Land Use Change Diversification in Northland

Kellogg Rural Leadership Programme
Course 44 2021

Rachel Weal

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Executive Summary

Whenua (land) is valuable. It is a place for us to live, to make a living and to grow food and materials we need for ourselves and export. Across New Zealand, huge variations in landforms, soil, and climate influence how land across the country can best be utilised and managed (Ministry for the Environment, 2021).

The state of our land today is a legacy of the ways previous generations used it. Some former land uses limit how we can use it today. In the same way, our choices about land today can be irreversible and will affect future generations and the potential production and profitability of our industry.

The Northland Region of New Zealand is a vital province for agriculture, horticulture, and forestry and, with its subtropical climate and mixed topography, offers a key competitive advantage.

A range of factors can drive land-use change, all of which tend to interact and influence each other and can be generally categorised into the following areas:

- Biophysical Factors
- Economic Factors
- Societal Factors
- Regulatory Factors
- Environmental Factors

These five factors are all interrelated. They are all equal in importance and in most cases, an aggregation of drivers will need consideration. An individual's risk appetite, as well as any future succession plans, will also influence these decisions.

A person or entity's drivers for change will be unique and must be treated as such. They could include:

- Looking to make a change to either reduce risk or maximise financial return (economically driven)
- Seeking an enterprise or activity that is more aligned to them personally (interest-driven)
- To improve the environmental impact (environmentally/regulatory driven)

Good land-use decisions depend on being well informed and understanding the trade-offs between profitability, physical land characteristics and environmental sustainability. To achieve all aspects, a mosaic approach to land uses may be required across the rural landscape in Northland. Many land uses can complement each other, helping to:

- Spread financial risk by diversifying investment
- Reducing environmental impact
- Improve the overall sustainability of the farm
- Creating succession options

There are three main aspects of land-use change and diversification identified in the Northland Region that are prominent today. I believe these factors will also be of most significant consideration moving forward into the future. The three main aspects are environmental

considerations (primarily availability of water and the use of forestry to reduce our impact on climate change and emissions), economic considerations (profitability and access to capital), and regulatory considerations (subdivision of rural land). Four examples have been given based on these factors.

From the research completed in this report and my professional experience, I make the following recommendations:

- I suggest further analysis and information on current land use is required to ascertain what enterprises are covering what land areas in Northland. Similarly, information on soil types is difficult to obtain and is generally high level. Statistics are primarily restricted and usually well out of date. Information at a district or regional level could assist in future land-use decision making.
- I suggest further investigation and research into different land uses, specifically for the Northland region, including new crops or subtropical varieties. We need to share our knowledge and experiences so others can make informed decisions regarding land use diversification.
- I propose the availability of specialist consultants who can be accessed easily by farmers to assist landowners in uncovering potential land-use change options and what would best suit them as people, their land, and the viability. Having previous case study examples would assist with this.
- I advocate that water storage investment for the Northland region remains a priority, and I recommend the proposed water storage sites continue to go ahead, as well as an investigation into other potential future sites.
- I suggest local councils continue to plan urban development and weigh up the requirement of residential housing versus products produced from highly productive agricultural land.

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Acknowledgements

The Kellogg Rural Leadership Programme has challenged me and pushed me outside my comfort zone, driving my personal and professional development. I want to thank Cohort 44 for making this experience one I will remember – for being such a diverse, interesting, thought-provoking group of people, who I know will continue to be great leaders of the industry in the future. Thank you for the laughs and memories and for making the programme enjoyable. I wish you all the best.

A big thank you to the Rural Leaders team - Scott Champion, Patrick Aldwell, Chris Parsons, Lisa Rogers and Desley Tucker for your mentoring, guidance, and leadership and for organising and running the programme. You are all amazing people who give so much to the food and fibre sector, through your accomplishments and by giving your time and experiences to help mould the industry's future leaders. I cannot thank you all enough.

To my parents, whose passion for farming and the upbringing and opportunities it has given me has led me to become a rural professional. I feel fortunate to have been brought up in the industry and be part of it today.

To my friends and family, thank you for encouraging me and helping me get through the programme and to complete my report. A big thank you to my sister Rebecca for using her incredible editing skills on this report.

A special thanks to my employer, ASB - thank you for supporting me throughout the programme and allowing me the required time off to attend. The programme has reinforced the importance of 'accelerating financial progress of New Zealand by backing food and fibre producers.' I look forward to using the skills and experiences I have learnt from this programme in my role.

Strategic, programme, service and academic partners, many thanks for your ongoing support of the programme.

I highly recommend the Kellogg Rural Leaders Programme to anyone aligned with the primary sector who is passionate and interested in challenging themselves and leading change within the industry.

1.0 Introduction

Northland has always been an integral region for agriculture production within New Zealand and remains a key region for food, forestry, and fibre production into the future. With its subtropical climate and mixed topography, it offers a key competitive advantage.

Where we chose to live and the food we, as consumers, chose to eat has an influence on the demand for land and how it is used in New Zealand. Our growing population will continue to drive this demand in the future. Additionally, overseas markets are another significant driver in land use, with most of our agriculture and forestry products being exported.

From this report, I want to understand what is driving land use change decisions in the Northland Region. Land-use change is a hot topic of discussion in Northland currently. For example, dairy land to horticulture or sheep and beef properties going into forestry or carbon farming. I want to understand the key factors and considerations that are driving these land-use changes. This will include examining both barriers and opportunities occurring, how farmers can access these potential opportunities, and how they can benefit from building resilience within their business financially and environmentally.

Good land-use decisions depend on being well informed and understanding the trade-offs between profitability, physical land characteristics and environmental sustainability. To achieve all aspects, a mosaic of land uses may be required across the rural landscape in Northland.

I will look at some key themes of land use diversification and change occurring in the Northland Region and identify both the positive and negative impacts these are having using real life examples.

2.0 Aims and Objectives

The purpose of this report is to understand the main driving factors for land-use change in Te Tai Tokerau, Northland. It examines some of the common land-use diversification options currently occurring in Northland and identifies some key factors that the landowner should consider before implementing the change. The key areas I will be analysing are:

- Assess the Northland Region as a whole – the geography, people, economy, climate, topography, and soils
- Review existing Northland land use, land use capability classes and traditional land uses
- Identify the key factors which drive land use change
- Identify the main drivers of land use change that are occurring in Northland today, and use real life examples to verify occurrence

3.0 Methodology

The method I have used for this project is primarily literature reviews and informal interviews.

The literature review focused mainly on research relative to New Zealand food and fibre producers but also includes overseas publications and examples. I studied a range of existing documents and reports available through central government departments as well as organisations such as rural consultancy firms.

I completed approximately 20 informal interviews and conversations which included Northland farmers and rural professionals including other bankers, real estate agents, council staff and consultants. The purpose of the discussions was to get their views on current and future land uses, what they see as barriers and opportunities to land use change in Northland and the key themes currently being witnessed.

Themes, opinions, and ideas were analysed using the thematic analysis technique and pulled together and that is how I have consolidated the discussion.

I have also included personal insights based on my rural valuation and banking experience working within a financial institution for the past ten years.

4.0 Northland

Overview

To provide context for this report, the following pages provide a high-level overview of the Northland region – geography, people, economy, climate, topography and soils.

4.1 Geography

The Northland Region is 13,286 square kilometres or 1.32 million hectares and is the northernmost region in New Zealand (Northland Regional Council, 2021). It is a long finger of land that is less than 100 kilometres wide at its widest point. The Tasman Sea is to the west and the Pacific Ocean to the east (Northland Regional Council, 2021). Key landmarks include Te Raupua mountain - highest point at 781m above sea level; 3,200 kilometres of coastline; lake Ōmāpere – largest lake; Northern Wairoa River – longest river; and the region having ten harbours (Northland Regional Council, 2021). The largest city in Northland is Whangārei, and there are several other smaller towns and settlements throughout the region.

The Northland Region is split into three districts being the Far North, Kaipara, and Whangarei. Each area has its own local district councils, alongside the overarching Northland Regional Council (Northland Regional Council, 2021).

