

**Māori perspectives on Kyoto policy: Interim Results**

**Reducing Greenhouse Gas Emissions from the  
Terrestrial Biosphere (C09X0212)**

**Garth Harmsworth**

## **Māori perspectives on Kyoto policy: Interim Results**

### **Reducing Greenhouse Gas Emissions from the Terrestrial Biosphere (C09X0212)**

Garth Harmsworth

Landcare Research NZ Ltd  
Private Bag 11052  
Palmerston North  
New Zealand

Landcare Research Report: LC0203/084

Discussion paper for policy agencies  
(Climate Change Office, MfE, MAF, TPK)

DATE: February 2003 (updated November 2003)

---

*Reviewed by:*

*Approved for release by:*

Kevin Tate  
Programme leader

Margaret Lawton  
Science Manager

---

**© Landcare Research New Zealand Limited 2003**

No part of this work covered by copyright may be reproduced or copied in any form or by any means (graphic, electronic or mechanical, including photocopying, recording, taping, information retrieval systems, or otherwise) without the written permission of the publisher.

---

## Contents

---

Executive Summary .....	5
1. Introduction .....	7
1.1 Project overview .....	7
1.2 Issues .....	7
2. Māori Land .....	9
2.1 Māori land .....	9
2.2 Māori land governance .....	9
3. Present Research .....	13
3.1 Present research (2 year timeframe) .....	13
3.2 Social-Economic data for Tairāwhiti District .....	13
3.3 Methods .....	14
3.4 GIS analyses and databases .....	14
3.4.1 New Zealand Land Resource Inventory (NZLRI) .....	14
3.4.2 Māori land information database .....	15
3.4.3 Land cover database (LCDB) .....	16
3.4.4 Vegetation Cover database (VCM) .....	16
4. Interim Results .....	17
4.1 Interim results from hui and collaborative research .....	17
4.2 Interim results from GIS analyses .....	19
4.2.1 Māori land in New Zealand .....	19
4.2.2 Māori land in the Tairāwhiti district .....	19
5. Summary .....	21
5.1 Summary .....	21
6. Future Research .....	22
7. Acknowledgements .....	24
8. References .....	25
9. Appendices .....	27
Appendix 9.1: Land Use Capability for Māori Land: Area and % of LUC Class I to VIII .....	27
Appendix 9.2: Māori Land Court Districts: Areas and % of Māori Land .....	27
Appendix 9.3: Total LUC Class for the North Island .....	28
Appendix 9.4: Total LUC Class for the South Island .....	28
Appendix 9.5: Total LUC Class for New Zealand .....	28
Appendix 9.6: Māori land and vegetative cover types for the North Island .....	29
Appendix 9.7: Māori land and vegetative cover types for the South Island .....	29
Appendix 9.8: Māori land and vegetative cover types for New Zealand .....	30
Appendix 9.9: Māori land, vegetative cover types, and LUC Class for New Zealand .....	30

## List of Tables and Figures

Fig. 1 Māori Land Court Districts in New Zealand. ....	12
Fig. 2 Māori land development opportunities under Kyoto policy .....	20
Table 1: Patterns of Māori Land Ownership from 1840 to 1996 .....	9
Table 2: Māori Land for each Māori Land District.....	10
Table 3: Governance structures for Māori Land .....	11



---

## Executive Summary

---

### Project and client

This preliminary report recognises the rapidly developing policies of the New Zealand Climate Change Office, and provides interim results from Objective 6 “Mitigation Processes” in Landcare Research’s FRST programme *Reducing Greenhouse Gas Emissions from the Terrestrial Biosphere* (C09X0212). The report brings together information on Māori land, and some interim and relevant Māori perspectives on Kyoto policy, for discussion among researchers, policy makers, landowners and other interested groups. It also identifies key areas for further FRST research.

### Project rationale

Vegetation grows by absorbing carbon dioxide, a major greenhouse gas, from the atmosphere. As part of this process, the vegetation builds organic matter—including leaves, wood and roots—from the carbon. Policies that encourage afforestation<sup>1</sup> and reforestation<sup>2</sup>, and discourage deforestation could be used as a short-term tool to mitigate greenhouse gas emissions, and hence have a role in climate change policy. Such policies would need to encourage landowners to afforest or reforest, and promote sustainable land-use management strategies. Māori own large tracts of land suitable for afforestation/reforestation: under the Treaty of Waitangi they have indigenous rights over large areas of land, are significant players in the primary industry sector, are represented in a large range of economic development initiatives, and have perspectives and views that must be considered if C mitigation policies are to be effective.

### Objectives

Objective 6 in *Reducing Greenhouse Gas Emissions from the Terrestrial Biosphere* (C09X0212) has two key milestones:

- Māori landowners engaged in dialogue on climate change issues with a specific focus on opportunities for indigenous vegetation restoration/reversion to mitigate CO<sub>2</sub> emissions.
- Pathways for the development of C mitigation projects improved by working with regional learning group(s) including science, policy and management stakeholders (including Māori).

A critical success factor for this objective is: “continued representation and participation by all key stakeholders including Māori”.

### Methods

Our collaborative research approach has included hui, workshops, field discussion, participation, exchange of discussion documents, and been supported by GIS analyses and Māori land information. Most collaboration to date has been with Ngāti Porou landowners and representatives, and with staff from departments such as Te Puni Kōkiri (TPK), Māori Trustees Office (MTO), and Ministry of Agriculture and Forestry (MAF). This has been carried out since November 2001, in the FRST programme *Reducing Greenhouse Gas Emissions from the Terrestrial Biosphere* (C09X0212), and the 2001/2002 Non-Specific Output Funding (NSOF) project *A Framework for Engagement of Māori Landowners in Carbon Farming Using Indigenous Forest Regeneration* (Carswell et al. 2002). These discussion forums, accompanying written documents and hui summaries have provided a Māori perspective on mitigating greenhouse gases, guides to the levels of understanding and interest, Māori comments on development of effective climate policy for carbon sequestration, and other issues of importance to Māori.

## **Results**

As at February 2003, a large number of provisional results have been recorded and collated from hui, discussions, summary documents, and GIS analyses. They include comments, concerns, ideas, and interests, documented in this report to guide research and ongoing climate change policy.

Interim figures on the area and proportion of Māori land that may be eligible for Kyoto forest are given in Interim Results, 4.2, Summary section 5, and the Appendices. While Māori consulted in the Gisborne-East Cape region are supportive of, and interested in options to afforest/reforest land that may be eligible for “C credits”, they are concerned that government policies are not aligning with broader Māori aspirations and objectives.

Interim results already indicate some possible barriers to Māori uptake of permanent forest protection schemes, including: concerns about retention of Māori land ownership and control; costs associated with joining such schemes; existing governance and management structures; costs of rates on ‘developed’ land; long covenant periods; payment schedules and returns; and schemes that limit other possible income sources that may still be compatible with afforestation/reforestation.

---

## 1. Introduction

---

### 1.1 Project overview

This report provides interim results from the programme *Reducing Greenhouse Gas Emissions from the Terrestrial Biosphere* (C09X0212) and brings together for discussion some early and relevant information on Māori perspectives of Kyoto policy.

The work has been carried in Objective 6 “Mitigation Processes”, and targets two key milestones:

- “Māori landowners engaged in dialogue on climate change issues with a specific focus on opportunities for indigenous vegetation restoration/reversion to mitigate CO<sub>2</sub> emissions”.
- “Pathways for the development of C mitigation projects improved by working with regional learning group(s) including science, policy and management stakeholders (including Māori)”.

A critical success factor for this objective is: “continued representation and participation by all key stakeholders including Māori”.

### 1.2 Issues

Vegetation grows by absorbing carbon dioxide—a major greenhouse gas—from the atmosphere. As part of this process the vegetation builds organic matter, including leaves, wood and roots, from the carbon. Policies that encourage afforestation<sup>1</sup> and reforestation<sup>2</sup> (FCCC 2001) and discourage deforestation could be used as short-term tools to mitigate climate change. Such policies would encourage landowners to afforest/reforest, promote and reward regeneration of scrub and forest on marginal land, maintain and increase forest areas, and encourage regeneration of scrub and forest as a land-use option and development opportunity (Figure 2). One policy option being considered is the use of carbon credits in a carbon trading market (Carswell et al. 2002).

