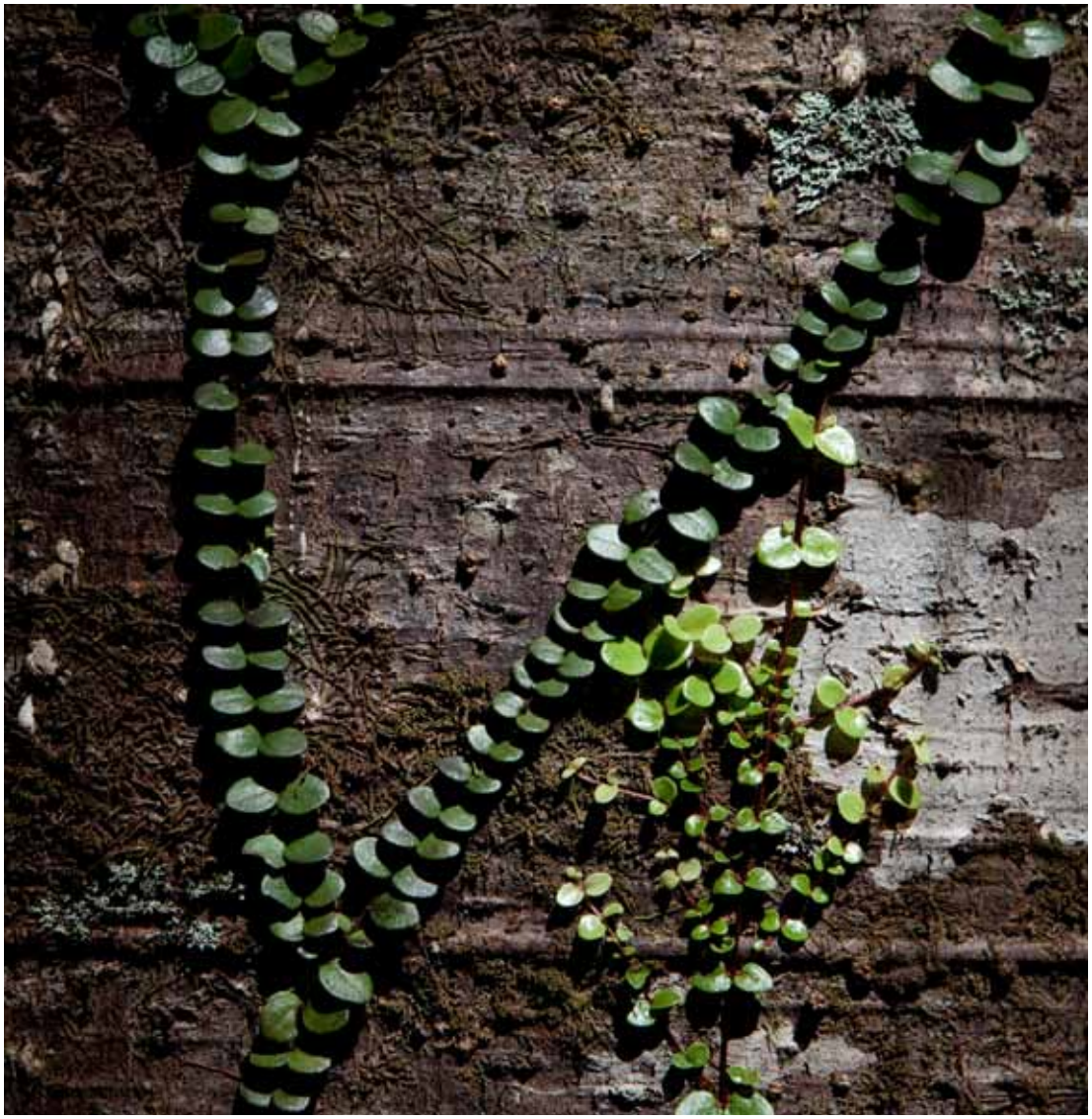
BRYNDERWYNS – BREAM TAIL

OPPORTUNITIES FOR ECOLOGICAL RESTORATION

To Teddy Goldsmith

Inspirational founder of Marunui, who secured its flora and fauna with a vision to conserve and protect what remains and restore that which has been lost



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Opportunities for Ecological Restoration

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December 2010

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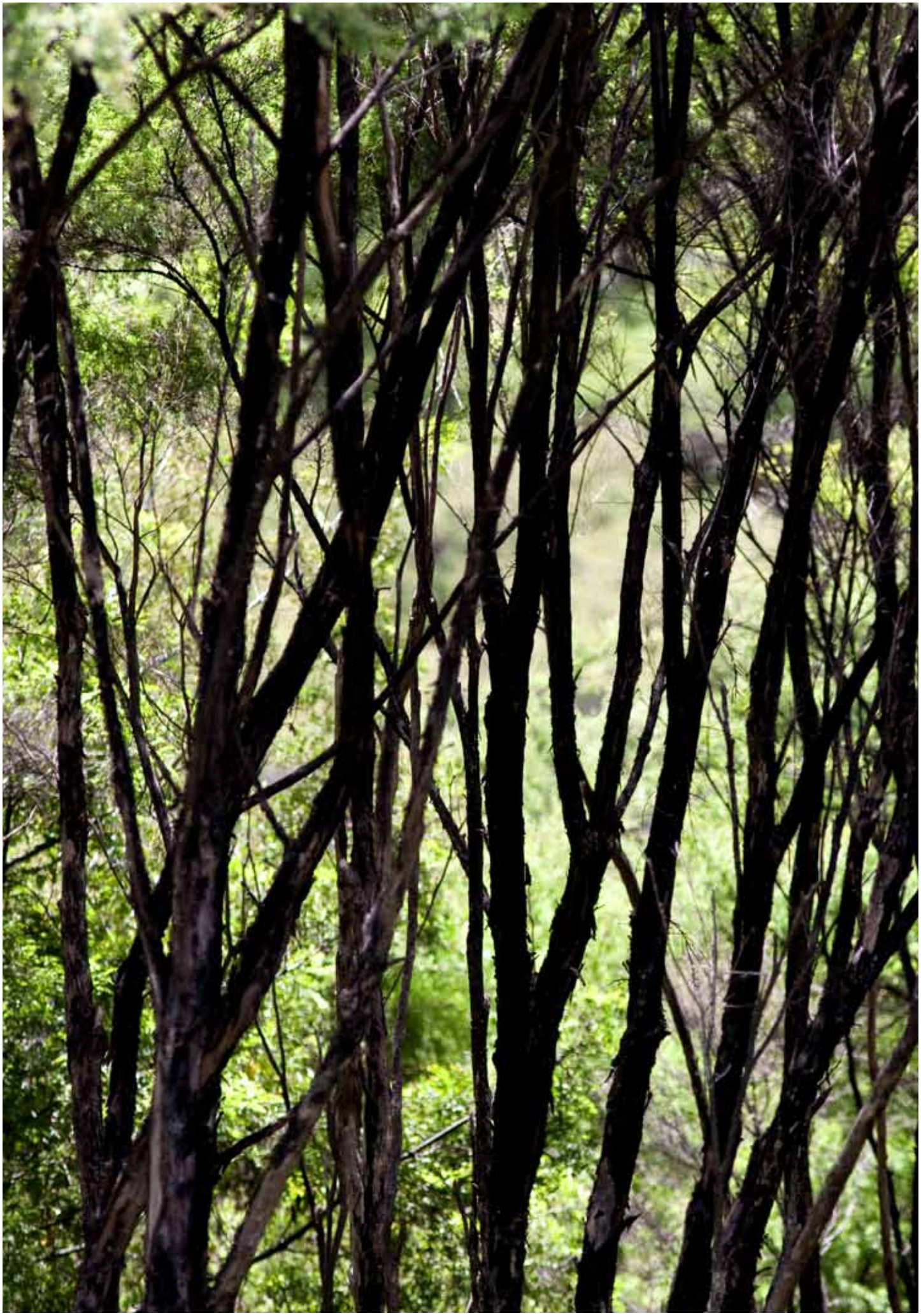

Kanuka shrubland

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FOREWORD

Protecting and enhancing Northland's unique biodiversity involves us all – landowners, the community, regional and district councils and government.

While individual landowners may work to solve particular issues, it is becoming increasingly evident that much more can be achieved when we manage our environment together on a landscape scale.

In the Brynderwyns-Bream Tail area there are people working co-operatively to protect and enhance the area's biodiversity values, but there is further need and considerable potential to expand on this work.

This resource document identifies opportunities for ecological restoration in the Brynderwyns-Bream Tail area. It summarises the considerable biodiversity values and advocates integrated active management to protect and enhance those values. It also provides a vision for the future.

I welcome the initiation of this study by local QEII covenantors. I hope it encourages individuals and the community to join together to look after this special area, as well as providing local authorities with sufficient ammunition and courage to lead the way in this the International Year of Biodiversity.

Sir Brian Lochore
Chairman Queen Elizabeth II National Trust

EXECUTIVE SUMMARY

This document describes the important biodiversity values of the Brynderwyns-Bream Tail area and identifies the threats to those values, together with opportunities for ecological restoration and more integrated and effective management. The biodiversity values include extensive indigenous forest and shrubland on hill country, coastal headlands, dunes, saltmarsh and many small clear-water streams. All these habitats support a wide range of flora and fauna, including many threatened or significant species of plants, snails, fish, frogs, lizards, bats and birds. However, biodiversity health is threatened by habitat loss and ongoing habitat degradation stemming from human-induced changes, including the impacts of invasive weeds and pest animals and activities associated with development.

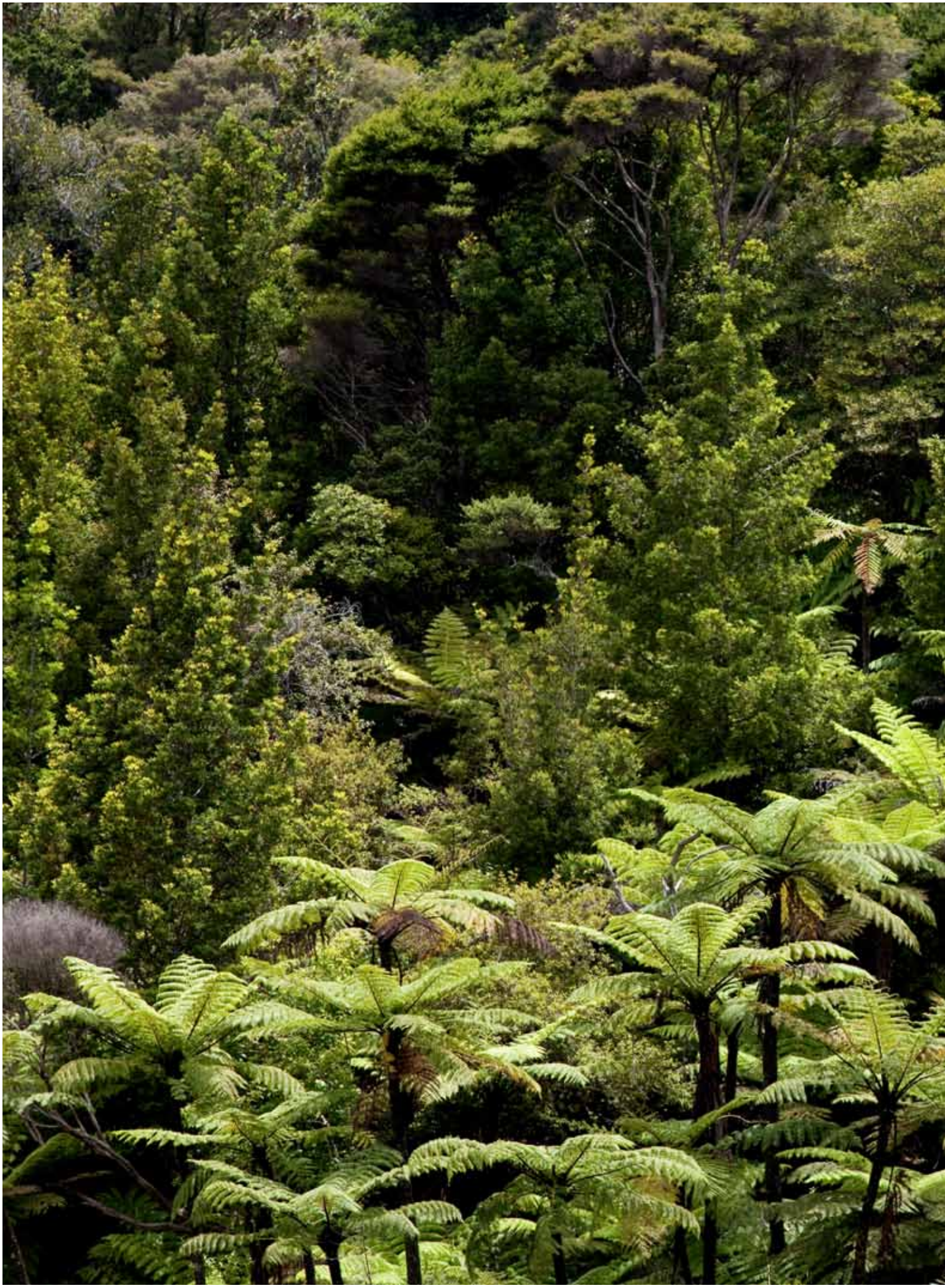
There are several existing initiatives to restore biodiversity in the area, ranging from the covenanting and fencing of forest remnants to the control of various invasive weeds and pest animals such as goats, pigs, possums, mustelids and rats. These projects are boosting forest health and stream values and in certain cases assisting some threatened fauna species as well. However, being relatively localised and undertaken independently of other initiatives, their effectiveness and sustainability is limited.

There are many opportunities for integrated management. At the statutory planning level an important first step would be the formal recognition of Brynderwyns-Bream Tail as a priority area for biodiversity protection and management. Regional and district planning documents need to accurately reflect statutory requirements to maintain and protect ecosystems and support more sustainable and integrated management. Non-regulatory methods in the form of assistance and incentives can also contribute to these objectives.

In terms of restoration initiatives at the local level and in the short term, individuals, groups and agencies could share information and combine efforts in various parts of Brynderwyns-Bream Tail to achieve common goals. In the medium-long term, consideration should be given to setting up a ‘landcare forum’, a broad structure which could potentially include a local manager coordinating overall activities.

Increasing the level of communication between agencies, landowners and groups and coordinating their work is important, as is identifying sources of technical support and funding for sustaining the management impetus. Opportunities should be taken to expand pest plant and animal control across the suite of key ecosystem species, together with more targeted management aimed at recovering key threatened species. This approach would enable the reintroduction of Northland brown kiwi and potentially other species, thereby encouraging the interest and involvement of the wider community.

This study recognises the unrealised potential and significant opportunities for Brynderwyns-Bream Tail to contribute to an enriched biodiversity on a region-wide scale.



Secondary forest, Brynderwyns south face

01 chapter one – INTRODUCTION

The Brynderwyn Hills range is a prominent, natural physical feature for the southern Whangarei and northern Kaipara districts. It extends for some 15 km, from just west of State Highway 1 to the Bream Tail headland on the east coast by Mangawhai (refer Figure 1). This area, hereafter referred to as Brynderwyns-Bream Tail, exhibits significant biological diversity encompassing extensive regenerating hill forest and shrubland habitats, many high-quality streams and a variety of coastal habitats, including saltmarshes. A correspondingly diverse fauna and flora is present, with a number of significant plants and threatened or rare fauna. Its significance increases when viewed against the historic loss of biodiversity in Northland and the ongoing decline of habitats and species.

Parts of the Brynderwyn Hills range have been identified as having landscape significance (KDC 1997) while its largely natural state provides amenity for and a striking scenic backdrop to the rural hinterlands and the settlements of Kaiwaka, Mangawhai, Langs Beach and Waipu Cove. It also offers recreational opportunities.

