

CONSERVATION PLANNING FOR THE NORTHLAND BROWN KIWI (*APTERYX MANTELLI*)

An investigation into the role of district plans to facilitate landscape
scale conservation of the North Island brown kiwi in Northland,
New Zealand

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ABSTRACT

Impacts resulting from human activity have lead to a dramatic decline of all species of kiwi (*Apteryx* spp.). Today, approximately 8,000 North Island brown kiwi (*Apteryx mantelli*) remain in Northland. Many of these kiwi are found within fragments of indigenous and exotic vegetation within working landscapes held in private ownership. This study investigates the potential for landscape scale conservation of the Northland brown kiwi and the potential role of statutory plans to facilitate conservation outcomes outlined by the Draft Taxon Plan for the Northland Brown Kiwi. The research utilised literature review, document analysis and key informant interviews to develop an understanding of the key threats to kiwi in Northland, assess the current state of kiwi conservation and identify benefits which could eventuate from landscape scale conservation for kiwi and a greater incorporation of statutory planning within threatened species management.

The implementation of rules regarding no dog or no pet conditions on rural subdivisions is a proposed avenue in which the statutory planning framework could better facilitate conservation outcomes in high-density kiwi areas. The study also identifies the need to apply landscape scale predator management to protect viable populations and facilitate the dispersal of kiwi throughout their historic range.

The study acknowledges that kiwi will continue to decline in some areas, but where key threats are managed, populations are able to recover. As many kiwi are situated on private land, facilitating and supporting community engagement with kiwi conservation will continue to be important, as will the provision of ongoing financial support for landcare groups and communities who undertake integrated pest management. The provision of advocacy and education regarding kiwi conservation could enhance the conservation value of private land without restricting the functional use of land. Further research which quantifies the value of conservation could provide an alternative mechanism in which conservation activity could be promoted on private land.

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1 INTRODUCTION

1.1 RESEARCH CONTEXT

1.1.1 The Loss of New Zealand Biodiversity

New Zealand's long history of isolation since its split from Gondwana 80 million years ago has resulted in the evolution of plants and animals that are so unique scientists have described them as the closest they will get to studying life on another planet (Diamond, 1990). High rates of endemism among New Zealand's indigenous species have resulted from this period of isolation. Included among these endemic species are all four species of native frog, all 60 reptiles, more than 90% of insects and marine molluscs, 80% of vascular plants and a quarter of all species of bird (Department of Conservation and Ministry for the Environment, 2000).

Despite being one of the last large land masses to be colonised, the impact of human settlement over the last 1000 years has seen New Zealand transform from an isolated, primarily forested archipelago to a highly modified, productive agricultural landscape that has undergone a loss of indigenous biodiversity at a rate not exceeded since the extinction of the dinosaurs 65 million years ago (Department of Conservation and Ministry for the Environment, 2000).

The first wave of biodiversity decline was triggered by the arrival of the Maori. Hunting led to the extinction of 26 species of endemic land bird and 4 species of endemic sea bird (Craig, *et al.*, 2000). Forest clearance using fire extended the range of native grasslands from 1.5 million hectares to 8 million hectares, while the accumulated action of habitat loss and introduced mammalian predators led to the extinction of a further 8 terrestrial species of bird (Craig, *et al.*, 2000). European settlement in the mid 1800s brought further habitat destruction. Forest clearance and the drainage of wetlands to establish pastoral agriculture, and the introduction of numerous mammalian predators and pest species have led to the extinction of an additional 16 species of terrestrial bird (Craig, *et al.*, 2000).

Over the past 800 years human activity and the actions of introduced pests have led to the extinction of 32% of indigenous land and freshwater birds, 18% of sea birds, three of seven indigenous frogs, at least 12 invertebrates, one bat and one fish (Ministry for the Environment, 1997). Human activity has altered over three quarters of New Zealand's

original terrestrial habitat with a loss of 90% of lowland wetlands and total forest cover declining from 75% to 35% (Saunders and Norton, 2001). Today, 63% of the mainland has been converted into farms, exotic forests, settlements and roads (Department of Conservation and Ministry for the Environment, 2000).

Much of the remaining unmodified habitat is located either on the west coast of the South Island, or in mountainous areas, on offshore islands, or within small fragmented lowland remnants (Craig, *et al.*, 2000). Pests are distributed throughout most of the remaining areas of indigenous vegetation and the majority of the remaining populations of indigenous fauna have declined. Native populations of bird, lizard, frog and invertebrate are often highly fragmented with range contraction and low population density common factors which lead to local extinctions (Craig, *et al.*, 2000).

1.1.2 Conservation of New Zealand's Biodiversity

The decline of New Zealand's biodiversity has long been acknowledged and multiple actions have been undertaken with the goal of reducing and ultimately reversing these trends. The first responses to the loss of biodiversity were made by Maori who developed conservation practices including tikanga (protocols), tapu (sacred prohibitions) and rahui (temporary restrictions) to control the season, area and species which were being harvested following the first waves of species extinction (Department of Conservation and Ministry for the Environment, 2000).

Early European conservation focused on the legal protection of land as reserves. The location of these reserves was chosen largely on scenic and aesthetic values rather than ecological worth and few were located in the lowland where biodiversity loss was greatest due to the potential for conflict with other land users (Saunders and Norton, 2001).

In more recent times destructive activities such as the widespread drainage of wetlands, reclamation of estuaries and clearance of native vegetation no longer occur on a large scale. Although it is noted that this is largely due to a lack of remaining habitat in which to carry out such activities, government subsidies for such action have ceased and changes in policy now encourage land owners to retain and preserve such habitat. As such there has been an increase in interest among private land owners seeking to attain formal protection of areas on private land with conservation values (Saunders and Norton, 2001). Conservation through the 'reserves' based approach has continued through to the present

day with more than 30% of New Zealand's land area now under legal protection (Saunders and Norton, 2001).

Investment into threatened species management programmes has resulted in New Zealand becoming a world leader in the establishment and management of offshore island sanctuaries. Successful conservation techniques including total pest eradication and population translocation are now being increasingly applied to establish and manage some of the most endangered species within 'island' sanctuaries on the mainland. However, despite the local success of these actions, New Zealand's current conservation measures remain inadequate to halt the ongoing national decline of indigenous biodiversity (Department of Conservation and Ministry for the Environment, 2000).

As previously stated, the conservation of New Zealand's biodiversity is largely undertaken through a reserves based approach where areas of identified natural value are protected (Freeman, 2003). These areas are primarily located on public land and are managed to preserve the selected habitats within the reserve boundaries. Despite the conservation estate spanning approximately a third of New Zealand's land area, many criticisms of the reserves system have arisen which explain the reasons underpinning the continued loss of biodiversity.

One major criticism of the reserves based approach is the tendency to focus on only a small number of individual ecological habitats while understating or overlooking the relationships between reserves and the surrounding environment (Freeman, 2003). Additionally the distribution of conservation land is not uniform and does not contain an equal representation of all habitat types. Much of the conservation land is situated in upland or montane regions and in areas with a low production value, while in fertile, lowland regions any remaining areas of native vegetation are generally small, fragmented and isolated (Craig, *et al.*, 2000). The matrix which separate and isolate fragments of conservation land often act as a barrier to dispersal of populations between the remaining fragments leading to local and regional extinction of populations and species. It is clear then that despite its importance, legal protection alone is not sufficient to provide the solution to biodiversity loss (Saunders and Norton, 2001).

The New Zealand Biodiversity Strategy identifies that there is a need to find "*ways to maintain the indigenous biodiversity values of natural habitats and ecosystems outside public protected areas, and to sympathetically manage indigenous biodiversity in*

production landscapes and seascapes. Both these tasks involve restoring connections between presently isolated fragments of natural ecosystems” (Department of Conservation and Ministry for the Environment, 2000, p. 9). The adoption of a strategic, ‘whole landscape’ planning approach that recognises the relationships between existing, fragmented conservation areas and the production landscape within which fragments are set, provides a unique opportunity to maximise the conservation potential of the whole landscape.

The development of conservation areas on public land has generally been implemented in an ad hoc manner and through the voluntary efforts of land owners. While these efforts are commendable, they are often limited in the level of conservation they can attain and are often developed in isolation to the wider environment (Freeman, 2003). The establishment of strategically placed corridors of vegetation between existing conservation fragments through privately owned land on a large, landscape or district scale could provide the necessary links required to ensure the long term survival of the habitat and species located within the existing fragments. The development of corridors could facilitate the movement of individuals between fragments and encourage dispersal and colonisations essential to the long term genetic health and continued ecosystem function within remaining remnants. Additionally a strategic conservation network linking existing patches of conservation land could provide added habitat for species on public land and provide a platform to encourage the long term survival of species both within formally protected areas, and in adjacent areas of vegetation located on private land.

To illustrate the importance of establishing and implementing a landscape wide conservation strategy, and the potential impact it could have on the long term survival of threatened species, the case example of the northern population of the North Island brown kiwi (*Apteryx mantelli*) in the Northland region will be investigated.

1.1.3 Conservation of the Kiwi

“Kiwi (Apteryx spp.) are among the most distinctive, recognised and cherished animals in New Zealand” (Holzapfel, *et al.*, 2008, p. 8). Endemic to New Zealand, these birds are considered taonga (treasure) and are of significant cultural, spiritual and historic importance to all New Zealanders. The kiwi, as an unofficial national icon, act as a unifying source of identity for our people and as *“a symbol for the uniqueness of New Zealand wildlife and the value of our natural heritage”* (Holzapfel, *et al.*, 2008, p. 20).

However, despite its importance as a symbol of our nation, our people and our wildlife, all five recognised species of kiwi are threatened. Harvesting by Maori, destruction of habitat and the introduction of efficient mammalian predators including cats, dogs and mustelids have acted to reduce both the range and population of all species.

The three most abundant species of kiwi, the North Island brown (*A. mantelli*), great spotted (*A. haastii*) and the Fiordland and Stewart Island populations of tokokea (*A. australis*) are either confirmed or assumed to be in decline despite the stabilisation of populations currently under management. The most critically endangered species, the little spotted (*A. owenii*), rowi (*A. rowi*) and Haast totokea (*A. australis* sub taxa) exist in such low numbers their species remain susceptible to inbreeding depression and catastrophic events such as disease (Holzapfel, *et al.*, 2008). The management of the most critically endangered species will continue to require intensely monitored breeding, translocation and predator protection, best provided within carefully controlled and managed environments such as offshore islands or within predator free mainland sanctuaries. A study regarding the conservation of the most endangered species would therefore be best undertaken and utilised within the fields of genetics or wildlife management. However, the conservation of the more common brown kiwi (*A. mantelli*) provides a unique opportunity to investigate the potential for the integration of the goals of pre-existing species conservation plans into a wider landscape scale conservation scheme.

1.1.4 Kiwi Recovery Plans

In 1991 the Department of Conservation published the first national Kiwi Recovery Plan, and in conjunction with the Bank of New Zealand and the Royal Forest and Bird Protection Society launched the Kiwi Recovery Programme to create coordinated conservation management for the Kiwi throughout New Zealand. In 2008 the third national Kiwi Recovery Plan was published outlining the strategic framework underpinning kiwi recovery until 2018.

The plan is situated within a national conservation framework. It supports three of the four goals of the New Zealand Biodiversity Strategy, and is aligned with the Department of Conservations Strategic Direction and Statement of Intent (Holzapfel, *et al.*, 2008). The long-term goal outlined by this plan is: “*to restore and, wherever possible, enhance the abundance, distribution and genetic diversity of all kiwi taxa*” (Holzapfel, *et al.*, 2008, p. 22) with the inclusion of the term ‘restore’ implying the re-establishment of kiwi as a

common component of New Zealand's ecosystems beyond the levels which existed at the time of the publication of the first plan in 1991.

Through the development and implementation of the first two Kiwi Recovery Plans (Butler, 1991; Robertson, 2003) critical gaps within the knowledge have been bridged to allow for more effective management of each species, and the public have become actively involved in conservation through increased awareness of the need for protection. Today there are around 70 community groups which provide kiwi with protection on over 50,000 ha of land, and private funding and corporate sponsorship through the BNZ Save the Kiwi Trust have significantly increased the available funds for kiwi recovery (Holzapfel, *et al.*, 2008).

Individual taxa plans are being produced to provide strategic direction for the conservation and management of each identified taxa of kiwi. The Draft Taxon Plan for Northland Brown Kiwi is the first taxa plan to be developed. The plan provides the strategic direction for the recovery of the Northland population of the North Island brown kiwi for the period 2010-2019 and identifies a series of key actions required for the recovery of this taxa (Craig, *et al.*, 2011).

1.1.5 A New Era of Conservation

The management goals of the national Kiwi Management Plan and the Taxon Plan for the Northland Brown Kiwi could be better realised if they were integrated into the formal planning framework which influences land use activity and development on a landscape scale, spanning both public and private land.

Indigenous biodiversity is poorest within lowland areas where land clearance and fragmentation has reduced the overall availability of habitat and spatial isolation of populations (Ministry for the Environment, 1997). Island biogeography theory states that small, isolated islands generally support a fewer number of species and smaller populations compared to larger islands situated closer to mainland populations. Small islands have less habitable area, and small isolated populations are at an increased risk of extinction through stochastic events such as fire, disease or inbreeding depression (Diamond, 1975). The remaining populations of the northern North Island brown kiwi are currently distributed throughout fragments of indigenous and exotic forest within a matrix of pastoral land throughout the Northland. Although population within managed fragments have been stabilised, and populations increases of up to 9% per year have been noted,

losses within unmanaged populations result in an overall population decline of 3% per year (Holzapfel, *et al.*, 2008).

If the Kiwi Management Plan and the Draft Taxon Plan for the Northland Brown Kiwi are to be successful, and if the long term goals are to be achieved, it is essential that the goals and objectives of the plan are integrated into the wider planning scheme which recognises the multiple uses of the environment. The integration of the goals and objectives of the Northland taxon plan into the formal planning framework at a district level through district plans would provide the necessary platform to facilitate the meaningful implementation of policy. This would act to influence land use and activity on a landscape scale and could be applied to parcels of private land in areas outside of the conservation estate.

1.1.6 Integrating Conservation Goals into the Formal Planning Framework

Decisions regarding land use allocation and development are primarily made at the local level yet district councils have a largely unrealised role in biodiversity conservation (Stokes, *et al.*, 2010). The current legislative framework for resource management within New Zealand is structured in such a way that district plans must give effect to regional policy statements and national policy statements. However, guidance provided by high level legislation does not provide for the consistent application of protection of indigenous biodiversity by local authorities. Implementing the goals of a species conservation plan within the formal planning framework at the district level would allow for the direct integration and application of appropriate conservation strategies relevant to the protection of kiwi and kiwi habitat on the ground.

The development of threatened species management plans founded on a thorough understanding of ecological processes while maintaining the district's ability to benefit economically from the land is paramount to its success. As stated by Rookwood "*It is almost inevitable that a biodiversity plan will have widely differing economic impacts on different landowners*" (Rookwood, 1995, p.354). In order to assess the potential for integration of the goals of the Draft Taxon Plan for Northland Brown Kiwi within the formal planning framework, other priorities and issues within the district must be acknowledged. Kiwi are known to use fragments of habitat within the matrix surrounding protected areas for foraging and other activities (Potter, 1990), and it is important to acknowledge that populations are not restricted to areas currently protected or managed for their benefit. Land on which remnant fragments of indigenous forest is found and

corridors between those fragments may be wholly or partly located on privately owned land and it is important to recognise the property rights, and activities of these landowners.

As stated by Holzapfel *et al.* (2008, p. 41) “*recovery and protection of kiwi relies on the interest, understanding and engagement of many sectors of New Zealand society, not just professional conservation organisations and ecologists*”. Involvement of the community including land owners, interest groups and conservation experts is essential to support species conservation plans which are effectively implemented on land which is not in public ownership. Community buy-in is essential especially when proposing the development or enhancement of wildlife corridors on private land which may be viewed as a potential source of lost income.

1.2 RESEARCH OBJECTIVES

With the above issues in mind, this study aims to investigate the potential for the conservation of the Northland brown kiwi on a landscape scale through the incorporation of relevant goals, objectives and action points outlined in the Draft Taxon Plan for the Northland Brown Kiwi, into the formal planning framework to enhance the conservation potential of the whole landscape. In order to achieve this aim, the study will fulfil the following objectives.

1. Investigate the potential for landscape scale conservation for the kiwi in Northland.
2. Identify ways in which the key issues and objectives of the national Kiwi Recovery Plan and the Taxon Plan for the Northland Brown Kiwi can be incorporated into and supported by the formal planning framework in Northland.
3. Develop and provide recommendations which can be adopted by other regional and district councils to develop integrated conservation strategies to enhance the conservation value of both reserved and private land.

Note in order to fulfil objective 1, an assessment of the current legislative and planning framework which underpins conservation of the North Island brown kiwi in Northland is necessary. In order for objective 2 to be fulfilled, the key issues facing conservation of the Northland brown kiwi in Northland need to be established, and ways in which these issues can be addressed outlined.

1.3 CHAPTER OUTLINE

Chapter 2 contains a description of the overall research approach employed by this study and a description of the specific methods used to collect and analyse data. Relevant ethical issues which were identified and addressed throughout the study are outlined and the strengths and weaknesses of the methods are identified and supplemented with a description of how the weaknesses were addressed.

Chapter 3 provides a review of the literature regarding established theory on planning for biodiversity and conservation. Key areas of investigation include an overview of the history and development of conservation theory including island biogeography and habitat fragmentation.

Chapter 4 contains an introduction to the history and development of New Zealand ecology, the current role of conservation planning for the long term sustainability of ecosystems and endangered species, and an assessment of the limitations and merits of the current approaches to conservation planning in New Zealand. An outline of the institutional framework for conservation within New Zealand is provided and the role of key agencies is discussed.

Chapter 5 contains a review of the ecology and biology of the North Island brown kiwi and outlines the current distribution and key causes of population decline. Current restoration and management efforts are also identified and a brief introduction to the Northland region provides the context for the study.

Chapter 6 contains an assessment of current conservation legislation which influence the conservation of the kiwi in Northland. The section contains a review of national, regional and territorial legislation including key acts of parliament, strategies, plans and policies. The section contains a review of the Kiwi Recovery Plan and the Draft Taxon Plan for the Northland Brown Kiwi, and identifies specific provisions within the Whangarei and Far North District Plans which relate specifically to the conservation and protection of kiwi. Existing provisions within each district plan which facilitate the conservation of kiwi are assessed and limitations and areas of opportunity are identified.

Chapter 7 contains the results of the key informant interviews. Primary data is categorised into stakeholder groups to allow for the comparison of data sourced from different

stakeholder groups. Results are presented in accordance with their relevance to the study objectives.

Chapter 8 contains a discussion of the results and provides recommendations for future research which would facilitate the implementation of effective landscape scale conservation. The chapter concludes with a summary of the key insights developed through the research and an outline of both the value and limitations of the study.

2 METHODOLOGY

2.1 INTRODUCTION

This chapter describes the overall research approach employed by this study and provides a description of the specific methods used to collect and analyse data. A discussion of the relative strengths and weaknesses of the methods is provided and supplemented by an explanation of how the identified weaknesses were addressed. An outline of relevant ethical issues which were acknowledged and addressed throughout the study is also provided.

2.1.1 Positionality

In order to determine the significance of the research findings, one must acknowledge that the results of this study are specific to the Northland context. Therefore, the recommendations eventuating from this research may not be directly applicable in other regions due to different ecology, biology and population structures among kiwi, habitat availability and the social and cultural values of and pressures on human populations and communities. The principals of this study, however, are broadly applicable to conservation planning for threatened species throughout New Zealand and abroad. The key findings of this study can be used as a guide to highlight the potential gains resulting from the implementation of conservation strategies, goals and objectives into formal planning frameworks to facilitate integrated conservation at a landscape scale which spans both conservation and private production lands.

In addition, one must also acknowledge the potential for the researcher's characteristics and interests to shape both the research direction and processes undertaken throughout the research which can ultimately influence the results. This research was undertaken by a New Zealand European with a postgraduate background in ecology who, prior to the undertaking of this research, had not visited the Northland region. As an outsider with knowledge of ecological theory, the researcher was able to look at the issue of conservation for kiwi in Northland in an objective manner. The ability to incorporate both scientific knowledge and evidence sourced from within the fields of social science provided the researcher with the tools required to undertake the necessary research to fulfil the research objectives.

2.2 RESEARCH APPROACH

In order to fulfil its objectives, the study utilised a combination of literature review, document analysis and key informant interviews. A theoretical basis for the research is established in chapter 3, while the general context for the study is established in chapter 4 which contains a brief account of the history of conservation in New Zealand. An investigation into the biology and current management of the kiwi in Northland was undertaken to inform and guide data collection and to ensure the objectives of the study were fulfilled. The results of this investigation are presented in chapter 5. The results of the document analysis are presented in chapter 6, and data collected through key informant interviews are presented in chapter 7. A discussion of the research findings is presented within chapter 8.

Please note that the scope of this study is limited to the conservation of kiwi in the Northland Districts of Whangarei and the Far North. Kaipara District has been excluded from the study as preliminary research indicated the current presence of kiwi in Kaipara is minimal. The focus of the study is, therefore, concentrated on the two districts in which the majority of North Island brown kiwi remain and where the implementation of goals and objectives of the Taxon Plan for Northland Brown Kiwi into the formal planning framework is likely to have a greater impact on kiwi populations. The results however, could have value for Kaipara if in the future conservation of kiwi becomes a priority for both those involved within kiwi conservation circles, and for the communities resident within the district.

2.2.1 Qualitative Research

The aim of qualitative research is to provide a precise description of how people act in a given location. Qualitative research often incorporates the study of a few key informants chosen specifically for their experience and knowledge within a research area (Davidson and Tolich, 2003). Research participants are treated as collaborators rather than research subjects (Corbetta, 2003), and data collected enables the researcher to document, analyse and understand behaviour, attitudes and experiences which support, extend and challenge data from alternative sources (Hay, 2000). The utilisation of a qualitative approach involving key informant interviews facilitated the identification and expression of views of a range of stakeholder groups whose work both directly and indirectly influences the protection and conservation of kiwi in Northland. The use of extracts from key informant

interviews also enabled reality, as seen through the eyes of the key informant, to be accurately recorded and portrayed (Corbetta, 2003).

2.3 DATA COLLECTION

2.3.1 Secondary Research

An extensive review of the relevant international literature regarding the theory of conservation planning was undertaken prior to a review of relevant New Zealand conservation and an investigation into the biology and current management of the North Island brown kiwi in Northland. A document analysis was undertaken to review New Zealand's key conservation documents and conservation plans for the Northland brown kiwi.

2.3.1.1 Literature Review

A review of the literature establishes the theoretical framework in which the research is set and establishes assumptions and knowledge on which the research is based (Marshall and Rossman, 2011). A literature review was undertaken to provide a background to the research problem and facilitate a greater understanding of key theory prior to the development of research questions and commencement of primary research. The literature review provides a base of knowledge regarding the origins of conservation planning, the limitation of past conservation techniques and the development of current best practice conservation tools.

An investigation into the biology and ecology of the northland population of North Island brown kiwi was undertaken to attain knowledge of the species required to implement effective conservation. This investigation assessed the current conservation status of the species, population, distribution, life history traits and current management undertaken for its conservation in Northland.

2.3.1.2 Document Analysis

Undertaking a document analysis is important in order to attain an understanding of the legislative and policy background of a particular case, and is particularly useful when undertaking a case study approach (Marshall and Rossman, 2011). Data collected through

document analysis is independent of the researches actions and does not contain social bias associated with key informant interviews (Corbetta, 2003).

A document analysis was undertaken in this study to identify, review and understand the relative legislative and policy framework which currently underpins and directs conservation of the kiwi in Northland. The current framework was critiqued to identify areas in which improvements could be made to increase the long term conservation potential for the kiwi.

The document analysis contains an overview of relevant Acts of Parliament, National Biodiversity Strategies and plans, and documents produced at a national, regional and territorial authority level as required under the Resource Management Act 1991. A review of relevant plans and strategies produced specifically for the conservation of kiwi and the conservation of the Northland population of North Island brown kiwi in Northland was also undertaken in order to provide an overview of current conservation strategies and provide a base from which policy can be implemented into the formal planning framework in Northland.

2.3.2 Primary Research – Key Informant Interviews

Primary research consisted of semi-structured key informant interviews undertaken in Northland between the 5th and 11th of July 2011. Fifteen key informants from eleven stakeholder groups were sought to develop a holistic understanding of the research topic which was based on a balanced view of related issues. Key informants were selected for interview due to their knowledge and involvement within kiwi management and recovery programmes in Northland or their role within district and regional councils and their associated planning frameworks. Representatives from the Northland Regional Council, Far North District Council, Whangarei District Council, the Department of Conservation, BNZ Save the Kiwi Trust, New Zealand Kiwi Foundation, New Zealand Landcare Trust, three landcare groups and one local landowner were sought to gauge the views on behalf of a range of stakeholder groups. A list of key informants and their role within kiwi conservation and planning in Northland is attached as Appendix A.

Key informants were found using an internet search for kiwi recovery programmes, trusts and landcare groups in Northland and through identified roles outlined within the Kaitaia Kiwi Directory Guide which provided the direct contact details of individuals and organisations involved in kiwi conservation in the Far North. Key informants were

approached by email and telephone and invited to participate in the study. An impromptu interview with one key informant was undertaken with a Whangarei landowner who showed interest in the study when asked for directions. In this case a full interview was undertaken after the aims of the study were explained and the relevant ethical consents signed.

Interviews primarily consisted of nine predetermined interview questions designed prior to the first interview. The list of interview questions used to guide key informant interviews are listed below and are also attached as Appendix B.

1. What role do you play within kiwi conservation/what role(s) have you played in the past?
2. How long have you been involved in kiwi conservation?
3. What do you think are the key issues regarding kiwi conservation on public and private land?
4. What conservation plans are you aware of, do you use them and how effective do you think they are?
5. Is conservation of the kiwi well co-ordinated? Are there clear lines of communication between agencies and stakeholders and are areas of responsibility clearly outlined?
6. Do you think the current conservation framework supports kiwi conservation on a regional scale?
7. Do you think regional scale conservation would benefit the kiwi?
8. What do you think needs to be done to improve support for kiwi conservation?
9. What is your view on the future of kiwi in Northland?

Questions were intentionally designed to be open ended to provide the opportunity to obtain an in depth knowledge of the views and experiences of key informants involved in the protection and recovery of kiwi populations in Northland.

The semi-structured nature of the interviews allowed for additional questions, or prompts to be asked to go attain more information and detail on relevant topics (May, 2001; Tolich and Davidson, 2003). Key informants were asked a series of additional questions within each interview to attain a greater understanding of the role and views of different

stakeholders in respect to the current and potential future conservation of kiwi in Northland.

Key informant interviews were recorded using a Dictaphone after consent to record was obtained. Each interview was transcribed to allow the researcher to accurately record data and revisit sections or interview where clarification or additional information was required within the data analysis.

2.3.3 Data Analysis

In order to provide for a greater understanding of the issues deemed relevant by key informants and fulfil the objectives of the study, data collected from key informant interviews were grouped by theme or topic to identify key issues deemed to be most significant as determined by number of responses. Data was also grouped into stakeholder categories to allow for a comparison of views between different stakeholder groups. Note, however, that due to the qualitative nature of the study no statistical analysis was undertaken as the focus of qualitative research is instead to develop an in-depth account of the subject (Corbetta, 2003).

2.4 STRENGTHS AND WEAKNESSES OF THE RESEARCH METHODOLOGY

2.4.1 Open Ended Questions

The use of key informant interviews allowed the researcher to access a depth of knowledge otherwise inaccessible through other forms of data collection such as a survey. The open ended nature of the interview questions allowed for each key informant to respond in a manner which best reflected their experiences with regard to conservation of the kiwi and conservation and recovery practices in Northland. The use of closed questions or surveys would not have provided adequate access to the individual perspectives of these actors, and could have limited the range of responses leading to artificially directed results.

Corbetta (2003) outlined the need for care to be taken during interviews to ensure any attempt to keep the interview on track do not alter the respondents thought, and that the interviewees true feelings were not confined by aggressive attempts by the researcher to direct the interview in a strict, predetermined manner. In order to avoid these issues key

informants were allowed to continue uninterrupted until a break in conversation provided an opportunity to steer the interview back onto the original track.

A weakness of open ended questioning was however, acknowledged. Responses provided by key informants varied as a result of the direction of previous questions. Although each key informant was asked each of the nine key questions, the order in which these questions were asked was fluid and dependent on the nature and direction of prior conversation. Where questions were not answered fully, further questioning was undertaken to obtain the required information. As interviews progressed and patterns within the data became apparent, further questions were informally added to the question list. These questions were not asked during every interview but were commonly incorporated into later interviews to obtain further information on issues identified by key informants who were earlier interviewed.

2.4.2 Interviewing of Key Informants Published in the Literature

The pool of published material regarding the Northland population of North Island brown kiwi has largely been developed by a limited number of people who have worked with kiwi for a significant period of time and have had a hand in the development of kiwi conservation techniques currently used today. Three key informants interviewed in this study are authors of current kiwi plans, resources, and peer reviewed journal articles. Works published by these key informants were used within chapter 5 to review the current ecology, biology, distribution and management of kiwi in Northland. The interview of these key informants then represents a ‘double dipping’ of information which could place extra emphasis on the issues deemed important by these individuals. In order to minimise this effect, a thorough review of relevant literature and resources was undertaken and the views of various different stakeholders attained through secondary research. The combination of both literature and data collected through key informant interview provided a mixed method approach which mitigated the potential of overemphasis from a single source.

2.5 ETHICAL ISSUES

The benefit gained from research must be deemed to outweigh the cost associated with its undertaking (Snook, 2003). Five primary issues which frequently arise through the course of qualitative research relate to informed consent, honesty, confidentiality, the avoidance

of deceit and faithful undertaking of both data analysis and report writing (Snook, 2003). To avoid such issues, ethical approval was obtained from the University of Otago Department of Geography on behalf of the University of Otago Human Ethics Committee prior to the commencement of fieldwork. To ensure the research aims and use of participant data was made explicit prior to interview, key informants were provided with an information sheet outlining the nature, scope and direction of the research, the role of the subject and how data would be collected, stored, analysed and presented within the final document (Appendix C). The information sheet was supplemented by the list of questions used to guide the direction of the interviews (Appendix B). Prior to the commencement of each interview, consent was obtained from key informants upon signature of a consent form (Appendix D).

2.6 CONCLUSION

The use of multiple research methods facilitated the development of a thorough understanding of the current state of conservation for the Northland brown kiwi, highlighted key issues and threats and allowed for realistic suggestions of how the formal planning framework can play a greater role in the conservation of this threatened species.

3 CONSERVATION THEORY

3.1 INTRODUCTION

In order to preserve biodiversity in the future, the role of conservation planning will become increasingly important, particularly when undertaken on a landscape scale. To implement effective planning for conservation, a thorough understanding of the current state of biodiversity, causes of biodiversity decline, the success and limitations of past conservation practices, and established ecological theory is required. This chapter provides an overview of the current state of global biodiversity, an introduction to the origins of conservation planning, and provides an outline of both historic and current best practice conservation techniques.

3.2 THE LOSS OF GLOBAL BIODIVERSITY

There is now a growing consensus that we are in the middle of an unprecedented spasm of species extinction and biodiversity loss (Beatley, 2000; Carsjens and van Lier, 2002). The expansion of human populations and dramatic changes in consumption patterns have altered and transformed virtually all of the Earth's ecosystems and has led to a detectable human footprint on over 83% of the Earth's land area (Sanderson, *et al.*, 2002).

Current rates of extinction have been estimated to be up to 1,000 times greater than background rates typical throughout Earth's history (Townsend, 2008). Based on the IUCN criteria for threats of extinction up to 12% of all bird species, 23% of mammals, 25% of conifers and 32% of amphibians are threatened with extinction (Millennium Ecosystem Assessment, 2005). Those species which are not subject to decline either thrive within landscapes modified by human activity, have had their threats removed or are actively protected and managed within reserves (Millennium Ecosystem Assessment, 2005).

Habitat loss and degradation are two of the leading drivers of global biodiversity decline (Ahern, Luduc, and Lee., 2006), while the introduction of invasive species and overexploitation can also adversely affect biodiversity (Townsend, 2008). The following sections provide further detail of the major threats to biodiversity.

3.2.1 Habitat Loss

Habitat loss resulting from land use change is one of the main driving forces underpinning current global trends in biodiversity loss (Hilty, Lidicker, and Merenlender, 2006). Each year between 0.5% and 1.5% of wild habitat is estimated to be lost (Balmford, Green, and Jenkins, 2003). The leading cause of this loss of habitat is the change in land use resulting from the expansion of agricultural activity (Smith and Smith, 2009). In 2005 the Millennium Ecosystem Assessment estimated approximately a quarter of the Earth's surface had been modified by agricultural activity and reported that 20-50% of the total area of over half of the 14 biomes assessed had been converted into cultivated lands (Millennium Ecosystem Assessment, 2005). The Assessment identified temperate and Mediterranean forests and temperate grasslands as the most affected biomes, of which up to three quarters of native habitat is now replaced by cultivated land. Where native habitat does remain it is generally highly fragmented or in areas which are less hospitable to human activity such as deserts, mountains, boreal forest and tundra (Millennium Ecosystem Assessment, 2005).

