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6. Managing native plants and animals

While the mainland island projects have ecosystem-focused restoration goals, management is largely focused at manipulating populations, or monitoring population trends or changes in individual native plants or animals. In addition to species recovery objectives, native species are also used as indicators of the effectiveness of pest control programmes, and as 'flagships' for generating and maintaining public support for these and other conservation projects.

6.1 TROUNSON

The draft strategic plan (Anon. 1997d) identifies three aims which involve a particular focus on native species:

- 'To recover or maintain viable populations of threatened species currently present, including North Island brown kiwi, kukupa, bats, kauri snails and banded kokopu.'
- 'To re-introduce species formerly present in Trounson, or at risk in the region.'
- 'To monitor plants and animals in order to test hypotheses of biota responses under intensive management, and compare with responses at sites under different management regimes.'

Details relating to the measurement of changes in pest plant and animal populations, and changes to native vegetation (mainly) which have been attributed to herbivore control are presented in pest control sections elsewhere in this report.

Two bird species—North Island brown kiwi and kukupa (New Zealand pigeon)—are used as indicators of the effectiveness of pest control.

Kiwi—kiwi chick survivorship to fledging is used as a measure of the effectiveness of pest control in the reserve. The main threats to kiwi are mustelids and cats during the first 6 months of a chick's life, and ferrets and dogs at any time. The strategic plan indicates that kiwi responses to pest control at Trounson will be assessed by monitoring the kiwi population structure, egg productivity and chick survival, and comparing this with a sample of Katui (reference area) kiwi, as well as with kiwi at other study areas in Northland. Hypotheses being tested are that management at Trounson will provide significantly improved population recruitment and adult survival rates compared to the reference areas, and that the population will increase in the Trounson reserve as a result of intensive management. In addition to survival and recruitment, information has also been collected on clutch sizes, hatching success and nesting ecology of males, chick dispersal, behaviour and habitat use, and on population demographics within the park. Kiwi monitoring using transmitters was initiated in 1996, and continues.

TABLE 12. KIWI SURVIVAL, TROUNSON (SOME INDIVIDUALS ARE STILL BELOW THE 'SAFE' WEIGHT).

YEAR	CHICK SURVIVAL RATE	JUVENILE SURVIVAL	HATCHING SUCCESS
1996/97	31% (n=14)	-	90% (n=20)
1997/98	29% (n=14)	-	93% (n=14)
1998/99	58% (n=12)*	3 alive, 1 missing	63% (n=19)

A key outcome after 3 years of intensive pest control is that the 'highest recorded kiwi chick survivorship recorded in managed kiwi populations in Northland/New Zealand has been achieved at Trounson' (Table 12).

Mustelids had previously been confirmed as being responsible for 70–80% of kiwi chick deaths. In the 1998/99 year no deaths have been attributed to mammalian predators. Adult mortality also appears to be low. Monitoring over the last 2 years has indicated that fewer eggs are produced in second clutches, and fewer of these chicks survive. These results indicating significant increases in kiwi survivorship have been interpreted as reflecting the success of management.

Kiwi and morepork (*Ninox novaezeelandiae)* call counts have also been conducted annually in May/June at Trounson since 1994, as part of the Northland bird monitoring scheme. It is expected that an increase in the number of kiwi calls will be detected as survival and recruitment to the population proceeds as a result of management. No such trends have so far been detected.

In addition, research on behavioural vulnerability of juvenile kiwi is being undertaken (see 'Research' section) and eggs from abandoned nests at Trounson have been reared in captivity as part of the Operation Nest Egg project.

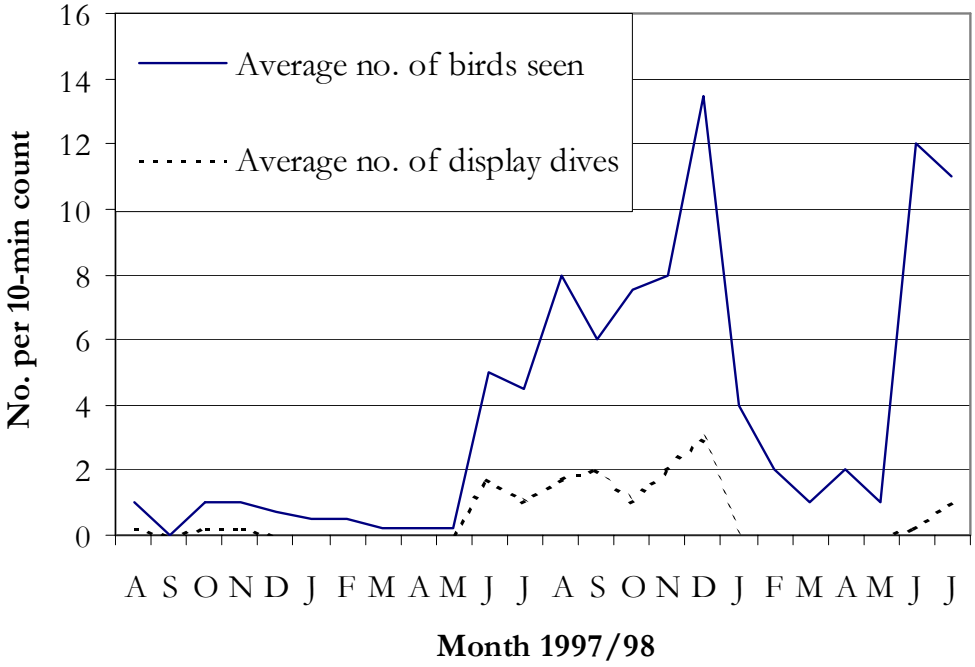
***Kukupa (New Zealand pigeon)*—**Kukupa have been monitored at Trounson since August 1996 in order to measure population trends. Six consecutive 10-minute counts are made on 2 separate days each month. Data from counts up to June 1998 have been analysed (Table 13). Increased numbers of kukupa and breeding activity have been observed.

TABLE 13. KUKUPA COUNTS, TROUNSON.

YEAR	1995	1996	1997	X^2 SIGNIFICANCE	
N =	50	77	100	1997 cf. 1995	1997 cf. 1996
Kukupa	2	37	80	**	**
Tui	22	33	82	**	**
Kingfisher	18	-	47	**	-
Fantail	48	86	128	*	NS
Pied tit	20	55	62	*	NS
Silvereye	35	134	118	*	*
Rosella	45	100	131	*	NS
Myna	46	-	209	**	-

* $p < 0.05$, ** $p < 0.01$, NS—NOT SIGNIFICANT

Figure 25. Bird counts, Trounson.



The increase in kukupa numbers reflected in these counts, and in 5-minute bird counts (see below) have been attributed to a combination of immigration to Trounson and increased kukupa productivity within the park. Birds are frequently seen flying between Trounson and Waipoua Forest. Also, an increased duration of display flights observed at Trounson has been taken as indicating a longer breeding season, coinciding with increased food availability in the reserve. Phenology observations show a heavy crop of taraire persisted on trees throughout the period of high kukupa activity.

Diurnal birds—One hundred 5-minute bird counts have been completed at Trounson each November/December since 1995. An additional 100 counts are also completed along nearby Marlborough Road. The purpose of these counts is to measure population trends of diurnal forest birds in Trounson, and to compare them with trends in forests under different management regimes. Count data for eight species have been analysed (Fig. 25). Some interpretations of these results are that kukupa have shown a spectacular increase in conspicuousness over the 3 years compared with low and unchanged indices at a reference site at Russell Forest. Also, increases in other birds including tui (*Prosthemadera novaezeelandiae*), fantail (*Rhipidura fuliginosa*), pied tit (*Petroica macrocephala*) and silvereye (*Zosterops lateralis*) have been recorded over the 3 years, with little change at the reference site. The number of rosellas (*Platycercus* spp.) and mynas (*Acridotheres tristis*) counted has also increased. 1998/99 bird count data have yet to be presented.

Invertebrates—Invertebrate samples have been collected in pitfall traps at Trounson. Some sorting of samples has been undertaken. A reference collection is proposed to be held at the Conservancy office. Preliminary results reveal some undescribed species and new records. It has been suggested that invertebrate species, particularly macro-invertebrates such as weta and kauri snails, are likely to be used in future monitoring—presumably as indicators of forest condition and the effectiveness of pest control.

Vegetation —Different characteristics of the reserve's vegetation are being monitored in order to detect changes which may be attributed to herbivore (particularly possum) control. These programmes and results are summarised elsewhere in this report.

Species re-introductions —Apart from dual objectives of enhancing populations of native species and monitoring changes in response to pest control, management programmes aimed at re-introducing extirpated native species have also been initiated. Translocations of three species; brown teal, North Island kokako and North Island robin have already been undertaken at Trounson, in line with the long-term goal and a re-introduction objective.

Pateke, the brown teal —two releases of brown teal were undertaken in 1996 and 1997. Neither were successful in establishing a breeding population of teal within the park. Reasons suggested for this lack of success include predation and/or released birds moving to unmanaged areas or otherwise unsuitable sites. No further releases of brown teal are planned.

North Island kokako —two attempts have been made to transfer adult kokako into Trounson. The first consisted of two single males prior to control and a pair in 1996, and resulted in three of these birds leaving the area. The other single male remained in the park for at least 2 years, but has not been seen since 1998. In December 1998 two hand-reared juvenile kokako were 'soft-released' in Trounson. Unfortunately both birds were confirmed dead within 2 months of release.

This transfer of near-fledging kokako to a managed site was an attempt to determine a successful mainland kokako translocation method. It was the first time kokako have been hand-reared for release. Although they were not successful in establishing translocated birds, important lessons were learned for any subsequent kokako translocations to mainland sites. The priority for kokako translocations in Northland has been transferred to Puketi Forest, with further attempts at re-introducing the species to Trounson being proposed following the recovery of the Puketi population.

Toutouwai, the North Island robin —the successful re-introduction of robins to Trounson after about 100 years absence from Northland has been one of the highlights to date of the Trounson project. 21 birds were released in April 1997. While a number of birds have disappeared, some breeding pairs have established and chicks sucessfully fledged. An important follow-up release to augment the establishing population has not been possible in the two subsequent autumns due to a lack of iwi support. Concerns have recently been expressed that unpaired birds are leaving Trounson, and that sibling pairs may form.

Other proposed re-introductions —A number of other native species have been proposed for re-introduction to Trounson in the next 7 years, including whitehead *(Mohoua albicilla)*, kaka, yellow-crowned parakeet, rifleman (*Acanthisitta chloris*), stitchbird (*Notiomystis cincta*), saddleback (*Philesturnus carunculatus*) and New Zealand falcon.

Based on progress to date it has been concluded that Trounson has great potential for the recovery of threatened species already present and the restoration of locally extinct biota. Migration of animals such as kukupa and

kiwi is increasingly likely to be boosting populations in neighbouring forests. In the future it is suggested that Trounson should be a source for translocations to other managed forests in western Northland.

6.2 NORTHERN TE UREWERA

Management objectives aimed at ensuring the long-term sustainability of the Northern Te Urewera ecosystem include several focused specifically on native species:

- 'To control currently known threats to levels which have a negligible effect on indicator species (e.g. rata, mistletoe, kokako, kiwi and toutouwai...'
- 'To develop detailed understanding of the key ecosystem components and processes... the relationships between key ecosystem components and processes, and threats; as well as an understanding of the tolerance thresholds of key indicators in the short term...'
- 'To maintain and restore threatened species populations' including:
- 'To implement the Kokako Recovery Plan in the Otamatuna management area in the immediate term, and over the wider Northern Te Urewera in the medium term.'
- 'To ensure the recovery of healthy populations of threatened species (short-jawed kokopu, pekapeka, kakariki, kiwi, kaeaea, whio, kaka, kereru, red mistletoe) in the Otamatuna management area in the immediate term... and over the wider Northern Te Urewera in the long term.'
- 'To work from knowledge of the full range of threatened species in the Otamatuna management area in the immediate term; of threatened species in the remainder of the Northern Te Urewera in the short term.'
- 'To develop threatened species management methods which are effective, efficient, predictable and sustainable for application to threatened species in the wider Northern Te Urewera in the short term' (Shaw et al. 1996).

A number of native species are monitored to gauge ecological responses to pest management regimes.

***North Island kokako*—**are monitored in the Otamatuna area using standard methods applied in the kokako recovery programme. These include individual colour banding, territory mapping, nest observations and juvenile searches. In addition extensive surveys, initially focused on kokako (Hudson & Jones, various reports), and more recently on other species, have been undertaken in the wider Northern Te Urewera forest complex.

The dynamics of the Northern Te Urewera kokako population were investigated from 1991 to 1998. Different levels of pest control have been undertaken in different parts of the forest complex. The Otamatuna study area currently receives the most intensive pest control. Results from these investigations indicate an increase in population size, age-specific survival and reproductive output in the Otamatuna area. An increasing proportion of productive versus unproductive kokako pairs has also been noted. Comparisons between the

Otamatuna area and other kokako populations in the Northern Te Urewera strongly indicate that increased density and changes in the ratio of single birds to pairs are a result of the pest control carried out. It is concluded that the kokako population in the Otamatuna area is recovering and a population size of approximately 160 birds is predicted by 2008. It is proposed that the future direction for kokako recovery in the Northern Te Urewera involves establishing 'core breeding areas' where intensive pest control is undertaken.

Needs are identified to refine sustainable pest management techniques, to determine kokako responses to pest control, and to establish whether kokako populations here can be stabilised based on a possum control programme alone using a less than 5% target.

North Island brown kiwi—were monitored in the Otamatuna area to gain information on kiwi population dynamics, and as an indicator to gauge the effectiveness of mustelid control. Transmitters were attached to adults and juveniles in the Otamatuna area so that nesting success and juvenile dispersal could be observed.

Nesting success, adult and juvenile survival provided information as a basis for estimating population trends. Recent data suggest an average reproductive output of 1.5 juvenile kiwi per pair. Adult survival is about 90–100%. Half of the juveniles monitored this last year have survived. The average rate of juvenile kiwi survival over several years is 43%. Of all juvenile kiwi killed this year, half were preyed on by stoats. This indicates that a very high level of mustelid control is required to protect juvenile kiwi. This conclusion is supported by research being undertaken by Landcare Research in the Waikaremoana Catchment immediately to the south. At the current level of mustelid control the overall results of kiwi monitoring indicate that the kiwi population in the Otamatuna area is increasing.

Toutouwai, the North Island robin—nesting success of 18 pairs of robins was monitored in the Otamatuna area over the 1997/98 breeding season. This was the second season of monitoring. Nesting success was determined by observing colour banded adults.

38 nesting attempts were monitored in the 1997/98 season. Of these, 61% were successful resulting in at least 51 fledged young, and an average reproductive output of 2.8 fledglings per pair. This equates to a conservative estimate that the population has increased at a rate of 33%, indicating a response to pest control. Research is proposed to investigate robin nesting success at various ship rat densities, and to determine the impact of long-tailed cuckoos on forest passerines, including robins.

Kereru and tui—both of these bird species, along with robins, were reported as more conspicuous in the Otamatuna area than in the Okopeka reference area. Peak periods of kereru and tui conspicuousness coincided with a number of fruiting and flowering events. The value of distance sampling techniques as an alternative index for the comparison of bird numbers between sites is being investigated in this project.

Bird counts—367 five-minute bird counts were conducted during 1997 and 1998 in the Otamatuna area to assess differences in bird numbers between seasons and years. A 51% increase in average total density for all species

recorded from Winter 1997 to Winter 1998, and an increase in 'diversity and richness values' over the same period, have been reported. These results have led to conclusions that pest animal control programmes have had a positive influence on bird communities, and that 5-minute bird counts are a useful tool for gauging gross changes in the distribution of individual species, for assessing bird community health, and as an indicator of ecosystem health (Questionnaire response).

Northern rata—41 trees were identified and photographed in the Otamatuna area in February 1997, and again in February 1998. Comparisons were made between years to gauge responses to reductions in possum numbers.

There was no statistical difference between the condition of trees in 1997 and 1998, despite possum numbers being at very low levels for the past 2 years (2% and 0.7% residual trap catch indices respectively). Foliage loss of monitored trees,measured by assessment of photographs and by a ground-based survey, was about 50%.

Pirirangi (mistletoe)—a total of 66 red mistletoe plants are being monitored in the Otamatuna area, including 34 plants previously unrecorded. 17 new *Quintinnia serrata* host trees have also been located. The visitation rate of nectivorous birds to flowering pirirangi was extremely high, with counts of flower remnants indicating that 99% of all flowers were pollinated. To date 35% of known pirirangi plants in the area are adult and juvenile plants which have recovered from possum browse, or have matured to the flowering stage. The increasing number of juvenile and recovered plants indicates that the population is recovering after the removal of possums from the core bait station area.

Broader fauna surveys—a survey was undertaken in the Southern Ikawhenua range within the greater Northern Te Urewera complex in March 1998. The purpose of this survey was to assess the potential of this area as another 'core breeding area', representing the second stage of a progressive expansion of management benefits across the 50,000 ha Northern Te Urewera forest complex. A range of animals were surveyed including kokako, kiwi. kaka, whio, bats, eels (*Anguilla* spp.) and koaro (*Galaxias* sp.). Further broad-scale species surveys are planned and a technique for this pupose is currently being developed.

Vegetation description—a vegetation description and species list for the Otamatuna area has been recently completed, with 237 species identified and an up-dated vegetation map produced. Detailed monitoring of changes in vegetation is also being undertaken, and is described in pest management sections elsewhere in this review.

It has been concluded that 'Overall, indicators of species recovery and ecosystem health suggest dramatic recovery of biodiversity within the Otamatuna study area. However, cumulative results from broadscale species survey suggest the remainder of the northern Te Urewera is experiencing continued degradation and loss of biodiversity. Results from some aspects of (the project) are inconclusive at this time (e.g. the effect of ungulate control on ecosystem health), and patterns of 'natural fluctuation' highlight the need for a consistent programme of pest management and monitoring in the medium to

long term. Refinements in the programme of survey, result and outcome monitoring, in conjunction with this year's advances in pest management techniques represent a significant step toward an integrated and ecosystem-based approach to management. These form an integral component of developing 'core breeding areas' for recovery, which represent the future for ecosystem recovery in the northern Te Urewera.'

6.3 BOUNDARY STREAM

Species-focused management objectives identified in the Boundary Stream strategic plan include:

- 'Monitoring of key environmental factors to establish baseline information and measure changes resulting from enhancement efforts.'
- 'The recovery of threatened species, e.g. kakabeak, yellow-flowered mistletoe, kiwi, kereru, etc. Determination of the status of threatened species known to be present, and the detection of other species that may be present.'
- 'The (re)introduction of species formerly present or at risk in the region, e.g. NI robin, NI saddleback, stitchbird, kokako, *Pittosporum obcordatum, Dactylanthus taylorii* etc.'
- 'The encouragement of local community and interest group involvement and assistance in the restoration programme...' (Anon. 1995a).

***Forest bird counts*—**A management objective 'to detect and follow change in ecosystem health by monitoring indicator bird species and changes in health and composition of BSMI bird communities' has been declared (Operational plan 1997–99). Thirty 5-minute bird counts are undertaken seasonally at Boundary Stream and the two non-treatment areas. Six 1-hour kereru counts are also undertaken seasonally at each count site.

Analysis of 5-minute bird count data for the 1996–98 period suggests no significant change in bird communities (Fig. 26). Comparisons have included

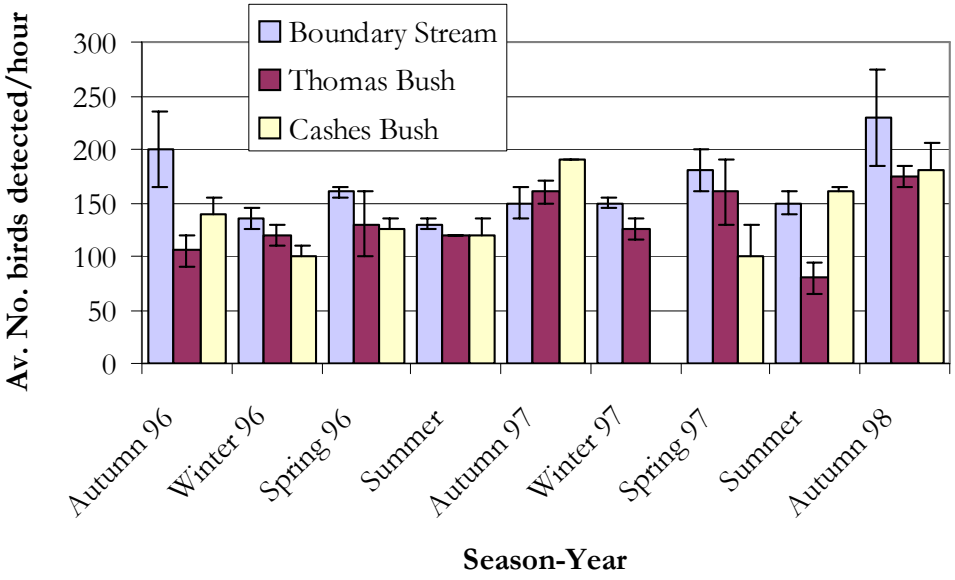


Figure 26. Average number of birds detected per hour, Boundary Stream.

bird count data collected over a 10-year period prior to the initiation of the restoration project. Also, no significant differences have been detected in kereru counts.