As with many parts of Northland there has in recent years been a significant shift in land management in and around the area, with a gradual move away from traditional land uses, particularly pastoral farming. Interest in 'lifestyle' farming, horticulture and retirement lots has generated subdivision. This has raised new issues for biodiversity but has also been accompanied by a more diverse range of environmental thinking including sustainable management. As part of these recent trends there has been a desire by some members of the community to engage in more effective biodiversity management in their 'own patch'. This has seen local initiatives undertaken to achieve various goals, such as forest and forest bird recovery and wetland restoration.

A key factor with many such initiatives is that they can be influenced negatively or positively by activities and processes occurring on adjacent properties, up-catchment and down-catchment. Often a negative impact is unintentional and could be avoided if there was shared information and collaboration. Moreover, added value can be achieved through adopting a more integrated approach to management within and between entire catchments.

The purpose of this document is to provide background information on the significant natural values of Brynderwyns-Bream Tail, outline the current and potential threats to its biodiversity and identify opportunities for more integrated ecological restoration and management. It is anticipated that it will help to inform landowners and encourage them to improve the condition of biodiversity on their land and stimulate interest in the wider community to assist in protecting and enhancing the area's natural values. The document will also provide statutory authorities with a resource to guide planning and policy formation.

KEY COMPONENTS ARE:

- Identification of the biodiversity values of representative habitats
- Information on threats
- Outline of existing restoration initiatives
- Statutory planning context
- Opportunities for additional management and monitoring

FIGURE 1: LOCATION OF STUDY AREA

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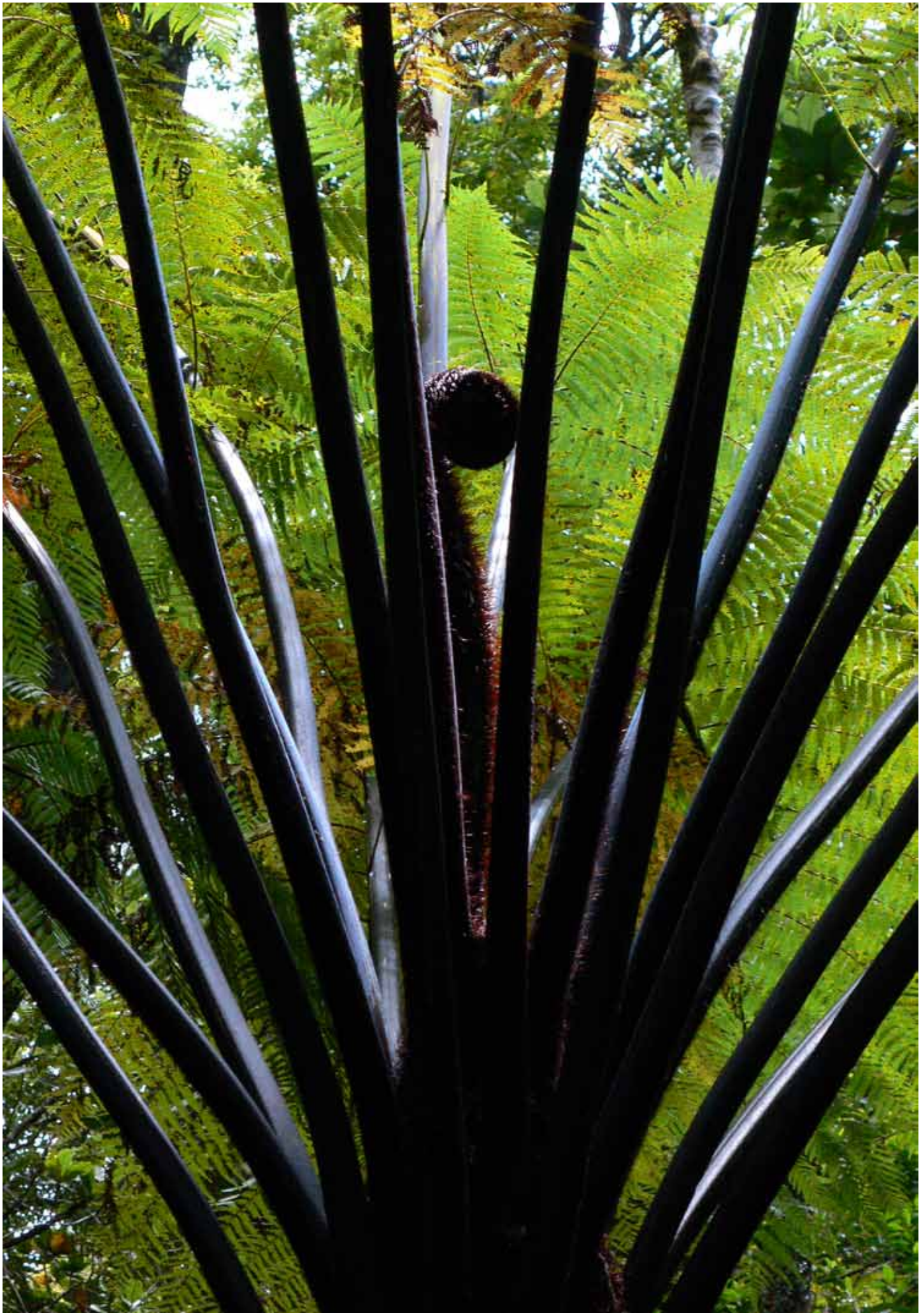
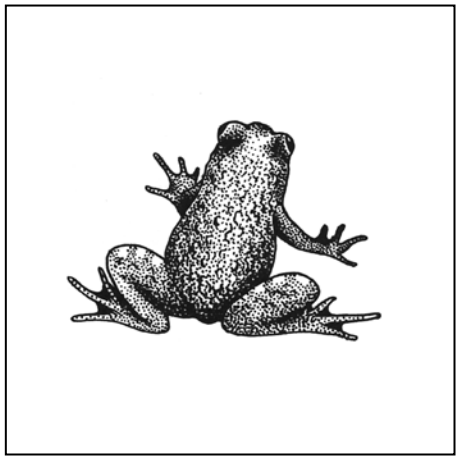


Mamaku frond unfurling

WHAT'S SO SPECIAL ABOUT BRYNDERWYNS – BREAM TAIL

- It has high biodiversity values including:
  - Continuous natural habitats along the length of the Brynderwyn Hills, encompassing forests of kauri and podocarp-broadleaf species, shrubland and stream environments
  - Diverse flora in the hill and coastal forests; flora lists recorded at Marunui (Marunui Conservation Ltd) and Bream Tail headland are extensive
  - Important freshwater habitats for aquatic and stream-edge fauna including fish, frog and invertebrate species
  - Excellent buffering of many forests and streams, especially in the Brynderwyn Hills where streams are well protected from erosion and siltation by surrounding shrubland and forests
- The presence of many threatened and significant fauna species, notably:
  - Hochstetter's frog, present along well-buffered streams
  - Australasian bittern, visiting some wetlands
  - NI kaka, visiting from Hen and Chicken Islands, along with red-crowned kakariki and bellbird
  - Recovering populations of NZ pigeon and NI tomtit
  - Blue penguin and grey-faced petrel along the Bream Tail coastline
  - NI fernbirds in saltmarsh and shrubland
  - Longfin eels and other representative freshwater fish species in the streams
- Cultural values, including the above natural values, are of importance to Maori.
- A significant proportion is in Crown reserve or under QEII National Trust Open Space Covenant or some other conservation covenant.

Refer to Figures 2 and 3 for locations, key habitats, threatened and significant fauna, reserves and covenanted areas.



Hochstetter's frog

02 chapter two – COMMUNITY

TANGATA WHENUA

Brynderwyns-Bream Tail has long been an important area for tangata whenua and discussion with representatives of those iwi holding mana whenua over the area confirmed this. Te Uri o Hau, Ngatiwai and its hapu Patuharakeke all have traditional links with the area, with their rohe encompassing various parts of the range. The diversity of habitats, from open sea coast to estuaries, streams and forests, would have provided varied and dependable food resources. Some land was also cleared for gardens. Today the spiritual and cultural values remain as strong for tangata whenua as in ancestral times.

The Te Uri o Hau Settlement Trust, the Ngatiwai Trust Board Management Unit and the Patuharakeke Te Iwi Trust Board have each expressed their kaitiaki role and relationship with the environment and their support in principle of efforts to protect and enhance indigenous biodiversity within their rohe in Brynderwyns-Bream Tail. Their statements are appended (Appendix 1).

EUROPEAN SETTLEMENT

The arrival of Europeans saw a profound change to the Maori community and the face of the land during the latter half of the 19th and early 20th centuries. Initially the exploitation of kauri and other forest timbers from the Brynderwyn Hills (known then as "Waipu Hills") would have seen temporary camps springing up across the area, serviced by the settlement of Waipu. There were other communities supporting the kauri timber trade, including Mangawhai and a bush track was formed between there and Waipu in the 1870s (DOC 2007). Permanent European settlement occurred when further land was obtained from Maori and cleared for livestock farming. Occasionally stands of indigenous forest were retained on steeper slopes as a source of domestic timber and food (DOC 2007) but overall the forest cover was decimated. After the timber boom of the 1870s-90s, farming and later exotic forestry activities became prevalent.

In the late 20th century there was a gradual move away from these traditional landuses towards smaller-scale activities and 'lifestyle' settlement. This included horticultural lots (for orchards, olive groves, vineyards and vegetables), conservation areas, retirement properties and in particular, holiday homes (KDC 2009). This trend has gained momentum in the last decade with increased subdivision of large, formerly farmed lots, the greatest pressure being on lowland areas near Mangawhai, in pockets of the foothills and at Bream Tail. Mangawhai has been designated a 'Growth Area' by Kaipara District Council in its Proposed District Plan (KDC 2009). The findings of the 2006 Census reflected the increase in holiday and lifestyle homes, recording that only 774 of Mangawhai's 1740 dwellings were permanently occupied (Statistics New Zealand 2006). Associated with this changing population demographic is a shift in environmental attitudes which include recognition of the need for more sustainable land-use practices, the protection of natural features and for ecological restoration.

Iwi, individuals and representatives of groups of landowners either undertaking or considering restoration work on their land, were contacted as part of the fieldwork and data gathering for this report.

Land use change, King Road, Mangawhai

03 chapter three – PHYSICAL & BIODIVERSITY VALUES

GEOLOGY AND LANDFORMS

The Brynderwyns-Bream Tail landscape is dominated by an east-west range reaching 430 m elevation at its highest point with smaller parallel ranges to the north and south. The southern side of the main range is the steepest, while the northern side has many leading spurs trending in a northerly direction. The bedrock of the range is dominated by Mesozoic greywacke overlain by sandstone and limestone of Eocene-Oligocene age and in places there are thicker layers of Miocene sandstone and mudstone (DOC 2007). Prominent outlying features include Bald Rock and Pukekaroro.

Bream Tail has more of a rolling landscape stemming from erosion of the dacite intrusions which pierce the underlying sedimentary rocks. Beaches here are characterised by sandy substrates in the more sheltered bays and pebble and bedrock substrates in more exposed areas. The adjacent marine environment is significant because it contains the only extensive sub-tidal reef habitat between Leigh and Bream Head (Northland Marine Library).

PRE-HUMAN BIOTA

In pre-human times the area would have been dominated by old-growth forests reflecting a temperate climate with plentiful rain (currently 1350-1800 mm annual rainfall increasing with altitude, DOC 2007). These would have included tall kauri forest on the inland ridges and slopes and moderately diverse podocarp-broadleaf forest throughout. Some of the valley floors (eg tributaries of Tara Creek) would have supported dense taraire, totara and kahikatea forest (DOC 2007) merging with extensive wetlands and saltmarshes in the lower reaches of Mangawhai Estuary. Coastal headlands and beaches around Bream Tail would have been backed by pohutukawa-dominant coastal forest but the then continuous forest would also have included many now less common species such as tawapou, karo, milk tree, coastal maire, puka and parapara.

The prehistoric fauna would have been spectacular with the forests supporting most bird species then present in northern New Zealand (Tennyson and Martinson 2006). They would likely have included kokako, piopio (NZ ‘thrush’), tieke (saddleback), huia, hihi (stitchbird), robin, whitehead and long-tailed cuckoo, along with several harsh-calling parrot species and the other more common species of today. The megafauna would have included Mappin’s moa and several carnivores including the extinct NZ harrier, adzebill (large rail-like bird), a raven and the extant NZ falcon. Large skinks and geckos of about ten species, together with tuatara, kauri snails and many others would have completed the notable terrestrial fauna. Nocturnal animals would have included two species of bat and kiwi, ruru (morepork), owlet-nightjar, the laughing owl, hukawai (NZ snipe) and kakapo. Bream Tail headland was probably home to burrow-nesting grey-faced petrels, penguins and other seabirds. Streams, wetlands and marshes in the lower catchments towards the coast and Mangawhai Estuary would have supported a variety of birds such as rails, waterhens, coots, swans, ducks, Australasian bittern and NZ little bittern. Additionally, the streams would have experienced large runs of whitebait of different galaxiid species and supported many other fish and bird species.

Brynderwyn Hills Scenic Reserve

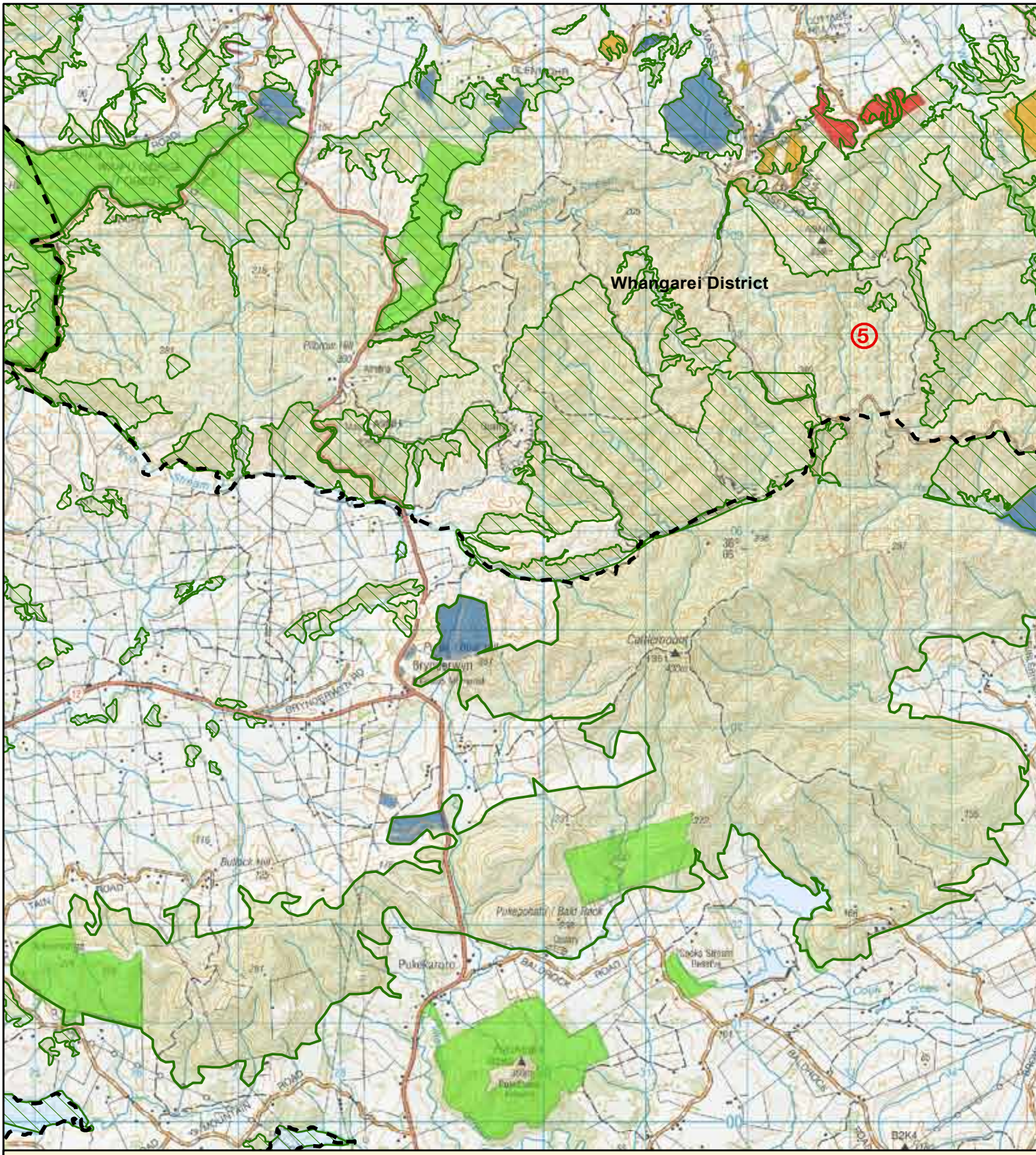
As with other parts of Northland the modification of Brynderwyns-Bream Tail habitats, human hunting activities and predation by mammalian pests through the periods of Maori and European settlement combined to bring about the demise of many of these species. During the middle of the 20th century habitat loss and modification accelerated via forest clearance and agricultural activities. Habitat loss and pressure on the remaining fauna and flora continues into the present.