3.2.2 Habitat Degradation

Habitat degradation through exposure to pollutants is becoming an increasing issue worldwide. Pollutants may be emitted locally into the receiving environment and primarily affect an isolated area, or they can affect large areas and multiple ecosystems. The burning of fossil fuel for example is a widespread pollutant which has been linked to the production of 'acid rain', a cited cause of the acidification of lakes and streams (Townsend, 2008), and the widespread death of trees throughout areas of Europe (Colville, *et al.*, 2001).

Each year over 4 million tonnes of oil enter waterways from oil tankers and wells and natural seepage through the ocean floor (Townsend, 2008). Single spill events have the potential to severely implicate biodiversity on both a local and regional scale. In 1989 the Exxon Valdez polluted thousands of kilometres of Alaskan coastline and killed 250,000 birds, 2800 sea otters and roughly 300 harbour seals while the toll on seaweeds, molluscs and crustaceans remains unknown (Townsend, 2008).

Increased agricultural intensity has resulted in a number of environmental impacts including increased soil erosion and desertification. Nutrient runoff from agricultural areas has been linked to algal blooms within rivers and estuaries, and the runoff of pesticides

often affects non-target species (Townsend, 2008). Intensive irrigation requiring the withdrawal of surface and ground water has significantly reduced the natural flow regimes and water within river systems. Today, many of the world's largest rivers including the Nile, Yellow and Colorado run dry during parts of the year (Townsend, 2008).

3.2.3 Habitat Fragmentation

Habitat fragmentation *“is believed to be one of the most urgent challenges facing environmental planners”* (Carsjens and van Lier, 2002, p. 80), and is the leading cause of many current conservation issues (Debinski and Holt, 2000). Fragmentation reduces the total area of available habitat and reduces the size of remnant patches. A reduction in habitat area and size reduces the carrying capacity of the remaining fragments which can lead to a reduction in population size and an increase in the chance of local extinction (Stewart and Hutchings, 1996). Additionally, fragmentation increases the distance between, and isolation of, patches of remaining habitat, and reduces the chance of recolonisation through migration (Gray, 1996; Stewart and Hutchings, 1996). The implications of these factors are further expanded within section 3.6.

3.2.4 Overexploitation

The extinction of many of the world's largest species reflects patterns of human migration. Examples of this trend include the extinction of Australia's giant marsupials following aboriginal settlement 50,000 years ago, and the extinction of the North American mammoth 12,000 years ago which coincides with an abundance of spear points which date to the same period (Townsend, 2008). More recent examples of this trend include the extinction of all species and genera of moa in New Zealand and the extinction of the elephant bird (*Aepyornithidae*) in Madagascar following human settlement (Townsend, 2008). Although the destruction of habitat would have affected some species of megafauna, overexploitation by humans is thought to have played a significant role in the extinction of these species (Townsend, 2008).

Overexploitation has also influenced the location and abundance of species within the last few centuries. The decimation of a number of species including wolves, foxes and panthers resulted from harvesting for the fur industry, and the harvesting of whales has led to the near extinction of numerous species (Leveque and Mounolou, 2003). Additionally, illegal poaching of endangered species prevents the recovery of endangered populations (Leveque and Mounolou, 2003).

3.2.5 Invasive Species

Species invasion is a natural and relatively frequent process. Often, unfavourable conditions within the receiving environment result in only the temporary existence of exotic species. Human induced invasions however, whether intentional or accidental, have significantly altered the function of natural systems and have had a considerable impact on global biodiversity (Leveque and Mounolou, 2003).

In the absence of native predators, competitors, and parasites, introduced species have the potential to establish and spread throughout the receiving environment (Smith and Smith, 2009). Invading animals can predate upon, compete with and displace native species through the alteration of the environment (Smith and Smith, 2009). This trend is particularly evident on islands where the introduction of animals have had a deleterious impact on native animal species, particularly birds (Sax and Galnes, 2008). The introduction of plants have also impacted on native systems (Sax and Galnes, 2008). The accidental introduction of the brown tree snake (*Boiga irregularis*) in Guam and the intentional introduction of bush currant (*Miconia calvenscens*) throughout islands in Polynesia illustrate the extensive impact of invasive species on the receiving environment.

The accidental release of the brown tree snake (*Boiga irregularis*) in Guam in the 1950s led to the extinction of 9 of 12 native species of bird, 6 of the 12 species of native lizard and two of three native species of fruit bat (Smith and Smith, 2009). The intentional introduction of bush currant (*Miconia calvenscen*) to Tahiti in 1937 resulted in an aggressive colonisation throughout the island. Due to a combination of biological traits, the species outcompeted indigenous vegetation and within 50 years had modified the structure of the indigenous forests by interrupting the natural distribution of light and water and had altered the natural cycling of nutrients (Leveque and Mounolou, 2003).

Human activity within the receiving environment can also increase the likelihood of the successful establishment of invasive species. The removal of potential predators or competitors and the alteration or disturbance of natural habitats can create a favourable environment for invasive species. In North America, the engineering of permanent wetlands to replace natural, semi-permanent wetlands facilitate the invasion of bullfrogs (*Rana catesbeiana*) and cattails (*Typha* spp.) (Sax and Galnes, 2008).

3.3 RATIONALE FOR CONSERVATION AND SPECIES PRESERVATION

A reduction in biodiversity has consequences for the ecosystem of which it is a part, and can ultimately impact on the wellbeing of human populations. Although the contribution of individual species to overall ecosystem process varies, it is accepted that any loss of biodiversity will generally lead to impaired ecosystem function and a loss of ecosystem services such as the provision of food, fibre and pharmaceuticals, and the natural filtration of water (Millennium Ecosystem Assessment, 2005). Additionally the loss of key species can alter natural nutrient cycles and create further implications for the environment (Millennium Ecosystem Assessment, 2005).

Throughout our evolution, humans are thought to have undertaken measures to protect important species (Hunter, 2007). Today, conservation exists in many forms. Factors which direct decisions on whether species or biological communities should be conserved are based on utilitarian, biological or ethical and cultural criteria as outlined by Spellerberg (1996) below.

Utilitarian

- Species currently used in food, agriculture, medicine
- Species on which the above depend ecologically
- Potential species for the above
- Species which play a role in maintenance of environmental health and quality

Biological

- Endemic species
- Taxonomically unique species
- Keystone species
- Species with fragmented distribution
- Species with declined population
- Species of those taxonomic groups which have until present not been the focus of conservation

Ethical and Cultural

- Flagship species
- Species we can easily relate to
- Culturally or spiritually important species

Human preference is thought to have an increasing role in determining the future survival of many species as “*aesthetic appeal is a powerful motivator for conservation*” (Stokes, 2007). Large, charismatic, colourful species which exhibit juvenile features are generally found to be more appealing and therefore it is much easier to raise public awareness and support for the conservation of these species (Stokes, 2007). The preference of the panda over spiders and other invertebrates exemplifies this point.

In addition to large, charismatic species, historically there has been support for the conservation of taxonomically unique species such as the Tuatara (*Sphenodon* spp.) which diverged from other extant species long ago and are positioned at the end of a long branch of the phylogenetic tree. Support for the protection of such species is based on the large amount of evolutionary novelty, while species of utilitarian importance have historically not been subject to conservation unless there has been biological or ethical reasons to do so (Spellerberg, 1996).

Stokes (2006) noted that often people who do not experience biodiversity will not miss species when they disappear because they have never experienced them. Providing the public with opportunities to experience biodiversity through images, exhibits and direct contact is important for increasing awareness and raising support for conservation (Stokes, 2006).

3.4 HISTORIC CONSERVATION MEASURES TO CONSERVE BIODIVERSITY

Today it is recognised that “*landscape scale conservation is essential to preserve significant environmental (e.g. biogeochemical cycles), ecological (e.g. nutrient cycling, community diversity) and evolutionary (e.g. adaptation, speciation) processes*” (Mace, 2004, p. 711). This however, was not always the case.

The first conservation practices undertaken by humans are likely to have occurred by the earliest members of our species to preserve critical food sources. Initially such behaviour would have been similar to the hoarding of caching of food currently exhibited by many species of animal (Hunter, 2007). Over time conservation efforts have evolved and have become more sophisticated and targeted for the specific protection of individual species and habitat areas. Decrees established to protect land and its biodiversity date back 3000 years to the kings of Egypt and Ikhnaton, and to royal members of Assyria, China, India and Europe in addition to the Greeks, Romans, Mongols, Aztecs and Incas (Hunter, 2007).

3.4.1 Parks and Protected Areas

Since the late 1800s, conservation efforts have primarily been undertaken through the creation of reserved areas or parks. Initially these areas were established to preserve scenery and were comprised of large areas of government owned land located in areas which offered access and recreational opportunities for the public. Such parks were generally managed as discrete entities in isolation from the surrounding landscape (Trombulak and Baldwin).

In 1872 Yellowstone National Park was established as the world's first national park. By the end of the 1800s many other national parks had been established in North America including Banff in 1885, Yoho in 1886 and the Yosemite and Sequoia National Park in 1890. During the same period national parks were established throughout the world including the Royal National Park in Australia in 1879, and New Zealand's Tongariro National Park in 1887. Protected areas in South Africa were established including the Hluhluwe-umfolozi Game Reserve in 1895 and Europe's first national park was established in Sweden in 1909 (Trombulak and Baldwin, 2010).

The creation of large protected areas prior to the 1900s was possible due to the relatively small human population and lower demand for land. During this period human population was less than a quarter of the size it is today and few people inhabited the isolated and mountainous areas in which they were established (Trombulak and Baldwin, 2010).

Initially, much of the wider landscape remained relatively unmodified and protected areas were not ecologically isolated from the surrounding habitat. Over time however, dramatic increases in human population resulted in the transformation of many landscapes adjacent to protected areas (Trombulak and Baldwin, 2010). Protected areas became increasingly isolated as a result of the increasingly fragmented matrix in which they were situated, and it was noted that despite their large size, parks established prior the 1950s were increasingly unable to achieve their conservation goals (Trombulak and Baldwin, 2010). By the mid 1970s limitations of the historic reserve model were acknowledged and implications of managing small isolated populations became apparent (see section 3.6.4 for further detail regarding the island biogeography theory)

By this time it was realised that a more holistic ecological view that included all species and all levels of biological organisation from genes to ecosystems would be necessary to conserve biodiversity (Poiani, *et al.*, 2000). Small scale conservation plans which focused

on individual, isolated areas were no longer an adequate approach to ensure species and ecosystems were effectively conserved. Instead, planning which considered the interaction and relationships between protected areas over a large scale, and the interaction with people and activities within the surrounding matrix was required (Trombulak and Baldwin, 2010). With this shift in mindset, concern for biological diversity increased and further attention was appointed to species and ecosystems at risk of extinction (Trombulak and Baldwin).

3.4.2 Limitations of Reserves

‘Despite heavy global investment and reliance on protected areas, almost invariably evaluations of existing protected areasystems have tended to conclude that they remain far from adequate’ (Jackson and Gaston, 2008, p. 1050). The reasons underpinning these inadequacies include ad hoc selection processes, inappropriate management and competition from more lucrative land use options. The implications of reserve size, connectivity and cross boundary movement of species are further expanded on below.

3.4.2.1 Size and Connectivity

Despite the existence of large reserves such as Yellowstone National Park, the Gir Sanctuary in India and the Serengeti National Park in Tanzania, such parks have been deemed to be too small to support viable populations of all species of indigenous wildlife, especially those with large area requirements (Bennett, 2003). The area requirement of mammalian species often exceed the size of national parks and the extinction rates of mammalian species within national parks exceed the potential rate of colonisation (Newmark, 1987). In 1979, Craighead identified the inability of Yellowstone National Park to support a viable population of grizzly bear (*Ursus arctos*) despite protecting over 9,000 km² of habitat. In order to facilitate adequate conservation planning for this species, it was necessary to consider Yellowstone National Park as part of the wider landscape, now known as the Greater Yellowstone Ecosystem (Baldwin, 2010).

The importance of connectivity between conservation areas and conservation areas and surrounding matrix is now acknowledged. Land transformation resulting from an ever increasing human population and the increased impact of human activity began to affect the short term and long terms patters of species dispersal. Today, connectivity between existing protected areas is deemed necessary in the design and management of conservation areas (Trombulak and Baldwin, 2010).

3.4.2.2 *Movement across Reserve Boundaries*

Due to a lack of authority to influence land use on adjacent property, the protection offered within the reserve boundaries often does not extend into the surrounding matrix (Bennett, 2003). Animals, however, do not recognise reserve boundaries and often cross into surrounding matrix to feed, breed or find shelter and are subject to threats not found within the reserve (Bennett, 2003). Processes which occur on adjacent land also have the potential to affect processes which occur within the reserve boundaries. It is now accepted that reserves cannot remain pristine and self sustainable in the long term if the surrounding matrix is degraded (Bennett, 2003). In order to increase the conservation potential of reserves, an integrated approach to conservation planning which extends management and conservation goals beyond the boundaries of protected land to encompass the whole landscape is required (Bennett, 2003).

3.4.2.3 *Social, Economic and Political Limitations of Reserves*

In addition to the ecological limitations of reserves, there exists an extensive literature regarding the social, economic and political impacts of protected areas (Blue and Blunden, 2010). The formation of reserves within developing countries for example have “*often deprived local residents of critical natural resources without providing for sufficient replacements such as alternative fuels, and jobs that would allow the purchase of replacement resources*” (Nightingale, 2003, p. 526).

3.4.2.4 *The Man and the Biosphere Program – An Example of Landscape Scale Conservation*

The Man and the Biosphere Program of UNESCO developed a new protected areas model which incorporated new design criteria. As drawing boundaries surrounding protected areas and managing these areas in isolation of adjacent unprotected areas was no longer sufficient to achieve ecological goals, buffer zones surrounding core ecological areas were introduced. This introduction indicated a shift in mindset from protected areas acting as discrete, individually managed parcels of land, to integrated areas functioning within a wider landscape (Trombulak and Baldwin, 2010). Buffer zones provided an area containing a gradient of purpose between the protected area and the cultural uses of the surrounding matrix with mixed use in between (Trombulak and Baldwin, 2010).

3.5 OTHER FORMS OF CONSERVATION

3.5.1 Ex situ conservation

Although the main aim of conservation programmes is to protect species within their natural habitat, the protection of habitat alone is not always sufficient to ensure species are conserved (Worley, 1996). The main benefits of *ex situ* conservation programmes is their ability to prevent the immediate extinction of threatened species and provide a platform for education and increase public awareness of existing conservation issues (Worley, 1996). They can also complement and support *in situ* conservation programmes by providing a source for the establishment of new populations in the wild and can supplement existing wild populations. Carefully managed breeding programmes can also increase the number of individuals within a population while protecting genetic diversity (Worley, 1996). The value of *ex situ* conservation programmes is illustrated by the captive breeding programme for the Przewalski's horse (*Equus przewalskii*), thought to be extinct in the wild since the 1960s. In the mid 1990s over 1000 individuals are held in captivity (Worley, 1996).

Despite the role of *ex situ* conservation to prevent the immediate extinction of the world's most endangered species, the use of this conservation tool is limited when target species are reliant on complex symbiotic relationships with other species. The Brazil nut (*Bertholletia excelsa*) for example is reliant on several species of bee for pollination which in turn require specific orchids to reproduce. Due to the tough exterior of the Brazil nut, the agouti (*Dasyprocta*) is required to release and disperse the seed (Spellerberg, 1996). In isolation of both the bee and rodent, the Brazil nut cannot be naturally sustained.

3.5.2 Flagship Species Protection

The conservation of individual species, or 'flagship species', can be beneficial for more than just the target species as the action for particular species is a proven way of stimulating financial support for conservation activities. Threats to primates including lemurs and orang-utan have been successful in raising awareness of the loss of tropical forest. Flagship species can also help legitimise conservation action and provide the catalyst for local communities to recognise the significance of conservation action (Adams, 2004).

3.6 ECOLOGICAL THEORY NECESSARY FOR EFFECTIVE CONSERVATION

‘The ultimate goal of wildlife-habitat restoration is to provide for the survival and protection of individual organisms in sufficient numbers and locations to maximise the probability of long-term persistence’ (Morrison, 2009, p. 17). In order to conserve the most endangered species and indeed all species, it is necessary to conserve functioning populations to secure long term viability (Smith and Smith, 2009). Endangered terrestrial species are often located within protected areas, however, due to limited resources and land, comprehensive conservation plans are needed which take into account the size of the population necessary in order to ensure the species persists, and acknowledge the role of the matrix which surround protected areas (Smith and Smith, 2009). This section contains an outline of the theoretical factors which need to be acknowledged in the formulation of successful conservation plans.

3.6.1 Minimum Viable Population

A minimum viable population is, in theory, the smallest number of breeding individuals required to sustain a population over time and prevent the effects of inbreeding depression (Gray, 1996). Populations comprised of fewer breeding individuals than required by the minimum viable population will inevitably go extinct while those with larger populations are considered stable (Morrison, 2009).

The minimum viable population required to ensure the survival of a given population is debated within the literature but is thought to be dependent on the life history traits of species such as the rate of reproduction, lifespan and ability to disperse between habitat fragments (Smith and Smith, 2009). Species which exhibit extreme variation in population size such as annual plants and invertebrates are thought to require a minimum viable population of 10,000 individuals to ensure long term survival (Smith and Smith, 2009).

Smith and Smith (2009) suggest that vertebrate species with an effective population size (number of breeding individuals) of less than 100, and an actual population of less than 1000 individuals have a high likelihood of extinction. Townsend (2008), also estimates an effective population of 500-1000 is required to maintain a high level of genetic diversity and allow for future evolutionary change which ensures the long-term survival of the population (Gray, 1996).

The assessment of the impact of minimum viable populations on the long term survival of populations is illustrated within a study of the survival of bighorn sheep (*Ovis canadensis*) in the United States. Of 120 populations studied, all populations with less than 50 individuals went extinct within 50 years (Berger, 1990).

3.6.2 Minimum Dynamic Area

In order to effectively manage species which have fragmented populations, it is necessary to establish the minimum dynamic area of habitat required to support the minimum viable population throughout the landscape. Attaining an understanding of size of the home range required by individuals, and the home ranges of viable populations of species on which other species depend is necessary to understand the full extent of area which is required for long term survival of species and ecosystems (Smith and Smith, 2009).

3.6.3 Metapopulations

“There is growing evidence that the population dynamics of many species are driven by environmental factors operating at a regional level” (Stewart and Hutchings, 1996, p. 133). Many regional population of species are spatially divided into discrete habitat patches which are often small and subject to periodic chance extinction. These habitat patches are, however, open to recolonisation and migration of individuals from other patches which act to sustain the regional population (Stewart and Hutchings, 1996). These interconnected populations are functionally linked and sustained by dispersing individuals as a metapopulation (Stewart and Hutchings, 1996). Metapopulations are also reliant on the probability of extinction within local populations to be independent, as if all populations were to go extinct at the same time recolonisation of vacant habitat would not occur (Stewart and Hutchings, 1996).

3.6.4 Island Biogeography Theory

The theory of island biogeography was first proposed by MacArthur and Wilson (1963) who developed an equilibrium model to explain and predict the number of species present on islands of differing size and location in relation to the mainland, the assumed source of colonisation.

This model predicts that at an equal distance from the mainland large islands would have more species than small islands due to a greater availability of habitat. Islands further away from the mainland would have fewer species than islands of a similar size located

closer to the mainland due to the decreased probability of dispersal and colonisation of islands far out to sea. At equilibrium it was considered that small isolated islands would contain fewer species than large islands located closer to the mainland due to both limited availability of habitat and decreased potential for recruitment from the mainland.

The theory also proposed that over time the total number of species present on an island would remain roughly constant due to immigration negating species loss through extinction. This turnover of species would however lead to a variation in the composition of species over time.

In 1967, MacArthur and Wilson suggested that physical islands were analogous to fragmented 'islands' of terrestrial habitat and suggested the theory could also be applied in a terrestrial setting with small, isolated fragments containing fewer species than larger fragments of habitat.

Island biogeography principals were applied to the design of nature reserves in the 1970s (Diamond, 1975). The most important recommendations were that reserves should be as large as possible and not isolated from one another. Corridors were recommended as a way to minimise the isolation of each reserve and to increase the rate of immigration into reserves and other fragments of habitat (Noss, 1993). Corridors could also increase the total number of species present within the equilibrium through the establishment of metapopulations.

Limitations of the application of the island biogeography theory within terrestrial ecosystems have, however, become apparent over time. Critically, patches of terrestrial habitat are not situated within a homogenous 'sea', rather the matrix surrounding remnant patches of vegetation is a heterogeneous mosaic, which a suite of flora and fauna which can act as a source of species (be they pest or indigenous) and can either facilitate or inhibit the movement of species between forest remnants (Bennett, 2003; Clevenger and Waltho, 2000). The issue of whether it is better to create one large reserve or several small reserves which add up to the same total area is a common debate (Townsend, 2008).

3.6.5 Problems for Populations in Small Isolated Reserves

Small isolated populations are susceptible to extinction through stochastic events and inbreeding depression. Populations within completely isolated reserves are often required to contain several thousand individuals to ensure long term persistence, although smaller

populations of only a few hundred individuals may persist in some cases, particularly if the species is long lived (Thomas, 1991).

Ecological corridors may mitigate some of the problems associated with habitat fragmentation. Corridors can increase the potential for dispersal between reserves and habitat remnants and through an increase in the connectivity and size of metapopulations. Further detail regarding corridors can be found within section 3.7.

3.6.6 Population Extinction

All animal populations undergo fluctuations in size over time although small populations generally have a higher risk of extinction compared to larger populations (Thomas, 1991). Factors which contribute to and increase the likelihood of extinction include demographic stochasticity, environmental stochasticity through natural catastrophes, genetic stochasticity and inbreeding depression, and social dysfunction also known as the allee effect. Further detail of the implications of these factors is provided below.

3.6.6.1 Demographic Stochasticity

Demographic extinction is generally accepted to be a threat to very small populations (Soule and Simberloff, 1986), or populations with naturally biased sex ratios which act to reduce the effective demographic size to much lower than the actual number of individuals (Thomas, 1991). For example, in highly fragmented and isolated matriarchal animal societies, males may not be able to disperse easily between populations, resulting in few males within each population and an enhanced chance of extinction through genetic stochasticity despite the proportionally large number of females present within the remnant population (Thomas, 1991).

3.6.6.2 Natural Catastrophes

Environmental stochasticity and natural catastrophes have a greater impact on small populations which occupy a small area compared to large populations which occupy a large area or multiple habitat types as there is a higher chance a single event could eliminate all suitable habitat within a small area.

3.6.6.3 Genetic Stochasticity

Models of genetic drift predict a loss of genetic variation from small populations. Populations maintained by only a small number of individuals in the absence of factors which act to maintain genetic variation including mutation, immigration or selection favouring heterozygotes, have a greater chance of losing genetic variation and are subject to adverse effects resulting from reduced population fitness (Lande, 1988). The effect of isolation on the genetic variation within small populations was illustrated by Soule (1980) who found lizards on small islands showed far less variation than populations on larger islands.

3.6.6.4 Inbreeding Depression

All populations contain recessive alleles which can be deleterious or even lethal in homozygotes. Deleterious alleles are usually selected against within large populations. In small populations however, these alleles can become fixed as related individuals are more likely to breed together therefore increasing the likelihood of producing offspring which express these deleterious alleles. This inbreeding can lead to sterility and inviability after several generations and decrease the evolutionary potential of small populations (Thomas, 1991).

3.6.6.5 Genetic Drift

Genetic drift reduces diversity through a reduction in heterozygosity and increases the amount of genetic differentiation between populations (Gray, 1996). As population size falls there is an increasing chance that an individual allele will, by chance, be lost from the population pool. Progressive loss of alleles or 'genetic drift' directly affects the mean heterozygosity of a population. In the absence of immigration or mutation, heterozygosity will decrease at a rate that is inversely proportional to population size (Stewart and Hutchings, 1996).

The loss of alleles may also occur through sudden, unexpected and catastrophic declines in population size. The resulting 'bottleneck' can induce a 'founder effect' where the genetic composition of the extant population is dependent on the small numbers of surviving individuals (Stewart and Hutchings, 1996).

Examples of animal populations which have low genetic diversity as a result of bottlenecks include the Asiatic lion which was reduced to less than 20 individuals in the early 1900s, and the northern elephant seal which descend from fewer than 30 individuals due to overexploitation by hunters (Gray, 1996).

3.6.6.6 Social Dysfunction - Allee Effect

In some animal species low population numbers may disrupt social functions such as aggregative behaviour for defence, mating, and migration.

3.7 ROLE OF ECOLOGICAL CORRIDORS TO INCREASE CONNECTIVITY

Rapid reduction in the total amount of habitat, increasing fragmentation and a growing understanding of the importance of dispersal and movement of individuals between remaining fragments for species survival led to the concept of creating or retaining wildlife ‘corridors’ between isolated reserves. Corridors have been defined as “*landscape structures that enhance the dispersal of organisms between suitable habitat patches in fragmented landscapes where isolates of suitable habitat are surrounded by a matrix of inhospitable habitat types*” (Vos, Baveco, and Grashof-Bokdam, 2002. p. 84). In theory, corridors promote the long term survival of species and the maintenance of species richness in increasingly fragmented landscapes (Vos, Baveco, and Grashof-Bokdam, 2002), by increasing the connectivity and dispersal of individuals between habitat fragments and reducing the risks associated with small, isolated populations (Stewart and Hutchings, 1996). Corridors also facilitate daily and seasonal movement of species and provide protection for ecological structure and function on a regional scale (Linehan, Gross, and Finn, 1995).

Observational studies undertaken at the landscape scale provide evidence to support a positive relationship between the density of corridors within the landscape and the probability of occupation or colonisation of suitable habitat patches (Verboom and Apeldoorn, 1990; Vos, Baveco, and Grashof-Bokdam, 2002).

The concept of using corridors as a conservation tool has captured the attention of planners, land managers and communities throughout the world. To date, a wide range of wildlife corridors, landscape linkages, dispersal corridors, green belts, and greenways have been proposed and drawn into conservation plans (Bennett, 2003). The scale of corridors

vary depending on their purpose and range from simple riparian strips and hedgerows implemented on a local scale to supraregional corridors which extend throughout the landscape (Bennett, 2003).

When considering the establishment of a corridor to facilitate the movement of species between areas it is necessary to understand the habitat requirements of target species. Narrow corridors are largely comprised of edge habitat and can provide adequate habitat and shelter for edge tolerant species. In order to facilitate the movement of species which inhabit forest interiors, corridors must be wide enough to contain an intact core. It is also important to consider the life histories of species and consider whether species are able to easily travel between fragments, or if several seasons or generations of movement are required for species to move to and colonise more distant fragments. If this is the case then the provision of habitat which provides shelter, food and adequate breeding habitat is required. Further detail regarding different forms and purpose of corridors is provided below.

3.7.1 ‘Supraregional’ Corridors

Ground dwelling species with large individual habitat requirements and large ranges are generally the first species to disappear when habitat is fragmented by human land use. Populations of large mammalian predators are particularly vulnerable and despite the protection of large tracts of land, often such areas are insufficient to ensure the long term survival of individuals and populations (Vos, Baveco, and Grashof-Bokdam, 2002). The provision of ‘supraregional’ corridors which connect several areas over a long distance has the potential to be effective as these species are often capable of long distance dispersal. Supraregional corridors are generally over a kilometre wide and can be over 10 km long (Vos, Baveco, and Grashof-Bokdam, 2002).

3.7.2 Regional Scale Corridors

Small mammals and amphibians have moderate individual area requirements and are able to disperse over several kilometres. Often these animals have the potential to form viable metapopulations at a regional scale. Local extinctions can occur within habitat fragments which become overtly isolated due to fragmentation. In this case, corridors can provide the necessary links to facilitate recolonisation through provision for the movement of individuals from surrounding habitat fragments (Vos, Baveco, and Grashof-Bokdam, 2002). These corridors rarely need to exceed 10 km in length and are typically between 10

m and 1 km wide. Regional corridors are often comprised of habitat which provide both shelter and food for target species. If the corridor connects habitat fragments which are located at a distance which exceeds the dispersal distance of the target species, additional nodes of appropriate habitat to facilitate breeding is thought to be required (Vos, Baveco, and Grashof-Bokdam, 2002).

3.7.3 Local Corridors

Local corridors are continuous stretches of habitat which support populations of species which have a low dispersal ability and small individual area requirements. These corridors can facilitate the movement of non flying insects and plants through extensively fragmented landscapes and can be less than 1 km long and narrower than 10 m (Vos, Baveco, and Grashof-Bokdam, 2002). Local corridors in the form of native vegetation growing within fencerows through agricultural fields are likely to contain a high proportion of species tolerant to exposed conditions and high light levels (Vos, Baveco, and Grashof-Bokdam, 2002). If the target species is susceptible to edge effects, this form of corridor may contribute little to its conservation.

Throughout Australia local corridors in the form of narrow strips of native vegetation lining roads are common and support a variety of species. In the wheat belt region of Western Australia, roadside corridors are used by a high proportion of birds (Saunders *et al.* 1987), while in south-eastern Australia roadside strips are inhabited by 78% of mammals (Bennett 1998). For extremely immobile species such as plants, corridors which contain suitable reproductive habitat could be the only effective means of increasing connectivity between isolated populations (Vos, Baveco, and Grashof-Bokdam, 2002).

3.7.4 Corridors to Overcome Hazards and Barriers

Wildlife overpasses and underpasses were first constructed in the 1970s to facilitate safe movement of animals across road barriers within protected areas (Clevenger and Waltho, 2000). In the Banff National Park, Alberta, Canada, 45 km of 75 km of the Trans-Canada Highway which runs through the national park is fenced to exclude wildlife. Within this fenced section, 22 wildlife underpasses and two over passes were constructed to mitigate the barrier effect of the fences. Mammals known to use the underpasses include black bear, grizzly bear, cougar, wolf, deer, elk and moose (Clevenger and Waltho, 2000).

3.7.5 Arguments for and Against Corridors

“Corridors can be a cost-effective complement to the strategy of large and multiple reserves in real-life landscapes” (Noss, 1987, p. 159). However, it is important consider each corridor on its own merits as theoretical considerations cannot be applied universally to all habitat types and provide adequate results for all target species (Noss, 1987). All corridors are subject to edge effects and corridors are required to be wide enough to contain sufficient areas of pristine central habitat in order to provide enough habitat to support species while moving between habitat fragments. A summary of the potential advantages and disadvantages of corridors as identified by Noss (1987) is provided below.

Potential Advantages of Corridors

1. Increased immigration rate to a reserve which could
 - a. increase or maintain species richness and diversity as predicted by island biogeography theory
 - b. increase population sizes of particular species and decrease probability of extinction (provide a “rescue effect”) or permit re-establishment of extinct local populations
 - c. prevent inbreeding depression and maintain genetic variation within populations
2. Provide increased foraging area for wide ranging species
3. Provide predator-escape cover for movement between patches
4. Provide a mix of habitats and succession stages accessible to species that require a variety of habitats for different activities or stages of their life cycles
5. Provide alternative refuge from large disturbances
6. Provide green belts to limit urban sprawl, abate pollution, provide recreational opportunities and enhance scenery and land values

Potential Disadvantages of Corridors

1. Increased immigration rate to a reserve which could
 - a. Facilitate the spread of epidemic diseases, insect pests, exotic species, weeds and other undesirable species into reserves and across the landscape
 - b. Decrease the level of genetic variation among population or subpopulations, or disrupt local adaptations and coadapted gene complexes (outbreeding depression)

2. Facilitate spread of fire and other abiotic disturbances (contagious catastrophes)
3. Increase exposure of wildlife to hunters, poachers and other predators
4. Riparian strips might not enhance dispersal or survival of upland species
5. Cost and conflicts with conventional land preservation strategy to preserve endangered species habitat especially when the inherent quality of the habitat is low

3.8 THE ROLE OF PRIVATE LAND IN LANDSCAPE SCALE CONSERVATION

In many countries, endangered or threatened species can be found on habitat held in private ownership. In the United States for example, two thirds of all species listed as endangered or threatened depend on private land for the majority of their habitat requirements (Groves *et al.*, 2000). The inclusion of private land into landscape scale conservation plans is therefore essential if effective management of biodiversity is to occur (Jansujwicz and Calhoun, 2010). This inclusion, however, can be challenging. Such strategies can be viewed to impose costs on landowners, lower the actual or perceived value of land, or restrict land use (Jansujwicz and Calhoun, 2010). Additionally, landowners may resent the implementation of additional regulations affecting their land and as such, obtaining the cooperation and buy in of landowners can be difficult. (Jansujwicz and Calhoun, 2010).

In order to reduce clashes between environmental policy and private property rights there has been a growing movement toward inclusive planning which include the involvement of multiple stakeholders including land owners into wider scale land use policy and landscape scale decisions (Jansujwicz and Calhoun, 2010). Increased stakeholder involvement within landscape conservation planning can increase local knowledge of what can be done on a local scale to contribute to benefits which will be seen throughout the region (Baldwin, 2010).

