ARK IN THE PARK
RESTORATION PLAN

2009

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Contents

1 Introduction

The Ark in the Park Restoration Plan outlines the ecological restoration proposed for the Ark in the Park Open Sanctuary Project, centred in the Waitakere River catchment of the Waitakere Ranges Regional Parkland. The plan outlines the proposed restoration strategy for the next 5 years along with a vision for the future. A reviewed version will be prepared in 2013. A separate management strategy will address other aspects of the project not covered in this plan.

The catchment includes original forest cover and a mosaic of regenerating forest types with a range of ecosystems, high landscape and species diversity. It was also chosen for ease of access by track and road to facilitate intensive pest control. However, like most of the Waitakere Ranges, the native animals in the project area are severely depleted, with many species locally extinct in the Waitakere Ranges or throughout the North Island. The Ark in the Park project aims to restore functioning native ecosystems through pest control and reintroduction of animals and plants lost from the Waitakere Ranges.

The catchment area, as at 31 March 2007, is 1100 ha; the initial pilot area was 250 ha. The plan takes account of the project area expanding to potentially include the catchment of the Waitakere Reservoir, as shown below. The Ark in the Park "buffer zone" where pest control is carried out on neighbouring private property is explained in greater detail in Section 15.2.

The restoration plan provides an integrated policy framework for restoring natural heritage, ecological processes and indigenous species in the project area. It integrates policies and actions within the Auckland Regional Council's Regional Parks Management Plan (2004) and The Ark in the Park – Strategic Plan for an Open Sanctuary (2002).

Figure 1 Location of the Ark in the Park Open Sanctuary project area in the Waitakere River catchment.

2 Ark in the Park vision

From the ridges to the sea: restoration of the Waitakere Ranges to retain and enhance their natural heritage values.

Within this overarching strategy, the vision for the Ark in the Park project is to enhance the biodiversity and ecosystem function in the Ark area to a state similar to that prior to logging and farming.

By doing so, the project aims to showcase how ecological values can be protected and enhanced through community involvement and interagency co-operation and commitment.

3 Ark in the Park goals

To enhance the biodiversity of the area by translocating and reintroducing flora and fauna species[1]

- Flora and fauna species that are part of the Auckland Ecological Region (Denyer *et. al.*1993) will be considered for translocation/reintroduction (see Appendices C and D).
- The project aims to assist current, previously reintroduced populations of whitehead, North Island robin and hihi to become self-sustaining by translocating more of these bird species.2
- We will also consider translocating additional flora or fauna species to supplement low populations, on a case-by-case basis.

To create self-sustaining populations though biodiversity and intensive pest control
Each translocated/reintroduced population will be supported in becoming self-sustaining by the project's intensive pest control work and the increased biodiversity associated with control and other translocations/reintroductions.[3]

To encourage community and inter-agency involvement
The project is committed to building and maintaining participation and support from the local community, tangata whenua and the general public.
The Ark in the Park – Strategic Plan for an Open Sanctuary (2002) states that the project will support and cooperate with other restoration and open sanctuary projects in the Waitakere Ranges. Ark in the Park is also committed to support and cooperate with Auckland-wide and national conservation projects and goals, where resources allow. See Appendix B for further details regarding the relevant sections of the ARC's Parks Management Plan.

To restore the dawn chorus for future generations
Future generations will enjoy a more varied dawn chorus of birdsong.

To promote research on ecosystem recovery

[1] The original document, The Ark in the Park – Strategic Plan for an Open Sanctuary, Cascades Kauri Park, Waitakere Ranges, also outlined species for re-introduction.

[2] Translocation is the process of preparing and moving individuals from one site to another, whether populations already exist at the destination site or not. Reintroduction refers to reintroducing new populations into an area from which they have become locally extinct.

3 Except in certain situations where conservation benefits outweigh the need for a self sustaining population.

The project aims to help advance traditional and scientific knowledge of indigenous biodiversity.

To expand the predator-control area
The next phase of the project is to expand the project's integrated predator control programme into the upper Waitakere River catchment, above the Waitakere Reservoir (as foreshadowed in the project's Strategic Plan 2002). Other opportunities for further expanding the area over private land and parkland will be investigated and include future revisions of the Restoration Plan as resources permit.

4 Actions

- There will be ongoing control of pests through intensive trapping and baiting. We aim for less than 5 percent rat-tracking indices and less than 2 percent residual trap catch for possums in the Ark in the Park area (see Pest Management section for an explanation of these terms).
- At least 10 animal species[4] resident in the site, but rare or absent from the surrounding area, will continue to benefit from increased biodiversity and low numbers of rats, possums and mustelids.
- Applications will be made to the Department of Conservation (DOC) and the Auckland Regional Council (ARC) for permission to translocate and/or reintroduce five fauna species within the next 5 years. At least two of these species will be initial re-introductions, e.g. Kokako. The other 3 species will be additional translocations of existing species already re-introduced into the Ark in the Park site (see Appendices C and D).
- Scientific knowledge will be advanced through carrying out best practice, satisfactory monitoring using appropriate methodology and encouraging further research. The Ark in the Park's Technical Advisory Group (TAG)[5] will help guide the project.
- There will be opportunities for the community and tangata whenua to be involved in the project including regular volunteer days, talks at the park and off-site and other possibilities for public education on community conservation, e.g. stalls at Eco-Day, involvement in the ARC's "Dawn Chorus" project for secondary schools etc.

5 Measuring performance

Monitoring is essential to assess progress towards achieving these goals and outcomes. Progress will be measured by:

- assessing and reporting against the Ark in the Park Annual Work Programme via the Ark in the Park Annual Report.
    1. Reporting pest control results and other information.
    2. Reporting indigenous flora and fauna information gathered through monitoring and research.
    3. Recording the commitment of key stakeholders, the number and make-up of volunteers involved in the project, visitor and volunteer surveys.
- regular reporting to the Ark in the Park's Technical Advisory Group, Governance Group and to the ARC's Parks & Heritage Committee[6].

[4] Including: Tui, grey-warbler, silvereye, NZ pigeon, pukeko, shining cuckoo, fantail, tomtit, Hochstetter's frog and long-tailed bats.

[5] The Ark in the Park's Technical Advisory Group (TAG) meets twice per year and is made up of representatives from Forest and Bird and the ARC, along with technical expertise from the ARC's Heritage and Biosecurity teams, Forest and Bird, Auckland and Massey Universities, Department of Conservation and other experts as required.

- recording information on an online database accessible through our website www.forestandbird.org.nz/ark

6 Rationale for chosen ecosystem restoration approach

The original ecosystems of the Waitakere Ranges were far more diverse than those remaining and regenerating today. Taking the vegetation as an example, it is unclear how many of the current vegetation communities reflect the pre-Maori, pre-European or pre-logging and farming vegetation communities of the Waitakere Ranges. The vegetation communities of the Waitakere Ranges today differ quite markedly from comparable (wet) west coast North Island forests on volcanic soils to the north and south. A number of dominant and subdominant tree and shrub species found in other localities are uncommon or rare in the Waitakere Ranges, e.g. tawa, tarairi, towai and kamahi, whereas rewarewa and most podocarp species are more common. In addition, it appears that larger-fruited trees, such as tarairi and mangeao are now rapidly expanding their range in the Waitakere Ranges.

It is likely that the forest ecosystem composition and local rarity of some species is a reflection of a number of factors, particularly:

- the alteration of landscapes and habitats (which includes habitat loss, fragmentation, isolation and degradation) due to past clear felling of all but a few hundred hectares of forest, followed by farming activities, as well as damming of streams
- the adverse impacts of introduced mammalian predators (e.g. feral cats, mustelids, rodents, and possums) and browsers (e.g. goats, pigs, and livestock)
- a reduction in ecosystem health and function due to the loss or decrease in abundance of species that fulfil essential function roles (e.g. seed dispersers, pollinators, and detritivores).

Given the above, restoration planning requires a focus on:

a) addressing the threats that have contributed to loss of biodiversity and ecosystem health
b) restoring the key ecosystem drivers that shaped the Waitakere Ranges prior to European colonisation. These key drivers can be restored primarily through the recovery or reintroduction of keystone species, i.e. those species that have important functional roles. Three primary ecosystem drivers within the Waitakere ranges are nutrients from seabirds; pollination and seed dispersal; and invertebrate biomass.

Importation of nutrients from seabirds into the forests. We have lost a major source of nutrients with the loss of seabirds and their guano from coastal and inland forests (Atkinson & Millener, 1991). The high nutrient levels around bird colonies are important for the survival of a number of species. These nutrient levels support abundant vegetation growth and high invertebrate biomass, with a cascade effect down through the ecosystem.

The black petrel was present in the coastal ranges of the North Island west coast from Herekino (Northland) to Taranaki until the 1970s, but the smaller inland breeding seabirds – such as Cooks petrel – appear to have become locally extinct much earlier. Grey-faced petrels appear to have nested further inland than their current coastal sites. In Northland they nested 5-10 km inland (David Crockett, pers. com), and if this was the typical prehistoric range for this species, then they could have occurred in the Ark in the Park project area.

[6] The Ark in the Park Governance Group, covered in the Ark in the Park Memorandum of Understanding, is made up of at least two representatives from the Auckland Regional Council and two from the Waitakere Branch of Forest and Bird. The group helps guide the strategic direction of the project.

Seabirds will be introduced to progressively restore higher levels of ecosystem functioning (see Appendices C and D for species under consideration). With seabirds in the forest ecosystem, a number of species will be more able to either find sufficient food or to reach self-sustaining populations. A 50-to-100 year lag is expected before the benefits of seabird introduction extends more widely than their nesting colonies, but effort could be also directed to plants, invertebrates and reptiles that live in the higher nutrient sites around the newly established seabird colonies.

This approach to ecological restoration is not new (Atkinson 1994), and there have been successful seabird translocations in New Zealand and overseas for more than a decade (Bell 2005).

In order to establish self-sustaining populations in the Waitakere Ranges and adjacent areas within their habitat range, this approach seeks to restore ecosystems with reintroduced species and enhancing present species (see Appendices C and D) based on:

- the limiting predators being reduced to minimal levels to ensure their survival
- sufficient habitat area being available for the species
- their nutrient or food requirements being available.

Pollination and seed dispersal; the local extirpation (i.e. local extinction) or decreased abundance of nectivores and frugivores (e.g. kereru, honey eaters [tui, bellbird, and stitchbird], and lizards) is likely to be limiting the growth and spread of plants in the forest and the movement of seed from sources further afield. For example, some species will recover due to pest control and others will need to be reintroduced.

Invertebrate biomass is artificially low, first because of seed and plant predation by rodents and introduced insects, and second because of the historical loss of seabird nutrients. This is reflected in the baseline invertebrate monitoring from the Ark (Brooker, 2001) and follow-up monitoring (Ark in the Park Community Restoration Project Annual Report, 1 July 2005 – 30 June 2006). An issue that may be particularly important is the loss of honeydew production due to introduced wasps and rodents that prey upon the scale insects, significantly affecting production. In some mammalian pest-free islands, and in New Zealand mainland systems, honeydew is a major food resource for some species of gecko and birds.

7 Overview of species translocation

7.1 Selection

Choice of species for reintroduction has been guided by available historic data and expert advice on species known from the Ranges. Assessment of species will be on a case-by-case basis, assessing their suitability, contribution to species recovery plans (nationally or regionally) and practical and ecological considerations. For translocation of species not historically found in the Waitakere Ranges Ecological District, consideration will be given to analogue species (for extinct species e.g. North Island takahe) or where the project can assist with species-specific national conservation goals.

Species that require assistance to form self-sustaining populations in the project area will be considered for translocation. Each translocation will be assessed through the DOC translocation process with input from the ARC, and all translocation applications accompanied by an assessment of the species status and distribution. (Some of the guidelines used in this process are contained in Appendix E.) Any species not covered by the Wildlife Act, e.g. plants and butterflies, will also be approached in a similar way, with a written proposal for

consideration by the ARC. The ARC will ultimately approve or decline each proposal on a case-by-case basis.

7.2 Dispersal

Reintroductions to the Ark in the Park area are carried out with the knowledge that dispersal is a reality of mainland translocation. Species may easily spread across the entire Waitakere Ranges and to adjacent forest areas through forest corridors etc. This dispersal may also be to any of the other areas within the Waitakere Ranges that have enhanced predator control.

The feasibility of monitoring species which disperse outside the Ark in the Park area will be investigated. Where possible, species that have dispersed after release into the Ark in the Park area will be monitored as it is in the project's interest to understand dispersal of different species both inside and outside the Ark in the Park area. We may also be able to add our project's experiences and understanding to information regarding translocation design and assist with conservation projects elsewhere on the mainland. Therefore we would, where possible, consider supporting groups or individuals to carry out pest control and monitoring in new areas where individuals have established territories following dispersal.