EXISTING HABITAT DIVERSITY

OVERVIEW

Today Brynderwyns-Bream Tail exhibits a high level of naturalness and supports important representative habitats, especially forests that were formerly prevalent. Virtually all these are secondary (regenerating) but there are many impressive stands of older kauri and other trees, particularly in steep gullies. Whereas Northland forests often lack linkages with other forested sites and sequences to other habitats are often missing or heavily modified (Conning 2001, DOC 2007), along the Brynderwyn Hills the continuous forest is a conspicuous feature. Its streams are well buffered and it is flanked by shrubland and exotic forestry. However, towards Bream Tail the coastal forest remnants become more fragmented and often modified by livestock grazing, weeds and animal pests.

Three Ecological Districts cover the study area: Waipu, Rodney (DOC PNAP survey in prep), and Otamatea (DOC 2006) on the western edge. Key habitats in the area are forest (several types), regenerating shrubland, freshwater streams and associated small wetlands and artificial ponds, small saltmarshes, and coastal headlands and bays. The distribution of these habitats is shown on Figure 2 (overleaf) and their principal characteristics and distinctive biota are described below.



LEGEND

Topographical map features

- Native forest / shrubland
- Exotic coniferous forest
- Shelter belt
- Trees
- Orchard or vineyard
- Mangroves
- Stream
- Open fresh water
- Saltmarsh

Overlay features

- Whangarei / Kaipara District boundary
- PNAP in Waipu ED & Otamatea ED
- Public Conservation Land
- Whangarei District Reserve
- Whangarei District Conservation Covenant
- QEII Covenant
- Indigenous forest / shrubland

Source: Department of Conservation - Public Conservation Land, PNAP
QEII National Trust - QEII Covenants
Whangarei District Council - Reserves and Covenants

Some biodiversity restoration initiatives

1. Marunui Conservation Ltd
2. Tara Road Group
3. Bream Tail Headland
4. Bream Tail Farm
5. Hancock Forest Management (NZ) Ltd

Key habitats of the study

- **Indigenous forest / shrubland**
- **Freshwater: streams, wetlands, ponds**
- **Saltmarsh**
- **Coastal headland and bays**

FIGURE 2: KEY HABITATS

0 0.5 1 2 3 Kilometres

Scale: 1:50,000

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FOREST AND SHRUBLAND HABITATS

The extensive forests and shrubland support a high diversity of plant and animal species. The *Natural Areas of Waipu Ecological District Reconnaissance Survey Report for the Protected Natural Area Programme* (DOC 2007) describes these habitats generally. Key components are:

- **Brynderwyn Hills Forest Complex**
  This is a mosaic of hill country indigenous forest of several types, interspersed with radiata pine plantations which are predominantly on the northern slopes. The complex is partially linked with forest to the south (eg Pukekaroro) and with coastal forest to the east. Its ecological units may be summarised as:
  - Ridges and upper hillslopes vegetation types, including kanuka forest, kauri forest, tanekaha forest, rimu forest, kanuka shrubland, manuka shrubland, and combinations of dominant species.
  - Hillslope and ridge vegetation types including kanuka shrubland (the largest coastal kanuka stands in Waipu Ecological District occur here) and kanuka forest, often in association with other species, eg mamaku, tanekaha, totara, kahikatea, rewarewa, puriri, rimu, taraire, mahoe, pate, mapou, hangehange, ponga, mingimingi and radiata pine.
  - Hillslopes and gully vegetation types including taraire-tawa forest, towai forest, towai-mamaku forest, taraire forest with various associations, totara forest including with various associations, mamaku forest with associations.
  - Gullies with vegetation types including taraire forest, taraire-puriri forest, puriri forest, puriri-nikau forest, kahikatea forest, nikau forest and with associations, and shrublands.

Kanuka shrubland with emergent kauri, Marunui

The DOC 2007 report also notes that ten ecological units of the Brynderwyn Hills Forest Complex are unusual and this includes localised stands of kohekohe forest, kohuhu forest, miro-tawa-rewarewa forest, nikau-rewarewa forest and several different species combinations of puriri, rewarewa, rimu and tawa, each associated with other species. Many regionally significant and threatened plant and animal species occur within the complex.

- **Bream Tail Coastal Headland**
  This area of predominantly coastal forest and shrubland supports a wide variety of coastal hill forest, shrubland and rockland vegetation and has close affinities with Hen Island (Taranga) vegetation, albeit more modified (Wright 1978). Key ecological units are:
  - Coastal kanuka shrubland and forest
  - Kanuka-tawa forest
  - Puriri forest
  - Taraire forest
  - Rocky outcrop and cliff habitat.

Bream Tail coastal headland

Covenanted coastal forest

Many of the ecological units are very important because they are unusual and/or they are not present elsewhere in Waipu Ecological District (DOC 2007). They include the following (refer DOC 2007 for complete list):

- Puriri forest with frequent totara, kowhai and nikau
- Puriri-rewarewa-pohutukawa forest with northern rata and kauri
- Dense, healthy pohutukawa forest with an understorey of houpara, harakeke, hangehange and nikau, plus some degraded areas
- Taraire forest with puriri, nikau, kohekohe and puka
- Gullies with dense nikau forest and puriri
- Kanuka-puriri-pohutukawa forest with kowhai and totara
- Kanuka-tawa forest with puriri, rimu and kauri
- Extensive coastal cliff habitat with rocky outcrops rising above intertidal platforms supporting harakeke, *Chionochloa bromoides* and *Astelia banksii*

- Hangehange-harakeke shrubland with ti kouka and pampas
- Harakeke-pampas flaxland
- Harakeke-kawakawa flaxland
- Kauri-kanuka forest
- Kahikatea forest.

There are also areas of indigenous treeland interspersed with patches of exotic grasses, indigenous ferns and regenerating shrubs. At least two regionally significant trees, tawapou and coastal maire, occur here (DOC 2007).

- **Coastal forest near Langs Beach**
  This 30 ha area is on the margin of the study area and is included for completeness. It contains some small but significant ecological units:
  - coastal kanuka shrubland
  - pohutukawa-rimu forest
  - pohutukawa forest at the northern end of Langs Beach is growing on limestone and has a lush understorey of kohekohe, houpara, nikau, mamaku, kawakawa, hangehange and kiekie, but also many weeds.

The importance of these hill country and coastal forest remnants cannot be over-emphasised because they contain virtually all of the plant species formerly present in the ancient, continuous forests of this area, including some rare or significant species. A list of vascular plant species recorded in Brynderwyns-Bream Tail is contained in Appendix 2.

FRESHWATER HABITAT

Many important streams and some relict wetlands are present. Although wetlands have been reduced to a fraction of their former area and most are now small and degraded as a result of grazing, drainage and surrounding land use, they may still include dominant plants such as raupo, harakeke/flax and herbfields (DOC 2007). The key streams and wetland systems are shown on Figure 3 and comprise:

- Waihoihoi Stream which arises in shrubland on the northern side of the Brynderwyn range and meanders northeast across alluvial flats to the Waipu Estuary.
- Waionehu Stream which arises in shrubland of the central northern Brynderwyn range and flows into the Waipu Estuary.
- Several streams that arise in shrubland of the eastern Brynderwyn range and flow north into the sea at Langs Beach and McKenzie Cove.
- Tara Creek which has several tributaries arising in the forested southern Brynderwyn slopes and which combine to flow southeast to Mangawhai Estuary.
- Hakaru River which arises in the forested southern Brynderwyns and flows southwest to Kaipara Harbour.
- Small areas of raupo reedland, including at Massey Road and Bream Tail coastal headland (DOC 2007).

- Many artificial ponds developed more generally as stockponds, but sometimes for amenity or waterfowl (such as at Bream Tail, the 'Sanctuary' lake beside Cove Road and elsewhere).

Many of the streams support important freshwater fish populations and are also the focus of Hochstetter's frog.

Forest stream, Marunui

SALTMARSH HABITAT

Saltmarsh has virtually disappeared from the area but a small remnant exists at the eastern end of King Road near Mangawhai (refer Figure 3). There are also good examples to the south of the study area at Mangawhai Estuary. Oioi and wiwi are dominant plants with some saltmarsh ribbonwood interspersed with stands of manuka and shrubs and the occasional mangrove. Saltmarshes provide important habitat for estuarine fauna (eg fernbird, banded rail and bittern), breeding areas for whitebait and other galaxiids, and they provide a link between freshwater and estuarine habitats. Saltmarshes also perform important filtering roles, trapping and preventing sediment and nutrients from entering estuaries.

Tara Creek saltmarsh, King Road

SIGNIFICANT FLORA OF FOREST AND SHRUBLAND

The area supports a large number of significant flora species. The Brynderwyn Hills section covers such a wide geographic area with significant habitat variation internally, that it is one of the more important Northland forest remnants. Its large size means that in the event of extreme conditions, (eg drought, fire or storm damage) there will be areas where plant and animal assemblages are likely to survive or find temporary refuge. Additionally, the large area provides opportunities for adaptation that, in the longer term, may be needed in response to climate change. Meanwhile, the smaller Bream Tail sector exhibits clear affinities with the Hen and Chickens group, containing many plant species associations that are rare on the mainland.

Significant flora species are presented in Table 1 (opposite page). At least eight at risk species and fifteen regionally significant plant species are present and further study is likely to reveal others.

Carmine rata

Tussock

Kawaka (seedling)

Hebe macrocarpa var. *macrocarpa*

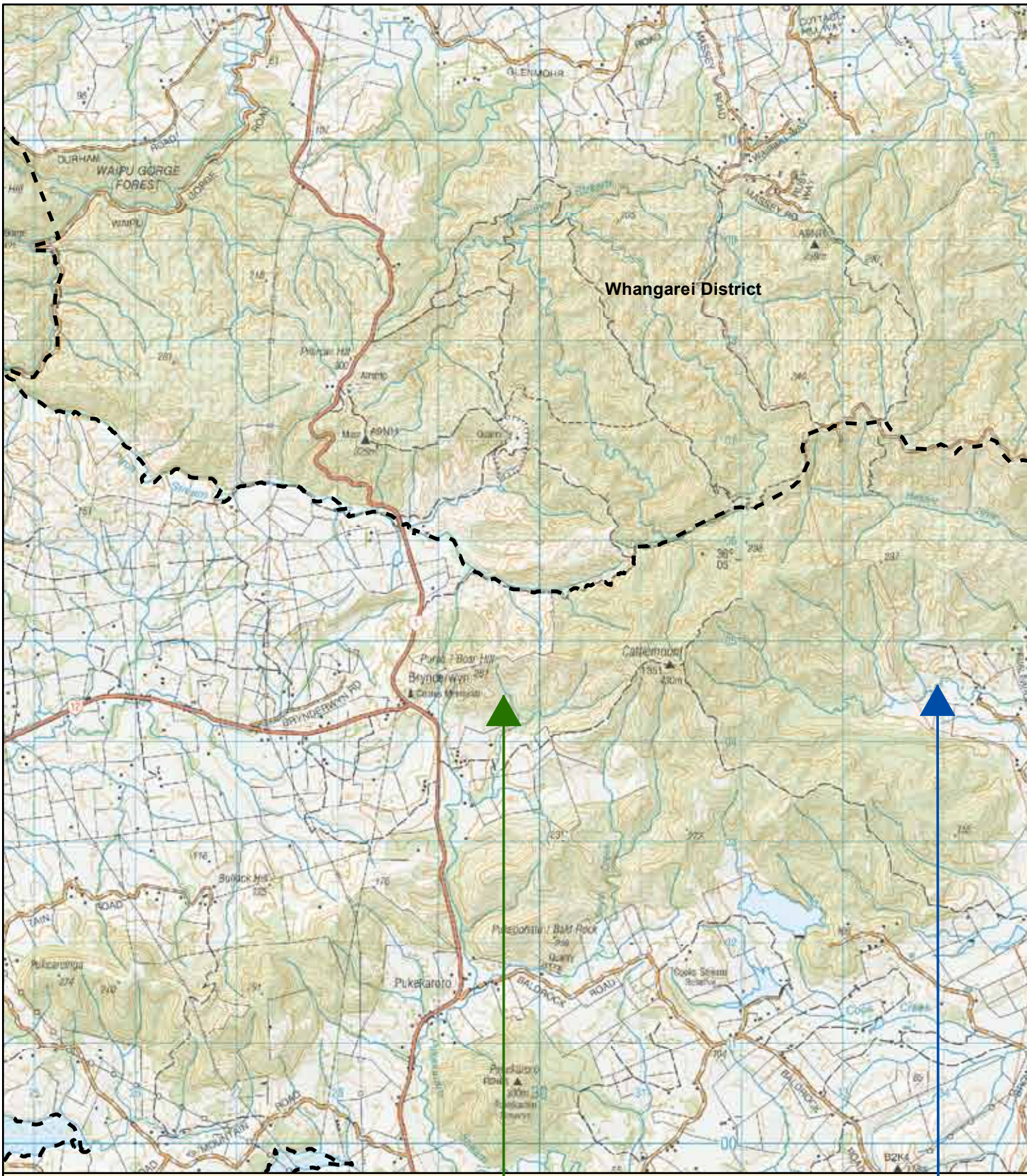
Tree fuchsia

Northern rata

TABLE 1 – Significant plants of Brynderwyns–Bream Tail ranked according to threat level

Threat level:
T6 = Relict
T7 = Naturally Uncommon
T8 = Regionally Significant (for Northland, sourced from a draft list developed by DOC Northland Conservancy).
Rankings from de Lange et al (2009).