3.9 INTEGRATION OF CONSERVATION GOALS INTO STATUTORY PLANNING FRAMEWORKS

As decisions regarding land use allocation and development are primarily made at the district level (Stokes, *et al.*, 2010), incorporating conservation goals into mainstream

policy and practice is essential in order to protect biodiversity situated outside of formally protected areas and reserves (Pierce, *et al.*, 2005).

The integration of conservation goals into local government policy has the potential to significantly strengthen the protection of endangered species and “*In most circumstances ... incorporating local organizations into species protection plans can pay enormous dividends in the effective implementation of conservation goals*” (Press, Doak, and Steinberg, 1996, p. 1539). Policy developed and implemented by local government can control and regulate land use activities undertaken by multiple owners of private land on a landscape scale. However, the potential for local governments to “*play a significant role in the protection of rare species is essentially absent from the minds of biologists, policy makers, and the general public*” (Press, Doak, and Steinberg, 1996, p. 1539).

Some endangered species, particularly plants endemic to North America, occur only in a small number of remnant patches which may be less than 100 ha, and entire geographic ranges may be contained within one or two counties within a single state (Press, Doak, and Steinberg, 1996). The incorporation of conservation goals for threatened species endemic to, or restricted within, the jurisdictional boundaries administered by local governments is therefore best incorporated into the statutory plans and planning framework active at that level. This integration, however, has rarely been exploited (Press, Doak, and Steinberg, 1996). In order for planners to implement sound policy which address relevant biodiversity issues, they must have access to relevant information, and the role and ability for councils to implement policy which could act for the benefit of biodiversity must be recognised by conservationists proposing or pushing for the development of such policy (Press, Doak, and Steinberg, 1996).

“*Distortions inevitably occur between the creation of policy and its practical application*” (Pollock-Ellwand, 2001, p. 99). The implementation of clearly drafted rules within statutory plans implemented at a local or district level, or through regional plans, could provide the necessary legislative backing needed to guide and influence land use and activities on privately owned land which may have an adverse effect on biodiversity throughout the landscape. However, despite the feasibility and desirability of incorporating species conservation goals into local government agendas, little work has been undertaken which focus on species protection at a local or regional level (Press, Doak, and Steinberg, 1996).

3.10 CONCLUSION

Biodiversity can no longer be preserved in small reserves in isolation of the surrounding landscape. Developments in conservation and ecological theory show that populations managed within small, isolated reserves are unable to support the number of individuals required to prevent local extinctions. Connecting populations on a landscape scale through the use of corridors and habitat protection within the matrix can promote and facilitate the dispersal of individuals and populations throughout the landscape, preventing local extinction and enhancing the conservation potential of the whole landscape.

4 CONSERVATION IN NEW ZEALAND

4.1 INTRODUCTION

This section provides an overview of the current state of New Zealand biodiversity, and the history, development and limitations of conservation measures currently undertaken to protect and preserve indigenous wildlife.

4.2 THE LOSS OF NEW ZEALAND'S BIODIVERSITY

New Zealand has been identified as a biodiversity hotspot and a 'treasure chest' of unique and interesting species including the internationally valued tuatara (*Sphenodon* spp.), kakapo (*Strigops habroptilus*), giant weta (*Deinacrida heteracantha*) and kiwi (*Apteryx* spp.). New Zealand's unique biodiversity, and high rate of endemism among indigenous species, is testament to a long history of physical isolation following its separation from Gondwana 65 to 80 million years ago (Craig, *et al.*, 2000). Over 90% of insects and marine molluscs are endemic as are 80% of vascular plants, a quarter of all bird species, 60 species of reptile and all four species of native frog (Department of Conservation and Ministry for the Environment, 2000). In the absence of ground dwelling mammalian species, birds diverged and evolved to occupy vacant niche, and became the "*largest animals in all terrestrial ecosystems*" (Craig, *et al.*, 2000, p. 62). New Zealand's pre human avifauna was dominated by forest and wetland birds (Holdaway, 1989), and ratites, many of which were large and flightless (Craig, *et al.*, 2000) .

Despite being one of the last major land masses to be colonised by humans, settlement of the Maori over 800 years ago, followed by the European in the early 1800s resulted in the destruction and clearance of much of New Zealand's native habitat and loss of many indigenous species (Craig, *et al.*, 2000). In 1997 biodiversity decline was identified as New Zealand's "*most pervasive issue*" (Ministry for the Environment, 1997, p. 10.9). The rate of biodiversity loss over the past 800 years has been deemed one of the highest in the world, not exceeded since the extinction of the dinosaurs 65 million years ago (Department of Conservation and Ministry for the Environment, 2000).

The settlement of the Maori and associated activities including hunting, habitat destruction and introduction of mammalian predators triggered the first wave of recent biodiversity

loss. Harvesting led to the extinction of 26 endemic species of terrestrial bird and four species of endemic sea bird (Craig, *et al.*, 2000). Fire was widely used to clear forests and expanded the range of native grasslands from 1.5 million hectares to 8 million hectares, and the introduction of mammalian predators including the kaori or pacific dog and the pacific rat led to the extinction of 8 species of terrestrial bird (Craig, *et al.*, 2000). Following the settlement of the European, large areas of forest were cleared and wetlands were drained to establish pastoral agriculture. The accidental and intentional introduction of numerous mammalian predators and pest species led to the extinction of a further 16 species of terrestrial bird (Craig, *et al.*, 2000).

Since human settlement, New Zealand has become “*one of the most biologically transformed countries on earth*” (Pryde and Cocklin, 1998, p. 87). Over three quarters of New Zealand’s original terrestrial habitat has been altered, up to 90% of lowland wetlands lost, and total forest cover has declined from 75% to 35% (Saunders and Norton, 2001). By 1993, New Zealand’s heavy dependence on primary agriculture had resulted in the conversion of 53% of the country’s total land area into farmland. The vast majority of this converted pastureland is located at low altitudes below 500m (Ministry for the Environment, 2007).

Today, a total of 63% of the mainland has been converted to farms, exotic forests, settlements and roads (Department of Conservation and Ministry for the Environment, 2000). Much of the unmodified habitat which does remain is located either on the west coast of the South Island, in mountainous areas, on offshore islands, or within small, fragmented lowland remnants (Craig, *et al.*, 2000). Introduced pest species are widely distributed throughout most of the remaining areas of indigenous vegetation and declines in the populations of the majority of the remaining indigenous fauna have been noted. Populations of native bird, lizard, frog and invertebrate are often highly fragmented and local extinctions are common where population densities are low and ranges severely contracted (Craig, *et al.*, 2000).

The combined action of human activity and the impact of introduced species has led to the extinction of 32% of indigenous land and freshwater birds, 18% of sea birds, three of seven indigenous frogs, at least 12 invertebrates, one bat and one fish (Ministry for the Environment, 1997). Typically, long lived species which exhibit a slow rate of

reproduction and specialised habitat requirements have declined, while species with more general habitat requirements and short life cycles have fared better (McLennan, 1988).

4.3 CONSERVATION OF NEW ZEALAND'S BIODIVERSITY

The ongoing decline of New Zealand biodiversity has long been acknowledged and multiple actions have been undertaken with the goal of reducing and ultimately reversing these trends. In recent times, a shift in national priorities has seen an end to destructive activities such as the large scale draining of wetlands, the reclamation of estuaries and subsidised clearance of native vegetation, although in many cases this change in activity has been shaped by a lack of remaining habitat. Although New Zealand is now viewed as a world leader in the development of threatened species management programmes (Saunders and Norton, 2001), sadly however, biodiversity continues to be lost despite conservation efforts to protect and preserve the most endangered species.

4.3.1 Early Maori Conservation

The first attempts to reduce the impact of human activity on biodiversity loss were undertaken by Maori prior to European settlement. Following the first waves of species extinction, Maori developed conservation practices such as tikanga (protocols), tapu (sacred prohibitions) and rahui (temporary restrictions) to control the season, area and species which were being harvested (Department of Conservation and Ministry for the Environment, 2000).

4.3.2 Formal Protection of Land

Conservation practices undertaken by the early European focused primarily on the formal protection of public land in the form of National Parks and Reserves. These reserves were largely located in areas chosen for their scenic and aesthetic values rather than their ecological worth and accordingly few were located in the lowland where the loss of biodiversity was greatest due to the increased potential for conflict with other land users (Saunders and Norton, 2001).

Today, New Zealand has one of the highest rates of protected land of any OECD country (J. Craig, *et al.*, 2000). In 2009, a total of 8,763,300 ha, or 33.4% of New Zealand's land was legally protected '*for the primary purpose of conserving biodiversity*' (Ministry for the Environment, 2010, p. 1). The majority (97.3%) of protected land is located on public

land administered by the Department of Conservation and Local Authorities. The remainder is located on private land and is protected through open space covenants established under the QEII National Trust Act 1977, conservation covenants established under both the Reserves Act 1977 and Conservation Act 1987, protected private land established under the Reserves Act 1977, and wildlife refuges established under the Wildlife Act 1963 (Northland Regional Council, 1999). Additional protection is also provided by Nga Whenua Rahui (Ministry for the Environment, 2010).

Despite this high rate of protection, New Zealand's reserves network is subject to a number of criticisms which contribute to the ongoing trends in biodiversity loss. Conservation land is not distributed uniformly throughout the country and does not protect an equal representation of all habitat types. Much of New Zealand's conservation land is situated within upland or montane regions and in areas with low production value while areas of native vegetation which still remain in fertile lowland regions are generally small, fragmented and isolated (Craig, *et al.*, 2000). In response to this limitation there has, since the 1980s, been an emphasis to develop a more representative network of reserves, particularly in lowland areas. Of particular note is the establishment of the Whanganui, Paparoa, and Kahurangi National Parks which protect a range of habitat including river systems and lowland forest (Department of Conservation, 2011a).

A further criticism of the current reserves based approach in New Zealand is the tendency to focus on only a limited number of individual ecological habitats in isolation from the surrounding environment (Freeman, 2003). The matrix surrounding conservation land often acts as a barrier to the dispersal of individuals and populations between remaining fragments of habitat and local extinctions of populations and species is a common result. The New Zealand Biodiversity Strategy recognises this limitation and identifies the need to manage biodiversity "*as best we can in farming and forestry environments*" (Department of Conservation and Ministry for the Environment, 2000, p. 1).

Although there has been an ongoing increase in interest from private land owners seeking to attain formal protection for areas of private land with conservation value (Saunders & Norton, 2001), the development of conservation areas on private land has generally been applied in an ad hoc manner through the voluntary efforts of individual land owners.

The Queen Elizabeth II National Trust was established in 1977 as an independent statutory organisation to "encourage and promote, for the benefit and enjoyment of the present and

future generations of the people of New Zealand, the provision, protection, preservation, and enhancement of open space” (Queen Elizabeth the Second National Trust Act 1977 s 20(1)). The Trust secures the long term protection of private land primarily through open space covenants which are monitored every two years to ensure that standards of the covenants agreements and conditions are adhered to Queen Elizabeth II National Trust, 2011). As at 30 June 2011 a total of 114,024.92 ha of land was protected under registered or approved covenants or through formal agreements with the QEII National Trust. The average area of protected land however was only 28.6 ha (Queen Elizabeth II National Trust, 2011).

The conservation potential of small, isolated areas of protected habitat is limited, especially when developed in isolation of the wider environment or within an inhospitable matrix of modified land (Freeman, 2003). Corridors to connect remaining areas of indigenous or contiguous vegetation have not been widely established in New Zealand, and little is known about how species indigenous to New Zealand respond to different forms of corridor (Thomas, 1991).

These limitations clearly illustrate that despite its importance and local success as a conservation tool, the legal protection of land alone is insufficient to prevent ongoing decline of biodiversity (Saunders and Norton, 2001).

4.4 MANAGEMENT OF THREATENED SPECIES IN NEW ZEALAND

Following heavy investment into threatened species management programmes, New Zealand has become a world leader in the establishment and management of offshore island sanctuaries. The development of successful conservation techniques such as total pest eradication and population translocation are increasingly being applied to establish and manage some of the countries most endangered species within mainland ‘island’ sanctuaries (Department of Conservation and Ministry for the Environment, 2000).

The Department of Conservation is the ‘central government organisation charged with promoting conservation of the natural and historic heritage of New Zealand on behalf of, and for the benefit of, present and future New Zealanders’ (Department of Conservation, 2009, p. 8). The Department is responsible for the management of protected native species under the Wildlife Act 1953 and has direct responsibility for the conservation and recovery of threatened species in New Zealand (Ministry for the Environment, 2007). The

work of the department is predominantly guided by four acts, the Conservation Act 1897, National Parks Act 1980, Reserves Act 1977 and the Wildlife Act 1953 but the Department has an administrative or functional role in a total of 41 acts (Seabrook-Davidson, 2010).

The Department produces threatened species management plans to provide a statement of intentions for the recovery of particular species over a defined period of time (Department of Conservation, 2011b). The plans state the goals and objectives for management and act to guide the allocation of resources needed to achieve the goals. The plans also promote discussion between practitioners involved in species recovery and the involvement of interested stakeholders including the public (Department of Conservation, 2011b).

4.4.1 New Zealand Threat Classification System

Until the publication of New Zealand's Red Data Book in 1981, the number of species threatened with extinction was unknown (Seabrook-Davidson, 2010). The first rudimentary list of threatened species was produced by Williams and Given using the IUCN threat classification system. This list determined 30 vertebrate and 62 vascular plant species to be threatened with extinction (Williams and Given, 1981). This list was updated in 1986 by the New Zealand Wildlife Service who also used the IUCN classification system available at the time (Bell, 1986).

In 2002, Molloy *et al.* developed and implemented the New Zealand Threat Classification System which has since been updated by Hitchmough *et al.* (2007) and Townsend *et al.* (2008). The New Zealand Threat Classification System was developed to provide a fundamental framework for biodiversity recovery programmes as '*the risk of extinction that a taxon faces is a critical facet of conservation management*' (Townsend, *et al.*, 2008). The classification system provides a list of threatened taxa or species to help prioritise the allocation of resources to recovery programmes and research, gain support for habitat protection and assist decision making related to natural resources (Townsend, *et al.*, 2008). Conservation resources are prioritised according to a species risk of extinction, the expected costs associated with conservation measures, and the likely effectiveness of management action. The extinction rate of each species is determined using an objective benchmark which can be reassessed over time. This benchmark also acts as a measure for the effectiveness of conservation management efforts and allows for the state of New Zealand's biodiversity to be reported (Townsend, *et al.*, 2008).

The New Zealand Threat Classification System aims to complement the IUCN Red Lists but as it is focused at a national level it is able to provide classification for taxa which are not formally recognised by the IUCN. Figure 1 below illustrates the current framework of the New Zealand Threat Classification System.

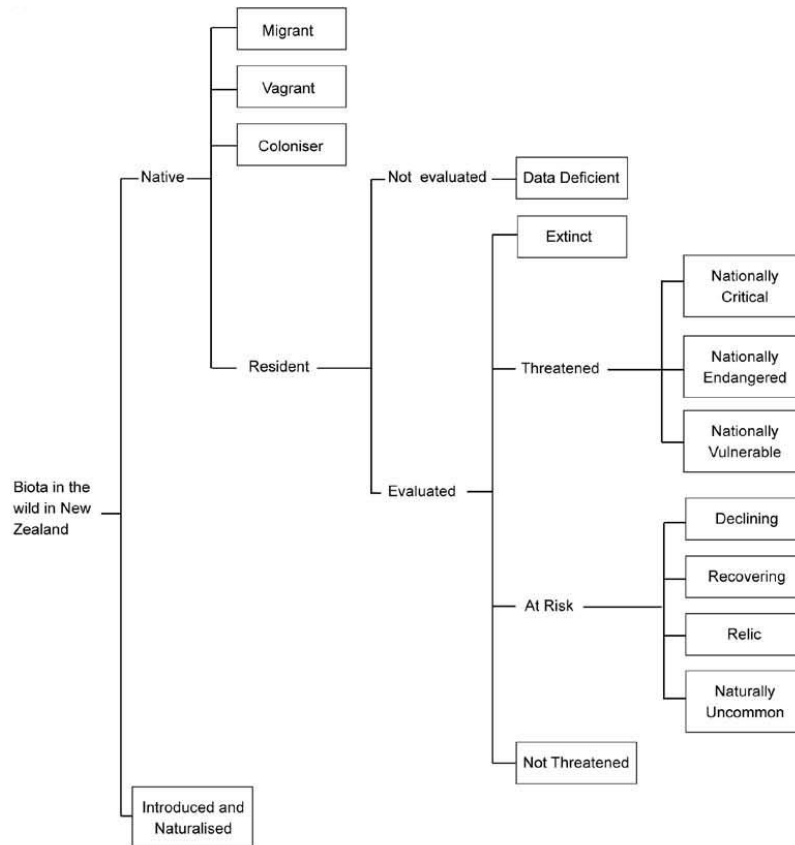


Figure 1. New Zealand Threat Classification System Framework (source: Townsend *et al.*, 2008)

4.5 CONCLUSION

Despite local success and international recognition for the development of threatened species management, conservation measures currently undertaken in New Zealand remain inadequate to halt and reverse the ongoing decline of indigenous biodiversity (Department of Conservation and Ministry for the Environment, 2000). Limitations of reserved areas within New Zealand reflect the limitations of reserved areas throughout the world. In order to halt the ongoing decline of biodiversity, conservation goals must account for the biology and ecology of target species and acknowledge the role of private land and production landscapes to facilitate long term protection and conservation. Incorporating conservation goals into the formal planning, or statutory framework, could facilitate the implementation of land use activity which enhance the realisation of such goals at a landscape level.

5 CONSERVATION OF THE NORTHLAND BROWN KIWI

5.1 INTRODUCTION

This study is set within the Northland Region and focuses on the conservation of North Island brown kiwi within the Far North and Whangarei Districts. In order to provide a background to this context, this section contains an overview of key features of the region including both physical and social aspects relevant to the conservation of kiwi. Following this introduction, the chapter investigates the biology and ecology of the Northland population of North Island brown kiwi and identifies the current distribution, key agents of decline and management efforts currently undertaken to conserve the species.

5.2 NORTHLAND – AN INTRODUCTION

Northland is the northern most region of mainland New Zealand and is comprised of 1.25 million hectares located north of the boundary stretching from the south-east of Manawhai to the Kaipara Harbour. Three District Councils, the Far North, Kaipara and Whangarei administer 684,100, 303,400 and 271,900 hectares respectively (Northland Regional Council, 1999). Figure 2 below illustrates the administrative boundaries and key features of the region.

At less than 100 km across at its widest point, the region contains over 3,000 km of coastline which is host to numerous mangrove and estuarine ecosystems and hundreds of islands situated off the east coast. The mainland is generally low lying at less than 300 m above sea level, however steep rolling hill country peak in the Waima Ranges at 781 m above sea level (Mullooly, 2007).

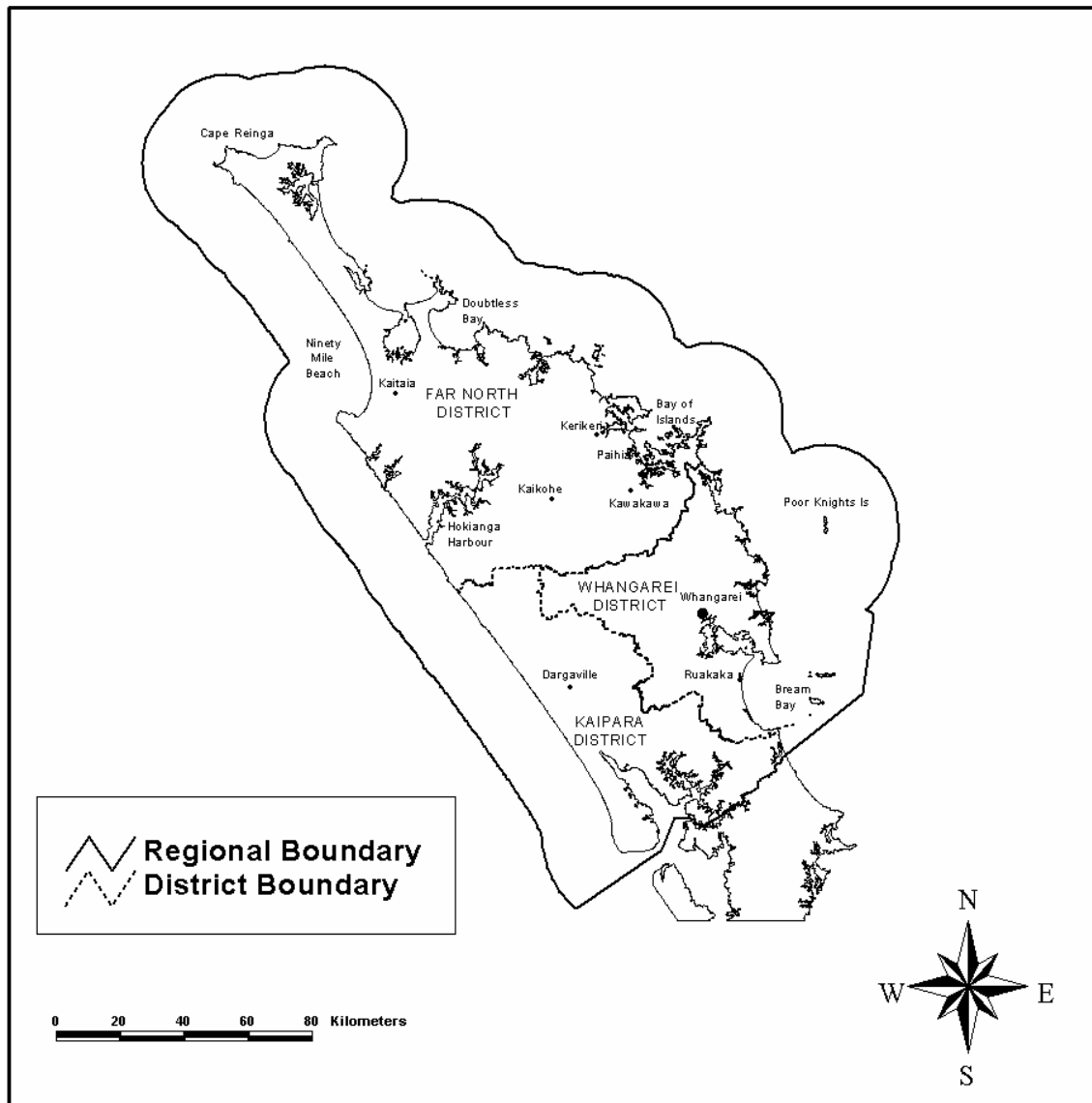


Figure 2. Administrative boundaries and key features of Northland (source: Northland Regional Council, 1999).

5.2.1 Population and Demographics

In 2006 148,470 people lived in Northland representing a population increase of 8,337 people or 5.9% since 2001. The population of the Far North District was 55,845, Kaipara 18,135 and Whangarei 74,463 (Statistics New Zealand, 2011). Between 2001 and 2006 Whangarei underwent the greatest rate of population growth with an increase of 6,369 people, or 9.4%. The population of the Far North grew by 2.3% representing an increase of 1,269 people, and the population of Kaipara grew increased by 675 people equating to an increase of 3.9%.

The majority of the population identify as being of European or Maori decent. Table 1 below illustrates the percentage of population in each district who identify as either European or Maori.

Table 1. Percentage of the Northland population who identified as being either European or Maori in 2006 (source: Statistics New Zealand, 2011)

District	Ethnicity	
	European	Maori
Far North	59.5	43.9
Kaipara	76.7	22.3
Whangarei	71.9	25.4
New Zealand	67.6	14.6

5.2.2 Economy, Employment and Education

The Region's economy is based on agriculture, tourism, forestry and wood processing, horticulture, construction and marine engineering (Northland Regional Council, 2011).

The median income for people 15 years and over in 2006 throughout the whole of Northland was \$20,900 compared to the \$24,000 for the whole of New Zealand. Whangarei District had the highest median income at \$22,500, followed by Kaipara, \$20,200 and the Far North, \$19,200 (Statistics New Zealand, 2011).

In 2006 the unemployment rate for Northland was 6.5% compared to 5.1% for all of New Zealand. The Far North District had the highest rate of unemployment at 7.6%, followed by Whangarei at 6.1% and Kaipara at 4.6%.

Throughout New Zealand, the percentage of people who do not hold any formal qualifications in 2006 was 25%. This rate was exceeded by all districts throughout Northland (Table 2). Whangarei had the highest post-school qualification rate within Northland at 33.7%, 2.3% lower than the rate for the whole of New Zealand.

Table 2. Highest qualification among people 15 years and over in 2006 (source: Statistics New Zealand, 2011)

District	No Qualification %	School Qualification %	Post-school Qualification %
Far North	33.6	39.3	33.7
Whangarei	29.7	32.7	37.6
Kaipara	35.9	34.1	30.0
Northland	31.9	32.6	35.5
New Zealand	25.0	35.1	39.9

5.2.3 Climate

Due to its close proximity to the sea, the region has a sub-tropical, oceanic climate resulting in warm, humid summers and mild winters. Throughout much of the region the prevailing wind is from the south-west however, north-easterly winds are common during tropical cyclones in the summer months (Northland Regional Council, 1999).

In low lying coastal areas, annual rainfall ranges between 1000 and 1300mm while in higher, inland areas annual rainfall can exceed 2500mm. Flooding often occurs during the winter months of June, July and August while droughts which can last several weeks or months are common in summer (Northland Regional Council, 1999).

Northland experiences a low variation in daily and annual temperatures (Northland Regional Council, 1999). Mean annual temperatures range from 15.5°C to 16°C in the far north and east of the region while in the south mean annual temperatures range between 14°C and 15.5°C (Northland Regional Council, 1999).

5.2.4 Ecology

Human activity over the past several hundred years has significantly influenced and shaped the regions current ecology. Human activity, exhibited throughout New Zealand, such as the clearance of forest and the drainage and reclamation of wetlands have resulted in pasture and exotic forest being the two most dominant ecosystem types throughout Northland (Northland Regional Council, 1999). Indigenous forests have been significantly reduced and the region has one of the highest numbers of threatened species (Northland Regional Council, 1999).

In 1999, the Regional Policy Statement for Northland stated the region contains over half of New Zealand's remaining kauri forest and almost 14% of total land area was native forest or shrubland. Podocarp/hardwood/kauri forests are the most extensive forest type found throughout the region and contain a range of hardwood species including rewarewa (*Knightia excelsa*), kohekohe (*Dysoxylum spectabile*), tawa (*Beilschmiedia tawa*), pukatea (*Laurelia novae-zelandiae*) and taraire (*Beilschmiedia tarairi*). Podocarp species scattered throughout the region include rimu (*Dacrydium cupressinum*), totara (*Podocarpus totara*), miro (*Prumnopitys ferruginea*) and matai (*Prumnopitys taxifolia*) while small clusters of kauri (*Agathis australis*) are located on steep sites (Northland Regional Council, 1999).

In addition to Podocarp/hardwood/kauri forests, the region is comprised of a range of other habitat types which are home to a high number of indigenous species (Northland Regional Council, 2008). A number of offshore islands are free of introduced pests and act as a refuge for threatened species. These islands play a key role in the restoration of populations of threatened species on the mainland through the natural dispersal of kaka (*Nestor meridionalis*), kakariki (*Cyanoramphus* spp.) and bellbird (*Anthornis melanura*) (Mullooly, 2007).

5.2.5 Protected Land

In 2009, a total of 172,500 ha or 13.9% of the region's land area was formally protected including 12.8% of the region's native land cover (Ministry for the Environment, 2010). The Department of Conservation Northland Conservancy oversees the management of 165,000 hectares of indigenous habitat (Mullooly, 2007). As at 30 June 2011, 9,569.54 ha of land was protected under registered or approved covenants or through formal agreements with the QEII National Trust. Northland currently has 578 registered covenants, the most of any region. The average covenant size is 15.2 ha while the largest covenant in Northland protects 417 ha of private land (Queen Elizabeth II National Trust, 2011).

5.3 KIWI - AN INTRODUCTION

Kiwi are unique. Described by Hutching (1998) as the most un-birdlike bird in the world, these endemic species are a well established and cherished part New Zealand's culture and identity. Considered by Maori as Taonga (treasure), kiwi are of "*special significance to all New Zealanders*" (Craig, *et al.*, 2011, p. 21). The term 'kiwi' has been adopted for both our currency and our people, and 'kiwiana' has become an established term commonly used to encompass "*collectable items redolent of New Zealand life*" (Blue and Blunden, 2010).

Despite the iconic nature of kiwi, all species have undergone a dramatic and ongoing decline since human settlement as a result of habitat destruction and the introduction of numerous mammalian predators. Today, kiwi occupy around 17% of their historical range (Ministry for the Environment, 2007). Populations have declined from tens of millions (Young, 2004) to as few as 72,600 (Holzapfel, *et al.*, 2008), and very few people have the privilege of seeing or hearing kiwi in the wild (Holzapfel *et al.*, 2008).

5.3.1 Taxonomy

Five species of kiwi are formally recognised, the rowi (*Apteryx rowi*), tokoeka (*A. australis*), great spotted (*A. haastii*), little spotted (*A. owenii*) and North Island brown (*A. mantelli*) (Burbidge, *et al.*, 2003). The North Island brown kiwi is one of the more populous species with a total population estimated at around 25,000 birds. The species is classified as 'endangered' by the IUCN Red List of Threatened Species (IUCN, 2010), and Nationally Vulnerable by the New Zealand Threat Classification System (Miskelly, *et al.*, 2008).

In 2003, four genetically unique taxa of North Island brown kiwi, were identified using mtDNA analysis (Burbidge, *et al.*, 2003). The four taxa commonly referred to as the Northland, Coromandel, Eastern and Western taxa are located in Northland, the Coromandel, the Eastern North Island including Hawkes Bay, the East Cape, Bay of Plenty and Rotorua, and Western North Island within Waikato, the King Country, Central Plateau, Taranaki and Wanganui respectively (Craig, *et al.*, 2011). The evolution of these distinct taxa is thought to be the product of 200,000 years of physical isolation (Baker, *et al.*, 1995) resulting from volcanism and sea level change in the North Island (Holzapfel, *et al.*, 2008).

The Northland taxa of North Island brown kiwi (hereafter referred to as the Northland brown kiwi) is comprised of approximately 8,000 birds (Holzapfel, *et al.*, 2008). Although morphologically similar to the other three taxa of North Island brown kiwi, the unique genetic makeup, behaviour and ecology of the Northland brown kiwi warrant its conservation in isolation of other brown kiwi populations (Craig, *et al.*, 2011). As such, current conservation plans discourage the mixing of birds sourced from the Northland population with birds sourced from populations of North Island brown kiwi.

5.4 BIOLOGY AND ECOLOGY OF THE NORTHLAND BROWN KIWI

The Northland brown kiwi is the largest and heaviest taxa of brown kiwi growing to a height of up to 40 cm. Sexual dimorphism typical of all kiwi is exhibited in adults with females weighing 20-30% more than males at 2.8kg (Pierce, *et al.*, 2006). Female birds also have a longer bill which range in length between 117 mm and 156 mm. Male bills generally measure between 86 mm and 119 mm (Colbourne and Kleinpaste, 1983).

Northland brown kiwi are monogamous and usually pair for life. Breeding can occur throughout much of the year subject to adequate rainfall. Successful breeding usually starts when birds are between three and five years old but can occur in birds as young as one (Craig, *et al.*, 2011). Two clutches of eggs are usually produced per season however up to three clutches have been recorded (Burbidge, *et al.*, 2003). The first clutch, often laid in June or July is followed by a second clutch laid between October and December (Pierce, *et al.*, 2006). Each clutch usually consists of two eggs laid approximately three weeks apart (Pierce, *et al.*, 2006). The first egg is often left unattended prior to the laying of the second egg. Eggs are incubated by males for 75-85 days in nests located in excavated burrows or beneath vegetation, logs or tree roots (Pierce, *et al.*, 2006), although nest sites excavated within open pasture have been recorded (Craig, *et al.*, 2011). Nest sites may be reused by males over multiple years (Ziesemann, Brunton, and Castro, 2011).

Chicks hatch fully feathered and become completely independent of their parents after several weeks (Colbourne, *et al.*, 2005). Within the first 6 months many chicks remain within 1 km of their nest, but over time disperse over 20km to establish new territories (Pierce, *et al.*, 2006). Once settled, birds can remain in the same area for as long as suitable habitat is available (Pierce, *et al.*, 2006).

Kiwi utilise a variety of vegetation and habitat types including damp gullies in both indigenous and plantation forest and shrubland, gorse shrubland, wetlands and pasture (Craig, *et al.*, 2011). Kiwi have been found in areas of clear felled exotic forest up to several weeks after trees were felled, however once the soil dries and the number of invertebrates is significantly reduced, kiwi are prompted to move (Colbourne and Kleinpaste, 1983).

During the day, kiwi shelter in burrows excavated under vegetation such as toetoe (*Cortaderia totoe*), dense bracken, dead treefern fronds or pine slash (Colbourne and Kleinpaste, 1983). Natural shelters including hollow logs, and volcanic boulders are also used as shelter sites during the day (Colbourne and Kleinpaste, 1983).