Current climate change policies (see Landcare Research draft discussion paper) being developed in New Zealand are likely to require indigenous afforestation schemes to be covenanted against any harvest, in perpetuity, and to propose a “permanent forest sinks mechanism”. Two main policy strands are being developed:

- Permanent non-harvest indigenous reforestation is now close to implementation (likely to receive all or a portion of the total carbon credits for the land)
- Other policies including “projects” are still in the process of development (initial funding rounds are expected to “learn” how this will work)

Between 1 and 2 million hectares of New Zealand marginal land<sup>3</sup> (NZLRI GIS database 2003, Appendix 9.3, 9.4, 9.5) are currently available that could sequester 2–4 million tonnes of carbon per year [MtC/y], approximately equal to 25% of New Zealand’s annual emissions. Large tracts of Māori owned land have been described as ‘undeveloped’<sup>4</sup>; much of this typically marginal (Appendix 9.1; over 600 000 hectares). The creation of indigenous forest sinks offers an important opportunity for Māori to realise their aspirations for improved use of marginal hill country land. However, to date little work has been carried out to quantify the area, type or nature of the land, the present management structure of this land, sustainable development opportunities, and the role Māori land could play in sequestering carbon.

Policy that includes Māori aspirations, cultural values and rights under the Treaty of Waitangi and other New Zealand legislation, will greatly benefit New Zealand and will help achieve Kyoto goals

for the mitigation of greenhouse gases to 1990 levels, or additionally will help New Zealand achieve international carbon credits. Effective policy could also make a major contribution to Māori economic (BER Ltd.& FOMA 1997; TPK 2000) and social development, and achieve additional environmental (e.g., biodiversity and water quality) and cultural (enhance Māori values and customary use) benefits (Figure 2). These policies must reflect inclusivity for Māori, and not alienate Māori from the policy process. Good policy should maximise land-use options for Māori.

---

<sup>1</sup> Afforestation: as agreed in the FCCC/CP/2001/13/Add.1 p. 58 ANNEX Definitions, modalities, rules, and guidelines relating to land use, land-use change and forestry activities under the Kyoto Protocol. “Afforestation” is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources (FCCC 2001).

<sup>2</sup> Reforestation: as agreed in the FCCC/CP/2001/13/Add.1 p58 ANNEX Definitions, modalities, rules, and guidelines relating to land use, land-use change and forestry activities under the Kyoto Protocol. “Reforestation” is the direct human-induced conversion of non-forested land to forested land through planting, seeding and /or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forest land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989 (FCCC 2001).

<sup>3</sup> Marginal land: “land with severe limitations to agricultural use, often steep >26°, typically highly susceptible to erosion, can have moderate to extreme soil limitations. Generally land with a low productive pastoral capacity and least versatility. Not suited to long-term pastoral use. Land suited to a protective vegetative cover and requiring very good environmental management. Most Class VII and VIII land, and some Class VI land (TPK 1998; NZLRI 2002) at more detailed scales > 1:50 000.”

<sup>4</sup> Undeveloped land is usually used to reference land regarded as under utilised, not developed, not in a productive state, usually in unimproved pasture and /or scrublands, and not used to attain its productive potential or productive capacity. Much Māori freehold land, however, is Class 6, 7, and 8 (Appendix 9.1), and may be naturally less productive. Whether land reaches its productive capacity relies on its physical characteristics, development opportunities, and sustainable land management.

---

## 2. Māori Land

---

### 2.1 Māori land

“Māori land” is defined by Te Ture Whenua Māori Act 1993. This definition is used by the Māori Land Court whenever it is required to determine the status of Māori land. The status may be one of the following:

- Māori freehold land: Land that, with very few exceptions, has not been out of Māori ownership. The Māori Land Court determines whether land is Māori freehold land.
- Māori customary land: Land held by Māori in accordance with tikanga Māori. It has not been transferred into freehold title by the Māori Land Court, nor ceded to the Crown. Before 1840, all land was Māori customary land (Table 1). Today, the exact amount is unknown but is believed to be extremely small.
- General land owned by Māori: Land owned by five or more people, where the majority of the owners are Māori.

### 2.2 Māori land governance

Less than 6% of New Zealand’s land mass is now, in 2002 (Table 1, Appendix 9.2, 9.10), classified as Māori land. Revised figures (Landcare Research GIS) indicate Maori land area in New Zealand is now only 821 721 ha, or 3% (Table 1).

**Table 1: Patterns of Māori Land Ownership from 1840 to 1996 (Durie 1998)**

Year	Acres	Hectares
1840	66 400 000	29 880 000
1852	34 000 000	15 300 000
1860	21 400 000	9 630 000
1891	11 079 486	4 985 000
1911	7 137 205	3 211 000
1920	4 787 686	2 154 000
1939	4 028 903	1 813 000
1975	3 000 000	1 350 000
1986	2 626 091	1 181 740
1996	3 743 689	1 515 071
2003 (Landcare Res. GIS)	2 030 508	821 721

Most of this land (95%) is registered under the Māori Land Court, under the Te Ture Whenua Act 1993, and under the old Māori Affairs Act of 1953. The land records and information are administered within NZ Māori Land Court districts (Table 2). Maori Land Court Districts are shown in Figure 1.

**Table 2: Māori Land for each Māori Land District (TPK 1998, Durie 1998, Landcare Research 2003)**

<b>Māori Land District</b>	<b>Total Land Area (ha)</b>	<b>Total Māori land (ha)</b>	<b>Māori Land as % of District</b>
Tai Tokerau	1 592 842	139 873	8
Maniopototo	2 019 874	143 388	7
Waiariki	1 780 502	426 595	23.5
Tairāwhiti	1 075 041	310 631	28
Takitimu	1 780 706	88 608	5
Aotea	1 180 967	334 207	28
Te Wai Pounamu	15 370 489	71 769	0.5
Total NZ	24 800 421	1 515 071	6.1
Total NZ (Landcare Research)	26 730 450	821 721	3.07

Māori land can therefore be regarded as “Māori freehold land” under Te Ture Whenua Act, or Māori land on the “general roll”. The definition of “Māori land” is land still under Māori control and ownership, having a majority shareholding by Māori, or taonga tuku iho land, Māori land passed through generations. The Te Ture Whenua Act replaced the Māori Affairs Act in 1993 and focusses mainly on retaining Māori ownership and control of Māori land. It is based on the Treaty of Waitangi (1840) and recognises that Māori land is taonga tuku iho, an asset inherited from earlier generations (see Table 1). The purpose of the Act is to make sure owners of Māori land keep this land so it may be passed onto future generations. Under the Te Ture Whenua Act, therefore, Māori land is difficult to alienate (Durie 1998). At the same time, provision has been made in the Act to focus on better use of Māori land, and on owners making maximum commercial use of their land.

Among other provisions, there are five main types of Trust:

- Ahu Whenua Trusts: Most common Māori land trust, similar to the section 438 trusts in the old Māori Affairs Act. They are intended to promote and facilitate the use and administration of the land in the interests of the owners;
- Whanau Trusts: Preserve family links to particular land, but without expectation of individual interests or dividends;
- Kaitiaki Trusts: Available for persons who are minors, or under disability and are unable to manage their own affairs and land;
- Whenua Topu Trusts: Tribal trusts. Designed to facilitate the use and administration of land in the interest of iwi or hapū. This type of trust is used for receiving Crown land as part of any Treaty settlement;
- Putea Trusts: Small uneconomic interests pooled for the common benefit without individual dividends.

The number of Māori land blocks and the types of trusts governing these are shown in Table 3.

**Table 3: Governance structures for Māori Land (under Te Ture Whenua Act) for New Zealand (Durie 1998)**

Governance Structure	Number of Land Blocks	% Total Area
Ahu Whenua Trusts (old 438 trusts)	6303	50
Whanau Trusts	108	6
Kaitiaki Trusts	8	0.01
Whenua Topu Trusts	10	2
Putea Trusts	1	0
Incorporations	259	13
Trust Boards	106	4
No Clear Structure	16 405	13
Other	1 129	2
Not Described	1 307	4
Total	25 636	100

The Table indicates Ahu Whenua Trusts are by far the most common type of trust. Te Ture Whenua Act (1993) also encourages the formation of incorporations, where shareholders remain owners, while day-to-day management activities remain in the hands of an elected committee of management or of a Māori Trustee. The Māori Trustee is therefore given either legal responsibility to look after assets and liabilities for the benefit of the owner, or “equitable obligation”—the trustee manages the land on behalf of the Māori landowners. Under the 1993 Act it has become easier for Māori owners to change general land back to Māori freehold land, but some provision to convert Māori land to general land under special circumstances has also been retained.