These results have been interpreted as a reflection of the lack of objectivity and sensitivity of the bird count technique, the short time perods involved (2 years of management), and the influence of different observers. Casual staff observations and those of visitors to the reserve suggest that many birds have increased in abundance, particularly bellbirds (*Anthornis melanura*) and tui. Similarly, staff have noticed increases in the number of kereru flying above the reserve, and it has been predicted that 1998/99 count data, once analysed, will show significant increases. It was commented that 'there is some concern that quantitative results do not accurately reflect actual changes at BSMI—due to limitations associated with this [bird count] technique. Specifically, the results obtained are in contrast to expectations of both staff and independent observers.' (Boundary Steam questionnaire). A review of bird monitoring programmes in the reserve is being undertaken. It has been suggested that specific indicators should be used for particular pests being managed, rather than broad-scale counts.

Threatened plants—Yellow mistletoe, neinei and kakabeak are monitored to meet the management objective 'to measure the response of Mistletoe (*Alepis flavida*), Kakabeak (*Clianthus puniceus*) and Neinei (*Dracophyllum latifolium*) to intensive possum and goat control' (Operational plan). Monitoring techniques and results are discussed in the possum control section. Kakabeak and mistletoe are managed because they are listed threatened species. Mistletoe is also monitored because it is known to be sensitive to the presence of possums, and is used as an indicator of the effectiveness of possum control. A focus on the neinei plant is due to it being the only specimen within the reserve, and the Ecological District.

Invertebrates—A management objective is included in the Operational Plan: 'to assess forest restoration through a comparison of invertebrate abundance, body size and diversity recorded at BSMI [sic[with those recorded at the reference areas (Cashes Bush and Thomas Bush).' Monitoring programmes and results are described in the possum control section. It is concluded that an apparent increase in invertebrate numbers in the Boundary Stream reserve (Fig. 27) may be due to complex factors, and possibly not to pest control alone. It is

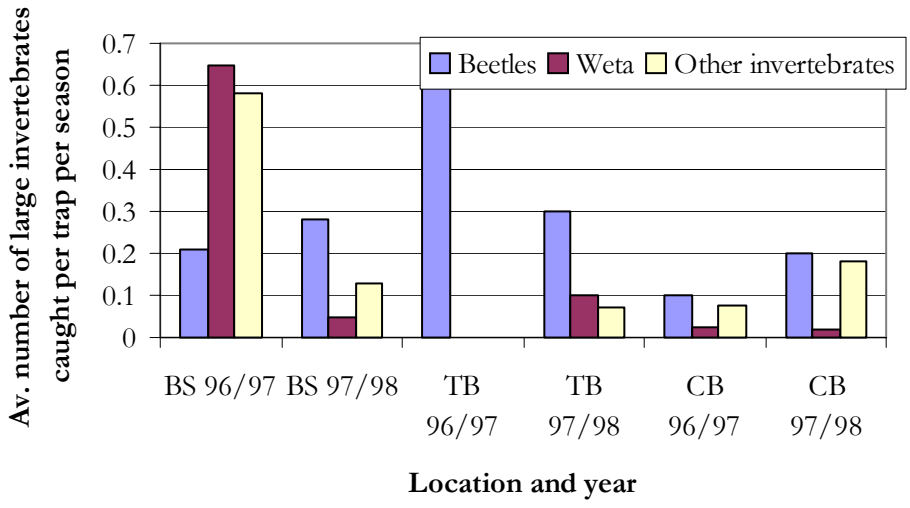


Figure 27. Invertebrates trapped, Boundary Stream (BS), Thomas Bush (TB), Cashes Bush (CB).

recommended that invertebrate pitfall trapping and weta house monitoring programmes should be continued, and that standardised approaches to invertebrate monitoring and data interpretation should be established between mainland island projects. It is also recommended that diets of insect predators, especially hedgehogs, is studied to assess the impact of mammalian predation and to gain a better understanding of invertebrates as indicators.

Lizards—Management objectives to initiate lizard monitoring, to establish which lizard species are present, and to detect changes in population density are listed in the Operational Plan. Three lines of 50 pitfall traps were established from March 1997 in three different habitat types covering the full altitudinal gradient of the reserve. Traps were spaced at 20 m intervals along a 1 km transect. In March 1997 only one line of 50 traps was operational. All three lines were operational for the 1997/98 summer. Gecko searches were also undertaken between September 1997 and January 1998, and 120 artificial gecko houses were located (60 in the Boundary Stream reserve, and 60 in the two reference areas) from April to July 1998.

46 common skinks (*Oligosoma nigriplantare polychroma*) have been caught, 45 of these on one line. No lizards were seen in 43 hours of searching. Several incidental sightings of lizards have been made since May 1996, including 7 common skinks, 4 common tree geckos and 2 common green gecko tails. A forest gecko was observed in the Thomas Bush reference area. It is recommended that pitfall monitoring should continue each summer in order to monitor changes in the density of the common skink population and to detect the presence of *Cyclodina* skinks.

Bats—The Operational Plan includes objectives to 'Record baseline data to establish species and the frequency of bat encounters' and to'monitor for change in the frequency of encounters.' Five 1 km transects were established in the reserve. Each transect was walked six times and hand-held bat detectors used to pick up calls. Information was recorded on standard bat record sheets. In addition, automatic bat detectors were set up at potentially productive sites within the reserve.

No bats were detected on any transects in 28 hours of searching during the 1997 and 1998 summers. A small number of definite and possible 'passes' recorded on the automatic detectors suggest that bats are present in low numbers in distinct areas of the reserve. It is suggested that this information will provide a good baseline. It is also suggested that bat numbers can be expected to increase as rat, cat and mustelid control is sustained.

6.3.1 Re-introductions

North Island robin—In line with the re-introduction objective in the strategic plan, 28 North Island robins were translocated to the Boundary Stream reserve in April and May 1998. The last two naturally-occurring robins disappeared 12 and 6 months prior to these releases. Post-release monitoring was undertaken to determine success of the transfer, and nest monitoring was carried out until March 1999. It is reported that the release was successful, and that 26 of the 28 birds have been subsequently seen. Six pairs formed and 16 fledglings were produced. No females were lost through predation during nesting. Three nests failed, including one to unknown causes. As a result of difficulties in sexing

birds at capture, fewer females than planned were transferred. It has been suggested that this resulted in fewer fledglings being produced in the breeding season following release. The successful translocation and subsequent breeding of robins has been interpreted as indicating the success of predator control in the reserve. Further details will be included in the 1998/99 annual report.

North Island brown kiwi—management objectives in the operational plan provided for the establishment of a self-sustaining population of kiwi, to restore biological diversity 'reflecting an earlier era', to strengthen the advocacy role of the reserve through allowing the public to appreciate the return of kiwi to part of their range, and to contribute to further management technique development and research associated with the kiwi recovery programme. Kiwi call count surveys between 1996 and 1998 indicated that kiwi occur within the reserve in very low numbers. It was determined that the most feasible method to enhance this population was to transfer and release juvenile birds into the reserve. In May/June 1999 adult male kiwi were located in the Kaweka Ranges and transmitterised. It is proposed that eggs from nests will be artificially incubated, the chicks hand-raised and then released into the reserve starting in January/ February 2000.

Concern was expressed during the planning process about the potential impact of hedgehogs on the success of the kiwi re-introduction. Research was initiated to investigate this question; it was subsequently determined that hedgehogs did not pose an unreasonable threat. Interim approval has been given by the Conservator for this re-introduction to proceed subject to further consultation.

6.4 PAENGAROA

Six objectives are listed in the strategic plan (1996–2001) relating to species translocations and enhancement:

Plants:

- 'To enhance the population of *Olearia hectorii* (now *O. gardneri)* through planting out nursery grown specimens.'
- 'To revegetate grass margins with appropriate species from the reserve.'
- 'To conduct a review of species which would benefit from, and lend themselves to, translocation or enhancement.'
- 'To carry out species translocations and enhancements which are recommended in the review.'

Animals:

- 'To conduct a review of species which would benefit from, and lend themselves to, translocation or enhancement.'
- 'To carry out species translocations and enhancements which are recommended in the review' (Barkla 1996).

Olearia gardneri and North Island robins were identified separately from the review as a suitable species to enhance and re-introduce (respectively). An internal review of other fauna and flora that might be suitable for establishing in the reserve is planned for the 99/00 year.

Olearia gardneri—two plants grown from cuttings from the area were re-planted in the reserve in 1996. Rapid growth of these plants led to a decision to plant the remaining 13 cultivated plants in 1997. All have individually numbered tags and the heights are measured annually. In 1998/99 a programme of numbering and measurinmg each naturally-occurring *O. gardneri* in the reserve. This programme will continue opportunistically.

All but one of the planted shrubs have produced extension shoots, although plant height is not proving to be a good measure of growth rates in the short term due to shoots drooping. Two naturally-occurring trees were marked and measured in 1999. It is suggested that further propagation and planting of *O. gardneri* is warranted in order to enhance the existing population.

North Island robin—40 robins were taken from Waimarino Forest and translocated to Paengaroa in March 1999. It is suggested that other species may be considered for re-introduction as part of the forthcoming review 'if and when the robin transfer programme has been completed successfully' although '... introductions of plants need not be limited by the success or otherwise of the robin introductions' (Paengaroa questionnaire response).

A Master's student has been contracted to monitor the translocated birds from March 1999 through to April 2000. This work involves monitoring birds and nests and measuring nesting success. Rodent and mustelid numbers will also be monitored using tracking tunnels every 8 weeks. 21 robins, including 7 pairs were found in a grid search of the reserve in May 1999. While it is too early to determine the success or otherwise of this translocation, birds appear to have settled well, establishing territories and pair bonds.

6.5 ROTOITI

A number of native animals are monitored to gauge ecological responses to pest control. Vegetation responses to herbivore control are described in pest control sections elsewhere in this report.

Honeydew—the monitoring objective is 'to record changes in honeydew levels with reduced wasps following control.' A 50 cm × 50 cm quadrat is placed on the north side of selected honeydew trees 1.5 m above the ground. The number of threads, both with and without drops, are counted within the quadrat. The concentration is measured using a refractometer. Other calculations such as energy (J/m^2) and mean drop volume can be determined from the concentration measurement. Honeydew sampling is undertaken once a week at both, the Rotoiti (treatment) site and the Rotoroa reference area. Monitoring was initiated in November. Six of 20 monitored trees in the Rotoiti area died during the summer, reducing the sample for comparison.

In 1997/98, honeydew levels dropped off at both sites initially, then increased dramatically at Rotoiti after wasp control. The level stayed low at Rotoroa. A target was to keep energy levels in the honeydew above 2,500 joules which had been shown by Landcare Research scientists to be a level that birds could feed on productively. The level never went below this target at Rotoiti where wasps were poisoned, but did at Rotoroa for a 5-week period. 1998/99 data are still being analysed.

Invertebrates —an assumption that certain invertebrate species populations will increase in size if predation by wasps, rodents and possums is reduced, underpinned invertebrate monitoring. Work has initially been focused on flying insects in relation to wasp predation. Monitoring was also aimed at assessing changes in wasp numbers. Flying insects are captured from November to May using 20 malaise traps placed randomly on the lower slopes at Rotoiti, and 10 traps at Rotoroa. Samples are collected weekly from both sites, then stored for later identification.

In 1997/98, wasp numbers increased steadily during the initial part of the season at both sites. Wasp numbers dropped at Rotoiti following wasp control, and carried on increasing at Rotoroa (reference site). Certain insect genera were counted in sub-samples, based on advice from Landcare Research scientists. No clear differences could be attributed to the wasp control. It has been suggested that the influence of insect life cycles means any effect (of wasp control) is unlikely to show in the first year. In 1998/99, a dramatic reduction in wasp activity recorded in nest transects is reflected in preliminary analyses of malaise trap samples. Counts of wasps in malaise traps have re-inforced the picture of the impact of control shown in nest transects. They also show what happens in the weeks following control. In 1997/98 the level of post-control wasp activity in the treatment area appears higher than in 1998/99 according to samples analysed to date. This reinforces assessments that wasp control the previous year was less effective, with some nests recovering to some degree. Stronger conclusions are anticipated following analyses of a consecutive year of wasp control. In addition to malaise trapping of flying insects, a Canterbury University student is evaluating beetles as an indicator of wider ecosystem values. A second student has undertaken a pitfall trapping study to assess ground invertebrates. It is hoped that this study will provide some guidance on future invertebrate monitoring programmes.

NZ falcon —work is undertaken as part of a national study of falcon nesting success coordinated by the NZ Raptor Association. In 1997/98 a nest was located and chicks observed on the ground and after fledging. In 1998/99 the nest was not located although chicks were seen after fledging. All casual observations of falcon in the area are noted. Falcons are normally observed between November and February.

In 1997/98, three chicks were reared by two adult birds. All three chicks fledged and were occasionally seen feeding with their parents. In 1998/99 a pair in exactly the same area reared two chicks. It is proposed to continue falcon monitoring at a slightly increased level in order to record all falcon nesting attempts and results.

Bats —initial objectives were to determine whether long-tailed and/or short-tailed bats are present, and to ascertain which areas these species are using yearly with a view to setting up a monitoring system to determine responses to management. Bat boxes were used to survey for long-tailed bats only in the 1997/98 (13 nights in total) and 1998/99 (12 nights in total) seasons (November to April). New sites were also surveyed for short-tailed bats (5 nights in total). One night each was devoted to surveying for short and long-tailed bats in the Rotoroa area.

In 1997/98, 9 'passes' were recorded at the farm boundary and one other at Kerr Bay (Rotoiti treatment area) in March. 1998/99, and one long-tailed bat pass at the farm boundary in late February. A more comprehensive bat survey is planned of both species in the treatment area.

South Island robin—five monitoring objectives are recorded:

- 'To record the success of breeding attempts in the treatment area as a measure of effectiveness of rat control.'
- 'Record survival of robins as a measure of the effectiveness of cat and stoat control.'
- 'Document any increase in the robin population over time.'
- 'Document robin dispersal at Rotoiti to determine the value of the treatment area as a source of birds to recolonise other sites.'
- 'Provide information on robin breeding ecology at Rotoiti to contribute to the national programme.'

Breeding success is measured using the national monitoring protocol written by Ralph Powlesland. Female survivorship is measured by recognising individuals and recording their presence or absence over the summer. 10 breeding pairs were individually marked and recorded, nesting attempts monitored and most fledglings banded. Monitoring was initiated in August 1998. Robin data from Kowhai bush (Kaikoura) were used for comparison, as there were no resources to establish a non-treatment study area. Robin sightings were recorded by staff and the public from different areas throughout the region. Robin monitoring work here was based on an initial study conducted by a student, Amanda Byrne in 1997/98. 90% of 30 nesting attempts successfully raised young. Of the three which failed, only one failed due to predation (rat?). The average number of offspring per pair was 5.3. A similar success rate was observed in a smaller sample in 1997/98 (9 out of 10 nests successful). It may be concluded from these results that rat control works well in a non-mast year. At Kowhai Bush where there was no predator control, predation by rats on robin nests in 1971–76 accounted for 57% of them. There were no deaths of monitored birds at Rotoiti. 1998/99 was the first season of comprehensive monitoring. With 53 chicks raised from 10 pairs, a significant increase in the local population is anticipated. In relation to dispersal, notable records included a juvenile at Hopeless Creek 15 km away from where it was banded at Rotoiti, and another at Lake Rotoiti 6 km away.

Kaka—the monitoring objective was to monitor kaka nestling and fledgling survival in response to management strategies in the Rotoiti Nature Recovery Project area. Adult kaka were transmitterised, nests were located and checked regularly to determine nesting success, and juvenile kaka transmitterised and their survival regularly monitored. Monitoring was initiated in October 1997.

In 1997/98, 12 chicks hatched and fledged from four nests. Three chicks died after fledging. Seven out of nine surviving chicks are transmitterised. In 1998/99, four nests were located in the treatment area. Nine chicks fledged from three nests. Four chicks were preyed on from one nest just prior to fledging, evidence suggests stoat. Three chicks died after fledging, causes unknown. Remaining six are transmitterised. All adult females are surviving.

Kaka nesting success in the last 2 years was significantly greater than in the previous study at nearby Big Bush where no predator control was undertaken. 100% of nests were successful at Rotoiti in 1997/98 when local nest protection was carried out. 75% of nests were successful in 1998/99 when protection was afforded by a system of widely-spaced stoat trapping lines. At Big Bush, nesting success over a 12-year period (1985–97) was 11.1% (3 of 22 nests). In 1998/99 all three nests outside the treatment area failed.

Associated research includes the multi-year study (1985–97) at Big Bush, and concurrent research undertaken by SRU staff, in conjunction with project staff, at Rotoiti as part of a national kaka research programme.

Snails—'To monitor changes in large land-snails (*Powelliphanta rossiana*) as pest control proceeds.' Six 5 m × 5 m quadrats, established just above the bushline at the northern end of the project area in 1997, were monitored once every 3–5 years using a standardised search technique published by Kath Walker. Six further quadrats were established in the same area in 1999: four just below the bushline, and two in tussock adjacent to the original quadrats.

In 1997/98, further snail shells were found, extending the known distribution of *Powelliphanta.* Initial plot surveys found 13 live snails, 6 empty shells—of which 4 were intact, and 2 dead (from unknown causes). In 1998/99, 1 intact empty shell was found in the bush quadrats. 10 live and 7 empty shells (all intact) were found in the tussock quadrats. Shells have also been found further north along the St Arnaud Range, outside the project boundary.

The high proportion of live snails and intact shells suggests that this population is healthy in tussock areas, and is suffering limited predation. A longer run of data is needed, however, to be certain of this. Numbers are much lower in the adjacent forest. This might be due to predators, or simply to this being a sub-optimal habitat.

Birds—'to document changes in bird populations (activity) as pest control proceeds.' five-minute bird counts were undertaken on two altitudinal transects: one in the treatment area (21 stations), and one at the lakehead reference area (14 stations). Each transect was counted four times a year (February, May, August and November) for 3 days by two observers rotating between the two (i.e. three counts done of each transect each time). Monitoring was initiated in October 1997. No analyses have yet been undertaken pending further counts.

6.6 HURUNUI

'Species management in the Hurunui is restricted to pest control.' (Hurunui questionnaire response). Native species being monitored to indicate the effectiveness of pest control are mohua, kaka, falcon, kea, parakeets, mistletoe, kiwi and NZ pigeon. These monitoring programmes are described elsewhere in this report. More detailed analyses of results from monitoring of mistletoe condition in relation to possum control, and mohua encounters and kiwi calls and general bird conspicuousness in relation to stoat control are presented in the 1997/98 annual report (Grant et al.1998).

With the discovery of the only known thriving population of orange-fronted parakeet (*Cyanoramphus malherbi)* in the Hurunui project area, however, the focus of the project 'has now split with both "mainland island" objectives and orange-fronted parakeet population protection and recovery objectives. Fortunately these objectives are compatible, but this development has raised the significance of the area to be a key species conservation area.' (Hurunui questionnaire response). In addition to orange-fronted parakeet, two recovery programmes identify the South Branch in recovery objectives:

- Mohua Recovery Plan—monitor and control stoats
- Kiwi Recovery Plan —monitor great spotted kiwi through call counts.

6.7 MANAGING NATIVE PLANTS AND ANIMALS—DISCUSSION

Observations of significant changes in populations of native species have been made at all projects. These observations are important in that they reflect progress towards population enhancement, species recovery and, perhaps, ecological restoration at mainland sites. Prior to the initiation of intensive multi-pest control projects, conservation management at mainland sites was essentially limited to protecting one or a few identified attributes, or minimising further declines.