Potter (1990) suggested the “*actual vegetation may be of minimal importance to kiwi so long as two requirements are met: (i) the area has a rich surface and soil invertebrate fauna; (ii) the area provides dense cover for shelter and roost sites*” (Potter, 1990, p. 22). Such requirements are likely to be met in areas where a range of vegetation types are present (Potter, 1990). North Island brown kiwi regularly disperse out of protected forest areas to vegetation stands on neighbouring farms and have been found in open pasture up to 280m from the nearest forest cover (Potter, 1990).

Kiwi are highly territorial and use vocalisations to maintain their territories. Adult kiwi permit chicks and juveniles within their territories but the presence of other adults is not tolerated. An exception applies to mating individuals who have a high degree of territory overlap (Colbourne and Kleinpaste, 1983). The size of an individual territory is dependent on the availability of resources and may be smaller in areas where food is abundant and soil easy to probe (Colbourne and Kleinpaste, 1983).

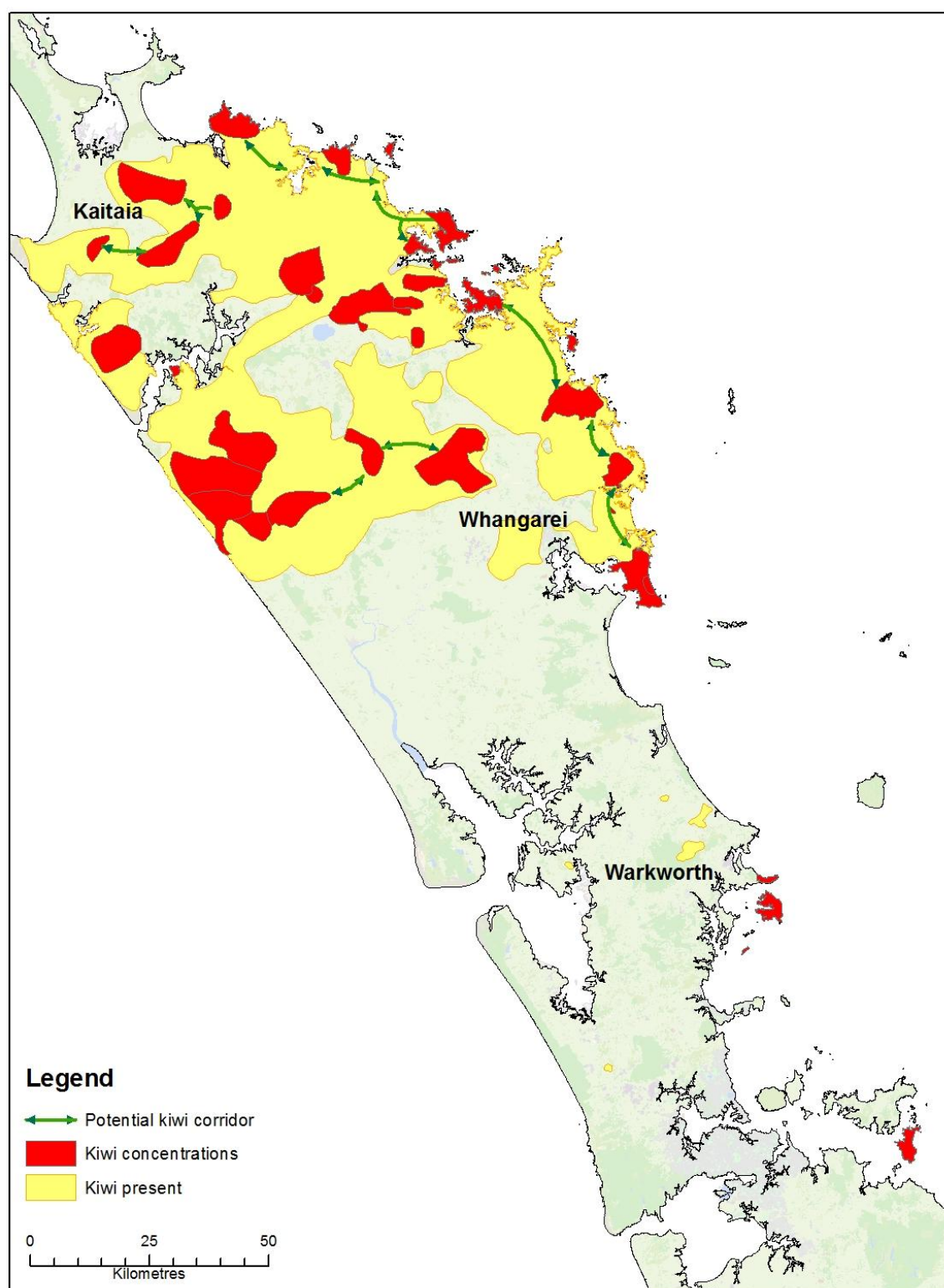
Up to 20% of a kiwis diet is comprised of leaf litter invertebrates (Cunningham and Castro, 2011), largely consisting of ground dwelling insect such as larvae, weta, crickets, centipedes, earthworms and spiders (Robertson and Colbourne, 2003). Moths, fruit, berries and leaves are also eaten on occasion (Robertson and Colbourne, 2003). During drought, kiwi often forage in lower, damper slopes and near swamp margins where soil is easier to probe. Individuals whose territories do not contain such habitat are more likely to lose weight during prolonged dry conditions (Colbourne and Kleinpaste, 1983).

A study undertaken by McLennan, Rudge and Potter (1987) on brown kiwi populations in Hawke's Bay deemed the minimum viable population required in order to support long term viability of North Island brown kiwi to be 500-1000 breeding individuals. This study determined the area required to accommodate this number of individuals is at least 7,500 to 15,000 ha provided each pair had a range of 30 ha with little overlap between neighbouring pairs. In Northland, population densities up to 10 times greater than those in Hawke's Bay have been recorded with densities of one kiwi per 2.5 ha in Paerata (Potter, 1990). Provided all components of a forest ecosystem are sufficiently managed 1,000-2,500 ha is thought to be adequate to support 500 breeding pairs necessary for a viable, long term population (Pierce, *et al.*, 2006).

5.5 DISTRIBUTION OF NORTHLAND BROWN KIWI

Prior to human settlement North Island brown kiwi would have been widely distributed throughout Northland from the Aupouri Peninsula through to Northern parts of Auckland Region (Craig, *et al.*, 2011). Following human settlement, ongoing restriction of the species range resulted in rapid decline in the species distribution and total population. By the 1970s, kiwi were restricted to areas of forest and shrubland between Awanui and the Brynderwyn Ranges (Pierce, *et al.*, 2006). In 1991 populations extended to the Mangawhai Heads in the east and the top of the Kaipara harbour in the west (Butler and McLennan, 1991), however during the 1990s rapid declines in populations throughout Northland resulted in localised extinction in many areas (Pierce, *et al.*, 2006). Such areas included the majority of southern Northland and the Aupouri Peninsula (Craig, *et al.*, 2011).

Today, Northland brown kiwi are primarily located within 25 main population clusters (Pierce *et al.*, 2006). These populations are distributed between Whakaangi in the north and the Tawharanui Open Sanctuary within the Auckland Region to the south (Craig, *et al.*, 2011). Figure 3 indicates the general distribution and relative abundance of Northland brown kiwi throughout Northland and the upper Auckland Region as known in 2009.



Map prepared: Jan 2011

 Department of Conservation
Te Papa Atawhai
New Zealand Government Te Kāwanatanga o Aotearoa

Figure 3. Approximate distribution and relative of abundance of Northland brown kiwi as known in 2009 (source: Craig, *et al.*, 2011)

5.5.1 Kiwi on Private Land

At present, the majority of kiwi are thought to be located on private land. Figure 4 indicates the location and distribution of kiwi on private land and within the conservation estate.

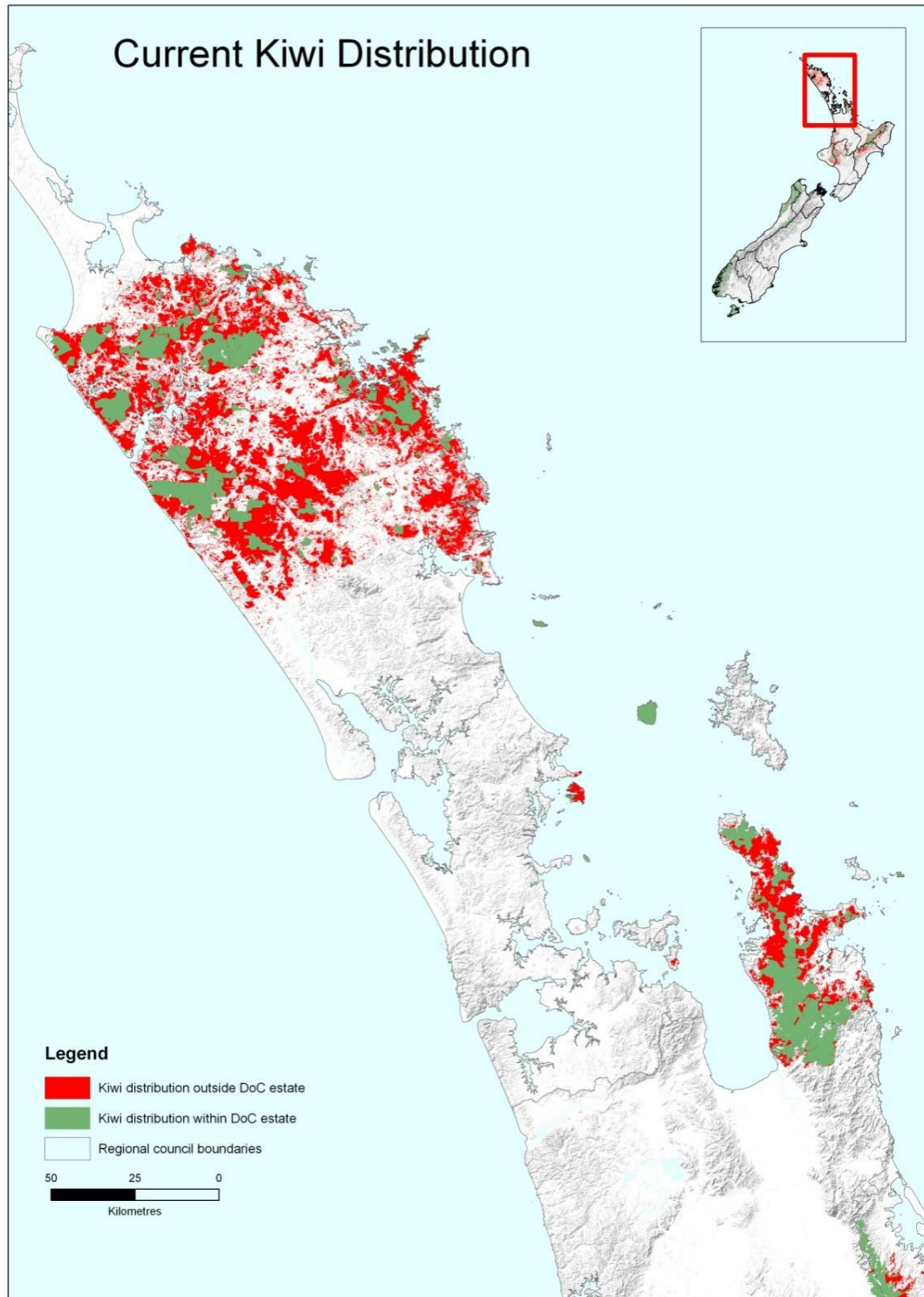


Figure 4. Distribution of Northland and Coromandel brown kiwi within the Department of Conservation estate and on private land (source: Ministry for the Environment, 2011)

5.5.2 Kiwi on Offshore Islands

As a result of ongoing conservation efforts, additional populations have been established on islands off the east coast of the mainland between the Bay of Islands and the Hauraki Gulf. Figure 5 below indicates the location of these offshore populations. Note that although kiwi are present on Ponui Island, this population was established through the interbreeding of birds from both the Northland taxon and the Taranaki taxon of Brown kiwi and are not considered a true Northland population (Craig, *et al.*, 2011).

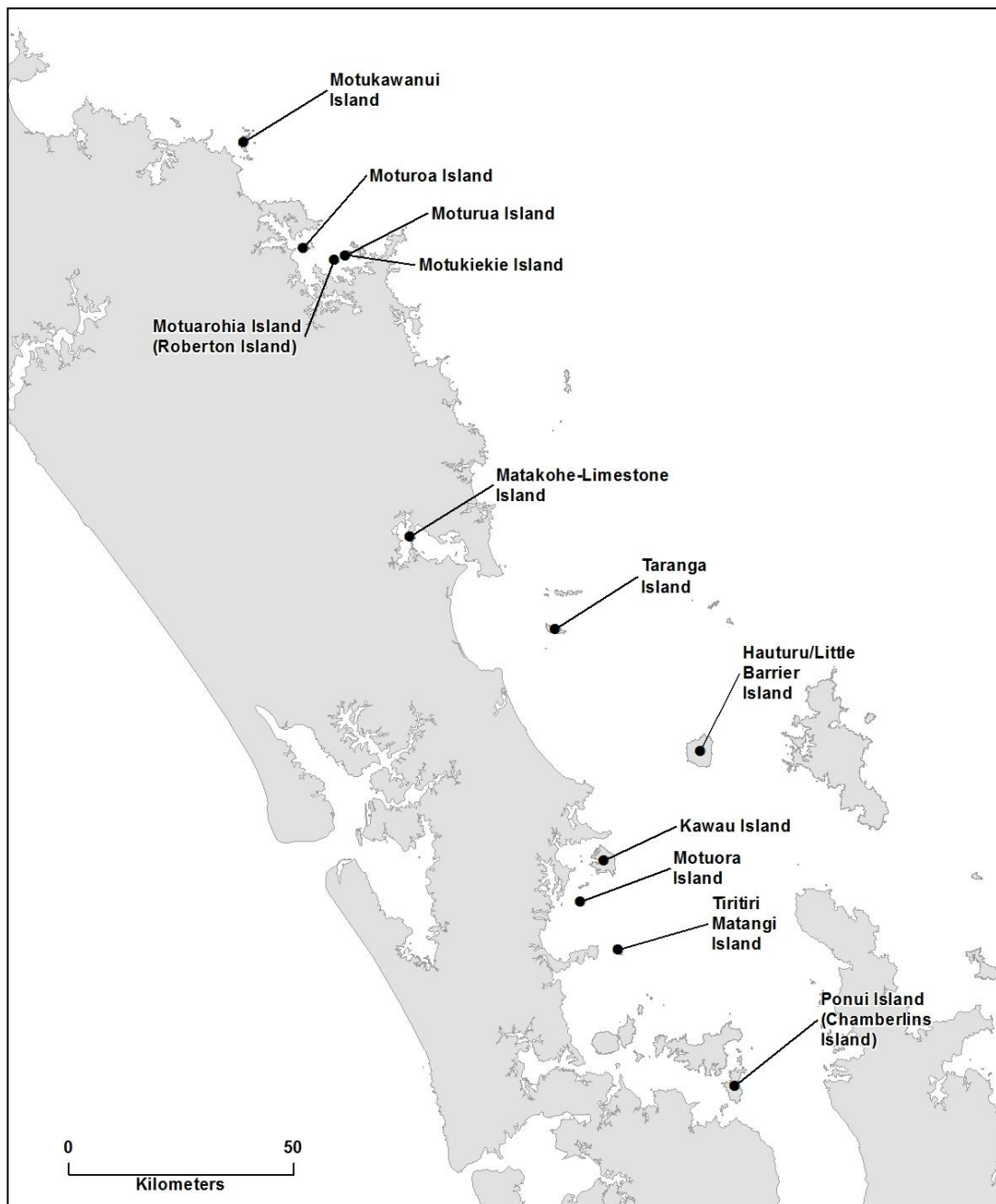


Figure 5. Offshore island populations of North Island brown kiwi (source: Colbourne, 2005)

5.6 POPULATION TRENDS AND KEY CAUSES OF DECLINE

The Northland population of North Island brown kiwi have the highest productivity rate of all kiwi species. In the absence of management, however, high rates of mortality among both adults and chicks lead to one of the highest rates of population decline among all species of kiwi (McLennan, *et al.*, 1996; Renwick, Craig, and Sporle, 2009).

It is irrefutable that ongoing fluctuations in kiwi populations would have occurred prior to human settlement in New Zealand in response to changes in climate and local disturbances. Episodes of volcanism and sea level changes are thought to have played an active role in establishing the geographic separation required to genetically isolate populations of brown kiwi populations which eventually led to the evolution of the four taxa of North Island brown kiwi recognised today (Holzapfel, *et al.*, 2008). Following human settlement however, the accumulated impact of activities such as the widespread clearance of native habitat, harvesting and predation by introduced mammalian predators have acted to reduce the abundance and distribution of Northland brown kiwi.

Initial human induced declines resulted from the direct harvesting of the species by Maori, destruction of habitat and the introduction of dogs and rats (Craig, *et al.*, 2011). European settlement brought further habitat destruction and new mammalian predators. Although direct harvesting and widespread habitat destruction are no longer leading threats (Craig, *et al.*, 2011), introduced mammalian species continue to decimate kiwi populations (Holzapfel, *et al.*, 2008). Within unmanaged populations, the primary cause of decline is predation from four key predators, dogs, stoats, cats and ferrets (Pierce, *et al.*, 2006).

Research undertaken by Robertson (2005) at Purua indicated that for a population to be sustainable, a minimum of 6.1% of eggs are required to develop into adults. In the absence of predator control, only 3% of eggs achieve adulthood resulting in an average annual decline of 4% (Robertson, 2005b).

In 1996, McLennan *et al.* stated that '*predation by introduced mammals on young kiwi is the single most important factor contributing to the demise of mainland populations*' (McLennan, *et al.*, 1996). Juveniles and chicks have a high mortality rate of up to 94% which sees only 6% of young kiwi reaching adulthood. This high rate of loss has been attributed to the behavioural traits of young kiwi which developed in the absence of mammalian predators. Typical behaviour which increases the exposure of chicks to

predators includes a tenancy to freeze rather than flee when approached by predators. This response is adequately suited to historic predators including as birds of prey, but is not effective against introduced mammals which hunt by scent (McLennan, *et al.*, 1996). Additionally, young kiwi emerge from daytime burrows up to an hour before adults and forage independently of adults (McLennan, *et al.*, 1996).

The loss rate of kiwi eggs to mammalian predators is low compared to the losses of many other forest birds despite the long incubation period of up to 85 days (McLennan, *et al.*, 1996). The high survival of eggs is likely a result of the site selected for the nest, the attentiveness of the incubating males, the ability of these adults to repel predators and the large size and weight of the eggs which are too large to be punctured or removed by rats (McLennan, *et al.*, 1996). Additionally, nest sites are generally well hidden or camouflaged as the eggs are often unattended at night while the adult male forages for food (McLennan, *et al.*, 1996).

The risk posed by specific predators change with the life stage of kiwi (McLennan, *et al.*, 1996). Stoats and cats are generally the largest introduced predators in New Zealand's forest ecosystems yet the number of adult kiwi lost to these predators is low. Adult kiwi generally exceed the prey size of these predators and can defend themselves if attacked (McLennan, *et al.*, 1996). The continued existence of both the brown and the great spotted kiwi is attributed to their large adult body size, while the little spotted kiwi remains vulnerable to such predators at all life stages. Table 3 identifies the key predators of North Island brown kiwi at different life stages of the kiwi.

Table 3. Key predators at different life stages of the North Island brown kiwi (adapted from Pierce *et al.*, 2006)

Life Stage	Known Predators
Egg	Dog, ferret, cat, stoat, possum, pig
Chick / juvenile	Dog, ferret, cat, stoat, pig, harrier hawk
Adult / subadult	Dog, ferret, cat, possum, possibly pig, people

In the northern and eastern parts of Northland dogs are believed to be the single most important factor influencing the mortality of adult kiwi (Miller and Pierce, 1995). Kiwi at all life stages are vulnerable to dogs due to the ease at which they can be caught, the noise they create and their strong smell. Additionally, the absence of a sternum and severely

underdeveloped wing and chest muscles increase the birds susceptibility to crushing injuries caused by biting dog (Pierce, *et al.*, 2006). A single dog is capable of killing many kiwi and can have a catastrophic impact on local populations (Pierce, *et al.*, 2006). The extent of the potential damage caused by dogs was illustrated by Taborsky in 1998 who attributed the deaths of up to 500 kiwi in a population of around 900 birds to a single dog in Waitangi Park in the late 1980s.

The ability of dogs to kill adult birds is of significant concern due to the impact on the breeding potential of a population and future population recruitment (Craig, *et al.*, 2011). Throughout Northland all breeds of domestic dog whether they be pets, farm or hunting dogs, are thought to show interest in, and kill kiwi (Craig, *et al.*, 2011).

In addition to dogs, stoats (*Mustela erminea*) are considered a key agent of decline responsible for up to half of the deaths of kiwi chicks on the mainland (McLennan, *et al.*, 1996). Stoats are present throughout mainland Northland and can swim up to 3km to offshore islands (Pierce, *et al.*, 2006).

Additional threats to kiwi include ferrets and cats which can have a significant impact on local populations. Domestic cats are capable of killing chicks and juveniles while ferrets have the capacity to kill adults (Craig, *et al.*, 2011). Possums, rats, hedgehogs and pigs compete with kiwi for food. The close proximity of many kiwi populations increases the risk of human induced threats including vehicle strike, entrapment within cattle stops and possum traps, and drowning in ponds, troughs and swimming pools (Pierce, *et al.*, 2006). Genetic bottlenecks caused by population fragmentation and barriers to dispersal and further fragmentation of habitat also threaten the Northland brown kiwi (Craig, *et al.*, 2011).

5.7 MANAGEMENT OF KIWI IN NORTHLAND

Historic recovery efforts for kiwi tended to focus on the protection of individual birds. More recently however, the focus for management has shifted to encompass an ecosystem approach where kiwi habitat is managed to benefit of all indigenous species.

Currently, an estimated 20% of kiwi are managed throughout Northland although additional birds located within National Parks benefit from a general protection from threats through dog control and habitat protection (Holzapfel, *et al.*, 2008). Gains of up to 9% per year have been documented within managed populations, These gains however do

not offset losses within unmanaged populations and the overall population of the taxon continues to decline (Holzapfel, *et al.*, 2008).

Multiple management efforts have been undertaken to reduce the impact of introduced species on kiwi and conserve current populations. Conservation efforts currently undertaken include the work of the Department of Conservation on public land and that of multiple community and kiwi conservation groups on both public and private land.

In early 2011 approximately 38 sites throughout Northland and the upper Auckland region were either actively managed, or in the process of becoming managed for the purpose of kiwi recovery (Craig, *et al.*, 2011). These sites, located on both public and private land are primarily managed to reduce pest numbers and restore native habitats. Sites on public land are primarily managed by the Department of Conservation while those on private land are managed by individual land owners or community groups, or in conjunction with the Department of Conservation, New Zealand Kiwi Foundation, Queen Elizabeth II National Trust, and Hancock Forests (Craig, *et al.*, 2011). Figure 6 indicates the location of these recovery programmes and the primary authority(s) responsible for the management of each project are identified in Table 4.

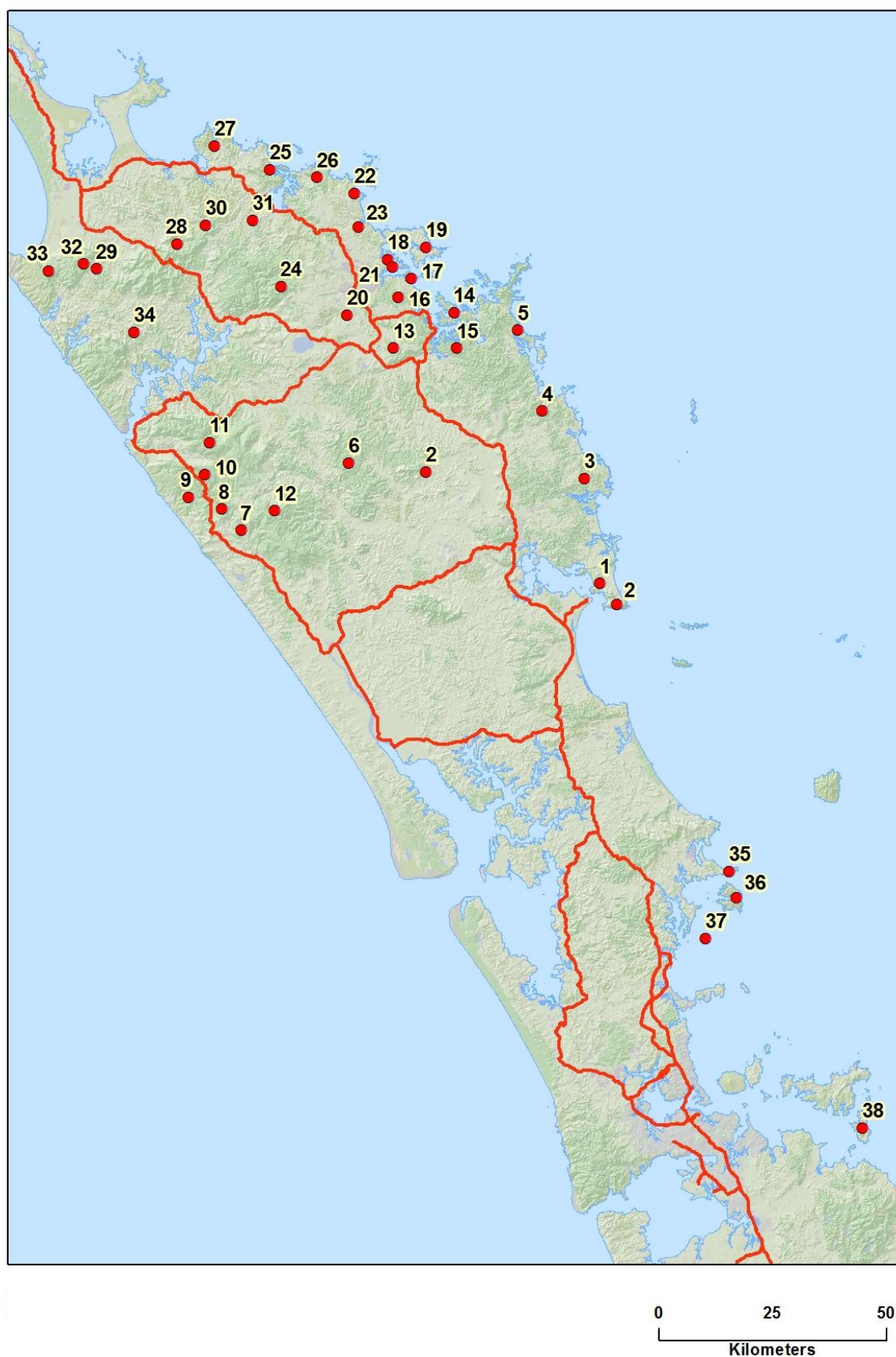


Figure 6. Location of kiwi recovery projects in Northland (source: Craig, *et al.*, 2011)

Table 4. Primary authority responsible for the management of Northland kiwi recovery projects
(source: Craig, *et al.*, 2011)

Project Number	Project name and primary authority responsible for management
1	Whangarei Heads Landcare Forum
2	Whangarei Kiwi Sanctuary - Department of Conservation
3	Ngunguru - Tutukaka Landcare Coalition
4	Mimiwhangata - Department of Conservation
5	Taupiri and Elliots bay - NZ Kiwi Foundation
6	Pipiwai - Hancocks Forest
7	Trounson Kauri Park - Department of Conservation
8	Waipoua Forest Trust
9	Waipoua - Department of Conservation
10	Wekaweka Landcare Group
11	Te Mahurehure Roopu Whenua Taonga Trust
12	Opouteke - Hancocks Forest
13	Hupara Landcare Group
14	Department of Conservation, Russell Landcare Group and NZ Kiwi Foundation
15	Waikino Landcare Group
16	Waitangi Forest - Department of Conservation
17	Wharau Road - NZ Kiwi Foundation
18	Kerikeri Peninsular - NZ Kiwi Foundation
19	Purerua Peninsular - NZ Kiwi Foundation
20	Waimate North Landcare
21	Aroha Island Charitable Trust
22	Kauri Cliffs - NZ Kiwi Foundation
23	Takou Were to Mokai Trust/NZ Landcare Foundation
24	Puketi Forest Trust
25	Taupo Bay Landcare
26	Mahinepua, Radar Hill Landcare
27	Whakaangi Landcare Trust
28	Wells Road - Higginson/Khaine
29	Herekino - Sporle/Renwick
30	Honeymoon Valley and Puhoi (Native Forest Restoration Trust)
31	Kohumaru
32	East Herekino - NZ Landcare Foundation
33	Herekino Landcare
34	Humphries Road - Blunden
35	Tawharanui Open Sanctuary (ARC TOSSI)
36	Kawau Island
37	Motuora Island (Department of Conservation and Motuora Restoration Society)
38	Ponui Island - Massey University

5.7.1 Whangarei Kiwi Sanctuary

The Whangarei Kiwi Sanctuary is one of five kiwi sanctuaries established around mainland New Zealand as part of the Bank of New Zealand Kiwi Recovery Programme and the New Zealand Biodiversity Strategy (Holzapfel *et al.*, 2008). The other four sanctuaries are located at Moehau, Tongariro, Okarito and Haast (Holzapfel *et al.*, 2008). Kiwi sanctuaries were established with the aim of facilitating the recovery of the most critically endangered kiwi species (the rowi and Haast tokoeka) and to ensure the overall genetic diversity of kiwi is maintained (Craig, *et al.*, 2011). The purpose of the Whangarei Kiwi Sanctuary is to enhance New Zealand's mainland population of North Island brown kiwi through the intensive control of predators including stoats, ferrets and cats. Research is undertaken to monitor chick survival, population growth and the effect of pest control on other species (Department of Conservation, 2010).

The sanctuary is comprised of 17,400 ha of fragmented habitat located on both public and private land to the south east and north west of Whangarei as illustrated by Figure 7 on the following page. Areas of habitat range in size between 30 and 700 ha (Craig, *et al.*, 2011).

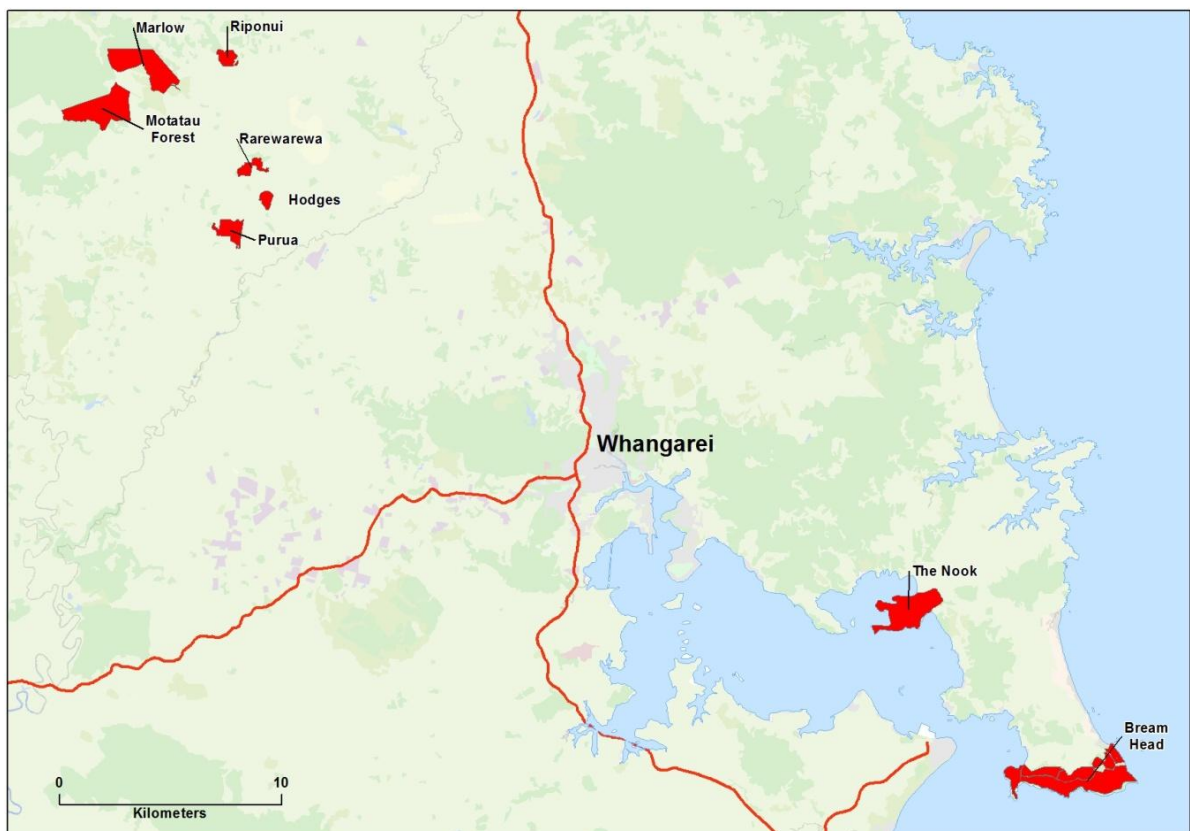


Figure 7. Location of habitat comprising the Whangarei Kiwi Sanctuary (source: Craig *et al.*, 2011)

The Whangarei Kiwi Sanctuary is currently the sole source of kohanga kiwi for Northland brown populations. Kohanga kiwi are adult and chicks which are taken from the existing population within the kiwi sanctuary to establish new populations within the species historic range or supplement existing populations within a 50 km radius (Craig, *et al.*, 2011).