SPECIES	THREAT LEVEL	LOCAL STATUS
Pisonia brunoniana	T6 Rel	Parapara; recorded at Bream Tail coastal headland
Anzybas rotundifolius	T7 Nu	Orchid; in forest at Marunui, Brynderwyn Hills
Doodia mollis	T7 Nu	Tufted fern; at Bream Tail coastal headland
Halocarpus kirkii	T7 Nu	Monoao; Waipu Gorge
Libocedrus plumosa	T7 Nu	Kawaka; recorded at a few sites in Brynderwyn Hills
Streblus sp.	T7 Nu	Milktree/turepo; hybrids recorded at Bream Tail
Tetragonia tetragonioides	T7 Nu	Kokihi, a spinach; Bream Tail coastal headland
Chionochloa bromoides	T7 Nu	A tussock grass; Bream Tail coastal headland
Brachyglottis kirkii var. *angustior*	T8 RSig	A daisy; present in Brynderwyn Hills
Coprosma rigida	T8 RSig	Bream Tail coastal headland and possibly elsewhere
Coprosma parviflora	T8 RSig	Brynderwyn Hills forest complex
Cyathea cunninghamii	T8 RSig	Gully tree fern; Brynderwyn Hills forest complex
Fuchsia excorticata	T8 RSig	Tree Fuchsia; Brynderwyn Hills forest complex
Hebe macrocarpa var. *macrocarpa*	T8 RSig	Brynderwyn Hills forest complex is a stronghold for this species (DOC 2007)
Metrosideros carminea	T8 RSig	Carmine rata; Brynderwyn Hills forest complex
Metrosideros robusta	T8 RSig	Northern rata; Brynderwyn Hills forest complex
Nestegis apetala	T8 RSig	Coastal maire; Bream Tail coastal headland
Nothofagus truncata	T8 RSig	Hard beech; Bream Tail coastal headland
Pelargonium inodorum	T8 RSig	Annual herb; Brynderwyn Hills forest complex
Phormium cookianum	T8 RSig	Mountain flax; Bream Tail coastal headland
Plagianthus regius	T8 RSig	Ribbonwood; Brynderwyn Hills forest complex
Pouteria costata	T8 RSig	Tawapou; Bream Tail coastal headland
Pratia angulata	T8 RSig	A herb; Brynderwyn Hills forest complex
Schizaea bifida	T8 RSig	A herb; Brynderwyn Hills forest complex



Indigenous forest / shrubland throughout Brynderwyns-Bream Tail

- NZ pigeon, NI tomtit, NI fernbird
- Long-tailed cuckoo
- Auckland green gecko
- Kauri snail
- Long-tailed bat
- Bellbird, NI kaka, red-crowned kakariki

Freshwater: streams, wetlands, ponds throughout Brynderwyns-Bream Tail

- Hochstetter's frog
- Longfin eel, banded kokopu
- Grey duck
- Bittern, pied stilt
- Little shag, black shag, NZ dabchick

Bream Tail: coastal headland and bays

- Blue penguin, red-billed gull
- Grey-faced petrel, white-fronted tern
- Pied shag, reef heron
- Northern NZ dotterel, variable oystercatcher
- NZ pipit

Tara Creek saltmarsh

- Banded rail
- NI fernbird

FIGURE 3: THREATENED / SIGNIFICANT FAUNA

0 0.5 1 2 3 Kilometres

Scale: 1:50,000

N

LINZ Topo50 sheets AY30 and AY31. December 2010

THREATENED FAUNA OF FOREST AND SHRUBLAND

The area supports a large number of indigenous fauna species spanning birds, mammals, amphibians, reptiles, fish and invertebrates. Many of these are threatened or regionally significant (refer Table 2 and Figure 3). Key fauna species include Hochstetter's frog which is close to the northern end of its range, many forest birds and two species of seabirds - the grey-faced petrel and blue penguin, both apparently attempting to breed locally. Recolonisation by NI tomtits has occurred in response to regenerating forest and the inter-connecting corridors with the Mareretu Forest area provided by shrubland and exotic forestry. Meanwhile three bird species, NI kaka, red-crowned kakariki and bellbird, are visiting from nearby offshore islands and could potentially re-establish if assisted (refer Chapter 7). A full list of vertebrates is provided in Appendix 4 but more work is needed to determine the full suite of lizard species and those bat species present, if any, together with further study of invertebrates.

NZ pigeon (kukupa, kereru)

Top left: North Island kaka
Bottom left: Auckland green gecko

Top right: Red-crowned kakariki
Bottom right: Grey-faced petrel

Opposite page

TABLE 2 – Threatened & other significant fauna of Brynderwyns Bream Tail ranked by threat level

Threat level:

T1 = Nationally critical	T2 = Nationally endangered
T3 = Nationally vulnerable	T4 = Declining
T5 = Recovering	T6 = Relict
T7 = Naturally uncommon	T8 = Regionally significant

Source: DOC Northland Conservancy data. Data sourced from Miskelly et al 2008.

Coast	Forest
Streams & wetlands	Open country

SPECIES	THREAT LEVEL	LOCAL STATUS
Grey duck	T1 Cr	Uncertain status; very rare visitor to streams
Bittern	T2 En	Rare visitor to wetlands & stream edges, eg Tara Creek
NZ dabchick	T3 Vu	Rare visitor to artificial ponds, eg Cove Road
Long-tailed bat	T3 Vu	Unidentified bats (possibly this species) seen at Marunui
Northland brown kiwi	T3 Vu	Formerly in Brynderwyn Hills; now locally extinct
North Island kaka	T3 Vu	Annual visitor to coastal forest and Brynderwyn Hills
Pied shag	T3 Vu	Coastal resident, breeding in coastal trees at Bream Tail
Reef heron	T3 Vu	Rare, along coast, potentially breeding in cliffs, trees
Northern NZ dotterel	T3 Vu	Rare, breeds at Langs Beach and nearby sandspits
Red-billed gull	T3 Vu	Coastal resident, breeding on rocky headlands
Blue penguin	T4 De	Present, potentially breeding, along Bream Tail coastal edge
White-fronted tern	T4 De	Feeds offshore
Pied stilt	T4 De	Rare visitor to wetlands, flooded fields
North Island fernbird	T4 De	Saltmarsh and shrubland
Hochstetter's frog	T4 Nu	Stream edges in forested parts of Brynderwyn Hills
Longfin eel	T4 De	Streams and wetlands of the area
Koura	T4 De	Mid to upper stream catchments, often where Hochstetter's frogs found
Auckland green gecko	T4 De	Mainly kanuka & manuka shrubland, northern Brynderwyn slopes & Bream Tail QEII covenant
Kauri snail	T4 De	Forests of Brynderwyn Hills (Brook 2002)
NZ pipit	T4 De	Rare in open areas, eg rough pasture, beaches, headlands
Variable oystercatcher	T5 recover	Potentially breeding on coastal dunes, eg Langs Beach
Red-crowned kakariki	T6 Relict	Rare but regular visitor from offshore islands to forest
Long-tailed cuckoo	T7 Nu	Migrant through the area, heard at night
Banded rail	T7 Nu	Reported from Tara Creek saltmarsh
Black shag	T7 Nu	Visits streams and artificial wetlands
Little shag	T7 Nu	Visits artificial wetlands
Banded kokopu	T8 RSig	Forested streams of Brynderwyn Hills
Grey-faced petrel	T8 RSig	Attempting to breed at Bream Tail headland forest
NZ pigeon	T8 RSig	Resident or visitor to indigenous forest
Bellbird	T8 RSig	Regular visitor, particularly Bream Tail
North Island tomtit	T8 RSig	Recolonising hill forest and shrubland

04 chapter four – THREATS TO BIODIVERSITY

Threats to Brynderwyns-Bream Tail biodiversity are many and varied but all are human-induced whether directly or indirectly. Some impacts are the result of historic actions, in particular deforestation and the introduction of pest animals and plants. Rodents, mustelids, possums and numerous weeds have become the widespread invasive species of today. Other impacts are direct and localised and include, for example, various legal activities associated with developments and illegal or inappropriate actions, like dumping toxic or garden waste. Impacts can occur at a broad landscape scale, such as the ongoing impacts of invasive species, or be more specific, like earthworks causing stream siltation, or vegetation clearance and roading causing fragmentation, weed introduction and edge effects.

Impacts that could or do affect the area's biodiversity, whether at the ecosystem or species level, are described below with examples.

DIRECT HUMAN IMPACTS

- Habitat loss has had the greatest impact on habitat viability because of the widespread reduction of forests, wetlands and saltmarsh. Such loss would have been relatively minor during Maori occupation but peaked in the late 19th and early 20th centuries with logging of indigenous forests and pastoral land use. In recent years, following the regeneration of shrubland and forest on the hill slopes, much of the Brynderwyn Hills forest has recovered to provide a significant habitat. Other habitats, such as wetlands and saltmarshes, have been less fortunate, with little regard being given to these nationally rare habitats during the 20th century. As a consequence wetland and saltmarsh fauna and flora are rare in the area and what remains has become more valuable.
- Habitat fragmentation and loss of linkages are a significant problem. Fauna and flora are more vulnerable when this occurs and without intervention, such as the revegetation now occurring at Bream Tail Farm, populations will be less genetically viable in the long term. Subdivision can contribute to fragmentation and even driveways can be a barrier to biota, especially some invertebrates. Linkages between natural areas are important to the dispersal of plants and animals thereby enabling the genetic health of populations to be maintained.
- Habitat degradation brought about by grazing and weed encroachment can also be a serious problem. This is particularly so for Bream Tail forest remnants, compounding the issue of fragmentation. Accidental fire is always a danger. Subdivision too can degrade habitats through vegetation clearance and earthworks.
- Poor farming practice resulting in eutrophication of streams and wetlands can impact on stream health, invertebrate and fish populations.
- Dams and culverts can be barriers to upstream migration of fish.
- Inappropriate land use can result in soil erosion and sedimentation of streams especially during high intensity rainstorms.

- Attempts to straighten streams can lead to gravel build up and movement with subsequent stream bank erosion.
- Direct disturbance by humans and their domestic pets of ground nesting birds, particularly bittern, will have contributed to local declines and in the case of kiwi, its extinction.
- Phythothora Taxon Agathis, a soil-borne disease or pathogen that kills kauri, may be spread by people, their equipment and animals.

Unfenced forest remnant

Fragmented forest remnants

INDIRECT HUMAN IMPACTS - PESTS

- Invasive weeds (or pest plants) can impact on forest health by smothering new growth or preventing flowering and fruiting. They are often shade-tolerant understorey species, like wandering willy and climbing asparagus, or they can climb into the canopy like moth plant. Exotic palms also have the potential to become problematic as wildings. Without surveillance and management, invasive weeds can very quickly become significant problems requiring a major investment in time and effort to contain and eradicate. Subdivision development can introduce weeds accidentally via machinery and through garden escapes and inappropriate planting choices, eg agapanthus, arum lily and hydrangea (Sullivan et al 2005, DOC 2007). Streams can transport weeds, eg *Glyceria maxima*, hereafter referred to as reed sweet grass. Weeds in more open habitats, such as coastal cliffs and eroded sites, include windblown seeds of pampas, ragwort and other species. (An example of weed impact can be found in the pohutukawa forest at the northern end of Langs Beach where the understorey is being compromised by ginger, garden nasturtium, cotoneaster, agapanthus, tuber ladder fern, arum lily and hydrangea (DOC 2007)).

  Other invasive weeds for surveillance and control or eradication identified in the general area include African club moss, aristea, Himalayan and Japanese honeysuckle, jasmine, Mexican devil weed, mistflower, privet species, wilding pine and woolly nightshade. Pest plants mentioned in this report are listed in Appendix 3 and some key invasive ones are illustrated overleaf.

Moth plant

Climbing asparagus

Periwinkle

Wandering willy

Tree privet

White monkey apple

Kahili ginger

Reed sweet grass

- Possums and rodents impact on entire forest ecosystems by disrupting ecological processes (Cowan 2001, Innes 2001). Possums are selective feeders and deplete species like pohutukawa, rata and kohekohe and interfere with flowering and fruiting. This has flow-on impacts for the NZ pigeon and other seed dispersers. Meanwhile rodents (rats and mice) impact on populations of invertebrates, lizards, some birds and potentially Hochstetter's frog and they deplete seeds and seedlings on the ground.
- Goats, rabbits, hares and wandering or grazing livestock can impact on rare or uncommon plant communities and regeneration generally. Leaves of several threatened plants, eg parapara, are especially palatable to browsing animals (DOC 2007). Where livestock are allowed to graze in forest or remnants, resultant trampling and destruction of vegetation prevents regeneration.
- Mustelids (ferret, stoat, and weasel), cats and potentially uncontrolled dogs impact on rare species, eg nesting seabirds at Bream Tail. For NI kaka and red-crowned kakariki to breed successfully, effective control of mustelids and rats is needed.
- Pigs can impact on ecosystems and rare fauna, eg Hochstetter's frog and kauri snail. They also spread weeds.
- Hedgehogs are known to impact on some invertebrates and lizard species and on ground-nesting birds, eg NZ dotterel.
- Alien wasps and alien ants (eg Argentine ants) are present and likely to impact on ecological process and species but data are scarce from New Zealand.
- Introduced birds (like magpie, myna and rosella) and lizards, (eg rainbow skink) could have adverse effects on indigenous fauna but their impacts are generally less than those of introduced mammals.

Vertebrate pests can have effects on forest health that are often poorly understood and possibly underestimated. For example, the recent removal of rodents, possums and other pests from virtually predator-free Maungatautari in the Waikato has shown spectacular responses of fungi, invertebrates and lizards, reflecting a release from predation pressure (C Smuts-Kennedy pers comm). Approaching management in a holistic way is clearly desirable if a high level of ecological functioning is to be achieved.

Detailed information and strategic direction for the management of plant and animal pests is provided in the document, Northland Regional Pest Management Strategies 2010-2015, (NRC 2010a), prepared by the Regional Council in accordance with the Biosecurity Act 1993.

Top left: Weasel; top right: Stoat; bottom left: Ferret; bottom right: Argentine ant

05 chapter five – STATUTORY PLANNING CONTEXT

The Resource Management Act 1991 together with its amendments is the primary piece of environmental legislation. Part 2 (section 6) covers matters of national importance which include the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna. Section 5 refers to the need to safeguard the life supporting capacity of ecosystems while section 7 states that particular regard shall be had to their intrinsic values. Amendments to the Act in 2003 included making the maintenance of indigenous biological diversity a particular function of regional and district councils, to be addressed through their respective plans. In addition the New Zealand Coastal Policy Statement (DOC 2010), which came into force on 3 December 2010, gives greater direction to all statutory authorities on the protection of indigenous bio-diversity in the coastal environment. Importantly this incorporates not only the coastal marine area but also indigenous ecosystems, coastal vegetation and habitats.

Brynderwyns-Bream Tail is located in the Northland Region and spans Kaipara and Whangarei Districts. Its statutory management is determined by their district plans and the Northland Regional Council's Policy Statement and regional plans. All three authorities recognise the historic loss of biodiversity in Northland, the modification of significant indigenous vegetation and habitats and the need to maintain, enhance and protect that which remains. Surviving areas are often small and fragmented and in this regard Brynderwyns-Bream Tail with its considerable land area, extensive indigenous forest and diverse habitats, assumes greater importance. Within Kaipara the Brynderwyn Hills are registered in the Operative District Plan (KDC 1997) as a nationally significant ecological feature.

The Northland Regional Policy Statement (NRC 1999) identifies the need to integrate provisions in statutory documents involving the management of major natural features crossing local authority boundaries, including the Brynderwyn Hills. However, there is no integrated approach and the operative Kaipara and Whangarei District Plans have different objectives, policies and rules applying to indigenous forest areas and habitats and different methods of assessing their significance and ranking. At time of writing, there are also differences between Kaipara's Operative District Plan and Proposed District Plan (KDC 2009) with regard to the identification of sites of ecological significance and associated provisions. Identifying Significant Natural Areas on district plan maps would provide guidance and certainty to landowners and authorities. Decisions on submissions to the Proposed Kaipara District Plan are expected in 2011.

To maintain biodiversity the Regional Policy Statement considers it essential to protect ecosystems and areas of significant indigenous vegetation, fauna and their habitats from adverse effects. Avoidance of such effects is given priority over remediation and mitigation and it is important that district plans apply appropriate zonings (or overlays), policies and provisions to achieve this objective. Subdivision, earthworks and vegetation clearance have the potential to adversely affect biodiversity and their activity status determines the level of control and resource consent conditions able to be applied. After prohibited status, non-complying and discretionary status give greatest control.

Prescribing large lot sizes and restricting vegetation clearance and earthworks can limit fragmentation and ecosystem disturbance. Conditions requiring ecological assessments, conservation covenants, fencing where appropriate, use of eco-sourced plants, exclusion of domestic dogs and cats, and animal and weed

pest management plans can be effective tools. Monitoring of their implementation is crucial to achieving expected outcomes. With respect to conservation covenants, their mapping and recording on a database would assist this exercise.

Besides statutory control mechanisms, authorities offer incentives for protection such as additional development rights, rates relief on covenanted areas and funding for environmental enhancement projects. They also promote and encourage voluntary mechanisms for biodiversity protection and enhancement.