### **Māori Trustee**

The role of the Māori Trustee is to help manage Māori land. The role has been in existence since 1921 and is now governed by the Māori Trustee Act 1953. The Trustee is independent of the Crown and is accountable to landowners and the Māori Land Court. The Māori Trustee is responsible for:

- acting either as a trustee or agent for owners of Māori land, usually in leasing the land
- collecting and paying rent and other income to owners
- regularly publishing the unclaimed monies list for distribution to organisations
- investing trust monies
- keeping landowners informed about how their land is managed.

The [Māori Trust Offices](#) service the Māori Trustee's clients by collecting and distributing income for landowners.

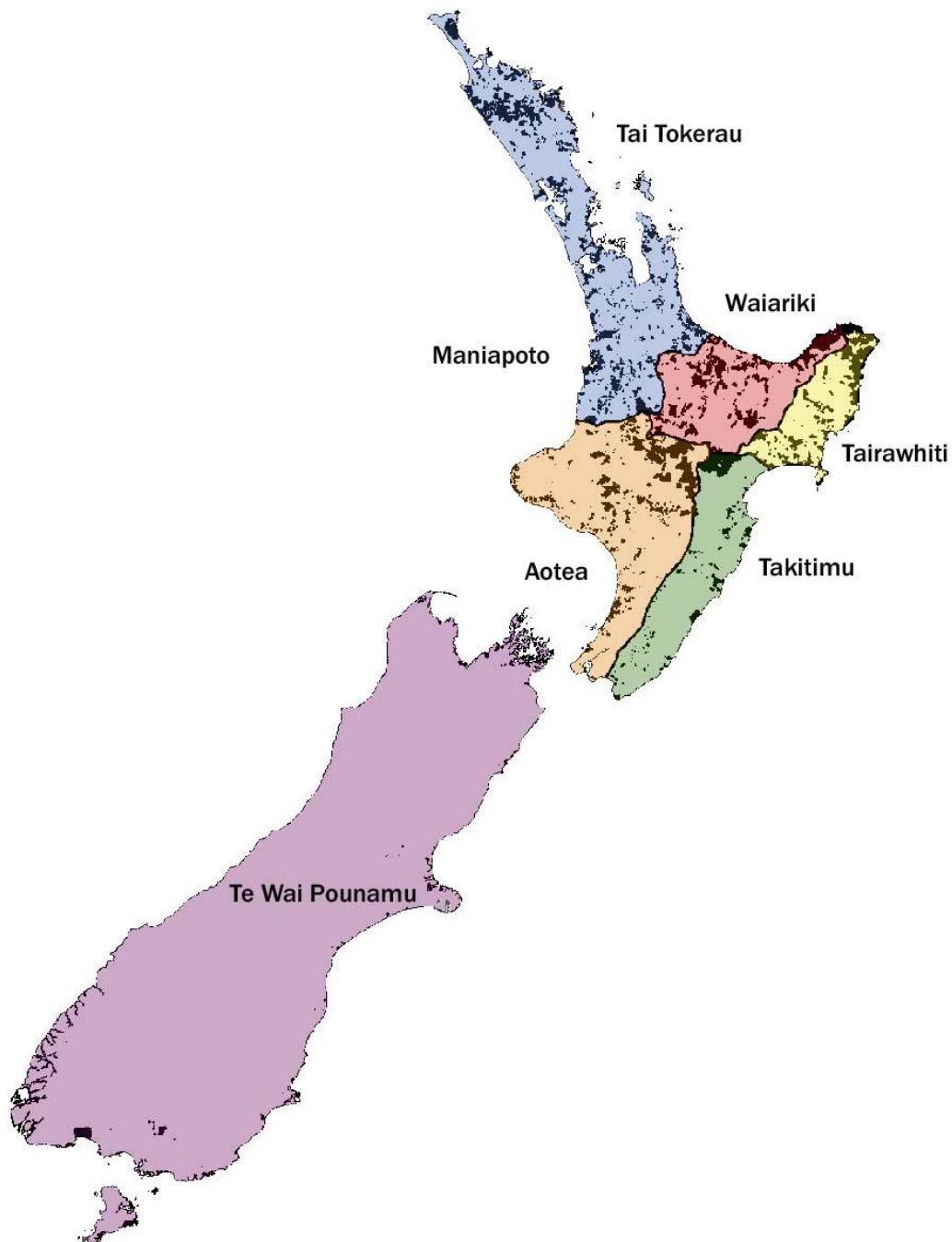
### **Māori Land Court**

The Māori Land Court (Te Kooti Whenua Māori) is the New Zealand court that hears matters relating to Māori land (Table 2, 3). The special bond between Māori people and land is recognised by the Court, and the land records form an invaluable part of the whakapapa for all Māori. The Māori Land Court is the only Māori court of its type, and its operation is unique, as summarised in Parliament's directive to the Court, contained in section 2(2) of Te Ture Whenua Māori Act 1993:

“...it is the intention of Parliament that powers, duties, and discretions conferred by this Act shall be exercised, as far as possible, in a manner that facilitates and promotes the retention, use,

development and control of Māori land as taonga tuku iho by Māori owners, their whanau, their hapū, and their descendants.”

Issues relating to multiple-ownership of land, and the law relating to succession of ownership, mean Māori land transactions can be complex. At the Māori Land Court, these transactions are dealt with in a traditional and culturally appropriate manner. While the [Department for Courts](#) administers the Māori Land Court, the [Minister of Māori Affairs](#) deals with legislative matters.



**Fig. 1 Māori Land Court Districts in New Zealand. Maori freehold land can be seen as the black squares within Māori Land Court Districts**

---

### 3. Present Research

---

#### 3.1 Present research (2-year time frame)

Present research in *Reducing Greenhouse Gas Emissions from the Terrestrial Biosphere* (C09X0212), Objective 6 “Mitigation processes”, provides national data on marginal land, and on Māori land, land type and land cover, along with a regional case study concentrating on work in the Gisborne-East Coast region with Ngāti Porou, a large proportion of whose land is in Tairāwhiti (Gisborne-East Coast Māori Land Court district; Table 2). The research also includes some GIS analyses and interpretation of Māori owned land in this region. Total Māori land area in the Tairāwhiti district is 310 631 hectares (Appendix 9.2), with large areas of Māori owned land being undeveloped, steep and erosion prone. Current best estimates indicate that at least 60% of the Māori Land in the District is ‘undeveloped’ or ‘marginal’, under mainly scrub, native forest, and unimproved pasture, and a large proportion may be eligible as Kyoto forest for future carbon trading.

Using the Gisborne-East Coast as a case study and regional learning group, researchers are discussing climate change issues with Māori landowners and other agency representatives. Hui to date have focussed specifically on understanding greenhouse gases research, climate change issues, and opportunities for indigenous vegetation restoration/reversion to mitigate CO<sub>2</sub> emissions. The work with Ngāti Porou and Government Māori representatives (TPK, Māori Trustee, MAF, MfE) is providing information both to develop effective policy and carbon mitigation projects, and to improve the working relationship between science, policy and management stakeholders. Critical to the success of this work is “continued representation and participation by all key stakeholders including Māori”.

This research provides interim quantification of Māori land areas, current land cover, type of land, and of the amount of marginal Māori owned land (Appendices) that could be used for sequestering carbon through afforestation/reforestation schemes. This research identifies some barriers to these proposed schemes if policy is not developed appropriately in conjunction with Māori.

#### 3.2 Background: Socio-economic data for Tairāwhiti District

Socio-economic statistics for the Gisborne District (Ministry of Māori Development 2002) provide useful background information for the Tairāwhiti Māori Land Court District. Ngāti Porou is one of the largest iwi represented in the District, accounting for almost 50% of iwi affiliation in the Gisborne region. Many live outside of the region.