High community support for the sanctuary and public awareness programmes has increased understanding and knowledge among local communities of the need to keep dogs and predators under control (Biodiversity New Zealand, 2011).

5.7.2 BNZ Operation Nest Egg

BNZ Operation Nest Egg is an intensive management programme which involves the removal of eggs from the wild and raising chicks in captivity prior to release back into the wild. Eggs are hatched at Auckland Zoo and the Whangarei Native Bird Recovery Centre prior to release onto crèche islands. Chicks remain on Limestone and Motuora Islands until they attain a body weight of 1200g and deemed large enough to defend themselves against stoats. Chicks are then either released back into their original population, introduced to other populations to increase population numbers and introduce new genetics, or are used to establish new populations within the species historical range historical range of the species (Craig, *et al.*, 2011). ‘Operation Next Chick’, a simplified version of Operation Nest Egg where chicks hatch in the wild then translocated to island crèches until a weight exceeding 1000g is attained.

5.7.3 National Kiwi Call-Count Monitoring and other Monitoring

Since 1995, annual call counts have monitored kiwi at 23 listening stations throughout Northland, and as more community groups have taken on conservation work for the kiwi, the number of managed sites undergoing call count monitoring increased to at least 113 in 2009 (Craig, *et al.*, 2011). The use of telemetry, recording of footprint size and surveys undertaken with the use of a trained kiwi dog are also undertaken to monitor kiwi throughout Northland.

5.7.4 Kiwi Aversion Training

Kiwi aversion training is a tool used to reduce the risk of dogs to kiwi. Dogs are exposed to the scent of kiwi often through the use of a dead kiwi or kiwi scat. An electric shock through a collar is given to the dog if it shows interest in the stimulus. It is recommended

for dogs to be retrained after six months and if aversion is achieved testing can resume at one year intervals. The aversion training provides a vector for communication between kiwi conservationists and dog owners regarding the risks dogs pose to kiwi and ways in which to reduce the chance of contact between dogs and kiwi. Several thousand dogs throughout Northland have undergone training (Craig, *et al.*, 2011).

5.7.5 Kiwi Corridors

The potential to establish kiwi corridors on both a local and regional scale is outlined by (Pierce *et al.*, 2006). Local corridors implemented within the range of populations are deemed necessary to connect individuals within a single population. In order to provide linkages between populations, long distance dispersal corridors are required.

Kiwi within some managed kiwi populations are dispersing out of protected areas and juvenile kiwi are capable of long distance dispersal of up to 60km (Pierce, *et al.*, 2006). Maintaining and facilitating this dispersal is important to both extend the current range of kiwi and promote genetic mixing of populations. However, this dispersal can be problematic if kiwi travel through areas in which key threats are not managed (Pierce, *et al.*, 2006).

Pierce *et al.* (2006) identify the importance of both local and regional corridors. However, at present the priority lies with local corridors to ensure local populations of kiwi remain viable. The implementation of such corridors would involve the control of predators and dogs. The planning of long distance corridors between populations would require planning at the “*District Council level to ensure that conflicting land uses are not permitted in proposed corridors*” (Pierce, *et al.*, 2006, p. 17).

5.7.6 Advocacy

Since the Kiwi Recovery Plan was published in 1991, Northland has acted as a pilot study for intensive advocacy (Craig, *et al.*, 2011). Today, advocacy work focuses primarily on “*reducing the effects of dogs and other threats, assisting landowner and community groups with their kiwi protection projects, and encouraging these groups to establish their own advocacy programmes*” (Craig, *et al.*, 2011, p. 13). Advocacy efforts have also raised the awareness of district councils and influenced the implementation of consent conditions which act to protect and conserve the kiwi (Craig, *et al.*, 2011).

Blue and Blunden (2010) provide an account of the importance of advocacy for the conservation of kiwi in the Far North. *“Advocacy remains a key tool for kiwi protection: lobbying to FND Council, public speaking about kiwi, talking with groups and landowners about managing kiwi, and representing kiwi presence and vulnerability through signage: kiwi painted on roads, ‘no pets allowed’, ‘control your dog’ and others”* (Blue and Blunden, 2010, p. 116). Figure 8 below illustrate examples of advocacy signage in the Far North.



Figure 8. Examples of kiwi awareness signage on Opito Bay Road, Far North (source: personal collection July, 2011).

5.8 CONCLUSION

In order to facilitate the conservation of kiwi into the future, the threats to kiwi must be managed on a landscape scale and populations must be connected to ensure genetic diversity is retained. Throughout Northland dogs and stoats present the biggest threat to kiwi populations and where these threats are unmanaged populations continue to decline. However, where key threats are managed or controlled, kiwi populations have stabilised and increases of up to 9% per year have been recorded.

Conservation of kiwi in Northland is largely reliant on the actions of landcare groups, the BNZ Save the Kiwi Trust and the Department of Conservation, but as the majority of kiwi are found on private land, the role of statutory planning to direct and control land use and activity within high density kiwi areas presents a unique opportunity for kiwi. The incorporation of conservation goals into statutory plans could provide the legislative backing for the necessary conservation action needed to halt the decline of this iconic species, and facilitate the recovery of kiwi throughout its historic range.

6 CONSERVATION LEGISLATION AND PLANNING FRAMEWORK FOR THE NORTHLAND BROWN KIWI

6.1 INTRODUCTION

A range of legislation acts to conserve New Zealand's indigenous species. This section provides a brief summary of the key legislation implemented at a national, regional, and territorial level which influence the conservation of the North Island brown kiwi in Northland. In order to provide a context for the integration of key goals and objectives of the Draft Taxon Plan for the Northland Brown Kiwi within relevant District Plans, the section contains an overview of New Zealand's planning framework and conservation goals, relevant Acts of Parliament, national and regional policy and strategies, District Plans, the Kiwi Recovery Plan and the Taxon Plan for the Northland Brown Kiwi.

6.2 KEY ACTS OF PARLIAMENT

6.2.1 Conservation Act 1987

The Conservation Act 1987 promotes the conservation of New Zealand's natural and historic resources and sets out the functions of the Department of Conservation. The Act provides for the preparation of conservation management strategies by each of the 13 regional conservancies and for the preparation of management plans to provide for integrated management of sites of particular importance such as national parks. The Act provides of the protection of private and Maori land which can be achieved through Conservation Covenants, Nga Whenua Rahui Kawenata and Management Agreements.

6.2.2 National Parks Act 1980

The National Parks Act 1980 sets out provisions which have "effect for the purpose of preserving in perpetuity as national parks, for their intrinsic worth and for the benefit, use, and enjoyment of the public, areas of New Zealand that contain scenery of such distinctive quality, ecological systems, or natural features so beautiful, unique, or scientifically important that their preservation is in the national interest" (National Parks Act, 1980, s

4(1)). The Act provides National Parks with a greater protection than provided within other acts, protection which can only be removed by an Act of Parliament (Department of Conservation, 2011a).

6.2.3 Reserves Act 1977

The Reserves Act 1977 is administered by the Department of Conservation for the purpose of providing for the preservation and management for the benefit and enjoyment of the public, areas of New Zealand which possess recreational use, wildlife, indigenous flora or fauna, environmental and landscape amenity or interest, and natural, scenic, historic, cultural, archaeological, biological, geological, scientific, educational, community, or other special features or value. The Act ensures that as far as possible, the survival of all indigenous species of flora and fauna, both rare and commonplace, in their natural communities and habitats, and the preservation of representative samples of all classes of natural ecosystems and landscape which in the aggregate originally gave New Zealand its own recognisable character (Reserves Act, 1977).

The Act sets out eight categories of reserve. Those which act those which are for the purposes of conserving wildlife include National Reserves, Nature Reserves, Scientific Reserves, Government Purpose Reserves including wildlife management areas, Local Purpose Reserves and Wilderness Areas. The Act also contains provisions for the protection of private land for conservation purposes. Covenants can be entered into by private landowners or lease holders of Crown land and Maori landowners and Maori leasing Crown land may enter into Nga Whenua Rahui Kawenata.

6.2.4 Wildlife Act 1953

The Wildlife Act 1953 frames the protection and control of wild animals in New Zealand (Department of Conservation, 2011c). The majority of wild species, both native and introduced, are absolutely protected under the Act. In order to permit the limited harvest of species and to manage the adverse effects caused by wildlife, some species are granted a lower level of protection. Species declared to be game, partially protected wildlife, wildlife that is not protected, wildlife that may be hunted or killed subject to the Minister's notification and animals declared to be noxious are listed within schedules 1 to 6 of the Act. Animals that are declared to be noxious are subject to the Noxious Animals Act 1956.

Although the Act contains provisions for the protection of indigenous wildlife, the Act does not contain requirements for its conservation (Seabrook-Davidson, 2010).

6.2.5 Biosecurity Act 1993

The Biosecurity Act 1993 provides for the exclusion, eradication and effective management of pests and unwanted organisms in New Zealand. The Act provides for the preparation of regional pest management strategies by regional councils and for national pest management strategies and sets out provisions for the contents and rules contained within these strategies. Under s 79(4) regional pest management strategies must not be inconsistent with any regional policy statement or regional plan prepared under the Resource Management Act 1991.

6.2.6 Forests Act 1949, Forests Amendment Act 1993

In 1993 the Forests Act 1949 was amended to prevent unsustainable harvesting and clear felling of indigenous forests. Under the amended Act the harvest or removal of indigenous timber can only occur in forests which are managed to maintain continuous forest cover and ecological balance (Ministry for the Environment and Department of Conservation, 2007).

6.2.7 Dog Control Act 1996

The Dog Control Act 1996 sets out the obligations of dog owners to ensure dogs are registered, kept under control at all times, and that reasonable steps are taken to ensure dogs do not injure, endanger, or cause distress to any protected wildlife. Councils are responsible for the enforcement of the Act.

Pursuant to s 57 a person may, for the purpose of stopping an attack, seize or destroy a dog if the person witnesses the dog attacking any protected wildlife. Once seized, a dog must, as soon as practicable, be delivered into the custody of a ranger or dog control officer. Dogs may be destroyed if a dog control officer or dog ranger has reasonable grounds to believe that an offence has been committed or if seizure of the dog is not practicable. The owner of a dog which causes an offence under s 57 is liable on summary conviction to a fine not exceeding \$3000 in addition to any liability incurred for any damage caused by an attack.

Pursuant to s 58 the owner of any dog that attacks any protected wildlife and causes the death of protected wildlife or such injury to any protected wildlife that it becomes necessary to destroy the animal to terminate its suffering, is liable on conviction to imprisonment for a term not exceeding 3 years or a fine not exceeding \$20,000 or both and the court may order the destruction of the dog.

Pursuant to s 59 where any dog is at large and is an immediate disturbance or threat to any protected wildlife the occupier or person having control of the land on which the dog for the time being is situated, or any agent or employee of that person, a constable, dog control officer or dog ranger with consent may seize the dog. Dogs may only be destroyed by a dog control officer or dog ranger.

6.2.8 Resource Management Act 1991

The Resource Management Act 1991 is the primary piece of legislation which governs the use of both natural and built environments and has a key role in the management of indigenous biodiversity. The purpose of the Resource Management Act 1991 is to promote the sustainable management of natural and physical resources by managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enables people and communities to provide for their social, economic, and cultural well-being and for their health and safety while (a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and (b) safeguarding the life-supporting capacity of air, water, soil, and ecosystems; and (c) avoiding, remedying, or mitigating any adverse effects of activities on the environment. Specific sections which acknowledge and provide for the maintenance of ecosystems and indigenous biodiversity are identified below.

Under s 6(c) the protection of areas of significant indigenous vegetation and significant habitats of indigenous fauna is a matter of national importance. All persons exercising functions and powers under the Act in relation to managing the use, development and protection of natural and physical resources must recognise and provide for this matter. Section 7(d) refers to the intrinsic value of ecosystems and the values derived from biological and genetic diversity. Section 30(1)(ga) provides a function for regional councils to establish, implement and review objectives, policies and methods for the maintenance of indigenous biological diversity. Section 31(b)(iii) provides a function of

territorial authorities to control any actual or potential effects of the use, development or protection of land for the purpose of the maintenance of indigenous biodiversity.

The act sets out a hierarchy of documents produced at national, regional and territorial levels which fulfil the purpose of the act. Figure 9 illustrates the relationship between various documents produced under the Resource Management Act.

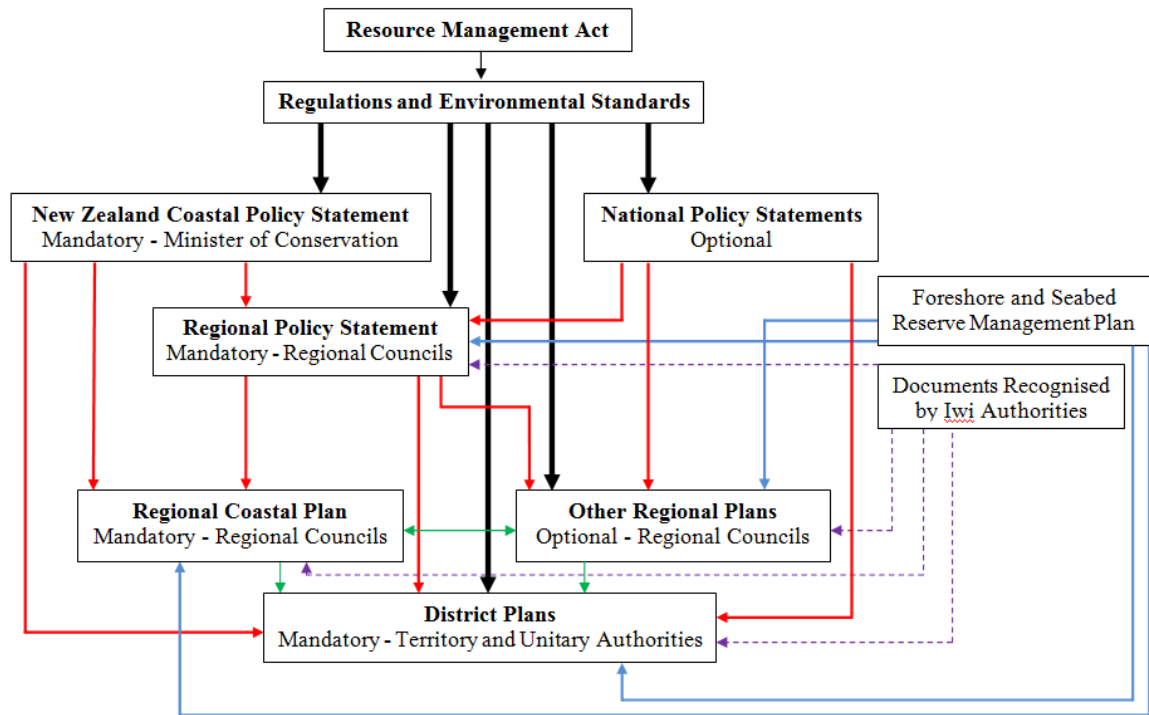


Figure 9. Hierarchy and linkages between key documents formed under the RMA. Line thickness and colour indicate the legal weighting given to the relationship between documents. Red: must give effect to, green: not inconsistent with, blue: must recognise and provide for, purple: must take into account (adapted from Quality Planning, 2011).

6.3 NATIONAL STRATEGIES AND STATEMENTS

6.3.1 New Zealand Biodiversity Strategy

The New Zealand Biodiversity Strategy was produced as part of New Zealand's commitments made under the Convention of Biological Diversity. The Strategy aims to halt the decline of indigenous biodiversity and outlines the need to “*sustain the more modified ecosystems in production and urban environments and do what else is necessary to maintain and restore viable populations of all indigenous species and subspecies across their natural range and maintain their genetic diversity*” (Department of Conservation and Ministry for the Environment, 2000, p.18).

An independent review undertaken 5 years after the strategy was identified the “ongoing loss of rare and threatened biodiversity from private lands”, “adverse impacts of animal pests on threatened species and forest ecosystems” and “serious declines in the status of many acutely or chronically threatened species” as significant issues which still affect indigenous biodiversity (Clarkson and Green, 2005, p. 2).

6.3.2 Statement of National Priorities for Protecting Rare and Threatened Native Biodiversity on Private Land

The Statement of National Priorities for Protecting Rare and Threatened Native Biodiversity on Private Land was produced by the Ministry for the Environment in 2007 to “*provide a framework for decision making regarding biodiversity on private land*” (Environment and Conservation, 2007, p. 2). The statement intends to focus conservation efforts undertaken on private land to where it is most needed. The statement identifies four priorities which are used to support and inform the responsibilities of Councils with regard to biodiversity under the Resource Management Act 1991. Of particular relevance to kiwi is National Priority 4, ‘*to protect habitats of acutely and chronically threatened indigenous species*’ (Environment and Conservation, 2007, p. 6).

This statement was produced using the New Zealand Threat Classification System developed by Molloy *et al.* (2002), since replaced by Townsend *et al.* (2008). The revised threat classification system has removed the umbrella categories ‘acutely threatened’ and ‘chronically threatened’ which contained the sub categories ‘nationally critical’, ‘nationally endangered’ and ‘nationally vulnerable’, ‘serious decline’ and ‘gradual decline’. Such categories are now reclassified under the umbrella category ‘threatened’ as either ‘nationally critical’, ‘nationally endangered’ or ‘nationally vulnerable’. In 2002 the North Island brown kiwi was classified as ‘chronically threatened’ as it was ‘serious decline’, but has since been reclassified as “threatened” as it is ‘nationally vulnerable’. This reclassification should not affect its status under this statement however could create confusion among those unaware of the changes to New Zealand’s Classification System.

6.4 NATIONAL POLICY STATEMENTS

6.4.1 New Zealand Coastal Policy Statement

The New Zealand Coastal Policy Statement reflects the importance of New Zealand’s coastal environment. Under the Resource Management Act, regional policy statements and

plans developed by local authorities must give effect to the New Zealand Coastal Policy Statement which states that *“It is a national priority for the preservation of the natural character of the coastal environment to protect areas of significant indigenous vegetation and significant habitats of indigenous fauna in that environment”* (Department of Conservation, 1994, p. 4).

6.4.2 Proposed National Policy Statement on Indigenous Biodiversity

The proposed National Policy Statement on Indigenous Biodiversity sets out the government’s expectations for the management of indigenous biodiversity under the Resource Management Act 1991. The policy statement is intended to provide direction for local authorities regarding their responsibilities for managing indigenous biodiversity under the Act. As it is not yet published, this study contains no further reference to this National Policy Statement.

6.5 REGIONAL COUNCIL POLICIES, PLANS AND STRATEGIES

6.5.1 Regional Policy Statement for Northland

The Regional Policy Statement for Northland was produced by the Northland Regional Council in 1999 to fulfil the requirement outlined by the Resource Management Act 1991. The purpose of the Regional Policy Statement is to promote the sustainable management of the region’s natural and physical resources by providing an overview of the region’s resource management issues and by setting out policies and methods to achieve integrated management of the resources.

The statement identifies the region contains large populations of North Island brown kiwi and identifies the adverse effects of human activity including forest clearance and the activity of introduced animal pests including wild cats and poorly controlled domestic dogs as a threat to nationally rare and declining species throughout the region.

Objectives, policies and methods contained within section 23 of the Regional Policy Statement are principally aimed at the protection of areas of significant indigenous vegetation and significant habitats of the indigenous fauna (Northland Regional Council, 1999).

The policy statement identifies the lack of linkage between areas of ecological significance through the use of corridors and buffer zones as a significant issue for biodiversity. Policies relevant to the conservation of the kiwi include policy 6, 7 and 10 listed below.

6. *To protect significant indigenous vegetation and significant habitats of indigenous fauna so that the ecological values of such sites are maintained. When assessing adverse effects, to emphasise avoidance unless remediation or mitigation would more effectively maintain the life-supporting functions of natural ecosystems.*
- 7 *To promote habitat restoration as a mechanism for the protection of significant indigenous vegetation and the significant habitats of indigenous fauna, and in the maintenance of general ecosystem health and indigenous biodiversity*
- 10 *To encourage co-ordination and integration between all agencies involved in the protection, management of, and research on, significant habitats of significant indigenous vegetation and fauna within the region.*

Methods to implement the above policies include appropriate policies, methods and other provisions within Regional Plans to control the adverse effects of activities in order to protect significant indigenous vegetation and significant habitats of indigenous fauna and maintain indigenous biodiversity. Such methods include rules, economic incentives, and conditions on resource consents.

Similarly, the policy statement identifies the inclusion of appropriate policies, methods and provisions within District Plans necessary in order to implement the policies outlined in the statement. District Plans may incorporate rules, economic incentives including rates remission, and conditions on resource consents to control the adverse effects of subdivision, development and protection of land in order to protect significant indigenous vegetation and significant habitats of indigenous fauna.

In addition, the policy statement also identifies the promotion and encouragement of voluntary mechanisms for the protection and restoration of indigenous vegetation and habitat of indigenous fauna particularly at significant sites and sets out the provision for the establishment of an Environment Fund as viable methods to implement its policies.

6.5.2 Northland Regional Pest Management Strategy

Under the Biosecurity Act, Regional Councils are responsible for processing and approving regional pest management strategies. While Regional Councils have no statutory obligation to undertake pest management, many councils have significant roles in this area.

The Northland Regional Pest Management Strategy 2010-2015 is the primary mechanism of the Northland Regional Council to control pest species. Strategies remain in force for five years and apply to the entire Northland region including land, rivers, lakes and coastal marine area within the administrative boundaries of the Northland Regional Council. The purpose of the Northland Regional Pest Management Strategy is to *‘provide a strategic and statutory framework for the efficient and effective management of pests in Northland’* (Northland Regional Council, 2010, p. 3). The primary objective is to reduce or eliminate the impact of introduced pests on environmental, economic and social values.

The strategy categorises pest species as exclusion, eradication, containment, suppression, or risk assessment species and outlines a set of management tools to be implemented which act to retain the gains of previous work and expand on new community pest control schemes which generally work at a site level (Northland Regional Council, 2010).

Feral and stray cats, stoats, weasel, ferret, rats and possums are classified as suppression animals as they are widespread in suitable habitat throughout the region. The strategies intention for suppression species is to reduce pest densities to decrease the impacts on the community and the environment. The 5 year objective for the strategy is to minimise the effects of the suppression animals on environmental and economic values in Northland and raise public awareness of the economic, biodiversity, social and cultural impacts of the suppression animals. The council proposes to do this using the site led programmes to assist communities and stakeholders to control the suppression animals where they impact upon local values, providing pest control products to customers on a non-profit basis to assist with animal pest control, provide training to relevant Northland Regional Council staff and stakeholders in the identification and control of animal pests, provide advice and attend community meetings and field days and run publicity campaigns to educate the wider public about animal pests.

6.6 DISTRICT PLANS

The Resource Management Act 1991 requires each District Council to prepare a District Plan. The Act directs Councils to manage the effects of the use of the Districts natural and physical resources in a sustainable manner as defined in s 5 of the Act.

Section 31 of the Act establishes the duty of territorial authorities to manage the effects “of the use, development, and protection of land and associated natural and physical resources” and the “control of any actual or potential effects” by avoiding, remedying or mitigating adverse effects. Accordingly, many provisions within District Plans adopt an effects based approach through standards. The extent to which a proposed activity complies with such standards determines its status as a permitted, controlled, restricted discretionary, discretionary, or non-complying activity (Far North District Council, 2009).

The implementation of environmental standards can play an important role for conservation on private land. Through controlling the adverse effects of activities, threats to biodiversity can be alleviated. Both the Far North District Plan and the Whangarei District Plan contain provisions which either directly or indirectly refer to and implicate the North Island brown kiwi. An outline of provisions which refer directly to the kiwi are provided within the outline of the Far North and Whangarei District Plans below.

6.6.1 Far North District Plan

The purpose of the Far North District Plan is to promote the sustainable management of natural and physical resources as outlined in s 5 of the RMA. The plan recognises the importance of balancing a satisfactory level of environmental protection while providing for the economic development required to improve the well being of its people. Significant resource management issues have been identified during the preparation of the plan and include the management and protection of indigenous flora and fauna.

The plan adopts both regulatory and non-regulatory methods of protection with the expectation that the Districts exceptional biodiversity is both maintained and enhanced and that existing areas of significant indigenous biodiversity and significant habitats of indigenous fauna are not further degraded and where possible managed to enhance existing areas or develop new areas of habitat.

The Far North District Plan acknowledges the region contains one of the largest populations of North Island brown kiwi and therefore '*recognises high density kiwi habitat as a significant habitat in terms of the relevant provisions of the plan*' (Far North District Council, 2009, p.2).

The Plan contains a range of measures aimed at protecting or enhancing kiwi habitat including advocacy and education, conditions on consents in areas of confirmed high density kiwi habitat and use of other procedures including the Dog Control Act 1996.

Specific reference to the kiwi and high-density kiwi habitat is made throughout section two of chapter 12 'Indigenous Flora and Fauna' including within the context, policies, methods and assessment criteria subsections. Exerts from the plan which contain specific reference to the kiwi are provided below.

Context

The Far North is fortunate to have one of the largest populations of North Island brown kiwi in the country. Council holds indicative maps of high and medium density kiwi habitat and will make that information freely available. Council recognises high-density kiwi habitat as significant habitat in terms of the relevant provisions of the Plan. Kiwis are still under threat in the Far North, especially from predation by cats, dogs and mustelids but increasingly more are dying on our roads. Council has a range of measures aimed at protecting or enhancing kiwi habitat including advocacy and education, conditions on consents in areas of confirmed high-density kiwi habitat, and use of other procedures such as the Dog Control Act.

12.2.1 Policies

12.2.4.10 In order to protect areas of significant indigenous fauna:

- (a) that dogs (excluding working dogs), cats, possums, rats, mustelids and other pest species are not introduced into areas with populations of kiwi, dotterel and brown teal;*
- (b) in areas where dogs, cats, possums, rats, mustelids and other pest species are having adverse effects on indigenous fauna their removal is promoted.*

- 12.2.4.11 *That when considering resource consent applications in areas identified as known high density kiwi habitat, the Council may impose conditions, in order to protect kiwi and their habitat.*

12.2.5 *Methods of Implementation*

District Plan Methods

- 12.2.5.7 *Council retains the discretion to impose conditions on subdivision or land use consents within areas of confirmed high density kiwi habitat regarding the keeping of dogs and cats.*

- 12.2.5.8 *Council holds indicative maps showing both high and medium density kiwi habitat, and will make that information available on request.*

Other Methods

- 12.2.5.11 *The Council will progressively develop a database on indigenous vegetation areas and habitat. The database will include, but not be restricted to:*

(f) known high density kiwi habitat.

Council will progressively develop maps of the District's significant indigenous vegetation and significant habitats of indigenous fauna, including confirmed high density kiwi habitat, as allowed for in the Long Term Council Community Plan and in collaboration with other key agencies, in particular the Department of Conservation and the Northland Regional Council.

- 12.2.5.12 *Education is an important method. The Council will provide information to landowners and the public generally about the existence and value on management practices that protect kiwi and other indigenous fauna in exotic forests will be provided.*

12.2.7 *Assessment Criteria*

The matters set out in s104 and s105, and in Part II of the Act, apply to the consideration of all resource consents for land use activities.

In addition to these matters, the Council shall also apply the relevant assessment matters set out below:

(m) the extent to which the activity may adversely affect areas of known high density kiwi habitat.

6.6.1.1 Kiwi Areas Map for the Far North

The map used by the Northland District Council to identify areas which contain high and medium density populations of kiwi within the Far North is provided within Figure 10 below. The map is based on mapping undertaken by Pierce *et al.* for the publication Sustainable Management of Brown Kiwi and Other Threatened Birds in Northland (Pierce *et al.*, 2006). Under method 12.2.5.7, the Far North District council retains the discretion to impose conditions on subdivision or land use consent within areas of confirmed high and medium density kiwi habitat. At present the map is used by planners to implement conditions on consent with regard the keeping of dogs and cats within new subdivisions located in high-density kiwi areas as identified on the map

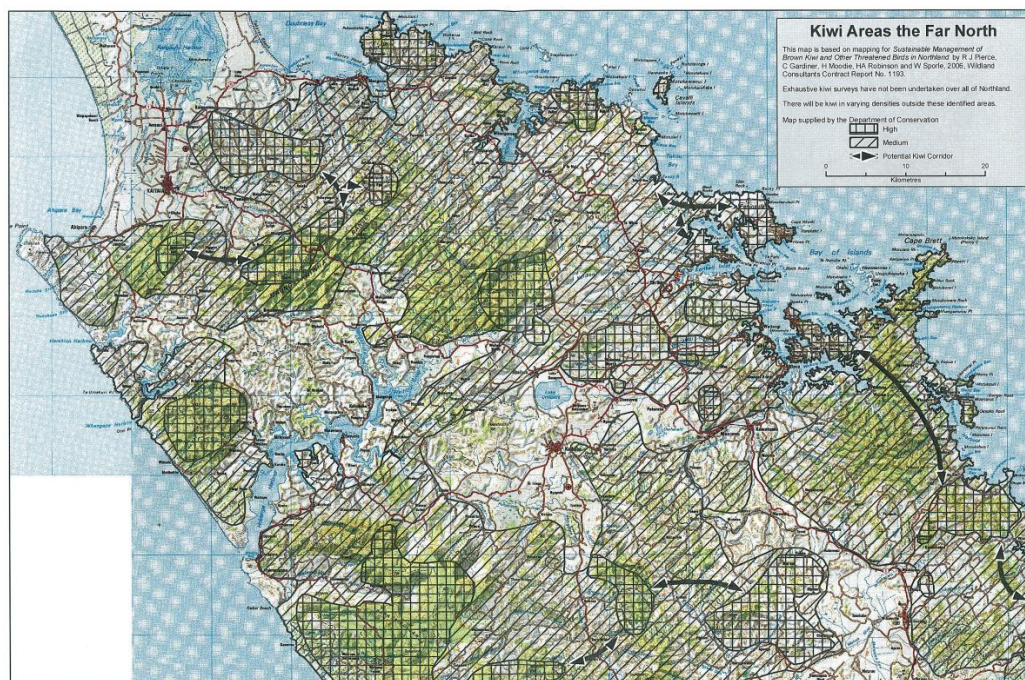


Figure 10. Kiwi area map used by the Far North District Council

6.6.2 Whangarei District Plan

The Whangarei District Plan acknowledges that throughout the district it is becoming increasingly challenging to maintain viable areas of habitat and ensure the ongoing

regeneration, migration, colonisation and breeding of plant and animal species. The Plan states that in the absence of adequate provision of suitable habitat, threatened indigenous flora and fauna will be lost.

The North Island brown kiwi is identified in the Plan as a threatened indigenous species of particular concern (section 17.2). Provisions within the Whangarei District Plan which provide specific reference to the kiwi are listed below.

17.4 Policies

17.4.5 Environmental Pests

17.4.5C To recognise that dogs, cats and mustelids are a significant threat to kiwi.

Explanation: The role of introduced plant and animal pests in damaging native vegetation, native communities and biota is well established. Council has a role which may include regulatory, education and information mechanisms to limit adverse effects and environmental risks that may be associated with pests. Council also has a complimentary role to the Northland Regional Council's pest management functions.

17.5 Methods

17.5.3 Information, Education and Advocacy

Promote and support programmes to exclude dogs, cats and mustelids from known high-density kiwi habitat (Policy 17.4.5C).

Schedule 17B – Status of Northland's Wildlife Species Applicable to the Whangarei District

The North Island Brown kiwi is listed as Outstanding Value (Endangered Endemic Species) under Schedule 17B – Status of Northland's Wildlife Species Applicable to the Whangarei District which is adapted from the Northland Conservation Management Strategy 1999.

6.6.2.1 Whangarei District Kiwi Map

Similarly to the Far North District Council, the Whangarei District Council consults kiwi density maps when considering applications for subdivision.

6.7 KIWI MANAGEMENT PLANS

6.7.1 Kiwi Recovery Plan

In 1991 the Department of Conservation, in conjunction with the Bank of New Zealand and the Royal Forest and Bird Protection Society launched the Kiwi Recovery Programme to coordinate the conservation management of kiwi throughout New Zealand. The first national kiwi recovery plan (Butler and McLennan, 1991), was published in 1991, and has since been surpassed by two further plans (Robertson, 2003; Holzapfel *et al.*, 2008). Research undertaken as a result of the implementation of the first two plans filled many pre-existing gaps in knowledge regarding kiwi ecology and has allowed for more effective management of each species and an increase in both public awareness and public involvement in kiwi conservation.

The first plan provided a five year management and research strategy which aimed to facilitate the achievement of the long-term goal of '*maintaining and, where possible, enhancing the current abundance, distribution and genetic diversity of kiwis*' (Butler and McLennan, 1991, p. 1). The research commissioned under the direction of the plan focused on identifying the taxonomic status, population, key threats and causes of decline of each species of kiwi (Holzapfel, *et al.*, 2008).