Figure 1: Northland Council Boundaries
Source: Northland Regional Council, 2021

The region's economy is primarily based on agriculture, with approximately 54 percent of the land in pasture, 10 percent planted in forest, and 0.4 percent in orchards or crops (Northland Regional Council, 2021).

4.2 People

The Northland population totals 188,700 people (Northland Regional Council, 2021). The below population statistics are from the 2018 Census Data. As seen, the unemployment rate is significantly higher in Northland than the national average of four percent, and it is typically a low wage society with a median income much lower than the national average of $31,800. The number of people earning over $70,000 is also lower than the national average of 17.2 percent, sitting at just 11.5 percent (Statistics New Zealand, 2018).

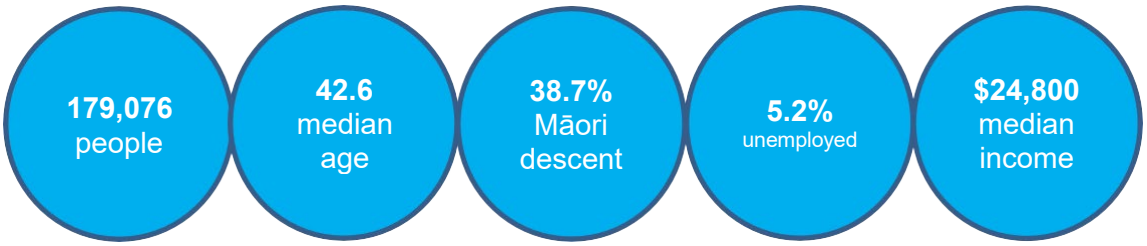


Figure 2: Population Statistics. Source: Statistics New Zealand, 2018

There is also clear socio-economic differentiation between the three districts in Northland, with the Far North District having an even higher unemployment rate and a lower median income. The below table provides a breakdown of the three districts.

Table 1: Quick Facts by District

	Far North District	Kaipara District	Whangārei District
Land Area (sq km)	6,686.75	3,108.96	2,712.12
Population	65,250	22,869	90,960
Median Age	43.2	46.0	41.4
Males	32,595	11,520	44,583
Females	32,655	11,349	46,374
Māori	31,505	5,622	27,336
Māori Descent	50.50%	27.80%	32.90%
Unemployed	6.60%	3.50%	4.70%
Median Income	$22,600	$24,500	$27,500

Source: Statistics New Zealand, 2018

Northland as a region has an opportunity to reduce this unemployment rate and increase median incomes by encouraging more people into jobs in the primary industry. There are a range of initiatives in progress to help get people into training and jobs, and this could be a real opportunity for Northland.

4.3 Economy

The Northland economy comprises of a range of diverse industries. Manufacturing is the largest industry, followed by agriculture, forestry, and fishing. Manufacturing and agriculture made up 20.4 percent of Northland's Gross Domestic Product (GDP) in 2018. Northland's manufacturing includes the country's only oil refinery in Marsden Point.

To the year ended March 2019, the Northland Region GDP totalled $7.8 billion or 2.59 percent of the total New Zealand GDP (Statistics New Zealand, 2020). In 2019, Northland's GDP increased 4.5 percent, driven mainly by health care and social assistance along with strong growth in the property sector (Statistics New Zealand, 2020). A fall in agriculture (mainly dairy cattle farming) partly offset this increase (Statistics New Zealand, 2020). Over the last five years, the Northland economy increased by 37.4 percent compared to the national increase of 30.4 percent (Statistics New Zealand, 2020).

As of November 2020, the median house price in Northland was $589,000. Property prices have increased on average 6.63 percent every year for the last ten years (Opes Partners, 2020).

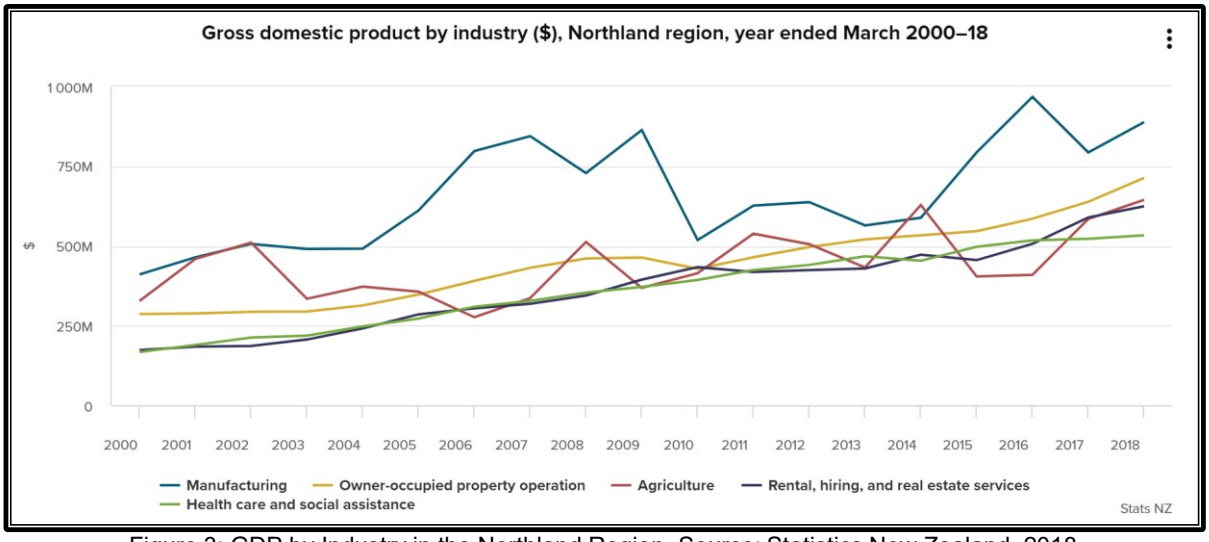


Figure 3: GDP by Industry in the Northland Region. Source: Statistics New Zealand, 2018

With agriculture already contributing a large amount to GDP, the Northland economy has more opportunity with changes in land use via horticulture and forestry to further increase this return for the economy, having a positive flow on effect for the region's economy growth.

4.4 Climate

With its Northern location, low elevation, and proximity to the sea, Northland is characterised by a mild, humid, and rather windy climate. Rainfall is typically plentiful all year round with sporadic, very heavy falls; however, dry spells do occur, especially during summer and autumn. Most parts of Northland receive around 2,000 sunshine hours per year (NIWA, 2013). Parts of the region only get the occasional light frosts each year. The different physical characteristics across the region, combined with variable rainfall, result in large variations in plant and pasture growth and thus productivity each year.

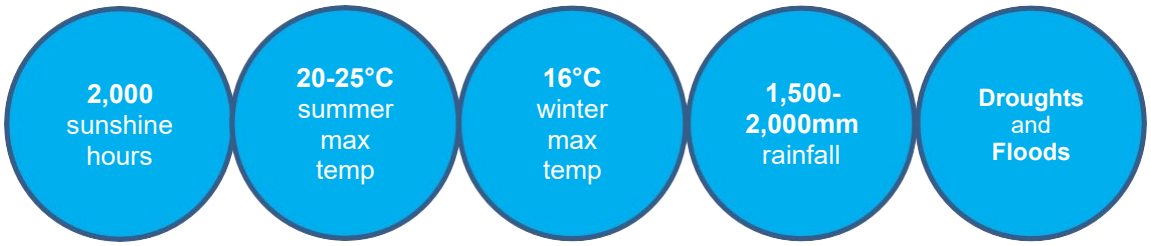


Figure 4: Climate Statistics

Ministry for the Environment, provides the below climate change projections for the region to 2090 (compared to 1995):

Table 2: Climate Change Projections for Northland

Temperature	0.7°C to 1.1°C warmer by 2040 & 0.7°C to 3.1°C warmer by 2090
Rainfall	Spring rainfall to decrease by 1 to 12 percent in Kaitaia by 2090 Spring rainfall to decrease by 3 to 17 percent in Whangarei by 2090
Wind	Extremely windy days to decrease by up to 5 percent by 2090
Storms	Some increase in storm intensity, local wind extremes & thunderstorms
Sea-level Rise	Average rise in relative mean sea-level of 1.7mm per year