7.3 Self-sustaining population

The main goal of translocation is that a population will become self-sustaining in the Ark in the Park area. The key measures for determining self-sustainability will be outlined in each translocation proposal.

7.4 Use as a source population

As reintroduced populations of endangered species become established in the Ark, it may become appropriate to use these populations for a source of further translocations (to other sites) for the benefit of the national conservation of that species. All translocation proposals must be approved by DOC and/or ARC and as part of this process the effects on the source population will be assessed, including the removal of individuals. As long as the source population is likely to remain viable if individuals are removed, the long-term gain of reducing the risk of a species becoming extinct is considered to outweigh the possible short-term loss of their visibility in Ark in the Park.

7.5 Self-reintroduction

Species with the potential for self-reintroduction should be considered as a lower priority. This will allow for natural reintroduction or recovery of existing non-visible populations, e.g. kaka, bellbird and Dactylanthus. If self-reintroduction/recovery does not occur, reintroduction or translocation will be considered on a case-by-case basis in the future, taking into account conservation priorities and the prudent use of resources.

7.6 Modification of vegetation or substrate

Localised and site-specific modification of vegetation or substrate may need to be considered to facilitate reintroductions and to increase breeding opportunities for a species on a case by case basis (the erection of a temporary holding facility for birds, planting for skink and butterfly communities, etc). All species selected for replanting will be chosen according to best practice outlined in the ARC Revegetation Strategy (Stanley *in prep*) and the ARC Regional Parks Management Plan. All species selected for replanting will be native to the area and eco-sourced from within Ark in the Park area or the Waitakere Ecological District, unless they are locally extinct.

Any proposed modification will take into consideration the possible presence of archaeological, historical and culturally valued sites and advice will be sought from an archaeologist.

Consultation with Te Kawerau a Maki and stakeholders will be undertaken as appropriate to the circumstances.

Any modification or planting beyond those described above will be consistent with the Regional Parks Management Plan and require approval of the Principal Ranger Western Sector Parks. Departures from the Regional Parks Management Plan will require advice from the ARC Heritage and Parks teams and approval from the Governance Group.

7.7 Pest control

No perimeter predator proof fences are proposed for the project in the term of this plan. Ark in the Park will be a mainland island where pest control will be ongoing, will follow current ARC/DoC best practise, and will be consistent with the Auckland Regional Pest Management Strategy. Predator control will be based predominantly on the use of a control grid.

For further details see section 16.4 on pest management.

7.8 Consideration of wider conservation gains

One of the aims of the Ark in the Park project is to contribute to the national conservation of New Zealand biodiversity. Therefore all decisions relating to the running of the project will be made to give effect to (or help achieve) wider conservation gains. The use of resources will be considered on a case-by-case basis with the aim of achieving the maximum possible gain for the conservation of New Zealand's biodiversity.

8 Monitoring

The Ark in the Park project carries out the following monitoring:

- pest monitoring
- biodiversity monitoring
- threatened species monitoring
- re-introduction/translocation monitoring under permit/guidance from DoC/ARC
- community and stakeholder measures (to be covered in the Ark in the Park Management Plan available in 2009).

Most monitoring is species specific and is outlined in the relevant section below. Monitoring is essential to assess progress towards achieving the goals and objectives described above and will be measured by assessing and reporting progress against the Ark in the Park Annual Work Programme via the Annual Report. Records will be kept in an online database accessible through our website.

In general, liaising with ARC (and Technical Advisory Group) will be ongoing and additional monitoring may be considered, as appropriate and practical, to further Ark in the Park and ARC's common interests.

9 Restoration of plants

9.1 Original plant community

"In pre-human times most of the Waitakere Ranges was clothed in a dense forest, with kauri, northern rata and rimu the dominant species" (Harvey & Harvey 2006).

The vegetation of the Waitakere Ranges is a mosaic of small, original forest patches and different regimes of disturbance over hundreds of years. The major disturbance period was 1880s-1930s and since then much of the cleared land has returned to forest and scrub. Selective loss of plant species has occurred, particularly from stock, possum and rodent browsing of plants, flowers, fruit and seeds.

9.2 Current situation

The Cascade Kauri Park area consists of some 1800 ha of modified podocarp/broadleaf forest on dissected hill country and 150 ha of original mature kauri forest. Podocarp/broadleaf forest dominates the Waitakere catchment, but other areas of ponga-broadleaf forest, kanuka forest and young kauri forest exist. The Ark area retains much of its original character, despite former logging. Hall's totara, kahikatea, miro and rimu are the most common podocarps in this association. Other trees and large shrubs include heketara, lancewood, mahoe, mamaku, nikau, pigeonwood, ponga, rata and rewarewa. The shrub and ground layers include dense tree ferns, sedges and lianes vegetation. In most forest areas, there is a lower tier of epiphytes on tree and tree fern stems.

The Cascade Kauri Park area is one of the largest original forest remnants in the Waitakere Ecological District (and one of the largest kauri forest remnants in the Auckland Region).

In 2004, a small replanting project began in a fenced area between the golf course and the entrance to the Whatitiri track. The initial plantings have been added to over time. The majority of the fenced area is currently mown to control weeds, e.g. blackberry. Our aim is to continue planting at this site over the next 5 years until the area has been revegetated. Plants including kowhai, lacewood, rewarewa and puriri have been eco-sourced from several Waitakere sites. Aims of the planting include:

- to help control weeds
- to provide supplementary food for nectar feeders
- to provide an opportunity for further community involvement and contribution to the project by providing a task for volunteers who are unable to physically manage servicing bait lines etc.

The area also adds to the visual beauty of the park, being near a popular picnic area, adding to the amenity plantings in the vicinity.

9.3 Monitoring

Permanent vegetation plots are currently being set up to measure long-term vegetation changes in the Ark in the Park project area to assess long term vegetation changes. These could also be used to compare similar vegetation types with and without rodent control. This would incorporate existing permanent plots in other parts of the Waitakere Ranges.

In addition to the vegetation plots, surveys will be carried out for plants that are expected to be present, or that were recorded in the past, from the Ark in the Park managed area. Such species include *Nestegis cunninghamii, Dactylanthus taylorii, Ophioglossum petiolatum, Pittosporum ellipticum, Pittosporum kirkii, Halocarpus kirkii,* and other suitable species, with advice from ARC staff and other botanical experts.

9.4 Re-introductions

Mistletoe (Ileostylus micranthus)

Ileostylus micranthus is a mistletoe that was formerly common in the Auckland region. It is now restricted to less than 10 sites in the region (Cameron 2000) including one in the Waitakere Ranges on Piha Road, approximately 6 km from the Ark in the Park area. One hundred seeds were gathered from the 6 source plants on Piha Road in May 2005 (from the many thousands of seeds available). Seeds were placed on totara trees (its natural host in the area) in the management area. No germination has been observed to date. Mistletoe transfer is complex and there are many stages involved in a successful establishment. No further attempts have been made as the plants have since been seen regenerating in the management area.

9.5 Restoration options

Vegetation recovery has already started in the Ark in the Park area due to intensive pest control, which assists natural successional processes. As bird numbers increase along with the reintroduction of bird species that have become locally extinct, it is assumed that pollination and seed dispersal in the Ark should also increase and positively affect vegetation recovery. For example, the reintroduction of hihi (stitchbird) has resulted in sightings of hihi feeding on the nectar of kiekie (*Freycinetia banksii*) flowers, which may be significant as the flowers are thought to be pollinated by bats.[7]

However, there is little need for revegetation planting and this would be considered if appropriate for threatened species recovery, to facilitate an animal transfer, or to supplement food for certain species (as mentioned under "Current situation"). Any potential plant translocation/reintroduction would be assessed using the ARC's translocation proposal guidelines.

9.6 *Phytophthora* taxon Agathis

Kauri dieback is caused by a pathogen (a disease-causing agent) known as Phytophthora taxon Agathis (PTA). Until April 2008 it had not been identified as a new species, nor was it known that PTA killed kauri. Symptoms include yellowing of foliage, canopy thinning, dead branches and tree death. Affected trees can also develop lesions that bleed resin. It kills kauri of all ages and sizes. The disease has been found in the Waitakere Ranges and is under observation at Cascade Kauri, Karekare, Anawhata and Huia.

PTA is believed to be a soil-borne species spread by soil and soil water movement, plant to plant transmission through underground root-to-root contact, and human and animal vectors. There are significant information gaps about the disease, its vectors and management options. ARC is funding initial research including a delimitation survey of where the disease is present in the Auckland region, its vectors of spread, and preliminary work on control of the disease.

ARC has developed an operating procedure for its staff and contractors working in kauri forest. Ark in the Park volunteers and contractors will strictly adhere to all ARC requirements and operating procedures e.g. cleaning shoes and any other equipment that comes into contact with soil. (Also see section 18)

[7] From an email from Sandra Anderson, School of Biological Sciences/School of Geography and Environmental Science, University of Auckland dated 22 April 2008 to Sandra Jack, Project Manager, Ark in the Park, mentioning the publication by Lord, J.M. 1991. Pollination and seed dispersal in Freycinetira baueraiana, a dioecious liane that has lost its bat pollinator. *NZJ Botany* 29, 83-86.

9.7 Recommended actions

- Monitor vegetation with permanent vegetation plots, phenology and specific species surveys, in consultation with the ARC and other experts.
- Consider suitable plant reintroductions or supplementary translocations of plant species in consultation with the ARC and other experts. Each proposal will be considered on a case-by-case basis.
- Strictly adhere to ARC operating procedures for working in kauri forests (to minimise risks caused by PTA)

10 Restoration of invertebrates

10.1 Original invertebrate community

Forest clearance and farming in the 19th and 20th centuries, along with predation from rodents and other introduced mammals, substantially reduced invertebrate populations and probably led to local or regional extinction of a number of large-bodied species of insects (Harvey and Harvey 2006). Subsequent colonisation by exotic predatory wasps is likely to have affected populations of a number of other insects, particularly butterflies and moths.

10.2 Current situation

Introduced (and uncontrollable) vespid wasps, in particular German wasps (*Vespula germanica)* rise to very high numbers in the height of summer at the Ark in the Park site. These pest species impact on our native invertebrates and may also be responsible for the death of nestlings.[8]

Invertebrates monitored in our pitfall-traps show an increase in number, size and variety (pers comm. Peter Maddison) which is likely to be due to the intensive pest control carried out by the project since 2003. A number of large-bodied insects are unlikely to recolonise as they are flightless or have limited abilities to disperse.

According to Dr Robert Hoare (Landcare Research): “Helms' butterfly (*Dodonidia helmsii* or forest ringlet) shows clear evidence of a decline in the Waitakere Ranges in general. Copper butterflies of the two common species (*Lycaena salustius* and *L. rauparaha*), along with the common blue and long-tailed blue (neither of the latter two are endemic to New Zealand) are still common to abundant at Whatipu, and the Ranges themselves are a marginal habitat for coppers due to the low abundance of Muehlenbeckia australis”. Hoare adds that although it is nearly impossible to suggest particular moth species that are likely to be in serious decline, they are very likely to be affected by wasps.[9]

10.3 Monitoring

Several projects monitoring invertebrate diversity have been undertaken in the Ark by researchers and volunteers. Comparison between non-managed and managed sites shows predator control leads to more biomass including more hunting spiders and more ground weta (Brooker, 2001). Significant increases in mollusc size and numbers were also recorded (Brooker, 2001).

Regular pitfall-trap monitoring has occurred since 2004 with 12 pitfall traps along a 200 m section of the Auckland City Walk boosted by a new line of 12 pitfall traps near Scenic Drive in

[8] Towards the end of the 2007/08 hihi (stitchbird) season, wasps were observed entering the cavity of a large kauri tree where a nest was being monitored. It is highly likely that the wasps caused this nest to fail (pers comm. Dr Jacqueline Beggs, University of Auckland).

[9] From an email from Dr Robert Hoare to Sandra Jack, Project Manager, Ark in the Park dated 21 April 2008.

January 2007. The Auckland City Walk, Scenic Drive and Spragg Bush control areas are maintained by volunteers and all specimens from these traps are analysed by Dr Peter Maddison.

10.4 Restoration options

- Wasp and other parasitoid control should be the major focus of invertebrate restoration for the project, along with continued pest control.
- Helms' butterfly may be the only butterfly candidate for restoration in the long term. Despite a number of searches in recent years, it is extremely rare and may be extinct in the Ranges and at the Ark in the Park site.
- Any potential translocation/reintroduction of invertebrates will be assessed following the Department of Conservation translocation proposal format, with input from ARC staff and other experts. Translocation of species may be considered if surveys reveal local extinction at the Ark in the Park site and no likelihood of natural re-establishment.