Measuring and interpreting progress in relation to protecting and recovering native species is problematic at these projects. Reports of significant increases in some populations, and the condition of monitored individuals are supported by data analyses in some cases (e.g. increased numbers of kereru counted at Trounson, increased kokako numbers and chick production in the Northern Te Urewera), whilst in others data do not support anecdotal observations (e.g. staff observations of significant increases in the number of tui, bellbirds and kereru are not supported by count data at Boundary Stream). Where anticipated responses have not yet been confirmed, interpretations have included a need for more time, and for improved monitoring techniques (e.g. improvements to 5-minute bird counts and invertebrate sampling). The consistent application of appropriate and, wherever possible, standardised monitoring techniques, and the development of new techniques would result in important benefits for these, and other, projects.

A primary selection criterion for these projects was the presence of threatened species. Most, if not all threatened species targeted for management at these projects are vulnerable to depradations by pests. Some birds, in particular, have already been shown to be able to respond as a result of effective pest management. Management objectives for these projects reflect assumptions (and, in some instances, hypotheses) that vulnerable species will respond to intensive pest control, and that measured increases in abundance or distribution may be interpreted as an indication of the effectiveness of pest control regimes. Changes already recorded suggest that these assumptions are sound. However, a better understanding of other factors which may also have a strong influence on these populations will be required if indicators are to be used to interpret on-going changes, or to provide a basis for refining

management regimes. Using more common species, for example, may allow larger samples to be collected and interpreted. Using different taxa at different trophic levels—including invertebrates, may also improve our capacity to interpret changes and to improve management regimes.

In addition to using species as indicators of the effectiveness of pest control, there is potential to use 'keystone' and 'umbrella' species approaches (Simberloff 1998) in order to focus management better. For example, a focus on kereru in lowland forests may provide important insights into key ecological processes such as seed dispersal and germination, and of threats such as rodent predation of seeds. In this example management objectives would need to be broadened from a focus on the species alone, to kereru as a seed distributor.

While most objectives do not yet reflect this broader ecosystem focus, there are indications that a more process-focused approach is being taken at several projects (e.g. increased bird pollination of mistletoes at Northern Te Urewera, increased calorific value of honeydew at Rotoiti). In effect, some of these projects reflect a shift from a focus on species alone, to one encompassing ecosystem processes. Such a shift will be fundamental if ecosystems are to be managed as entities, as well as species.

The Rotoiti project stands apart in that the declared long-term project goal is focused on a key ecological process: energy transfer via honeydew. This is a good example of a keystone focus for management. An umbrella species approach, though essentially undeclared, is also being applied at several projects where the presence of viable populations of species such as kokako is being interpreted as indicating other species in the same area are also protected. Developing a better understanding of the application of keystone, umbrella and indicator species approaches and, perhaps, others, so that guiding principles may be tested and applied more widely is probably one of the most pressing needs to emerge from this review.

Few conflicts have emerged to date between species recovery and ecosystem-focused restoration goals. There is potential, however, for conflict in that preventing extinction is paramount in the former, whereas restoring ecological processes is the key in the latter, with particular species possibly being relatively unimportant. The use of threatened species as 'flagships' (Simberloff 1998) probably presents the greatest risks in this regard. There are indications that public support for conservation has been enhanced as a result of advocacy focused on species which readily generate public interest and support such as the Chatham Island black robin (*Petroica traversi*), kakapo and tuatara (*Sphenodon punctatus*). The promotion of flagship species such as kaka at the Rotoiti project, mohua at Hurunui, and robins at Paengaroa, while valuable in raising the profile of these projects, may also lead to unreasonable expectations of success in relation to these species alone, and detract from wider ecosystem-focused goals. Protocols have been developed at Rotoiti to minimise the risks of conflicts between kaka protection and wider ecosystem-focused goals. It is not clear how such risks are to be managed at other projects.

Native species have already been re-introduced at several of these projects—either to re-establish extirpated populations (e.g. kokako at Trounson, robins at Boundary Stream) or to enhance existing populations (e.g. *Olearia gardneri* at Paengaroa, kaka at Rotoiti). Further translocations are planned. The main reason

for these re-introductions seems to be to restore historical species assemblages. Priorities appear to be largely based on a combination of what is appropriate for the site, and what is available and able to be transferred. While some comments have been reported relating to the value of translocated species as indicators, justifications in relation to long-term goals are less clear. Perhaps the greatest stimulus for these translocations has been their indication of significant progress towards effective pest control, and as a major step towards ecological restoration goals. In addition to demonstrated community and stakeholder support for re-introductions, their value in reinforcing the commitment and motivation of project staff has probably also been a factor. While an evaluation of the application of the Department's translocation guidelines was not undertaken as part of this review, available information suggests that several of these translocations have not been successful, and that the successful outcome of others is not assured. A closer examination of the reasons for a lack of success to date at some projects may indicate the need for some changes to translocation procedures.

6.8 MANAGING NATIVE PLANTS AND ANIMALS— KEY POINTS

Recovering threatened species is a key objective, and important progress has been made in relation to these objectives at all of these projects.

In addition to species recovery, native species are also used as indicators of the success of pest control. Observations of significant changes in populations of selected native species have been made. In some cases these changes have been related to pest control.

There was no opportunity during this review to critically evaluate interpretations of reported changes in populations of native species. A need for more time and for improved monitoring techniques is identified in several reports. In other cases, analyses have yet to be undertaken and changes have not been interpreted. There is a pressing need for a formal technical review process to be established for these projects.

While not declared as such, native species are being used as 'keystones' and 'umbrellas' at some projects. Developing a better understanding of the strategic value of particular species in moving towards ecosystem-focused management programmes will be important.

There is a pressing need to develop a better understanding of the value in using species as keystones, umbrellas and indicators.

Some of these projects represent a shift from a focus on species alone, to one encompassing ecosystem processes. Such a paradigm shift will be fundamental if a management focus on ecosystems, rather than on species in isolation is to be achieved.

A closer examination of reasons for a lack of success may lead to changes in re-introduction objectives and techniques.

7. Enhancing public awareness and community participation

7.1 TROUNSON

7.1.1 Goals and objectives

The long-term goal of the project includes concepts of Trounson being a 'model for the expanding mainland island programmes in Northland, both departmental and private, and it will become a showcase for the local community and visitors to the park.' (Strategic plan, Anon. 1997d). In line with this goal, three general headings have been identified: 'community ownership', 'transportable technology' and 'DOC making a difference'. Activities identified under these headings were:

Community ownership:

- Develop local support for the project
- Minimise the risk of re-invasion of pests, including cats and dogs
- Provide opportunities for participation in site management decisions

Transportable technology:

- Within the wider Northland community and the New Zealand wide scientific community, the project should demonstrate techniques and disseminate information that can be applied to other conservation management situations.

DOC making a difference:

- For educational groups and recreational visitors fom Northland, other parts of New Zealand and overseas, a visit to the site should:

  — develop an understanding of the problems of pests and their effect on the native ecosystems;

  — teach them about species management techniques;

  — demonstrate how the Department is involved in active management and achieving conservation results.

That advocacy and interpretation activities will evolve is recognised in the strategic plan. The first 3 years were to be focused on interpreting and advocating ecological restoration at Trounson, and beyond, and maintaining close contact with the local community to engender community ownership. A need to regularly monitor and re-assess advocacy activities is identified in the strategic plan.

A draft interpretation concept plan (Burns 1996) was prepared to guide interpretation activities. This plan links DOC's national Public Awareness Strategy with the Trounson project objectives. It identifies constraints, target audiences and advocacy topics and themes as well as outlining a range of detailed interpretation proposals.

7.1.2 Reported management activities and results

Advocacy activities have followed the broad outline of the draft interpretation plan. The focus has been on utilising information and results from the various research projects, and providing current information to landholders, schools and special interest groups. Work is undertaken mainly by a staff member with 1 day per week allocated specifically to Trounson. This officer is also involved with kiwi recovery advocacy programmes in Northland. Key activities and events have included:

- A significant up-grading of interpretation facilities has been planned and is about to commence, including a new interpretation shelter and new interpretation panels.
- The adjacent DOC camping ground and amenities, and boardwalk through the reserve, including electronically controlled talking points, have been installed.
- A number of events have been staged for local residents and stakeholders. A celebration in May 1998 drew a good crowd and favourable reactions.
- Conservation Theatre was initiated by a Northland Polytechnic group which visited Trounson. The play was about a night in the life of a kiwi. On the last day of Conservation Week 1100 people attended the performance.
- A '60 Minutes' TV documentary was filmed in 1998 focusing on predator control work, and cat trapping in particular in the reserve.
- Project staff participate in the Dargaville Field Day each year to promote predator control generally. QEII Trust representatives are able to assist DOC staff in Northland to advise farmers on predator control.
- Good national, regional and local media coverage of several stories about Trounson has been achieved, and a rapport established with some reporters.
- Significant on-going interaction with several schools has been developed. A number of study areas have been established school group needs.
- A logo competition amongst four local schools resulted in a new logo being developed.
- Feedback through a visitors' book, direct comments and the continued operation of the Night Walk concession where visitors are escorted along the boardwalk at night, coupled with steadily increasing numbers of visitors suggest public interest and visitation will continue to grow. Most neighbours have demonstrated a measure of interest and support for the project.

7.2 NORTHERN TE UREWERA

7.2.1 Goals and objectives

Several objectives are identified in the strategic plan reflecting needs to give effect to the Treaty partnership, to gain support and cooperation of community and interest groups, and information dissemination to interest groups, the news media and local schools.

7.2.2 Reported management activities and results

Activities and results have included:

- A number of local press releases have been published
- Wide circulation of annual reports, including elsewhere in the Department and to relevant research organisations
- A 2.5-minute television news item went to air on the national news
- Over 20 public addresses have been given to various groups, including schools
- Hui are attended with tangata whenua
- The presentation of scientific papers at conferences and workshops
- A number of guided trips into the study area have been undertaken.

'There has been much positive feedback from all groups visiting the project. There are some contentious issues between local iwi and the Government which translate to animosity towards the Department from a narrow sector within local iwi. In spite of this, project staff maintain a strong commitment to liaise with tangata whenua, placing a strong emphasis on information dissemination. The result has been support from the wider community, evidenced by the quality of relationships maintained and frequency of involvement with local iwi and other community groups' (Northern Te Urewera questionnaire response).

7.3 BOUNDARY STREAM

7.3.1 Goals and objectives

An objective to encourage local community and interest group involvement and assistance in the project is included in the strategic plan. Five relevant objectives are listed in operational plans 1997/98 and 1998/99):

- 'To foster good relationships with adjacent landowners/managers and keep them informed of project activities and advances.'
- 'To maintain good relationships with local iwi, encourage their input and to involve tangata whenua in the project.'
- 'To promote Boundary Stream (to) DOC and their respective objectives to the public locally and nationally.'
- 'To increase public awareness and appreciation of BSMI and its conservation values.'
- 'To encourage public involvement in the project.'

7.3.2 Reported management activities and results

Management has included:

- The circulation of a newsletter to key stakeholders, at least annually.
- The maintenance and upgrading of walkways, and the erection (and regular updating) of interpretation panels.

- Information on project activities provided to other departmental reports, newsletters, etc.
- Monthly contact with local news media has been established,a nd several articles published.
- An average of 20 public addresses are made each year to interest groups.
- Twice-yearly guided walks are held.
- Displays are maintained in the Conservancy office, and made available when required elsewhere.
- A Boundary Stream brochure has been completed, and will be updated in 2000.
- An organised event with landowners is held each December, and contact with individual farmers made at least quarterly.
- Contact is maintained and information supplied to universities.

Results have included:

- 626 volunteer days contributed to the project's management between August 1996 and June 1999.
- Anecdotal observations suggest an increase in the number of visistors to the reserve.
- 3 Boundary Stream newsletters and contribution to 5 'Hawkeye' (Conservancy) newsletters.
- Completion of 7 interpretation panels.
- Completion of a project brochure and reserve recreation strategy.
- Publication of 12 newspaper articles
- An annual field trip by Massey University's 'Fauna of NZ' course.

Results have been interpreted as follows:

- A high level of acceptance and endorsement of the project is evident from neighbours. Access across private lands to project staff is willingly provided, and support is provided in controlling goats before they reach the reserve.
- Iwi support is also evident. Tanagata whenua have blessed various activities, and enthusiastically supported species re-introduction initiatives. Direct involvement of local hapu in project activities has resulted in a large volunteer response and subsequent request that this relationship be maintained and opportunities for sharing information furthered.
- The erection of several detailed interpretive panels and the completion of an informative brochure enhances visitors' understanding of the project and the role of the Department.
- Interest from universities in the project is high with a large number of university students exploiting volunteer opportunities, as well as participating in research initiatives.
- Involvement by the local school is now formally included in the school's curriculum. An interpretation package for school teachers is being

developed by a teacher on a Royal Society scholarship, which will cover the activities and outcomes of the project.

The recent completion of a recreation strategy will provide a clear direction for the provision of recreational activities in the reserve Questionnaire response). A review of all public awareness activities in the reserve is planned in the 1999/2000 year, leading to the preparation of a Public Awareness strategy for Boundary Stream.

7.4 PAENGAROA

7.4.1 Goals and objectives

One of two project goals in the strategic plan for this project is 'To utilise the reserve's outstanding values to promote public awareness of the composition and functioning of a unique ecosystem with many rare elements.' This is translated to an objective 'To develop public facilities with emphasis on interpretation of the unique features of the reserve.' (Strategic Plan 1996). Identified 'interpretation management requirements' are:

- 'To prepare a site plan for interpretation and picnic facilities in the main clearing.'
- 'To construct picnic and interpretation facilities in the main clearing as per site plan.'
- 'To prepare a pamphlet which interprets features of interest along the circuit track.'
- 'Promotion management requirements' are also identified;
- 'To prepare and disseminate an information flyer which introduces the 'mainland island' concept and management of this reserve.'
- 'To make timely media releases concerning events and discoveries.'
- 'To organise visits for interest groups which promote the reserve's attractions and management.'
- 'To pursue sponsorship opportunities which may provide additional sources of funding for reserve management.'

7.4.2 Reported management activities and results

- A number of volunteers have been involved in the weed control programme.
- Guided tours have been conducted to the reserve as part of the conservancy's Summer Nature Programme.
- A community meeting was held at Mataroa School to promote local awareness of the project.
- Iwi, school pupils, local community and interest group representatives attended the release of robins into Paengaroa. Local schools were involved in the release, and continue to be involved in follow-up monitoring.
- Local schools involved in Arbor Day planting of trees and shrubs at the carpark.

- Local people have been visited to discuss weeds and weed control.
- Several news items have been released on events or items of interest in the reserve.

Positive feedback was received from local schools, community and iwi on consultation and involvement with the robin transfer. Local people did not express any concern to DOC's suggestion that cat control may be undertaken in the reserve. Generally positive responses, and subsequent support was received for weed control in gardens and farmland surrounding the reserve. Local community and interest groups have asked if they can assist in the management of Paengaroa. Newspaper articles and a *Forest & Bird* journal article has stimulated interest in *Olearia gardneri* and other aspects of the project.

These results have been interpreted as 'Public interest in Paengaroa has been building steadily over the past two years. The local community and schools are now much more involved and interested in what is happening in the reserve and how they can participate. It is important to have a base of local support and 'ownership' of the reserve before heavily promoting the area to the wider public. Positive progress has been made in achieving all 3 objectives' (Paengaroa questionnaire response).

7.5 ROTOITI

7.5.1 Goals and objectives

Three objectives are listed in the strategic plan in line with the overall long-term goal:

- 'To advocate for indigenous species conservation and long-term pest control, by providing an accessible example of a functioning honeydew beech forest ecosystem, so a large number of people experience a beech forest in as near-to-pristine condition as possible.'
- 'To develop ownership of the programme by the people of St Arnaud and the wider Nelson and Marlborough communities.'
- 'To use the programme as an educational resource for local schools and colleges.' (Strategic plan, Butler 1998).

7.5.2 Reported management activities and results

- Developed and maintained a project profile—including a project 'launch' involving Sir David Attenborough, followed by an anniversary event celebrating the first year of management.
- Regular media releases about progress in the project.
- Designed and promoted 'Revive Rotoiti' newsletter and brand name—newsletter produced 6-monthly and distributed to c. 500 people and organisations.
- Wasp control programme launch held in conjunction with Departmental annual business planning.

- Involvement with Lake Rotoiti School and Rotoiti Lodge, with students studying in the project area and staff members giving talks on the project.
- Plans developed to up-grade tracks, introduce on-site interpretation, and improve visitor service information on the project in line with a draft visitor services plan.
- Two high standard short walking completed and four of 10 planned interpretation panels in place on these.

Funds were sought but not obtained for collection of initial baseline data on community attitudes and understanding. Funds have been provided in the 1999/2000 year, and the detail of this work is currently being discussed.

It has been concluded that 'Positive feedback and strong community identification with project and support. This is evident in comments recieved, in people visiting St Arnaud expressly for the purpose of visiting the project' (Rotoiti questionnaire response).

7.6 HURUNUI

7.6.1 Goals and objectives

Although there is no reference to public awareness or community participation in the declared long-term project goal, a 'Hurunui Mainland Island Public Awareness Strategy' has been compiled (Grey 1998). This strategy includes objectives to:

- Provide the public with information on the programme and its progress.
- Develop public support for the programme.
- Raise public understanding of Mainland Island ecosystem restoration, species protection and pest control.
- Provide the public with an accessible 'experience' of the programme within Christchurch city so that few people will physically try to visit the area and put pressure on the landowners.

7.6.2 Reported management activities and results

The strategy highlights the following advocacy and public awareness methods to achieve the objectives:

- Mainland Island information booth at Willowbank Wildlife Reserve, with up-to-date displays and audio-visual presentations.
- Information sheets and displays.
- Fact sheet.
- Interpretive panels.
- Education resource kits.
- Mobile display.
- A large poster was produced which has been used in conferences, shows, fairs etc.

- A Fact sheet was also produced to accompany the poster.
- A number of local radio and TV interviews have been undertaken.
- There have been several newspaper feature articles as well as regular news releases published.

These results have been interpreted as the Hurunui having a 'high profile in Canterbury' (Hurunui questionnaire response).

7.7 PUBLIC AWARENESS AND COMMUNITY PARTICIPATION—DISCUSSION

The interests of people are alluded to in the long-term goals for most of these projects; objectives to promote public awareness and community participation are included in strategic plans for all of them. While the scope of these objectives and the range of activities varies between them, it is apparent that the importance of advocacy in sustaining these projects is generally acknowledged.

Operational plans and, in some cases, public awareness or interpretation strategies have been prepared which contain quite specific advocacy objectives. Important progress has been recorded in relation to some objectives—including evidence of community support. Difficulties associated with measuring progress towards some advocacy objectives have no doubt had an influence on the range of achievements recorded. Research funds have recently been allocated in response to a bid from the Rotoiti project to measure changes in community attitudes and understanding. This research will also involve the Trounson project.

While not necessarily comprehensive, target groups have been identified at all projects. Neighbours, local residents, tangata whenua and other stakeholders have been identified, and activities undertaken which are directed to these groups' needs. The establishment and maintenance of good neighbour relations has been given a high priority at all projects. The support and involvement of tangata whenua has also been successfully encouraged at several projects. The Northern Te Urewera project is notable in that Tuhoe people are closely involved with all aspects of the project. A key component of routine management in this project is consulting with kaumatua, attending hui and facilitating tangata whenua inputs into planning activities. There are indications of strong support from neighbours at most projects—including access for project staff to adjacent private lands, and assistance in pest control in buffer areas. These responses suggest that good-neighbour relations have been established. Maintaining these relations as projects proceed will continue to be important.

The Paengaroa project has an essentially local profile, apart from within botanical circles. It has been proposed to develop local community support before promoting the project more widely. Starting from a cadre of volunteers involved in weed control, the awareness and involvement of neighbours and local residents has been encouraged. Support is now being provided by some local residents in removing weeds from adjacent private lands. The

conservation of relatively unspectacular (to most people at least) threatened plants such as *Olearia gardneri* has been successfully promoted, including to local school children, newspaper articles and in the *Forest & Bird* journal. Growing community support has been reported as part of the re-introduction of North Island robins into the reserve. It is not yet clear how the robin work will complement the messages promoted relating to threatened plant conservation.

Although not promoted in declared objectives, volunteers have played, and will continue to play a key role in promoting ecological restoration based on their experiences at these projects. Where this has not already been done, procedures should be established to ensure volunteers leave these projects feeling suitably acknowledged and rewarded, as well as knowledgeable of restoration activities.

