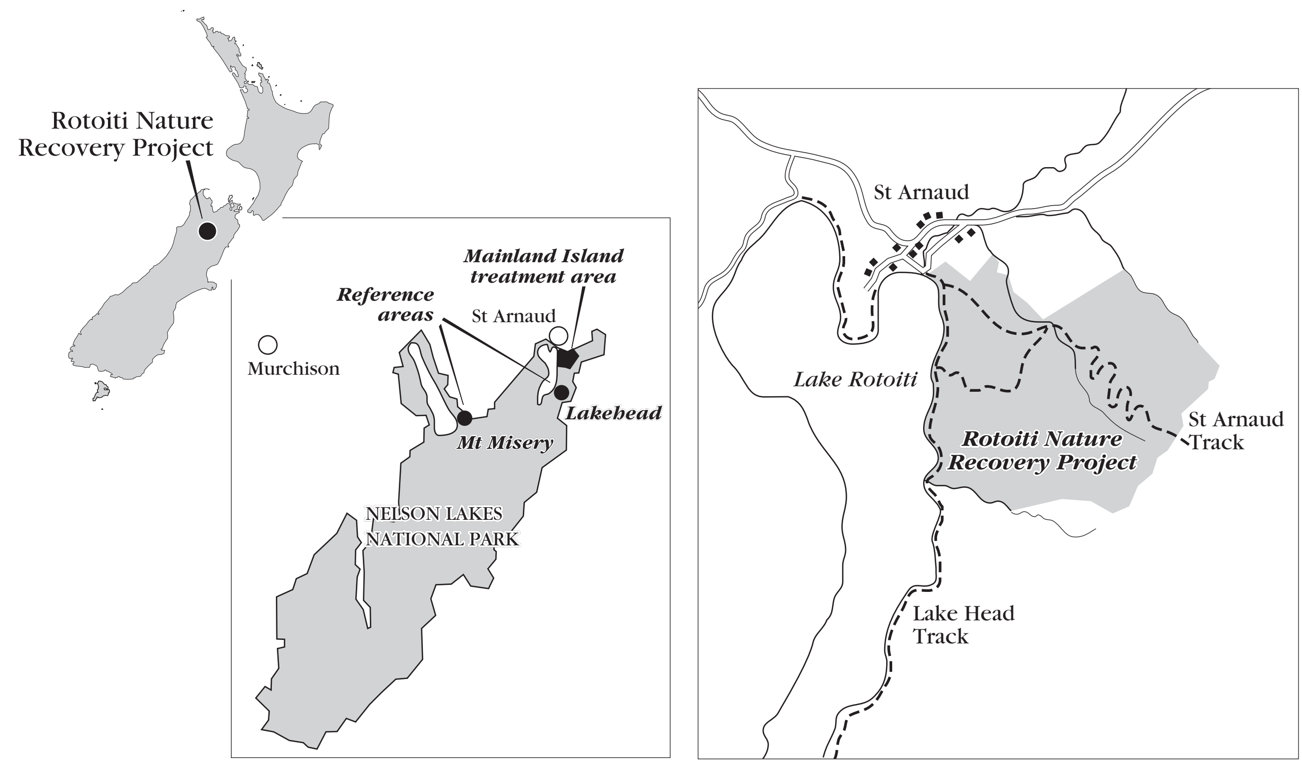


Figure 10. Rotoiti Nature Recovery Project, including Lakehead and Rotoroa reference areas.

Figure 11. Rotoiti Nature Recovery Project with Lake Rotoiti in foreground

been located within the operational area, several species of lizard are present nearby. The invertebrate fauna has been sampled and is currently being analysed.

Introduced mammals present include mice, Norway rat and ship rat, hedgehog, stoat, ferret, weasel, cat and possum. Red deer and chamois (*Rupricapra rupricapra*) are occasionally seen in the area.

Detailed information is available on the birds of the Park and surrounding areas, from the National Parks and Reserves Bird Mapping Scheme, as well as studies at nearby Big Bush (NZ Forest Service and Landcare Research) and Mt Misery (DSIR/Landcare Research). These programmes included several significant series of bird counts and, in combination, constitute an important source of historical information.

The Nature Recovery Project area lies beside the township of St Arnaud and on the shores of Lake Rotoiti. It is directly accessible by three short walking tracks from the township. One of the tracks is the start of the Travers/Sabine 5-day circuit of the Nelson Lakes National Park. Lake Rotoiti provides an important recreational resource for the local community as well as for visitors from Nelson and Blenheim. National and international tourists also visit the area. Approximately 100,000 people visit the lake shore beside the project area annually.

There has been significant community involvement in the project to date, including a public launch and anniversary celebration. A project newsletter 'Revive Rotoiti' is produced regularly for circulation in the local community. Numerous talks have been given by project staff to stakeholder groups and their participation in monitoring programmes and wasp control are encouraged. There are indications that the St Arnaud community identifies with, and supports the project.