10.5 Recommended actions

- Work alongside the ARC Biosecurity and Park ranger staff to help control wasp numbers at the park using available toxins and current best practice, as well as advocating, where appropriate, the availability of a more effective wasp toxin.
- Continue to monitor invertebrates.
- Translocation of species now absent from the Ark in the Park area may be considered if surveys reveal local extinction in the Waitakere Ranges and no likelihood of natural re-establishment.
- Carry out surveys over a number of seasons to determine the presence of Helms' butterfly in the ranges.

11 Restoration of the native bird community

11.1 Original native bird community

The Waitakere Ecological District, part of the Auckland Ecological Region (Denyer et al.,1993), has a diverse range of both endemic and introduced wildlife species. Originally about 4 species of moa could have been present, with takahe and the flightless goose in wetlands and open areas. Forest species would have included brown and little spotted kiwi, adzebill, several rail species including weka, NZ snipe, and possibly 2 species of flightless wrens. Also present would have been bush wren, robin, saddleback, huia and piopio (NZ thrush), kaka, red and yellow-crowned kakariki, kereru, kingfisher, long-tailed and shining cuckoos, rifleman, tomtit, whitehead, fantail, grey warbler, tui, bellbird, hihi (stitchbird), kokako, kakapo, laughing owl, morepork and owlet-nightjars, with NZ quail along forest edges (Harvey and Harvey, 2006).

To this list of original birdlife we can add wetland species, including pukeko, Finsch's duck, Scarlett's duck, grey duck, grey and brown teal, shoveler, musk duck, NZ swan, bitterns, marsh and spotless crakes. Other predators would have included harrier, falcon, Eyle's harrier and the giant eagle. Inland ridges of the Ranges would have harboured a number of species of nesting petrels (black, Cook's, grey-faced and mottled petrels). Five shag species (pied, black, little, little black and spotted) were also present in the region (Harvey and Harvey, 2006).

11.2 Current situation

Many of the original species are now extinct and others have become locally extinct including: North Island weka, North Island brown kiwi, whitehead (now reintroduced), bellbird,

hihi/stitchbird (now reintroduced) and red-crowned and yellow-crowned parakeets (occasionally recorded in the Ranges but likely to be escaped/released aviary birds) (Denyer et. al.,1993).

Amongst the special features of the Cascades site now are:

- kaka visiting
- tomtits (miromiro) widespread throughout the area
- whitehead (popokatea) sited irregularly in kanuka shrubland
- North Island robin (toutouwai) actively breeding
- higher numbers of tui, NZ pigeon (kereru), grey warbler (riroriro), silvereye (tauhou) and fantail (piwakawaka)
- a colony of black shags (kawau) nesting on trees in one arm of the Waitakere reservoir
- reports of long-tailed cuckoo (koekoea) passing through the area in autumn
- Australasian bittern and North Island fernbird (spotless crake, NZ shoveler, paradise shelduck, grey teal, and grey duck likely also) in the Waitakere Reservoir area.

A number of these are due to intensive pest control and/or reintroductions carried out by the Ark in the Park project.

11.3 Monitoring

John Staniland (Chair of Waitakere Branch of Forest & Bird and member of the Ornithological Society) carries out ongoing monitoring of birds on a specific track circuit inside the Ark in the Park area and on one “control” circuit in an area in the Ranges where no pest control is being carried out, except possum control carried out across the Ranges by the Auckland Regional Council’s Biosecurity staff. This is in addition to ARC’s five-minute bird counts that have been conducted since 1997 in the Waitakere Ranges.

Keeping variability to a minimum, birds are recorded using a distance-sampling method where birds that are seen and heard are noted. The circuits are: the Auckland City Walk-Cascade Track-Upper Kauri Track circuit in the core area of the Ark site, and comparing it using the same methodology to the Fairy Falls-Old Coach Road-Goodfellow Track circuit about 2 kilometres south of the Ark in the Park site.

The two areas are generally but not exactly similar in forest type, altitude and circuit length, and both counts are each carried out in spring, summer and autumn at the same time of day and in similar good weather.

The project is also interested in carrying out monitoring in areas of regenerating forest/edge habitat where whiteheads are sometimes seen. Methods for this type of monitoring, where information about specific species is the aim, are being developed with advice from the DoC and the ARC.

The project is also working on an online mapping tool where visitors to the website can record their own sightings, which will add to a database of sightings and other monitoring information.

11.4 Reintroductions

11.4.1 Whitehead (popokatea)

Fifty-five popokatea were introduced in August 2004 from Tiritiri Matangi. Another 50 birds were translocated from Tiritiri Matangi in April 2008. The post-release monitoring of this species has proved difficult, as they dispersed widely and are relatively inconspicuous canopy dwellers. Small groups of whiteheads, including unbanded individuals, have been seen in the Waitakere Ranges. Whiteheads are still seen and heard in the Ark in the Park area by volunteers and members of OSNZ. As numbers increase, these birds should become more conspicuous. The population may need a "top up" translocation to boost numbers, especially now as some whiteheads are well established in the managed area. The existing birds should attract any new birds that are released and would help to anchor them in the managed area. Evidence of whitehead breeding may be detected during the upcoming breeding season monitoring of robin, hihi and other bird species.

Whitehead sightings can be recorded on the Ark in the Park online database (including web-mapping) which allows both volunteers and general visitors to indicate the area and other information (nesting, feeding etc) with their sighting via the internet.

11.4.2 North Island Robin (toutouwai)

Fifty-three robins were re-introduced into the park in April 2005, from Mokoia Island. Volunteers monitored them informally in the first year and more intensively by two overseas volunteers. The first student observed the dispersal of robins from release and over the following twelve weeks; the second student monitored breeding pairs and nesting success. Five to six breeding pairs have been monitored over subsequent breeding seasons with an average of 4.5 chicks per female successfully fledged. Chicks have been colour-banded for future identification.

11.4.3 Stitchbird (hihi)

Fifty-nine hihi were reintroduced into the park in April and June 2007, from Tiritiri Matangi Island. The reintroduction was experimental as it is the first transfer to an area with low numbers of predators. . Following a recommendation from the Hihi Recovery Group meeting in 2008, an additional 51 hihi (50/50 male /female) were translocated from Tiritiri Matangi Island to Ark in the Park. The Hihi Recovery Group is interested in the survival and breeding success of hihi in the Ark in the Park area. If successful, this may increase the opportunities for potential populations in other suitable areas with pest management. Volunteers, tertiary students and a dedicated Masters student, Kate Richardson, have monitored their progress, using radio telemetry. Bird feeders and nesting boxes have been located in the central area of the Cascades to assist their establishment.

Monitoring: post release monitoring and breeding-season monitoring will be carried out to determine dispersal, survival, territories and breeding success.

11.5 Restoration options

Restoration of the Ark in the Park native bird community will involve the reintroduction or translocation of species that have been lost or are low in numbers in the area. These actions will follow the principles and assumptions set out in this plan.

11.6 Recommended actions

- Plan and carry out the reintroduction of kokako in 2009.
- Plan for the reintroduction of petrels (including Cooks and grey-faced petrels, target 2011).
- Plan for supplementary translocations of reintroduced species: whitehead, robin, and hihi.
- Continue to monitor reintroduced species, as required by translocation plans.
- Continue to assess opportunities for translocations of other bird species on Appendix D.
- Continue to monitor bird species through regular formal bird surveys.
- Monitor other bird species where resources allow, e.g. continue to monitor bird communities through distance sampling.

12 Restoration of reptiles

12.1 Original reptilian community

Although no sub-fossil remains have been found from Waitakere sites, extrapolation from sub-fossil-containing sites with landscape and vegetation connections with the Waitakere Ranges can be made. Reptilian species in pre-human times may have been as many as 20, including tuatara (Chapman and Alexander, 2006).

12.2 Current situation

The current diversity is probably no more than 6 reptile species with one of those, the striped skink, having been recorded infrequently and long ago. In addition, there are copper and ornate skinks, and pacific, forest and Auckland green geckos. Little is known of their distribution and abundance. The New Zealand Threat Classification system lists Auckland green gecko and Pacific gecko as “Gradual decline (human induced)”, and ornate skink as “Gradual decline (data poor). Therefore these are a priority to safeguard and enhance its numbers within the Waitakere Ranges.

A small area (25-30 ha) along the Whatitiri Track has increased pest control (bait stations at 50m x 50m grid baited at the same time as the rest of the Ark in the Park site). The area was started in mid 2006, and a set of 10 monitoring tunnels established. The most recent monitoring result in April 08 showed a 10% index of mice prints. This area has been chosen because of its value as a site for gecko monitoring and potential site for rescue translocations.

12.3 Monitoring

Skink monitoring protocols have been set up with assistance from members of the Society for Research on Amphibians and Reptiles New Zealand (SRARNZ). Skinks will be monitored using artificial cover objects (ACOs) made of corrugated iron 50 x 75cm to 1m x 75cm laid out around the “edge” habitat of the Waitakere golf course. Between 50 -100 of these ACOs will be placed in autumn and spring for a few weeks. They will be removed between these periods to reduce the potential for learned predation.

Geckos will be monitored at night using spotlighting approximately 2-3 times per year on selected tracks with the assistance of SRARNZ members. Alternatively tree trunk or branch hugging ACO may be employed for geckoes.

12.4 Restoration options

At the time of writing, given the current technology available for pest control in an unfenced mainland island situation such as at the Ark in the Park site, there are no suitable reptile

species suitable for re-introduction. Advances in pest control technology may mean this situation could change in the future.

Any re-introduction of a reptile must satisfy the following criteria: 1) the species is not currently present, 2) the habitat is suitable and 3) the species proposed is known to do well in the presence of low densities of rats, mustelids, cats, hedgehogs and probable elevated densities of mice. Although there may in future be predator exclusion sites developed within the Ark in the Park or there may be technologies which achieve virtual predator eradication, currently no lizard species not already present in the Ark could satisfy the criteria No. 3. If and when those changes, translocation proposals developed with DoC, ARC and SRARNZ can be initiated. However a draft proposal will be made ready for rescue translocations of species currently present (e.g. Auckland green gecko) from habitats about to undergo destruction [e.g. motorways] where Ark in the Park appears to be an appropriate site for relocation.

The Ark in the Park project will also support, as appropriate and practical, efforts to protect important lizard populations within the Waitakere Ranges through recovery of existing populations.

12.5 Recommended actions

Develop a plan to:

- Survey existing reptiles.
- Continue to monitor rodent levels especially in the Whatitiri Track area with 50m x 50m bait stations.
- Implement where possible, any advances in mice control.
- Complete and have approved in principle a draft translocation proposal for “rescue” situations of, for example, Auckland green gecko.
- Include monitoring, as appropriate and practical, for introduced rainbow skink,

13 Restoration of native mammals

13.1 Original mammalian community

Long-tailed bats are present in the Cascades, representing a significant population persisting in kauri-dominated forest near an urban area, in “highly fragmented habitat” (Alexander and Chapman 2006). It is likely that the lesser short-tailed bat was once present in the Waitakere Ranges (Waitakere City Council’s Biodiversity Report 2007).

13.2 Current situation

Resident long-tailed bats can often be observed at the Cascades foraging from the bush fringes. Their distribution and ecology in the Waitakere Ranges has been studied (Alexander and Chapman, 2006). Causes of a decline in bat population remain unclear; remaining bat roosts are probably the least accessible to mammalian predators and large-scale clearing of forest is no longer occurring in the ranges, however other direct and indirect effects may be operating, e.g. predation, competition, disturbance and inbreeding.

13.3 Monitoring

Some monitoring of Waitakere long-tailed bats has been carried out – in 1998[10] and 1999-2001 by Simon Chapman who monitored bats at the Cascade Kauri Park (Alexander and Chapman, 2006).

13.4 Restoration options

Short-tailed bats could be translocated to the Ark. A translocation of short-tailed bats has been carried out to Kapiti Island. Short-tail bats would be a longer-term candidate for translocation to the Ark in the Park but the progress of the Kapiti Island and any other intervening transfers will inform the process of reintroduction of this species.

13.5 Recommended actions

Support, as appropriate, long-term monitoring of long-tailed bats in the Ark area and support for wider Waitakere studies.

14 Restoration of amphibian species

14.1 Original amphibian community

Prior to the impacts of human colonisation, New Zealand had 7 amphibian species, all of which were frogs from the genus Leiopelma. Four of these, Hochstetter's frog (*L. hochstetteri)*, Archey's frog (*L. archeyi),* Hamilton's frog (*L. hamiltoni*), and *L. markhami* are assumed to have been present in the Waitakere Ranges. These species were likely to be abundant and played important ecological roles as regulators of invertebrate populations and as food for a variety of taxa including reptiles, birds, and bats.