A multitude of Māori organisations at different hierarchical levels serve the interests of Ngāti Porou and people from other iwi in areas, including land development, health, social services, corporate services, education, tourism, forestry, pastoral farming, environment, commercial ventures, fisheries and politics. These organisations include Rūnanga (iwi and hapū councils and boards, incorporated societies), Whare Wānanga (learning institutes), land incorporations, trust boards, Māori companies, marae committees, etc. Ngāti Porou, like other iwi, is made up of many hapū and marae communities, and many are owners of Māori land, and belong to Māori land trusts. The owners of Māori land blocks are often engaged in activities such as pastoral farming, forestry, tourism, and other commercial ventures, or may be owners of land that is regarded as undeveloped and may still be in scrub or native forest. Many of these activities on land, and in areas such as fisheries, are planned and coordinated by trust boards, incorporated societies, Rūnanga, or hapū committees.

Gisborne region data show 42% of the region is Māori (of which a large part is affiliated to Ngāti Porou). The region's average unemployment rate is 21%, although this is much higher in localised rural areas such as Tokomaru, Ruatoria and Te Araroa in the north of the region.

Personal income in the region is very low: annual median income for Māori is \$10,900, with 40% of Māori 15 years and over earning between \$5,001 and \$15,000. Only 3% of Māori in the region earn more than \$40,000 per annum. Less than half the Māori in the Gisborne region own their own homes. Around 37% of Māori in the region leave school with no qualifications, the highest rate in New Zealand. Over half of Māori in the region had no formal qualifications.

### 3.3 Methods

To date, a number of hui and workshops have been held with Ngāti Porou landowners, particularly those with land in the north of the region near Ruatoria. Case studies of local landowners provide a typical Māori perspective of land ownership issues. Māori policy staff have been contacted about participation in the present research, from the following Government departments: Te Puni Kōkiri (Gisborne), Te Puni Kōkiri (Wellington), Māori Trustee Office (Māori Land Court, Gisborne), Ministry for the Environment (MfE), Department of Conservation (DOC), Nga Whenua Rahui, Wellington (DOC), and Ministry of Agriculture and Forestry (MAF), and many have been involved in previous climate change hui (NZCCP 2001a,b; MAF 2002).

The present research is being used to gather information on Māori perspectives for mitigating greenhouse gases, as a guide to levels of understanding and interest, and to document Māori issues and statements on the development of effective climate policy for carbon sequestration.

All hui are being supported by information from GIS analyses and interpretation, using environmental and Māori land information datasets. Some of the datasets used to provide information on Māori land are described below.

### 3.4 GIS analyses and databases

#### 3.4.1 New Zealand Land Resource Inventory (NZLRI)

The New Zealand Land Resource Inventory (NWASCO 1975–1979; NZLRI GIS database 2003) is a spatial land resource database with nationwide coverage at a uniform scale of 1:50 000 (Jessen et al. 1999; Jessen 2001). The database is an integral part of regional and district policy/plan development in New Zealand, underpins sustainable land management planning, and is a central source of land resource information. The database is made up of over 100 000 land management polygons (map units) delineated primarily on the basis of landform. Information for the NZLRI database has been acquired through field assessment, aerial photograph interpretation, existing land resource information, land management information, field knowledge, land use history, base maps, and field and office mapping and checking. All mapping has been carried out within regional areas to boundaries and there are 12 NZLRI regions. The NZLRI comprises two core sets of information:

- An inventory of classified data describing five physical factors (rock type, soil unit, slope angle, erosion type and degree, and vegetative cover)
- A Land Use Capability (LUC) assessment for each map unit.

Resource information in each map unit is supplemented by information on grazing and forestry, productivity assessments such as stock carrying capacities (top farmer, average, potential), fertiliser application, and a forestry site index.

Each map unit is assessed according to the Land Use Capability classification system. The LUC system is particularly useful for identifying the long-term agricultural potential and sustainable use of land. It is this system, along with erosion and slope information in each NZLRI map unit, that can be used to identify marginal land (i.e. not pastorally sustainable in the long-term) in contrast to land that can sustain long-term pastoral production. The LUC system categorises and ranks land according to its limitations and versatility for agricultural production and sustainable land use. It is a national standardised classification for New Zealand that classifies land into eight main classes, Class I to Class VIII, 1–8. Roman numerals are used on maps as unique identifiers. Land is further classified into LUC sub-classes to show the dominant physical limitation for each LUC Class, and then subdivided further into large regional sets for each LUC class and subclass (Jessen 2001): LUC Class 1 land represents the best, most versatile land in New Zealand with virtually no limitations for agricultural use, while Class 8 (VIII) land is the least versatile land, with severe limitations requiring restricted use, typically landforms such as mountainous terrain, cliffs, gravel floodplains. Classes 1–4 (I–IV) are suited to arable use, while 6–8 (VI–VIII) are suited to pastoral or increasingly forestry or protective use. Class 7 (VII) land has severe limitations for pastoral use and usually is very steep and erosion prone. Class 6 (VI) land is typically stable hill country but some areas of Class 6—at detailed scales—may be unsustainable in pasture, particularly in the Gisborne–East Coast and Northland regions.

The NZLRI for the Gisborne–East region was remapped between 1995 and 1998 as part of the 2<sup>nd</sup> edition NZLRI mapping programme, and provides a comprehensive 1:50 000 land resource database for the region, which includes a detailed single-factor vegetative cover layer using the NZLRI vegetation classification (Jessen et al. 1999).

### 3.4.2 Māori land information database

The Māori Land Information Base (MLIB; Te Puni Kōkiri 1998) was first developed in 1997 and provides a snapshot of Māori freehold land as at August 2000. The data in the MLIB are presently sourced from the Māori Land Court. The Māori Land Information Base (MLIB) is used to locate individual Māori land blocks on a computer-generated map. It contains Māori Land Court information about Māori freehold land that the Māori Land Court, in consultation with Māori, has approved for release on the Internet. This information is overlaid on a digital cadastral database and includes:

- The size of each Māori land block
- An indication of the number of owners
- Topographical information such as roads and rivers, and
- Relevant and appropriate management information, e.g., if an incorporation or trust manages the land, etc.

Fields in the MLIB include: the name of the land block; Māori District ID; Total shares; area; owners; type of trust; whether blocks have been aggregated; whether there is a gazetted Māori reservation on the land block; whether the block has been leased; whether or not there is mortgage on the block.

The Ministry of Māori Development makes a disclaimer on the MLIB and does not warrant the accuracy of the Māori Land Information Base. Information is subject to confirmation from the actual Māori Land Court records. Information obtained from the MLIB is not a legal document but an approximation of summary data. Queries about this data can be directed to: [mlcnationaloffice@courts.govt.nz](mailto:mlcnationaloffice@courts.govt.nz).

### 3.4.3 Land-cover database (LCDB)

The LCDB (MfE 2000) is a national database of land cover derived from visual interpretation of mainly SPOT 2 and SPOT 3 satellite imagery recorded during the New Zealand summer of 1996/97. To date, this survey has achieved national coverage in its first edition. A second edition is currently in preparation, and future editions are planned at 5-year intervals. A minimum map unit size of 1 ha is claimed, with a mapping accuracy of 92%. The survey maps to a classification of 16 classes (10 vegetative and 6 non-vegetative) The following vegetation land cover codes are used: bare ground (can include herbaceous and sparse vegetation from the NZLRI); coastal sands; coastal wetlands; indigenous forest; inland water; inland wetlands; mangrove; mines and dumps (e.g., landfills, quarries); planted forest; primary horticultural; primary pastoral (i.e. dominant pastoral); scrub; tussock; urban; urban open space (e.g., parks, golf courses, open fields) (Appendix 9.6).

The LCDB classification is superficial and uses terms that alternately have connotations of land use (e.g., primarily pastoral) and of land cover (e.g., indigenous forest). The LCDB was compiled to fulfil a local and central government need for general land-cover information that was spatially precise and up to date, for state of environment monitoring and reporting. Ironically, many current applications are more appropriately addressed with land-use rather than land-cover information (Scott et al. 2002). Being geographically comprehensive but lacking thematic detail, the LCDB provides default land-use interpretations not covered by other databases.