3.6 HURUNUI MAINLAND ISLAND PROJECT

The Hurunui restoration project involves an operational area of approximately 6000 ha in the upper South Branch of the catchment, and a reference area covering some 6000 ha in the North Branch (Fig. 12). Extension of the project to include the North Branch was funded in the 1997/98 financial year. It is proposed to eventually include all or part of the North Branch area into the operational area.

The upper Hurunui catchment occupies the south-western corner of Lake Sumner Forest Park about 200 km north-west of Christchurch. Apart from Forest Park, some sections of riverbed are designated as Unoccupied Crown Land. The South Branch lies within the Minchin Ecological Area and the North Branch is in the Hope Ecological Area.

The upper Hurunui River catchment features steep-sided glaciated valleys with wide river flats of braided river gravel and short tussock grassland with oversown pasture (Fig. 13). The North and South Branch valleys have similar topography, although the North Branch area has a slightly wider valley floor. The area is characterised by relatively intact eastern dry beech forest with red and mountain beech associations on steep slopes and red beech dominant on terraces. Two species of mistletoe (*Peraxilla tetrapetala* and *Alepis flavida*) are present. River flats and ridge tops are characterised by relatively intact grassland/herbfields.

The fauna of the area is diverse and unique with the best known population of orange-fronted parakeet (*Cyanoramphus* sp.) as well as significant populations of mohua (*Mohoua ochrocephala*), kaka, yellow-crowned parakeet (*Cyanoramphus auriceps*), New Zealand falcon, great spotted kiwi (*Apteryx haastii*) and good representations of other beech forest bird species.

Figure 12. Hurunui Mainland Island operational area (South Branch) and reference area (North Branch).