The Trounson, Boundary Stream and Rotoiti projects are already important sites for public visitation. Additional effort has been applied to develop interpretation facilities at these sites so that visitors leave with a better appreciation of ecological restoration. Visitation at the other sites is generally more specialised and interpretation tends to be more focused (e.g. guided walks). The Hurunui project represents the other end of the visitation spectrum from Trounson or Rotoiti in that public visitation is not encouraged. A public awareness strategy has been prepared which focuses on providing information on the project and its progress through 'distance interpretation'. That is, audio-visual displays, posters and interpretive panels are used at such places as the Willowbank Wildlife Reserve in Christchurch to inform interest groups. Local news media releases and an informative video are also intended to provide information, whilst reducing public demand for visitation to the project area. It will be interesting to monitor stakeholder and public attitudes as this project proceeds.

7.8 PUBLIC AWARENESS AND COMMUNITY PARTICIPATION—KEY POINTS

The importance of advocacy in sustaining these projects is acknowledged in all project plans.

The need to incorporate the needs of stakeholders is alluded to in the long-term goals for most projects and objectives to promote public awareness and community participation are included in plans for all of them.

Important progress has been recorded in relation to some objectives, although measurements are essentially subjective.

Some target audiences have been identified and activities directed at these groups. Most projects report progress in relation to maintaining good neighbour relations.

These projects lie across a spectrum of public visitation opportunities ranging from c.100,000 visitors per annum to Kerr Bay next to the Rotoiti project, to the remote Hurunui operational area where public visitation across private land is discouraged.

Effort is being applied to develop interpretation facilities at sites with high visitor use. Narrower advocacy objectives are being pursued elsewhere. Differences between these projects with respect to their attributes as 'showcases' are more apparent than their similarities.

8. Research

Experiments are being undertaken at all projects, including field trials, experimental management and applied research.

8.1 REPORTED RESEARCH

Trounson

- Predator and rodent responses in managed northern forests.
- Environmental risks of using brodifacoum at managed sites.
- Seasonal abundance patterns and dietary preferences of hedgehogs at Trounson Kauri Park.
- Behavioural vulnerability of juvenile brown kiwi.
- The effects of introduced predators on kauri snails, *Paryphanta busbyi busbyi*.

Northern Te Urewera

- Assessment of ungulate effects on forest and implications in Northern Te Urewera.
- Rodent control trials through three areas and compared with a non-treatment area.
- Rat trapping as a viable method of control for *Rattus rattus*, a field trial.
- An 'A' line as effective bait station protection for kokako.
- Mustelid scented trail field trial.
- Scent trails and scented trail trials to influence mustelid behaviour.
- Selected phenology and ground transect comparisons between the intensively managed Otamatuna study area and the Okopeka non-treatment study area.
- Selected comparisons between the intensively managed Otamatuna study area and the Okopeka non-treatment study area, of some key forest bird species.

Boundary Stream

- European hedgehogs and their significance to the ecological restoration of Boundary Stream Mainland Island, Hawke's Bay.
- Comparison of 'Coreflute' and 'Philproof' tracking tunnels.
- Measuring benefits of possum control using leaf rollers.

Paengaroa

- *Olearia gardneri* Heads (was included in *O. hectorii* Hook.f.): regeneration ecology, conservation status and recovery planning.

- Dynamics of kahikatea forest remnants in middle North Island: implications for threatened and local plants.
- Weed impacts on biodiversity and forest structure.
- Mosses and lichens of Paengaroa Scenic Reserve.
- An insect survey of Paengaroa Scenic Reserve.
- Comparison of two North Island robin (*Petroica australis longipes*) populations: the influence of habitat quality on survival and reproduction.

Rotoiti

- South Island kaka research (the effect of predator control, population viability, feeding and breeding).
- Introduced small mammals and invertebrate conservation in a mixed beech forest.
- Effects of *Vespula vulgaris* on a beech forest *Coleoptera* community.
- Investigation into the effect of honeydew on invertebrate communities.
- Productivity, juvenile mortality and dispersal of Kea (*Nestor notabilis*) in Nelson Lakes National Park.
- Breeding success and the behaviour of South Island robin.
- Wasp aerial bait trials.
- Trials on the siting and effectiveness of various types of bait station for mouse control.
- To compare the effectiveness of two different spacings in order to control wasp populations effectively.
- The effectiveness of mustelid baits and traps.

Hurunui

- Determining the most cost effective way to control possums in a valley-based beech forest ecosystem.
- Determining the most cost effective way to control stoats in a valley-based beech forest ecosystem.
- Determining the impact of browsers on forest margins and river flat grasslands.
- Orange-fronted parakeet genetic status.
- Orange-fronted parakeet status and to determine if the pest control being carried out in the South Branch of the Hurunui is maintaining or improving the species survival prospects.
- The relationship between leaf roller population and forest health.
- Possum diet in the Hurunui.
- Scoping study to determine what sort of analysis is required from existing datasets to identify and describe vegetation communities in the Hurunui.

8.2 RESEARCH PROVIDERS

In addition to departmental staff, researchers from a number of non-departmental agencies are actively involved in research in these projects.

Trounson

- Science & Research (DOC)
- Auckland University
- Project staff

Northern Te Urewera

- Massey University
- Waikato University
- Auckland University
- Area/Project staff

Boundary Stream

- Victoria University
- HortResearch
- Science & Research
- Project staff

Paengaroa

- Canterbury University
- Massey University
- Landcare Research
- Otago Museum
- Science & Research
- Area/Conservancy staff
- Independent consultant

Rotoiti

- Canterbury University
- Landcare Research
- Independent consultants
- Project staff

Hurunui

- Conservancy/Area staff
- Science & Research
- Landcare Research
- Victoria University
- Canterbury University

8.3 REPORTS AND PUBLICATIONS

A relatively large number of technical reports and scientific publications have been produced since these restoration projects were initiated. Most are produced as unpublished reports with a small number of copies circulated to (mainly) departmental staff. Peer review and approval procedures are not reported. Some will be published as contract reports or other departmental publications. Post-graduate research programmes have been published as theses. In the case of these latter 'formal' programmes, standard peer review and publication procedures have been applied. It was difficult during this review to compile comprehensive lists of reports from each project. A list of publications and reports from the Northern Te Urewera project is appended as an example of the range of reports and publications produced (Appendix 4).

8.4 RESEARCH — DISCUSSION

Despite their not being chosen as experimental sites, a feature of these projects is the number of research programmes being undertaken. There is probably more research being undertaken at these projects than most other operational projects. Research needs have been identified and management programmes designed so that management may be treated as experiments at all of these projects. The emphasis given to experimental objectives, however, and the rigour of the science applied varies considerably.

In some cases, assumptions underpinning management objectives have been included in strategic or operational plans, and hypotheses to be tested by management declared. No results have yet been reported, however, which show how these hypotheses were tested. Monitoring at reference (non-treatment/'control') sites is now being undertaken at five of the six projects, although not all parameters being measured at treatment sites are also being monitored at reference areas. Monitoring at some reference areas has been initiated only after management has been in place for some time in treatment areas. In some cases reference areas are probably not discrete from treatment areas in relation to more mobile species. Concerns have been expressed at one or two sites about biodiversity declines at reference sites in the absence of pest control, and justifications for their continued use as experimental reference areas challenged.

Advice on the experimental power of management experiments and the statistical bases for interpreting results has been sought at several projects. Evaluations of the statistical foundations of two projects (Trounson and Boundary Stream) have been undertaken and reports prepared using SRU 'unprogrammed advice' funds (Gentleman 1997, Arnold 1997). These reports recommend a number of changes to improve the power of data collected and inferences that may be drawn. One of these reports suggests co-ordination of student research projects so that they can better complement overall project activities and goals.

While the processes for interpreting results, reviewing and disseminating information are not clear for any project, it is likely that procedures vary

between them, and within them over time. In some cases, such as for Science & Research-funded contract reports and university theses, peer review and publication procedures are established. In the case of research projects and field trials funded within the conservancy, or from project funds, the processes followed are not clear. A number of comments in questionnaire responses refer to reports on research and field trials in project annual reports being prepared.

Although not always declared, a distinction has been made at most of these projects between 'formal research' projects and 'field trials'. Research projects generally feature declared hypotheses, definitions of key terms, descriptions of experimental methods and an experimental design incorporating prior assessments of experimental power, replication, non-treatment (reference) areas and, perhaps, treatment switches. Research results are typically subjected to peer review and published as scientific papers or reports. Unlike formal research, field trials may or may not have declared assumptions and hypotheses, experimental design and methods are not necessarily declared at the outset, and results are generally not subjected to statistical tests or widely disseminated for peer review. Field trials are usually undertaken by management staff, rather than scientists, and the results of such trials are normally applied locally. The essential difference between formal research and field trials is the strength of inference which may be drawn from their results (Platt 1964). Generally, formal research allows strong inference, whereas less rigorous trials only allow weak inferences to be drawn. In some cases, field trials at these projects have been described as 'pilot' or 'preliminary' studies. While there is a place for both approaches, there is a pressing need for conservation management activities to be underpinned by sound scientific procedures so that stronger inferences may be drawn, prediction of conservation outcomes enhanced, and decision making supported. For example, it will be important to relate particular pest control regimes to targeted pest densities and impacts and, in turn, to conservation outcomes if the cost-effectiveness of pest control is to be improved.

Ecosystem-focused restoration at mainland sites probably involves more uncertainty and operational risks than most other conservation management projects. The intensity of management undertaken and the scale of ecological responses suggest that they may be most usefully managed as adaptive management projects (Walters & Holling 1990), perhaps as part of a coordinated national restoration experiment. Such an approach is proposed in Part C of this document.

Alternatives to applying a coordinated national restoration experiment include maintaining existing approaches at these projects. Current approaches are characterised by;

- A local focus.
- Different research providers.
- Different levels of scientific rigour.
- Different monitoring techniques.
- Different review procedures.
- Unclear information uptake mechanisms.
- Inconsistent information dissemination.

It is important to recognise that circumstances at each project are different, and that simple conclusions and management prescriptions are unlikely to have universal application. Nevertheless, a detailed assessment of research and monitoring programmes in place at these projects is likely to show that important economies of scale could be achieved through applying a more strategic approach to learning from management activities.

Another approach may be to reduce the effort applied to research and monitoring, perhaps restricting measurements to identified high-risk activities where there are few precedents. In this scenario decisions would be based largely on the observations and intuition of experienced practitioners. Such an approach has been applied successfully in a number of species recovery programmes. Most experienced species recovery practitioners would readily acknowledge, however, that there are significant limitations to applying intuitive decision-making approaches. It can be assumed that these limitations would be even more pronounced in multi-faceted, on-going ecosystem-focused management programmes. For these reasons it is concluded that a more rigorous hypothetico-deductive approach to addressing issues which have tactical and strategic implications is required if strong inferences are to be drawn, decisions confidently made, and ecological restoration goals achieved and sustained.

8.5 RESEARCH — KEY POINTS

- A feature of these projects is the amount of research activity. There is probably more research being undertaken than at most other operational projects.
- While hypotheses have been declared in relation to key management activities at some projects, it is not clear from results presented to date how these hypotheses have been tested, nor of the outcomes of these tests.
- The emphasis given to experimental objectives and the rigour of the science applied varies within and between projects. As a result interpretations are based largely on weak rather than strong inference.
- Information compiled during this review suggests that there is considerable variation in the way results are analysed, interpreted, reviewed and disseminated. Opportunities to advance understanding and to develop management capacity as outcomes from these projects are not being comprehensively exploited.

It is suggested that a lack of understanding of how ecosystems respond to management is a fundamental impediment to predicting conservation outcomes. It is proposed that a more proactive approach to identifying strategic research themes, and applying sound scientific procedures to address them will result in important benefits to the Department.

9. Project administration and support

Administration is a key factor in the success of conservation management projects. It is through the application of comprehensive and effective administrative procedures that appropriate and consistent institutional support is maintained.

TABLE 14. STRATEGIC PLANS.

	STRATEGIC PLANS	COMMENTS
Trounson	Trounson Kauri Park, Strategic Plan for Mainland Island Management. DOC unpublished report.	Compiled in 1995. Revised in 1997. Covers period 1995–2000. Next plan to be compiled in 1999/00.
Northern Te Urewera	Northern Te Urewera Ecosystem Restoration Strategy: a mainland ecosystem restoration project. Shaw, W.B., Shaw, P.G., Gooch, L. 1996. Contract report No.154. DOC unpublished report.	Existing plan covers period from 1996 to October 1999. A revised strategic plan will be prepared and operative by November 1999. The new plan will cover a 15 year period, with revisions anticipated 3-yearly. The relationship between this plan and objectives in the East Coast/Hawke's Bay Conservation Management Strategy is detailed in this plan.
Boundary Stream	Boundary Stream Mainland Island Project: Strategic Plan, 1995. Revised May 1997. DOC unpublished report. Boundary Stream Advocacy Strategy—a draft for discussion. Boundary Stream Recreation Strategy.	Planning period 1995–October 1999. A revised strategic plan will be prepared and operative by November 1999. The scope for this strategy has yet to be set. The relationship between the strategic plan and the East Coast/Hawke's Bay Conservation Management Strategy is detailed in this plan.
Paengaroa	Paengaroa Scenic Reserve: a strategy for management as a 'Mainland Island', 1996–2001. Barkla, J. 1996. DOC unpublished report.	Strategy is due for review in 2001.
Rotoiti	Rotoiti Nature Recovery Project: St Arnaud's Honeydew Beech Mainland Island Strategic Plan. Butler, D.J. 1998. Internal report No.29, DOC Nelson publication.	Strategic plan originally drafted together with an operational plan in August 1997. The strategic plan was finalised in June 1998 following the first season of operations. It was re-drafted following input from the Technical Advisory Group. Separate operational plans and annual reports will be produced each year.
Hurunui	No overall strategic plan as yet. Hurunui Mainland Island: public awareness strategy. Grey, J. 1998.	Management to date has been guided by the South Branch Hurunui 'Mainland Island' Project Operations Plan 1995/96—and revisions.

TABLE 15. OPERATIONAL PLANS.

	PLANS
Trounson	Trounson Kauri Park (TPK) Restoration Plan, January 1996. TPK Work Plan 1997/98. TPK Work Plan 1998/99. Interpretation Concept Plan (draft) 1996.
Northern Te Urewera	Operational plans are prepared each financial year for the restoration project and for Wild Animal Control in the Opotiki Area office.
Boundary Stream	Operational plan prepared for 1995/96. More comprehensive plans prepared for 1997/98, 1998/99 and 1999/00. Operational plans cover financial years. Actions in operational plans relate to a recreational strategy, fencing plan, ungulate control plan and monitoring strategy for the reserve.
Paengaroa	No operational plan as such. A project plan is prepared each year by the Area office, guided by the strategic plan.
Rotoiti	Rotoiti Nature recovery Programme Draft Strategic and Operational Plan, August 1997—included 1997/98 season. 1998/99 draft operational plan.
Hurunui	South Branch Hurunui 'Mainland Island' Operations Plan 1995/96, Andrew Grant, Canterbury Conservancy, unpublished report.

9.1 STRATEGIC AND OPERATIONAL PLANS

Strategic plans covering either the entire project, or specific activities, such as advocacy and recreation, have been developed at some projects (Table 14). In some cases these strategies include a number of projects in the wider area, while in others they are confined to the restoration project.

Operational plans covering specific activities and/or a defined period (usually a single financial year) have been prepared to link strategic plans to management activities at some projects (Table 15).

9.2 PERFORMANCE REPORTS

Reports detailing some/all activities and results at these projects have been produced (Table 16).

9.3 ADVISORY GROUPS

Four of the six projects have strategic and or technical advisory groups in place (Tables 17 and 18) in order to guide management and to facilitate liaison.

TABLE 16. PERFORMANCE REPORTS.

	PERFORMANCE REPORTS
Trounson	1996/97 Annual Report, DOC Whangarei unpublished report. 1997/98 Annual Report, DOC Whangarei unpublished report. 1998/99 Annual Report due for completion September 1999. Kiwi project reports. Translocation reports: Monitoring the NI robin transfer (1997), Kearns & Stevens unpublished report. Conservation Dog Annual Report, 1999. Seedling plots: Northland Polytechnic reports, 1998 & 1999. Research progress reports; Paul Craddock, Richard Hendra, Sarah Gibbs.
Northern Te Urewera	First Annual Report on Monitored Species, Northern Urewera Ecosystem Restoration Project, Te Urewera National Park 1996/97. Beaven, B.M. 1997. DOC Opotiki unpublished report. 1997/98 Annual Report, B. Beaven (Ed.) 1998. In prep. 1998/99 Annual Report in prep. (will be completed by the end of August).
Boundary Stream	Project updates covering all project activities were prepared every 1–3 months from June 1997 to January 1999. Interim project reports have been completed annually as follows: Possum trap catch results (from 1996). Lizards (from 1998). Bat monitoring (from 1996/97). Fish survey (from 1998/99). Invertebrate monitoring (1996/97, 1997/98). Contract goat hunter reports following each visit (from June 1998). Anon. 1996: Boundary Stream restoration project: report to first annual mainland island hui. Additional performance reports have included: Annual Report 1996-98 (Harrison in prep). NI robin post-release report. Snail monitoring report. Snail management report. Kiwi Kaweka survey results; 1998 & 1999. Occasional reports to Conservation Board (from March 1997).
Paengaroa	Paengaroa Mainland Island Annual Report 1997/98. La Cock, G, Beggs, W. 1999. Anon. 1997. A summary of the work completed at Paengaroa reserve over the 1996/97 summer. Wanganui Conservancy, Department of Conservation. Over 30 technical and scientific papers and reports relating to species and their management at Paengaroa are listed in the attached bibliography.
Rotoiti	Monthly reports to the Area office and Conservancy. Thirdly reports to Head Office for National Performance Reporting. Annual Report for 1997/98 complete and to be printed shortly. Annual Report for 1998/99 being drafted.
Hurunui	South Branch Hurunui 'Mainland Island' Project First Season's Report, 1995/96. Grant, A.D., Kearvell, J.C., King, W. 1996 DOC unpublished report. Informal Second Season's Report—Report to Pureora Mainland Island Hui, June 1997. Grant, A.D., Kearvell, J.C., King, W. 1997. DOC unpublished report. South Branch Hurunui 'Mainland Island' Project 1997/98 Report. Grant, A.D., King, W., Kearvell, J.C., Van Dijk, A. 1998. DOC unpublished report.

TABLE 17. ROLES AND COMPOSITION OF STEERING GROUPS.

	ROLES	COMPOSITION
Trounson	Strategic steering/advisory group in place to oversee strategic direction, ensure coordination of conservancy resources, revise and approve strategic plan. Meets twice annually for business planning and performance reporting.	Regional Conservator. Area Manager. Conservancy Advisory Scientist. Kaupapa Atawhai Manager. Project Manager. Field Centre Supervisor (optional). Public Awareness Officer.
Northern Te Urewera	No formal group. Strategic meetings held (approximately) six-monthly as a forum for input from tangata whenua, research institutions, Conservancy science and technical support staff as well as project staff. A sub-group consisting of the Conservancy Technical Support Officer and project staff will review the strategic plan.	Project staff. Conservancy staff (Conservancy Advisory Scientist, Technical Support Officer). A tangata whenua representative. Specialist advisors (e.g. Mainland Island Technical Coordinator, Landcare Research scientists).
Boundary Stream	Originally (pre-1997) strategic and technical groups in place. Following amalgamation of 2 Conservancies, technical and management groups were established. The technical group has responsibilities for the strategic direction of the project, to review annual reports and propose future activities for the operational plan. The group meets twice a year (has met twice to date) in concert with reporting and business planning schedules.	Technical Support Manager and staff. Conservancy Advisory Scientist. Project Managers (Boundary Stream and Northern Te Urewera). Area Manager. Mainland Island Coordinator. Other technical and project staff (including Head Office) as required.
Paengaroa	No formal group established. Irregular meetings of key Conservancy and Area office staff to discuss project direction, progress and key issues. Provides opportunity for relevant Conservancy experts to provide advice/support and keeps key staff up to date with progress and developments.	Key Conservancy and Area office staff.
Rotoiti	Technical Advisory Group—meets once a year. Provides advice on technical matters, oversees an annual technical review, and facilitates liaison with research agencies.	Conservancy technical support staff. Project manager and staff. Area staff. Representatives of other research agencies (e.g. Landcare Research). Other specialists as required, including Mainland Island technical Coordinator.
Hurunui	No formal group established.	Before new activities are undertaken, or others modified, meetings are held drawing appropriate experts from Landcare Research, Universities, Science & Research, and other parts of the Department.