The second plan (Robertson, 2003) focussed on the development and fine tuning of conservation and management tools such as Operation Nest Egg and the management of populations using landscape scale stoat trapping to minimise predation threat (Holzapfel, *et al.*, 2008). Work to provide further clarification of kiwi taxonomy and genetic structure was undertaken and five kiwi sanctuaries were established throughout mainland New Zealand. A key aim of the plan was to increase the knowledge and active involvement of communities involved in kiwi recovery. This was successful during the term of the plan and resulted in a dramatic increase in both the number and scale of community led kiwi recovery projects (Holzapfel, *et al.*, 2008).

Kiwi Recovery Plans are situated within the national conservation framework and support three of the four goals of the New Zealand Biodiversity Strategy, and are aligned with the Department of Conservation Strategic Direction and Statement of Intent (Holzapfel, *et al.*, 2008).

6.7.2 Kiwi (*Apteryx* spp.) Recovery Plan 2008-2018

The 2008-2018 Kiwi Recovery Plan (Holzapfel, *et al.*, 2008), builds upon the knowledge gained since the Kiwi Recovery Programme was instilled in 1991. The plan outlines the strategic direction for long term viability of all kiwi taxa at a national level and provides a framework underpinning kiwi recovery until 2018.

The ultimate goal of the plan is to ‘*restore and, wherever possible, enhance the abundance, distribution and genetic diversity of all kiwi taxa*’. Nine further goals regarding management, community relations and engagement and research and innovation are also provided. In order to implement these goals, the plan contains 55 issues, 41 objectives and 92 prioritised actions. Each action is accompanied by a timeline and linked back to the original goals of the plan.

Many of the goals refer directly to the most endangered kiwi species and are not directly relevant to the conservation of the Northland brown kiwi. Those goals which are relevant to the Northland brown kiwi are listed below.

4.2.1 Management

Goal 1.2: To halt the overall decline of great spotted kiwi, tokoeka and brown kiwi

Goal 1.3: To minimise the loss of distribution and genetic diversity of populations in the wild for all species of kiwi

4.2.2 Community relations and engagement

Goal 2.1: To increase and sustain community-led projects in kiwi recovery for all species and across a broad range of sectors of the New Zealand society

Goal 2.2: To double the corporate sponsorship funding for kiwi recovery

Note: The baseline for Goal 2.2 is the current (2008) level of sponsorship.

4.2.3 Research and innovation

Goal 3.1: To clarify kiwi taxonomy and provide robust information guiding management of genetic diversity

Goal 3.2: To undertake robust population modelling for all species

Goal 3.3: To undertake or support research

The plan identifies four options for the recovery of kiwi. These options are as follows

1. *Do nothing: This would result in the continued decline of most taxa, the probable extinction of the most threatened taxa and the loss of many recovery gains made over the terms of the first two recovery plans.*
2. *Protect kiwi in captivity only: This would lead to similar losses in the wild as doing nothing. Outcomes in captivity are uncertain, as for many taxa captive management has not yet proven a successful tool for maintaining healthy populations.*
3. *Protect minimum numbers of each taxon: This would likely result in no further extinctions, but the more numerous species (great spotted kiwi, tokoeka and brown kiwi) would decline to population levels much below present, with the complete loss of many local populations.*
4. *Protect kiwi over their current range: This would result in a slowing and eventually a halting of the decline of the more numerous species, and the continued survival of current main populations of all species.*

Options 1-3 are considered inappropriate due to the multiple threats to kiwi, the range of tools available for their management and the strong public support to minimise current losses in populations and increase kiwi numbers. The Plan therefore supports and works towards the protection of kiwi over their current range as proposed by option 4 (Holzapfel *et al.*, 2008).

6.7.3 Taxon Plans

The Kiwi Recovery Plan outlines the role of taxon plans to translate the relevant goals, objectives and actions of the Kiwi Recovery Plan into a local context and provide strategic direction for the conservation and management of individual taxa at a regional level. Taxon plans are considered the key documents which support the implementation of the Kiwi Recovery Plan. In order to be successful, the management recommendations contained within each taxon plan are required to be of sufficient detail to guide the development of operational plans (Robertson *et al.*, 2003). Note, however, that although taxon plans are intended to focus at a more operational level than the Kiwi Recovery Plan, they are not so detailed as to provide a work plan or provide details regarding best

practice. This information can instead be found within national documents such as the Kiwi Best Practice Manual (Robertson *et al.*, 2003).

Accountability for taxon plans rest with the lead conservancy. It is intended for taxon plans to be developed in collaboration with the key stakeholders for each taxon including iwi, landowners, community-led kiwi projects and other conservancies involved in its recovery and prior to implementation. Prior to implementation, each plan is peer reviewed by the Kiwi Recovery Group to ensure it fulfils its role as part of the Kiwi Recovery Plan (Robertson *et al.*, 2003). The first taxon plan to be developed is the Taxon Plan for the Northland Brown Kiwi which is currently in press.

6.7.4 Draft Taxon Plan for Northland Brown Kiwi (*Apteryx mantelli*)

The Draft Taxon Plan for the Northland Brown Kiwi (hereafter referred to as the taxon plan) is the product of collaboration between the Department of Conservation and kiwi practitioners and interest groups involved in the recovery of the Northland brown kiwi. The Northland Conservancy Whangarei Area office is the lead conservancy accountable for the development of the plan.

The taxon plan is a guide for all individuals, groups and agencies involved in the conservation and recovery of the Northland brown kiwi. The taxon plan provides an account of the current conservation status of the taxa, management and monitoring techniques which are currently undertaken throughout Northland, and outlines the issues, objectives and required actions needed in order to halt further decline in populations and restore the species throughout its historic range.

The plan sets out 21 goals and 112 action points situated under three main areas of management, community relations and engagement, and research and innovation. Each action point is accompanied by set time frames and accountabilities to ensure and enable each point to be achieved.

The long term recovery goal of the plan is to '*restore, and wherever possible enhance, the abundance and distribution of Northland brown kiwi*'. Further goals regarding the kiwi management, community relations and engagement and research, monitoring and innovation have also been established and are presented below

Management

- Goal 1.1: To halt the overall decline of Northland brown kiwi.*
- Goal 1.2: To minimise the loss of distribution and genetic diversity of Northland brown kiwi populations in the wild.*
- Goal 1.3: To control threats at all managed sites with greater than 200 pairs of Northland brown kiwi.*
- Goal 1.4: To control threats at a minimum of six sites with 50 to 200 pairs of Northland brown kiwi, and/or where BNZ Operation Nest Egg (BNZONE) is complementing the population.*
- Goal 1.5: To secure a minimum of 1600 breeding pairs of Northland brown kiwi from threats. Goal 1.6: To expand and connect Northland brown kiwi habitat and population clusters at a minimum of two key protected sites.*
- Goal 1.7: To restore Northland brown kiwi to at least two new areas within their former range.*
- Goal 1.8: To further develop and refine tools to minimise the impact of dog predation on Northland brown kiwi populations.*

Note: The baseline for Goals 1.1 and 1.2 is the current (2010) estimated population size and distribution. Goal 1.3 will secure a representative population in each of the northern, western, eastern and southern areas of current Northland kiwi concentrations.

Community Relations and Engagement

- Goal 2.1: To actively engage with, and provide for, tangata whenua involvement in the kaitiaki and management of Northland brown kiwi.*
- Goal 2.2: To share best practice and technical information amongst Northland brown kiwi stakeholders to optimise recovery efforts.*
- Goal 2.3: To sustain and increase community-led projects for Northland brown kiwi.*
- Goal 2.4: To establish a Northland Kiwi Forum to facilitate implementation of this plan.*

Goal 2.5: To increase awareness of the threat of dogs to kiwi, including via kiwi aversion training for dogs, and the use of a marketing campaign.

Goal 2.6: To increase education and advocacy opportunities for Northland brown kiwi conservation.

Research, Monitoring and Innovation

Goal 3.1: To support research into clarifying brown kiwi taxonomy, and manage Northland brown kiwi according to findings.

Goal 3.2: To undertake and/or support new initiatives in predator control and habitat management and enhancement.

Goal 3.3: To ascertain carrying capacity of Northland brown kiwi.

Goal 3.4: To develop strategies to prevent genetic bottlenecks with Northland brown kiwi.

Goal 3.5: To undertake and/or support research into improving dog control techniques including kiwi aversion training for dogs and dog toxins.

Goal 3.6: To undertake or support development of strategies for prevention and response to threats, including biohazards.

Goal 3.7: To promote and support the use of kiwi best management practices by the forestry and farming sectors.

The main focus of the plan is to conserve a minimum of 1900 to 2800 breeding pairs by 2019. These birds are to be located in 10 management sites secured from threats and sustained in permanent protection and supplemented by a further 15 secured management sites also undergoing effective management of key threats.

Predation by dogs is identified as the single largest predation issue for Northland brown kiwi. The plan aims to address the impact of dogs through intensive advocacy campaigning, the creation of no dogs zones in some areas, kiwi aversion training for dogs and through development of dog control techniques.

The establishment of the Northland Kiwi Forum is a key feature of the taxon plan. The role of the Forum is to facilitate the implementation of the taxon plan and to provide best practice information and support to community kiwi projects and practitioners. The

provision of support and information will ensure stakeholders involved in Northland brown kiwi recovery have access have access to necessary guidance, advocacy and funding.

The Forum includes representatives from a range of sectors including the Department of Conservation, local government, community groups, Iwi, business, tourism and forestry, Landcare Trust, NZ Kiwi Foundation, and BNZ Save the Kiwi Trust. The Forum will enable the facilitation of information between the wider community and the national Kiwi Recovery Group to ensure the goals of the taxon plan are achieved and the plan is updated as required by the Kiwi Recovery Plan.

The plan contains a detailed account of issues related to the conservation of the Northland brown kiwi and outlines objectives and actions to rectify the issues. As the objectives of this study focus on the conservation of kiwi on a landscape scale and the incorporation of goals into the formal planning framework to further facilitate and enable this scale of conservation to occur, objectives and actions which relate back to the study objectives have been identified and presented below. Note that the purpose of this study relates to the conservation of kiwi on a landscape scale within mainland Northland. For this purpose, Topics, Objectives and Action Points which regard kiwi on offshore islands have been excluded from the following summary.

6.7.4.1 Declining Populations

The taxon plan acknowledges that at present there is no strategy to manage scattered isolated birds and the potential and actual carrying capacity of Northland brown kiwi is poorly understood. Key objectives regarding the decline of Northland brown kiwi and a key action point aimed to achieve the objective is listed below.

Objective 7.1: to halt the decline of Northland brown kiwi and

Objective 7.2: to manage a sufficient proportion of the Northland brown kiwi taxon to ensure that recruitment exceeds mortality

Action point 7.1: apply landscape-scale integrated predator control targeting mustelids and cats, at the sites of greatest potential gain.

6.7.4.2 *Distribution and Genetic Diversity*

The taxon plan acknowledges the importance of genetic variation within populations to reduce the impacts of inbreeding depression and reduced population fitness. The plan notes that kiwi populations throughout Northland have reduced significantly in both density and distribution. Both natural and manmade barriers currently prevent dispersal and exacerbate the loss of genetic variation within remaining populations. The following objectives and actions are implemented to decrease the impact of these limitations.

- Objective 8.1: To manage Northland brown kiwi and habitat over as much of their historical range as possible.*
- Objective 8.2: To maintain the genetic integrity of Northland brown kiwi.*
- Objective 8.3: To restore Northland brown kiwi populations within their former range.*
- Objective 8.4: To facilitate Northland brown kiwi dispersal and gene flow throughout their current and historical range, through habitat enhancement.*

Table 5. Taxon Plan Actions required to achieve distribution and genetic diversity objectives (adapted from Craig, *et al.*, 2011)

#	Action	Priority	Delivery
8.2	Maximise opportunities to establish corridors between managed sites of Northland brown kiwi habitat.	High	DOC/NKF/KRG
8.4	Manage Northland brown kiwi to maintain fine-scale diversity by minimising translocations between geographic extremes and natural boundaries.	Essential	DOC
16.7	Work with councils to develop and implement the Northland brown kiwi habitat corridors identified.	Medium	DOC/NKF/NRC/DCs

Key: DOC = Department of Conservation, NKF = Northland Kiwi Forum, KRG = Kiwi Recovery Group, NRC = Northland Regional Council, DCs = District Councils.

6.7.4.3 *Statutory Planning*

The Draft Taxon Plan identifies that many kiwi are within close proximity of residential areas including rural residential and lifestyle blocks as a result of peri-urban subdivision and development. The plan acknowledges the vulnerability of kiwi to human activities

including forestry, vegetation clearance, land development and ongoing lifestyle factors associated with residential activity and the role of statutory authorities to assist the recovery of the species through the development and enforcement of planning regulations.

The issues, objectives related to increasing the level of interaction with statutory authorities and the integration of conservation goals within planning regulations are listed below. Action points defined to achieve the objectives are presented in table 6.

Issues

- *Predation of kiwi by domestic animals, in particular dogs and cats, is likely to increase with further land development;*
- *Land development has the potential to impact negatively upon kiwi habitat but can also provide opportunities for increased kiwi protection;*
- *The presence of kiwi may be seen as a liability and may potentially limit development in some cases;*
- *Councils need to be aware of the current distribution of kiwi and the issues and solutions for kiwi recovery;*
- *The support and commitment of statutory authorities is critical to minimising the effects of people, their pets, development and land modification on kiwi populations;*
- *The capacity of councils to monitor conditions of consents needs to be addressed;*
- *The distribution and management of kiwi is irrespective of land tenure and council jurisdiction;*
- *Some landowners with existing and potential kiwi habitat would like incentives to protect, retain and restore that habitat;*
- *Finding a balance between the needs of people and communities and kiwi is sometimes challenging; and*
- *Kiwi practitioners and certified kiwi dogs need to be available to service the need for kiwi survey and location.*

Objective 16.1: To avoid, remedy or mitigate threats to Northland brown kiwi and their habitat by promoting legislative and policy changes by statutory authorities.

Objective 16.2: To encourage and empower councillors and council staff to advocate for Northland brown kiwi

Table 6. Taxon Plan Actions required to achieve statutory planning objectives (adapted from Craig, *et al.*, 2011)

#	Action	Priority	Delivery
16.1	Encourage local government involvement in the Northland Kiwi Forum.	High	NKF
16.2	Provide a copy of the Northland brown kiwi taxon plan to all councils and work with staff to apply it, as appropriate.	High	DOC/NKF
16.3	Develop and deliver kiwi advocacy material for statutory authorities and update as required.	High	NKF/NMA
16.4	Encourage council monitoring of consent conditions when relevant to kiwi.	Medium	DOC/NKF/KP
16.5	Advocate and provide for consent conditions that protect kiwi habitat, and establish cat and dog free zones in subdivisions within high-density kiwi areas.	High	DOC/NKF/NR C/DCs
16.6	Work closely with councils to establish consistent habitat protection, dog control and enforcement strategies.	Essential	DOC/NRC/DCs
16.7	Work with councils to develop and implement the Northland brown kiwi habitat corridors identified in action 8.2, section 5.1.8	Medium	DOC/NKF/NR C/DCs
16.8	Work with councils to develop innovative incentives that encourage landowners to retain, enhance and protect areas of existing and potential kiwi habitat.	High	DOC/NKS/NR C/DCs

Key: NKF = Northland Kiwi Forum, DOC = Department of Conservation, NMA = National Mentor for Advocacy, KP = Kiwi Projects, NRC = Northland Regional Council, DCs = District Councils.

6.7.4.4 Predator Management

The taxon plan acknowledges a range of issues related to the presence of predators. Introduced mammalian predators are the primary cause of population decline. Where predators are controlled kiwi populations are stabilised and can recover. However, current pest control methods are labour intensive and new technologies are required if predator

control is to move beyond the protection of small pockets. The plan calls for methods to implement cost effective pest control at a landscape scale as unmanaged populations will continue to decline and some will become extinct in unmanaged areas. This landscape approach is deemed particularly important for chicks as they are capable of long distance dispersal and movement out of current protected areas.

The plan also acknowledges that trapping top predators can lead to an increase other predators such as rats which although are not a major threat to kiwi, can adversely affect other biodiversity, and that current tools to control dogs, the main predator of kiwi, are currently limited or unproven. The plan's objectives for pest control are listed below. Action points necessary to achieve the objectives are presented in Table 7 on the following page.

- | | |
|------------------------|--|
| <i>Objective 19.1:</i> | <i>To reduce the impact of predators so that Northland brown kiwi recruitment and survival outweighs mortality.</i> |
| <i>Objective 19.2:</i> | <i>To reduce kiwi deaths by dog predation.</i> |
| <i>Objective 19.3:</i> | <i>To encourage the use of fences (predator, and deer or electric) for the protection of kiwi habitat where appropriate.</i> |
| <i>Objective 19.4:</i> | <i>To investigate effective, innovative methods to reduce the impact of dogs on kiwi populations.</i> |
| <i>Objective 19.5:</i> | <i>To support investigations to develop cost-effective large-scale predator control.</i> |
| <i>Objective 19.6:</i> | <i>To support the investigation of pig control techniques.</i> |
| <i>Objective 19.7:</i> | <i>To refine kiwi aversion training for dogs.</i> |

Table 7. Draft Taxon Plan Actions to achieve predator management objectives (adapted from Craig, *et al.*, 2011).

#	Action	Priority	Delivery
19.1	Continue to use predator control to protect Northland brown kiwi.	Essential	DOC/TW/LG/LO
19.2	Advocate for dog control and offer kiwi aversion training for dogs where dogs are present in or near kiwi habitat.	Essential	DOC/NKF
19.3	Complete the certification of all kiwi aversion trainers to enable training throughout Northland.	Essential	DOC
19.4	Advocate for the use of fences to protect Northland brown kiwi from predators.	Essential	DOC/NKF
19.5	Support and assist with the research, development and trial of predator control methodologies for key predators, including dogs.	Essential	DOC
19.6	Test dog advocacy and dog control within the WKS and, if successful, apply elsewhere.	Essential	DOC
19.7	Develop and trial pig control (including trapping) techniques, and, if successful, apply elsewhere.	Medium	NKF
19.8	Refine kiwi aversion training for dogs and, if successful, apply elsewhere.	Essential	KRG/WKS/ R&D/BNZSKT
19.9	Support the trialing of a dog toxin for uncontrolled dogs in kiwi habitat.	Essential	DOC/NKF

Key: DOC = Department of Conservation, TW = tangata whenua. LG = landcare groups, LO = Landowners, NKF = Northland Kiwi Forum, KRG = Kiwi Recovery Group, WKS = Whangarei Kiwi Sanctuary, R&D = Research and Development, BNZSKT = BNZ Save the Kiwi Trust.

6.8 CONCLUSION

The legislative framework within New Zealand provides the basis from which conservation strategies have developed over time. Recent acknowledgement of ecological theory and the need to conserve biodiversity throughout the landscape within both protected areas and within production land held in private ownership have shaped the direction of high level conservation policy in New Zealand. The Biodiversity Strategy identifies the need to incorporate modified land into conservation plans in order to protect species throughout the landscape. The implementation of the Kiwi Recovery Plan and the

Draft Taxon Plan for the Northland Brown Kiwi recognise and facilitate the conservation of kiwi on a landscape scale and have a particular focus on the role of the management of private land and the role of statutory planning to achieve identified conservation goals.

The Kiwi Recovery Plan is situated within the national conservation framework and supports the goals of the New Zealand Biodiversity Strategy and is aligned with the Department of Conservation Strategic Direction and Statement of Intent. The Taxon Plan for the Northland Brown Kiwi has been developed to implement the goals of the Kiwi Recovery Plan. In order to increase the potential for the realisation of the conservation goals outlined within these plans, selected goals and aspects of the plan may be integrated into the statutory planning framework which influences land use activity on private land. The integration of aspects of the taxon plan, for example the adoption of consent conditions which protects kiwi habitat and those which protect kiwi from the threats of predators including dogs, mustelids and cats, when rural land is developed into subdivisions.

7 RESEARCH FINDINGS

7.1 INTRODUCTION

This chapter contains the research findings sourced from key informant interviews. Key informant interviews consisted of nine key questions which were designed to identify the key threats to kiwi in Northland, assess current conservation strategies undertaken for the protection of kiwi and determine whether landscape scale conservation would be of benefit to kiwi and if so, how this could be achieved. The role of statutory planning and the role of local authorities for conservation were also ascertained. As outlined within chapter 2, a range of key informants from different stakeholders were selected for interview including planners and policy analysts from local authorities including the Northland Regional Council (key informants 1, 2 and 3), the Whangarei District Council (key informants 4 and 5), and the Far North District Council (key informant 6); a representative from the Department of Conservation (key informant 7); representatives from two kiwi agencies, the New Zealand Kiwi Foundation (key informant 8) and the BNZ Save the Kiwi Trust (key informant 9); two representatives from the New Zealand Landcare Trust (key informants 10 and 11); representatives from three landcare groups from within the Far North and Whangarei districts (key informants 12, 13 and 14); and one rural land owner from the Whangarei District who is not strictly involved within structured conservation of kiwi although kiwi are present on the property and predator control is currently being undertaken for the benefit of biodiversity (key informant 15).

Data from the key informant interviews have been categorised according to the stakeholder group of the key informant to identify similarities and disparities within the responses and values held by different stakeholders.

7.2 OBJECTIVE 1

Investigate the potential for landscape scale conservation for kiwi in Northland

In order to investigate the potential for landscape scale conservation of kiwi in Northland, the current issues and threats to kiwi have been identified, as has the perception of the coordination of current conservation measures for kiwi. This section contains the results of

an investigation into whether the current conservation framework supports the conservation of kiwi on a regional scale; whether regional scale conservation would be of benefit to kiwi; and the potential for, and nature of, kiwi corridors throughout Northland to promote and facilitate the movement of kiwi. The section concludes with an enquiry into the actions required in order to further support kiwi conservation on a regional scale.

7.2.1 Current Issues and Threats to Kiwi in Northland

Dogs, pests, funding for pest control, sustaining management effort, enforcement of consent conditions and lack of management were identified by key informants as the key issues and threats which currently face kiwi in Northland. Table 8 indicates the number of positive responses for each issue and the role of the key informant within kiwi conservation in Northland. Further detail on the perceived implication of each issue is provided below.

Table 8. Current issues and threats to kiwi in Northland identified by key informants.

Issue or Threat	Landcare Group	Kiwi Agency	Land Owner	Local Authority	DOC	NZ Landcare Trust	Total
Dogs	***	**	*		*		7
Pests	**	*	*	***	*		8
Funding for pest control	***			*		*	5
Sustaining management effort	*	*		*		*	4
Enforcement of consent conditions	*	*		*		*	4
Lack of management				*			1

Key: * indicates a positive response from one key informant

7.2.1.1 Dogs

Dogs were identified as a leading threat to kiwi on both public and private land by seven key informants representing all three landcare groups, both kiwi agencies, the Department of Conservation and a local land owner. Dogs, however, were not identified as an issue by representatives from any of the three local authorities or the New Zealand Landcare Trust.

The threat posed by dogs in Northland was unknown until research commissioned by the Department of Conservation “*established that the large proportion of kiwi are on private land*” (key informant 9 - kiwi agency). This finding was explained by a high level of

hunting activity on public land and historical control of dogs on farmland (key informants 9 and 12). The threat posed by dogs on public land is thought to have decreased as a result of this knowledge and subsequent education, advocacy and changes in hunting behaviour. Historically hunters would take multiple dogs onto conservation land and dogs were often lost or left behind. Today, fewer dogs are taken onto conservation land, fewer dogs are lost or left behind, and the localised eradication of pigs has negated the need to take hunting dogs onto some parts the conservation estate as “*generally it is only pig hunters that go in with dogs*” (key informant 14 - landcare group).

The threat posed by dogs was deemed to be greater on private land due to smaller lot sizes and the keeping of dogs as family pets (key informant 14 - landcare group). Dogs resident within high-density kiwi areas are often free to roam and have a high chance of coming into contact with kiwi. The keeping of dogs on lifestyle blocks near high-density kiwi areas is therefore viewed as a significant threat to kiwi (key informant 12 - landcare group). Additionally, some dog owners do not take the threat posed by dogs seriously as the damage caused by wandering dogs can be difficult to detect (key informant 15 - landowner), and owners of pet dogs are often reluctant to believe their dog could kill kiwi (key informant 9- kiwi agency).

In order to minimise the impact of dogs on kiwi at Whangarei Heads, the Whangarei Heads Landcare Forum encourage the community to only own dogs in the villages where fewer kiwi are located. Dog ownership on lifestyle blocks is discouraged where dogs are free to roam over large areas of land which contain a high density of kiwi (key informant 12 - landcare group). Kiwi aversion training and dog awareness campaigns are also currently being undertaken to address the issues posed by dogs on both public and private land and in areas where dogs are controlled, kiwi are returning (key informant 12 - landcare group).

7.2.1.2 Pests

The impact of introduced mammalian pests was identified by eight key informants, four of which identified pests as a secondary issue to dogs. A representative from the Department of Conservation acknowledged that overall the impact of pests are secondary to dogs despite the “*miniscule survival rate*” of chicks in unmanaged areas. Similarly, representatives from two kiwi agencies stated that “*stoats are the more pervasive issue, they are everywhere and they are the key predator of juvenile kiwi. Dogs however, a*

single dog has the ability to cause a local extinction” (key informant 8 - kiwi agency) and *“if you remove the threat of dogs and still have the pressure of stoats, kiwi populations will usually increase. No, they won’t increase as fast but it’s the pressure from dogs that is the more limiting factor”* (key informant 9).

In addition to stoats, representatives from two landcare groups identified pigs as a significant issue due to implications resulting from the presence of pig dogs. In most places throughout Northland where dogs are controlled, trapping is *“an extra bonus”* for kiwi as kiwi populations can be maintained in unmanaged areas due to the productivity and long lifespan of the birds (key informant 12 - landcare group).

Issues regarding the movement of pests from areas of unmanaged public land to adjoining areas of private land where pest control is being undertaken were raised. Unmanaged areas act as a *“nest”* for pest species, decrease the long term effectiveness of pest management undertaken on private land and require heavy investment to mitigate (key informant 14 - landcare group).

7.2.1.3 Funding for Pest Control

Issues surrounding funding for pest control were identified by representatives from each of the three landcare groups, one local authority and the NZ landcare Trust. In order to facilitate the long term protection of kiwi, landcare groups require ongoing financial support (key informants 10 and 13). This view was supported by key informant 14 who stated that in order to undertake the current level of integrated pest management the landcare group is heavily reliant on the taxpayer and outside funding despite efforts to secure independent sources of funds.

A lack of resourcing within the Department of Conservation was raised by a number of key informants including a representative from one landcare group, the Northland Regional Council and the New Zealand Landcare Trust. Key informant 13, a representative from one landcare group stated that *“there was no question”* that the Department of Conservation is underfunded. A reason underpinning this perception is that the Department of Conservation *“is only funded to work in only a small scale compared to the amount of land it administers in Northland”* (key informant 1 - local authority). Currently, pest management is undertaken on less than 10% of land held in the conservation estate and even less of the area is subject to intensive pest (key informant 1).

7.2.1.4 *Limitation of Working on Public Land*

Community groups undertaking pest control on conservation land have access to a limited number of funding sources as many major funds only fund work undertaken on private land (key informant 13 - landcare group). Additionally, Department of Conservation best practice must also be applied when working on public land which restricts the type of traps and toxins which can be used (key informants 13 and 15 - landcare groups).

7.2.1.5 *Sustaining Management Effort*

Support for community groups, sustaining the effort and enthusiasm of community groups and the prevention of burnout is a significant issue (key informant 1, 9, 11 and 14 representing a local authority, kiwi agency, New Zealand Landcare Trust and a landcare group respectively). Generally, motivation within the community is highest within the first five years of starting a community group as people are driven, energised, killing lots of predators and seeing a lot of change. By year 10 however, fewer animals are trapped, change becomes less noticeable and resourcing becomes more difficult. As stated by a representative from the New Zealand Landcare Trust, 99% of landcare groups start because of a perceived crisis, and over time, as the perceived crisis dissipates, the urgency of undertaking of such work decreases and landcare groups can disband. Therefore, there is a “*need to be really careful to protect your energy and make sure you are invigorated*” (key informant 9 - kiwi agency)

7.2.1.6 *Enforcement of Consent Conditions*

Enforcement of recourse consent conditions, particularly those regarding no dog subdivisions was raised by four key informants representing one landcare group, a kiwi conservation agency, one local authority and the New Zealand Landcare Trust. A representative from the Far North District Council noted the ability of such conditions to protect kiwi is limited unless the condition is monitored and enforced.

7.2.1.7 *Lack of Management*

As noted by a representative from the Far North District Council, conservation on public land relies either on the regulatory framework set up by the District Plan or on the goodwill of landowners and currently there is no consistency in how that might be approached by landowners.

7.2.1.8 *Habitat Loss*

Habitat loss was deemed by one key informant to be an issue for kiwi while eight key informants representing five stakeholder groups believed habitat loss is no longer a major threat in Northland (Table 9).

Table 9. Key informant perception of habitat loss as a threat to kiwi

Response	Landcare Group	Kiwi Agency	Land owner	Local Authority	DOC	NZ Landcare Trust	Total
No		**		*****	*		8
Yes				*			1

Key: * indicates a positive response from one key informant

Vegetation clearance and habitat loss on private land was deemed no longer a significant issue, but a “*remnant of past perceptions*” (key informant 2 - local authority). Requests for the clearance of large areas of native vegetation are received by the Far North District Council on occasion (key informant 6 - local authority). Such requests tend to be uncommon in the Whangarei district due to voluntary action to protect remaining habitat often being a part of applications for subdivision and development (key informant 5 - local authority).

The sole key informant who viewed habitat loss to be a current issue was a representative from the Far North District Council. It was expressed that although less significant than other threats, habitat destruction remains an issue for kiwi. In particular, the Far North District Plan does not contain rules regarding the control or protection of exotic vegetation in which kiwi reside, and the removal of this exotic vegetation could have an adverse affect on kiwi.

7.2.2 Key Informant perception of the Coordination of Kiwi Conservation in Northland

Eleven key informants provided a comment on the coordination of kiwi conservation in Northland. Five key informants indicated that kiwi conservation is well coordinated, five believed there is room for improvement, and one key informant thought that coordination is not clear (Table 10).

Table 10. Key informant perception of the coordination of kiwi conservation in Northland

Response	Landcare Group	Kiwi Agency	Land Owner	Local Authority	DOC	NZ Landcare Trust	Total
Yes		**		**		*	5
Room for improvement	**		*	*	*		5
No	*						1

Key: * indicates a positive response from one key informant

Specific mention of the work undertaken by Wendy Sporle of the BNZ Save the Kiwi Trust and the New Zealand Landcare Trust to increase communication and coordinate with landcare groups was noted by all interviewed representatives from landcare groups and the New Zealand Kiwi Foundation.

The BNZ Save the Kiwi Trust maintains a database of all kiwi projects throughout New Zealand and has at least one person identified as a contact person for each project. The Trust acts as a mentor to landcare groups and provides guidance and resources including DVDs, workshops and simple handouts, and facilitates problem solving in local areas to address local issues. The Trust has been asked to develop a simple one page handout for planners and developers to provide options which can be applied in high density kiwi areas to raise awareness of kiwi issues and to provide planning opportunities and mitigations in high density kiwi areas (key informant 9 - kiwi agency). The provision of such information to councils was deemed particularly important for new staff to Northland who may be are unaware of the key issues and threats to kiwi. Kiwi distribution maps used by district councils are also produced by the Trust to identify high density kiwi areas.

The role of the Taxon Plan in facilitating increased communication between stakeholders was noted by representatives from the Whangarei District Council, the Department of Conservation and the New Zealand Kiwi Foundation. It was noted that the taxon plan has been central to facilitating more interagency integration (key informant 4 - local authority), and that the working group and forum set up by the Taxon plan will go “*a long way to resolve some of those issues*” (key informant 7 - Department of Conservation). As the Northland Kiwi Forum is still in its infancy, it is believed that the forum will be better in the future (key informant 8 - kiwi agency).

National Kiwi Hui were noted by four key informants representing all three landcare groups and the Whangarei District Council, as an opportunity for interested stakeholders to attend and exchange information.

Issues regarding the integration of, and communication between, community groups were identified as community groups tend to operate within their own areas (key informant 13 - landcare group) and generally “*individual land groups don’t talk to each other*” (key informant 14 - landcare group). “*This flow of information is really important*” (key informant 13 - landcare group), and landcare groups both want and need more interaction between groups to facilitate the exchange of information and knowledge regarding issues such as successful trapping methods.

The sole key informant who believed that conservation efforts are not well coordinated stated that although many groups work well together, some stakeholders do not see eye to eye. Additionally, people who are in a position to influence change are often unaware of the issues and developments associated with kiwi conservation (key informant 12 - landcare group). A lack of commitment from agencies was also viewed as an issue particularly in relation to dog control. Key informant 12 cited a case where a member of the community contacted the district council with regard to a wandering dog only to be directed to the Department of Conservation, who directed responsibility back to the district council. During this time, the wandering dog was still at large (key informant 12).