14.2 Current situation

Amphibians are suffering from extinctions, range contractions, and population declines on a global scale. New Zealand is no exception with 3 of the 7 known species extinct and the remaining 4 classified as threatened. This loss of biodiversity is largely attributed to predation from introduced mammalian predators such as rodents and mustelids but habitat alteration also plays a major role.

At present only Hochstetter's frog remains in the Park and while the Waitakere Ranges serve as a stronghold for this threatened species, numbers are likely to be well below carrying capacity. Interestingly, numbers are currently much lower within the Ark in the Park compared to relative abundance in adjacent areas. The reason for this is unclear but could be due to differences in habitat quality, historic mammalian predator densities, or anthropogenic disturbance.

14.3 Monitoring

Regular updating of monitoring, based on EcoQuest amphibian monitoring in the Ark in the Park area, will be considered, as appropriate.

14.4 Restoration options

Preliminary evidence from work in the Hunua Ranges suggests that Hochstetter's frog populations in Ark in the Park are likely to increase in response to pest-control efforts. It may also be possible to reintroduce Archey's Frog (a terrestrial and more threatened species) in the

[10] Alexander, J. L. 2001. Ecology of long-tailed bats *Chalinolobus tuberculatus* (Forster, 1844) in the Waitakere Ranges: Implications for monitoring. Unpublished MApplSc thesis. Lincoln University, Canterbury.

future, though translocation priorities for this species are focused on large predator free offshore islands (e.g. Little Barrier).

14.5 Recommended actions

Monitor the spatial and temporal extent of the Hochstetter's frog population inside and outside the Ark in the Park site.

15 Restoration of freshwater species

15.1 Original freshwater community

More information is required about the original freshwater community in the area prior to logging.

15.2 Current situation

There is a variety of freshwater invertebrates (mayflies, stoneflies, caddis flies, Dobson flies, beetles, true flies and molluscs) associated with the waterways in the area due to the Ark in the Park site being part of the Watercare catchment for Auckland's water supply. Koura, inanga, banded kokopu and koaro, short finned and long finned eels, Cran's, common and red-finned bullies, torrentfish, lamprey and common smelt are present in the freshwater ecosystems in the area (Harvey and Harvey, 2006). The Waitakere River wetlands downstream are the largest remaining freshwater wetlands in the Auckland region and the endangered giant kokopu has been recorded there (C McCullough pers com.).

15.3 Monitoring

ARC has a long-term freshwater monitoring site in the Cascade Stream, that includes water quality and the freshwater community. Watercare have also monitored the state of the Waitakere river for its reservoir consents.

15.4 Restoration options

There are currently no plans for active restoration of these systems however it is assumed that general ecosystem health, from the actions of the project, is likely to benefit these systems.

15.5 Recommended actions

Opportunities to monitor, research or restore these ecosystems will be considered where appropriate.

16 Pest management – fauna

16.1 Introduction

The Ark in the Park project follows in the footsteps of the initial 6 mainland-restoration projects initiated during 1995 and 1996 by DoC. Its success to date owes much to the methods of pest control trialled in these projects (Saunders 2000).

As the Ark in the Park project is not a suitable site for using a predator exclusion fence[11], it will continually be invaded and reinvaded by pest species. Ongoing vigilance and intensive predator control will serve to mitigate this challenge.

[11] Predator exclusion fences are used by many mainland island restoration projects. Ark in the Park has always intended to extend the area of predator control making the use of a perimeter fence incompatible. Erecting a fence in the Waitakere Ranges environment may not be appropriate considering the terrain and the costs, hence no perimeter predator proof fences are proposed for the project in the term of this plan. Ark in the Park will be a

In general the project will continue to evaluate existing and new methods, baits and technologies in order to minimise the use of toxins, while maintaining effective and efficient protection against pests. Minimisation trials will be supported as appropriate (E.g. bait effectiveness trial initiated in November 2009) and implementation will be kept under review

Rats, possums and mustelids are the priority species targeted. Mice are difficult to control in a mainland island sanctuary site, although further research may resolve this issue in the future. The Waitakere Ranges are currently free of deer and goats. The other species listed below are either part of the programme with less priority or require further research.

16.2 Pest species

16.2.1 Rats

Impacts
Since their arrival in New Zealand, Ship (*Rattus rattus*) and Norway (*Rattus norvegicus*) rats have been implicated in the decline of numerous native flora and fauna. They have a varied diet that includes large quantities of native seeds either from the ground or straight from the tree (in the case of Ship rats), which impacts on species diversity and regeneration. Rats also eat native bird eggs, nestlings, invertebrates, native snails, frogs and lizards (ARC 2007).

Priority
High

Control
Controlling Ship and Norway rats to low levels (below 5% rat tracking indices) is the focus of predator control in the Ark in the Park. To date this has been achieved with "year-round" availability of brodifacoum baits ("Pest Off") in Philproof bait stations on gridlines spaced at 100 x 50m throughout the managed area. As at April 2008, 2035 bait stations have been placed in the Ark in the Park project area. Baits, provided by ARC, are contained in 150g doses in sealed plastic bags, keeping bait fresh for longer. The project's aim is to reduce rat numbers to under a 5 percent index over the period September to February (the breeding season of many of our native species). Comparable, unmanaged areas in the Waitakere Ranges typically have a 70-80 rat tracking index. Bait uptake estimates at each bait station are recorded. This information is used to guide bait distribution.

Our experience using this "bagged bait" technique is that less and less bait per hectare is being used over time, as rat numbers are reduced, particularly in the core of the area. For example, in the existing Ark in the Park area, in 2003 approximately 1200g per bait station was used, and in 2006 only 450g - 600g per bait stations was required while by 2008 many baitstations were using only 300g - 450g per bait station per season. However, more bait is required on the "perimeter" of the area where rat "invasion" occurs, and in newly baited areas.

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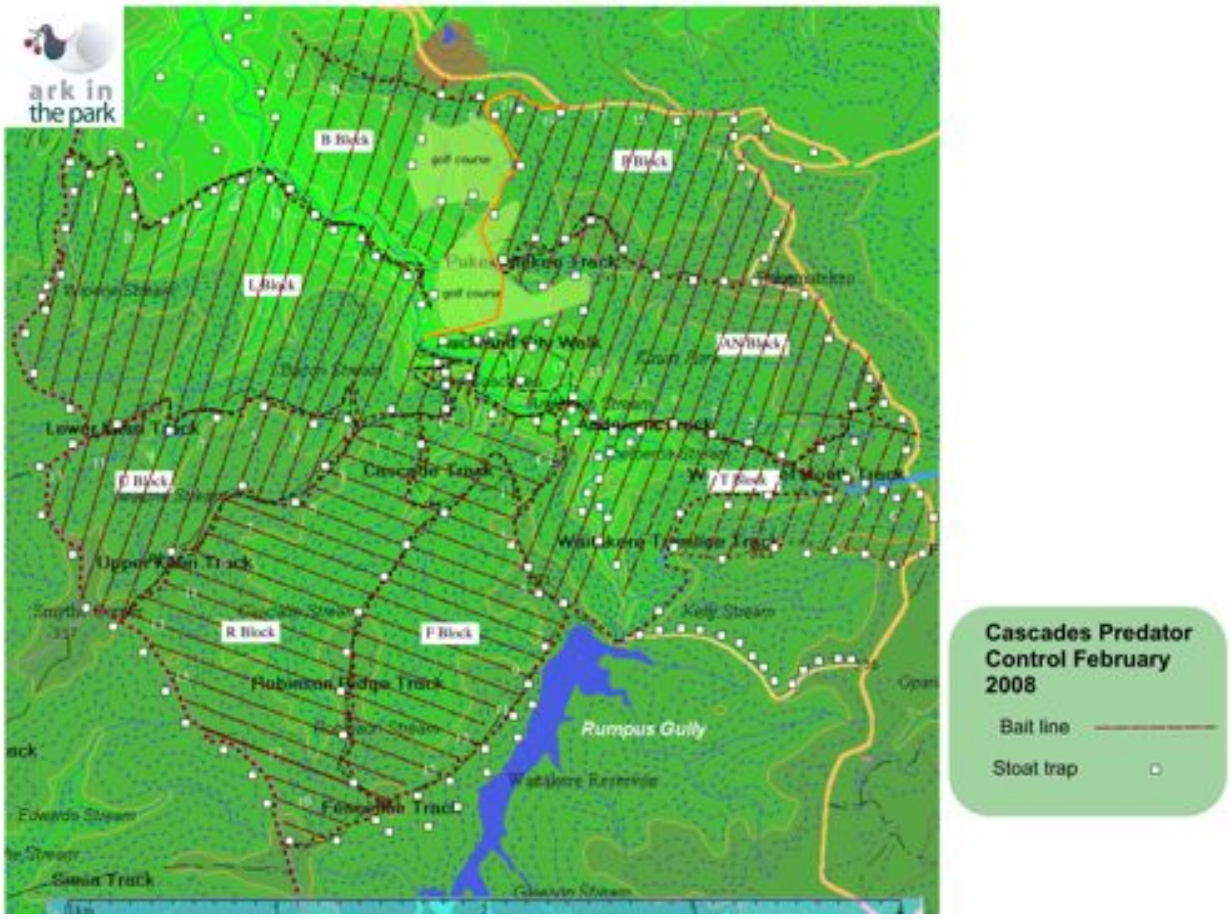
mainland island where pest control will be ongoing, will follow current ARC/DoC best practise, and will be consistent with the Auckland Regional Pest Management Strategy. Predator control will be based predominantly on the use of a control grid

The project will continue to evaluate existing and new baits, methods and technologies in an ongoing attempt to minimise the use of toxins while maintaining effective and efficient protection.

Figure 2 Current management area as at June 2008 – bait lines and mustelid traps

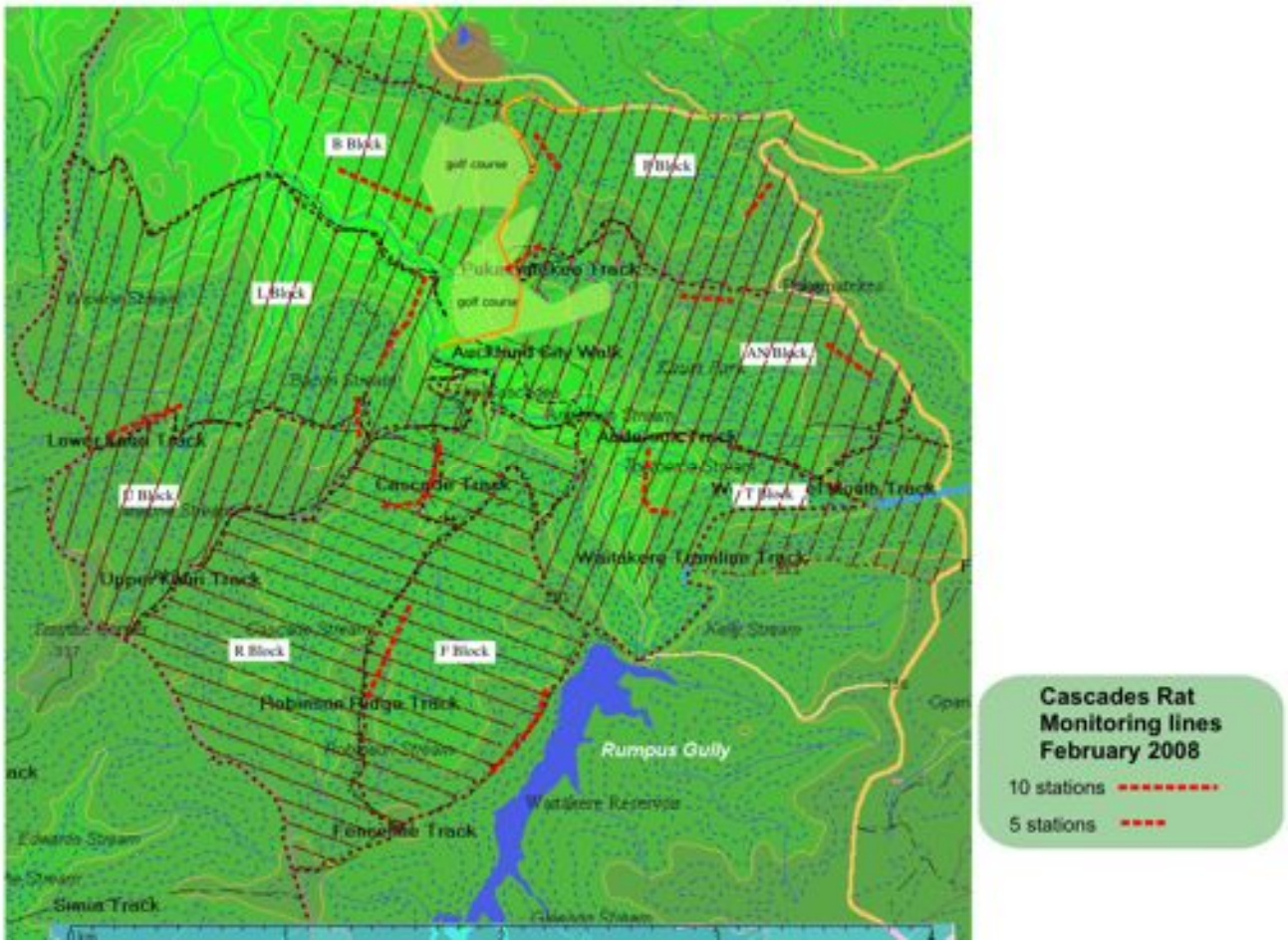


Monitoring

Tracking tunnels are used to monitor rodent numbers, following standard DoC protocols. All markings (rat, mouse and invertebrate "prints") on the paper are assessed and recorded, including their abundance. There are currently 105 tunnels spread over 13 sites throughout approximately 1100 ha and an additional 20 tunnels in non-managed sites. Additional sites of non-managed tunnels set up by other Waitakere Ranges projects are utilised to provide a statistically robust comparison.