TABLE 18. ROLES AND COMPOSITION OF WORKING GROUPS.

	ROLES	COMPOSITION
Trounson	A Technical Group has been established to advise on methods and standards, to keep standards under active review, to monitor overall progress and to advise on aspects of the draft annual Work Plan (as part of business planning). Meets 3 times annually.	Conservancy Advisory Scientist (Convenor). Project Manager. Area Manager. Conservancy Technical Support Manager and staff. Field Centre Supervisor (optional). SRU predator ecologist.
Northern Te Urewera	No formal group established.	Regular dialogue between project staff and Area and Conservancy office specialists.
Boundary Stream	A Management Group has been established (1997) to oversee implementation of the Operational Plan, updating on project activities, and dealing with localised issues. Meetings are held monthly.	Project Manager. Technical Support Officer. Boundary Stream Team Leader. Other project and Conservancy staff as required.
Paengaroa	No formal group established.	Annual debrief held with Conservancy and Area office staff to discuss what has happened during the year.
Rotoiti	A Working Group has been established to undertake general work planning and to oversee project management. Meets every 8 weeks.	Project, Area and Conservancy staff.
Hurunui	No formal group established.	Regular dialogue between Area and Conservancy staff.

9.4 REVIEW AND AUDIT PROCEDURES

The following procedures were reported:

Trounson

Progress of project activities is reviewed through the monthly reporting process and at technical group meetings. Meetings are held 3 times a year where procedures and results are reviewed.

Northern Te Urewera

Six-monthly strategic meetings allow for input from tangata whenua, research institutions, technical specialists and project staff, as well as information sharing and peer review. The process of preparing the (annual) operational plan also requires intensive audit and review of past and proposed activities, as does preparation of the annual report. Annual Mainland Island hui are also an important forum for informal review. Regular meetings with tangata whenua and other interest groups also provide opportunity for wider community audit and review.

Boundary Stream

Preparation of the operational plan and its implementation is the basis of review and audit procedures. Several changes to management regimes (e.g. cat and mustelid trapping) have resulted from reviews of existing procedures. In some cases specialist advice has been obtained. The planned review of the strategic plan is expected to provide another opportunity for audit and review of the project.

Paengaroa

An annual de-brief is held with Conservancy and Area Office staff to discuss activities and progress.

Rotoiti

Monthly reports to Area and Conservancy Offices, thirdly reports to Head Office (National Performance Reporting process) and annual reporting process all provide opportunities for review and audit. Technical Advisory and Working Groups also involve technical and peer review. Staff participation at Mainland Island Hui is encouraged to facilitate wider peer review.

Hurunui

No review or audit procedures identified.

9.5 PROJECT STAFFING

The numbers of staff employed at each project during the 1998/99 financial year are presented in Table 19.

TABLE 19. PROJECT STAFFING (1998/99).

	STAFF
Trounson	Project manager (FT), Protection officer (FT), Predator researcher (PTC), Public Awareness officer (1 day/week), Predator ecologist—SRU (PT), Kiwi monitor (LTV).
Northern Te Urewera	Project manager (FT), Species staff—4 (FT), Wild Animal Control staff—2 (FT), Contract hunters (PTC)—c.10/annum.
Boundary Stream	Project manager (PT), Team leader (FT), Project staff (FT)—4, Contractors (PT)—equivalent to 1 person/year.
Paengaroa	No full-time staff. 82.5 person days of Field Centre, Area and Conservancy Office staff during the 1998/99 financial year. Contractors (PTC) spent 138 person days in the reserve. Incomplete records of volunteer days, but significant inputs.
Rotoiti	Project manager (FT), Predator officer (FT), Project staff—3 (LTC), Project staff—2 (STC).
Hurunui	Project manager (PT), Field supervisor (FT), Project staff—3 six-month contractors (PT), Conservation Corps Volunteers—100 hrs.

Key: FT = Full time; PT = Part time; PTC = Part time contract; LTV = Long term volunteer; STC = Short term contract

9.6 PROJECT ADMINISTRATION AND SUPPORT—DISCUSSION

There are marked differences in the way each project is administered and supported. Five of the six projects have strategic plans. A plan for the Hurunui project is in preparation. While they all contain long-term goal statements, these plans vary in their content and range from a few pages to relatively large documents containing background information. Only two of these plans have been published to date. It is not clear how useful strategic plans have been in guiding management to date, although references to strategic goals are included in a number of operational objectives. Reviews proposed of strategic plans in the next 1 or 2 years should allow for evaluation of the value of these plans as guiding documents.

Operational plans are also variable in format and content. In some cases these plans serve to link project activities with other projects in the Area or Conservancy, as well as providing a basis for annual work programmes to be set. Clarification of the purpose of operational plans, and some guidelines on their preparation and content would be useful.

Along with project planning there is considerable variation in the way performance reports for these projects are produced. Regular (usually annual) performance reporting is the key mechanism through which progress towards management objectives and long-term goals is assessed, and details on project activities and results disseminated. Following discussions at Mainland Island Hui considerable effort has been applied to compiling annual reports at most projects. It was agreed that these reports should cover the July–June financial years, and be completed by the following September. To date only two annual reports have been completed for the 1997/98 year, although several others are close to completion—including at least two for the 1998/99 year. The absence of comprehensive and current project reports was a major impediment to this review, and is a major potential problem as the risk of information being lost increases with time. The lack of comprehensive reports also limits opportunities for technical review, as well as advocacy opportunities. The establishment of standard procedures for the preparation and dissemination of annual reports, including clearing the current backlog must be a high priority if a more coordinated and proactive approach is to be adopted to ecological restoration.

Advisory groups have been established for three of the six projects. These groups have essentially advisory and liaison roles. Membership is different for each project, and has changed in at least one case. Only the Trounson group includes the Conservator, although key Conservancy and Area managers are represented on some others. It is not clear what influence these advisory groups have on resource allocation decisions, or technical programmes. Direct Conservator representation on strategic groups would seem advisable. Tangata whenua are directly represented on one group (Northern Te Urewera), and indirectly by the Kaupapa Atawhai Manager at another (Trounson). While a single compositional model is unlikely to be appropriate, clarification of the roles of these groups, and an evaluation of their performance in relation to these roles may lead to some changes being proposed.

The roles and composition of technical/working groups, where they exist, is also variable. The liaison role is emphasized in the single Rotoiti group with representatives of research agencies, as well as project staff and other specialists being invited. Participation by Area, Conservancy and Head Office staff, as well as project staff in several groups has been reported as advantageous, stimulating dialogue and peer review. Representation of project managers on advisory groups of the East Coast/Hawke's Bay Conservancy's two projects makes good sense. In other projects no formal groups have been established. In these cases strategic directions and work plans are discussed in meetings involving key departmental staff and, in the case of the Hurunui project, external advice is sought when new activities are being considered. Strategic advisory and technical working groups were reported as providing important opportunities for technical review and audit, along with regular reporting (especially annual reports).

The numbers of staff committed to these projects is variable, and have changed over the 3 or 4 years these projects have been operating. Comparisons between projects based on staffing levels and funding are particularly complex due to the experimental and rapidly-evolving nature of the management being undertaken, as well as the physical characteristics of each site and the range of attributes being managed. Because of the intensity of management involved, and associated high labour costs, management inputs should be regularly reviewed.

Opportunities may well emerge to reduce inputs as a result of improved management techniques. Also, once pest management programmes have moved beyond initial 'knockdown' phases it may be possible to reduce labour inputs whilst maintaining conservation outcomes. Similarly, monitoring constitutes a major component of on-going costs at these projects. Significant savings can be anticipated following improvements to monitoring techniques and refinements to regimes. There may also be merit in developing specialist team approaches to achieving particular tasks, such as low-intensity pest monitoring, and invertebrate surveys.

There is evidence that skills sharing and staff training programmes are increasingly being incorporated into project plans. This may be taken as an indication that departmental managers have recognised the critical importance of maintaining a high level of professionalism, technical competency and personal commitment amongst project staff. While not reported in questionnaires, there are already indications of staff 'burn-out' in some projects. Given the intensity and complexity of management programmes, and the limited opportunities for project staff to broaden their skills and to expose themselves to peer review, staff retention problems can be expected to increase. A planned approach to staff development and support, including transfers between projects, training programmes and participation at conferences and workshops will be critical if the necessary competencies and commitments of project staff are to be maintained. It is clear that the annual Mainland Island Hui are highly valued by project staff as a forum for information exchange and peer review. While the aims and agendas of these hui could be refined to reduce duplication with other forums and training courses, annual meetings of this kind have important and measurable benefits.

9.7 PROJECT ADMINISTRATION AND SUPPORT—KEY POINTS

- There are marked differences in the way each project is administered and supported.
- Project plans vary in their detail. It is unclear how useful plans have been in guiding project activities to date.
- At the time of this review only two annual reports had been completed for the 1997/98 financial year, although considerable effort has been applied to addressing the backlog at some other projects. The absence of current and comprehensive project reports was a major impediment to this review and constitutes a significant risk to these projects. The implementation of standard planning and reporting procedures is recommended as a high priority.
- Most projects have at least one advisory group. The roles and composition of these groups varies. It is not clear what influence advice provided by these groups has had on management activities, although they appear to have provided important opportunities for dialogue between specialists and, in some cases, key stakeholders.
- The number of personnel involved varies between projects, and over time. Staffing levels are likely to reflect a range of variables including the operational area, the range of pests targeted for control, the scope and intensity of monitoring, etc. Simple comparisons of staffing levels between projects would be problematic.

Although there has been some support for skills sharing and staff development, a more proactive and consistent approach will be needed if necessary competencies and commitments of project staff are to be maintained.

10. Project costs

Total (fully costed) project costs are made up of direct staff costs and operating expenses such as contractors and materials, and overheads which have been allocated using methods adopted by the Department for its external reporting to Treasury. Hours for both permanent and temporary staff have also been included.

Mainland Islands 2000 (Expected Effort) suggests that the Department is expecting to spend $1,704,000 of direct expenditure (staff and operating) this coming financial year. After allocating overheads the fully costed total amounts to $3,111,000. This compares with what was spent in the 1999 financial year of $819,000 of direct expenditure and a fully costed total of $1,810,000.

10.1 PROJECT COSTS—DISCUSSION

New financial reporting procedures have recently been put in place allowing for 'fully costed' totals to be declared. No attempt was made as part of this review to compare the fully costed totals for mainland restoration projects with other management projects. Following a follow-up review of technical aspects of these projects (see Recommendation 5) a template for depicting project costs as well as benefits could be developed. Evaluations of the merits of a wider range of pest control projects funded by the Department could then be undertaken.

TABLE 20. CURRENT AND ANTICIPATED PROJECT COSTS.

FINANCIAL YEAR	2000	1999
Total Hours	46,911	33,024
People Equivalents (divided by 1650 hours)	28.4	20.0
Staff Costs (Perm)	458,852	361,186
Perm Staff Cost Rate per hour	13.8	17.3
Direct Expenses	1,244,813	458,047
Total Direct Expenses	1,703,665	819,233
Staff $$ % to Total Direct Expenses	26.9%	44.1%
Direct $ % to Total Direct Expenses	73.1%	55.9%
Total (Fully Costed)	3,110,995	1,809,953
Overhead $$ included in Total (fully costed)	1,407,330	990,720
Overheads $ % of Total (fully costed)	45.2%	54.7%
Staff SS % to Total (fully costed)	14.7%	20.0%
Direct $ % to Total (fully costed)	40.0%	25.3%

Part C

GENERAL DISCUSSION

In this section key features of these projects that set them apart from others are identified and discussed. Their importance in relation to the Department's statutory responsibilities and strategic goals is also outlined.

Several of the recommendations in Part D relate to the adoption of a stronger scientific basis for ecological restoration. Consideration is given in this section to the elements of scientific experiments and the strengths and weaknesses of existing projects as experiments. A nationally coordinated programme of adaptive management projects is proposed.

11. What sets these projects apart?

Based on this review it is concluded that, in combination, four features set these projects apart from other approaches employed to conserve biodiversity in New Zealand:

- Ecological restoration goals.
- Intensive multi-pest control.
- Detailed monitoring.
- High costs and returns.

11.1 ECOLOGICAL RESTORATION GOALS

The concept of ecological restoration is incorporated in the generic programme title 'mainland restoration'. An ecosystem focus has been declared for each project, and enhancement or restoration goals stated or implied. It is suggested that two key features define ecological restoration: an ecosystem focus, and improvement goals.

11.1.1 An ecosystem focus

The term 'ecosystem' is used to describe a complex of biological and physical factors at a site. It is assumed that managing these interrelated factors at defined sites is likely to result in more extensive and sustainable biodiversity services than less holistic approaches. Thus, ecosystem-focused management projects can be expected to be more cost-effective than others aimed at individual ecological components.

There is continuing debate over what 'ecosystem management' actually is, and how achievable ecosystem-focused goals may be (e.g. Simberloff 1998, Lackey 1998, Brussard et al. 1998). There seems to be general agreement, however, that ecosystem-focused management requires a focus on ecological processes (i.e. ecosystem functions), rather than solely on the components of ecosystems (e.g. Grumbine 1994). There has been extensive disruption to ecological processes such as forest succession, energy transfer, natural predation, parasitism and migration as a result of human colonisation of New Zealand. Few biodiversity management projects to date have been specifically aimed at revitalising such processes. Rather, they have been directed at recovering particular species or controlling some agents of decline. It is the adoption of management goals focused on important natural ecological functions, as well as structural components (i.e. plants and animals) which is at the heart of the required paradigm shift from the traditional focus on species and habitats alone. It can be anticipated that a focus on ecological processes will result in more sustainable outcomes than less holistic approaches. Because an ecosystem focus also involves a human dimension, benefits can be anticipated from involving

and empowering stakeholders in decision making and on-going management. Important progress has been reported at these projects in relation to advocacy and stakeholder participation objectives.

While some outcomes reported from these mainland restoration projects have been interpreted in an ecosystem context (e.g. the recovery of honeydew as a summer food source for animals in the Rotoiti area), most are still essentially species-focused. It can be anticipated that as these projects evolve and more appropriate performance measures are applied, important progress towards ecosystem management goals will be declared.

11.1.2 Improvement goals

Restoration is defined in oneOxford English Dictionary (Fowler & Fowler 1971) as 'the act of restoring to a former state or position… or to an unimpaired or perfect condition.' Many criticisms of the concept of ecological restoration stem from these inferences of a return to some 'original' state, which is 'perfect and healthy.' (Bradshaw 1996). The need for an historical context in which restoration goals may be set is reflected in many definitions of ecological restoration. For example 'The return of an ecosystem to a close approximation of its condition prior to disturbance' (US Natural Resources Council 1992) suggests an intent to emulate a previous state. In a New Zealand example Atkinson (1994) proposed that restoration is 'Management that aims to restore particular biotic communities to a condition more like that of a selected time period in the past.' In recognising the dynamics of ecosystems, Atkinson's definition includes an aim to 're-activate major successional processes likely to have operated during the selected time periods and within the physical conditions (site features and climate) specified for each restoration programme.'

Some definitions do not include reference to a previous condition. For example, 'Ecological restoration is the process of renewing and monitoring ecosystem health.' (Society for Ecological Restoration Board of Directors 1995). Norton (1993) suggested that ecological restoration is 'the active intervention and management to restore biotic communities, both their plants and animals and the associated physical environment as fully functioning and sustainable with a predominance of indigenous species.' Miller and Norton (1993) proposed that mainland sites in New Zealand should be 'restored to a condition, where natural processes occur as free from human intervention as possible; where New Zealand's plants and animals can persist without threat of extinction, and where people can enjoy the full splendour of natural New Zealand.' While it could be argued that concepts such as 'fully functioning' and 'free from human intervention' in the above definitions imply an historical context, the gist of these definitions is not to emphasise a previous condition.

It is important to acknowledge that ecosystems are constantly changing, and that restoration goals based on narrowly defined and static historical pictures are inappropriate. It is also important to recognise, however, that conservation management goals without any historical context may not be focussed on key ecological processes and would more appropriately be defined as 'creation' projects, with management objectives changing according to the perceptions of

individual managers and stakeholders. While such projects may also be important, they may do little to contribute to strategic biodiversity conservation goals.

It is noteworthy that most of the projects reviewed here have goal statements which do not specify a previous time period to which management is directed, although a pre-human disturbance condition is implied in several objectives. While project goals may be subsequently modified to include historical benchmarks, it is likely that current goals are based on an undeclared null hypothesis that a restored system is one not significantly different from normal dynamic processes of contemporary communities and ecosystems (Simberloff 1990). Given the extensive changes, which have taken place in mainland ecosystems in particular, including major disruptions to processes such as forest succession, energy cycling and migration, restoration goals based on perceptions of contemporary processes may be problematic.

A philosophy underpinning restoration is that all natural resource management must have ultimately positive, or at least neutral effects on biodiversity (Noss & Cooperrider 1994). While not measured in relation to wider ecosystem parameters, most protection management regimes in New Zealand have probably resulted, at best, in neutral medium-term outcomes. Given the ecological degradation which has occurred in New Zealand, and the potential achievability of species recovery and habitat rehabilitation at mainland sites, there is now a need to properly investigate the part ecosystem-focused restoration could play in future conservation programmes. An improvement in natural heritage assets, rather than just slowing or halting the decline is at the heart of the move towards ecological restoration. Restoring species and ecosystems is an important component in the New Zealand Biodiversity Strategy (Anon. 2000).

It is concluded that ecological restoration lies on a continuum of conservation management activities which extends from reducing the rate of biodiversity loss at one end, to creating new species assemblages and systems at the other. Successes achieved on offshore islands and, potentially at least, at some mainland sites, suggest that increased emphasis should be placed on restoring damaged ecosystems in order to halt further losses, and to restore natural heritage values.

Ongoing debate about ecological restoration stems from the inherent complexity in defining goals and actions directed at conserving biodiversity at different hierarchical levels (including species, communities and ecosystems). Definitions are further complicated by the fact that the pursuit of ecological restoration goals is a relatively new endeavour, with few precedents. It is also clear that management goals may change over time, perhaps from enhancement initially, to maintenance subsequently.

While these mainland restoration projects are notable for the intensity of the management undertaken and the degree of integration compared to most other conservation management projects, the definitive features of ecological restoration relate to project goals, and outcomes, rather than the nature of the management undertaken to achieve these goals. Further consideration of the features of ecological restoration will be required as the Department sets its conservation management priorities.

Central to the concept of restoration is a goal to sustain an improved condition of a suite of ecosystem attributes, rather than maintaining (in many cases on the mainland) degraded *status quo* conditions. Once restoration goals have been achieved maintenance (protection) goals may be more appropriate to sustain them. There may also be a spatial component in that ecological restoration goals may be pursued in core areas within a wider landscape context.

Secondary features of restoration relate to the selection of restoration areas (such as ecological representativeness and stakeholder support) and management activities (such as an historical context, integrated management programmes and minimal interference goals). It is suggested that a working definition of ecological restoration is refined as part of the development of strategic and operational policy.

11.2 INTENSIVE MULTI-PEST CONTROL

Although comparisons were not undertaken as part of this review, few other projects involve the active control of as many pests as are targeted at these projects. In addition to the range of pests targeted, the low pest indices or disturbance thresholds sought, and the intensity of management necessary for these to be achieved and maintained also sets these projects apart from more conventional pest control projects.

Mainland restoration projects may be seen as 'pilots' in that they are based on a 'maximum effort' approach where all pests assumed to constitute a risk to desired outcomes are initially targeted (i.e. the 'priority place–all pests' model suggested by Parkes & Nugent 1995). The continuous targeting of all pests is unlikely to be sustainable for environmental, social or financial reasons. The identification of critical pests and the development of cost-effective management regimes which result in their disturbances being reduced to acceptable levels at critical periods are key challenges. Initiatives have already been taken at individual projects to reduce the risks and costs associated with intensive, ongoing pest control. For example, at the Trounson project a 'pulsed' regime for possum and rodent control is being considered to reduce the risks of environmental contamination from prolonged toxin use. No moves have yet been taken to 'ease off' or stop control of particular species. Experience at the Mapara project suggests, however, that intensive control of possums and ship rats for several consecutive years, rather than continuous control of a wider array of pests present is enough to enhance the kokako population in the reserve. It may be that a reduced range of pests may be targeted at some of these restoration projects in the future as a better understanding of their impacts and implications of controlling them is acquired, and more target-specific control techniques are developed.