7.2.3 Does Current Conservation Framework Support Conservation on a Regional Scale?

One key informant believed the current conservation framework “*absolutely supports a regional approach*” as the taxon plan looks at kiwi conservation on a broad scale and that it is “*starting to come together*” (key informant 7 – Department of Conservation). One key informant believed the success of the framework is dependent on what can be done about dogs and dog control (key informant 12 - landcare group) and six key informants indicated that at present, the current framework does not support the conservation of the kiwi on a regional scale. Among these six were representatives from a district council, the New Zealand Landcare Trust, BNZ Save the Kiwi Trust and a local landowner (Table 11).

Table 11. Key informant perspective of the current conservation framework to support conservation on a regional scale

Issue	Landcare Group	Kiwi Agency	Land Owner	Local Authority	DOC	NZ Landcare Trust	Total
Yes					*		1
Dependent on dog management	*						1
No		*	*	**		**	6

Key: * indicates a positive response from one key informant

Although the BNZ Save the Kiwi Trust, the Taxon Plan and the Northland recovery group aspire to large landscape scale protection, they currently do not have the necessary tools, such as effective landscape scale predator control, which would enable them to do so (key informant 9 - kiwi foundation). Given the current limitations *“really what’s achievable at the moment is enhancing the capacity of protection pockets”* despite the *“will and the wish to actually make it bigger”* (key informant 9).

A representative from the Northland Regional Council stated the *“current network throughout northland lets kiwi down a bit”*. At present resources are directed to where there is community interest in the protection of kiwi, but there are plenty of kiwi areas in which no protection work is undertaken. Additionally, where kiwi projects have been successful, kiwi disperse *“into areas where they are not protected and they get lost”* (key informant 1).

Weaknesses within the current policy framework and a lack of consistency in council rules was cited by three key informants as one reason underpinning this lack of regional conservation. At present, district councils have different rules (key informant 11 - New Zealand Landcare Trust), and councils are not consistent in the way rules are implemented (key informant 10 - New Zealand Landcare Trust). A representative from the Whangarei District Council stated that *“it would be good to have some regional policies that we could all rely on imposing in our district plans and conditions of consent”* (key informant 5).

7.2.4 Corridors for Kiwi

All key informants thought linking high density kiwi areas through corridors would be of benefit to the kiwi. A number of reasons were cited including the genetic advantages resulting from interbreeding populations, protection for kiwi dispersing from protected

areas, and that ultimately linking populations and protected areas is “*really important because a little block on its own is doomed*” (key informant 13 - landcare trust).

Five key informants believed there is, at present, a drive to establish corridors and link areas which are currently managed for the benefit of kiwi. Four key informants believed there was no drive or were unaware of any drive to create such linkages and one key informant believed that to a certain degree links would, or could be created informally by landowners.

Those that believed there was a drive to create corridors included representatives from a landcare group the New Zealand Kiwi Foundation, the BNZ Save the Kiwi Trust, the New Zealand Landcare Trust and the Department of Conservation. A representative from the New Zealand Kiwi Foundation stated that although the Foundation looks “*for opportunities where there is a good residual kiwi population*”, the Foundation’s philosophy has always been to link up large areas. The New Zealand Kiwi Foundation is currently undertaking work to create links between managed areas in the Bay of Islands. With an estimated 70% of this area currently subject to integrated pest management, such links are well on the way to being created, although issues relating to sustaining management in the long term were identified (key informant 8 - kiwi agency). The landscape scale nature of the work undertaken by the New Zealand Kiwi Foundation particularly in the Bay of Islands area was also noted by representatives from a landcare group and the BNZ Save the Kiwi Trust.

The BNZ Save the Kiwi Trust is looking at creating corridors and linkages between high density kiwi areas throughout Northland, but at present the creation of these connections is not a top priority (key informant 9 - kiwi agency). The Trust is, however, deliberately targeting key forestry companies throughout Northland to actively manage kiwi through harvest and at a minimum manage dogs. As an indirect result, kiwi corridors are being secured where industrial forestry is situated between areas currently managed for the kiwi. The potential for forestry management to provide a good outcome for kiwi was also recognised by a representative from the Northland Regional Council.

A representative from the Department of Conservation believed that over time corridors will be established and the current range of the kiwi will expand. This view is supported by a representative from the New Zealand Landcare Trust who believed that in 10 years

some of the corridors will have formed as community groups encourage neighbours to take action to protect dispersing kiwi.

Representatives from one landcare group, the Far North District Council, the Northland Regional Council and a local land owner indicated that at present there was no drive to link managed areas. Key informant 14, a representative from a landcare group, believed that although linkages between managed areas are required in order to effectively control predators over large areas, at this stage it is *“in the too hard basket”* due to the time, money and resources required to communicate with, and educate landowners.

At present the Far North District Council focus on where kiwi populations are rather than where they could expand or disperse to. In order for the District Council to provide for increased protection of corridor areas, the issue would need to be seen as a priority by elected members of council (key informant 6 - local authority). Similarly, the Northland Regional Council directs funds to *“where there is an engaged community with a proven track record of success because that is probably the best bet for sustained control”* (key informant 1 - local authority). The Northland Regional Council has not defined areas in which corridors would be beneficial as to do so in a top down manner could immediately create a difficult environment. Implementing corridors from the top down is not deemed to be best approach to landscape scale protection as *“there has to be some sort of community base for ongoing sustained management and that is not everywhere in Northland”* (key informant 1 - local authority).

As previously stated, resources are currently directed to where the community is interested and committed to the protection of kiwi as *“people are probably not going to be too happy if you turn around and use a planning tool and say hey we would like to have kiwi walking though this 50km area, get rid of your dogs”* (key informant 12 - landcare group). This focused approach is also supported as it is deemed important that resources are not stretched too far (key informant 12), and that not too much funding is diverted to save kiwi in small blocks when bigger blocks might miss out (key informant 13 - landcare group).

7.2.4.1 Nature of Potential Kiwi Corridors

Although additional indigenous habitat would be beneficial to the kiwi, six key informants deemed the creation of more habitat and vegetation corridors unnecessary in order to link

existing populations of kiwi in Northland. Kiwi are able to move across open land and unlike other regions throughout New Zealand, Northland has retained sufficient habitat to facilitate the dispersal of kiwi. What kiwi require instead, is a safeguarding from predators provided through protection corridors where pest and predator control is undertaken to prevent kiwi being “*nobbled*” when moving between managed areas (key informants 8, 9, 13 and 15 representing both kiwi agencies, a landcare group and a land owner).

A representative from the New Zealand Landcare Trust identified a common misconception that New Zealand’s ecological corridors need to provide a corridor of vegetation as demonstrated in overseas corridors. However, “*we don’t because we don’t have the ground mammals that need to move through such environment, especially if you are just looking at kiwi*”. “*It’s all about having a mosaic or even just the strongest network you can in an area where there is pest control and community support*” (key informant 10 - New Zealand Landcare Trust).

7.2.5 Actions Required to Increase Support for Kiwi Conservation

A range of actions were identified which would increase support for kiwi conservation in Northland (Table 12).

Table 12. Actions identified by key informants as necessary to increase support for kiwi conservation in Northland

Action	Landcare Group	Kiwi Agency	Land Owner	Local Authority	DOC	NZ Landcare Trust	Total
Education and advocacy	**		*	**			5
Access to funding	*			**	*	*	5
Tools for effective pest control		*				*	2
Support for communities		*		*			2
Dog control and pet free areas	*		*				2
Keeping profile of kiwi alive				*			1
Support kiwi forum	*						1
Strong guidelines for regional planning						*	1

Key: * indicates a positive response from one key informant

In order to increase support for the conservation of kiwi in Northland, five key informants deemed an increase in public education and advocacy to be necessary as summarised by

the following quote *“money for advocacy and education I think is the main thing that is going to save the kiwi”* (key informant 14 - landcare group). The potential role of internal up-skilling of district council staff to increase awareness of key threats and the location of kiwi was also identified (key informant 6 - local authority).

Education and increased awareness among the wider community of the impacts of key threats including pests were identified to be of particular importance by key informant 4 and 15 (representative from a local authority and a land owner). This education is of particular importance for people moving into kiwi areas. Key informant 4 also noted the importance of keeping the profile of kiwi alive, and the potential to promote high density kiwi areas as a part of the sense of place people have within the community.

Access to more funding was identified by five key informants representing a landcare group, the Department of Conservation, local authority and the New Zealand Landcare Trust. The provision of sustainable funding in particular was deemed to be of particular importance to provide landcare groups working on the ground with security that there will be ongoing support for their work (key informant 10 - New Zealand Landcare Trust).

The need for more tools for effective pest control was raised as at present *“we haven’t got the tools for landscape scale predator control apart from aerial toxins and that’s not acceptable in Northland”* (key informant 9 - kiwi agency). There is also a need to refine tools for stoat control as although current tools can kill stoats, how to effectively lure them to a trap remains unknown (key informant 9).

Two key informants representing the Whangarei District Council and the New Zealand Kiwi Foundation identified support for voluntary and community activity as essential as *“at the end of the day it really boils down to getting landowners on board because you can do a hell of a lot with nothing which sounds ridiculous but if you have people on board you can have a massive amount of change ... in behaviour and attitudes”* (key informant 8 - kiwi agency).

Other aspects and issues which were raised and could increase support for kiwi conservation include keeping dogs out of kiwi areas, trapping of stoats and cats and supporting the kiwi forum (key informant 12 - landcare group) and better communication between agencies (key informant 6 - local authority).

A representative from the New Zealand Landcare Trust proposed a three tiered approach to increase support for kiwi conservation which incorporated, top down, bottom up and technical aspects. From the top down a regional framework to facilitate the implementation of consistent and strong planning and guidelines surrounding kiwi management and give strength to the work people are undertaking on the ground is required. People working on the ground need some form of sustainable funding and security that they will be able to continue undertaking current management, and on a technical level more tools for pest control such as toxins and traps are required that are both user and community friendly and effective.

7.3 OBJECTIVE 2

Identify ways in which the key issues and objectives of the national Kiwi Recovery Plan and the Taxon Plan for the Northland Brown Kiwi can be incorporated into and supported by the formal planning framework in Northland

7.3.1 Stakeholder Knowledge of and Interaction with the Taxon Plan for Northland Brown Kiwi

All key informants interviewed in this study were aware of the Draft Taxon Plan for the Northland Brown Kiwi except one landowner who does not work directly with kiwi. The development of individual taxon plans specific to their locality and context was deemed important as the issues facing kiwi differ with both taxon and location. In Northland dogs pose the greatest threat to kiwi populations while in other areas kiwi are so widely dispersed they cannot find each other to breed (key informant 7 - Department of Conservation). The development of plans which identify and focus on relevant issues is therefore critical and without this plan, conservation for kiwi in Northland would “*still be a bunch of silos*” (key informant 7).

The degree to which agencies and stakeholder are currently engaged with the plan is dependent on the stakeholder’s direct role within the functioning of the plan. Key informant involvement within the development of the plan ranged from contribution within the initial scoping stages prior to the development of the plan through to direct

involvement in writing of the plan (key informant 7 and 9 - Department of Conservation and a kiwi agency).

The level to which local authorities are currently engaged with the plan ranged from knowledge the council held a copy through to direct and active involvement in the Northland Kiwi Forum and working group. A member of staff from the Whangarei District Council currently acts as the working group's district plan representative and has the role of passing on relevant information to other district councils. A representative from the Northland Regional Council is also a member of the working group.

A funded position to coordinate the Northland Kiwi Forum and implement the plan was established midway through 2011. The appointment of this coordinator has been described as "*very much needed*" and "*a very good concept*" (key informant 13 - landcare group).

7.3.2 Kiwi Maps

The Far North and Whangarei Districts Councils both hold kiwi distribution maps which indicate high density kiwi areas. These maps are used by consents planners and influence conditions placed upon subdivisions. The Far North District Council has implemented dog, cat and mustelid free subdivisions for a number of years and similar conditions are starting to become more common in the Whangarei District. The maps held by councils are however, becoming out of date and need to be revised in order to provide councils with accurate, up to date information on the distribution of kiwi populations (key informant 9 - kiwi agency).

7.3.3 Kiwi Aversion Training for Dogs

All six key informants who commented on kiwi aversion training for dogs noted that current training methods are not 100% effective (key informants 7, 8, 9, 12, 13 and 14 representing the Department of Conservation, both kiwi agencies and all three landcare groups). One key informant believed all dogs should be aversion trained and five indicated that aversion training should only be used for hunting and working dogs which need to be in high density kiwi areas.

Key informants who supported aversion training for working and hunting dogs cited the results from research undertaken in the Coromandel which indicate aversion training is less effective on pet dogs. Key informants identified that pet dogs are often poorly trained

(key informants 8 and 9) and have never been taught to focus (key informants 9 and 12). Issues regarding complacency among owners whose pets have undergone aversion training were also raised by key informants from two landcare groups (key informants 12 and 13).

Kiwi aversion training at Whangarei Heads is discouraged as it is not deemed necessary to take dogs into the area (key informant 12). Key informant 12 identified that at present aversion training is not effective enough on pet dogs for it to be promoted and used on dogs that do not have to be in kiwi areas.

At present, aversion training is too ineffective for conditions to be placed on subdivision consents which permit aversion trained dogs to be in kiwi areas. Additionally, dogs must be tested every 12 months in order to facilitate the best results. Enforcing this testing would be difficult and as such kiwi aversion training should not be used within council planning documents in this manner (key informant 9).

The opportunity provided by aversion training to establish relationships with dog owners and increase awareness of the threat posed by dogs was deemed to be of equal or even more importance than the effectiveness of the training on dogs (key informants 8, 9, 12 and 13). Aversion training is currently available to all dogs including those that are not registered. Key messages regarding kiwi conservation and the threat posed by dogs therefore able to be accessed by a greater number of dog owners throughout Northland (key informants 9 and 14).

Although in the ideal world dogs wouldn't be in kiwi country at all (key informants 7, 8 and 12), kiwi aversion training is a tool which can be used when dogs have to be in areas where they are likely to come into contact with kiwi. Certification that dogs are kiwi aversion trained is required in order to obtain a permit to hunt on land administered by the Department of Conservation (key informant 8), and landowners are increasingly requiring certification before permission is granted to enter their properties (key informant 14).

The potential to link aversion training with dog registration through a reduction in the registration cost for dogs undergoing kiwi aversion training was raised by two key informants representing a landcare group and the BNZ Save the Kiwi trust. It was noted however that that many dogs which have undergone aversion training are unregistered and

that it is important to ensure that all dogs which are taken into kiwi areas have access to aversion training.

7.3.4 Scope for the District Plan to Further Protect Kiwi – Dog and Pet Free Subdivisions

Five key informants believed there is scope for the district plan to do more to protect and conserve kiwi. A representative from the Far North District Council noted that although the current District Plan provides a good policy framework for kiwi and contains specific reference to kiwi within the indigenous flora and fauna section, the implementation of its policy could be improved.

The district plan was viewed as “*the most important document*” for the long term survival of kiwi due to the potential to implement dog control on future subdivisions (key informant 12 - landcare group). The development of dog and cat free subdivisions were viewed by six key informants as an opportunity to provide for the protection of kiwi provided the developments have no more than minor effects on the environment and conditions are adhered to. Although no dog, cat and mustelid conditions have been placed on rural subdivisions in the absence of district plan rules in both the Far North and Whangarei, such rules would provide greater clarity and uniformity in the implementation of such conditions.

Representatives from the Whangarei District Council and the Far North District Council identified the potential to implement a kiwi overlay within the District Plan. The benefit of such an overlay when imposing conditions on consents was acknowledged. The benefit of imposing conditions on new subdivisions was also noted as it would not impose restrictions on people already living in the area (key informant 13 - landcare group) and the implementation of no dog conditions does not impose large costs to landowners (key informant 9 - kiwi agency). The potential to implement grandparent clauses to provide an exception to dogs resident in high kiwi areas prior to the implementation of dog free or pet free conditions was also proposed (key informant 7 - Department of Conservation).

Only one respondent believed the imposition of such restrictions would be of little benefit to the kiwi. Instead, they thought such restrictions would annoy the public and “*get people’s backs up*” (key informant 14 - landcare group).

7.3.5 Additional Conditions on Consents

Additional conditions which could be implemented by District Councils included a recommendation for a condition on land clearance consents which require a kiwi dog to pass through the area to remove kiwi prior to the clearance of vegetation (key informant 14 - landcare group). It was suggested that the incurred cost of fulfilling this condition should be met by the applicant.

The implementation of conditions regarding the control of mustelids on large rural subdivisions in high density kiwi areas was raised by key informant 9 representing the BNZ Save the Kiwi Trust. It was however acknowledged that the implementation of such conditions would impose considerable costs on landowners which in some areas of Northland could be too much to ask.

7.3.6 Monitoring of Consent Conditions

Councils are unable to actively monitor all conditions placed on consents. Community support for imposed conditions is therefore, required in order for breaches to be reported to councils (key informants 6, 9, 10 and 12 – representing a local authority, kiwi agency, the New Zealand Landcare Trust and a landcare group). Such community support and reporting of dogs or pets within subdivisions subject to no pet clauses is especially important due to the difficulty in enforcing such conditions (key informant 2 - local authority). Issues regarding the monitoring of consent conditions and dog control are acknowledged and discussed by the Northland working group during meetings (key informant 4 - local authority).

7.3.7 Consistency and Standardisation of District Council Rules Throughout Northland

Throughout Northland there is a lack in the consistency of district plan rules (key informants 6, 10 and 11 representing a local authority and the New Zealand Landcare Trust). This issue is effectively summarised by the following quote, “*one of the issues not just with indigenous flora and fauna but all our district plan rules is the definite lack of consistency among the three district councils*” (key informant 6 - local authority).

Although having standardised rules regarding kiwi throughout Northland could be beneficial, there are issues surrounding the creation and implementation of such rules.

Under the current planning framework district councils are required to undertake consultation within their districts prior to the insertion of new rules to the district plan. As each district would be required to undertake separate consultation it is likely councils would end up with slightly different rules due to different wants and needs of people within each district (key informant 10 - kiwi agency). Even if such a process did occur, there is a risk the rules could get watered down in order to satisfy the majority. The resulting rules may therefore not produce the best outcome for kiwi (key informant 11 - kiwi agency). Additionally it was noted that the application of such rules within the Kaipara District Plan may not be necessary or relevant as there are so few kiwi in the district (key informant 11 - kiwi agency).

7.3.8 Other Roles of the District Council - Animal Control

Key informant 9 identified a need for councils to tighten animal control bylaws and stated that *“animal control staff have a huge scope to be part of the solution around dogs”* provided councils seize and destroy dogs in high density kiwi areas. It was also believed that councils could *“do more to insist dogs are restrained”* (key informant 13 - landcare group).

Issues regarding the seizure and destruction of dogs which have attacked kiwi include difficulty associated with the seizure of offending dogs, and difficulty associated with prosecuting offending dogs when they are not seen attacking kiwi. Currently under s 57 of the Dog Control Act a dog must be witnessed attacking protected wildlife in order to prosecute. Under s 59 a dog may be seized or destroyed if it is at large and is an immediate disturbance or threat to any protected wildlife. However, the interpretation of threat is relatively open and it may not be deemed a threat until the kiwi is in a dog's mouth. New technology able to identify dogs through saliva has been developed but in order to prosecute, dogs still have to be caught for identification and samples from specimens must be analysed within a certain time frame in order to return results (key informant 9 - kiwi agency).

In conclusion, although it is noted that dogs can be hard to catch, and the damage caused by dogs difficult to detect, the seizure and destruction of dogs is reliant on an efficient response from dog control officers. Currently the response of dog control officers is variable and largely dependent on the individual officer (key informant 9 - kiwi agency).

7.3.9 Issues Related to Single Species Focus in Plans

At present the Northland Regional Council is wary about identifying iconic species within their plans (key informant 3 – local authority). Under the Resource Management Act the Regional Council does not have a conservation mandate, instead it has to protect significant habitat of indigenous biodiversity. Selecting one species or interpreting the Act and applying more weight to one species would therefore be open to challenge (key informant 2 – local authority). Additionally it was stated that the Resource Management Act does not necessarily provide for the planning for conservation of a particular species or the prioritisation of one species over another. Ultimately planning for species for iconic reasons comes down to grass roots efforts (key informant 3 - local authority).

Further issues regarding the protection of ‘significant habitats of indigenous fauna’ instead of the protection of fauna itself arise due to predation. Unlike trees which can withstand a certain level of predation, kiwi are mobile and get “*smashed*” by predators (key informant 3 - local authority). Therefore, the act of protecting land for fauna species cannot be expected to have the same results as those aimed at the protection of flora (key informant 3).

7.3.10 Importance of Both Top Down and Community Based Conservation Initiatives

Key informants emphasized the importance of having a balance between top down and bottom up initiatives to support the long term conservation of kiwi in Northland. Although it was generally acknowledged that conservation of the kiwi currently relies, and will continue to rely, on the action of committed communities, it was deemed necessary to support this voluntary work with a strong regulatory framework. In order to protect the kiwi both formal planning legislation and ground up community based initiatives are required as “*you can have a dog free area but what’s stopping people taking dogs in?*” (key informant 10 – New Zealand Landcare Trust).

It was acknowledged that conservation would work best if grown from the bottom up and that although it is good to have encouragement from the top down, “*people don’t like a big stick it gets their back up*” (key informant 13 - landcare group). Policies and rules can often put up barriers, but if people can be motivated to undertake conservation work in other ways, the resulting value for conservation is often a lot greater (key informant 9 -

kiwi agency). The role of laws and rules legal mechanisms was acknowledged provided communities support them (key informant 12 - landcare group).

7.3.11 Role of Community Based Conservation for Kiwi in Northland

The importance of community support for the conservation of kiwi was widely acknowledged by key informants. In Northland, more work is undertaken for the kiwi on private land than public land and conservation effort largely comes from the ground up (key informant 10 - New Zealand Landcare Trust). This view is reflected by a representative from the Northland Regional Council who stated that councils are no longer leading conservation work and *“the restoration of the north island brown kiwi is occurring despite any conservation planning policies* (key informant 1). Instead, it is the public who care enough about conservation values in their community to win the support of neighbours to undertake trapping and develop joint community plans and ultimately *“it is really though their efforts that I see anyway the new initiatives for conservation”* (key informant 1). *“They are succeeding, kiwi numbers are increasing”* and *“councils shouldn’t be getting in the way of this”* (key informant 1). This view is reflected by a representative from the New Zealand Kiwi Foundation who stated:

it does rely upon land owners principally to take the initiative and I think the key point of success for the Regional Council and the current Pest Management Plan is that they are not leading it. People know of the assistance that’s available if they want to demonstrate that they want to do it and I think that is critical (key informant 8).

Praise for the Northland Regional Council’s support of communities wanting to undertake conservation work and manage pests in a defined locality was expressed by representatives from both the New Zealand Kiwi Foundation and landcare groups. The Environment Fund provided by the Regional Council provides funding to establish community pest control areas and provides assistance to attain training and necessary equipment (key informant 8 - kiwi agency).

Areas identified by the Northland Regional Council to be of significant activity for the protection of biodiversity and are currently subject to funding from the Environment Fund include the Bay of Islands and Whangarei Heads. Activities in these areas are *“driven by*

the huge amount of resources that people are putting in as opposed to the agencies” (key informant 8 - kiwi agency).

The importance of this community drive was acknowledged by one representative from the Northland Regional Council who believed it would be a big step back if community drive were to be lost and people stopped wanting to undertake work for the kiwi. Key informant 1 asked how regional policy statements can *“help to sustain that kind of community”* and how councils can help facilitate and sustain the current energy and effort put in by the community. The view among landcare groups is similar. Key informant 12 stated that in order for effective pest eradication to be undertaken by community groups, communities have to be on board, and in order to establish community groups there has to be a genuine interest and concern.

Engaging the community and fostering a sense of ownership of the kiwi was deemed essential to its conservation. In order to engage the community and foster support for kiwi conservation through appropriate management of dogs, it was deemed important to show people *“their own kiwi so they have ownership of the kiwi”* (key informant 12 - landcare group). This idea of ownership was also raised by a representative from the New Zealand Landcare Trust who stated *“you can tell people to look after kiwi but they are not going to do it unless they really want to”* (key informant 10).

In order to engage the *“hearts and minds”* of those working directly to protect kiwi and to further facilitate interest among the general public, individual kiwi monitored by transmitter are given names (key informant 10 - New Zealand Landcare Trust). Two of the three landcare groups interviewed for this study monitor a number of birds using transmitters and have given names to these birds. The Department of Conservation also name birds carrying transmitters and actively seek opportunities to increase public engagement about issues regarding threats to kiwi (key informant 7 - Department of Conservation).

7.3.12 View on the Future of Kiwi in Northland

Of the 12 key informants who provided a comment on the future of kiwi in northland, six believed the future of the species was positive in some areas, three indicated the future of kiwi to be good, ‘encouraging’ or ‘positive’, one viewed their future as “secure”, one believed their future is dependent on the economic wellbeing of the region citing *“you*

can't be green if you are in the red" (key informant 3 - local authority), and one was not sure (Table 13).

Table 13. Key informant view on the future of kiwi in Northland

Response	Landcare Group	Kiwi Agency	Land Owner	Local Authority	DOC	NZ Landcare Trust	Total
Positive in patches	**	**	*	*			6
Good / secure	*			*	*	*	4
Not sure				*			1
Contingent on economic wellbeing				*			1

Key: * indicates a positive response from one key informant

Key informants who believed the future of kiwi is positive in some areas indicated that unmanaged populations are likely to continue to decline while those which are managed will be secure. Where key threats are managed through dog control and trapping "*kiwi call counts have just gone up and up and up*" (key informant 12 - local authority). Strikingly similar responses were recorded by representatives from multiple stakeholders including that "*in patches it is looking the best it has ever done*" (key informant 1 - local authority) and "*in managed areas the future is better than ever*" (key informant - 14 landcare group).

Key informants shared a view that throughout Northland there would be "*winners and losers*" (key informant 1 - local authority), or "*haves and the have nots*" (key informant 12 - landcare group), and that realistically kiwi can not be everywhere in Northland. Continued management necessary to secure populations (key informant 13 – landcare group), and that inevitably, the management of pockets of wildlife will not be enough to sustain the species in the long term as once management stops, gains established over many years quickly disappear (key informant 10 and 14 representing the New Zealand Landcare Trust and a landcare group).

The differences in conservation efforts throughout Northland was also noted and could potentially influence the long term survival of kiwi populations throughout Northland. The successes and gains on the western side of the region have been noted to be far less than on the eastern side where there is more money (key informant 9 - kiwi agency). In western Northland there are large tracts of Department of Conservation and Maori land while in the east there are more private land owners, more development and more human and financial resources. Areas in which community groups are particularly engaged and where

predator control is well funded tend to be the more affluent areas such as Whangarei Heads and the Bay of Islands (key informant 1 - local authority). It is believed that “*to some extent conservation is an upper middle class luxury in a lot of areas in northland*” (key informant 9 - kiwi agency). A lack of Maori projects in Northland was also noted, influencing the disparity in total conservation effort between Northland’s east and west.

7.4 CONCLUSION

The results from the key informant interviews supplement and add to data sourced from the literature. These results provide an insight into the current threats to kiwi and current workings and limitations of the conservation framework which is in place to protect the Northland population of North Island brown kiwi. The potential for statutory planning frameworks to play a greater role in the conservation of kiwi is outlined as is the importance of community action and conservation work based from the ground up. The implementation of rules into the District Plan which outline dog and pet free conditions and conditions to undertake pest management within rural subdivisions have been identified as a potential avenue for more effective conservation of kiwi as such action would enable landscape scale protection for kiwi to be implemented.

8 DISCUSSION

8.1 INTRODUCTION

This chapter provides a discussion of the research findings presented in chapters 5, 6 and 7, and identifies the implications of the findings in relation to the research objectives. The objectives of the study, previously outlined within chapter 1 were to

1. Investigate the potential for landscape scale conservation for the kiwi.
2. Identify ways in which the key issues and objectives of the national Kiwi Recovery Plan and the Taxon Plan for the Northland Brown Kiwi can be incorporated into and supported by the formal planning framework in Northland.
3. Develop and provide recommendations which can be adopted by other regional and district councils to develop integrated conservation strategies to enhance the conservation value of both reserved and private land.

The chapter also provides links to conservation theory established in the literature and outlined in the chapter 2. The results of this study indicate that Northland, like much of New Zealand, has been subject to massive ecological change similar to that experienced throughout the world. Early conservation mechanisms implemented in New Zealand have also been subject to many of the same limitations as those overseas. The implication of the vast and devastating ecological change throughout Northland on the Northland population of North Island brown kiwi has been significant. However, due to broad habitat requirements, and with the management of key threats, kiwi populations have the potential to recover and re-establish throughout Northland on both reserved land and within production landscapes. The chapter concludes with a discussion of the disparities and similarities between the research findings and the literature with regard to the ecological landscape required to support kiwi populations at a landscape level.

8.2 OBJECTIVE 1

Investigate the potential for landscape scale conservation for the kiwi in Northland

Conserving biodiversity within small, isolated pockets of protected land does not provide for, or facilitate the long term survival of species. Conservation strategies which incorporate conservation goals into the working of the wider landscape have a higher chance of providing the necessary protection required for the long term conservation of species.

In order to investigate the potential for landscape scale conservation of kiwi in Northland, it was necessary to identify the key threats to the Northland brown kiwi, assess the current state of kiwi conservation throughout both the Far North and Whangarei districts and assess the potential for kiwi corridors to link isolated populations. A discussion regarding the type of corridor which would be required to connect kiwi populations and problems associated with the implementation of such corridors are provided in the sections below.

8.2.1 Key Threats to Kiwi in Northland

Data collated through a review of the literature and key informant interviews determined dogs to be the key threat to kiwi in Northland. Kiwi at all life stages are susceptible to dogs. Kiwi have a strong, distinctive smell, are easily caught and are susceptible to extensive internal damage caused by crushing injuries due to poorly developed wing and chest muscles and the absence of a sternum (Pierce, *et al.*, 2006).

In Northland, the majority of kiwi are found on private land due to historically high levels of hunting activity within the conservation estate. Thankfully, today the adverse impacts of hunting dogs on kiwi within the conservation estate have reduced due to increased awareness of the potential damage caused by dogs, and an ongoing drive to educate both dogs and owners.

Kiwi aversion training for dogs was developed in the Coromandel primarily for hunting dogs but has since been used on working dogs and pets throughout Northland. Although the training is not 100% effective and the limitations of the training are acknowledged, the New Zealand Kiwi foundation, BNZ Save the Kiwi Trust and the Department of Conservation support aversion training due to the unique opportunity it provides to

establish relationships with dog owners, increase knowledge and understanding of the threats posed by dogs. This interaction and flow of information between conservation experts and dog owners is important as the impacts and devastation caused by wandering dogs are often difficult to detect, and in order to minimise the impact of dogs on kiwi populations, dog owners must be aware of the threat posed by dogs and ensure their dogs are contained.

Second to dogs, stoats are the next most significant threat to kiwi. Stoats primarily attack chicks which weigh less than 1200g and can have a devastating impact on the recruitment rate of a population. In order for kiwi populations to increase, a minimum of 6.1% of eggs produced are required to develop into adults. In the absence of predator control only 3% of eggs reach adulthood resulting in an overall average annual decline of 4% (Robertson, 2005a; Robertson 2005b). Cats, ferrets, weasels, pigs and possums are also identified threats to kiwi, and people too pose a threat with numerous kiwi killed on roads and drowned in ponds and pools.

Following trends found throughout the world, habitat loss has had a devastating impact on kiwi populations throughout New Zealand and Northland. Interestingly however, habitat loss is generally no longer viewed as a significant threat to kiwi. Although large scale clearance of native vegetation and other devastating activities were common in the past, changes in policy at a national, regional and district level now act to preserve much of Northland's remaining habitat, and few applications for large clearances are received by the Far North and Whangarei District Councils.

Today, unlike many other regions throughout New Zealand, Northland has retained a significant proportion of forest cover and indigenous vegetation which is deemed sufficient to provide for the habitat needs of kiwi and facilitate movement between populations. Prior research also indicates kiwi are able to inhabit a range of vegetation including commercial forests and exotic scrub. Unlike other endemic and endangered bird species in New Zealand, kiwi are able to live in the vicinity of, and within, production landscapes. As kiwi are flexible in the habitat they can inhabit, and with an abundance of vegetation remaining throughout Northland, habitat is not seen to be a limiting factor.

8.2.2 Population Size and Area Required for the Long Term Conservation of Kiwi

International literature suggests that in order to maintain a high level of genetic diversity and to avoid issues associated with inbreeding depression, vertebrate species require a minimum population of 500-1000 effective or breeding individuals (Smith and Smith, 2009; Townsend, 2008). McLennan, Rudge and Potter (1987) stated the minimum viable population required in order to support the long term viability of North Island brown kiwi to also be between 500 and 1000 breeding individuals.