Source: Ministry for the Environment, 2018

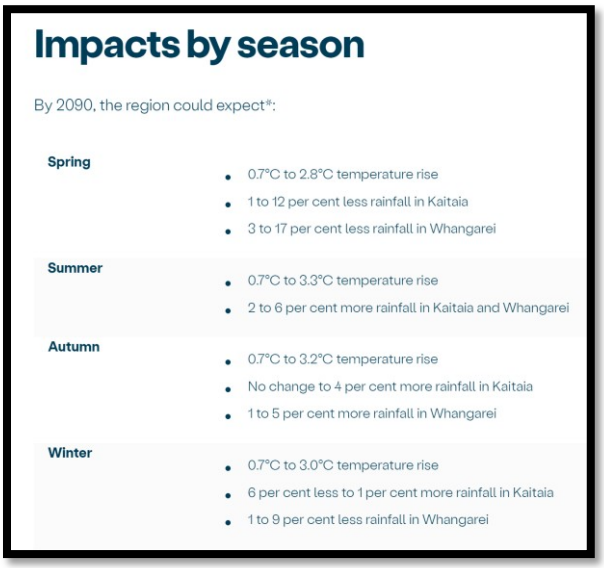


Figure 5: Climate Impacts by Season. Source: Ministry for the Environment, 2018

Overall, warmer temperatures, a longer growing season, and frosts becoming rare could provide opportunities to grow new sub-tropical crops. Farmers might benefit from faster growth of pasture and better crop growing conditions (Ministry for the Environment, 2018). However, adverse effects of climate change such as prolonged drought, increased flood risk, and greater frequency and intensity of storms could limit these benefits. Some crops such as Kiwifruit may become uneconomic in Northland by 2050 due to a lack of winter chilling (Ministry for the Environment, 2018).

4.5 Topography and Soils

Northland is predominately undulating to moderately steep hill country and has a very complex mix of soils, with over 230 distinct soil types. The majority of the soils generally have clay-rich profiles over deeply weathered rocks. Several factors have contributed to the high levels of physical and chemical weathering of the rocks, including:

- A warm humid environment
- Strong influence of vegetation on soil formation
- Old topography with little rejuvenation from glaciation
- A scarcity of tephra
  (Molloy, L, 1988)

“While only scattered remnants of pre-European forest remain, their influence on pedogenesis was considerable. Kauri produced deep layers of highly acidic litter, which is implicated in the podzolisation and gleying processes that have contributed to the poor physical properties of many of the region’s soils” (Molloy, L, 1988).

Gley podzol soils are generally used for sheep and beef farming, and dairying. They have brown clay topsoil’s and are wet in winter and spring. Other Northland soils are mostly a mix of brown soils, free-draining soils from basalt, and poorly drained hill and steep land soils from old andesitic volcanic action. The best free draining (oxidic) soils, from more recent basaltic volcanism, are used for dairying and a range of horticultural crops (Molloy, L, 1988).

Overall, there are pockets of land throughout Northland that are best suited to particular land uses based on their soils and topography. Knowing the capabilities and limitations of soils is the key to sustainable land use in Northland and is a key factor in deciding what land use is best suited for that country.

5.0 Northland Land Use

The Northland Region consists of 1.32 million hectares (Northland Regional Council, 2021). In 2019, of this area, agriculture covered 588,210 hectares (44.6%). Although declining in area over the last 20 years, beef farming remains the most prominent agriculture type, covering the most extensive area at 240,118 hectares (40.8%). Dairy farming and forestry land are still major land use areas at 166,101 hectares (28.2%) and 137,155 hectares (23.3%). The below figure shows a breakdown of the change in land use areas in Northland from 2002 through to 2019.

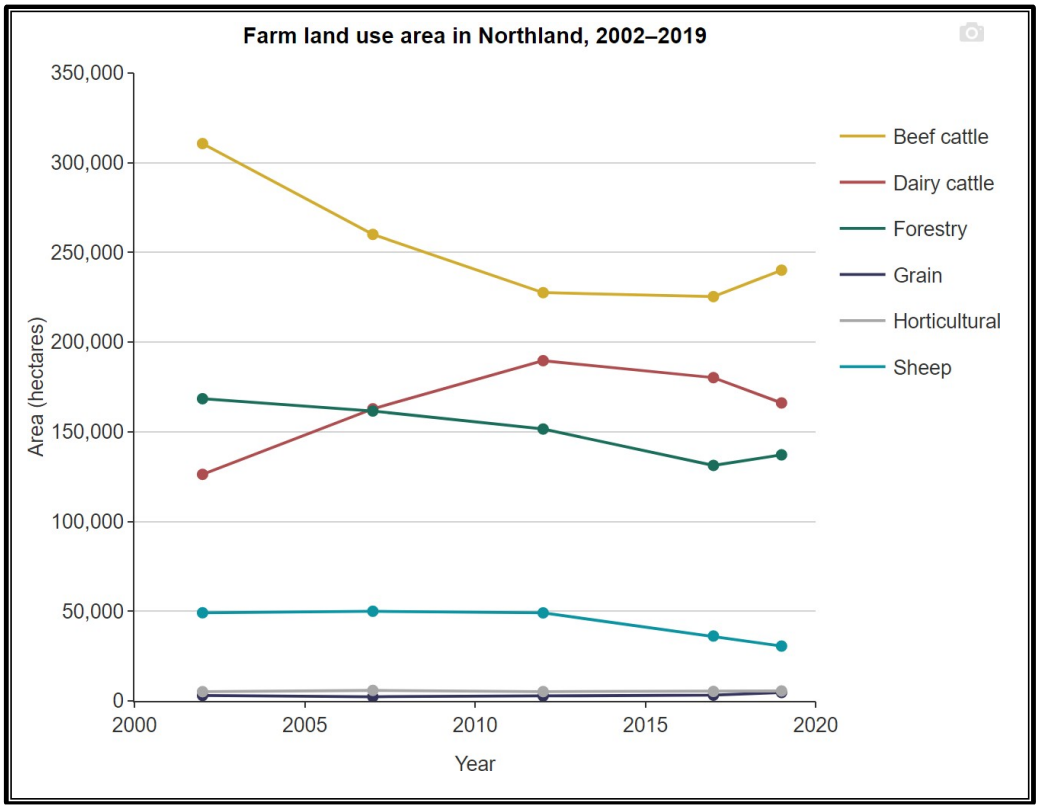


Figure 6: Farm Land Use Area in Northland. Source: Statistics New Zealand, 2020

From the above figures and graph, between 2002 and 2019, the total agricultural land area in the Northland Region reduced by 82,369 hectares. The most likely fate for this land is varied including; incorporation of land into the conservation estate, reversion of pastoral land into scrub, farmers closing land to QEII covenants, and subdivision to lifestyle blocks/urban use (AgFirst Report, 2017).

In Northland, the total farm count also reduced significantly over this period. There was a 31 percent reduction in farm count from 5,733 farms in 2002 reduced to 3,960 farms in 2019 (Statistics New Zealand, 2019). These trends are in line with the rest of New Zealand. Reduction in farm count can be attributed to increased average farm size and conversion from productive farms to lifestyle/uneconomic blocks.

These trends support the discussion themes outlined later in the report where forestry land is increasing at the detriment of sheep, beef, and dairy farms, as well as the loss of productive farms to lifestyle blocks.

5.1 Land Use Capability

The land use capability (LUC) classification is a system of arranging different kinds of land according to its capacity to support long-term sustained production after considering the physical limitations of the land. First devised in 1969, the classification has had two revisions in 1971 and 2009 (Greater Wellington Regional Council, 2017).

There are eight broad land classes under the system, along with several more detailed sub-classes and units. Class 1 land is considered the most versatile and productive in terms of conventional agriculture, horticulture, and forestry. Class 8 land has such limitations that it is considered incapable of productive use (Northland Regional Council, 2021). The below figure shows a summary of the suitability of LUC classes for different uses.