The Northland Regional Council in its 10-Year Efficiency and Effectiveness Review (NRC, 2009c) noted that although non-statutory approaches to biodiversity management have worked well, there are few rules in its regional plans to protect biodiversity. (There are rules in the Regional Water and Soil Plan [NRC 2004] prohibiting vegetation clearance within significant indigenous wetlands and controls on vegetation clearance on erosion prone land.) The review also observed that lack of awareness of ecological processes and values can lead to inappropriate land use that may unintentionally result in adverse environmental impacts.

The Regional Policy Statement is undergoing a review process so there is an opportunity to introduce policies for the better protection and maintenance of biodiversity which must then be carried into district plans. This should result in a more integrated approach and give effect to the 2003 amendment to the Act.

It is hoped this report on Brynderwyns-Bream Tail will inform future statutory planning processes, policies and provisions and encourage co-ordination between regional and district authorities to protect and enhance the area's ecosystems and biodiversity and achieve integrated and sustainable management.

Large Monocotyledons (1) *Freycinetia baueriana* subsp *banksii,* kiekie, growth habit, with (2) female flower inflorescence. Leaves of *Cordyline* species: (3) *C. banksii,* ti ngahere; (4) *C. australis,* cabbage tree, ti; (5) *C. pumilio*, ti rauriki. (6) a small specimen of *C. pumilio* with inflorescence and (7) fruit. (8) *Dianella nigra,* blueberry, turutu, with (9) fruit.

06 chapter six – CURRENT & POTENTIAL BIODIVERSITY INITIATIVES

Many landowners interviewed during this study are either currently or considering undertaking restoration work in or near their properties in the Brynderwyns-Bream Tail area and some 21 local residents provided a snapshot of their broad objectives and aspirations (refer Acknowledgements). Unsurprisingly, most (16) identified strongly with the protection of overall landscape values, but forest health (16), together with protection of streams/wetlands (14) and fauna (10), also figured prominently. Landscape values were loosely defined as comprising a high level of naturalness, ie excluding artificial structures (buildings and roads) and monoculture.

Besides the representative examples of biodiversity restoration initiatives described below (refer Figure 2 for location), there will be individuals undertaking various small-scale activities. There are also other projects such as the management of ecosystem pests in DOC reserves as funding permits, control of roadside invasive weeds by councils and general awareness-building projects by these agencies.

Group planting activity, Marunui

MARUNUI CONSERVATION LTD	
Tenure	Private conservation company in the Brynderwyn Hills. 18 shareholders. Total area of 423ha is covenanted with QEII and called Marunui.
Habitat, fauna and flora values and significance	• Diverse hill country forest with many ecological units • Well-buffered streams supporting representative fauna • Many threatened or regionally significant flora species • Populations of NZ pigeon, tui, NI tomtit and other birds • Seasonally visiting offshore island birds - NI kaka, red-crowned kakariki, bellbird • High potential to restore and manage diverse natural forest and stream ecosystems
Threats	• Mammalian pest threats to ecosystems – goats, pigs, possums, rats • Mammalian predator threats to species - mustelids, cats, rats, hedgehogs, dogs (to kiwi) • Invasive weed impacts • Potentially Argentine ants
Vision / Objectives	• Protect, conserve and enhance Marunui's flora and fauna • Advocate for the Brynderwyns
Current restoration	• Control and surveillance for invasive weeds, eg climbing asparagus, great bindweed, blackberry, wandering willy, Mexican devil weed, African club moss, aristea, moth plant, and panic grass • Gradual felling or ring-barking of wilding pines, wattle and eucalypts • Control of possums and mustelids throughout • Rat control over core areas of diverse forest • Targeted control of wasp nests, magpie, cat and hedgehog • Surveillance for and control of pigs • Eco-sourced planting (eg puriri, kowhai and harakeke) to enhance nectar sources
Potential restoration opportunities	• Maintain efforts to contain, significantly reduce or where possible, eliminate key invasive weeds • Expand current control to further reduce impact of invasive mammalian pests and predators and monitor level of recovery as guided by baseline studies (eg Pierce 2003) • Coordinate activities with neighbouring properties, including those of government agencies, to maximise impact and sustainability of management • Maintain ability to adapt to any new approaches for managing threatened or significant species • Review options for more intensive management, including mammalian pest exclusion sites, and test these against rapidly changing knowledge acquired at fenced sites elsewhere • Plant threatened and regionally significant species using eco-sourced seeds/plants • Pending effective dog and mustelid control, reintroduce Northland brown kiwi

TARA ROAD GROUP	
Tenure	Multiple private tenure comprising six properties in the Hakaru River catchment of Tara Road, Jude Road area and hillslopes adjacent to Marunui Conservation Ltd.
Habitat, fauna and flora values and significance	• Diverse hill country forest of southern slopes of Brynderwyn Hills • Upper reaches of Hakaru River catchment and tributaries and associated wetlands • Significant flora assumed to be present within management area • Populations of NZ pigeon, tui, NI tomtit and other birds • Seasonally visiting birds from offshore island - NI kaka, bellbird • Linkages with another high value natural area - Marunui
Threats	• Mammalian pest threats to forest and streams - goats, pigs, possums, rats • Mammalian predators (mustelids, cats, rats) posing threats to birds and others and infestations of Argentine ants • Significant and widespread invasive weed issues modifying the forest including wilding pine, moth plant, Himalayan honeysuckle and white monkey apple, and in wetlands reed sweet grass • For the upper river catchment in particular, potential for accelerated erosion and sedimentation following exotic forest harvesting on upper slopes
Vision / Objectives	• Forest and wetland restoration via active pest management, covenants, advocating development controls, raising awareness of conservation issues and associated surveillance and management needs • Protect, conserve and enhance the area's flora and fauna
Current restoration	• Some control of and surveillance for forest and wetland weeds, particularly wilding pine • Some possum and predator control • Surveillance for pest ungulates and wandering stock
Potential restoration opportunities	• Work with neighbours (eg Marunui Conservation Ltd, Hancock Forest Management) and Councils to coordinate key management and surveillance work for ecosystem pests, eg possum and goat control, surveillance for moth plant and others; monitor pine harvesting methods • Maintain efforts to contain and eliminate wilding pine from target area • Seek professional advice from Council staff and specialists to plan the management of stream and wetland weed species, especially reed sweet grass • Evaluate approaches for specific predator control, ie determine costs and benefits of predator regimes aimed at protecting specific fauna species compared with doing nothing; or focus on ecosystem pests (especially possums, ungulates, weeds)

BREAM TAIL HEADLAND	
Tenure	Two contiguous properties at the north-western sector of Bream Tail, together with neighbours.
Habitat, fauna and flora values and significance	• Excellent example of coastal forest and cliff habitats with improving linkages • Links with small wetland • Presence of threatened/significant plant species including coastal maire • Presence of threatened/significant fauna including grey-faced petrel mainland colony, blue penguin, NI kaka, red-crowned kakariki, NZ pigeon, bellbird and Auckland green gecko
Threats	• Edge effects especially weed invasion and wind damage • Impacts of possums on tree health • Potential impacts of possums, mustelids, cats and rats on seabirds and other avifauna • Grazing of remnants
Vision / Objectives	• General forest restoration • Flora and fauna values protected
Current restoration	• QEII covenants on forest, shrubland and wetland; fencing of remnants • Has been recent pulsed control of possums and rats to protect tree health • Has also been some mustelid and cat control to protect seabirds and other birds • Feral pigs reduced
Potential restoration opportunities	• Maintain or increase possum management to a level that will encourage ecosystem recovery. Base timing on annual assessments of health of indicator trees, eg pohutukawa and kohekohe, and work in with pest management plans to the east, ie Bream Tail Farm • Consider fencing off additional forest remnants and wetlands from grazing stock as appropriate • Consider planting to link remnants • Evaluate seabird population to determine whether predator control is needed and consider applying results

Bellbird

BREAM TAIL FARM	
Tenure	A large gated subdivision in multiple private ownership, with operating farm and resident farm manager. Located in the eastern sector of Bream Tail. Controlled public access through property provided by coastal walkway.
Habitat, fauna and flora values and significance	• Diverse coastal forest remnants and wetlands with rapidly improving linkages • Presence of significant plant species • Presence of threatened/significant fauna including bittern, NI kaka, bellbird, pied shags (breeding), NZ pigeon (flocks up to 30), longfin eel reported
Threats	• Reinvasion of weeds (eg moth plant, woolly nightshade) and impacts of wind, etc on forest remnants • Domestic importation of invasive weeds and ants • Invasion/reinvasion of possums, pigs, cats and other mammalian pests • Disturbance by walkers' dogs on fauna, eg bittern
Vision / Objectives	• Forest and wetland restoration to enhance biodiversity and visual amenity • Flora and fauna protected
Current restoration	• 250 ha of old growth and extensive new plantings fenced and managed for invasive weeds, (mainly moth plant and woolly nightshade) • Wetlands enhanced with peripheral planting and fenced • Selected areas of pasture retired from grazing, fenced and planted to link existing remnants • All plantings eco-sourced, propagated from seeds gathered on the property • Possums and pigs managed to low levels and reinvasion points targeted; puriri and pohutukawa trees are responding positively to pest management • Cats and magpies controlled to low levels
Potential restoration opportunities	• Maintain pest management to encourage ecosystem recovery • Evaluate approaches for predator control and maintain an ability to respond to new situations as they arise, eg intensifying pest management via mustelid control if threatened fauna such as kaka attempt to nest, and consider other options such as providing penguin nest boxes in secluded sites • Integrate pest work with coastal neighbours to the north west and inland to the west to minimise reinvasion and provide greater benefits to all sites

HANCOCK FOREST MANAGEMENT (NZ) LTD	
Tenure	Hancock Forest Management (NZ) Ltd (HFM) in the Brynderwyn Hills, especially on the northern slopes.
Habitat, fauna and flora values and significance	• Diverse hill-country forest remnants and fauna (refer Chapter 3) with extensive exotic plantations
Threats	• Impacts of possums, pigs and goats on forest health including understorey • Impacts of predators on fauna • Invasion of weeds along forest roadways • Potential accelerated erosion and sedimentation of waterways post-harvesting
Vision / Objectives	• Managing forestry production to comply with industry's ecological best practice
Current restoration	• Control of possums using contractors and/or fur-trappers (and previous funding of community group to manage possums at Glenmohr Road) • Goat survey (2008) to determine levels of goat infestation • Co-operates with Marunui Conservation Ltd on complementary possum control • Significant natural areas within the holding have been mapped and ranked so that forest operations can be planned accordingly and consents applied for where appropriate
Potential restoration opportunities	• Assess the level of possum impact in Brynderwyn Hills annually or biennially and determine best management approach working with landowners and groups managing possums along HFM boundaries and individuals or contractors trapping for fur • Assess potential impacts of harvesting on stream catchments and respond accordingly, eg retirement of blocks, restoration planting, protective covenants • Following harvesting and prior to replanting, consider impacts on adjacent conservation areas and where appropriate provide for unplanted buffer zone/s to regenerate indigenous forest

Wilding pines, Marunui

BRYNDERWYN HILLS SUBDIVISIONS	
Tenure	Recent subdivisions in the Brynderwyns.
Habitat, fauna and flora values and significance	• May include, or are on the edge of, diverse hill-country forest and shrubland containing important streams • May include significant stream and forest fauna, ie Hochstetter's frog
Threats	• Impacts of ecosystem pests, eg possums, pigs and goats, on forest health • Impacts of predators on fauna • Earthworks involved in construction of roads, driveway access and building sites with potential erosion and sedimentation of waterways • Invasion of weeds and potentially other invasive pests (eg Argentine ant) along vehicle access and/or around dwellings • Impacts of domestic dogs and cats on fauna • Inadequate implementation and monitoring of consent conditions
Objectives	Various resource consent conditions have been required by Councils, including: • Implement best practice earth-works to avoid or mitigate potential erosion and sedimentation of streams • Conservation covenants on significant natural areas • Preparation of various plans for ecological management; animal pest and invasive weed control and management; streamside and wetland enhancement using eco-sourced plants • Bond payments to enable management of and surveillance for ecosystem pests into the future • Fencing of riparian areas and restoration planting using eco-sourced plants • Exclusion of domestic pets – cats and dogs • The formation of a body corporate responsible for implementation of conditions on ecological management and enhancement
Current restoration	In most cases there was little or no environmental management occurring prior to subdivision.
Potential restoration opportunities	Conditions of consent, if implemented, will enable basic environmental values to be sustained or enhanced but effectiveness will depend on the commitment of lot owners and/or body corporates, and the monitoring of conditions by Councils. Additional work by body corporates or individual landowners could also be effective: • restoration of habitat buffers and corridors using eco-sourced plants • coordination of pest management with neighbouring properties to improve extent and duration of benefits

Northern rata vine on puriri

07 chapter seven – OPPORTUNITIES FOR INTEGRATED MANAGEMENT

GENERAL

As identified, the various initiatives to manage biodiversity range from comprehensive control of forest ecosystem pests to more localised management of streams, wetlands, coastal headland vegetation and seabirds. It is sometimes difficult to assess how successful such activites are because the level of outcome monitoring varies widely. Some projects appear to have been very effective in meeting individual objectives, eg the monitoring of several indicator species at Marunui has shown a general improvement in forest health and an increase in some bird populations over the years. This coincides with sustained possum and mustelid control and targeted rat control (QEII 2010, J Hawley pers comm). Similar positive responses in vegetation health and bird numbers have followed sustained possum control in some coastal forest sites, particularly at Bream Tail Farm (D Burchett pers comm).

Whilst such initiatives may be achieving excellent local outcomes, the broader Brynderwyns-Bream Tail area warrants a more integrated management approach to secure widespread and lasting benefits to biodiversity. Integrated approaches are those which not only have geographically wider target areas, but which also address a range of issues to improve ecological processes generally and more effectively, ie a more holistic approach. For example, targeting just one ecosystem pest like the possum may improve some very important aspects of forest health, including the flowering and fruiting of trees, but if understorey pests like goats and others are neglected, the long-term benefits of possum control on the forest ecosystem are less effective. Also relevant is consideration of the potential impact of subdivisions which, without careful planning and appropriate controls and restrictions, can result in fragmented habitats, adverse physical impacts and the introduction of new pests. Meanwhile roaming domestic pets, especially dogs, would negate some future programmes such as the reintroduction of Northland brown kiwi and other rare or locally extinct fauna (refer Table 3).

Some potential examples of more integrated management are considered below according to habitat and also by generic issue, eg fauna recovery, pest surveillance and climate change considerations.

STREAMS AND WETLANDS

The many streams flowing out of the Brynderwyn Hills pass through a wide range of management regimes, some of which are causing the degradation of stream systems and their fauna. For example, most freshwater fish species in New Zealand are threatened because of poor land management including farming impacts on water quality, loss of riparian habitat, increased sedimentation, barriers to upstream migration and water abstraction (Allibone et al 2010). Based on those findings, a useful approach for many of the poorly known stream systems would be to survey their lengths (including estuarine sections outside this study area), locate and map specific issues, and plan for their restoration.

Initiatives at other better known streams such as Tara Stream, the upper Hakaru River and their tributaries, could focus directly on restoration. This might simply involve the removal of an old obstructive weir or the

fencing and planting of stream banks, particularly at high-risk erosion sites and at saltmarshes where whitebait and other fauna could be recovered. In severely degraded areas more detailed restoration planning may initially be needed to map out suitable approaches to planting riparian areas, undertaking weed control and monitoring in accordance with established guidelines (eg NRC 2009b). Specialist advice and field days may be needed to address complex issues, such as how to approach control of reed sweet grass infestations in the Hakaru River catchment.

Stream-length approaches would ensure that key background information on a catchment and its issues were known, thereby allowing a simple management plan to be developed and implemented. If such plans can be linked with the management of adjacent forest and shrubland habitats, the benefits would be maximised and ultimately improve overall stream health.