Additional information on rodent density patterns occurs through the incidental trapping of rats in the mustelid trap network. Although the majority of such bycatch occurs at perimeter sites and may be taken as re-invasion from adjacent non-managed areas, some rats are caught in interior traps.

Figure 3 Rodent monitoring lines as at April 2008



Non-target effects

The non-target effects of second-generation anti-coagulants such as brodifacoum are well documented. Primary poisoning is likely to only affect non-target species capable of accessing the baits contained in bait stations, e.g. weka (locally extinct) and pukeko (not found in forest areas where the majority of bait stations are deployed). Invertebrates such as weta, beetles (Coleoptera), cockroaches etc also feed on the bait but are unlikely to be poisoned. However, they may pose a risk to species, which eat them (see below) (Eason & Wickstrom 2001).

Secondary poisoning from brodifacoum is far greater than from first-generation anticoagulants, which are more substantially metabolised and excreted before death. Beneficial secondary poisoning of pests such as mustelids and cats is likely to occur but cannot be measured. Birds are vulnerable when rats (and mice) are a major component of their diet (e.g. morepork, Australasian harriers, falcon etc). Secondary poisoning via invertebrates is possible but has not been widely reported. This would also potentially affect insectivorous birds, skinks, lizards and geckos (Eason & Wickstrom 2001).

To assess the secondary poisoning threat to resident morepork, the project has conducted a morepork population study both in the managed area and adjacent non-managed areas. Numbers were found to be higher inside the managed area, indicating

that there seems to be no adverse impact on morepork populations (Fraser & Hauber 2008). Ongoing monitoring will be undertaken.

The Ark in the Park pest control uses bait in measured amounts sealed in plastic bags, reducing accessibility to non-target species and minimising soil contamination from spillage. Rodents and possums have no problem accessing the bait through the plastic bags. Rats may drop bait or cache it underground, potentially adding to the risk of soil contamination.

Brodifacoum is most unlikely to be found in water, as it is not readily soluble, instead binding strongly to organic matter. This would require erosion of the soil itself into waterways or leaching. Even then the brodifacoum would settle out in the sediment and degrade (Eason and Wickstrom, 2001). Recent research by Paul Craddock (2004) suggests that brodifacoum does not bio-accumulate and does degrade over time.

Any changes to the baiting procedure or type of bait used will be as recommended and supplied by the ARC.

16.2.2 Brushtail possums

Impacts
Possums are one of the most damaging pests in New Zealand. Not only do possums have a huge impact on indigenous fauna but they also eat eggs, nestlings and adults of native bird species such as kokako, kiwi, ruru (morepork), fantail and kereru/kukupa (NZ pigeon). Possums also impact on invertebrates including native snails. Possums are also the main vectors for bovine tuberculosis.

Priority
High

Control
Currently possum levels are at less than 1% RTC in the Ark in the Park project area and this is being maintained by the project's bait control programme. The Ark in the Park project area benefits from the initial ARC Operation Forest Save possum control programme carried out from 1997 to 1999. Follow-up control is now carried out in targeted areas throughout the Ranges by the ARC.

Bags of bait are sometimes completely removed from bait stations, indicating possum activity. We have begun to collect and analyse this data along with the amount of bait taken in all our bait stations. This will help us identify "possum (and rat) hotspots" which can then be targeted to maintain possum levels to below 2% RTC.

Non-target effects
See Rat section above.

Monitoring
The ARC continues to monitor possum numbers across the Waitakere Ranges using the national protocol of leg hold trapping (RTC method).

16.2.3 Mustelids

Impacts
Stoats (*Mustela erminea*) and the less common weasels (*Mustela nivalis vulgaris*) and ferrets (*Mustela furo*) are all targeted by the Ark in the Park pest-control programme. The impacts of these species have been and continue to be devastating to native bird life and other fauna. Stoats have devastated kiwi populations by killing vulnerable juveniles. They also predate kaka and kokako (particularly eggs, chicks and nesting females as stoats are good climbers) along with other native birds, lizards, frogs and large native invertebrates. Weasels have a similar impact but on a smaller scale – i.e. smaller prey such as mice, insects and lizards. Ferrets also eat small mammals and birds, as well as eggs, lizards, frogs, eels and various invertebrates.

Priority
High

Control
Mustelid control is achieved with the use of either Fenn or DOC 200 traps enclosed within tunnels. Traps are placed at approximately 200 m spacings along the existing ARC track network to facilitate the frequent checking/clearing required. The project aims to have the managed area encircled by traps at all times, with additional trap lines running through the interior. A stoat dog, belonging to one of the volunteers, is also being trained to supplement the trapping.

As at April 2008, there are 196 traps deployed. Maintenance of traps is responsive to seasonal flushes in mustelids numbers i.e. more frequently checked in summer and warmer periods.

Non-target effects
Commonly the only non-target species also caught in mustelid traps are both Ship and Norway rats and hedgehogs, which are also pest species. However a female hihi (stitchbird) was caught and killed in a DoC 200 trap in July 2007. The bird had been resident in the core area of the park for a few months. It is thought she may have been investigating the trap box as a potential nest/roosting site.

Monitoring
Trap catches are currently our only method of monitoring mustelids. Tracking tunnels may be investigated as another monitoring option.

16.2.4 Feral pigs

Impacts
Feral pigs are present in the project area. They destroy native bush by disturbing the ground, eating roots and other native plant matter, as well as invertebrates such as earthworms and native snails. This possibly affects long-term ecosystem processes (nutrient cycles and plant species composition) (King 2005). Pigs also eat frogs and lizards (Baber et al, 2006) and ground-nesting birds and their eggs (King 2005).

Priority
High

Control

Currently available control methods of hunting restrict the capacity of Ark in the Park members to carry out any control. The ARC has contractors and staff who undertake control; however feral pigs are still present in the area. Signs of feral pig activity and occasional live sightings are reported by Ark in the Park volunteers to the ARC.
Ark in the Park is happy to undertake poisoning for feral pigs should any appropriate toxin become available.

Non-target effects
Hunters are unable to eat pig meat where the animal has been exposed to brodifacoum. Only ARC contracted hunters are allowed to hunt for pigs in the Waitakere Ranges but there is a risk to illegal hunters.

Monitoring
Other than via reports by the public and our volunteers, pig numbers are not currently formally monitored. Any formal monitoring would be carried out by the ARC.

16.2.5 Feral cats

Impacts
Feral cats are widely distributed throughout the Waitakere Ranges and can live in pasture, scrub and native forest (ARC 2007). They eat a range of animals including rabbits, rats, mice and mustelids, as well as native birds (e.g. juvenile kiwi) bats, lizards and invertebrates (King 2005).

Priority
High

Control
Some cat control started in 2004, focusing on the private land buffer to the north of the project area using cage type live capture traps. On average 5 - 9 cats are captured each year. Funding from the DOC Biodiversity fund has enabled project volunteers to visit adjacent landowners to advise of the presence of rat toxins in the managed area and the possibility of secondary poison if cats stray, and to offer free ID collars. With advice from Auckland area DoC staff, the project intends to deploy a number of “Conibear” kill traps in the interior of the park. These will be deployed in a way that meets NAWAC (National Animal Welfare Committee) draft criteria for humane killing of cats.

Non-target effects
All cats caught in live traps with collars are returned to owners where possible. “Conibear” traps will only be deployed in the interior of the forest and neighbours will be notified.

Monitoring
Cats are not currently monitored. As appropriate, options to monitor feral cat presence in the Ark in the Park area may be considered.

16.2.6 Dogs

Impacts
Dogs are a significant threat to ground-nesting birds (kiwi, weka) and could potentially harm curious birds such as the North Island robin. Recently fledged kaka chicks may also be at risk (nesting kaka have yet to be detected but this may be occurring or may happen in the near future).

Dogs are currently allowed into the Cascade Kauri Park with visitors, provided they are kept on a lead. Unfortunately this park rule is not always followed and a significant number of dogs are seen walking freely in the park by Ark in the Park volunteers. Illegal hunting of pigs in the area also means that dogs are 'off track' and away from the supervision of their owners.

Priority
High

Control
Dog control is an on-going problem as the ARC is currently unable to adequately enforce their 'dogs on a lead' policy. Signs/interpretation are important tools and Ark in the Park is currently using these to help educate dog owners of the importance of controlling their animal. Uncontrolled dogs may be at risk from eating bait, interfering with traps or from secondary poisoning if eating possum or rat carcasses. The Technical Advisory Group has recommended that a dog-free park be pursued as soon as is practicable.

Non-target effects
Nil

Monitoring
Ark in the Park volunteers report dogs off leads to ARC staff where practicable. The web-mapping programme may provide an additional tool to record sightings of dogs off leads. Formal monitoring and the ability for Park rangers to patrol the park and issue infringement notices would be supported by the Ark in the Park project.

16.2.7 Wasps

Impacts
Wasps are a significant pest reaching high numbers in mid-late summer. They impact on the diversity and density of native invertebrates and are also a risk for volunteers, often affecting our ability to service bait stations at this time.

Priority
High

Control
Wasp nests found are treated with Permex where possible; however due to the large number of nests in the area, this method does not give effective overall control. A "one-off" wasp control programme was carried out in March 2006 using "Xtinguish", a protein-based wasp bait containing the active ingredient Fipronil. Wasp bait stations have been placed above existing rat bait stations resulting in a 100 x 50m grid in the

core area (250 ha). No pre or post-baiting surveys were carried out so the effectiveness of the bait was not scientifically measured. However bait was noticed to be highly attractive to wasps. The project would be interested in using any effective bait that becomes commercially available. We would anticipate using the bait annually to control wasp numbers.

Non-target effects
Permex - this is a residual insecticide toxic to bees and fish. Wasp nests will be treated with 40g of powder sprinkled or blown into nest entrances using an appropriate applicator (supplied by the ARC). Care will be taken to ensure that no excess powder washes into waterways. Only wasp nest sites will be treated. All volunteers using Permex will follow the label instructions regarding safety precautions for users.

Monitoring
In December 2005 and January 2006, 6 flight intercept traps were installed under the initial supervision of Jacqueline Beggs, University of Auckland. These consisted of 2 clear perspex rectangles set at right angles with a cover on top and funnel below leading into a container of glycol. These were set up to catch flying invertebrates in an attempt to indicate wasp numbers and assess increases over the period. Three were set up within the area which in February 2005 had wasp bait (Xtinguish) placed in bait stations attached in a 100 x 50m grid. Three were set up outside this area. From initial observations very few wasps were caught in the 4 separate monthly collections so it was not useful as an indicator, probably due to the small number of traps.

16.2.8 Sulphur-crested cockatoo

Impacts
Sulphur-crested Cockatoos occur in the project area as a flock of approximately 25-35 birds. The project is primarily concerned at the impact on native vegetation regeneration and niche overlap/competition with visiting kaka. To date, there is no available research on the impact of sulphur-crested cockatoos on native bird populations, but kaka appear to avoid areas where there are high cockatoo numbers in the Cascades.

Priority
Medium - High

Control
Under the proposed ARC Regional Pest Management Strategy (RPMS) 2007-2012 cockatoos are classified as pests, allowing selective control of wild populations. The Ark in the Park project will consult with the ARC regarding the control of the Cascade Kauri population to facilitate kaka reintroduction/translocation.

Non-target effects
This will be addressed in the planning of any proposed eradication programme.