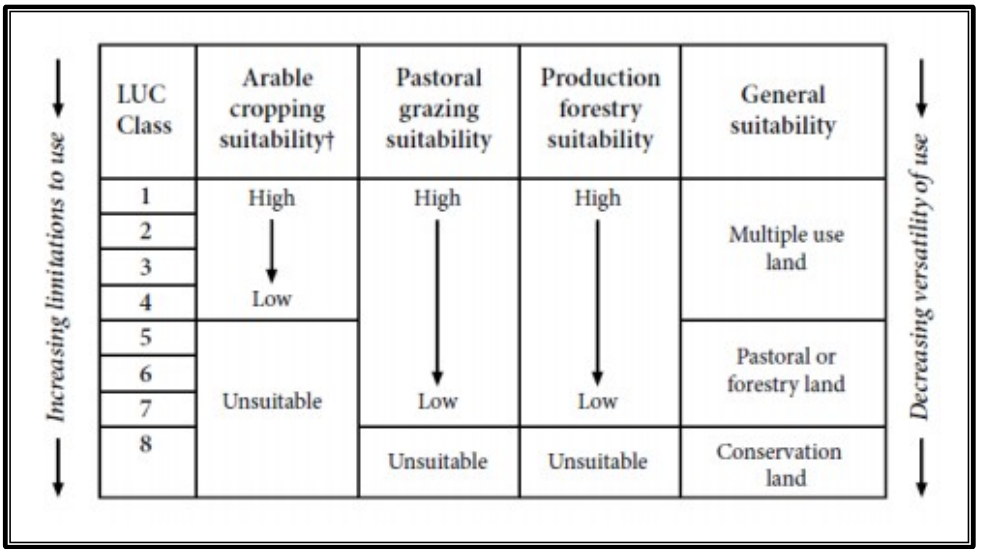


Figure 7: LUC Classes for Different Uses. Source: Greater Wellington Regional Council, 2017

There are four physical limitations recognised in the LUC subclasses that limit land use, which are:

- Erodibility – where susceptibility to erosion is the dominant limitation.
- Wetness – where a high water table, slow internal drainage, difficulty/high cost to drainage required, and/or flooding constitutes the dominant limitation.
- Soil – where the dominant limitation is within the rooting zone. This can be due to shallow soil profiles, subsurface pans, stoniness, rock outcrops, low soil water holding capacity, low fertility, salinity, or toxicity.
- Climate – where the climate is the dominant limitation. This can be summer drought, excessive rainfall, unseasonal or frequent frost and/or snow, and strong winds or salt spray exposure.
  (Horizons Regional Council, 2009).

LUC classes 1-2 are known as highly versatile land and LUC 1-3 as highly productive land. Highly versatile and highly productive land are scarce, finite resources – Five percent of New Zealand's total land area is highly versatile, and 15 percent is highly productive (Ministry for the Environment, 2021). This land is particularly good for food production and has a good climate, suitable soil, and is flat or gently sloping. Here, less irrigation and fertiliser are needed

to grow food than in other areas. This highly productive land is often on the fringes of our cities (Ministry for the Environment, 2021).

The Northland region only has 400 hectares of Class 1 land and 36,000 hectares of Class 2 land, making up about 3% of the total land area. This potentially highly productive land is either volcanic or alluvial in origin and located in the Kerikeri, Whangarei, and Dargaville areas (Northland Regional Council, 2021). The below figure shows the percentage of land in the Northland Region in each Land Use Capability (LUC) class.

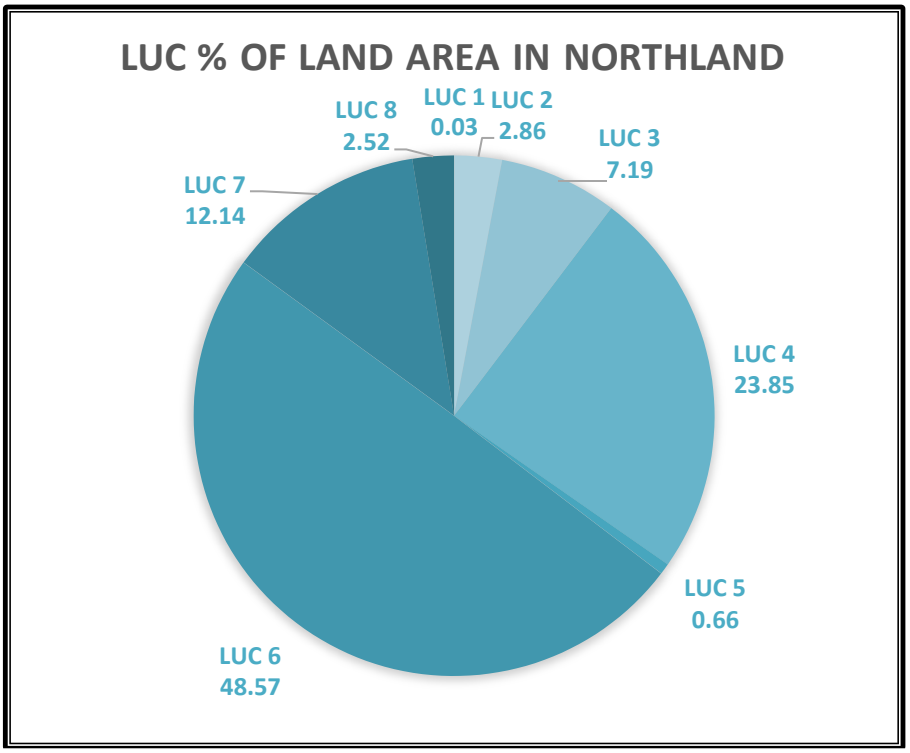


Figure 8: LUC % of Land Area in Northland. Source: Northland Regional Council, 2021

As seen in the above figure, the majority of the LUC classes in the Northland Region are LUC Class 6 (48.57%), followed by Class 4 (23.85%). This is reflected in the activities used on these land classes, with approximately 46% of land in pasture, 32% in indigenous forest, 14% in exotic forest, and a small proportion of 1% of land in horticulture (Northland Regional Council, 2021).

Table 3: LUC Class Percentages

Land Use Capability Class	Region as a percentage of land use capability class			
	Northland	NI	SI	NZ
1-4	34%	28%	22%	25%
5-6	49%	36%	23%	29%
7-8	15%	33%	51%	43%

Source: Northland Regional Council & Stats NZ

The Northland Region holds a significant proportion of these high-quality soils compared to the broader North and South Island regional scales. It, therefore, reinforces the importance of the agriculture and horticulture sectors in Northland and how valuable this resource is.

The potential for Northland land use change is within the LUC classes 1-3 where there is potential to maximise land use for a range of horticulture uses, extending productivity off these

land classes. As well as LUC classes 6-7, where there could be better environmental and profitability measures by having more of these land classes in forestry.

LUC is an important consideration for due diligence of land-use change or diversification. It gives guidance to the capability of the land resource for sustained production, which can be matched to a farming enterprise or activity.

The below map shows an overview of all Land Use Capability Classification Classes in Northland.