### 3.4.4 Vegetative Cover Map (VCM)

New Zealand's vegetative cover can exhibit significant change over relatively short time intervals. The Vegetative Cover Map (VCM; Newsome 1987) is a national database of vegetation at a scale of 1:1 000 000. The VCM was developed between 1981 and 1987 by a series of steps including: reclassification of NZLRI map units, polygon generalisation, addition of new information, field checking, and corrections. The vegetation data in the 1:63 360 New Zealand Land Resource Inventory NZLRI maps (NWASCO 1975–79) were the primary starting point in the compilation. Data were plotted to a working scale of 1:250 000, edited and reclassified, and data from sources such as forestry plans, vegetation maps and other land resource maps incorporated. The VCM was compiled from many sources and extensively field checked before publication. The result was field checked both from the ground and from fixed wing aircraft, and corrections made.

The VCM depicts New Zealand's vegetation at a relatively small scale, with a minimum map unit size of about 500 ha. Because the data were compiled (and digitised) at a larger scale (1:250 000) than the final publication scale, its locational precision (of about 250 m) is better than one would expect from a 1:1 000 000-scale survey. Peer review of the final 1:250 000-scale draft maps preceded digitising for computer storage, and cartographic drafting at a reduced scale of 1:1000 000 for publication.

The map is published as two sheets 730 mm x 880 mm covering the three principal islands of New Zealand and all offshore islands within 100 km of the coast.

The VCM provides a level of detail complementary to the LCDB. The map classification recognises 8 Vegetative Cover Groups (Cropland, Grassland, Grassland–Scrub, Scrub, Grassland–Forest, Forest–Scrub, Forest, Miscellaneous), 47 Vegetative Cover Classes identified by alphanumeric code, and 17 Vegetative Cover Elements identified (only on the printed map) by symbols and patterns. The vegetative cover classes represent important vegetation communities.

The VCM of New Zealand was the first vegetation survey to be applied nationally for planning, research, and education. It makes optimum use of the cartographic potential of the vegetation information available in the early 1980s, and provides a historical record to help future analyses of

vegetative cover and land utilisation. The map was accompanied by a 153 page, illustrated, book that discusses New Zealand's vegetation and describes the 47 classes (Newsome 1987).

---

## 4. Interim Results

---

### 4.1 Interim results from hui and collaborative research

Findings from Māori research, as at February 2003, have been acquired through collaborative research, including hui with Ngāti Porou land owners and representatives, carried out since November 2001 (Pohatu 2001) in the FRST programme *Reducing Greenhouse Gas Emissions from the Terrestrial Biosphere* (C09X0212) and from the 2001/2002 NSOF project *A Framework for Engagement of Māori Landowners in Carbon Farming Using Indigenous Forest Regeneration* (Carswell et al. 2002). The results provide a Māori perspective on mitigating greenhouse gases, a guide to the level of understanding, a guide to the level of interest, a large number of Māori issues, and Māori statements on development of effective climate policy for carbon sequestration. Interim results indicate the following areas of Māori interest and thinking:

- Understanding greenhouse gas research, and participating in research and policy to mitigate greenhouse gas emissions (NZCCP 2001a, b; Pohatu 2001, MAF 2002) is very important
- The effect and implications any policy to mitigate greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) will have on Māori land, land use, and land management practice is a major issue
- Māori participation in some form of carbon trading is of great interest
- Māori have identified large areas of marginal and other land types with potential for carbon sequestration (as a carbon sink)
- Any policy to mitigate greenhouse gases must take into account Te Ture Whenua Act (1993) and the Treaty of Waitangi
- Carbon trading is seen as another land use opportunity within the context of Māori sustainable development
- What constitutes a 'Kyoto forest' needs to be clarified, but many understood 'Kyoto forest' to be those areas not under forest or scrub at 1990, and potential carbon sequestration areas must target marginal pastoral country with limited or scattered scrub
- A range of policy options to encourage scrub reversion, and financial reward for areas allowed to afforest<sup>1</sup> (or reforest<sup>2</sup>) since 1990 need to be developed
- Māori are reluctant to form contract agreements that permanently (indefinitely) retire or 'lock up' land and exclude other development considerations, and wish to develop contracts that acknowledge prolonged rights of control, ownership, and use
- Māori accept that land used for carbon sequestration needs to have a binding contract of perpetuity, which could be in the order of 25 years, but a contract agreement to protect land

should be based on the Nga Whenua Rahui (DOC) model guaranteeing Māori ownership and control

- Potential sustainable uses of forest/scrubland (including fuel, wood harvesting, biofuels) to maximise returns from marginal land (Figure 2) would encourage afforestation/reforestation additional to what would be achieved through covenants. This is still being discussed with Māori and this opportunity needs to be fully explored
- The identification of reasonable and innovative options for using Māori land by working with the Climate Change Office and other agencies is strongly recommended
- An ‘opt out’ clause is strongly recommended at the completion of each contract term (e.g., 25 years) to promote and encourage carbon sequestration on Māori land, although most Māori land retired and protected under Kyoto policy may stay in indigenous vegetation permanently with the signing of new contracts. Appropriate contract terms for Māori land are recommended
- An annual payment for land sequestering carbon is attractive
- Definition of the full term of a carbon payment needs to be determined, so the return to Māori is maximised and they are able to make long-term land decisions
- Māori are very wary of Government schemes, especially those that introduce penalties at the end of contract agreements and take away rights of control and ownership
- Continued rates relief on ‘undeveloped’ land used for carbon sequestration would be necessary, and policy needs to include definitions of ‘undeveloped land’ versus ‘developed’ land and provide rates relief for land used to achieve regional or district environmental goals (e.g., soil conservation, biodiversity)
- Any agreement to use land for carbon sequestration must also allow continued customary use and acknowledgement of cultural rights (Figure 2) for limited, low-impact development (e.g., manuka honey, medicines, pharmaceuticals, customary use of native plants, tourism)
- With any agreement to use land for carbon sequestration, financial assistance with fencing, destocking and pest management control (as in Nga Whenua Rahui agreements) is essential
- Māori would like to also participate in the identification and negotiation of non-Māori land for carbon sequestration (within a tribal rohe), that may include land such as erodible marginal hill country, coastal cliffs, and inland blocks with low pastoral production), especially where non-Māori land can be used to achieve Māori aspirations, including environmental and cultural goals
- There is a high level of interest for gaining carbon credits for large tracts of Māori owned production forest (mainly *Pinus radiata*), planted after 1990
- Under Kyoto agreements, Māori land owners and forest companies are concerned at penalties they might incur following clearfelling, even though the vast majority of Māori land in production forest will be replanted for continued production
- More dialogue over the ownership of carbon credits and methods of payment is required

- There is present dissatisfaction with Government intent to own all the carbon credits

## **4.2 Interim results from GIS analyses**

### **4.2.1 Māori land in New Zealand**

Interim results using the Māori Land Information Database (MLIB), NZLRI, and LCDB (Appendix 9.6, 9.7, 9.8, 9.9) show about 33% of all Māori land in NZ is in indigenous forest, roughly a third 29.6% is under pasture, and almost 19% in scrub. Exotic or planted forest accounts for about 12.1%.

Appendix 9.9 separates the land cover classes from the LCDB (Appendix 9.8, section 3.4.3) into LUC classes (section 3.4.1). It is inferred that Class 7, Class 8, and some Class 6 (between 10% and 30% of Class 6 could be marginal) are most likely to fit the definition of marginal land, and most suited for sequestering carbon. Under the present Kyoto definitions pastoral and limited scattered scrub areas on marginal land would most likely be eligible for Kyoto forest. Early results suggest the total area of Māori land in New Zealand available for afforestation<sup>1</sup>/reforestation<sup>2</sup>, and eligible under Kyoto, is around 150 000–200 000 ha.

### **4.2.2 Māori land in the Tairāwhiti district**

The appendices of this report document the distribution of Māori land nationally. To obtain a more detailed understanding of ways in which the distribution of Māori land influences greenhouse gas mitigation options, a more detailed analysis of the distribution Māori land in the Gisborne-East Coast (Tairāwhiti) district is presently being carried out.