As noted earlier, wetlands in this area have been considerably reduced and degraded by grazing, drainage and the effects of surrounding land use but some landowners recognise their importance and are actively working to fence and restore them. The Northland Regional Council is currently assessing and scoring wetlands and the survey data could be used to determine priorities for protection, including fencing and pest control.

COASTAL FOREST

There are several important remnants of coastal forest in the Bream Tail area, some of which are being managed via fencing and possum control, eg on Bream Tail Farm and others. Using these examples for other properties, the approach would be to first extend the geographic area in which ecosystem pests are being managed and secondly, to consider what levels of management and monitoring are appropriate. Individual sites merit an initial survey and threat assessment to confirm key issues and management needs. The latter would generally include combinations of fencing, possum and invasive weed control, monitoring for pest reinvasion and responses from indigenous plants.

In the medium term, as key environmental pests are removed or reduced to acceptable low levels, consideration should be given to further enhancing these sites via rodent control and by providing linkages or corridors to other stands, including the Brynderwyn Hills. Rodent control would facilitate rapid regeneration of understorey plants and potentially allow threatened and sensitive fauna species to recover. Linkages with other sites would facilitate gene flow of plants and animals between formerly isolated populations.

In some cases goats and pigs could be greatly reduced or eliminated through surveillance and control and livestock excluded from sensitive forest remnants by fencing. This approach is already being taken at Bream Tail Farm and within a QEII covenant on another Bream Tail property. Clearly this task would be easier and more effective if source populations in the Brynderwyns could be reduced to very low levels and ultimately eliminated.

Coastal forest remnant and fenced pond

Reinstatement of habitat linkages, Bream Tail Farm

There are precedents to this approach. For example, at Whangarei Heads pigs and goats were removed from Bream Head in the 1980s-90s (DOC 2005) and this has since been extended by the Whangarei Heads Landcare Forum out to the wider Whangarei Heads area (Pierce et al 2002) and with further successes the target area has been extended north to the Mt Tiger/Waikaraka area (D McKenzie, NRC, pers comm). Similarly, the Tutukaka Landcare Coalition has successfully removed goats and pigs from a very large area and maintains surveillance there (Eco Oceania Ltd 2007, M Camm pers comm).

BRYNDERWYN HILLS FOREST

The above comments for coastal forests generally apply to the Brynderwyn Hills, except that this area is largely interconnected. The urgent needs are for widespread sustained control or elimination of key ecosystem pests, ie possums, goats, pigs and invasive weeds, and localised control of rodents and mustelids. The approach taken at Whangarei Heads (which also involves a mosaic of private and public land) for pest management provides some pertinent lessons. For key pests there is a need for a coordinated approach, with agencies and community groups first discussing and agreeing on the objectives. This would be followed by a feasibility study covering achievability of targets, funding sources, tactical approach, reinvasion potential, ongoing surveillance and cost/benefits of eradication versus sustained control for some pests. Pest management costs are significant so planning and feasibility studies are important. A wider approach may be needed regarding funding sources, including ongoing sponsorship and implementing ecological mitigation measures associated with developments. Increasing the level of technical support from agencies is also needed.

FOREST FAUNA RECOVERY

Although the Brynderwyn Hills appear to have a widespread and possibly healthy population of Hochstetter's frog, the birds, reptiles and bats have fared poorly. The targeting of possums is being accompanied by observations of greater numbers of NZ pigeon and tui in two or more management areas, while NI tomtit has recolonised the Brynderwyn Hills in recent decades. Other species continue to struggle, including most of the lizards, seasonally visiting NI kaka, red-crowned kakariki and bellbird and relict populations of seabirds. The reason for the demise of lizards and most birds is a combination of predators, particularly rats, mustelids and feral cats, while hedgehogs also impact lizards and invertebrates. Uncontrolled dogs can have devastating effects on seabird populations and kiwi (where they exist).

Four key approaches could be used in different combinations for recovering bird and lizard populations – controlling ecosystem pests, controlling nest predators, fencing out predators, and reintroductions.

- **Controlling ecosystem pests**

  As already implied, controlling ecosystem pests in areas with diverse vegetation will see some recovery in NZ pigeon and potentially kaka, red-crowned kakariki and bellbird because of improved levels of fruit and nectar food resources. The sustained control of possums will also boost breeding success of the NZ pigeon by reducing nest predation. The flowering and fruiting levels might also lead to higher numbers of tui, silvereye and other common birds and potentially nectar-feeding lizards. By itself though, possum control only goes part way to significant recovery of fauna.

- **Controlling nest predators**

  All breeding birds benefit from control of nest predators. For the kaka, red-crowned kakariki and bellbird to re-colonise Brynderwyns-Bream Tail and for NZ pigeon to recover quickly, ongoing possum management plus local control of rats and mustelids is needed (refer Appendix 5). As it is difficult to predict where any of these birds might nest, options would be to either anticipate potential nesting areas and maintain an August-February predator control regime, or to undertake surveillance and implement management immediately nesting activity is observed.

  Perhaps an initially more pragmatic option would be to survey several potential sites during the spring and evaluate activity levels. Nesting is most likely in the area with highest diversity and healthiest forest and should it occur, a permanent rat and mustelid control regime could be justified. There is also potential for birds to nest in or near an existing managed habitat where there is greater chance of success. Such surveys could, with specialist help, be extended to include lizard surveys thereby enabling an evaluation of site suitability based on vegetation, birds and lizards.

  Nesting seabirds can be disrupted by livestock, pigs and especially predatory mustelids and probably also possums, cats and rats. The Bream Tail grey-faced petrels are protected from livestock, pigs and possums and a mustelid-control regime has previously been in place. This level of control has the potential to be very effective if it applies current best practice techniques as used by the kiwi programme and others in Northland (Pierce et al 2006a), with associated outcome monitoring. Penguins could also benefit from this approach, particularly if nest boxes were provided in safe locations.

- **Fencing out predators**

  Predator-fenced areas ranging in size from several hectares to c.3000 ha and the removal of all pests inside is a method increasingly used to protect fauna at many sites in New Zealand. If fauna is the key focus for restoration then the method could be considered and different sites evaluated. If landowners were supportive, their particular sites would need to be surveyed and evaluated against many physical and biological criteria, eg ground suitability, habitat type, plant diversity, reinvasion risks and public access. Larger sites are more effective, but even small areas could be used to protect populations of lizards and macro-invertebrates and potentially be used as crèches for kiwi and other reintroductions. Although costs can be significant, a successfully fenced site can be a major public focus and provide impetus for species recovery and conservation work generally.

- **Reintroductions**

  The area has lost many of its fauna species, especially birds, since human settlement. Many still survive in more secure locations, especially offshore islands or in less diverse forests where predator populations are lower. Currently very few if any of these species could be safely reintroduced

to the local area because most factors responsible for their original decline remain. However, as appropriate sustained site management elsewhere in Northland has demonstrated, some species could be considered for reintroduction as per Table 3. Any planning for the relocation of species would require the involvement of iwi to facilitate tribal tikanga.

TABLE 3 – Some potential species for reintroduction

SPECIES	POTENTIAL SITES	MANAGEMENT NEEDS
Northland brown kiwi	Marunui - Hakaru River	Plan: dog, mustelid and cat control, intensive monitoring (Pierce et al 2006a)
Lizards Macro invertebrates NI robin	Predator exclosures or intensively managed areas	Surveys. Plan: fence, pest removal including rat, mouse, hedgehog, rabbit, hare, cat and mustelids; or reduce rat, cat and mustelids to very low densities
Bellbird	Marunui	Plan: possum control (to promote food), rat and mustelid control in breeding season; potentially supplementary feeding, supplement island visitors (refer also DOC 2005)

BIOSECURITY ISSUES

Currently biosecurity is being addressed very locally by individuals, groups, councils and through conditions of consent for some subdivisions. These issues will be ongoing and increase until the following are achieved:

- the control of key invasive weeds
- a heightened community awareness of the impacts of invasive pests generally and a significant change in attitude towards biosecurity
- the operation of an effective pest surveillance and emergency response programme throughout the area.

Examples of new issues include:

- the illegal dumping of weeds and household rubbish along Cove Road and some local back roads
- pests such as African club moss and Argentine ant being transported into new subdivisions via vehicles or goods

  Councils and other agencies need to work with the community to help solve these problems. A concerted public awareness programme is required, together with the removal and safe disposal of existing road-side weed infestations and appropriate follow-up to complete site eradications. Identifying the reasons for dumping would be helpful, for example by determining whether offenders deem it to be too far to travel or too expensive to take rubbish to Council transfer stations.

- The potential impact of *Phythothora Taxon Agathis* (PTA) on kauri. PTA is a soil-borne disease or pathogen that kills kauri, ranging from seedlings to the most mature trees. It is spread by soil and water movement and appears to require suspension in water to infect a host plant, but the

Weeds and household rubbish dumped in reserve, Cove Road

additional role of animal vectors (including humans) is poorly understood. Strict hygiene standards, such as washing footwear and equipment with *trigene*, and control of pigs, livestock and dogs are important precautionary measures to reduce the spread of PTA.

SOME LONG-TERM MATTERS

With increasing evidence of potentially extreme climate events in the future, there is a need to consider ways of better buffering the coastal and hill-country forests from catastrophic weather effects, eg drought and fire at one extreme and severe storms at the other. The best buffers are undoubtedly those provided by large, diverse landscapes in which forest habitats and species occur over a wide area, with many potential refuges for biota being available in the form of sheltered and/or damp valley systems, different ridge and spur alignments, and high altitude ridges. Brynderwyns-Bream Tail with its diverse topography is such a landscape and the ability of fauna to move to refuges during extreme events could be further enhanced by the reinstatement of corridors and 'stepping stones'.

Related to this issue is the question of sustainable development and what levels of subdivision and type of consent conditions applied are appropriate, whether they will adequately maintain, protect or enhance biodiversity and how they integrate with the wider Brynderwyns-Bream Tail ecology.

Permanent protection through land acquisition by agencies or statutory authorities, or in combination, warrants serious consideration. In past years the Department of Conservation has successfully secured three areas of significant indigenous forest in the Brynderwyns through purchase by the Nature Heritage Fund. These areas are now permanently protected as scenic reserve under the Reserves Act 1977 (refer Figure 2). There may be opportunities to secure additional areas with high biodiversity values and the creation of linkages with, or consolidation of, existing reserves and covenanted land could be targeted. At the same time there could be significant community benefit from associated landscape and recreational values. As human population growth occurs, with accompanying development, there will be further challenges to biodiversity and an increasing need for protected natural areas. The notion of a regional park in the Brynderwyns could be explored.

08 chapter eight – CONCLUSIONS AND RECOMMENDATIONS

The Brynderwyns-Bream Tail area has a wide diversity of habitats encompassing forest, shrubland, coastal headland, saltmarsh, streams and wetlands. Many support threatened and sensitive flora and fauna populations but nearly all are under some level of threat from the direct or indirect impacts of human activity. While there are several initiatives by landowners, community groups and agencies to protect and enhance local biodiversity, most of the area does not receive any form of biodiversity management. There is enormous unrealised potential for Brynderwyns-Bream Tail to contribute to enriched biodiversity on a region-wide scale. All current projects would benefit from a more integrated approach to restoration, primarily involving better communication, resourcing and coordination of effort. Some key aspects of biodiversity management over the study area include the following:

FOREST HEALTH

- Maintain current impetus to restore biota at Marunui, Bream Tail and other local sites and determine benefits of these medium-long term efforts to assist with planning for the wider area. Monitoring should include the levels of pest control effort, residual pest levels and reinvasion rates (operational monitoring), plus the benefits to indigenous biota (outcome monitoring).
- Encourage the management of other key sites for biodiversity and the development of improved linkages between them, including Bream Tail with Brynderwyn Hills.
- Build on and improve the outcomes of existing projects by coordinating a wider and more integrated Brynderwyns-Bream Tail approach to ecosystem pests, one that targets possums, goats, pigs and invasive weeds and potentially other pests. This would involve meetings with landowners, relevant agencies and companies to discuss and evaluate objectives, initial feasibility, steps needed to achieve targets, management structure, funding sources and sustainability.

THREATENED FLORA AND FAUNA

- Maintain and expand ecosystem pest management as described above.
- Maintain and/or implement predator management around key breeding sites, eg mustelid and cat control around seabird sites; consider cat, mustelid and rat control around areas where bellbirds, red-crowned kakariki and kaka are suspected or anticipated to be nesting. (This could also benefit NZ pigeon and others. See also Appendix 5 for pests to target).
- Survey above sites for lizard management opportunities. If key species are present or suspected to be present, maintain year-round rodent control. Determine the distribution and potential adverse impacts of rainbow skink and liaise with herpetologists on the management of Hochstetter's frog and Auckland green gecko.

Rock pool waterfall, Marunui

- Encourage people to report bat sightings and follow these up with bat-detectors, (audio devices that enable identification of species).
- With Department of Conservation, evaluate the feasibility of threatened bird reintroductions, starting with Northland brown kiwi given its iconic status, the success of releases elsewhere in Northland and consistency with the kiwi Taxon Plan (C Gardiner, DOC, pers comm). Provide for tangata whenua involvement as kaitiaki.
- Maintain strong links with botanists and ecologists who can advise on specific management for threatened plants and their habitats.
- Encourage scientific study and research by tertiary institutions.

STREAM AND WETLAND HEALTH

- Support existing initiatives, including the Tara Road group, in restoring riparian habitats. This could involve significant technical support at an advisory level covering feasibility, methodology, sustainability and monitoring.
- Consider other catchments where there are potentially significant benefits for low levels of restoration work, eg removing obstructions and undertaking riparian fencing and planting. This could also involve collection of baseline information for some of the less well known streams.
- Coordinate efforts with other agencies and groups with an interest in enhancing stream and wetland health, recognising any existing guidelines on catchment management.

OVERALL MANAGEMENT

- Recognise and identify Brynderwyns-Bream Tail as a priority biodiversity area for protection and management in regional and district council planning documents.
- Provide opportunities through workshops and field days for the exchange of ideas and information between different groups, landowners, iwi and agencies. These would cover animal pest control methods, weed identification and control and more generic management issues and solutions across boundaries.
- Draw on the technical expertise of staff and contractors at national and regional agencies, such as the Department of Conservation and Northland Regional Council, for advice on specific issues ranging from biota surveys to planning pest management, biosecurity and monitoring.
- As restoration initiatives develop, consider setting up a framework for co-ordinating activities. This could be a landcare forum, possibly following the model established amongst landcare groups of the Whangarei Heads Landcare Forum. An initial task could be the development of a long-term action plan to identify objectives and implement appropriate management tasks.
- Explore the potential with Northland Regional Council for the sustained funding of a project manager to help build community awareness and co-ordinate activities.
- Advocate the need for regional and district councils to address inconsistencies in statutory planning documents to achieve integrated management of major natural features like Brynderwyns-Bream Tail; and to effectively protect and maintain indigenous biodiversity as required by the

Resource Management Act 1991, its amendments and the New Zealand Coastal Policy Statement.

- Alert the relevant agencies and local and regional authorities to the potential for further acquisition of land with significant biodiversity and ecosystem values within Brynderwyns-Bream Tail to secure permanent protection through reserve status and consolidate linkages with other protected areas.

Northland brown kiwi reintroduction

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Auckland Museum granted permission for the use of illustrations from *Native Animals of New Zealand*, 3rd ed, 1993, while Professor John Morton allowed the use of his drawings from *The Flora of Marunui*, 1998.