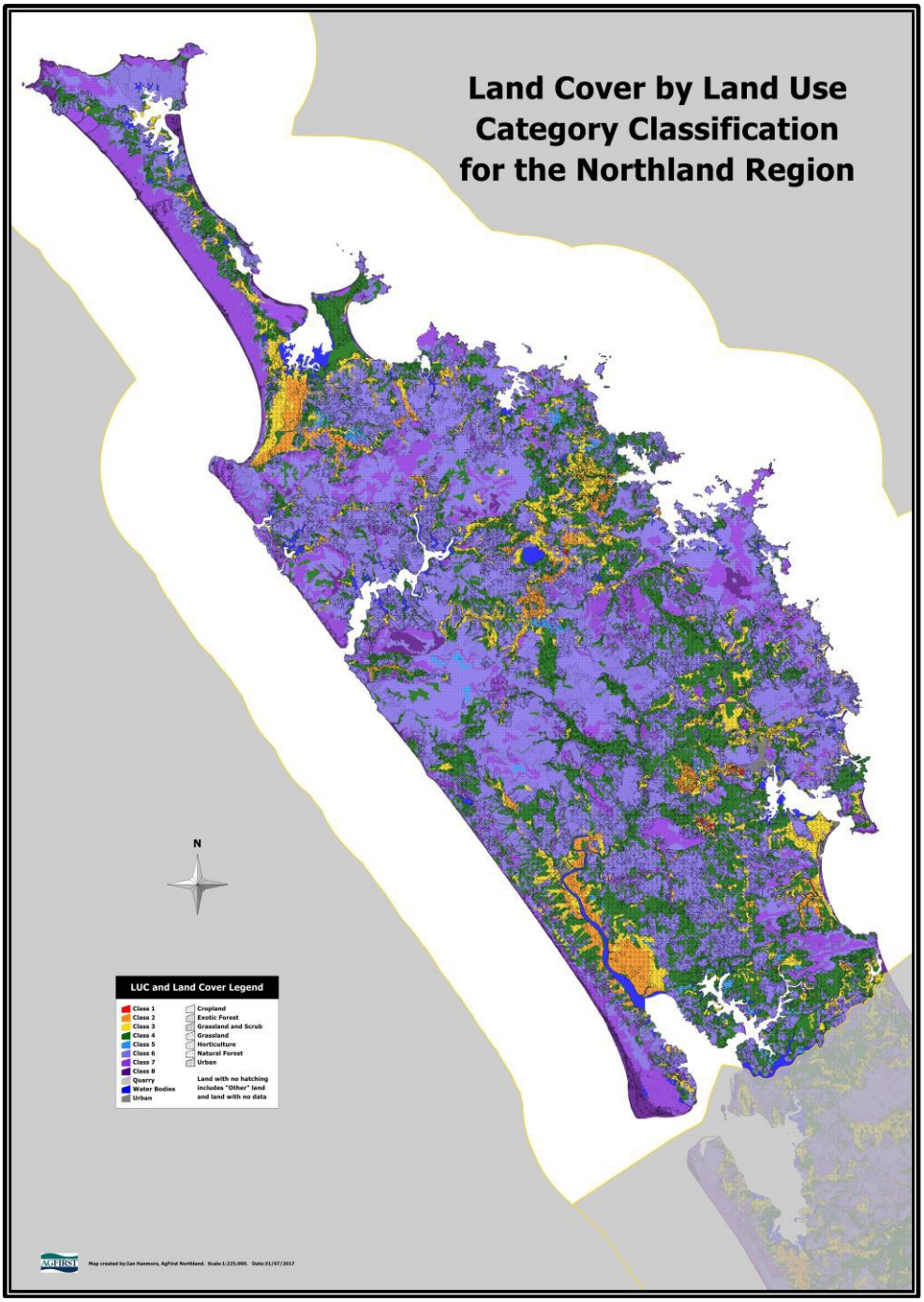


Figure 9: Land Cover by Land Use Category Classification. Source: AgFirst Report, 2017

Appendix One shows the Land Cover by LUC Classification, specifically for the Northland region. This table confirms there is still a large portion of land LUC classes 1 & 2 in 'grassland,' which has the potential to be converted to higher-value horticulture or cropping land (depending on the biophysical features of the land). It also reveals 17.44% of 'grassland' under LUC 6, which may be better utilised as forestry. We will explore some of the barriers or opportunities to these potential land-use changes later in this report.

5.2 Traditional Northland Land Uses

As mentioned above, agriculture dominates the Northland regions land use. The dominant agricultural land uses of the region are further described below.

5.2.1 Dairy

Dairy farming has been an essential element of the Northland economy for many decades. Over this time, it has become the dominant industry, stimulating the conversion of sheep and beef properties and production forestry into dairy farms.

Land use for dairying in New Zealand increased 45 percent, from 1.2 million hectares in 2002 to 2.2 million hectares in 2019. Northland had a significant increase in the land used for dairying during this time (up 24 percent), or 39,000 hectares to 166,000 hectares between 2002 and 2019 (Statistics New Zealand, 2021).

In 2019 the Northland region had 793 herds and 258,292 milking cows. The average herd size was 326 cows, and the average farm size was 143 hectares. Twenty-four percent of dairy farms had sharemilkers. The value of milk production to the Northland economy in 2019 was $486 million, from 81 million kilograms of milksolids produced. 7.1 percent of New Zealand's dairy herds are in Northland (Dairy New Zealand, 2020).

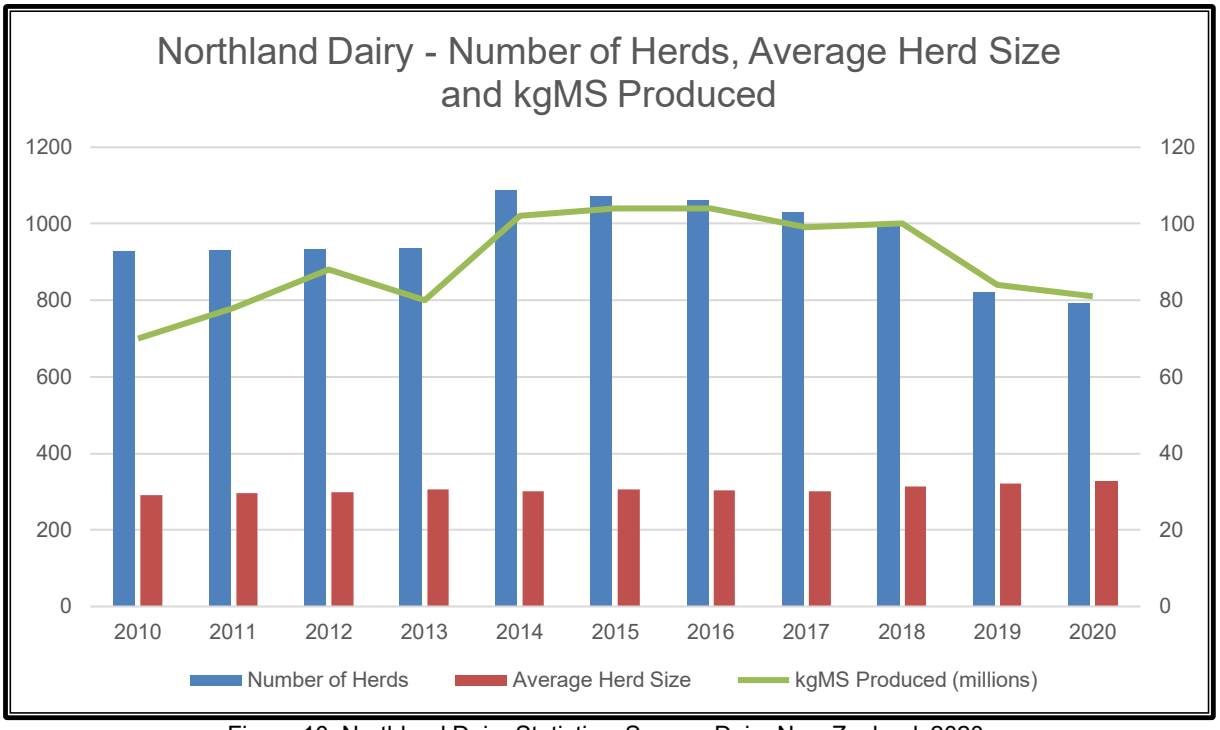


Figure 10: Northland Dairy Statistics. Source: Dairy New Zealand, 2020

The above graph shows that the average herd size in Northland has changed little over the last ten years. However, the total number of herds has significantly reduced, especially in the last two years, along with reducing the total kilograms of milksolids produced. There is a range of outside factors which could have influenced these figures, with the main one being weather patterns. However, overall, this shows a reduction in dairy herds and production, with the likelihood of excess land going into differing land uses.

5.2.2 Sheep and Beef

Between 1990 and 2019, across New Zealand, beef cattle numbers reduced 15.3 percent from 4.6 million to 3.9 million. Sheep numbers also decreased 53.6 percent across this period, from 57.9 million sheep to 26.8 million (Statistics New Zealand, 2021).