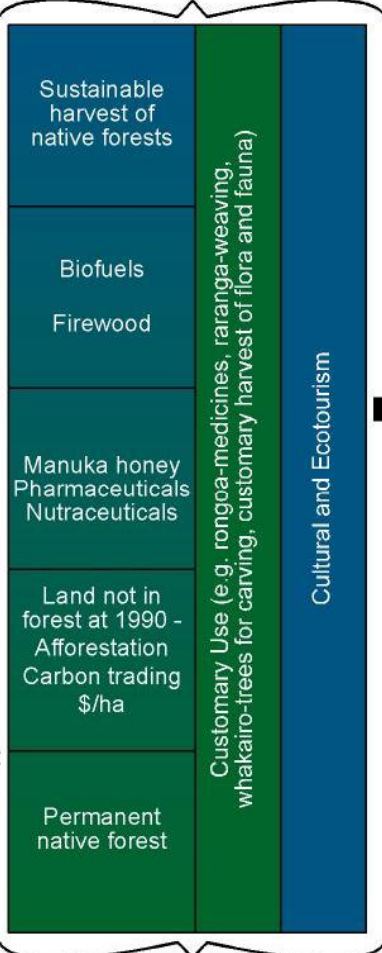
Current Policy Development

Effective policy for afforestation/reforestation and sustainable utilisation of Maori owned land

Policy Strands  
(encouraging Maori participation)



Scrub and Forest on Maori Land



Development opportunities for Maori

Goals/Outcomes

- Reduce carbon emissions, create 'forest sinks'
- NZ society aspirations for sustainable development
- Maori aspirations to achieve economic, social, cultural and environmental goals

- Benefits:**
- Social and economic development
  - Biodiversity enhancement
  - Enhancement of Maori values
  - Aquatic health
  - Soil conservation, reduced erosion risk
  - Reduced flooding risk to lowlands
  - Reduce biosecurity threats

Fig. 2 Māori land development opportunities under Kyoto policy

---

## 5. Summary

---

### 5.1 Summary

Over 600 000 hectares of Māori land in New Zealand are commonly referred to as ‘undeveloped land’, and much is typically marginal (TPK 1998, 2000; NZLRI 2002) (see Section 1 notes for definitions). Although ‘undeveloped’ or ‘marginal’ land has never been specifically defined or quantified, this area of over half a million hectares is believed to be a realistic estimate based on 1996 TPK MLIB figures (Appendix 9.1). It usually refers to land in an unimproved and relatively unproductive state, with unrealised capability, and includes unimproved pastures, commonly with scattered scrub or full scrub cover, and native forest. Marginal land is typically erosion-prone Class 6 land, and Class 7 or 8 land (NWASCO 1975–79; Jessen 2001; NZLRI 2003, section 3.4.1). Māori are interested in all options under Kyoto policy for an economic return from ‘undeveloped’ and ‘developed’ land. Many have also identified productive land that could be used for carbon sequestration under special circumstances (e.g., adjacent to native forest rehabilitation, land with significant biodiversity and/or cultural values). They are also interested in identifying, and contributing to discussions on, issues related to non-Māori land, where the nature of those issues mean that land can help achieve Māori aspirations through environmental and cultural goals.

To develop effective Kyoto policy, and to increase Māori participation and reduce barriers, it is important to identify accurately — following Kyoto criteria — land that is eligible to become ‘Kyoto forest’ (i.e. not forest at 1990), and that is suited for future carbon trading. Policy frameworks must recognise both Māori development aspirations for land and the various governance structures of Māori land, particularly the different types of Māori trusts under the Te Ture Whenua Act (Section 2 of this report).

Within the Tairāwhiti District, Gisborne–East Coast, Māori land accounts for 310 631 hectares, as at 1996 MLIB figures (Te Puni Kōkiri 1998, Durie 1998). From the current ‘Kyoto’ models developed in this project, it is estimated that of this total about 60% of the Māori land in the Tairāwhiti District (Table 2, Fig. 1) could be eligible for establishing forests eligible for carbon trading in future. However, the government has yet to finally adopt a definition for Kyoto forest, and until this is achieved, the area of eligible Māori land cannot be defined precisely. This project has identified key factors, that can be used to identify Māori land suitable for establishing manuka/kanuka scrub and indigenous forest that qualify as ‘carbon sinks’ and for ‘carbon trading’ under the Kyoto protocol. Of the total Māori land deemed suitable, other issues involving Māori governance structures (e.g., Ahu Whenua Trusts, Māori Trustee), Māori aspirations on control and ownership, appropriate models for kawenata (covenants), customary use, perpetuity, Māori economic development, and legal definition are all factors that must be considered in future national and regional policy.

If the Kyoto Protocol comes into force internationally, and this now requires only the signature of Russia, carbon value is likely to be between \$12 and \$25 per tonne CO<sub>2</sub>. The \$25 upper limit, set as a capped value by the New Zealand Government, is to reduce impacts on the national economy arising from those who must pay for CO<sub>2</sub> emissions. Carbon is currently trading internationally at about \$8/t CO<sub>2</sub>. Recently measured carbon accumulation rates in manuka /kanuka stands in hill country sites in the Gisborne region (Trotter pers. comm.) have averaged 7t CO<sub>2</sub>/ha/yr in stands with ages up to about 50 years. Economic returns from carbon credits are projected to be between \$55 and \$175 per hectare..

If the Government decides to allow individual landowners to own and trade carbon credits, afforestation of pastoral land is most likely to be eligible under Kyoto schemes, provided that for carbon trading the land would have to be retired from use (e.g., through fencing, or closing off existing paddocks on the most marginal areas of farms) and allowed to revert to scrub. The time taken for an area of pasture to afforest/reforest and achieve a full canopy cover of scrub remains uncertain, but is likely to be about 10 years. Practical methods to achieve a full canopy cover sooner are under investigation. Once a full canopy cover is achieved, it may take another 50 to 100 years for indigenous forest to develop. Policies relating to the use of this land generally would need to be developed with this 100-year period in mind.

Māori are presently waiting to see how Kyoto policy develops, and the conditions that apply, before they determine for themselves how they can participate and contribute, whether opportunities are created for Māori land owners, or whether they will be excluded from development options. Options and models of the way Māori landowners could use land under carbon trading, and receive carbon credits under different types of contract, are given in “A Framework for Engagement of Māori Landowners in Carbon Farming Using Indigenous Forest Regeneration” (Carswell et al. 2002).

---

## 6. Future Research

---

Opportunities for indigenous vegetation restoration /reversion to mitigate CO<sub>2</sub> emissions can only be achieved through dialogue, education, partnerships, and effective policy. Māori input into future climate change research and Kyoto policy is vital. Future research in the *Reducing Greenhouse gas Emissions from the Terrestrial Biosphere* (C09X0212), Objective 6 “Mitigation processes”, intends to continue working with Māori and stakeholders in many different forums, including regional case studies with Māori on the East Coast and — at a higher planning, policy, and research level — with Māori and non-Māori staff from Government departments, private research agencies, and private industry.

This research intends to provide a solid platform for increasing Māori participation in climate change research and in policy development, and should increase interaction between Māori and other stakeholder groups. Through hui, collaborative research, and GIS analyses, future research will provide more definitive information on the nature and extent of Māori land, and indicate requirements and barriers for Māori participation in Kyoto afforestation/reforestation schemes. To guide future research and policy, Māori perspectives will be grouped into: level of interest, level of understanding, and Māori specific issues, and matrix tables will be developed to guide policy (Suzi Kerr pers. comm.).

Future research will identify accurate figures for Māori land, governance types, and a more accurate assessment of the availability of marginal land, land type, land cover, and eligibility of land under Kyoto criteria. It will also identify Māori land blocks that can be used to research reversion to scrub from pasture, (e.g., through fencing or closing off existing paddocks on the most marginal areas of farms), the time taken for an area of pasture to afforest/reforest and achieve a full canopy cover of scrub, and regeneration rates under different types of land use in conjunction with different seed source environments. Some assessment of carbon accumulation will be given under these different Māori land use scenarios. It is assumed that once a full canopy cover is achieved, it may take another 50 to 100 years for indigenous forest to develop.