Monitoring
Sulphur-crested cockatoos are not currently monitored.

16.2.9 Rabbits

Impacts
Rabbit numbers are often high on the Waitakere Golf Course and Pae o te Rangi farm area. Rabbits are a potential attractant to mustelids and feral cats and their presence may limit the effectiveness of baited traps in the area.

Priority
High

Control
The Ark in the Park will work with ARC and Waitakere Golf Club staff to reduce rabbit numbers with the aim of achieving 'zero density'. Control attempts to date have used Pindone in bait stations that limit access by birds and shooting. Work is continuing in 2008 to reduce the rabbit population.

Non-target effects
No systematic studies have been conducted to monitor the non-target impact of Pindone bait. Anecdotal evidence from the control operations to date suggests that rats and mice have suffered non-target fatalities.

Monitoring
Rabbits will be monitored by ARC to ensure appropriate levels of control are achieved.

16.2.10 Mice

Impacts
Mice eat both plant and animal matter and are prolific breeders. They compete with native species for food sources and eat rimu and kauri seed, which in turn could affect regeneration. They also prey on native insects (such as weta, beetles and moths), lizards and other fauna. Mice can eat small eggs and nestlings, but are seldom associated with nest predation (King 2005). An increase in mouse number accompanied the decrease in rat numbers until mid 07 when mouse numbers also dropped to low levels. Achievement of very low mouse population densities is currently not feasible in non-fenced "mainland island" sanctuaries. For some of the translocations proposed, such as macro-invertebrates and skinks (see Appendix D) new management tools will have to be developed and trialled.

Priority
Medium (there is currently no effective control method available).

Control
Brodifacoum bait provided primarily for rat and possum control also kills mice.

A small area (25-30 ha) along the Whatitiri Track has increased pest control (bait stations at 50m x 50m grid baited at the same time as the rest of the Ark in the Park site). The area was started in mid 2006, and a set of 10 monitoring tunnels established. The most recent monitoring result showed no mice prints. This area has been chosen because of its value as a site for gecko monitoring and potential site for rescue translocations.

Non-target effects
See Rat section above.

Monitoring
Mice presence is monitored via the rat monitoring programme, which is carried out according to DoC best practice (see 16.4.1 above).

16.2.11 Hedgehogs

Impact
Hedgehogs are mainly insectivorous but they also prey on mice, lizards, frogs, and the eggs and chicks of ground nesting birds. Hedgehogs pose a potentially serious threat to indigenous invertebrates and may compete for food with native species, e.g. kiwi.

Priority
Medium

Control
Although no targeted control is carried out, hedgehogs are regularly caught in mustelid traps on or adjacent to grassed areas. Control options can be revisited if appropriate (e.g. depending on further information, Technical Advisory Group recommendations, etc).

Non-target effects
Refer to Mustelid section.

Monitoring
Hedgehogs are not currently monitored.

16.2.12 Eastern Rosella

Impact
Rosellas are present in the project area. Further research is needed on the impacts of the Eastern rosella in regards to native vegetation regeneration, niche overlap/competition with kakariki and with other endemic fauna, particularly in relation to its aggressive behaviour (Wright and Clout, 2001).

Priority
Medium

Control
Rosella are not currently controlled in the Ark in the Park, but this may be revisited as appropriate in the future, in conjunction with translocations of kakariki and other cavity nesters to the Ark in the Park. Further information and/or research would l be required including recommendations for control methods.

Non-target effects
Nil

Monitoring
Eastern rosellas are monitored with other bird species.

16.2.13 Magpies & Mynahs

These species are recognised as potential pests in the Ark in the Park area. While there are no current plans to monitor or control them, this may be revisited as appropriate in future (depending on further information, Technical Advisory Group recommendations, etc).

16.2.14 Rainbow skink

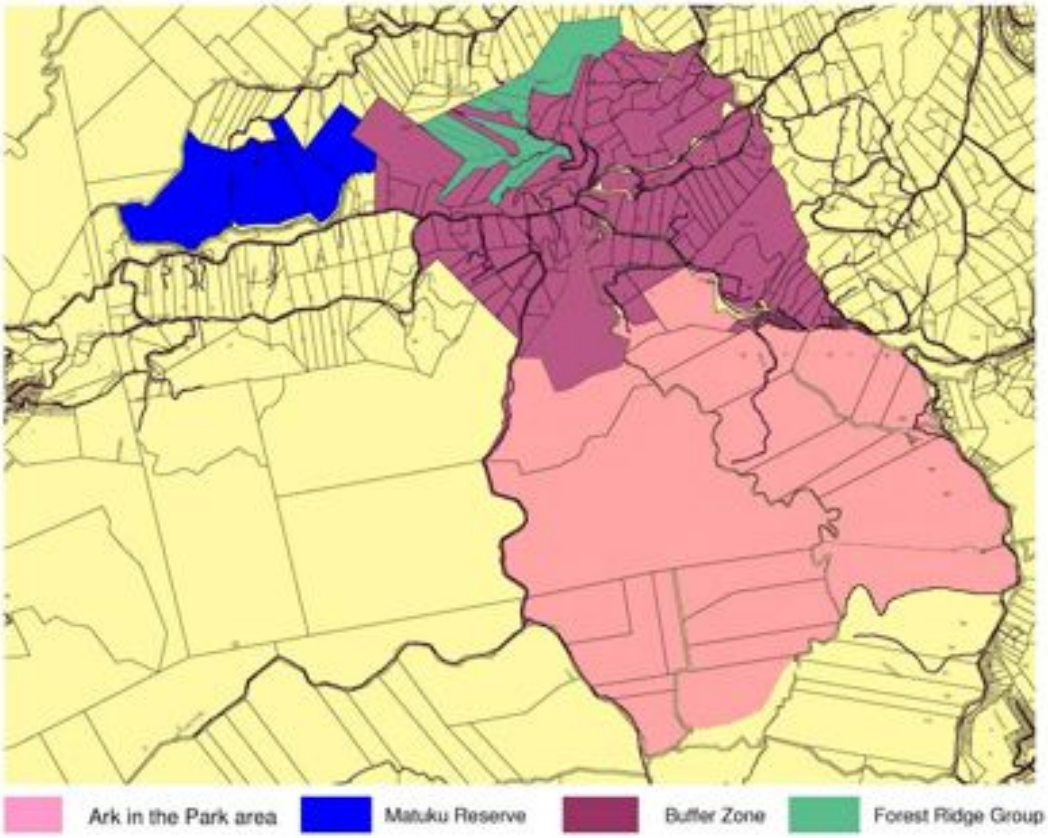
Rainbow skink are recognised as a potential pest in the Ark in the Park area. There is currently no targeted monitoring for this species, but they are found during the ongoing monitoring for native reptiles (see section 12.3). As appropriate (depending on further information, Technical Advisory Group recommendations, etc). Control options may be considered in future.

16.3 Ark in the Park Buffer Zone

Continued support from neighbours in the Ark in the Park's original Buffer Zone (Te Henga, Aio Wira, Bethells, & Long Roads, Steamhauler Track and Stoney Creek) is being harnessed to create groups of adjoining properties and provide them with predator control expertise and traps, bait and bait stations etc. This work involves both Ark in the Park and the ARC. An example of the success of this venture is an area of over 120 ha in the Forest Ridge estate between the northwest corner of the Ark in the Park and the eastern corner of Forest & Bird's Matuku Reserve. This enhanced wildlife corridor, will soon link Ark in the Park with Forest and Bird's Matuku reserve in Jonkers Rd.

Pest management hardware is supplied by Forest & Bird (with funding from the Government's Biodiversity Advice & Condition Fund); bait is supplied by the ARC and pre-bagged by Ark volunteers. There is potential for the buffer zone area to grow, provided this can be sustained by both the project and the ARC.

Figure 4 Ark in the Park's Buffer Zone



17 Pest management – flora (weed management)

17.1 Introduction

The project aims for ecological restoration and the "elimination or reduction in numbers of introduced weeds" - KPI 1 from Strategic Plan (2002). To achieve this, the project will assist with weed control in accordance with each annual weed plan prepared in consultation with the ARC. The ARC undertakes weed control in the park as part of their usual Biosecurity operations.

17.2 Pest Species

The ARC's current weed programme focuses on plants present in smaller numbers and those that can be feasibly eradicated. Visitor arrival areas are also targeted with the intention of removing all weeds.

Species currently targeted across the Ark area by ARC are –

Moth plant (*Araujia hortorum*)
Eleagnus (*Eleagnus x reflexa*)
Arundo (*Arundo donax*)
Banana passionfruit (*Passiflora tripartita var. mollissima, P. mixta & P. tarminiana*)
Jasmine (*Jasminum polyanthum*)
Blue morning glory (*Ipomoea indica*)
Himalayan honeysuckle (*Leycesteria formosa*)
Cherry laurel (*Prunus laurocerasus*)
Periwinkle (*Vinca major*)
Chinese privet (*Ligustrum sinense*)
Formosen lily (*Lilium formosanum*)
Monkey apple (*Acmena smithii*)
Willow (*Salix fragilis*)
German Ivy (*Senecio mikanioides*)
Agapanthus (*Agapanthus praecox*)

Species currently targeted at particular sites to reduce their seed source are –

Blackberry (*Rubus fruticosus*) (site)
Climbing dock (*Rumex sagittatus*)
Ginger (*Hedychium gardnerianum & H. flavescens*) (site)
Gorse (*Ulex spp*) (site)
Tradescantia (*Tradescantia fluminensis)*
Woolly nightshade (*Solanum mauritianum*) (site)

Impacts

Weeds have a variety of negative impacts on native ecosystems such as native seedling suppression, smothering of the canopy, displacement of native species, alteration of soil nutrient levels and impeding waterways. The weed species of most concern in a forest habitat are weeds that are climbers, or those that can tolerate shady conditions under the canopy enabling them to become established. On forest margins weeds that form dense masses and suppress regeneration or displace native species are a problem. Disturbed habitats are prone to invasion by weeds that are quick growing and prolific seeders.

Priority
High

Control
The Ark in the Park project will support the ARC's weed programme and supplement it where possible. An annual weed control plan is prepared in consultation with the ARC, and efforts are focused on areas that are easily accessed by volunteers, and/or requiring non specialist skills. The project will use ARC's best-practice control methods in the annual weed plan. ARC will provide training of selected volunteers and supply all chemicals used, but the project will need to supply all applicators and safety equipment for volunteers. Any chemical application will only be undertaken by people with the appropriate training, i.e. Growsafe certificate.

Areas targeted to date are the golf course perimeter, Falls Road, Whatitiri track and the temporary aviary site. Species targeted are -
Bamboo *(various genus)*
Banana passionfruit (*Passiflora tripartita var. mollissima, P. mixta & P. tarminiana*)
Jasmine (*Jasminum polyanthum*)
Tradescantia (*Tradescantia fluminensis*)
Woolly nightshade *(Solanum mauritianum)*

Some interior forest sites have also been targeted for ginger (*Hedychium gardnerianum* which is seen as one the most significant weed threats to the flora ecology.

Subsequent weed control in the mid to long-term will focus on site-led control projects at areas identified as significant by the ARC.

Monitoring
Success of weed control projects will be assessed by ARC staff quarterly. Any adjustments to the programme or methods used will be made as required. Weed control is a long term commitment and eradication is often not possible if a seed source exists in the area. Control programmes therefore focus on eliminating local seed sources, controlling out-lying satellite weed populations and working towards the parent population and creating a buffer zone around areas of high conservation value. Prevention of establishment by new species is also a priority.

Due to the large amount of off-track area covered by volunteers, members of the project will assist the ARC when possible with identification of new weed infestations and monitoring the spread of existing weed species/sites.

In addition, sightings of weed infestations can be recorded on the new Ark in the Park web-mapping programme which allows both volunteers and general visitors to indicate the area and other information (species and number of plants/area covered) with their sighting via the internet.

Non target effects
Environment – there is a possibility of non-target effects when using herbicides. The project aims to minimise any effects by using best practice control methods as detailed in the ARC's pest plant manual www.arc.govt.nz/plantsearch. Ark in the Park members who undertake weed control using herbicides will have either completed a "Growsafe" certificated course, had a 'Vigilant' use workshop with Parks staff, or will be under the supervision of a Growsafe certified person. All herbicides applied will be recorded in a spray register. To minimise disturbance to other plant species in the vicinity, control methods using the least disturbance will be used where possible.

Human health – Ark in the Park members undertaking weed control using herbicides will be trained or under the supervision of a trained applicator (as above). All appropriate safety gear will be supplied by the project and volunteers will follow all label safety recommendations regarding individual herbicide use to minimise any effects on human health.