Land-use change in Northland reflects this national trend, with land used for sheep and beef decreasing by 25 percent from 2002 to 2019 primarily due to land conversions to dairy or production forestry. Sheep and beef livestock numbers also reduced significantly by 30% during this period (Statistics New Zealand, 2021). The principal reduction is in sheep numbers, as seen in the graph below.

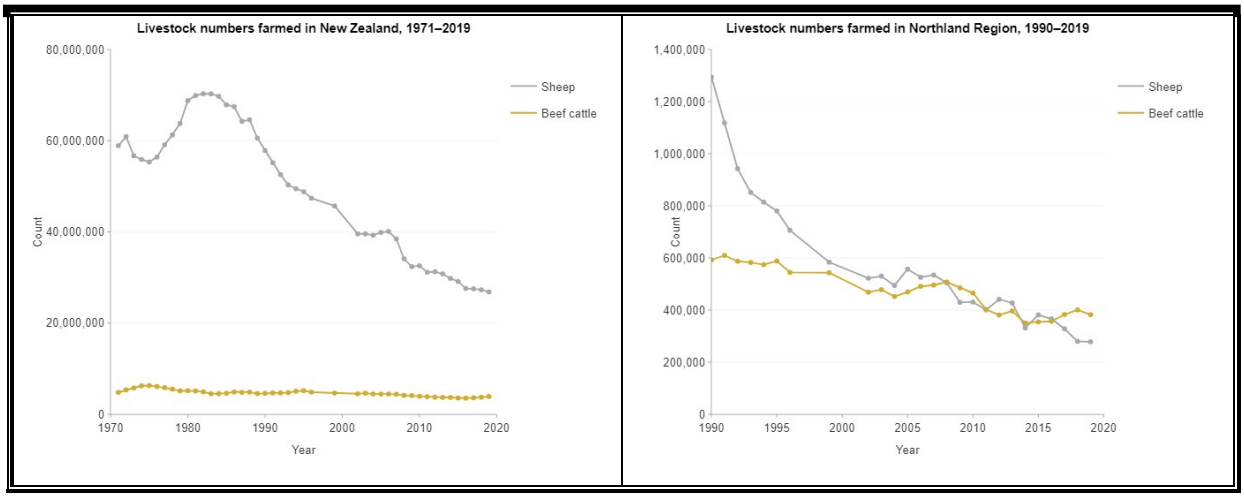


Figure 11: Sheep & Beef Numbers Farmed in New Zealand & Northland. Source: Statistics New Zealand, 2020

The change in land use and loss of productive sheep and beef farms can have both social and economic impacts on rural communities. Conversion from a sheep and beef farm to forestry can result in a reduction of labour units from five to one and income typically goes to mainly absent landowners rather than the local communities.

5.2.3 Horticulture

Northland's wide variety of soils and subtropical climate mean that a vast selection of crops are able to thrive in the region. Northland's largest crop is kiwifruit, with avocados becoming another fast-growing market. Other established horticulture crops include citrus fruits (mandarin, lemons, and oranges), tamarillos and berries (blueberries in particular). Northland is also home to the largest area of New Zealand for kumara, grown mainly in the Kaipara area. Other smaller horticulture productions include vineyards, olives, and more recently, apiculture, specifically producing manuka honey. Below is a list of key facts from the Northland Horticulture industry.

- 654 hectares of kiwifruit planted in Northland as of 30th June 2020
- 2,001 hectares of avocados planted in Northland as of 30th June 2020
- 138 hectares of olives planted in Northland as of 30th June 2020
- Northland contributes to 3.6 million trays of green and gold kiwifruit grown annually
- Northland contributes to 45% of New Zealand's avocado export crop
- Majority of kumara crop is grown in Northland
  (Statistics NZ, 2020)

Land suitable for future horticulture developments across the Northland Region have been identified by Bob Cathcart. Considerations across several factors to determine suitability suggests a maximum uptake of around 21,000 hectares could be in Horticulture across the Northland Region (Cathcart, 2012), as shown in the table below.

Table 4: Maximum horticulture potential in the Northland Region

	Avocado	Kiwifruit	Vegetables	Total
Far North	2,768	8,855	654	12,277
Kaipara	1,623	0	2,716	4,339
Whangarei	3,758	800	19	4,577
Northland	**8,149**	**9,655**	**3,389**	**21,193**

Source: Green, S., Schulze, H., 2018

This would be a very large increase on the current total horticulture land area in Northland of approximately 4,423 hectares (New Zealand Horticulture, 2020), but shows the potential the region has if resources like water can be guaranteed. This would in turn open more employment opportunities for locals and increase economic returns, benefitting local communities.

5.2.4 Forestry

Plantation forestry is a well-established and significant part of the Northland economy due to the region's warm climate, rainfall, and fertile soils (Northland Inc, 2021). Northland has a solid exotic timber harvest, and there are several processing plants in the region. Northland has established transport links connecting the region to local and global markets. Northport is New Zealand's second-largest export facility for forestry products and the closest port to overseas markets in Asia and beyond (Northland Inc, 2021).

In the Northland region, forestry and logging contribute $147.7 million to the region's GDP (1.7%). In 2019 the total area of plantation forestry was 137,000 hectares. This is an 18 percent reduction from the 2002 area of 168,000 hectares (Statistics New Zealand, 2021). However, the below graph shows the planted area is on a rising trend again.

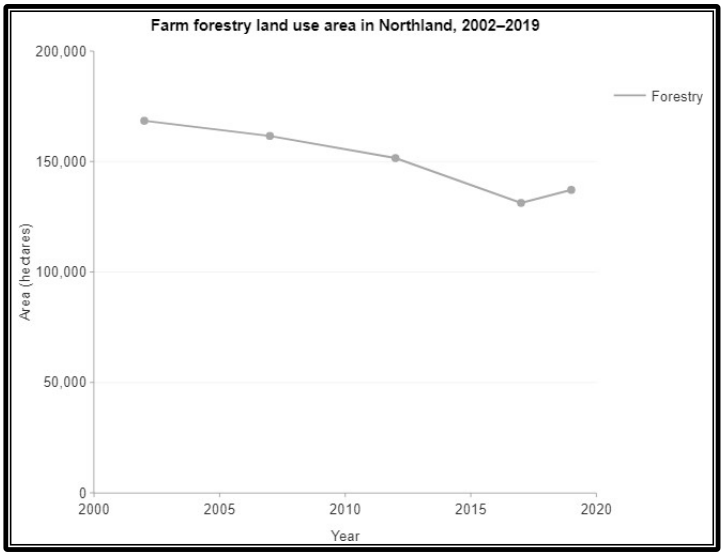


Figure 12: Forestry Land Use Area in Northland. Source: Statistics New Zealand, 2020

This increasing trend is largely due to the influence that carbon farming is having on the forestry sector. A big consideration is whether these new forests being planted are production forests (carbon credits are claimed for the first 17 years, and then the forest is harvested around year 28, carbon credits can only be claimed on the first rotation) or permanent forests (carbon credits can be claimed for 50+ years).

- In Northland in 2018, 852 hectares of new area was planted
- In Northland in 2018, 5,560 hectares was replanted
- 5,518,995 cubic meters or 11,834 hectares was harvested in 2018 (Statistics NZ, 2018)

There are concerns of the unintended consequences from emissions targets which incentivise a high level of afforestation and can result in a destructive impact on rural communities, due to loss of employment and reduced income going back into small towns. However, there can be positive impacts from planting forestry on marginal land for erosion control, which can reduce sediment loss and improve water quality, which is especially a problem in Northland.

6.0 Discussion - Factors which drive Land Use Change

Whenua (land) is valuable. It is a place for us to live, make a living, grow food and materials we need for ourselves, and export. Across New Zealand, considerable variations in landforms, soil, and climate influence how land across the country can best be used and managed (Ministry for the Environment, 2021).

The state of our land today is a legacy of the ways previous generations used it. Some former land uses limit how we can use it today. In the same way, our choices about land today will affect future generations (Ministry for the Environment, 2021).