It might be argued that because of the intensity of pest control required, restoration will only ever be achievable at relatively small sites and, by implication, restoration projects may never contribute significantly to regional or national biodiversity conservation goals. It is clear that more intensive management means that smaller areas can be treated for the same resources than less intensively managed ones. There are a number of qualifiers to such a

statement, however, including the wider potential benefits associated with intensively managed sites acting as sources for dispersal of native species into less intensively managed adjacent areas. In this scenario, benefits from re-colonisation and recruitment in the wider area may change overall benefit-cost ratios. Also, it can be anticipated that costs of intensive pest control will reduce as critical pests are identified and as management techniques are improved. Relatively small refinements to management regimes may lead to significant reductions in operating costs. Furthermore, intensive pest control may be interspersed with extended periods of minimal management. 'Pulsed' regimes are already being applied at several restoration projects. It is suggested elsewhere in this report that intensively managed projects offer important opportunities to better understand ecological changes and to develop new approaches than is usually the case at less intensively managed sites. Strategic learning opportunities and capacity building may, in fact, be primary outcomes from some projects. Any comparison of the costs and benefits of extensive and intensive pest control would need to include consideration of such spatial, temporal and capacity building factors.

Apart from the scope and intensity of pest control, the level of integration at most of these projects is also notable. Cooperation between project managers, Area and Conservancy staff is evident, with some excellent examples of integrated approaches. At Opotiki, for example, close dialogue between Area office specialists and Northern Te Urewera project staff seems to have led to animal control and species protection funds being more productively expended. Such cooperation has probably also helped to break down a tradition of splitting responsibilities for the control of herbivorous and carnivorous pests. In addition to pest control programmes, these projects have also been important in promoting the better integration of research and advocacy programmes with 'core' pest control activities.

Whilst a feature of these projects currently, the intensity and scope of pest control is not necessarily a definitive characteristic of mainland restoration projects. A relatively small task such as building a weir to inundate a previously de-watered wetland, for example, may be all that is required to restore key ecological processes.

11.3 DETAILED MONITORING

More parameters are measured at these projects than in most conservation management operations. That detailed information is being collected about changes in pest populations in relation to specific management regimes, for example, is important. Such information should allow more objective decisions to be made about the costs and benefits of pest control. In addition to results, conservation outcomes have also been attributed to the management undertaken (Anon. 1998b). While the simultaneous targeting of multiple pests complicates any interpretation of recorded responses, their measurement nevertheless constitutes an important first step.

Many monitoring programmes are labour-intensive and involve major on-going resourcing commitments. Monitoring constitutes a significant component of

the costs of these projects. Even relatively minor refinements to monitoring programmes which resulted in reduced commitments could lead to significant savings in overall project costs. An evaluation of the objectives of monitoring at these projects may also lead to important changes.

The ability to make comparisons is critical to objectively assessing the merit of management activities. A feature of these mainland restoration projects is the amount of information which has been collected to allow temporal (pre- and post-treatment) and spatial (treatment and reference sites) comparisons to be made. With the exception of Paengaroa all of these projects have nearby reference areas for comparison with treatment sites. There is some variation in the monitoring undertaken in treatment and reference sites, and some treatment and reference areas may not be independent in relation to some parameters monitored. At Trounson monitoring is linked to annual monitoring undertaken at selected sites elsewhere in Northland. In the Northern Te Urewera vegetation plots and exclosures established more than 10 years ago have been re-measured providing a temporal baseline for comparison. Similarly, at Boundary Stream bird count data have been collected for more than 10 years prior to the restoration project being initiated. At Rotoiti a considerable amount of research and monitoring information is available from intensive studies of forest birds, including kaka and wasps. Evaluations of the statistical bases for management at two projects (Trounson and Boundary Stream) suggest that improvements could be made to the way that monitoring is undertaken and comparisons made (Arnold 1997, Gentleman 1997). Given the fundamental importance of monitoring in determining progress towards project objectives and goals, and the major resourcing commitments involved, there is a pressing need to rationalise monitoring at these projects so that key questions are appropriately addressed and unnecessary duplication avoided.

The main purpose of monitoring is to determine changes in relation to project goals and objectives. It is suggested earlier in this report that declared project goals, while appropriately evocative, are probably not very useful as a basis for setting management objectives, performance measures and designing monitoring programmes. Monitoring has been successful at most projects, however, in detecting anticipated pest control results and outcomes in relation to the enhancement of populations of selected native species. Given that these projects were chosen primarily for their attributes as sites where threatened species may be recovered, reported species-focussed outcomes suggest important progress has been made. Monitoring programmes, in most cases, have not been directed at detecting changes which may be attributed to ecosystem responses. A notable exception is the interpretation at the Rotoiti project that honeydew has been restored as a summer food source for forest animals. In this case outcome monitoring has allowed for progress to be declared in relation to the goal of 'restoration of a beech forest community with emphasis on the honeydew cycle.' In the Northern Te Urewera, an observation of a significant increase in pollination rates of mistletoes also has direct relevance to ecological processes, although it is not clear how such a response may be related to the goal 'to acknowledge and nurture the mauri of the northern Te Urewera ecosystem.'

As with management intensity, detailed monitoring is not necessarily a definitive characteristic of mainland restoration projects. As our confidence grows in our ability to predict outcomes from particular management actions, the intensity of monitoring programmes may be reduced. Given our current inability to predict many outcomes with any certainty, however, it is anticipated that detailed monitoring—in association with research, will continue to be an important feature of mainland restoration projects for the forseeable future.

11.4 HIGH COSTS AND RETURNS

Although the costs and benefits of these projects were not compared with those of other projects, it is clear that the costs per hectare of intensive management and associated monitoring are higher than at others where less intensive management, and less detailed monitoring, is undertaken. Apart from financial costs, there are also opportunity costs associated with the intensive use of skills and resources within each Conservancy. Concerns have been expressed about the impacts on other projects in the Area or Conservancy of maintaining these restoration projects.

There are also operational and outcome risks associated with these being 'ground-breaking' projects in that there are few precedents upon which outcomes of intensive, multi-pest control programmes may be predicted. Risks may be even higher if a more proactive approach is to be taken to address ecosystem-focused management goals.

Results and outcomes from these projects have not been comprehensively interpreted and reported. Indeed, the lack of detailed and current reports was a major impediment to the completion of this review. An important component of any planned approach to restore mainland ecosystems will be the identification of costs and risks, and the development of mechanisms to reduce them as projects proceed. Detailed assessments of costs and risks could then be related to measured results and outcomes, allowing more objective evaluations of the merit of these, and other conservation projects to be obtained. Consideration of strategic, capacity building values of these projects would need to be included in any evaluation of project merit. The development of a better understanding of how ecosystems function and of improved management techniques may both result in important advances being made and applied more widely. Such advances can be expected to lead to more cost-effective approaches being applied, with concomitant reductions in costs and risks. Most of the existing restoration projects have objectives which reflect an intention to use them as strategic 'research and development' sites so that new capacity may be developed.

Despite relatively high costs, important benefits have been reported from these projects. These are discussed in the following section.

12. Why are these projects important?

These projects are important for at least three reasons:

- They have shown that further biodiversity losses on the New Zealand mainland are not necessarily inevitable.
- They constitute an important advance for the Department towards meeting statutory requirements and strategic goals.
- They represent a more integrated approach to conservation management.

12.1 FURTHER BIODIVERSITY LOSSES ARE NOT INEVITABLE

Reported results and outcomes from these projects indicate that further losses in native biodiversity on the New Zealand mainland are not necessarily inevitable. While it is by no means certain that important conservation outcomes can be sustained, these preliminary results are significant in showing that declines in some parameters at least, can be halted. Recognition of the potential to 'stem the tide' of biodiversity loss underpins the impetus which has led to these projects being maintained and additional restoration projects being initiated or proposed elsewhere. Identification with the concept of 'healing and repairing' is probably also behind growing stakeholder support for these projects.

12.2 STATUTORY REQUIREMENTS AND STRATEGIC GOALS

The declaration of ecological restoration goals at these projects constitute an important step towards international obligations, statutory provisions and declared strategic goals. The Department of Conservation was established under the Conservation Act 1987. The purpose of this Act is '…to promote the conservation of New Zealand's natural and historic resources…'

Natural resources are defined in the Act as '…

a) Plants and animals of all kinds; and

b) The air, water and soil in or on which any plant or animal lives or may live; and

c) Landscape and landform; and

d) Geological features; and

e) Systems of interacting living organisms, and their environment; and includes any interest in a natural resource…' (Part 1(2), Conservation Act 1987).

The inclusion in this definition of plants and animals, the biological and physical environments in which they live, and interactions between them suggests that the intent of the Act is that the Department's biodiversity management programmes should be focused on genes, species and ecosystems.

Other statutes also provide for biodiversity conservation at different levels of biological organisation. For example, the Reserves Act 1977 includes

'Ensuring, as far as possible, the survival of all indigenous species of flora and fauna, both rare and commonplace, in their natural communities and habitats, and the preservation of representative samples of all classes of natural ecosystems and landscapes which in the aggregate originally gave New Zealand its own recognisable character…' (Part 1(3), Reserves Act 1977).

In the international arena, the Convention on Biological Diversity (to which the New Zealand Government is a signatory) also recognises a need to manage at different levels of biological organisation, noting 'the fundamental importance of *in situ* conservation of ecosystems and natural habitats for the maintenance and recovery of viable populations of indigenous species' (Anon. 1993). This emphasis on *in situ* activities reflects a need to manage biological and physical components of ecological sites.

A need for biodiversity conservation to incorporate activities directed at different organisational levels is also reflected in the New Zealand Biodiversity Strategy (Anon. 2000) which proposes three goals which, in combination, address biodiversity at the ecosystem, species and genetic levels:

Goal 1 — 'Maintain and restore a comprehensive and representative range of remaining natural habitats and ecosystems to a healthy functioning state, and sustain those features which support indigenous biodiversity in a range of more modified ecosystems (including those in primary production areas and urban environments)'.

Goal 2 — 'Maintain and restore representative populations of all indigenous species in selected natural habitats where threats can be controlled or there are reasonable prospects for controlling them in the future.'

Goal 3 — 'Maintain the natural resilience and economic usefulness of our domesticated and cultivated species by conserving their genetic diversity.'

A move towards broader biodiversity conservation goals is also reflected in the Department's strategic plans. In its discussion document Atawhai Ruamano Conservation 2000 (Anon. 1993), a key goal is the protection of indigenous biological diversity which is described as genetic material, species and ecosystems. It is concluded in this document that 'Conserving biological diversity is primarily about ecosystem conservation.' The Department's Strategic Business Plan 1998–2002, 'Restoring the Dawn Chorus' (Anon. 1998a) identifies two key steps towards the protection of New Zealand's natural heritage: 'Policies and plans that integrate species protection and ecosystem conservation work…' and 'Restoration of high priority offshore and mainland island ecosystems and advancing recovery programmes for threatenes species in accordance with an integrated approach to management…' (p. 10). In addition to incorporating species and ecosystem management goals, this plan

signals an intention to more effectively integrate management activities than has previously been the case.

The incorporation of an ecosystem context in strategic biodiversity conservation goals reflects two factors:

- A recognition that management directed at populations and species alone is unlikely to result in comprehensive and sustainable biodiversity conservation outcomes.
- Anticipated economies of scale in managing biological communities and ecological systems compared with activities directed at populations or species in isolation.

Some Conservation Management Strategies (CMSs) also declare intentions to adopt an ecosystem-focused approach in a regional setting. For example, the East Coast CMS (Department of Conservation 1994) includes the following objectives:

Section 3.3.12 'Ecosystems and Habitats—Ecosystems Management' (p. 142):

1. To contribute to national initiatives which give effect to obligations flowing from the International Convention on Biological Diversity or similar international agreements
2. To maintain the full diversity of native terrestrial acquatic and marine ecosystems found in the conservancy, through the integration of whole ecosystems management concepts in all of the conservancy's management activities.
3. To develop specific management techniques and systems.
4. To facilitate a programme of whole ecosystem monitoring, research and management trials in the Northern Urewera Forest tract.

Section 3.3.21 'Species Conservation—Threatened Species' (p. 180):

1. To prevent, where possible, the loss of any threatened species from areas where they currently exist.

While results from these restoration projects should be seen as preliminary, they nevertheless indicate that they constitute important steps towards fulfilling strategic obligations. It is probably in this context that it has been suggested that the initiation of ecosystem-focused restoration projects was well overdue.

12.3 INTEGRATED MANAGEMENT APPROACHES

The wide range of activities undertaken at these sites including pest control, native species management, advocacy, monitoring and research has led to more integrated approaches than has typically been the case in the past. Pest control programmes, for example, are designed to target carnivores as well as herbivores, and to link species and habitat management activities—breaking down unhelpful distinctions of the past. Similarly, project staff are likely to be actively involved in advocacy roles and assisting in research projects in addition

to more traditional management tasks. The relatively large number of research programmes supported at these projects indicates that a more cooperative approach to achieving operational and research objectives is also emerging at these projects than has generally been the case in the past. An intention to better integrate conservation activities is declared in the Department's Strategic Business Plan. These mainland restoration projects may be important as models of integrated management programmes.

It is concluded that while existing mainland restoration projects are characterised by intensive management and monitoring, and by relatively high costs and risks, these are not necessarily the definitive features of ecological restoration *per se*. The scale and intensity of management, and associated risks and costs can be expected to diminish as management proceeds. For example, the range and intensity of pests targeted for control is likely to decrease as the impacts of critical pests on key processes are identified and management regimes refined. Similarly, the need for detailed monitoring of a range of parameters may decline as our ability to predict outcomes from particular management regimes grows. There is little doubt, however, that intensive management and monitoring will continue to be a feature of mainland restoration projects for the forseeable future.

Preliminary results presented in this review indicate that the returns to the Department are already significant in relation to its planned intentions to '… integrate species protection and ecosystem conservation work.' And '… restoration of high-priority offshore and mainland island ecosystems and advancing recovery programmes for threatened species in accordance with an integrated approach to management…' (Anon. 1998a).

The definitive characteristics of mainland restoration projects relate to their goals, rather than the style of management undertaken. While the distinctions between species and ecosystem-focused management programmes, and between protection and restoration goals may be blurred, the key features of these projects are that they are aimed at enhancing ('restoring') biodiversity rather than minimising further loss, and they are focused on ecosystems rather than on populations, or assemblages of species alone. Although few outcomes from these projects have yet been interpreted in an ecosystem context, or related to restoration goals, it is only a matter of time before these links are made. It will be important that support is maintained for these projects in order to determine the achievability of ecological restoration goals on the New Zealand mainland.

13. Advancing a science-based management approach

Lawton (1997) observed that 'Conservation is not essentially a scientific activity, but science can be a valuable tool in making informed choices'. He added that 'Conservation action without good science to underpin it is like alchemy, or faith healing. Both sometimes produce desirable results, but you have no idea why, and mostly they do not.'

A need to improve the quality of information to underpin the management of New Zealand's natural environment is identified in the Government's Environment 2010 Strategy (Anon. 1995b). A Ministry for the Environment report (Anon. 1997a) also identified specific needs to improve the quality and applicability of basic and applied research. The Department of Conservation has declared its intention to base conservation management on strong science. In deciding on the outcomes of a review in 1995 of science and research activities within the Department, the Director-General affirmed that a strong scientific component is essential for underpinning effective conservation management (briefing note to Minister of Conservation, 5 Aug 1996 —File 96/8318).

13.1 WHAT IS SCIENCE AND RESEARCH?

The New Zealand edition of the New Collins Concise English Dictionary (Gordon 1982) defines science as '*n.* 1—the systematic study of the nature and behaviour of the material and physical universe, based on observation, experiment, and measurement. 2—the knowledge so obtained or the practice of obtaining it. 3—any particular branch of this knowledge: the *applied* sciences. 4—any body of knowledge organised in a systematic manner. 5—skill or technique. 6—*Arch.* Knowledge.' In the scientific literature Hawthorn (in Dickison 1994) suggested science was '... objective, rational, cooperative knowledge acquisition'. Bailey (1982) described science as '... the process of finding, testing, organising and communicating knowledge.' In essence these definitions indicate that science includes a body of information, and the process of collecting it.

Ziman (1984) suggested science may be used as a means of solving problems, as an accumulation of organised knowledge, as a method for obtaining reliable information, and as whatever is discovered by scientists. He distinguished between 'academic science' (acquiring knowledge with little regard to the world at large) and 'industrial science' (focused on the technological application of knowledge). Other workers have subsequently endorsed Ziman's call for stronger links between internalised academic and externalised industrial approaches, and for better integration of the psychological, philosophical and sociological aspects of scientific activity (for example, Lawton 1997, Craig & Norton 1999).

The purpose of science is to reduce uncertainty. Its goal is not the accumulation of factual information alone; but rather, to acquire knowledge in relation to patterns in nature. Science is directed at gaining strong inference which has been defined as the process of formulating clear hypotheses and devising acceptable tests (Platt 1964). A characteristic of weak inference is that there are alternative explanations for observations, and little assurance that they are right: that is, there are low levels of proof for declared conclusions (Hairston 1989). Romesburg (1981) bemoaned the widespread problem of 'unreliable knowledge' in wildlife science. He attributed this to researchers using induction (drawing laws of association between observations) or retroduction (circumstantial evidence) plus sheer repetition to inappropriately promote conclusions as reliable knowledge. Instead Romesburg suggested hypothetico-deductive methods should be used where hypotheses are formulated and carefully tested using rigorous experimentation.

The process of research involves critical investigation. It includes the development and testing of hypotheses, the explanation of facts and the promotion of concepts, models and laws and is more sophisticated than observation and the use of intuition alone. A feature of research is the set of rules and requirements by which scientists acquire knowledge. In 1942 Merton proposed five norms by which scientists should behave: communalism, universalism, disinteredness, originality and scepticism (Merton 1973). These 'Mertonian norms' are still largely accepted today.

13.2 ECOLOGICAL EXPERIMENTS

Some of the investigations undertaken at mainland restoration projects to date have been referred to as 'field trials'. Tilman (1988) argued that in order to describe patterns in complex natural systems, ecological research should involve observational, theoretical and experimental approaches applied simultaneously. Emphasis is typically placed in field trials on observations, with less effort given to theoretical and experimental elements. Because of the complexity of nature observational approaches, by themselves, are unlikely to allow strong inferences to be drawn. Similarly, while the development of theories is a critical part of ecological research, theories must be tested using real data collected in nature. In most cases field trials at mainland restoration projects have not involved a mix of observational, theoretical and experimental approaches. As a result there is a risk that conclusions drawn from them are based on weak, rather than strong, inferences.

Manipulative experiments where one or more variables are deliberately changed while other variables are held constant or rendered unimportant through suitable experimental design, play an important part in modern ecology. Although manipulative field experiments inevitably require compromises, a knowledge of original (or pre-treatment) conditions, randomisation, replication and treatment switches can be used to control non-experimental variables. Provided appropriate controls are used, and they are adequately replicated, manipulative experiments can be the key to determining any causal link between a manipulated variable and a measured response.

Unreplicated and uncontrolled field trials focused on observational approaches will continue to be an important tool as 'pilot studies', or where only weak inference is needed. Manipulative experiments, however, in conjunction with basic research offer the opportunity to gain reliable knowledge about ecosystem patterns and dynamics.

Several reviewers (e.g. Romesburg 1981, Hurlbert1984, Moller & Raffaelli 1996) have criticised the inadequacy of experimental controls in many manipulative experiments. Specific criticisms have included pseudo-replication where the assumed independence of replicates is violated, 'cage effects' where measurements are affected by the experiment itself, and divergence in controls where problems arise because of differences between experimental areas. Inadequate experimental design leading to these sorts of problems has led to a suggestion that some investigations at mainland restoration projects have been 'more experiential than experimental' (Choquenot & Veltman 1999). Moller & Raffaelli (1996) concluded that 'If the only experiments which can be done are subject to these constraints then we suggest that they should never be attempted'.

There are increasing calls for ecological experiments to be undertaken over longer periods than has so far normally been the case in order to understand ecological processes. Also, experiments must be of sufficient spatial scale to appropriately reflect system responses (Choquenot & Veltman 1999).

13.3 LEARNING FROM MANAGEMENT ACTIVITIES

The New Zealand edition of the New Collins Concise English Dictionary (Gordon 1982) defines management as: '...

3—the technique, practice or science of managing or controlling.

4—the skilful or resourceful use of materials, time, etc...'