18 Pest Management - *Phytophthora* taxon Agathis (PTA)

18.1 Introduction

Phytophthora taxon Agathis **(**PTA) is believed to be a soil-borne species spread by soil and soil water movement, plant to plant transmission through underground root-to-root contact, and human and animal vectors. There are significant information gaps about the disease, its vectors and management options. The disease has been found in the Waitakere Ranges and is under observation at Cascade Kauri, Karekare, Anawhata and Huia.

18.2 Pest species: *Phytophthora* taxon Agathis

Kauri dieback is caused by a pathogen (a disease-causing agent) known as Phytophthora taxon Agathis (PTA). Until April 2008 it had not been identified as a new species, nor was it known that PTA killed kauri.

Impact
PTA kills kauri of all ages and sizes. Symptoms include yellowing of foliage, canopy thinning, dead branches and tree death. Affected trees can also develop lesions that bleed resin.

Priority
High

Control
ARC has developed an operating procedure for its staff and contractors working in kauri forest. Ark in the Park volunteers and contractors will adhere to ARC requirements, recommendations and operating procedures (Cleaning shoes and any other equipment that comes into contact with soil, etc).

Liaising and cooperation with ARC will be ongoing.

Monitoring
Due to the large amount of off-track area covered by volunteers or contractors, members of the project will assist ARC, as possible, with identification of new cases. Liaising and cooperation with ARC will be ongoing.

19 Acknowledgements

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Forest and Bird: John Sumich (Chair, Ark in the Park committee), Mark Bellingham (North Island Conservation Manager), Sandra Jack and Maj De Poorter (former and present Project Manager, Ark in the Park), Karen Colgan (Ark in the Park Volunteer Co-ordinator), Maurice Colgan, John Staniland (Chair, Waitakere Branch), Troy Makan (ex-Central North Island Field Officer);
Auckland Regional Council: Rosalie Stamp (Natural Heritage Scientist), Su Sinclair (Biosecurity Community Co-ordinator), Miranda Bennett (Biosecurity Officer), Graham Ussher (ex-Natural Heritage Scientist), Matt Baber (Natural Heritage Scientist);

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21 Glossary

Brodifacoum	Brodifacoum is a lethal anticoagulant poison used as a pesticide
Extirpation	Extinction of a species within a localised area
Fauna	The animals of a particular region, habitat or geological period
Flora	The plants of a particular region, habitat or geological period
Reintroduction	Reintroducing new a population of a species into an area from which it has become locally extinct, i.e. extirpated
Restoration	Restoration is defined in this strategy as the enhancement of biodiversity and ecosystem functioning to resemble a state prior to European colonisation and disturbance from logging and farming
Substrate	Material on which sedentary organisms live
Translocation	The processes involved in preparing and moving individuals of a certain species from one site to another, whether populations already exist at the destination site or not

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Appendix A: Project history

The beginnings

The genesis of the Ark in the Park concept came from meetings in early 1999 between Waitakere branch members of Royal Forest & Bird Protection Society (Forest & Bird) and Waitakere Ranges Protection Society members. A steering committee was set up in May 1999 to develop the concept and to consider options for restoration in the Ranges. This included the establishment of an "open sanctuary", where, with increased pest/predator control and targeted weed control, the ecology of the Ranges could be restored and species reintroduced that were historically "lost" from this system. In discussions with the ARC and others, the concept of "The Ark in the Park" within the regional parkland was developed.

Fourteen sites were evaluated and three of these were short-listed. The site at the Cascades Kauri Park was selected in 2000 as the priority site for restoration for a number of reasons. It had an intact forest remnant, a range of ecosystems and good access via tracks and roads. Good access made it both feasible and practical to carry out pest control, and therefore low predator numbers would facilitate successful reintroductions.

Since 2003

In 2003, Forest & Bird carried out predator control in a 250 ha pilot area around Pukematekeo, in the north-eastern Waitakere Ranges. Volunteers controlled rodents, possums, and mustelids (stoats, weasels and ferrets). Rodent monitoring was started at this time to compare the effects of integrated pest control with uncontrolled areas in the parkland. In 2004, the area of pest control began to be expanded to cover 1100 ha of the Waitakere River catchment, downstream of the Waitakere Reservoir. In August 2004, whiteheads were reintroduced from Tiritiri Matangi, which have now bred in the Ark in the Park and dispersed throughout the Waitakere Ranges. This was followed with a robin translocation in April 2005 and a hihi (stitchbird) translocation in April and June 2007. All three of these species had been absent from the Waitakere Ranges since the 1880s.

Predator control has rapidly expanded to include a buffer zone (See 16.3 Ark in the Park Buffer Zone) of approximately 2000 ha of neighbouring properties in the lower Waitakere Valley surrounding the project area, of which 50 percent has effective predator control for mustelids and a lesser proportion with rodent control. The Ark in the Park project in association with ARC Biosecurity staff have assisted with predator control on about 50 percent of these properties, providing a wildlife corridor between the Ark in the Park and Forest & Bird's Matuku Reserve. Tomtits have spread from the parkland through this buffer zone and hihi have been recorded there.

There are also a considerable number of predator-control projects and other restoration work which has been and continues to be carried out in the Waitakere Ranges area by various stakeholders.

Natural characteristics of the Cascade/Kauri Park

The project area was selected in the Waitakere River catchment, and initially consisted of the Cascade Kauri Park and Waitakere Reservoir catchment. The area's former and current conservation significance and importance are described fully in the Waitakere Protected Natural Area Programme Report (Denyer et al.,1993) and Waitakere Ranges (Harvey and Harvey, 2006). Key features for the area's selection include:

- diversity of landform and soils
- diverse and intact forest communities and fauna
- a variety of community systems, e.g. forest, grasslands, shrub and scrublands
- accessibility of the area for management i.e. intensive pest control.

Cultural heritage of the Cascade/Kauri Park

In addition, the area is significant for its Maori and Pakeha history. Te Kawerau a Maki is the tangata whenua of the Waitakere Ranges and their main settlement was at nearby Bethells Beach. Logging of the lower valley was carried out by Pakeha in the late 19th century. In 1925, the area was bought jointly by the Government and the Auckland City Council and designated a reserve. The golf course area was originally farmed. There is historical interpretation associated with the Montana Heritage Trail of Maori and Pakeha occupation and use of the area.

Access to the park

Access to the park, concessions and visitor numbers are determined by the ARC's Parks Management Plan. Any potential impact on these by the Restoration Plan will be addressed through the project's Governance Group, as stated in the group's Memorandum of Understanding. It is not the project's aim to increase access to the park. Signage will be discreet and appropriate.

Appendix B: Statutory planning context

The Ark in the Park restoration project is predominately situated in the Waitakere Ranges Regional Park (Figure 1), and primarily occurs within a Scenic Reserve that is administered by the Auckland Regional Council (ARC). The land is available for use by the general public and the Regional Parks Management Plan (ARC 2004) guides park management. The Waitakere Golf Course lease and the Pae O Te Rangi block are designated as Recreation Reserves.

In the Regional Parks Management Plan, the following objectives set out the ARC's management approach to all parkland in the Auckland Region.

- To protect indigenous habitats and ecosystems on regional parks whilst enabling current and future generations to use and enjoy the parks with priority given to large areas of continuous forest in the Waitakere and Hunua.
- The restoration and enhancement of habitats and ecosystems.
- To protect and enhance indigenous flora and fauna on regional parks.
- To assist in recovery or re-establishment of populations of rare or missing species in suitable habitats.
- To implement management programmes for introduced plant species.
- To reduce the numbers of introduced animals in parks to allow the recovery of indigenous ecosystems.

In particular, the Regional Parks Management Plan states that the management of the Waitakere Ranges Regional Park will focus primarily on maintaining and enhancing the natural heritage features whilst providing a diverse range of recreational activities.

The Ark in the Park Restoration Plan outlines ways that the restoration goal can be achieved, consistent with the objectives and policies for the site described in the ARC Regional Parks Management Plan 2004.

Relevant objectives and policies in the Regional Parks Management Plan

The Auckland Regional Council's Regional Parks Management Plan (ARC 2003) outlines the planning context for the management of regional parks, including the Waitakere Ranges Parkland. The Ark in the Park project assists ARC with achieving the following objectives and policies:

14.2 Community partnerships

14.2.1 Objectives

14.2.1.1 To increase community understanding of, and support for, regional parks through involving individuals and groups in park management.

14.2.1.2 To add value to ARC activities/projects through involvement with individuals, businesses, groups and the public generally.

14.2.1.3 To provide opportunities for volunteers to become involved in park activities as a recreation and leisure activity.

14.2.2 Policies

14.2.2.1 Promote and provide opportunities for individuals, businesses and groups to work in partnership with the ARC on activities that support the objectives and policies in this Plan.

55.1 Park focus

Over the next five years the management of the Waitakere Ranges Regional Park will focus primarily on maintaining and enhancing the natural heritage features whilst providing a diverse range of recreational activities. Specific actions will also be directed at:

- *maintaining an integrated plant and animal control programme to maintain viable habitats for native flora and fauna*
- *providing visitor education services*
- *providing varying levels of infrastructure, including tracks, according to the character of the different areas: very low in the remote wilderness areas such as Lake Wainamu and Pae O Te Rangi; medium in areas such as Cascade-Kauri*
- *managing and protecting the water catchment areas for metropolitan water supply purposes.*

55.2 Management actions

General
1. The Council will consider undertaking ecological enhancement of specific locations in partnership with community and interest groups where the strategy proposed is consistent with the objectives and policies in this Plan.

Relationships
52. Liaise with groups representing …… heritage and environmental interests, including …. the Royal Forest and Bird Protection Society.

Other relevant policies and plans

The Auckland Regional Council's Long Term Council Community Plan (2004) provides for the Ark in the Park project in the Waitakere Ranges parkland. The Department of Conservation's Auckland Conservation Management Strategy (1995-2005) identifies Tiritiri Matangi as a source of threatened species for community restoration projects, but makes no particular reference to where these might be.

Appendix C: Proposed reintroductions and translocations over the next five years

Year	Type	Species	Current Status	Likely source population/s	Management needs to increase likelihood of success
2009	First re-introduction	Kokako	Kokako are locally extinct in the Waitakere ranges.	• Mangatutu (Pureora Forest Park) and Kaharoa Forest Park – as recommended by the Kokako Recovery Group (2007 meeting). • 10 pairs (20 birds) to be released with another 5 pairs (10 birds) in 2009 and possible further translocations depending on dispersal/success. • Re-introduction will need to be approved by DoC and ARC.	• Current predator control of possums and stoats is sufficient for kokako. • Increased area of predator control (into Watercare catchment area) will provide further pest controlled habitat. • Acoustic anchoring will be provided in first 6 weeks following each release. • Use of transmitters for the initial release (and possibly additional releases). • Post release monitoring. • Breeding season monitoring - 2009/10, 2010/11 and 2011/12. • On-line monitoring tool will track sightings in the ranges.
2010-2012	Ongoing "top up" transfers	Kokako	Pairs and single birds would be in the Ark in the Park area from the 2009 translocation.	To be recommended by the Kokako Recovery Group and approved by DoC and ARC.	See above.
2010	Possible 2nd "top up" transfer	North Island Robin	Currently existing in the Ark in the Park project area from translocation of 53 birds in April 2005 from Mokoia Island. Genetic variability would be the main aim of this additional transfer.	• Tiritiri Matangi Island (preferred) or Mokoia Island – or anywhere where the genetic diversity differs from the original transferred birds. • This additional transfer would need to be approved by DoC and ARC.	• Consider transmitters. • Consider provision of a dedicated monitoring person (student, volunteer or paid contractor) following release and during first breeding season. • On-line monitoring tool will track sightings in the ranges.

2010	Possible 3rd "top up" transfer	Hihi (Stitchbird)	Currently existing in small numbers in the Ark in the Park project area from translocations of 59 birds in February and June 2007. and a "top up" translocation of 51 juvenile birds from Tiritiri Matangi Island in May 2008.	• Tiritiri Matangi Island and/or Hauturu/Little Barrier Island. • An additional transfer would be initially recommended by the Hihi Recovery Group, then approved by DoC and ARC.	• Ongoing predator control. • Ongoing provision of supplementary food. • Breeding season monitoring until deemed unnecessary by the Hihi Recovery Group. • On-line monitoring tool will track sightings in the ranges
2011	Possible 3rd top up transfer	Whitehead	Currently existing in small numbers in the Ark in the Park project area from translocation of 55 birds in August 2004 from Tiritiri Matangi Island. And a "top up" translocation of 50 juvenile birds from Tiritiri Matangi Island in April 2008.	• Tiritiri Matangi Island (preferred) or Pureora Forest Park for genetic diversity. • Additional transfers would need to be approved by DoC and ARC.	• Monitoring is currently being planned to try to detect these birds in the Ark in the Park area. • On-line monitoring tool will track sightings in the ranges
2011	Re-introduction	Grey-faced petrel, Cooks petrel, black petrel, mottled petrel, fairy prion (one of these)	Locally extinct	• Pre-planning will require research into source population feasibility and translocation methodology.	• Intensive predator control will be required at the colony site and possibly artificial burrows and sound anchoring. These will be assessed when feasibility investigation and planning is undertaken..