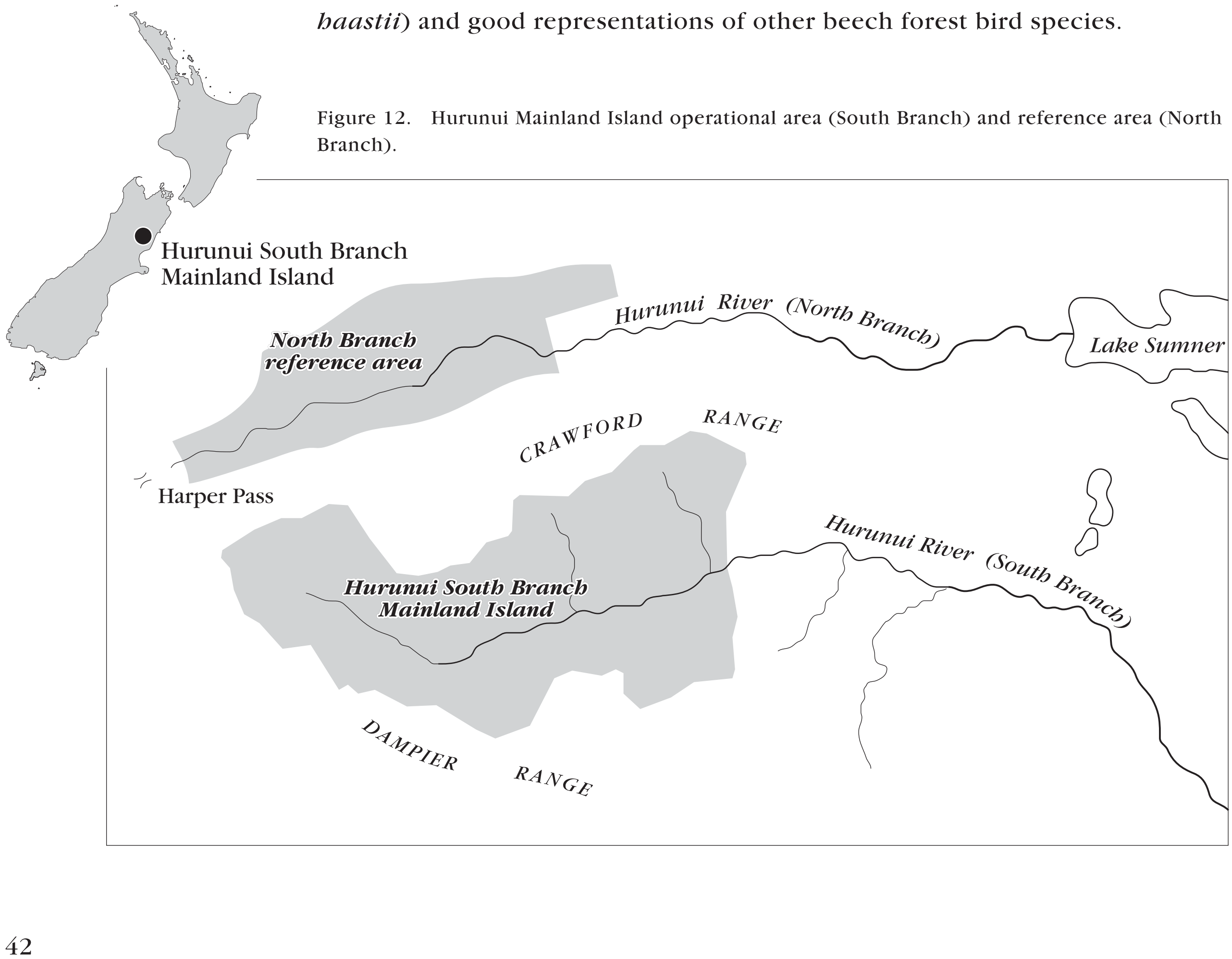


Figure 13. Hurunui South Branch operational area, looking up-river.

The upper Hurunui catchment is isolated and difficult to access. Four-wheel drive access for project staff involves obtaining permission to cross private land—to the South Branch from the owners of Eskhead Station, and to the North Branch from the owners of Lakes Station. School parties and some other recreational groups do visit the area, but access to the general public is limited. Hunters and trampers occasionally visit the Hurunui catchment from neighbouring areas.

3.7 SITE FEATURES—KEY POINTS

Operational areas range from 117 ha (Paengaroa) to about 6000 ha (Hurunui). A total of approximately 11,500 ha are currently being intensively managed (Table 1). The area managed has already increased at two sites. Most project areas are forested although some grasslands are also included.

TABLE 1. RESTORATION PROJECT OPERATIONAL AND REFERENCE AREAS.

OPERATIONAL AREA	AREA (ha)	REFERENCE AREA	AREA (ha)
Trounson Kauri Park	445	Katui Reserve	295
Northern Te Urewera Forest	50,000 (c. 3300 ha)	Okopeka	550
Boundary Stream Reserve	800	Cashes Bush Reserve	187
		Thames Bush Reserve	130
Paengaroa Reserve	117		
Rotoiti honeydew beech forest	825	Lakehead	400
		Mt Misery	200
Hurunui River (South Branch)	6,000	Hurunui River (Motu Branch)	6,000
Total:	11,487		7,762

Part B

MANAGEMENT ACTIVITIES, RESULTS AND PRELIMINARY OUTCOMES

In this section information provided by project and Conservancy office staff — either in project plans and reports, or in questionnaire responses—is presented. Additional comments are made at the end of each sub-section.

It should be noted that this review does not necessarily include the most comprehensive and current information available relating to each of these projects. Rather, it is a compilation of information provided by project managers. In addition to depicting activities and results, this review should be valuable in identifying information needs for future evaluations.

A number of figures, tables and graphs have been included with the purpose of showing how information has been presented and interpreted. No attempt was made during this review to critically examine these interpretations. It is anticipated that a detailed assessment of activities, results and outcomes will be undertaken once all projects have been comprehensively and consistently reported.

4. Long-term project goals, or visions

Five of the six projects have strategic plans which include a long-term project goal, or vision.

4.1 TROUNSON

'Intensive management at Trounson will restore the park's kauri forest ecosystem to a much healthier condition and approaching that of pre-European times. Ecological processes will be enhanced, whilst threatened species of wildlife will recover in the impoverished environment. It will be a site where management techniques will be improved following precise experimental designs and the results closely monitored. While supporting research and monitoring programmes of individual species and the biota generally, we will be able to determine the responses to particular levels of management, and compare these with responses at localities with different management regimes, thereby finding the most effective techniques for specific responses. In this way Trounson will provide a model for the expanding mainland island programmes in Northland, both departmental and private, and will become a showcase for the local community and visitors to the park.' *(Draft strategic plan,* Anon. 1997d*).*

Seven aims listed under this goal for the Trounson project cover ecosystem recovery, threatened species recovery, re-introductions, community interest, ecosystem monitoring, sharing knowledge and research.

4.2 NORTHERN TE UREWERA

'To acknowledge and nurture the mauri of the northern Te Urewera ecosystem.' *(Northern Te Urewera Ecosystem Restoration Strategy, Shaw* et al. *1996.)*

'The strategic approach to fulfilling this vision involves: initially focusing management on a small study area (Otamatuna); developing management techniques at this site for broader application in conjunction with field trials at other sites; assessing such techniques through monitoring the results and outcomes of treatment relative to a non-treatment (control) site at Okopeka; then systematically expanding the application of these techniques into "core breeding areas".' (*1997/98/99 annual report, Beaven* et al. *1999.)*

A management philosophy underpinning the vision is declared in the strategic plan which emphasises a vision to sequentially develop capacity to restore a 50,000 ha area. Management trials are proposed to develop and refine techniques based on reliable data, to identify separate management areas within the greater complex, to use non-treatment 'controls', and the need for an integrated management approach is emphasized.