Research using GIS, environmental databases, and the Māori land information database (TPK 1998; NZLRI 2002) will use the Gisborne–East Coast region (GECR) (using the regional council boundary that closely approximates the Tairāwhiti District boundary—Appendix 9.2) as a case study for understanding afforestation/reforestation opportunities on Māori land. Using GIS, we will estimate:

- the area and spatial distribution of Māori land for the GECR
- the area and spatial distribution of marginal land for the GECR (erosion prone Class 7; Class 8, and some erodible class 6 land—to be defined)
- the spatial distribution and area of main vegetation classes (pasture, scrub, native forest, and *Pinus radiata* production forest) for the GECR
- the area and spatial distribution of vegetation classes for Māori-owned land. The GECR allows vegetation classes to be mapped using both the LCDB and nearly simultaneous mapping by the 2<sup>nd</sup> edition NZLRI. The 2<sup>nd</sup> edition NZLRI provides a method that captures fractional cover of scrub species in greater thematic detail than the LCDB.
- the area and spatial distribution of marginal Māori owned land for the GECR
- the area and spatial distribution of Māori land eligible (and not eligible) for Kyoto forests (indigenous revegetation for permanent carbon sequestration).

In terms of helping identify eligibility for carbon trading under Kyoto forests, spatial maps from Gisborne–East Coast NZLRI vegetation data will show areas in pasture, scrub and native forest as at 1996. Combined with MLIB data, these will be used as a first cut to help reduce some of the technical difficulties of proving what marginal Māori land was not forest at 1990, and by identifying all scrub areas that need validation. This information will be used to discuss Kyoto eligibility with Māori landowners at future hui. Areas under pasture as at 1996 will most likely be eligible for afforestation/reforestation under the Kyoto Protocol, but areas under scrub need confirmation as to their canopy cover composition and characteristics—once government decisions finalising a definition for “Kyoto forest” are finalised. Areas under native forest as at 1996 will not be eligible as forest under the Kyoto Protocol. Specific focus will be placed on land, identified through spatial analysis and consultations, which Māori see as having the greatest potential for afforestation/reforestation under carbon mitigation policies.

The above information will be used as a visualisation and communication tool at future hui and workshops. Final products will determine, for the GECR: Māori land eligible as Kyoto forest, not eligible as Kyoto forest, and eligibility uncertain (e.g., thinly scattered scrub), and the location, area, and governance structure of each class of Māori land block. Methods will have to be developed to provide sound 1990 baseline data to validate scrub areas.

Hui, workshops and consultations will work toward understanding the economic, social and cultural factors that influence decisions about land use, including the opportunity to use land for carbon mitigation. Results are expected to contribute to climate change and environmental (e.g., biodiversity) policy, increase Māori representation and participation, identify Māori land-use opportunities, especially for carbon sequestration, and underpin sustainable land management scenarios. They will also help direct future greenhouse gas research in this (C09X0212) and other science programmes, and provide social, cultural, biophysical, and economic research results to maximize and enhance economically viable carbon mitigation opportunities.

## **7. Acknowledgements**

---

I thank those Māori land owners and staff of various organisations and departments (including Te Puni Kōkiri and Māori Trustees office, Gisborne) who have given their time to date to help with this study, Pia Pohatu and Tui Aroha Warmenhoven for organising hui in Gisborne and Ruatorea, Kevin Tate, Troy Baisden, and Craig Trotter who provided information and comments on the manuscript, Hamish Heke for helping with GIS analyses, supplying GIS data and Māori land tables and maps, and Anne Austin and Alison Fordyce for editing the manuscript.

---

## 8. References

---

- BER Ltd. (Business and Economic Research Ltd.) and FOMA (Federation of Māori Authorities 1997: The nature and extent of the Māori economic base (updated by Te Puni Kōkiri 1999). Wellington, New Zealand (Rose et al. 1997) (unpublished).
- Carswell, F., Harmsworth, G.R., Kerr, S.; Kirikiri, R., Turney, I. 2002: A framework for engagement of Māori landowners in carbon farming using native forest regeneration. Landcare Research Contract Report No. LC 0102/116 to NSOF (unpublished). 44 pp.
- Durie, M.H. 1998: *Te Mana, Te Kawanatanga. The Politics of Māori self-determination*. Oxford, Oxford University Press. 280 pp.
- FCCC (Framework Convention for Climate Change) 2001: FCCC/CP/2001/13/Add.1 p58 ANNEX Definitions, modalities, rules, and guidelines relating to land use, land-use change and forestry activities under the Kyoto Protocol.
- Jessen, M.R. 2001: Updating the New Zealand Land Resource Inventory. A modern review of the structure and components of the NZLRI. *Planning Quarterly*: 6–8.
- Jessen, M.R.; Crippen, T.; Page, M.J.; Rijkse, W.C.; Harmsworth, G.R.; McLeod, M. 1999: Land Use Capability classification of the Gisborne–East Coast region: A report to accompany the second-edition New Zealand Land Resource Inventory. *Landcare Research Science Series No. 21*. Lincoln, Manaaki Whenua Press.
- Landcare Research (draft): Draft discussion paper. Submission on Proposed Kyoto Protocol Projects Policy. A potential policy gap: Creating maximum opportunity for investment, participation, and environmental co-benefits in indigenous forest sink mechanisms. Reducing greenhouse gas emissions from the terrestrial biosphere FRST programme C09X0212 (unpublished). 5 p.
- Landcare Research 2003: Revised GIS data tables for Maori land in New Zealand. Palmerston North, Landcare Reserarch.
- Ministry of Māori Development 2002: *Te Māori i Nga Rohe: Māori regional diversity*. Wellington, Te Puni Kōkiri, Ministry of Māori Development. 168 p.
- MAF (Ministry of Agriculture and Forestry) 2002: Climate change: Māori and Treaty of Waitangi issues. *Korero Whenua*, Vol 3, August 2002, p 5. Wellington, Ministry of Agriculture and Forestry. Newsletter. 12p.
- MFE (Ministry for the Environment) 2000: New Zealand Land Cover database. Wellington, New Zealand, Ministry for the Environment.
- Newsome, P.F.J. 1987: The vegetative cover of New Zealand. *Water and Soil Miscellaneous Publication No. 112*. 153 p., 2 map sheets. ISSN 0110-4705.
- Scott, N.A.; Tate, K.R.; Giltrap, D.J.; Smith, C.T.; Wilde, R.H.; Newsome, P.F.; Davis M.R. 2002: Monitoring land use change effects on soil carbon in New Zealand: Quantifying baseline soil carbon stocks. *Environmental Pollution* 116: S167–186.

- NZCCP (New Zealand Climate Change Programme) 2001a: He Parongo Whakaatu mo te Rereketanga o te Ahuarangi mo te Māori. Information update on climate change for Māori. Newsletter March 2001. Wellington, Ministry for the Environment.
- NZCCP (New Zealand Climate Change Programme) 2001b: Te Hotaka Rereketanga Ahuarangi o Aotearoa 2001: Climate change Māori issues presentation. Series of national hui. Wellington, Ministry for the Environment.
- NZLRI (New Zealand Land Resource Inventory) GIS database 2003. Palmerston North, Landcare Research New Zealand Ltd.
- NWASCO (National Water and Soil Conservation Organisation) 1975–79: New Zealand Land Resource Inventory Worksheets 1: 63 360. Wellington, National Water and Soil Conservation Organisation.
- Pohatu P. 2001: Climate change – Carbon hui. Te Puni Kōkiri offices, Gisborne. 22 November 2001. Hui meeting notes. 3 p.
- TPK (Te Puni Kōkiri) 1998: National Māori Land Information Database. Wellington, Ministry of Māori Development.
- TPK (Te Puni Kōkiri) 2002: Māori in the New Zealand economy. Wellington, Te Puni Kōkiri (Ministry of Māori Development). Third Edition, June 2002. 62pp.

## 9. Appendices

### Appendix 9.1: Land Use Capability (LUC) for Māori land in New Zealand: Area and % of LUC Class I to VIII (adapted from TPK 1998; NZLRI 1998, recalculated MLIB 2002 & NZLRI – Landcare Research NZ Ltd. 2003).