New Zealand's primary sector success has been supported by the evolvement of land-use change over the past decades. Land-use change may not always be overtly visible in a broad pattern. However, it is constantly occurring, often at the regional level, as new or more profitable ways to farm arise, whether driven by markets, climate, water, or other factors (Thorrold, B.S, 2010).

Land will commonly move to its best use over time as determined by the potential productivity, and therefore the potential profitability (Anastasiadis, S., Kerr, S., Zhang, W., Allan, C., & Power, W. 2014). On this basis, "landowners looking to maximise their returns or profit, will select land use according to the quality of their land, with the best quality land being used for the most intensive, profit-generating use, and the poorest quality land being less productive" (Anastasiadis, S., Kerr, S., Zhang, W., Allan, C., & Power, W. 2014).

It is essential to differentiate between land use and land cover. Land cover reflects the physical or biological categorisation of land, for example, grassland, forest, or concrete. However, land use refers to the purpose relating to land cover, for example, pastoral farming, horticulture, urban (Meyer and Turner, 1994). This report concentrates on land-use change, which is defined as a change from one specific use to another rather than an intensification within a similar system.

In the past 25 years, land use has intensified by increasing the number of livestock and the yields per hectare and by adding more fertiliser and irrigation (Wynyard, 2016). Intensification has benefitted the economy but has also had adverse effects on the environment. Those effects can last for a long time. Levels of nitrogen and phosphorous in groundwater and aquifers are likely to be a result of fertiliser applied to the land decades ago (Wynyard, 2016).

Where we chose to live and the food we chose to eat as consumers, has an influence on the demand for land and how it is used in New Zealand. Our growing population will continue to drive this demand in the future. Additionally, overseas markets are another significant driver in land use. Most of our agriculture and forestry products are exported, and these activities cover half of our land area (Ministry for the Environment, 2021).

The population of New Zealand is projected to reach 6.8 million by 2073, having passed 5 million in June 2020 (Statistics New Zealand, 2020). A growing population also drives urban expansion and the development of rural residential areas. Urban areas currently cover only one percent of land in New Zealand, but 87 percent of the population lives in towns or cities (Ministry for the Environment, 2021). The concern is around urban expansion outwards onto productive land, creating tension between land use for housing and agriculture.

A range of factors can drive land-use change, all of which tend to interact and influence each other, including but not limited to:

6.1 Biophysical Factors:

- Soil Type – fertility, drainage, suitability for horticulture vs. pastoral.
- Topography – slope or aspect of the land, altitude, vegetation, erosion.
- Climate – rainfall, sunshine hours, temperature, winds, seasonal variation.
- Water availability – consumption, irrigation, quality.

6.2 Economic Factors:

- Profitability – comparative profit.
- Capital – access to capital (investment, development, seasonal).
- Markets – proximity, demand.
- Infrastructure – servicing or processing firms, transport.
- Labour – access to labour (skilled or seasonal).
- Expertise – access to information or technical advice.

6.3 Societal Factors:

- Social license – 'license to farm' from societal pressures.
- Changing diets – changing food preferences or population demand.
- Individual preferences – age, education, experience, family circumstances, attitude to risk, attitude to change, personal preferences.
- Technology – mechanisation, agrochemicals, production.

6.4 Regulatory Factors:

- Council regulations – Resource Management Act (RMA), could restrict or promote land-use change, controls on amenity effects, intensive farming, building controls.
- Government policy – political events, subsidies, taxation.
- Subdivision – zoning, population change and the demand for land for urban settlement.

6.5 Environmental Factors:

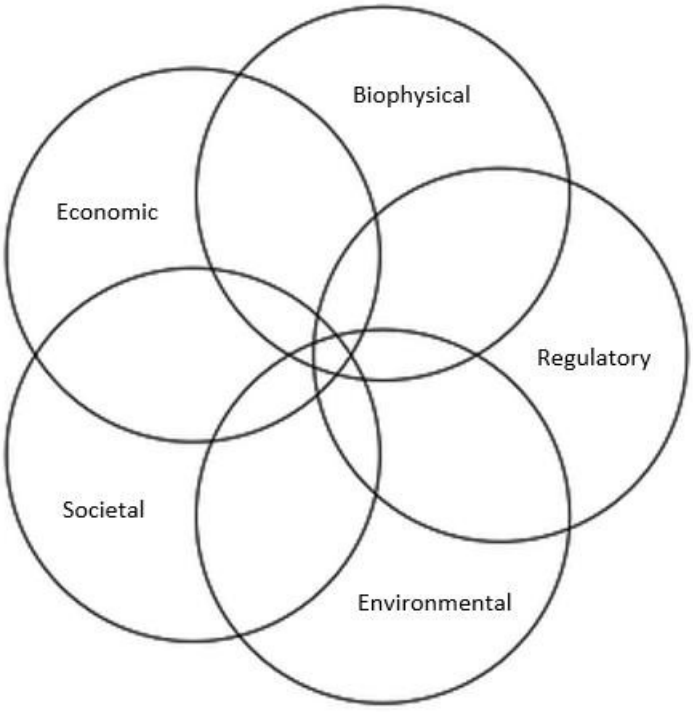
- Water management – water takes, quality, irrigation.
- Climate change & Greenhouse Gas Emissions – emission reduction targets, carbon farming.
- Nitrogen – freshwater management and nitrogen reduction targets.

6.6 Aggregation of Factors:

A pivotal viewpoint to consider is that the driving force for land-use change is an amalgamation of all the above factors; they all interact in different ways and each situation will be unique. These interacting factors can drive or deter land-use change and can be difficult to influence as a group. Briassoulis (2009) noted:

"The establishment of unambiguous casual relationships among the particular biophysical and societal factors that act as driving and mitigating forces of land use and land cover change is not straightforward because their relative influence and importance, as well as their interactions, depend on the spatial and temporal level of analysis and the geographical and historical context of study, their intricate spatial and temporal interplay, their changes over time and the difficulties to observe and describe many of them, as well as the processes through which they influence land-use change."

More work is needed to quantify the relative contributions of drivers and how they interact with each other to shape land use. This includes the value each specific driver holds in comparison to one another and if the importance of different drivers is changing over time (Ministry for the Environment, 2021).



The above diagram shows how these five factors cross over and how they are all interrelated. Not one is more important than the other, and in most cases, an aggregation of drivers will need consideration. The 'risk factor' involved in all the above factors also needs to be considered, and each individual will have a unique risk appetite.

For example, the AgFirst Report 'Land Use Change Diversification in the Waikato prepared for the Waikato Regional Council' identified a risk matrix for numerous enterprises. These risk assessments were based on professional experience and can be considered subjective. The higher the score, the greater the diversification risk. Note, a lower risk score does not indicate any risk, and conversely, a higher score does not indicate that the development is not feasible. A risk score of 1 is low risk, and a 5 is high risk.

Table 5: Risk Assessment Table

Enterprise	Flexibility to Change	Water Usage	Production Certainty	Labour	Upskilling	Total Risk Score
Dairy Goats	3	2	2	3	3	13
Maize	1	1	1	1	1	5
Kiwifruit	4	4	2	4	4	18
Avocados	4	5	4	4	4	21
Forestry	5	1	2	1	1	10

Source: AgFirst, 2020

This table can be used as a base risk assessment for differing enterprises, but there are some key considerations that could influence the scoring if assessed on a Northland scenario. For example, the risk score for avocados is likely to be lower if based on a Northland example. Avocados are a more established crop, which have been grown in Northland and the Bay of Plenty for many years now. They are technically a bi-annual crop, but production certainty would likely increase given the improved subtropical climate in Northland compared to the Waikato. Northland has higher pollination rates resulting in an earlier harvest, and we have seen some examples of stable annual production. Northland also has higher unemployment rates and lower median income, therefore could possibly attract labour more easily, reducing risk scores for both avocado and kiwifruit. Additional water storage facilities (once operational) and depending on location, could also reduce the water usage risk score based on a Northland risk table, especially compared to the Waikato, which has higher council regulated water processes.

Another increasingly common scenario is using land-use change to aid succession planning on-farm. A recent survey completed in March 2021 by Kantar and ASB showed that 57% of farmers are considering succession planning, and 21% are considering diversifying their existing farming enterprise into a different farming type.