4.3 BOUNDARY STREAM

'Boundary Stream Scenic Reserve will be restored, by careful nurturing and enhancement, to the vibrant indigenous ecosystem it once was. The reserve will be a place where the public can visit and enjoy a flourishing fauna and flora reminiscent of a typical Hawke's Bay forest of the past. It will be a showcase for the Conservancy, providing a centre for community involvement and demonstrating what can be achieved in protecting and enhancing biodiversity given sufficient resources, enthusiasm, commitment and public support.' (*Boundary Stream Strategic Plan, Anon. 1995a*).

Nine management objectives are given that support the vision: establishing a project infrastructure, monitoring environmental changes, ecosystem recovery through intensive control of animal pests, threatened species recovery, re-introductions, research, community interest, sharing knowledge and staff development.

4.4 PAENGAROA

'To restore and enhance the outstanding biodiversity of Paengaroa Scenic Reserve. To utilise the reserve's outstanding values to promote public awareness of the composition and functioning of a unique ecosystem with many rare elements.' (*Mainland Island Strategy 1996–2001, Barkla 1996.*)

Three specific objectives underpinning the goal are identified; manage weed and animal threats, develop interpretation facilities, introduce plants and animals.

4.5 ROTOITI

'Restoration of a beech forest community with emphasis on the honeydew cycle. A restoration goal such as this has been expressed evocatively as 'restoring the mauri (health and life force) of the forest ecosystem (Shaw et al. 1996).' (*Rotoiti Nature Recovery Project Strategic Plan, Butler 1998.*)

Objectives listed in support of the vision include: to control selected pests to allow recovery of ecosystem components (species) and processes (especially the honeydew cycle), to re-introduce recently-depleted species, to advocate for species conservation and pest control by providing an accessible example of a functioning ecosystem. In addition, the following objectives are listed to 'widen the scope' of the project; to provide an asset for St Arnaud and the Nelson/Marlborough region, to participate in a national restoration experiment, to become a centre of learning, to provide staff development opportunities, to act as a catalyst for pest control elsewhere, and to act as a departmental showcase.

4.6 HURUNUI

'To protect the beech forest ecosystems of the North and South Branches of the Hurunui River and restore them, as much as possible, to their original states and secure their species assemblages and unique habitat character.' 'To develop effective and efficient predator and pest control programmes for large valley based forest habitats, and to ensure these developments are tested in a robust and scientific manner.' (*1997/98 annual report, Grant* et al. *1998*.)

4.7 LONG-TERM PROJECT GOALS, OR VISION—DISCUSSION

It is not clear how useful these statements have been in guiding management to date. Some are 'visions' which may evoke recognition and support from stakeholders (e.g. '... restore the 'mauri', or life force'...), although such statements may be of little value as a basis for management objectives or performance measures. Others are management objectives, describing specific actions (e.g.'... to develop effective and efficient management programmes...'), but lacking a longer-term vision.

All statements include the word 'ecosystem' and refer to, or imply, restoration although only one specifies a previous period at which management is aimed, e.g. Trounson: '... a much healthier condition and approaching that of pre-European times.' Several allude to ecosystem components (species) and functions (processes). One project goal (Rotoiti) focuses on a specific natural process '... with emphasis on the honeydew cycle.'

Most project goals and supporting statements promote wider (off-site) benefits through the acquisition of new information, developing management capacity and advancing awareness. An integrated approach to management is implied, and the need for a sound scientific basis for management identified in several statements. All but the Hurunui project have goals which emphasise community involvement.

No strategic plan for the Hurunui project was available at the time of this review. Declared goals for this project have changed since its initiation in 1995/96. They are now broader, with greater emphasis on ecosystem processes and on developing pest control capacity than the earlier statements. The intention to employ a science-based approach has been retained.

4.8 LONG-TERM PROJECT GOALS, OR VISION—KEY POINTS

Long-term goals, or visions have been declared for all six projects. It is unclear how useful goal statements have been in guiding management. There are few obvious links between declared departmental goals and management objectives at these projects. This is due, in part, to inconsistent use of planning terms.

All goal statements include the word 'ecosystem' and refer to, or imply, restoration. Only one specifies a previous period to which restoration is aimed (Trounson).

One project goal (Rotoiti) includes reference to ecosystem processes (the honeydew cycle). Most emphasize species.

Most projects have objectives promoting wider (off-site) benefits through acquiring new information, developing management capacity and advancing awareness.

Most objectives reflect an intention to apply an experimental approach. All were chosen and are managed primarily as operational, rather than experimental, projects.

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