<b>Māori Land Use Capability – New Zealand – 2003</b>				
Land Use Capability Class	2002 Māori Land area (ha)	% of Total NZ Land	% of Māori Land	Description of Land Use Capability
1	2771.28	0.7%	0.34%	Most versatile multiple-use land – virtually no limitations to arable use
2	18 418.89	4.55%	2.25%	Good land with slight limitations to arable use
3	40 338.55	9.22%	4.93%	Moderate limitations to arable use restricting crops able to be grown
4	81 147.38	10.5%	9.92%	Severe limitations to arable use. More suitable to pastoral and forestry
5	3 385.59	0.8%	0.41%	Unsuitable for cropping – pastoral or forestry.
6	275 484.46	28.1%	33.68%	Non-arable land. Moderate limitations and hazards when under a perennial vegetation cover
7	259 369.76	21.4%	31.71%	With few exceptions can only support extensive grazing or erosion control forestry
8	127 023.20	21.8%	15.53%	Very severe limitations or hazards for any agricultural use
Other	9 927.15	2.97%	1.21%	Non-arable land. Moderate limitations and hazards when under a perennial vegetation cover
TOTAL	817 866.26	100.00%	100.00%	

### Appendix 9.2: Māori Land Court Districts: Areas and % of Māori land (based on TPK MLIB 1998 data)

<b>Total Māori Land Area, Number of Māori Land Blocks and Average Land Area per Land Blocks by Māori Land Court District – 1996</b>					
NZ Māori Land Court Districts	Total Land Area per Māori Land District (ha)	Māori Land Area (ha)	% of Māori Land by Land District	Number of Land Blocks	Average Land Area per Land Block (ha)
Tai Tokerau	1 732 192	139 873	8.07%	4889	29
Waikato-Maniapoto	2 156 583	143 388	6.65%	3,594	40
Waiariki	1 936 270	426 595	22.03%	5,074	84
Tairāwhiti	1 169 091	310 631	26.57%	5,320	48
Takitimu	1 936 492	88 608	4.58%	1,254	71
Aotea	1 284 284	334 207	26.02%	3,710	90
Te Wai Pounamu	16 715 185	71 769	0.43%	1,795	40
TOTAL	26 930 100	1 515 071	5.63%	25,636	59

**Appendix 9.3: Total Land Use Capability (LUC) Class for the North Island**

<b>LUC Class</b>	<b>Area (ha)</b>	<b>Area (%)</b>
1	152 582.6	1.3
2	695 806.8	6.1
3	1 064 530	9.3
4	1 300 393.0	11.4
5	93 531.8	0.8
6	4 078 883.0	35.6
7	2 774 702.0	24.2
8	1 015 408.0	8.9
e	22 040.8	0.2
L	113 225.8	1.0
q	1042.5	0.1
R	28 123.8	0.2
T	115 654.3	1.0
Total Area	11 455 930.0	100.0

**Appendix 9.4: Total Land Use Capability (LUC) Class for the South Island**

<b>LUC Class</b>	<b>Area (ha)</b>	<b>Area (%)</b>
1	34 486.9	0.2
2	506 239.8	3.3
3	1 377 771.0	9.1
4	1 476 896.0	9.8
5	116 649.9	0.8
6	3 394 314.0	22.5
7	2 914 810.0	19.3
8	4 785 278.0	31.7
e	11 671.9	0.1
L	220 357.6	1.5
q	15.7	0.0
R	245 751.0	1.6
T	31 566.3	0.2
Total Area	15 115 810.0	100

**Appendix 9.5: Total Land Use Capability (LUC) Class for New Zealand**

<b>LUC Class</b>	<b>Area (ha)</b>	<b>Area (%)</b>
1	187 069.5	0.7
2	1 202 046.6	4.5
3	2 442 301.0	9.2
4	2 777 289.0	10.5
5	210 181.7	0.8
6	7 473 197.0	28.1
7	568 951.2	21.4
8	5 800 686.0	21.8
Other (e, l, q, r, t)	789 449.7	2.97
Total Area	26 571 740	100

**Appendix 9.6: North Island Māori land (MLIB 2002) and NZ vegetative cover types (LCDB v1.2 2001 section 3.43)**

<b>Land cover/Vegetation LCDB</b>	<b>Area (ha)</b>	<b>Area (%)</b>
Bare ground	10 325.73	1.32
Coastal sands	2 971.43	0.38
Coastal wetlands	888.29	0.11
Indigenous forest	252 932.3	32.34
Inland water	9 725.51	1.24
Inland wetlands	2 660.99	0.34
Mangrove	558.74	0.07
Mines and Dumps	49.76	0.01
Planted forest	100 586.3	12.86
Primary Horticultural	709.64	0.09
Primary Pastoral	223 082.28	28.52
Scrub	144 691.8	18.5
Tussock	32 428.74	4.15
Urban	510.79	0.07
Urban Open Space	85.89	0.01
<b>Total Maori Land NI</b>	<b>782 208.19</b>	<b>100</b>

**Appendix 9.7: South Island Māori land (MLIB 2002) and NZ vegetative cover types (LCDB v1.2 2001 section 3.43)**

<b>Land cover/Vegetation LCDB</b>	<b>Area (ha)</b>	<b>Area (%)</b>
Bare ground	82.04	0.22
Coastal sands	78.28	0.21
Coastal wetlands	18.57	0.05
Indigenous forest	21 793.99	58.74
Inland water	59.93	0.16
Inland wetlands	120.48	0.32
Planted forest	976.75	2.63
Primary Horticultural	0.14	0.0
Primary Pastoral	3 676.99	9.91
Scrub	9 517.29	25.65
Tussock	737.81	1.99
Urban	6.09	0.02
Urban Open Space	32.5	0.09
<b>Total Maori Land SI</b>	<b>37 100.86</b>	<b>100</b>

**Appendix 9.8: New Zealand Māori land (MLIB 2002) and NZ vegetative cover types (LCDB v1.2 2001 section 3.43)**

Land cover/Vegetation LCDB	Area (ha)	Area (%)
Bare ground	10 407.77	1.27
Coastal sands	3 049.71	0.37
Coastal wetlands	906.86	0.11
Indigenous forest	274 726 .29	33.53
Inland water	9 785.44	1.19
Inland wetlands	2 781.47	0.34
Mangroves	558.74	0.07
Mines and Dumps	49.76	0.01
Planted forest	101 563.05	12.40
Primary Horticultural	709.78	0.09
Primary Pastoral	226 759.27	27.68
Scrub	154 209.09	18.82
Tussock	33 166.55	4.05
Urban	516.88	0.06
Urban Open Space	118.39	0.01
<b>Total Maori Land NZ</b>	<b>819 309.05</b>	<b>100</b>

**Appendix 9.9: Māori land, vegetative cover types (LCBD v1.2), and LUC Class for New Zealand**

Land cover/Vegetation LCDB	Area (ha)	Area (%)	LUC Class	Area (ha)	Area (%)
Bare ground	10 291.47	1.26			
Coastal sands	2 861.25	0.35			
Coastal wetlands	833.75	0.10			
Indigenous forest	274 530.71	33.59	6	79 949.17	9.78
			7	108 418.47	13.26
			8	73 054.67	8.94
			1-5	12 938.92	1.58
			Other	169.48	0.02
Inland water	9747.25	1.19			
Inland wetlands	2741.49	0.34			
Mangroves	527.5	0.06			
Mines and Dumps	49.75	0.01			
Planted forest	101 543.31	12.42	6	44 085.33	5.39
			7	34 347.33	4.20
			8	2063.43	0.25
			1-5	20 988.78	2.57
			Other	58.44	0.01
Primary Horticultural	706.92	0.09			
Primary Pastoral	226 582.53	27.72	6	94 173.5	11.52
			7	41 727.01	5.11
			8	3 049.83	0.37
			1-5	87 226.52	10.67
			Other	405.67	0.05
Scrub	153 820.18	18.82	6	51 457.15	6.30
			7	64 670.03	7.91
			8	21 671.35	2.65
			1-5	15 886.75	1.94
			Other	134.9	0.02
Tussock	32 462.34	3.97			
Urban	516.31	0.06			
Urban Open Space	118.37	0.01			
<b>Total</b>	<b>817 333.13</b>	<b>100</b>			<b>100</b>