The area requirement of the Northland population of North Island brown kiwi is currently not well understood. A study undertaken on brown kiwi in Hawke's Bay indicated between 7,500 and 15,000 ha of suitable habitat would be required to accommodate the necessary number of breeding individuals to ensure the long term viability of kiwi populations. Population densities of Northland brown kiwi, however, have been recorded at up to 10 times greater than those in Hawke's Bay at one kiwi per 2.5 ha (Potter, 1990). Provided all components of a forest ecosystem are sufficiently managed, 1,000 to 2,500 ha is thought to be adequate to support 500 breeding pairs (Pierce *et al.*, 2006), however, further research into the true carrying capacity of populations of Northland brown kiwi is required.

Assuming that 1,000 to 2,500 ha is the minimum dynamic area required in order to fulfil the requirements of the minimum viable population, the provision of this habitat alone will not ensure the survival of kiwi populations. This point is illustrated by the abundance of suitable habitat in areas of Kaipara and western Northland where kiwi are either extinct or exist in small, dispersed populations. If the Draft Taxon Plan for the Northland Brown Kiwi goal to halt the overall decline of Northland brown kiwi and the objective to restore Northland brown kiwi population within their former range is to be realised, kiwi must also be protected from key threats through effective dog control and predator management within areas exceeding 1000 ha. The limitations of protecting small areas, outlined within the literature and summarised in chapter 3, must be acknowledged. Key informants interviewed in this study expressed concern that with increased interest from the public and communities to protect and manage areas of private land, funding could be diverted away from larger projects which, which according to conservation theory, have a higher conservation potential for the long term conservation of species.

8.2.3 Corridors to Connect Kiwi Populations

Ecological theory suggests that small isolated populations have a higher risk of extinction while those which are larger, and have greater connectivity to neighbouring populations are more likely to remain viable in the long term (MacArthur and Wilson, 1963; 1967). This is the case for populations of North Island brown kiwi in Northland. Northland brown kiwi are primarily found within 25 population clusters throughout the Far North and Whangarei districts. While many of these population clusters are within the dispersal range of chicks, which can disperse over 20 km before establishing their own territory, the need for corridors on both local scale within populations and on a wider regional scale to connect populations and enhance gene flow is identified (Pierce et al., 2006). These potential kiwi corridors are indicated in Figure 3 (chapter 5).

This research suggests that contrary to findings within international literature, the creation of kiwi corridors on both local and regional scales would not require the creation or protection of additional habitat. Instead, kiwi require corridors of protection where key threats are managed or removed. Controlling dogs throughout high density kiwi areas and in potential corridors would enable the safe passage of kiwi throughout the landscape. The control of dogs alone, however, would not mitigate the threat posed to dispersing chicks. In order to facilitate and provide for the safe dispersal of chicks over long distances, stoats must be managed or controlled. At present, stoats are primarily managed through trapping, a method which is both labour intensive and time consuming, particularly within steep, inaccessible terrain. There is therefore, a need to develop wide scale pest control which is both cheap and user friendly. At present the only tool available for wide scale pest control is the dispersal of 1080 pellets by helicopter. This method can be particularly useful in inaccessible areas where trapping is not practical. The use of 1080 in Northland, however, is currently socially unacceptable. In order to protect kiwi, and biodiversity in general on a landscape scale, further research into landscape scale pest control is required.

The potential for exotic forests to provide both habitat and corridors for kiwi was identified within the key informant interviews. The BNZ Save the Kiwi Trust is deliberately targeting key forestry companies throughout Northland to control dogs and actively manage kiwi during harvesting activities. Large tracts of exotic forests are situated between a number of high density kiwi areas, and if properly managed for kiwi,

could provide a unique opportunity to facilitate the conservation of the species while retaining the commercial value of the land.

8.2.4 Funding for Landscape Scale Pest Control

The need for, and benefit of, landscape scale pest control has been widely acknowledged. Typically in the past, funding would be granted to single, site specific projects, however, increasingly the Northland Regional council is looking at providing funding for pest management projects which are implemented on a wider landscape scale. The recent funding granted for the undertaking of pest management on over 8,000 ha of land at Whangarei Heads is a testament to this change in mindset. The provision of funding for landscape scale application of integrated predator control within high density kiwi areas could provide the necessary protection required to stabilise remaining populations of kiwi.

At present the Northland Regional Council focuses the provision of funds to where communities are engaged with conservation and where community action is proven to achieve good results. Creating widespread community engagement where all land owners support such action can be difficult due to differing values and priorities of landowners. Building good relationships and fostering a community desire for pest control can take a long time to develop and cannot be easily created through top down planning mechanisms. Where there is community support to undertake pest control a major limitation for long term protection is the reliance on individuals to coordinate recovery efforts and to continuously source funding to continue current practices. Funding is primarily provided on a short term basis of less than three years, and many funders primarily act as seed funders to help establish new projects but do not provide ongoing support for established landcare groups. In order to maintain predator control in the long term, community groups are required to source funding from other avenues. This can prove to be challenging for an ever increasing number of communities wanting to undertake biodiversity protection of private land. Additional issues regarding funding experienced by landcare groups undertaking pest control on private land include the restriction in the number of funders who support conservation work on public land. If landcare and community groups could be provided with constant support and secured funding over a long period of time it is more likely communities will remain engaged with protection work for kiwi and biodiversity in general.

Projects such as the ‘Whole of Northland Project’ have investigated the potential for a pest-free Northland and the need to apply landscape scale integrated predator control targeting mustelids and cats, at the sites of greatest potential gain is also acknowledged within Action Point 7.1 of the Draft Taxon Plan for the Northland Brown Kiwi. Targeting funding to where there is a high density of kiwi, and to where communities are engaged with and passionate about kiwi conservation and biodiversity protection is necessary as funding sources are limited. Concentrating primarily on sites where the greatest potential gain can be attained can provide a base from which wider pest management and conservation work can develop.

It is also important to note that the removal of too many higher predators such as stoats could increase the number of rats and other prey species. Although prey species such as rats do not pose as a significant threat to kiwi they can have a devastating impact on other threatened native species. It is therefore, recommended that where stoats are controlled, integrated pest management is undertaken in order to increase the conservation potential of the whole landscape. Additionally, for pest control to be effective at a landscape scale, all landowners need to be on board and working towards a common goal. As indicated through this research, unmanaged lots next to or surrounded by managed areas act as a source of continual pest re-invasion which reduce the overall effectiveness of the implemented pest management and require additional resources to mitigate.

Investigations into the potential for the erection of predator free fences surrounding managed areas on peninsulas have been undertaken, however such fences are expensive to establish and maintain and effectively isolate kiwi populations. In order to facilitate the long term and widespread survival of kiwi providing a level of protection over large areas which allows for kiwi populations to stabilise and recover may be a better approach.

In order to address the threat posed by dogs, continued advocacy and education is required, and ultimately the integration of pest and dog control into the formal planning framework though the inclusion of rules within district plans would further enable landscape scale protection for kiwi to be realised. In order to implement the actions required to create corridors of protection and facilitate the conservation of kiwi throughout Northland on a landscape scale, community support within key corridor areas is required.

8.2.5 Importance of Community Support for Conservation

The importance of community support for conservation action cannot be understated as more work is undertaken for kiwi on private land than within the conservation estate. In Northland, conservation for kiwi is largely from the ground up. Representatives from local authorities and landcare groups believed it is important for councils to support such efforts and not get in the way of progress made through more informal processes by implementing too many statutory regulations regarding land use. Community support could, however, be supported by statutory planning tools which provide for the protection of kiwi but do not interfere with, or impose unreasonable restrictions or expectations on landowners, especially in areas where kiwi conservation is not a top priority.

8.2.6 Potential for Conservation within Production Landscapes

As previously discussed, commercial forests have the potential to derive value from the land while facilitating the protection and conservation of kiwi. Unlike many other forest species, kiwi are able to live within exotic forest and scrub. Although forestry activity and harvesting have the potential to kill kiwi, the impact of harvesting is much less than that imposed by pest species. Guidelines enabling harvesting practices which reduce the risk to kiwi are being developed and forestry companies are being educated about the potential actions which can be undertaken which would provide added protection for kiwi while still allowing for commercial harvesting activity.

In addition to exotic forests, kiwi are able to move over and even nest within pastoral landscapes. Provided kiwi are protected from predation by dogs and chicks are protected from stoats, kiwi are able to survive within pastoral farmland which contain areas of scrub or regenerating forest which provide a degree of shelter.

These examples show that unlike other endangered forest species, kiwi primarily require protection from dogs and stoats in order for populations to stabilise and recover within production landscapes. Conservation of kiwi does not require any significant changes in land use, farmers can still farm and exotic forests can still be harvested. What is required is the will and the drive to implement rules within statutory plans to enhance the protection of kiwi within core areas so eventually, kiwi populations can recover and, provided landscape scale predator control can be developed which is both cheap and easy to do, kiwi will return to much of their historic range.

8.3 OBJECTIVE 2

Identify ways in which the key issues and objectives of the national Kiwi Recovery Plan and the Taxon Plan for the Northland Brown Kiwi can be incorporated into and supported by the formal planning framework in Northland.

Decisions regarding land use allocation and development are primarily made at the district level (Stokes, *et al.*, 2010). Pierce *et al.* (2005) and Pres, Doak, and Steinberg (1996) state the incorporation of conservation goals into local government policy has the potential to significantly strengthen the protection of endangered species and greatly enhance the implementation of conservation goals.

New Zealand's planning framework currently provides for the physical protection of significant habitat of indigenous fauna from adverse affects resulting from the development and use of land. District Plans are largely shaped by policies held within the regional plan although the specific values deemed important by the people within each district can also influence the policy direction of District Plans.

The implementation of select conservation goals of the Taxon Plan for Northland Brown Kiwi into the Far North and Whangarei District Plans have the potential to increase the conservation potential of landscapes throughout Northland and provide for the greater protection of kiwi populations throughout the region. Clearly all of the goals and objectives of conservation plans cannot be incorporated into statutory plans, however, key themes or goals which are appropriate and can realistically be addressed by, and implemented into statutory plans, have the potential to influence meaningful changes in land use activity and to enhance biodiversity conservation.

The Draft Taxon Plan for the North Island Brown Kiwi identifies the role of statutory authorities for the conservation of kiwi in Northland. The plan also identifies a range of issues regarding the impact of development and human activity on kiwi. The plan establishes eight action points which aim to rectify these issues (see section 6.7.4.3 within chapter 6). Provided these action points are implemented, the ability of statutory planning to facilitate and support conservation for kiwi would be enhanced. The sections below

contain further discussion regarding the implementation of key action points outlined by the taxon plan.

8.3.1 Implementation of Dog and Pet Free Subdivisions as a Rule in High Density Kiwi Areas

The Taxon Plan contains two action points which have regard to the development and monitoring of consent conditions which would benefit kiwi populations, action point 16.5 to advocate and provide for consent conditions that protect kiwi habitat, and establish cat and dog free zones in subdivisions within high-density kiwi areas and action point 16.4 to encourage council monitoring of consent conditions when relevant to kiwi.

In order for District Councils to consistently implement consent conditions relevant to kiwi and establish cat and dog free subdivisions within high-density kiwi areas, councils must first be aware of the key threats to kiwi and the areas in which high-density populations are situated. Action point 16.3 outlines the need to develop and deliver and update kiwi advocacy material for statutory authorities. The development of such resources is currently undertaken by the BNZ Save the Kiwi Trust and numerous resources have already been produced which are freely available through the BNZ Save the Kiwi website. The establishment of the Northland Kiwi Forum and Working Group has also increased the level of integration and flow of information between kiwi conservationists and local authorities and in the future this vector could increase the level of knowledge within both Regional and District Councils.

Although conditions for dog and pet free subdivisions have been imposed by both the Far North and Whangarei District Councils, at present such conditions are implemented by consent planners or volunteered by developers in the absence of a rule directing the imposition of such conditions. The current Far North District Plan contains policy 12.2.4.10 which acts to protect areas of significant fauna by ensuring dogs (excluding working dogs), cats, possums, rats, mustelids or other pest species are not introduced into areas which contain population of kiwi, dotterel and brown teal, and where these species are established their removal is promoted. Policy 12.2.4.11 provides for the Council to impose conditions to protect both kiwi and kiwi habitat when considering resource consent applications in areas identified as known high density kiwi habitat. The current Whangarei District Plan contains policy 17.4.5C which recognises dogs, cats and mustelids as significant threats to kiwi.

The implementation of a rule or rules within District Plans which outline and require the implementation of no dog or no pet conditions on rural subdivisions within high-density kiwi areas could provide greater guidance to consent planners within council. They would also minimise disparities between consent decisions and the lack of consistency in the implementation of conditions due to a turnover in staff and lack of knowledge of kiwi issues within different areas and enable councils to implement consent conditions with a greater consistency. The implementation of such rules would provide the legislative backing needed for the blanket implementation of such conditions for all rural subdivisions in high-density kiwi areas and therefore significantly reduce the key threat to kiwi populations.

At present both the Far North and Whangarei District Councils hold kiwi distribution maps which identify high-density kiwi areas. Although these maps need to be regularly updated, they can serve as a tool which could help the implementation of District Plan rules with regard to the development of rural subdivisions and the ownership of dogs and pets within these developments when located in high density kiwi areas. The implementation of a kiwi overlay area based on up-to-date kiwi distribution maps could provide the legislative backing needed for consent planners to consistently impose such conditions where the benefit would be greatest to kiwi while avoiding unnecessary impact on communities where kiwi are not found. The potential for such an overlay was identified by planners from both the Far North District Council and the Whangarei District Council.

The physical identification of high-density kiwi areas in which rural subdivision developments would be subject to no dog or no pet conditions within planning maps would allow for the implementation of such conditions where they are likely to have the greatest impact for kiwi populations. The benefit of imposing pet free conditions on subdivisions where there are no kiwi is minimal and therefore the imposition of such conditions should be focused to where kiwi are concentrated and where the implementation of the conditions are likely to be of the greatest benefit to kiwi.

8.3.2 Limitations of Implementing a Rule for No dog and No Pet Subdivisions in High Density Kiwi Areas

Issues surrounding the identification of high density kiwi areas and the potential for a rule relating to development in such areas were noted by a range of key informants interviewed in this study including planners from both the Far North and Whangarei District Council

and representatives from landcare groups. It was noted that land owners often do not like having their land subject to additional regulation and that the imposition of policies and rules can in fact create barriers for conservation.

Arguments raised by developers in opposition to the imposition of no dog conditions on rural subdivisions in Northland are based on the potential for such conditions to decrease the value of the subdivided properties make them harder to sell. This finding was in line with that of the literature which suggests the imposition of conservation strategies can be resented by landowners as they can be viewed as restricting land use and lowering the value of land (Jansujwicz and Calhoun, 2010). Such arguments were, however, debated by those involved in kiwi conservation who argued that the value gained from having kiwi on site or being able to hear kiwi compared to the loss associated with not being able to own a dog has not been quantified. Additionally, there are many areas throughout Northland where kiwi populations are not concentrated and where dog free conditions would not be necessary to protect kiwi.

In order to avoid issues resulting from disgruntled landowners having their properties identified as a high-density kiwi areas and subject to the imposition of such conditions should the property be subdivided, the Whangarei District Council proposed the use of ‘fuzzy boundaries’ surrounding high-density kiwi areas.

At present, kiwi aversion training for dogs is not adequate or effective enough to warrant an exclusion or exception within dog free subdivisions and as such, kiwi agencies are reluctant to see kiwi aversion training incorporated into statutory plans in such a manner. The requirement for dog free fences surrounding subdivisions are also deemed inappropriate as the implementation of such fences would be expensive and difficult and expensive to maintain in the long term. The best outcome resulting from the development of rural subdivisions in high density kiwi areas is no dog conditions.

8.3.3 Incorporation of Kiwi Aversion Training and Dog Registration

Although kiwi aversion training should not be incorporated into statutory plans as an exception to allow dogs within no dog subdivisions, the potential for the training to be linked into the registry system was proposed by representatives from kiwi agencies and landcare groups. It was proposed that although not all dogs which undertake kiwi aversion are registered, benefits could arise through the provision of discounted registration fees for

dogs currently undergoing aversion training, and could provide a means for continued training and assessment of dogs which have already undertaken training. Limitations of linking aversion training and registration too closely however, were noted and representatives from both landcare groups and kiwi agencies said that for kiwi, providing all dogs and owners with access to training and information is more important than whether the dogs are registered or not, and requiring dogs to be registered to undertake the training could be detrimental to its successes.

8.3.4 Incentives for Integrated Predator Control on Rural Subdivisions

The potential benefit from implementing conditions requiring integrated pest control on rural subdivisions has the potential to benefit kiwi and other forms of indigenous flora. At present habitat on private land is being protected on a voluntary basis, however, without adequate predator control, the conservation potential of particularly small tracts of habitat is limited. It was, however, noted by key informants that the implementation of effective integrated pest management is expensive. It was also noted that implementing requirements to undertake integrated pest management for kiwi may not be appropriate or realistic within some areas of Northland particularly in areas with less disposable income and significant social and economic issues. Along the east coast of Northland where land values are generally higher and demand for land is higher, the use of incentives to undertake predator control could be better utilised, particularly within valuable rural subdivisions within high-density kiwi areas. Such incentives could relate to the consent for extra lots provided pest management plans are implemented, or rates relief for properties who voluntarily undertake effective predator and pest management. Such incentives already exist within the District Plans, however, making the incentives more explicit and targeted could increase rate at which they are used.

8.3.5 Monitoring of Consent Conditions

Action point 16.4 of the taxon plan recognises the importance of monitoring consent conditions when relevant to kiwi. As noted by key informants, the implementation of no dog or pet conditions on rural subdivisions in high density kiwi areas is of little value to kiwi unless such conditions are monitored and enforced. This research indicates that district councils are not in a position where they are able to actively monitor every condition implemented. The community, however, is better situated to monitor such conditions and report any breach to the council. The council is then responsible to take

action with regard to the complaint. Limitations associated with such reliance on the community include the potential for members of the public not wanting to step forward or make a complaint against their neighbours. However, there is potential to enhance conservation effort and compliance to conditions by developing an enhanced sense of identity in which kiwi are seen as an integral component of both the place and the community.

8.3.6 Other Roles of Council

At present the response from councils regarding dog control and the response from individual dog control officers is variable. In order to provide the best protection for kiwi, councils need to take an efficient and timely response to such complaints. In order to increase the efficiency of the response it is important for dog control officers to be aware of the potential impact of wandering dogs on kiwi populations. Information and advocacy material provided to the council under action point 16.3 could be extended to focus on the provision of information to dog control officers to enhance their understanding of the importance of their role for the conservation of kiwi.

8.4 OBJECTIVE 3

Develop and provide recommendations which can be adopted within other districts to develop integrated conservation strategies to enhance the conservation value of both reserved and private land

The results of this study are specific to the context of the North Island brown kiwi in Northland. It is recognised that the issues facing other taxa of brown kiwi, other species of kiwi, and other forms of indigenous wildlife may differ from those experienced by the Northland brown kiwi. Nonetheless, the key principals learned from this study can be universally applied.

This study highlights the value of statutory planning to influence land use activities which are beneficial for kiwi, and restrict those which have adverse effects. The findings of this research suggest that where established populations of kiwi exist, pest management and dog control is essential for their long term survival.

At present, both the Far North and Whangarei District Plans contain reference to kiwi. This reference within council policy has aided the implementation of dog and pet free

rural subdivisions in high density kiwi areas. The implementation of a rule outlining a requirement for such conditions would further enable the District Plan to consistently aid the conservation of kiwi throughout private and production lands within high-density kiwi areas at a landscape scale. It could be unreasonable to expect such rules to be implemented within district plans throughout the country where kiwi are not abundant, however, the potential for kiwi to be acknowledged within district plans, perhaps in a similar way to how kiwi are acknowledged within the current District Plans within Northland, would provide a platform for the further development of regulations and rules in the future.

As noted by key informants, the role of District Councils through the District Plan can play a significant role for kiwi conservation. However, it is important for a balance to be met which supports conservation but does not impose undue restriction on land use. Within many districts throughout New Zealand kiwi are all but extinct and the implementation of kiwi specific policy would be of little conservation value. This research, however, indicates the potential for conservation goals relevant to the extant biodiversity to significantly contribute and support conservation goals.

The development of taxa plans similar in detail to that presented within the Draft Taxon Plan for the Northland Brown Kiwi could provide the direction needed to coordinate long term conservation practices. Once key conservation goals have been established, they may be incorporated into the statutory planning framework in such a manner that they contribute to the realisation of conservation goals in a way which facilitates and harbours community interaction and without unnecessarily impeding on the rights of private property owners.

To conclude, this study recommends that in order for the conservation value of entire landscapes to be enhanced, there is a need to:

1. Develop well informed conservation plans which identify key threats, ecology and biology of target species which can guide the implementation of action to mitigate key threats.
2. Incorporate key conservation goals into statutory plans to guide land use activity on private land.

3. Implement policy or rules which facilitate consistent application of consent conditions within key areas to provide a greater conservation potential for the surrounding landscape
4. Be aware of the social implications of implementing policy or rules which are too arduous or restrictive, particularly in areas where the implementation of such policy are unlikely to be enough to produce the results needed for effective conservation.
5. Provide ongoing and secured funding for established landcare groups over longer time frames to provide financial security to continue undertaking pest eradication.
6. Provide ongoing support and flow of information regarding best practice conservation methods.

8.4.1 Conclusion on the significance of the Draft Taxon Plan for the Northland Brown Kiwi

The Draft Taxon Plan for the Northland Brown kiwi is a carefully developed and potentially crucial document which has the potential to significantly improve the prospects for the conservation of kiwi throughout Northland. Clearly the purpose of this study was not to critique the plan itself, rather assess how key goals and objectives can be incorporated into the statutory planning framework to further enhance the support, and provide the legislative backing for the implementation of the plan.

The plan itself identifies the key aspects of conservation ecology identified by the literature including the limitation of small isolated populations and strives to create, or promote the creation of large areas in which key threats to kiwi are managed. Critically, the plan has a strong focus on the development of social interaction and relationships between stakeholders and does not treat conservation of kiwi in isolation of the priorities and activities undertaken by landowners and communities. Clearly the future issues for kiwi in Northland will not be a lack of understanding or a lack of a conservation plan. The issues will likely surround the integration of appropriate goals and objectives of the plan into statutory plans which are able to implement conditions and direct land use in a way which can facilitate good conservation outcomes on a landscape scale.

8.4.2 Conclusion on the role of stator plans for the conservation of kiwi in Northland.

The inclusion of conservation goals outlined by the Draft Taxon Plan for the Northland Brown Kiwi within the statutory planning framework could facilitate effective conservation for kiwi on a landscape scale. It was also noted that of equal importance is a change in the attitude toward conservation. In Northland, community and landcare groups are the drivers behind successful conservation, and if their actions are supplemented and supported by a strong legislative framework, the goals of the Kiwi Recovery Plan and Draft Taxon Plan to halt the decline of kiwi and restore kiwi within their historic range may indeed be realised.

8.5 CONCLUSION

This final section contains the concluding insights obtained through the study, outlines the benefits and limitations of the study and identifies and recommends areas for further research which would enhance the knowledge of kiwi biology and increase the potential to which the formal planning framework can facilitate and support landscape scale conservation of the kiwi in the long term.

8.5.1 Concluding Insights

Unlike many of New Zealand's threatened species, North Island brown kiwi in Northland are not restricted to protected remnants of indigenous forest. The birds are instead widespread throughout both indigenous and exotic habitats and can live both within and in the vicinity of production lands including plantation forest and pastureland.

It is not realistic or viable to have an outlook which focuses purely on conservation for kiwi, or indeed conservation of biodiversity in general. This study does, however, suggest that there is a need to incorporate conservation goals into the planning framework in order to improve the conservation value of the whole landscape and conservation potential of endangered species. Endangered and threatened species are not solely located within protected land and further integration of conservation goals within the planning framework would provide for a consistent and long term approach over private lands throughout functioning ecosystems.

It is also noted that rats, which are not deemed to be a threat to kiwi, are a significant threat to other indigenous species. Conservation work undertaken solely for the benefit of the kiwi such as the trapping of stoats could result in an increase in prey species such as rats which adversely affect other indigenous wildlife and plants. Attaining a sound understanding of ecological theory and ecosystem processes is critical if conservation action is to benefit a wide array of native species and increase the conservation potential of whole landscapes.

Kiwi are versatile and capable of living in and moving through a range of habitat and vegetation types. As such, corridors to facilitate the movement of kiwi on both local and landscape scales do not require the establishment of indigenous vegetation or habitat as required in other countries. Instead, kiwi require corridors of protection where key threats are managed.

Conservation of the kiwi should be more achievable and less costly than conservation of species which require a more targeted or specific habitat. Kiwi are an iconic bird and symbolise our culture and who we are as a nation. The implementation of dog and pet free subdivisions, combined with incentives to undertake integrated management of pests should, in the future, halt the decline of Northland brown kiwi and restore at least some populations within their former land.

It is acknowledged both within the literature and by key informants representing kiwi agencies, landcare groups and by planners within councils that throughout Northland, that kiwi will continue to be lost in some areas. However, where work is being undertaken, the gains could eventually outweigh the costs and when conservation goals are integrated into the formal planning framework and dog control is tightened, the goals identified by the Taxon Plan for the Northland brown kiwi could be realised.

8.5.2 Benefits of the study

This study shows that incorporating selected goals and objectives of the conservation plans for endangered species into the formal planning framework can provide a significant increase in the support and potential for landscape scale conservation of endangered species. The incorporation of key objectives and goals of the Draft Taxon Plan for the Northland Brown Kiwi into rules within the Far North and Whangarei District Plans could provide for the protection from key threats required for kiwi populations to recover and expand throughout both reserved and production lands.

8.5.3 Limitations of the Study

The results of this study are specific to the conservation of the Northland population of North Island Brown Kiwi. The recommendations arising through the research may not be directly applicable within other districts for the conservation of brown kiwi, other species of kiwi, or other forms of biodiversity as the population structure of species, habitat availability, land use and social priorities within districts may differ significantly from that of the North Island brown kiwi in Northland.

8.5.4 Recommendations for Further Research

In order to implement effective landscape scale conservation and implement appropriate policy into the planning framework at the local government level, further research into the true carrying capacity of kiwi populations within Northland is needed to determine the area necessary to protect genetically diverse populations which are protected from major threats including dogs and mustelids. The necessity of this research is identified by the Draft Taxon Plan for the Northland Brown Kiwi.

Additionally, an investigation into the value of kiwi verses the ability to own dogs in high density kiwi areas would facilitate discussion among the public and planners and could raise awareness of issues relating to kiwi conservation and the conservation of biodiversity in Northland in general. Quantifying the value held by the public for kiwi, and the benefit arising from establishing parts of Northland as Kiwi Zones as part of the sense of community identity could further assist the achievement of conservation goals.

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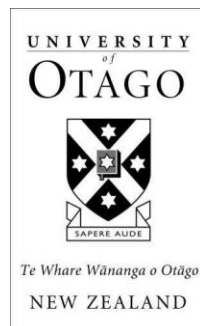
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APPENDIX A: LIST OF KEY INFORMANTS

Key Informant	Organisation	Key Informant Category
1	Northland Regional Council	Local Authority
2	Northland Regional Council	Local Authority
3	Northland Regional Council	Local Authority
4	Whangarei District Council	Local Authority
5	Whangarei District Council	Local Authority
6	Far North District Council	Local Authority
7	Department of Conservation	DOC
8	New Zealand Kiwi Foundation	Kiwi Agency
9	BNZ Save the Kiwi	Kiwi Agency
10	New Zealand Landcare Trust	New Zealand Landcare Trust
11	New Zealand Landcare Trust	New Zealand Landcare Trust
12	Whangarei Heads Landcare Forum	Landcare Group
13	Puketi Forest Trust	Landcare Group
14	Whakaangi Landcare Trust	Landcare Group
15	Whangarei Landowner	Land Owner

APPENDIX B: INFORMATION SHEET FOR PARTICIPANTS

June 2011



CONSERVATION PLANNING FOR THE NORTH ISLAND BROWN KIWI (*APTERYX MANTELLI*)

INFORMATION SHEET FOR PARTICIPANTS

Thank you for showing an interest in this project. Please read this information sheet carefully before deciding whether or not to participate. If you decide to participate I thank you. If you decide not to take part there will be no disadvantage to you and I thank you for considering my request.

This project is being undertaken as part of the requirements for the Masters of Planning programme at the University of Otago. The aim of the study is to determine whether the conservation planning framework currently implemented in Northland promotes the long term viability of populations of North Island brown kiwi (*Apteryx mantelli*) throughout the region. In order to answer this question key informant interviews with individuals actively involved in the conservation of the kiwi in the Far North and Whangarei Districts of Northland will be undertaken.

A range of participants have been sought for interview including private landowners and representatives from landcare groups, representatives from the Department of Conservation and planners from Regional and District Councils. Contact details for each participant were located through various kiwi recovery websites, the Kaitia Kiwi Directory and Guide, council websites and on the recommendation from other participants.

Should you agree to take part in this project, you will be asked to participate in a semi-structured 45 minute interview comprised of a series of open ended questions intended to shed light on the reasons underpinning the continued decline of kiwi populations in Northland and the perceived effectiveness of current conservation strategies. The interview will be audio-taped to allow relevant sections to be replayed to ensure results are accurately interpreted and recorded. Every effort will be made to ensure sufficient information is gathered within the interview, however, it is possible a follow up phone call or email may be required if clarification of a response, for further questioning is required.

Data obtained through the interview will be securely stored on the researchers computer and will only be accessible to the researcher and where required for the purposes of this study, the researchers supervisor. At the end of the project any personal information on which the results of the project do not depend on will be immediately destroyed. Data which the results are depended on will be retained in secure storage for five years, after which it will be destroyed as required by the University's research policy. Personal information collected will include names and identified roles within kiwi recovery.

Due to the nature of this research, it is anticipated that the results will be best presented if anonymity is not preserved within the completed document. Many individuals involved within kiwi recovery and conservation are well known and respected both within the community and the scientific literature, and

therefore results derived from such individuals would be better served if accompanied by their source. Additionally it cannot be guaranteed that the identity of representatives or leaders of community kiwi recovery groups will remain anonymous if the name of the group is given within the final document. On the Consent Form you will be given options regarding your anonymity. If you do not wish to be identified within the final document every effort will be made to ensure your anonymity is preserved. However, with your consent and where appropriate, your contribution may be accompanied by the source. It is absolutely up to you which of these options you prefer.

If at any stage during the interview you become uncomfortable with the questions or want to end the interview you may do so. Additionally, if you decide not to take part in the project, you may do so without any disadvantage to yourself. If after the interview you decide you do not want all or part of the information you provided to be used within the study please contact me and the information will be withdrawn.

If you have any questions about this project or if you would like to view the results of the research please feel free to contact either:

Sabrina Quarente

and/or

Claire Freeman

Department of Geography

Department of Geography

Telephone Number 64 274169199

University Telephone Number 64 3 4798785

Email Address sabby_q@yahoo.com.au

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This study has been approved by the Department stated above. If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (ph 03 479-8256). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.

APPENDIX C: QUESTION LIST

CONSERVATION PLANNING FOR THE NOTH ISLAND BROWN KIWI (*APTERYX MANTELLI*)

QUESTION LIST

10. What role do you play within kiwi conservation/what role(s) have you played in the past?
11. How long have you been involved in kiwi conservation?
12. What do you think are the key issues regarding kiwi conservation on public and private land?
13. What conservation plans are you aware of, do you use them and how effective do you think they are?
14. Is conservation of the kiwi well co-ordinated? Are there clear lines of communication between agencies and stakeholders and are areas of responsibility clearly outlined?
15. Do you think the current conservation framework supports kiwi conservation on a regional scale?
16. Do you think regional scale conservation would benefit the kiwi?
17. What do you think needs to be done to improve support for kiwi conservation?
18. What is your view on the future of kiwi in Northland?

APPENDIX D: PARTICIPANT CONSENT FORM

CONSERVATION PLANNING FOR THE NOTH ISLAND BROWN KIWI (*APTERYX MANTELLI*)

CONSENT FORM FOR PARTICIPANTS

I have read the Information Sheet concerning this project and understand what it is about. All my questions have been answered to my satisfaction. I understand that I am free to request further information at any stage.

I know that:

1. My participation in the project is entirely voluntary;
2. I am free to withdraw from the project at any time without any disadvantage;
3. Personal identifying information and audio-tapes will be destroyed at the conclusion of the project but any raw data on which the results of the project depend will be retained in secure storage for at least five years;
4. This project involves an open-questioning technique. The general line of questioning will focus on personal experiences associated with kiwi conservation in Northland and the effectiveness of current conservation strategies and tools. The precise nature of the questions which will be asked have not been determined in advance, but will depend on the way in which the interview develops and that in the event that the line of questioning develops in such a way that I feel hesitant or uncomfortable I may decline to answer any particular question(s) and/or may withdraw from the project without any disadvantage of any kind.
5. The results of the project may be published and available in the University of Otago Library (Dunedin, New Zealand) but every attempt will be made to preserve my anonymity except where I have given permission for my identity to be published as indicated below (please specify whether your preference by ticking the appropriate box).

I wish my anonymity to be preserved

☐

I consent to have my identity published

☐

I agree to take part in this project.

.....
(Signature of participant)

.....
(Date)