At an elementary level, both research and management are knowledge-based activities. Hanley (1994) distinguished between them, in that the role of research is to improve our understanding of our world, while the role of management is to translate this understanding into policy and action. While different rules may apply, it has been pointed out (Sinclair 1991) that science and management are not alternative processes, and that management requires scientific experiments to gain reliable knowledge. Further, Lancia et al. (1996) stressed that we can no longer afford to treat research and management as separate activities because the distinctions between basic and applied research are blurred. The central issue is the 'application of sound scientific principles to solve problems'.

Macnab (1983) identified three pre-requisites to achieving clear insights from management:

- Strict application of experimental design, controls and replication so that unambiguous interpretations of management results may be made.
- The assumptions underpinning management must be stated as testable hypotheses.

- The effect of the manipulation must be measured and the results reported in order to advance knowledge.

While there may be conflicts between scientific goals to gain reliable knowledge and management goals to induce change, such conflicts should be viewed in the context of the overall need to reduce uncertainty.

Hanley (1994) suggested that researchers are '… motivated by self-aggrandizement, rewarded within a system that is insensitive to the practical, real-life problems of management. Managers… choose not to use most of the research done for their benefit; they want too overly simplified, cookbook solutions to their complex problems'. Any such 'perception gap' amongst restoration practitioners in New Zealand may be exaggerated by our history of successful 'last-ditch' efforts to avert extinctions. In many cases managers have had to rely largely, or solely, on observations and intuition, rather than sound science, to make critical decisions. Philosophical and cultural changes may be needed in order to avoid institutionalising any perception gap, and to advance a more integrated approach to research and management. A key to better integration will be to establish common goals and compatible performance measures for research and management activities.

In order to gain reliable knowledge of ecological systems, scientists need to manipulate large areas for extended periods using sound experimental designs. Such experiments, however, have seldom been completed because of logistical, financial or social constraints. Managers, on the other hand, are required to routinely manipulate large systems for extended periods, usually based on information available at the outset of the project. The essential problem is how to gain reliable knowledge without jeopardising important management objectives. Walters (1986) suggested the solution to this problem was to treat management activities themselves as experiments. He proposed that management should be treated as an 'adaptive learning process' where both research and management goals are achieved. This 'fundamentally different approach to scientific management' has been subsequently widely acclaimed.

Although adaptive management has been employed in North America for more than 20 years, it has only recently been promoted as a conservation tool in New Zealand. Applications elsewhere have been largely directed at assessing ecosystem-scale effects of natural resource harvesting activities (Holling 1978, Walters 1986). Large-scale experiments in New Zealand have typically involved reductionist approaches, such as measuring the impacts of possums on forest vegetation, and extrapolating results as a basis for management. Adaptive management and reductionist approaches are not necessarily mutually exclusive—it may be that both should be employed.

The main attributes of adaptive management compared to other approaches are that management proceeds as a science-based enquiry rather than being based on an unquestioned statement, and it allows scientific rigour to be combined with management uncertainty and complexity. Adaptive management also offers important advantages over more conventional approaches such as 'linear-comprehensive' management (Bailey 1982) where it is (usually unjustifiably) assumed that there is sufficient knowledge at the outset to predict the outcomes of management. It is also a consultative and enquiring process by which models are developed, information interrogated and management objectives re-defined.

It may be seen as a 'win-win' process by which managers are able to continue management, researchers to undertake large-scale experiments, policy makers to hedge their bets by trialling several options, and stakeholders to influence decisions and to participate in the process of management (Lancia et al. 1993, 1996).

Despite any differences in attitudes and perspectives of scientists and managers, and consequent implications for the application of reliable knowledge, a lot of research has been undertaken in New Zealand to support conservation decision making. The use of experiments to advance knowledge as management proceeds has increased in the last decade (Innes et al. unpubl.). While a few of these studies incorporated some experimental design elements, many did not satisfy basic requirements for manipulative experiments such as the use of replicates and non-treatment areas, random allocation of treatments or the application of power analyses. Inadequacies in experimental design, coupled with spatial and temporal limitations, suggest that at least some of the conclusions drawn from these studies have been based on weak, rather than strong inference. At the root of declarations to enhance research underpinning departmental conservation management activities is a recognition that reliable knowledge is required. This is particularly so in relation to large-scale, on-going management operations such as the control of suites of pests at conservation sites on the mainland.

13.4 EXPERIMENTATION AT MAINLAND RESTORATION PROJECTS

In this context mainland restoration projects have been important in that a relatively large amount of effort has gone into establishing monitoring programmes to measure results and conservation outcomes. Also more research has been undertaken in association with management programmes at these sites than virtually anywhere else in New Zealand. While they are all managed primarily as operational projects, with research objectives being secondary, these projects have no doubt already contributed to a cultural shift within the Department towards more integrated research and management activities.

No critical analyses of experiments undertaken at mainland restoration projects were carried out as part of this review, nor any comparisons with other operational or research projects. A recommendation for a critical review of scientific and technical aspects of these projects (including information management activities) is attached. Some general observations can be made here, however, in relation to the application of science to underpin management operations. Rather than being intended as criticisms of these projects, these comments are made to highlight considerations which will need to be taken into account if more reliable knowledge is to be gained as part of ecosystem-focused restoration activities.

13.5 ATTRIBUTES OF EXISTING PROJECTS AS EXPERIMENTAL SITES

13.5.1 Significant spatial and temporal scales

A key requirement of experimental areas is that they must be large enough to ensure their independence, to avoid edge effects and to minimise heterogeneity (Choquenot & Veltman 1999). Larger areas are also more likely to represent scales at which management is undertaken. Management areas at mainland restoration projects extend from just over 100 to several thousand hectares. Although the sample size is small, these six projects probably reflect the size range of many intensively managed conservation projects. Where non-treatment reference areas are present, these are of similar size to associated management areas.

Experiments will need to continue for several years in order to reflect management time frames, as well as to accommodate ecological interactions, including episodic changes. Monitoring to measure results and conservation outcomes has been maintained for about 4 years at these projects. This term is inadequate to gain reliable knowledge about many intrinsic factors such as trophic and social interactions. The fact that consistent institutional support has been maintained for intensive management and monitoring programmes for 4 or 5 years, however, suggests there is potential for meaningful ecological and management time frames to be accommodated if support for these projects was to be continued.

13.5.2 Intensive management

All ecological experiments involve compromises between ideal and 'real world' conditions. Limitations in reducing specific pests to very low densities in management areas, for example, complicates experiments aimed at determining the impacts of these pests. A feature of mainland restoration projects is the intensity of pest control regimes in place and the relatively low pest densities maintained, compared to many other pest control projects. Although there are major challenges in separating targeted pests in order to identify critical pests, these projects represent an important step towards understanding pest impacts and establishing optimal management regimes.

13.5.3 Intensive monitoring

Measuring the results of management programmes and monitoring outcomes are key elements in any manipulative experiment. The wide range of parameters being monitored at these projects and the high intensity of monitoring programmes set these projects apart from most others. These monitoring programmes and the information which has been gathered potentially represent important databases for further experimentation.

13.5.4 Applied research

Another important feature of these projects is the amount of research which is being undertaken in order to address management questions. Results from some research projects have already been applied to management programmes. For

example, a study of the ecology of predatory mammals in Northern New Zealand, including the Trounson Kauri Park (Gillies 1998), research on the dynamics of kahikatea (*Dacrycarpus dacrydioides*) forest remnants (Burns et al. 1998*),* including at the Paengaroa reserve, and studies on the effects of *Vespulid* wasps and control techniques in the Nelson Lakes area, including the Rotoiti project area (Beggs et al. 1997) have had an important bearing on pest control regimes applied.

13.5.5 Collaboration and cooperation

Conservation is not essentially a scientific activity. Rather, decisions are determined by political, ethical, aesthetic, cultural and even religious considerations (Lawton 1997). Collaboration and cooperation between planners, stakeholders, researchers and managers will be crucial during all phases of ecological experiments if results are to be relevant and management applications sustained. Important progress has been made at all mainland restoration projects in enhancing collaboration (for example, between managers and research providers) and cooperation—including participation by stakeholder groups. The development of a culture of cooperation at these projects will be an important consideration in achieving and sustaining ecological restoration goals.

13.6 WEAKNESSES OF CURRENT PROJECTS AS MANIPULATIVE EXPERIMENTS

A number of the characteristics of current projects compromise their value as manipulative experiments.

13.6.1 Primacy of management goals

Mainland restoration projects were chosen essentially as operational projects; research goals are, in effect, secondary to management. The lower priority given to experimental objectives is reflected in various ways, including unplanned changes to treatments and inadequate reporting. Without formal recognition of 'learning goals' and appropriate priority given to research objectives, there is little prospect of manipulative ecological experiments resulting in strong inferences and contributing to our understanding of ecological systems. Prior agreement by key stakeholders—including departmental decision makers, to the concept of a 'learning-by-doing' approach, and consistent support in order to address strategic research themes will be crucial.

13.6.2 Experimental attributes

Some consideration was given during the selection process to the experimental attributes of most of these projects. For example, most have non-treatment reference areas for comparison. A few also have pre-treatment data from management areas, or nearby. Because research objectives are not primary, or were not declared until later, however, there is a degree of 'retrospective fitting' in the experimental design of research activities at these projects. In no

cases were treatments randomly allocated to blocks—an important experimental design step to minimise possible systematic bias. If a properly managed national experiment were to be initiated, key problems and issues to be addressed would ideally first be identified, experiments designed and sites then chosen with the necessary experimental attributes. A checklist for experimental design was suggested by Ratti & Garton (1980). They proposed a series of questions which should be answered to ensure four critical elements of experiments are in place: specification of the research population, replication, proper use of controls, and random assignment of treatments to experimental units. There would be value in employing such a checklist in designing future management experiments, as well as evaluating the science underpinning existing projects.

In many instances it may appear unrealistic for experimental design requirements to be met at management projects. There may, however, be opportunities to conduct smaller-scale experiments within management areas in order to replicate and control treatments. Random assignment of treatments presents particular challenges. There may be opportunities to meet this requirement by managing a suite of projects with similar treatments (for example, possum control) as a nationally coordinated experiment. The challenge in designing a national restoration experiment using adaptive management approaches will be to seek compromises between ideal experimental conditions, and 'real world' situations and opportunities. Provided proper reference was given to experimental design requirements it can be anticipated that creative solutions may be found to meet them in a management setting. Where compromises cannot be made it could be hoped that reference to experimental design criteria would at least allow for the risk of weaker inferences to be identified.

13.6.3 Assumptions and key terms

The assumptions underpinning management actions at these projects have only been stated as falsifiable hypotheses in a few cases. It has also been unusual for methods to be declared by which hypotheses will be accepted or rejected. Underlying assumptions are often quite evident in project plans and reports. Greater effort will be required, however, to declare conceptual models, hypotheses and experimental methods, as well as to determine their experimental power if these projects are to be managed as manipulative experiments. Several authors have also identified the need to define key terms so as to avoid misinterpretation by collaborators and stakeholders (for example, Murphy & Noon 1991, Innes et al. unpubl.).

13.6.4 Understanding causal links

Experimental objectives to be achieved through management operations would ideally be underpinned by 'pure' or 'basic' research to understand the key interactions through which conservation outcomes arise. Incomplete understanding of causal links in the ecological systems being managed could lead to risks of misinterpreting the mechanisms by which outcomes occurred. As part of the development (and on-going review) of a national strategy which identified research themes consideration would need to be given to existing

knowledge of relevant interactions, and of opportunities to investigate them further, or to progress new themes as part of adaptive management programmes.

13.6.5 Experimental controls

Attention to scientific methods will be critical if ecological restoration projects are to be used as manipulative experiments. The proposed critical review of technical and scientific aspects of these projects is likely to identify inadequacies in experimental controls employed. Key issues include the use of replicates, non-treatment reference areas and treatment switches.

13.6.6 Statistical analyses

Statistical significance is at the heart of sound science. The declaration of models and development of falsifiable hypotheses which may be accepted or rejected using statistical tests are key elements in any experiment. Preliminary assessments of the statistical bases at two of these projects indicated that changes are required in order to improve the rigour of management experiments (Arnold 1997, Gentleman 1997). No attempt was made during this review to assess the statistical bases of these projects, or of any statistical analyses undertaken.

13.6.7 Communication of results

The communication of experimental results and interpretations is also an integral component of sound science. Review by scientific and technical specialists is an important mechanism through which interpretations may be challenged and alternative hypotheses proposed. While a number of project reports have been published following appropriate scientific review, reporting procedures and standards have not been consistently applied. The absence of comprehensive plans and progress reports was a major impediment to meeting the objectives of this review.

Apart from reviewing the scientific bases of management, regular and comprehensive reports on progress in relation to specific activities at these projects will be important in order to keep stakeholders informed. Within the Department procedures will need to be refined to ensure decision makers are kept informed of progress. Other stakeholder groups may require different reporting mechanisms and styles.

13.7 AN ENHANCED SCIENCE-BASED APPROACH

Ecosystem-focused restoration projects at mainland sites are likely to involve greater costs and risks than those focused on single species on small off-shore islands. This is due mainly to the complexity of mainland systems and associated problems in understanding patterns and cause and effect relationships. Higher costs at mainland sites stem from the need for on-going pest control and related monitoring regimes compared to 'one-off', or infrequent island pest eradication operations. Restoration goals also involve greater risks than protection ones due to a lack of precedents and higher levels of uncertainty.

In reflecting the Department's declared intention that conservation management should be underpinned by sound science, and recognising the potentially greater costs and risks associated with achieving ecosystem-focused restoration goals at mainland sites, it is recommended that higher priority be given by the Department to reducing uncertainty. Apart from supporting further basic research it is suggested that a key will be to enhance scientific programmes to gain reliable knowledge as part of conservation management activities.

It is important to recognise that there will always be a need for good observations and interpretations based on the experience and intuition of field practitioners. The intent of these recommendations, however, is to promote a scientific approach so that inferences are not based on intuition alone.

Improving the way information is gathered, analysed and disseminated at operational projects will be a vital step towards improving the reliability of knowledge gained from management activities. The development, promulgation and application of further standard monitoring techniques, for example, would allow for comparisons to be made of management activities, results and outcomes at different times and between blocks. Similarly, standard review and reporting procedures would facilitate wider consideration and comment.

Central to several recommendations is the adoption of an adaptive management approach whereby operational projects are managed as manipulative experiments. In this way strategic research themes may be addressed at projects selected for their experimental attributes as well as for their merits as biodiversity conservation sites. Ideally, such experimental management areas would be managed collectively as a national restoration experiment where opportunities to randomise and replicate treatments and to apply appropriate experimental controls may be maximised. Inputs from a wide range of research agencies as well as other stakeholders in management outcomes would also be enhanced through a nationally coordinated approach.

Part D

WHERE TO FROM HERE?

Thirteen recommendations are presented below for approval by the programme sponsor and subsequent endorsement by the General Management Team. While they are all important, these recommendations are listed in the sequence in which they should be implemented.

14. Recommendations

14.1 MAINTAIN SUPPORT FOR EXISTING PROJECTS

These projects are important for several reasons;

- Significant changes in measured ecological parameters have been observed and attributed to management undertaken. While further time is needed to record and interpret these and other changes, these projects indicate that effectively protecting and enhancing biodiversity on the New Zealand mainland may be feasible. They therefore represent important steps towards the Department's mission of 'restoring the dawn chorus'.
- Ecosystem-focused restoration goals have been declared. Most results have not been interpreted in an ecosystem context but it can be anticipated that revitalised ecosystem processes will be recorded as these projects proceed.
- In addition to changes in ecological parameters, the range and intensity of management programmes at these projects, and associated monitoring means that they present important opportunities for the Department to enhance its capacity to manage ecosystems (for example, technique development, improved understanding and better predictions).
- Demonstrated strong support for most of these projects from within the Department and from key stakeholders is likely to lead to wider conservation benefits if they were maintained.

While some changes should be made to the way they are managed, departmental support for the six existing mainland restoration projects should be maintained until enough time has elapsed that progress towards ecosystem-focused goals can be evaluated. In the short-term ecological restoration policy should be prepared and approved (Recommendation 2) and other restoration projects identified (Recommendation 8). Winding down or increasing activity at current projects at this stage in the absence of any policy or formal mechanism for ranking their merits against other existing or potential projects would be premature. The availability of detailed progress reports for each of these projects (Recommendation 3) would allow for more objective evaluations of the benefits and costs of these projects to be made.

Recommendation 1—That the programme sponsor supports the maintenance of the six existing mainland restoration projects, subject to recommended changes and further actions, at least until an ecological restoration policy has been approved and results and outcomes properly evaluated in relation to ecosystem-focused goals.

14.2 ECOLOGICAL RESTORATION POLICY

Strategic and operational policies are urgently required to guide the Department's ecological restoration activities. Strategic policy should define ecological restoration within the spectrum of conservation management

activities, specify the purpose and desired outcomes from restoration programmes, identify priorities for ecological restoration and clarify roles and responsibilities for restoration activities at different sites.

Ecological restoration policy should be based on the following principles:

- Enhancement and restoration goals, in addition to maintaining the *status quo.*
- Management priorities based on ecosystem representativeness.
- A focus on maintaining the evolutionary potential of populations of species within their native ecosystems.
- Long-term goals related to ecosystem resilience.
- An ecosystem process focus.
- Integration of biological, physical, social and economic factors.
- An historic context for restoration.
- Multi-year planning.
- Minimal interference goals.

Progress has already been made by the Conservation Policy Division in developing strategic policy in this area, including proposed national outcome pictures incorporating restoration. Progress has also been made towards depicting New Zealand ecosystems and developing a model for measuring conservation achievement.

Recommendation 2—That the programme sponsor seeks the completion by the Conservation Policy Division of strategic policy to guide further (operational) policy development and ecosystem management activities undertaken by the Department. An internal and external reference group should be consulted for technical advice on all of the principles to be included in the policy. Provided such policy was in place it could be used to guide allocations for the 2001/2002 financial year.

14.3 PLANS AND REPORTS

The absence of standard procedures for planning and reporting made reviewing activities, results and outcomes at these projects difficult. The application of standard operational planning and reporting procedures, including the consistent use of appropriate planning terms, would allow for more effective information dissemination. Objective evaluations of management activities and outcomes could also be made providing a stronger basis for decision making. Since the absence of appropriate standards and procedures for plans and reports is a generic problem in the Department, there is potential for templates and procedures for mainland restoration project operational plans and reports to be applied more widely to other departmental projects.

Recommendation 3—That the Technical Coordinator, in consultation with regional Technical Support staff and project managers, develops templates and standard procedures by 30 June 2000 for the preparation of mainland

restoration project operational plans and reports. Following approval by the programme sponsor these templates and procedures should be used to guide the preparation of annual reports for the 1999/2000 financial year.

14.4 MAINLAND RESTORATION MEETINGS

Meetings, known as 'Mainland Island Hui', have been held annually since 1996 to discuss issues related to the implementation of management activities at ecological restoration projects. In addition to staff from the six 'core' projects, technical support staff and representatives from some other restoration projects—including some from other agencies—have attended these meetings. The main declared objective was to provide a forum for field staff to share information about management activities at these projects. Proceedings from these meetings include summaries of oral presentations, technical reports and recommendations for further action. Speakers have addressed specialist topics such as toxin use, databases and point-distance sampling. These meetings have also been used by the Technical Coordinator to review recent progress and to gauge perceptions, as well as to outline developments for participants from a national perspective.

These annual meetings are seen by project staff, the Technical Coordinator and others as an important forum for information exchange and peer review. There has been consistently strong interest amongst project staff in attending these meetings, and support has been maintained from Area and Conservancy offices for staff participation.

Professional isolation and the absence of a formal peer review mechanism constitute risks to the Department achieving ecological restoration goals. These meetings provide an important opportunity to reduce these risks. While other mechanisms may complement some of the objectives of these meetings (for example, regular circulation and peer review of project plans and reports, skills sharing, and the Department's Ecological Management Skills training programme), there is no substitute for the opportunity these meetings provide for project staff to meet and discuss specific issues and perspectives in detail. To maximise the benefits of future meetings, objectives should be refined to minimise duplication with other information exchange and training mechanisms. Following approval of departmental policy (Recommendation 2), invitations to attend should be extended to representatives of a wider range of projects—including those undertaken by other agencies. Provided it is determined that support will be maintained by the Department for these projects (Recommendation 1) it is proposed that the programme of annual meetings be re-instated as quickly as possible.