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Cover: Northern rata vine on puriri, Ivor Wilkins, 2010
Dedication: Kauri bark detail, Ivor Wilkins, 2010
p4 Kanuka shrubland, Ivor Wilkins, 2010
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p20 Kanuka shrubland with emergent kauri, Marunui, Ivor Wilkins, 2010
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p31 Unfenced coastal forest remnant; & Fragmented forest remnants, John Hawley, 2010
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Reinstatement of habitat linkages, Bream Tail Farm, John Hawley, 2010
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Regionally significant flora, p24
DOC, 1999 (Carmine rata)
John Hawley, 2010 (Kawaka seedling)
DOC (undated) (Tree fuchsia)
Peter James de Lange, DOC, 1993 (Tussock)
Robyn Salter (*Hebe macrocarpa* var. *macrocarpa)*
Shaun Barnett, DOC, 1977 (Northern rata)

Threatened fauna, p28
J L Kendrick, DOC, 1973 (NZ pigeon)
Nadine Gibbs, DOC, 2000 (North Island kaka)
J L Kendrick, DOC, 1969 (Auckland green gecko)
J L Kendrick, DOC, 1980 (Red-crowned kakariki)
Terry C Greene, DOC, 1990 (Grey-faced petrel)

Pest plants, p32
Jonathan Boow, Auckland Council (Moth plant)
Su Sinclair, Auckland Council (Periwinkle)
John Hawley, 2010 (Tree privet)
Auckland Council (Kahili ginger)
Auckland Council (Climbing asparagus)
Jonathan Boow, Auckland Council (Wandering willy)
Auckland Council (White monkey apple)
Auckland Council (Reed sweet grass)

Pest animals, p33
DOC, 1970s (Weasel)
DOC, 1980s (Ferret)
NRC (Stoat)
Andrew Townsend, DOC (Argentine ant)

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APPENDICES

APPENDIX 1: STATEMENTS OF INTEREST AND SUPPORT FROM TANGATA WHENUA

TE URI O HAU

The Te Uri o Hau area of interest covers land and coastal shoreline generally located in the Kaipara District and the northern portion of Rodney District and its rohe encompasses portions of the southern and eastern Brynderwyn Range.

In 2002, legislation passed to settle Treaty grievances specifically acknowledged the importance of Te Uri o Hau's association with indigenous species.

"The whaikorero (oral history) of our tupuna from of old and now honoured by each generation thereafter places the utmost importance on the role of Te Uri o Hau as Kaitiakitanga (guardians) for all the life forms of the environment, including all indigenous species of fish, flora and fauna alive. All are precious, important and play their particular role within the environment and their integration in it is woven within the holistic pattern of life itself. Te Uri o Hau as a people are part and parcel of the environment.

Te Uri o Hau recognise that any negative effects on one species may cause ill effects for other species. Te Uri o Hau continue to maintain a Kaitiaki (guardian) role to look after all species within our environment.

The mauri (life force) of all species is important to Te Uri o Hau, the essence that binds the physical and spiritual elements of all things together, generating and upholding all life. All species of the natural environment possess a life force and all forms of life are related."

To that end, Te Uri o Hau are supportive of efforts to protect and enhance our indigenous species.

Te Uri o Hau Settlement Trust
Cherelle Kidwell
June 2010

NGATIWAI

The Ngatiwai Trust Board Resource Management Unit would like to support in principle Marunui Conservation Limited's proposal to enhance the biodiversity values of the Brynderwyn Hills by controlling animal pest numbers and increasing successful breeding rates of taonga species within our Rohe.

Ngatiwai is very interested in the pursuit of further knowledge and protection of our indigenous species and the impacts that invasive species can have on them.

Ngatiwai Trust Board acknowledges the work that Marunui Conservation Limited has completed in the past in its efforts to reduce rats, possums, mustelids and plant pests within our Rohe.

Ngatiwai Trust Board Resource Management Unit
Whiria Fletcher and Clive Stone
September 2010

PATUHARAKEKE TE IWI TRUST

Ko Manaia te Maunga
Ko Whangarei Te Rerenga Parāoa Te Moana
Ko Takahiwai Te Marae
Ko Rangiora Te Whare Hui
Ko Patuharakeke Te Hapū

The Trustees are pleased to support in principle and practice, the initiative by the people of Marunui Conservation Ltd to enhance the biodiversity values of the Brynderwyn Hills.

STATEMENT ON 'CULTURE'

'Culture' [including language] is understood as the total way of living of [the] people such as Tangata Whenua/ People of the Land. That is, the relationship between the [indigenous] peoples, the land and water-based taonga/natural resources including kaimoana, fisheries, native birds, and wildlife; the foreshore, seabed, and surrounding islands; indigenous flora and fauna. This expansive and ethical knowledge of culture easily encompasses the beliefs, values, and customs of the kainga/villages of Patuharakeke Hapū at Takahiwai, Mangapai, Ōtaika, Toe Toe, and Tamaterau, where the indigenous peoples are in the minority of numbers and power. This Statement clarifies a relationship where the demands of competing users for land, air, and water space, be they customary or business interests or those who just want to maintain an undisturbed environment, confront each other 'head on' (Patuharakeke Iwi/Hapū Environmental Plan, 2006).

Patuharakeke Te Iwi Trust Board

Trustees: Dr Mere Kēpa, Luana Pirihi, Patsy Heperi, Ray Wassell, Juliane Chetham, David Milner, Gilbert Paki, Ani Pitman, Jared Pitman, Greg Mackie
May & July 2010

APPENDIX 2: LIST OF VASCULAR PLANT SPECIES RECORDED IN THE AREA

GYMNOSPERMS			
Agathis australis	Kauri	*Dacrycarpus dacrydioides*	Kahikatea
Dacrydium cupressinum	Rimu	*Libocedrus plumosa*	Kawaka
Phyllocladus trichomanoides	Tanekaha	*Prumnopitys ferruginea*	Miro
P. taxifolia	Matai	*Podocarpus hallii*	Hall's totara
P. totara	Totara		
DICOTYLEDONS			
Acaena novae-zelandiae		*Ackama rosifolia*	
Alectryon excelsus	Titoki	*Alseuosmia banksii*	
A. quercifolia		*Apium prostratum*	NZ sea celery
Aristotelia serrata	Wineberry	*Avicennia marina*	Mangrove
Beilschmiedia tarairi	Taraire	*B. tawa*	Tawa
Brachyglottis kirkii var. *angustior*		*B. repanda*	Rangiora
Callitriche muelleri		*Calystegia sepium* subsp. *roseata*	Bindweed
C. soldanella	Bindweed	*Carmichaelia australis*	NZ broom
Carpodetus serratus	Putaputaweta	*Centella uniflora*	Centella
Clematis cunninghamii		*C. paniculata*	Puawhananga
Coprosma arborea	Mamangi	*C. areolata*	
C. grandifolia	Kanono	*C. lucida*	Shining karamu
C. macrocarpa	Large seeded coprosma	*C. parviflora*	
C. propinqua		*C. repens*	Taupata
C. rhamnoides		*C. rigida*	
C. robusta	Karamu	*C. spathulata*	
Coriaria arborea	Tutu	*Corokia buddleioides*	
Corynocarpus laevigatus	Karaka	*Cotula coronopifolia*	Batchelors button
Dichondra repens	Mercury Bay weed	*Disphyma australe*	Native iceplant
Dodonaea viscosa	Akeake	*Dracophyllum latifolium*	Neinei
Drosera auriculata		*Dysoxylum spectabile*	Kohekohe
Elaeocarpus dentatus	Hinau	*Elatostema rugosum*	Parataniwha
Entelea arborescens	Whau	*Epilobium* spp.	
Fuchsia excorticata	Kotukutuku	*Gaultheria antipoda*	
Geniostoma rupestre	Hangehange	*Geranium homeanum*	
Gonocarpus incanus	Piripiri	*Griselinia lucida*	Puka
Haloragis erecta	Toatoa	*Hebe macrocarpa*	
H. stricta	Koromiko	*Hedycarya arborea*	Pigeonwood

Note: listed by botanical and common name where known. Read left to right across page. Data source: from DOC 2006, 2007 and Marunui's flora list. Study will reveal further species.

Hoheria populnea	Houhere	*Hydrocotyle moschata*	A pennywort
H. novae-zeelandiae		*Knightia excelsa*	Rewarewa
Kunzea ericoides	Kanuka	*Laurelia novae-zelandiae*	Pukatea
Lemna minor	Duckweed	*Leptospermum scoparium*	Manuka
Leptecophylla juniperina	Prickly mingimingi	*Leucopogon fasciculatus*	Mingimingi
Lobelia anceps	Punakuru, shore lobelia	*Macropiper excelsum*	Kawakawa
Melicope ternata	Wharangi	*Melicytus macrophyllus*	Large-leaved mahoe
M. micranthus	Small-leaved mahoe	*M. ramiflorus*	Mahoe
Metrosideros carminea	Carmine rata	*M. diffusa*	White rata
M. excelsa	Pohutukawa	*M. fulgens*	Scarlet rata vine,
M. perforata	Aka	*M. robusta*	Northern rata
Mida salicifolia	Willow-leaved maire	*Muehlenbeckia complexa*	Pohuehue
Myoporum laetum	Ngaio	*Myrsine australis*	Mapou
M. salicina	Toro	*Nertera depressa*	
N. dichondrifolia		*Nestegis apetala*	Coastal maire
N. cunninghamii	Black maire	*N. lanceolata*	White maire
Olearia furfuracea	Akepiro	*O. rani*	Heketara
Oxalis exilis	Creeping oxalis	*Parsonsia capsularis*	Native jasmine
Pelargonium inodorum	Herb	*Peperomia urvilleana*	
Pisonia brunoniana	Parapara	*Pittosporum cornifolium*	
P. crassifolium	Karo	*P. eugenioides*	Tarata
P. tenuifolium	Kohuhu	*Plagianthus divaricatus*	Saltmarsh ribbonwood
Pomaderris amoena		*P. kumeraho*	Kumarahou
Pouteria costata	Tawapou	*Pseudognaphalium luteoalbum*	
Pseudopanax arboreus	Fivefinger	*P. crassifolius*	Lancewood
P. lessonii	Houpara	*Quintinia serrata*	
Ranunculus reflexus	Hairy buttercup	*Rhabdothamnus solandri*	Taurepo
Rubus australis	Bush lawyer	*R. cissoides*	Bush lawyer
Samolus repens	Sea primrose	*Sarcocornia quinqueflora*	Glasswort
Schefflera digitata	Pate	*Selliera radicans*	Selliera
Senecio hispidulus		*S. minimus*	
Solanum aviculare		*Sophora microphylla*	Kowhai
Stellaria parviflora		*Streblus heterophyllus*	Small-leaved milk-tree
Tetragonia tetragonioides	“NZ spinach”	*Toronia toru*	Toru
Veronica plebeia	Speedwell	*Vitex lucens*	Puriri
Wahlenbergia violacea		*Weinmannia silvicola*	Towai
MONOCOTYLEDONS			
Acianthus sinclairii	Orchid	*Anzybas rotundifolius*	Orchid
Apodasmia similis	Oioi	*Arthropodium cirratum*	Rengarenga lily

Astelia banksii	Perching lily	*A. solandri*	Kowharawhara/perching astelia
Baumea articulata	Jointed twig rush	*B. juncea*	Sedge
B. rubiginosa	Sedge	*Carex dissita*	Sedge
C. flagellifera	Sedge	*C. lambertiana*	Sedge
C. solandri	Sedge	*C. virgata*	Sedge
Chionochloa bromoides	Tussock	*Collospermum hastatum*	Perching lily
Cordyline australis	Ti-kouka, cabbage tree	*C. banksii*	Ti ngahere
C. pumilio	Ti rauriki	*Cortaderia splendens*	Toetoe
Corybas cheesemanii.	Orchid	*Cyperus ustulatus*	Giant umbrella sedge
Desmoschoenus spiralis	Pingao	*Dianella nigra*	Turutu
Diplodium alobulum	Orchid	*D. trullifolium*	Orchid
Drymoanthus adversus	Orchid	*Earina autumnalis*	Orchid
E. mucronata	Orchid	*Eleocharis acuta*	Sharp spike sedge
E. gracilis	Sedge	*Ficinia nodosa*	Knobby clubrush
Freycinetia banksii	Kiekie	*Gahnia lacera*	
G. pauciflora		*G. setifolia*	
Gahnia xanthocarpa		*Ichthyostomum pygmaeum*	Orchid
Isachne globosa	Swamp millet	*Isolepis inundata*	
I. reticularis		*Juncus edgariae*	Rush
J.kraussii subsp. *australiensis*	Sea rush	*J. planifolius*	Rush
J. prismatocarpus	Rush	*J. sarophorus*	Rush
Lachnagrostis filiformis	Grass	*Lepidosperma australe*	Sedge
L. laterale	Sword sedge	*Libertia ixioides*	
Microlaena avenacea	Bush rice grass	*M. stipoides*	Grass
Microtis unifolia	Orchid	*Morelotia affinis*	
Nematoceras trilobum	Orchid	*Oplismenus hirtellus*	Native grass
Orthoceras novae-zelandiae	Orchid	*Petalochilus alatus*	Orchid
P. chlorostylus	Orchid	*Phormium cookianum*	Whaririki
P. tenax	Harakeke	*Poa anceps*	
Pouteria costata	Tawapou	*Pratia angulata*	Herb
Pterostylis agathicola	Orchid	*P. banksii*	Orchid
P. graminea	Orchid	*Rhopalostylis sapida*	Nikau
Ripogonum scandens	Supplejack	*Rytidosperma biannulare*	
R. gracile		*Schoenoplectus tabernaemontani*	Kuta
Schoenus sp.	Sedge	*S. tendo*	
Simpliglottis cornuta	Orchid	*Singularybas oblongus*	Orchid
Thelymitra aemula	Orchid	*T. longifolia*	Orchid

T. pauciflora	Orchid	*T. tholiformis*	Orchid
Typha orientalis	Raupo	*Uncinia banksii*	
U. uncinata		*Winika cunninghami*	Lady's slipper orchid
FERNS AND FERN ALLIES			
Adiantum cunninghamii	Maidenhair fern	*A. diaphanum*	
A. hispidulum	Rosy maidenhair	*Anarthropteris lanceolata*	Lance fern
Asplenium bulbiferum	Hen and chickens fern	*A. flaccidum*	Hanging spleenwort
A. oblongifolium	Shining spleenwort	*A. polyodon*	Sickle spleenwort
Blechnum chambersii		*B. discolor*	
B. filiforme	Thread fern	*B. fluviatile*	
B. fraseri		*B. membranaceum*	
B. novae-zelandiae	Kiokio	*Cardiomanes reniforme*	
Cyathea dealbata	Ponga	*C. medullaris*	Mamaku
C. smithii		*C. cunninghamii*	Gully tree fern
Deparia petersenii		*Dicksonia squarrosa*	Wheki
Doodia australis	Rasp fern	*Gleichenia dicarpa*	
G. microphylla		*Grammitis ciliata*	
Histiopteris incisa	Water fern	*Huperzia varia*	
Hymenophyllum demissum		*H. dilatatum*	
H. flabellatum		*H. revolutum*	
H sanguinolentum		*Hypolepis ambigua*	
Lastreopsis glabella		*L. hispida*	Hairy fern
Leptopteris hymenophylloides		*Lindsaea linearis*	
L. trichomanoides		*Loxogramme dictyopteris*	
Lycopodiella cernua	Lycopod	*Lycopodium deu x denterodensum*	Lycopod
L. volubile	Lycopod	*Lygodium articulatum*	
Microsorum pustulatum	Hound's tongue fern	*M. scandens*	
Pellaea rotundifolia	Button fern	*Pneumatopteris pennigera*	Gully fern
Pteridium esculentum	Bracken	*Pteris comans*	Coastal brake
P. macilenta		*P. saxatilis*	
P. tremula	Shaking brake	*Pyrrosia eleagnifolia*	Leather-leaf fern
Schizaea bifida	Comb fern	*Sticherus cunninghamii*	
S. flabellatus		*Tmesipteris elongata*	
T. lanceolata		*T. sigmatifolia*	
T. tannensis		*Trichomanes elongatum*	
T. endlicherianum		*T. reniforme*	Kidney fern
Trichomanes venosum			