Note that all translocations/re-introductions will require the approval of the Department of Conservation and the Auckland Regional Council. The Ark in the Park project also has a Technical Advisory Group which will have input into the consideration of species for translocation.

Appendix D: Re-introductions and translocations to be considered in the future

Note: Species listed on this appendix may require one or more of the following: Habitat suitability assessment; assessment of the suitability of the sources population(s); availability of translocation/re-introduction technology and resources; prior approval from the Technical Advisory committee for a translocation proposal being prepared (DOC – for protected fauna under the Wildlife Act 1953 or ARC – for other biota not covered by the schedules to the Wildlife Act 1953). Additional species not currently on the list may be considered on a case by case basis by the Technical Advisory Committee.

Category	Species	Explanation	Requirements of note	Supported by
Plants	None			
Invertebrates	Helms' butterfly	Re-introduction	• Wasps are the main threat and until a toxin is available that allows effective control, a Helms' butterfly re-introduction will not be considered. • Before any reintroduction is attempted, surveys will be carried out over a number of seasons to try to determine whether Helms' butterfly is still present in the Ranges and at the Ark in the Park site.	Dr Robert Hoare (Landcare Research)
	Red or Yellow Admiral	Re-introduction	• Effective wasp control required • Further research into the occurrence of Urtica spp. In the Waitakere Ranges	Dr George Gibb
	Copper butterflies (Lycaena salustius)		Survey of available Muelenbeckia australis food source	Dr George Gibb
	Large-bodied insects e.g. Little Barrier weta	Re-introduction	May be considered if surveys reveal local extinction in the Waitakere Ranges and no likelihood of natural re-establishment.	Dr Graeme Ramsey
Birds	Red-crowned parakeet; kakariki	Re-introduction	Possible now, but only practical if predator levels to practically 0%	Luis Ortis Catedral (Massey University)
	Yellow-crowned parakeet; kakariki	Re-introduction	Pre-planning required to source population (probably from captive stock).	
	NI brown kiwi	Re-introduction	Dog control needed	Dr Mick Clout
	Little spotted kiwi		Dog control needed	
	NI rifleman	Re-introduction	Possible now	Dr Mark Hauber (Auckland University)
	Brown teal (pateke)	Re-introduction	Increased predator control into the Waitakere Valley incorporating the support and involvement	Pateke Recovery Group and Ducks

			of landowners and other stakeholders.	Unlimited
	Fernbird*	Translocation from Kaipara estuarine area or "rescue" translocation from scrub areas where habitat is being destroyed.		
	NI kaka*	Supplementary translocations	Need to ascertain if kaka are currently breeding in the ranges. Any transfer would be of captive young to encourage the young kaka to become site bonded and breed in the Ranges.	Auckland Zoo
	NZ falcon	Re-introduction	Only once kokako population is self sustaining.	
	NI weka	Re-introduction from a Gulf Island population	Not until other species predated by weka are established and able to withstand weka predation. Dog control necessary	
	Yellow-crowned parakeet; kakariki	Re-introduction from captive sources	Possible now.	
Reptiles	Auckland green gecko*	Rescue translocation from areas from habitat being destroyed.	Approval of a draft translocation proposal by DoC and ARC before this could be considered.	ARC Heritage
Native Mammals	Short tail bats	Re-introduction	Only once translocation methods are successful elsewhere could this be used in the Ark in the Park site.	
Amphibian species	Hochstetter's' frog	Possible relocation within catchments in the Ark	Only if Hochstetter's' frog do not expand from their range	
	Archey's frog		Translocation priorities for this species are currently focused on large predator free offshore islands (e.g. Little Barrier)	
Freshwater species	None			

*Species with potential for self-colonisation: bellbird, fernbird, kaka.
Species that could be considered in future revisions of the plan: tuatara, saddleback, snipe, SI takahe.

Appendix E: Reintroduction guidelines

These are the kinds of issues and questions that will be investigated further regarding any proposed introduction of a native/endemic species to the Ark in the Park area. They are based on the guidelines outlined in the Department of Conservation permit application but may be considered even where a permit is not required.

- **Rationale/justification**

Does this species fit with our rationale for ecosystem restoration?

- **Expected outcome**

We expect to create a self-sustaining population of the particular species (what this is will be outlined in each species reintroduction proposal). Another outcome may be eventually having enough individuals to in turn offer another source population for future translocations.

- **Species distribution**

What is the known species distribution (former and current)? Is there a resident population already existing in the Ark in the Park/Waitakere Ranges? E.g. kaka has been known to visit and stay in the area for months but there is no resident (breeding) population. Have we surveyed/monitored adequately to know it is not already in the Ark in the Park? Are there related species in the park?

- **Reasons for decline/localised extinction**

What were the reasons for its decline/disappearance… and have these been remedied?

- **Potential source population/s**

What populations are available to us (wild, captive) and which are the most accessible/appropriate? What is the likely effect on the source population/s – demographic, genetic etc.

- **Recovery group**

What involvement/support do we have/need to ascertain from the relevant recovery group. How does the reintroduction fit with the species Recovery Plan (if relevant)?

- **Future translocations/long term plans**

Will it be a one-off off translocation (over one season)? Will there be subsequent translocations?

- **Timing of translocation**

What sort of seasonal timing would be likely? E.g. Winter, post- or pre-breeding.

- **Ecological requirements**

What are the ecological requirements of this species and how do we know they exist in the Ark in the Park area, e.g. monitoring of flora and fauna, size of control area relevant to requirements of species – will it support a viable population? Food and water availability, particularly during the breeding season is the key.
Is the species self-supporting or supported in some way? E.g. with the aid of a fenced area, supplementary food, nest/roost boxes. What are the justifications for this (usually to support the population while it is establishing and to allow for easier monitoring) and for how long?

- **Threats**

Threats to this species and what has been done to mitigate/manage these in the Ark in the Park. What are the possible future threats? E.g. future weed/pest/disease introductions that could affect this species.

- **Success/failure**

What if the reintroduction "fails" and what constitutes a success or failure for this species and over what timeframe?

- **Ecological interactions**

Interactions and impacts of the species in the park and on other native plants and animals, e.g. through predation, competition for food/nest sites, hybridisation, disease/parasites (particularly if captive animals or nursery plants), social behaviour of other species).

- **Disease management**

Often very relevant for bird species, disease management may include disease screening (who would undertake this, and how would it be funded?) from disease baseline data at source and release sites if required/available.

- **Additional management**

For example, the provision of feeder stations and nest and roosting boxes, ongoing management required for these additional items, funding, commitment, duration, how decisions are made to increase, reduce or stop additional management.

- **Restrictions**

Does reintroducing this species restrict/compromise any other species being translocated to the Ark in the Park, or impact on species turning up naturally e.g. bellbird and hihi.

- **Consultation**

Covers specific groups or individuals that will be consulted and/or informed about the proposed reintroduction, e.g. Auckland Regional Council, iwi related to the Ark in the Park and those associated with the source population/s, Department of Conservation, Waitakere Ranges Protection Society, Waitakere City Council, Supporters of Tiritiri Matangi Island etc. How will this be done?

- **Transfer Methods**

What are the likely methods to be used in the transfer, i.e. "catching", holding, feeding, transporting, release plans. Plus composition of translocation, i.e. number of individuals, females vs. males, juveniles vs. adults etc. Plants – mature plants, juveniles, seedlings, seeds or a mixture of these. Use of temporary or permanent enclosures at the Ark in the Park before release? Where would they be released in the park? Significance of release to the Ark in the Park and to conservation as a whole. Subsequent introductions – make up of these, how many might be likely and how will this be determined necessary.

- **Post release management and monitoring**

Monitoring methods detailed, funding of monitoring and over what time period are we committed to monitoring, and at what level, when to stop (how will we know?). Details regarding who is involved in making the decision to increase, reduce or stop monitoring. Post release report and monitoring information will be in what form and made available to who and how?

- **Dispersal**

Likelihood of dispersal? Possibility of monitoring/support of individuals outside of the Ark in the Park area e.g. trapping and baiting areas where they turn up. Note that the Ark in the Park bears no responsibility for individuals who move outside the predator-managed area. However we will do what we can to assist with protecting these areas where possible/practicable.

- **Security**

Any security issues e.g. theft of threatened species etc.

- **Financial Issues**

What will the reintroduction cost? Is this a prudent use of funding or are there more appropriate conservation outcomes to be gained from a different use of this funding? Where will the money be sourced? What is the cost of monitoring and additional management and how will this be budgeted for. Possible "contingency" budget for both the translocation and monitoring/additional management.

- **Experience and Learnings**

Are there some particular conservation-related experience/learnings that can be incorporated into such a reintroduction to improve future reintroductions? E.g. soft/hard releases, sound anchoring, juveniles vs. adults, etc.

- **Research Opportunities**

Are there any particular research opportunities related with the reintroduction of this species to the Ark in the Park and who or what institution/s are interested in being involved? How can we best design the reintroduction to assist with this and learn as much as we can from it for conservation and research outcomes?

- **Expertise**

What relationships are established or need to be established to benefit from the widest source of expertise about translocating, monitoring and improving the likelihood of creating a successful population of this species in the Ark in the Park: i.e. what experience do we have access to and what further steps are needed to gain more experience/advice etc. What do we know about past translocations or reintroductions of this species?

Appendix F: Other conservation work being carried out in the Waitakere Ranges

A number of other, predominantly volunteer/community led, conservation projects are being carried out across the Ranges. These include:

Pest Control

1. Forest and Bird's Matuku Reserve – approximately 120 ha of predator control (possums, rats, mustelids, goats), overseen by the Forest & Bird Ranger.
2. Forest Ridge community – approximately 120 ha, largely bush covered and part of the Ark in the Park Buffer Zone.
3. La Trobe Restoration Project – 200 ha at Karekare targeting rodents and possums using brodifacoum. The project began in 2001 and is now focusing on monitoring the impact of rodents on arthropods. The project also collects information on Hochstetter's frog populations in the project area.
4. Lone Kauri Restoration Project – 350 ha at Karekare targeting rodents and possums with bait and trapping mustelids. Control began in 2001.
5. Arataki Visitors Centre predator control – Initiated in October 2001. 250 ha area of predator control around the Centre and associated visitor tracks, targeting rats, possums, mustelids, hedgehogs and rabbits. Volunteers carry out the control, overseen by ARC staff. There is also a partnership (initiated in March 2003) with Watercare, which manages 20 traps targeting mustelids along the tramline to the Upper Nihotupu Dam.
6. Whatipu – 600 ha focusing on shorebird protection targeting rodents, possums, mustelids, hedgehogs, and cats (not as intensive as the Ark in the Park project). Control began in September 2003 and is funded by Friends of Whatipu Inc. in partnership with the ARC.
7. Huia/Cornwallis Landcare Group – 12 ha targeting rodents, possums, mustelids and hedgehogs using traps. Control began in October 2006.
8. Auckland Regional Council pest control at Piha – ARC rangers assist with the Lone Kauri Restoration Project and also have traps for mustelids on the headlands at Te Waha Point where seabirds are known to breed. Pindone is also used to control rabbits in the Piha dunes.
9. Coastal protection for NZ dotterel and other native sea/shorebirds at Bethells beach – targeting mustelids and rats in the dunes behind the beach (ARC Biosecurity and local community) and also protecting breeding birds around Bethells and O'Neills beaches.

Cultural

10. Flax planted for weaving etc – on ARC farmland alongside the Waitakere River (Pae o te Rangi farmland). Overseen by ARC staff.

Riparian

11. Waitakere Rivercare – replanting of riparian areas along the Waitakere river from the Te Henga Rd bridge to the Te Henga wetland.
12. Twin Streams – 56 km covering the Huruhuru Creek and Henderson Creek catchments. Streams and tributaries include Swanson, Waimoko, Momutu, Henderson, Waikumete, Whakarina, Bishop, Opanuku, Oratia and Pixie. The aim is to restore streams, linking the Ranges to the sea and to engage the community. Weeding and planting are key, with some property purchases, covenants and community contracts etc. Started in 2002. No pest control is currently being undertaken. NOTE due to the breadth of the work being done this project is not shown on the following map.


The Waitakere "Arkipelago": a developing network of predator-controlled areas.
Ark in the Park
Proposed Ark extension
1
2
10
11
9
8
5
4
3
7
6