Recommendation 4—That the programme sponsor endorses the concept of annual meetings for field staff and others involved in ecological restoration projects. Provision should be made by Conservancies and Areas for a meeting to be held in the 2000/2001 financial year. As part of this meeting participants should define the goals, objectives and anticipated outcomes of future meetings.

14.5. REVIEW OF TECHNICAL ASPECTS OF PROJECT ACTIVITIES

Although a considerable amount of information has been collated and presented as part of this review, the lack of comprehensive and current information about project activities, results and outcomes prevented detailed evaluations of many aspects being undertaken. The relatively high risks and costs associated with mainland restoration projects, and the important opportunities that they present to achieve strategic goals mean that a more comprehensive technical review is required. It is proposed that a working group be convened by the Technical Coordinator to identify the scope of this technical review. Following approval of its scope, the technical review should be completed by a multi-disciplinary group in time for recommendations to be approved by the programme sponsor and considered as part of business planning for the 2001/2002 financial year. This technical review team should include Regional, Conservancy and project representatives, as well as policy, information management, advocacy and research specialists from Head Office.

Recommendation 5—That the Technical Coordinator convenes a small group to identify the scope of a more comprehensive technical review of mainland restoration projects. Recommendations from this group should be submitted to the programme sponsor for approval by 15 March 2000. Following approval of its scope the Technical Coordinator shall oversee the completion of the technical review and the submission of a report to the programme sponsor by 30 November 2000.

14.6 ECOLOGICAL RESTORATION TECHNICAL ADVISORY GROUP

The issues which must be addressed if ecosystem management goals are to be achieved are increasingly complex, requiring inputs from a growing range of specialists from within and outside the Department. Advice to date has been provided largely on a project-by-project basis with project advisory group members having little or no mandate to comment on wider issues. There may be a need for a national technical advisory group to be established to advise the programme sponsor on strategic issues related to ecological restoration. The main roles of this group could be to comment on draft policies and strategies, suggesting Terms of Reference for future reviews, commenting on progress and advising on new directions and approaches. Such a group would also play an important role in enhancing links between the Department and other agencies with technical expertise to contribute to ecological restoration.

Recommendation 6—That following the approval of Departmental policy to guide ecological restoration activities, and completion of the proposed technical review of existing projects, the Technical Coordinator, in consultation with project managers, assesses the need for a national Ecological Restoration Technical Advisory Group. A report with recommendations shall be submitted for consideration by the programme sponsor by 30 November 2001.

14.7 TECHNICAL COORDINATION

There is considerable potential to reduce risks and costs associated with management activities at these projects if a more coordinated approach were to be adopted. The need for enhanced coordination has been expressed at several meetings of mainland restoration project staff. At the 1998 'Tutira Hui' several people undertook to coordinate specific activities such as vegetation and bird monitoring, and database management. The roles of such coordinators were poorly defined, however, and departmental support for the provision of such services remains unclear. There would be value in identifying specific needs for coordination of specialist activities at mainland restoration projects, and developing mechanisms for this to be achieved which may be supported by the Department. In addition to identifying roles which would most appropriately be assumed by the Technical Coordinator, others may be identified which could be undertaken by project staff working in specialist areas. Again, adopting a more coordinated approach is a generic issue for the Department, and not confined to mainland restoration projects. It is suggested, however, that the focus be on these projects initially.

Recommendation 7—That the Technical Coordinator, in consultation with project staff, identifies specific activities where a more coordinated approach would lead to improved cost-effectiveness. A proposal including recommendations for specific actions shall be submitted to the programme sponsor by 30 November 2000.

14.8 IDENTIFY OTHER ECOLOGICAL RESTORATION PROJECTS

Apart from the six projects reviewed here, others are being undertaken which have ecological restoration goals. These include departmental projects funded for species recovery and pest control, as well as some initiated by other agencies. An additional 14 existing, and 19 potential projects were identified in an earlier draft of this review. Preliminary observations suggest that some of these projects have similar attributes to the 'core' mainland restoration projects, with the main difference being their funding sources. If it was determined that a more coordinated approach was to be adopted, there may be merit in incorporating some of these other projects into a nationally coordinated programme. There are indications that some non-departmental agencies undertaking ecological restoration may also be interested in participating in a more coordinated programme.

It is proposed that, following approval of departmental policy which includes a prescription of mainland restoration project attributes, a survey be undertaken to identify projects with these attributes. Consideration could then be given to establishing appropriate mechanisms and procedures to enhance cooperation between these projects.

Recommendation 8—That following the approval of departmental ecological restoration policy, the Technical Coordinator undertakes a survey to identify existing and proposed projects with ecosystem-focused restoration goals. An

analysis of these additional projects should be undertaken to assess the degree of 'fit' with strategic policy. A report on this survey shall be submitted to the programme sponsor by 30 November 2001.

14.9 ENHANCED COOPERATION

With the exception of the two projects in the East Coast/Hawke's Bay Conservancy, existing mainland restoration projects are managed largely in isolation from each other. Information exchange and cooperation between departmental projects is relatively limited and variable. A need to improve the level of cooperation, including 'networking', 'skills sharing' and peer review has been consistently raised at annual meetings. A formal mechanism for regular staff exchanges between projects would be valuable, as would attendance by project staff at technical workshops and conferences. Cooperation between the Department and other agencies undertaking ecological restoration is also variable and should be enhanced.

Important benefits can be anticipated if a more cooperative approach to achieving management objectives was to be adopted. Benefits from reducing the risks and costs of management (for example, through developing mitigation procedures, testing new management techniques or minimising duplication of effort) at intensively-managed sites, in particular, would be significant.

Recommendation 9—That the Technical Coordinator, in association with a regional Human Resources manager, and in consultation with project staff, prepares a proposal for enhanced cooperation between ecological restoration projects. This proposal shall identify specific needs for cooperation, risks in inadequate cooperation, anticipated costs and benefits in maintaining enhanced cooperation and recommend mechanisms by which this may be achieved. The proposal shall be submitted to the programme sponsor by 30 June 2001.

14.10 ROLES AND SELECTION OF 'SHOWCASE' RESTORATION AREAS

The potential for ecological restoration outcomes to be sustained can be expected to be enhanced if there is public support and stakeholder commitment to them. It will be important to select and manage some ecosystem-focused restoration areas so that further opportunities for informing and involving key interest groups are taken. In addition to achieving biodiversity conservation goals, 'showcase' projects may result in further projects being initiated by community groups and other agencies, and in enhanced cost-effectiveness of management at these projects.

Not all mainland restoration projects will be well suited as Departmental 'showcases'. Public access may be problematic at some sites, and results and outcomes may be difficult to interpret to visitors at experimental projects. While progress has been made in identifying and achieving public awareness and community participation objectives at individual projects, and a national mainland islands public awareness strategy drafted, further effort is required as

part of the development of Departmental policy to refine selection criteria for 'showcase' sites, and to develop advocacy performance measures.

Recommendation 10—That advice is provided by advocacy specialists to Conservation Policy Division staff during the development of ecological restoration policy on the roles of 'showcases' and the part they may play in ecological restoration activities. Once Departmental policy is approved and the roles of 'restoration showcases' established, the External Relations Division should advise the programme sponsor on appropriate selection criteria and performance measures..

14.11 DEVELOPING CONSERVATION MANAGEMENT CAPACITY

Existing mainland restoration projects were chosen primarily for their potential to restore biodiversity attributes at particular sites. While some project plans include objectives to develop capacity, there are few examples to date of lessons learnt from these projects being applied more widely. This is because these projects are not managed primarily for their strategic capacity building potential.

Although significant progress has been made towards controlling pests at some (essentially forested) sites, our capacity to effectively conserve a representative range of indigenous ecosystems is limited. Our inability to predict ecosystem management outcomes also weakens decision making. Priority must therefore be given to developing ecosystem management capacity.

The roles mainland restoration projects may play in building the Department's capacity to protect and restore native biodiversity should be identified in policy currently being prepared. If capacity building needs are provided for, consideration should be given to setting priorities for addressing specific needs at mainland sites.

Recommendation 11—That provided strategic policy currently being drafted identifies a need for capacity to be built at mainland restoration projects, the programme sponsor should initiate a process whereby such needs are identified, and priorities for addressing them set.

14.12 STRATEGIC RESEARCH THEMES

A necessary task following approval for the concept of a coordinated ecosystem management experiment will be to identify key questions, the nature of experiments required, and the types of experimental restoration areas to be chosen. There is potential for some synergy between this strategy and one already drafted to guide restoration activities on offshore islands. A consultative approach to identifying strategic research themes is likely to not only result in a better set of questions being identified, but may also promote wider participation from other research providers and stakeholders. Some research themes which could be addressed at experimental restoration areas were identified at the recent mainland restoration workshop included:

- mechanisms and trends of ecological succession
- ecological effects of vertebrate pests, and interactions between pests
- predator-prey relationships
- toxins use and alternatives
- weed effects and weed control
- public understanding and perceptions
- indices of ecosystem functionality and resilience
- soil invertebrate-leaf litter interactions

Recommendation 12—That the 'Islands/Mainland Islands' programme group, in consultation with project managers and Conservancy Advisory Scientists, prepares and regularly refines strategic research need statements to underpin mainland restoration. The Science and Research Unit shall present refined statements by 30 November 2000.

14.13 A NATIONAL RESTORATION EXPERIMENT

An important conclusion from this review is that a more robust scientific basis for management is required in order to gain strong inferences. A science-based approach will be particularly important in achieving ecosystem-focused restoration goals where there are relatively high levels of uncertainty and associated risks. Provided strategic policy currently being prepared re-inforces the need to develop capacity to restore ecosystems, and strategic research themes and priorities have been determined, it is proposed that a coordinated approach to undertaking management experiments would be most appropriate. A national restoration experiment would present important advantages over other approaches in that experimental requirements such as the use of replicates and standard planning and review processes may be effectively and consistently provided for.

Recommendation 13—Following approval of strategic policy which identifies the need to actively enhance the Department's capacity to restore ecosystems, and once capacity needs have been identified and research themes prioritised, consideration should be given by the programme sponsor to the establishment of a national restoration experiment where suites of selected management projects are managed to address research objectives. Such projects will feature careful adherence to experimental design and scientific procedures.

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Appendices

Appendix 1. Criteria for assessing mainland restoration project bids for the 1995/96 financial year.

Appendix 2. Assessment table for ranking mainland restoration project bids for the 1997/98 financial year.

Appendix 3. Assessment criteria.

Appendix 4. Northern Te Urewera Ecological Restoration Project; relevant publications produced to date.

Appendix 5. Mainland restoration workshop proceedings.

Appendix 1

Criteria for assessing mainland restoration project bids for the 1995/96 financial year

Assess the quality of the project. This includes:

- Soudness of the objectives?
- Practicality and achieveability of the objectives of the proposal given current technology (including the appropriateness of the methods)
- Is the methodology outlined the most cost effective way to achieve the objectives?
- If there is an experimental element—check the scientific rigour of this element.
- If the project fails to meet these criteria, but is considered important, contact one of the people below so that they can have the bid revised. If a project is of dubious value, set it aside with a note indicating why it was set aside.
- Sort the projects that met the criteria outlined in point 1 above, into one of the six priority categories with the help of the decision table shown below.

Here is an example of how to use this table. If the area being managed does not contain a unique assemblage of species, but is a good representative example of an ecosystem once more widespread and is a stronghold for a number of category A and B plant and animal species then in the decision table it would read 'No, Yes, Yes and fall into Priority 3'.

Is it unique biotic assemblage?	Yes	Yes	Yes	Yes	No	No	No	No
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?	Yes	Yes	No	No	Yes	Yes	No	No
Is it a stronghold **or** important site for category A & B plants/animals?	Yes	No	Yes	No	Yes	No	Yes	No
Priority 1	X							
Priority 2		X	X					
Priority 3				X	X			
Priority 4						X		
Priority 5							X	
Priority 6								X

Thirdly, once the projects have been allocated to one of the six categories, assess a number of factors relating to the benefits associated with the completion of the projects. Assessment of these factors will be used to help further sort out the bids. Factors include:

- Assessment of the level of benefit to category A & B threatened species;
- Assessment of the level of benefit to other threatened and non-threatened species;
- Benefits from technique development for application elsewhere.

Give an overall high, medium or low score to each of these factors.

Assess the risks associated with the completion of the projects. Risk has not been included as a criterion for sorting the projects into the six categories, because many of the highly successful projects that have occurred in NZ have been high risk. We need to consider risk, but separately from assessing the value of the project. Tha main types of risk associated with threatened species projects are:

- Operational risk—the risk failing to carry out the operation.
- Outcome risk—the risk that the operation may not achieve the goal of the operation.
- Adverse effects—the risk of an impact on other biodiversity values.
- Public reaction—the risk of adverse reaction from a particular sector of the community, or the public as a whole.

Finally, in order to sort projects assess them according to the following factors:

- Is the project likely to give a high level of return within a 3-year period?
- Cost of the project (for two equally valued bids, select the lower cost bid).
- Advocacy opportunities (for two equally valued bids, select the one with greater opportunities to advocate the concept of 'mainland restoration management').

Appendix 2

Table for ranking mainland restoration project bids for the 1997/98 financial year

Using the criteria outlined in the memo, fill in this table when assessing the bids in the 'Mainland Restoration' group:

Reviewer's Name: Date:

Bid Ref. No.								
Priority: 1,2,3,4,5,6								
Level of benefit to cat. A & B Spp; high, med, low.								
Level of benefit to other threatened spp & non threatened spp.: high, med, low.								
Benefits from technique development for use elsewhere: high, med, low.								
Operational risk: high, med, low.								
Outcome risk: high, med, low.								
Adverse effects: high, med, low.								
Public reaction: high, med, low.								
High level of return within 3-year period: yes/no.								
Cost of project (comparative): High, med, low.								
Advocacy opportunities for technique: high, med, low.								

Appendix 3

Assessment criteria

- Does the bid relate to an existing mainland island project (yes/no)?
- Which one?

Assess the quality of the bid. This includes:

- Clarity and soudness of the objectives.
- Practicality and achievability of the objectives of the proposal given current technology (including the appropriateness of the methods).

Is the new methodology outlined the most cost effective way to achieve the objectives?

If there is an experimental element—check the scientific rigor of this element

Sort the bids into one of the following three levels of urgency:

- URGENT.
- IMPORTANT BUT COULD BE DELAYED.
- USEFUL BUT NOT URGENT.

Assess a number of factors relating to the benefits associated with the completion of the project. Assessment of these factors will be used to help further sort out the bids. Give an overall high, medium or low score to each of these factors. Factors include:

- The level of benefit to category A & B threatened species.
- The level of benefit to other threatened and non-threatened species.
- enefits from technique development applicable elsewhere.

Assess the risks associated with the completion of the projects. We need to consider risk, but separately from assessing the value of the project. The main types of risk associated with threatened species projects are:

- Operational risk—the risk of failing to carry out the operation.
- Outcome risk—the risk that the operations may not achieve the goal of the operation.
- Adverse effects—the risk of an impact on other biodiversity values.
- Public reaction—the risk of adverse reaction from a particular sector of the community or the public whole.

Appendix 4

Relevant publications produced to date, Northern Te Urewera Ecological Restoration Project

Beaven B M 1997: First Annual report on monitored species, Northern Urewera Ecosystem Restoration Project, Te Urewera National Park 196/97. *Unpublished Report.* Department of Conservation, Opotiki. 17 p.

Beaven B M 1997. Observations of a Long-tailed cuckoo (*Eudynamys taitensis*) as a predator of Tomtit (*Petroica macocephala toitoi*) nestlings. Notornis 44: 264.

Beaven B M (editor) 1998. Northern Te Urewera Ecosystem Restoration Project, 1996/97 Annual Report. *Published report.* East Coast/Hakes Bay Conservancy, Department of Conservation, Gisborne. 103 p.

Bockett F K 1997: Assessment of ungulate effects on tawa (*Beilschmiedia tawa)* forest and implications for a mainland island area in Urewera National Park. *Auckland University Report.* Produced for East Coast Conservancy, Department of Conservation, Gisborne. 30 p.

Hudson J 1994: A kokako survey in northern Te Urewera 1990-94. *Unpublished Report.* Department of Conservation, Opotiki.

Hudson J; Jones G; Shaw P 1996: Monitoring of North Island Kokako (*Callaeas cinerea wilsoni)* in northern Te Urewera National Park, 1994/95. *Unpublished Report.* Department of Conservation, Opotiki. 52 p.

Hudson J; Jones G; Shaw P. 1996: Northern Ikawhenua survey 1-10 March 1996. *Unpublished Report.* Department of Conservation, Opotiki. 26 p.

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King D. 1992: Monitoring of kokako in the Waimana Valley, Te Urewera National Park 1991/92. *Unpublished Report.* Department of Conservation Gisborne.

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King D. 1995: Monitoring of NI kokako in northern Te Urewera National Park, 1993/94. *Unpublished Report.* Department of Conservation, Gisborne.

Shaw P. 1997: Pirirangi (mistletoe) monitoring, Otamatuna study area, summer of 1995/96. *Unpublished Report.* Department of Conservation, Opotiki. 17 p.

Shaw P. 1997: Pirirangi (mistletoe) monitoring, Otamatuna study area, summer of 1996/97. *Unpublished Report.* Department of Conservation, Opotiki. 22 p.

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Wilson D: Te Urewera deer pellet lines 1997. Unpublished Report. Department of Conservation, Opotiki. 12 p

Appendix 5

Proceedings of the Department of Conservation mainland restoration workshop, Kiwi Ranch, Upper Hutt, 12–14 October 1999

Reproduced as compiled and formatted by Victoria Froude, Pacific Eco-logic resource management associates

Workshop Participants

Atkinson, Ian	Ecological Research Associates of NZ (Session leader)
Ayres, Graeme	Technical Support, Southern Region
Barkla, John	Technical Support, Otago Conservancy
Beggs, Wayne	Paengaroa project, Wanganui Conservancy
Broome, Keith	Technical Support, Northern Region
Brown, Kerry	Project River Recovery, Canterbury Conservancy
Butler, Dave	Rotoiti Project, Nelson/Marlborough Conservancy (Group facilitator)
Choquenot, Dave	Landcare Research, Lincoln (Session leader)
Cranwell, Steve	Boundary Stream project, East Coast/Hawke's Bay Conservancy
Ferreira, Sam	Conservancy Advisory Scientist, Auckland Conservancy (Group facilitator)
Froude, Vicky	Pacific Eco-Logic (Scribe/interpreter)
Gillies, Craig	Science & Research, Wellington
Grant, Andy	Conservancy Advisory Scientist/Biodiversity Management, Canterbury Conservancy (Group facilitator)
Gumbley, John	Technical Support, Waikato Conservancy.
Harrison, Andrew	Technical Support, East Coast/Hawke's Bay Conservancy.
Hay, Rod	Science & Research, Christchurch (Workshop chair)
Hogan, Kerry	Technical Support, East Coast/Hawke's Bay Conservancy (Group facilitator)
Hutchinson, Wayne	Technical Support, Southern Region (Group facilitator)
Johnston, Keith	Conservation Policy, Head Office.
Keys, Harry	Conservancy Advisory Scientist/Karioi Rahui project, Tongariro/Taupo Conservancy (Group facilitator)

McKenzie, Don	Technical Support, Northland Conservancy (Group facilitator)
Miller, Craig	Conservancy Advisory Scientist, West Coast Conservancy (Session leader)
Ogle, Colin	Conservancy Advisory Scientist, Wanganui Conservancy
Owen, Susan	Conservation Policy, Head Office (Group facilitator)
Parkes, John	Landcare Research, Lincoln.
Peters, Darren	Rotoiti Nature Recovery Project, Nelson/Marlborough Conservancy
Reed, Christine	CAS, Wellington Conservancy
Richmond, Chris	Conservation Policy, Head Office
Roberts, Andy	Technical Support, Southland Conservancy
Saunders, Alan	Science & Research, Wellington (Workshop convenor)
Shaw, Pete	Te Urewera, East Coast/Hawke's Bay Conservancy (Group facilitator)
Stephens, Theo	Science & Research, Northern Regional Office (Group facilitator)
Sutton, John	Rangitaiki Area, Bay of Plenty Conservancy
Towns, Dave	Science & Research, Auckland (Session leader)
Turner, Stephanie	PRS, Northern Region
Ward, Chris	Conservancy Advisory Scientist, East Coast/Hawke's Bay Conservancy (Group facilitator)
Warren, Paula	Conservation Policy, Head Office
Wright, Elaine	Principal Regional Scientist, Southern Region (Group facilitator)