APPENDIX 3: LIST OF PEST PLANTS MENTIONED IN THE REPORT

COMMON NAME	BOTANICAL NAME	COMMON NAME	BOTANICAL NAME
African club moss	*Selaginella kraussiana*	Agapanthus	*Agapanthus praecox*
Aristea	*Aristea ecklonii*	Arum lily	*Zantedeschia aethiopica*
Climbing asparagus	*Asparagus scandens*	Cotoneaster	*Cotoneaster glaucophyllus*
Garden nasturtium	*Tropaeolum majus*	Himalayan honeysuckle	*Leycesteria formosa*
Hydrangea	*Hydrangea macrophylla*	Japanese honeysuckle	*Lonicera japonica*
Jasmine	*Jasminum polyanthum*	Kahili ginger	*Hedychium gardnerianum*
Mexican devil weed	*Ageratina adenophora*	Mistflower	*Ageratina riparia*
Monkey apple	*Syzygium smithii*	Moth plant	*Araujia hortorum*
Pampas	*Cortaderia selloana*	Panic grass	*Entolasia marginata*
Periwinkle	*Vinca major*	Privet species	*Ligustrum* spp.
Ragwort	*Jacobaea vulgaris*	Reed sweet grass	*Glyceria maxima*
Tuber ladder fern	*Nephrolepis cordifolia*	Wandering willy	*Tradescantia fluminensis*
Wilding pine	*Pinus* spp.	Woolly nightshade	*Solanum mauritianum*

APPENDIX 4 - ANNOTATED LIST OF VERTEBRATE SPECIES RECORDED IN THE AREA

SPECIES	LOCAL STATUS AND HABITAT
A. Indigenous bird species	
Australasian bittern (matuku); *Botaurus poiciloptilus*	Uncommon visitor to streams and wetlands
Australasian little grebe; *Tachybaptus novaehollandiae*	Frequent visitor to farm ponds in the area
Australasian harrier (kahu); *Circus approximans*	Common resident, present in most habitats
Banded rail (moho-pereru); *Gallirallus philippensis*	Present Tara Stream saltmarsh, probably also elsewhere
Bellbird (korimako/makomako); *Anthornis melanura*	Rare visitor, may be increasing
Black shag (kawau); *Phalacrocorax carbo*	Regular visitor fishing in streams and ponds
Black-backed gull (kororo); *Larus dominicanus*	Common along coast
Blue penguin (korora); *Eudyptula minor*	Present along Bream Tail coast and attempting to breed
Bush falcon (karearea); *Falco novaeseelandiae*	Unconfirmed report from the Brynderwyn Hills
Caspian tern (taranui); *Hydroprogne caspia*	Fishing along coast, breeds at nearby Mangawhai Spit
Fantail (piwakawaka); *Rhipidura fuliginosa*	Locally common resident in shrubland and forest
Gannet (takapu); *Morus serrator*	Frequent fishing visitor off Bream Tail
Grey duck (parera); *Anas superciliosa*	Rare visitor to ponds, streams
Grey warbler (riroriro); *Gerygone igata*	Locally common resident in shrubland and forest
Grey-faced petrel (oi); *Pterodroma macroptera*	Colony at Bream Tail
Little black shag; *Phalacrocorax sulcirostris*	Visitor to larger ponds
Little shag (kawaupaka); *Phalacrocorax melanoleucos*	Visitor to local ponds, streams
Long-tailed cuckoo (koekoea); *Eudynamys taitensis*	Rare passage migrant
Morepork (ruru); *Ninox novaeseelandiae*	Locally common in forest
NI fernbird (matata); *Bowdleria punctata vealeae*	Locally common resident in saltmarsh and shrubland
NI kaka; *Nestor meridionalis septentrionalis*	Regular visitor to forest of area

NI tomtit (miromiro); *Petroica macrocephala toitoi*	Uncommon in forest
Northland brown kiwi; *Apteryx mantelli*	Occasional unconfirmed reports; presumed locally extinct
NZ dabchick (weweia); *Poliocephalus rufopectus*	Rare visitor to Cove Road wetlands
NZ dotterel (tuturiwhatu); *Charadrius obscurus aquilonius*	Visitor to Bream Tail and Langs Beach
NZ pigeon (kukupa); *Hemiphaga novaeseelandiae*	Present in forest remnants throughout
NZ pipit (pihoihoi); *Anthus novaeseelandiae*	Uncommon resident
Paradise shelduck (putangitangi); *Tadorna variegata*	Resident in wetlands; breeds locally
Pied oystercatcher (torea); *Haematopus finschi*	Visitor to beaches, eg Langs Beach
Pied shag (karuhiruhi); *Phalacrocorax varius*	Common coastal resident; breeds Bream Tail
Pied stilt (poaka); *Himantopus himantopus*	Visitor to wetlands and flooded pasture
Pukeko; *Porphyrio melanotus*	Common resident in many habitats, breeding
Red-billed gull (tarapunga); *Larus novaehollandiae*	Common along coast
Red-crowned kakariki (parakeet); *Cyanoramphus novaezelandiae*	Regular visitor to forest of area
Reef heron (matuku-moana); *Egretta sacra*	Rare along Bream Tail coastline
Sacred kingfisher (kotare); *Todiramphus sanctus*	Common in most habitats
Shining cuckoo (pipiwharauroa); *Chrysococcyx lucidus*	Locally common migrant in forest
Silvereye (tauhou); *Zosterops lateralis*	Common resident in shrubland and forest
Spotless crake (puweto); *Porzana tabuensis*	Unconfirmed but likely to be present in wetlands
Spur-winged plover; *Vanellus miles*	Common resident in open country
Tui; *Prosthemadera novaeseelandiae*	Common resident in forest remnants
Variable oystercatcher (torea); *Haematopus unicolor*	Bream Tail coastline
Welcome swallow; *Hirundo neoxena*	Common resident
White-faced heron; *Egretta novaehollandiae*	Common resident; streams, ponds, pasture
White-fronted tern (tara); *Sterna striata*	Fishing along coast, breeds at nearby Mangawhai Spit

SPECIES	NOTES
B. Exotic bird species	
Australian magpie; *Gymnorhina tibicen*	Common
Black swan; *Cygnus atratus*	Rare visitor to ponds.
Blackbird; *Turdus merula*	Common
Brown quail; *Coturnix ypsilophora*	Present
California quail; *Callipepla californica*	Common
Chaffinch; *Fringilla coelebs*	Common
Common myna; *Acridotheres tristis*	Common
Dunnock (hedge sparrow); *Prunella modularis*	Common
Eastern rosella; *Platycercus eximius*	Common
Goldfinch; *Carduelis carduelis*	Common
Greenfinch; *Carduelis chloris*	Common
House sparrow; *Passer domesticus*	Common
Mallard; *Anas platyrhynchos*	Common

Pheasant; *Phasianus colchicus*	Common
Redpoll; *Carduelis flammea*	Present in shrubland and forest of Brynderwyn Hills
Skylark; *Alauda arvensis*	Common
Song thrush; *Turdus philomelos*	Common
Starling; *Sturnus vulgaris*	Common
Yellowhammer; *Emberiza citrinella*	Common

SPECIES	NOTES
C: Indigenous reptiles	
Auckland green gecko; *Naultinus e. elegans*	Shrubland
Copper skink; *Cyclodina aenea*	Widespread
Forest gecko; *Hoplodactylus granulatus*	Forest; rare

SPECIES	NOTES
D: Indigenous fish species	
Banded kokopu; *Galaxias fasciatus*	Streams
Common bully; *Gobiomorphus cotidianus*	Streams
Common smelt; *Retropinna retropinna*	Lower reaches of streams
Cran's bully*; Gobiomorphus basalis*	Streams
Giant bully*; Gobiomorphus gobioides*	Possibly present
Grey mullet; *Mugil cephalus*	Lower reaches of streams
Inanga; *Galaxias maculatus*	Streams
Longfin eel; *Anguilla dieffenbachii*	Streams, ponds
Redfin bully; *Gobiomorphus huttoni*	Streams
Shortfin eel; *Anguilla australis*	Streams, ponds
Torrentfish; *Cheimarrichthys fosteri*	Streams

SPECIES	NOTES
E: Indigenous frog species	
Hochstetter's frog; *Leiopelma hochstetteri*	Forested streams of Brynderwyn Hills

SPECIES	NOTES
F: Exotic reptiles, frogs and fish species	
Green and golden bell frog; *Litoria aurea*	Wetlands
Mosquitofish; *Gambusia affinis*	Steams, ponds
Rainbow skink; *Lampropholis delicata*	Present

SPECIES	NOTES
G: Indigenous mammal species	
Long-tailed bat; *Chalinolobus tuberculatus*	Unconfirmed, Marunui, Brynderwyn Hills

SPECIES	NOTES
H: Exotic mammal species	
Black (ship) rat; *Rattus rattus*	Widespread
Brush-tail possum; *Trichosurus vulpecula*	Widespread
European hare; *Lepus europaeus*	Widespread
European hedgehog; *Erinaceus europaeus*	Widespread
European rabbit; *Oryctolagus cuniculus*	Widespread
Feral goat; *Capra hircus*	Widespread Brynderwyn Hills
Feral house cat; *Felis catus*	Widespread
Feral pig; *Sus scrofa*	Widespread
Ferret; *Mustela furo*	Widespread
House mouse; *Mus musculus*	Widespread
Norway rat; *Rattus norvegicus*	Waterways, dwellings
Stoat; *Mustela erminea*	Widespread
Weasel*; Mustela nivalis*	Widespread

Longfin eel, Marunui

APPENDIX 5 - WHICH MAMMALIAN PESTS TO TARGET AND HOW

The table below summarises the impacts of different pests on specific biota in the Brynderwyns – Bream Tail area and key management methods
Y = high impact and need to remove/manage these pests to very low levels
y = low / lesser impact and management may not always be essential
y / Y = uncertain levels of impact

Pest	Possum	Mustelid	Cat	Dog	Rat	H'hog	Pig
Biota to be protected	Likely impacts						
Kiwi	y	Y	Y	Y			Y
Bittern	y	Y	y/Y	Y			Y
Blue penguin	y/Y	Y	Y	Y	y/Y		Y
Petrels	Y	Y	Y	Y	Y		Y
NZ pigeon	Y	Y	y/Y		Y		
Kaka	Y	Y	Y	y	y/Y		
Kakariki		Y	Y		Y		
Bellbird	y	y/Y	y/Y		Y		
Tomtit	y	y/Y	Y		Y		
Lizards		y/Y	y/Y		Y	Y	
Kauri snail	Y	y	Y		Y+ mice	y/Y	Y+
Fernbird		y			y/Y		
Bats	y/Y	y/Y			y/Y		
Frogs		y/Y			y/Y		Y+
Understorey	Y				Y		Y+
Flowering/ fruiting	Y				Y		
Threatened plants	y/Y				y/Y		Y+
Preferred control methods	Cyanide capsules, trapping	Traps: DOC200, DOC250, Fenn	Traps: Timms, cage	Shoot	Diphac-inone	Traps	Shoot

Note: H'hog = hedgehog
In final (pig) column, Y+ indicates pigs and browsers in general have an impact, so includes goats and livestock

APPENDIX 6: GLOSSARY

Barrier	Obstruction to passage, eg dam walls can obstruct upstream movement of fish, while roads can obstruct some invertebrates.
Biodiversity	The diversity of plant and animal life in an area, including the habitats and species present and their genetic composition.
Biota	The sum of plant and animal life living in an area.
Buffer	An area or habitat, normally adjacent to a very sensitive area, that can absorb the impact of negative forces, eg riparian (streambank) vegetation can provide a buffer for a stream and its biota by reducing sediment and nutrients that can enter the waterways and pine plantations can provide protection to indigenous forest.
Coastal forest	Much-depleted forest-type near the sea dominated by broadleaf species, eg pohutukawa, and may include a variety of uncommon coastal species at Bream Tail, eg karo, tawapou, milk tree.
Corridor	A length of habitat type (eg saltmarsh or bush) that provides a linkage between two or more other sites, providing access for fauna and flora species. Can also be provided by exotic habitat, eg pine forest in the Brynderwyns can provide corridors for tomtits and other birds to transition between indigenous habitats.
Covenant	A voluntary agreement that ensures legal protection for a site.
Cryptic	Retiring or hard to see, eg spotless crake, fernbird, banded rail.
Dacite	A type of volcanic rock that has formed underground (igneous), c.f. lava and some other volcanic rocks formed at the surface.
Diversity	The range of species, biological communities and landforms in a given area.
Ecological District	An area of land where the landforms and habitats are distinct from the adjoining areas, eg Waipu ED spans the Waipu catchment while the contiguous Otamatea ED spans three catchments of the Kaipara Harbour.
Ecological processes	Important natural processes, eg flowering, fertilisation, seed dispersal and germination.
Ecological restoration	The restoring of habitats and one or more of the ecological processes above.
Ecological unit	Vegetation type occurring at a particular site.
Ecosystem	All living and non-living components of a defined area (eg Brynderwn Hills forest) and the relationships between them.
Edge effect	Applies mostly to narrow and fragmented habitats where the effects of weeds and predators are heightened along with wind damage, desiccation, etc.
Endemic	Confined to an area, eg kiwi and kereru are endemic to NZ.
Ephemeral	Of a temporary nature, eg seasonal flow in streams and pools that dry out in summer.
Eutrophication	Excessive levels of nutrients in a water body, eg stream or pond.
Exotic	Introduced to New Zealand. (Not indigenous).
Extant	Surviving, as opposed to extinct.
Flaxland	An area of flax-dominated habitat.
Food web	Relationship between plants and animals that consume different foods, including one another.
Frugivore	Fruit-eater, c.f. carnivore, herbivore, insectivore, omnivore, etc.
Habitat	The specific environment of an individual or species.

Habitat mosaic	An area of several different interconnecting habitats.
Habitat sequence	A succession of intergrading habitats, eg saltmarsh, shrubland and forest,
Herpetofuana	Amphibians (frogs) and reptiles
Holistic	Integrated view of functioning of ecosystems.
Indigenous	Native to an area (ie occurring there naturally), but not necessarily endemic, eg silvereye is indigenous to NZ but not endemic as it is also present in Australia.
Invertebrate	Animal with external skeleton, eg insects, molluscs, crustaceans.
Kaitiakitanga	Maori stewardship or guardianship of food resources and food webs.
Macro-invertebrate	Large invertebrate, eg giant land snail, large weta, freshwater crayfish.
Megafauna	Large vertebrate animals that are susceptible to the first arrival of humans, eg moa, giant rails and eagles lived in New Zealand for millions of years but succumbed shortly after the arrival of people.
Migrant	Animal with regular (usually annual) movement between breeding area and non-breeding area, eg cuckoos, freshwater fish.
Mustelid	Member of the mustelid family, which in New Zealand comprises ferret, stoat and weasel.
Naturalness	The degree to which an area is in its natural state as opposed to modified.
Omnivorous	Feeds on plant and animal matter.
Podocarp	Member of a family (Podocarpaceae) of native conifers, including totara, rimu and others.
Regionally significant biota	That is, assessed by the local Department of Conservation to be locally rare or threatened.
Rehabilitation	The reconstruction of a habitat type via planting.
Representative	The extent to which a site contains the original natural biodiversity of that site.
Riparian	Occurring along the banks of a stream, eg riparian vegetation.
Rodent	A mouse or rat.
Roost	A site where birds congregate to rest, eg waders at a high tide roost, pigeon in a tree. Not a nest site.
Saltmarsh	A marshland habitat frequently flooded by the sea and typified locally by saltmarsh ribbonwood, sea-rush and other species.
Sustainability	The long-term viability of an area in relation to size, shape, external pressures, etc.
Terrestrial	On land as opposed to arboreal (tree-dwelling), aquatic, marine, etc.
Threatened	A plant or animal considered to be at risk of extinction. Threat categories are formalised and periodically revised in New Zealand.
Treeland	Discontinuous canopy of trees, interspersed with shrubland, grassland, etc.
Understorey	A general term to describe the shrubs and other plants beneath a forest canopy.
Wetland	An area of land that is permanently or seasonally flooded with still or slow-flowing water.

Hound's tongue fern