Ben Speedy, General Manager of ASB Rural, noted: “At its core, diversification is building additional revenue streams within your business today while future-proofing it for the next generation. Historically New Zealand farms have been engaged in sheep, beef, and dairy farming. However, in recent years we have seen customers divesting sections of land traditionally used for grazing to forestry or horticulture, while others are seizing the opportunity for development and diversification for themselves.

The same research showed that 58% of farmers were considering adjusting their farming practices to cater to changing customer demands or supply premiums. Sustainable farms and orchards continue to be sought after, and significant work is being put into achieving more environmentally friendly practices. While diversifying may come with additional costs upfront, it can help ensure business sustainability or even provide an income stream in retirement.

Diversification is hugely varied: we have seen farmers get creative in various ways, adding mountain biking tracks or opening walking trails on the farm, investing in hives for honey production, and adding or changing to their farming operations entirely. We have also seen examples of customers leasing unproductive parts of the farm for carbon farming which can provide both financial and environmental returns. Diversifying is not without risk, but we have seen how it can pay off for farming families.”

AgFirst, a leading national rural consultancy firm, has developed some common questions that can help prompt farmers interested in diversification options. These questions can help them consider a range of matters that will affect the success of on-farm diversification. Some examples are:

- Is the principal reason for diversification financial or other?
- Why is your business considering diversification?
- What financial capacity does the farming business have to make a land-use change or to diversify?
- What are the activities of farming that you like most, what do you like least and why?
- Who are all the stakeholders in the diversification decision? Have they all been involved in the consideration?
- Where do you see your involvement in the value chain starting and or stopping?
- Through reflection, do the stakeholders in the business possess the skills to make the business work, or if not held, is there a strong desire to learn them?
- What is the farming business appetite for complexity? Is there a desire to grow the business with more moving parts and staff?
  (AgFirst, 2020).

Overall, there are many factors and considerations to be contemplated when looking at land-use change or diversification options. Many of them are interrelated, and each individual will prioritise these factors uniquely.

The following section investigates the most common considerations currently identified in Northland and the most frequent land-use changes we are seeing.

7.0 Discussion - Main Drivers of Land Use Change in Northland Today

From my analysis there are three main themes of land-use change and diversification identified in the Northland Region that are prominent today. I believe these factors will also be of most significant consideration moving forward into the future. The three main factors are environmental (primarily availability of water and the use of forestry to reduce our impact on climate change and emissions), economic (profitability and access to capital), and regulatory (subdivision of rural land).

7.1 Environmental Considerations

Access to water, climate change and reduction of greenhouse gas (GHG) emissions are all key players under the environmental flag when modern day farming in New Zealand.

Firstly, water is one of the most critical resources required to shift to higher-value land uses in the future. A recent project completed by AgFirst in the Waikato has identified securing water as the main barrier stopping Waikato farmers diversifying to alternative enterprises. “For the most part, people were saying that we went through a process and found that water was too difficult” (Phil Weir, 2021).

Suitable land for horticultural development is increasing in value across the Northland Region and New Zealand. A consistent supply of water is the key to unlocking this potential. With access to water, landowners can consider more diverse and profitable land uses (Te Tai Tokerau Water Trust, 2021). Climate change and global warming can also be a positive aid for the Northland region, creating options to grow different sub-tropical varieties such as pineapples, bananas, or peanuts, which previously had not been achievable.

In mid-2020, the Te Tai Tokerau Water Trust was created to initiate water storage and distribution schemes in two areas in Northland that have horticulture potential. The two areas are near Kaikohe in the Mid North and on the northern Pouto peninsula south of Dargaville. They will provide infrastructure to develop approximately 7,000 hectares of new horticulture land (Te Tai Tokerau Water Trust, 2021).

Northland has a relatively high annual rainfall, but lack of storage means this cannot be retained in times of shortage. Creating these reservoirs will give landowners greater options and confidence to implement future land-use changes. These schemes would also provide capacity for community water supplies in towns like Kaikohe and Dargaville, reducing current summer water restrictions in these areas.

The details of the planned reservoirs are shown in Appendix Two & Three and are detailed as:

<u>Matawii Reservoir:</u>

The Matawii reservoir is situated north East of Kaikohe, with an expected capacity of 750,000 cubic meters, and is estimated to be operational by summer 2022/23. It will supply water to the under-construction Ngawha Innovation and Enterprise Park and other surrounding horticulture ventures. It will also provide a backup supply to Kaikohe township.

Redhill Reservoir:

The Redhill reservoir is located near Glinks Gully on the Pouto peninsula. With an expected capacity of 270,000 cubic meters, Stage One will support 150 hectares of new horticulture development on property adjacent to the reservoir. To be operational by the end of 2021. Stage Two will see capacity increased to 3,200,000 cubic meters, which is currently going through the consent process.

Otawere Reservoir:

The Otawere reservoir is situated near Waimate North. It has an expected capacity of 4,000,000 cubic meters—currently going through the consent process.

Terence Brocx, who owns a dairy farm near Ohaeawai, said there was a strong interest in the project from within the wider primary sector in Northland and believed that there was significant potential to grow high-value horticulture in the region if a reliable source of water was available. "The whole area is ripe for development because the soils are so good and have the potential with the climate we have in the north to grow high-value crops. The only thing that is missing is reliable water. I am excited about the prospect of what these water schemes could mean for the region."

There is a range of opportunities for landowners choosing to develop or diversify their land. Others may decide to sell to investors or developers attracted to the region by the security a water scheme would provide for horticulture development. As well as providing a guaranteed water supply, these schemes will enable commercially viable and environmentally sustainable horticulture opportunities, which will also provide economic and employment prospects in both districts (Te Tai Tokerau Water Trust, 2021).

Already there are some well known and high-profile companies who have purchased land in the vicinity of these proposed reservoirs to take advantage of the opportunities that will be created. Proposed enterprises include avocados, kiwifruit, berries and olives.

There are examples of this through previous irrigation schemes such as the Kerikeri and Maungatepere irrigation schemes. A 2016 report showed that the Kerikeri irrigation scheme contributes more than $100 million per annum to the region's GDP and supports the employment of more than 1,300 FTE's (Te Tai Tokerau Water Trust, 2020).

How the Schemes Work:

The plan is that the schemes will ultimately be owned by the water users (shareholders) and operated using cooperative principles. Water companies are currently being created for this purpose (Te Tai Tokerau Water Trust, 2021). The cost of water shares is still being established, but indications are $25,000 per share in the Kaipara and $30,000 per share in the Mid North. Each share would provide access to 3,000 cubic meters of water per annum, which will be supplied at a daily volume of 30 cubic meters. These volumes are considered sufficient for various horticulture uses and align with other local schemes. There will also be annual fixed costs mixed with variable costs based on seasonal use, covering the ongoing costs of maintaining the scheme (Te Tai Tokerau Water Trust, 2021).

There are likely to be three main share purchase options:

1. Full payment of share price.
2. Share up option – a portion of shares paid for upfront and the remaining spread over the following four years.
3. Dry shares – shares that can be purchased in the scheme by paying a portion of the total share price, but while they are in the form of a dry share, the water cannot be taken.
   (Te Tai Tokerau Water Trust, 2021)

Based on the above options, these costs may be a barrier to some landowners changing land use due to the capital cost of converting the land and the annual cost to obtain the water. On the other hand, the opportunities a guaranteed water source could bring to the region could be hugely profitable.

Along with water availability, climate change and lowering GHG emissions will mean a change in land use will need to have a lower environmental impact. Environmental compliance is being cited increasingly by farmers as a reason for considering diversification. In 2016 New Zealand endorsed the Paris Agreement on climate change, committing New Zealand to reduce national GHG emissions to 30% below 2005 levels by 2030. The Climate Change Commission's report also anticipated there will be at least 3,000 hectares of land-use diversification per year, which is double the current rate (Farmers Weekly, 2021). As a mitigation strategy, land-use change to lower emitters such as forestry and horticulture is likely, especially where nutrient limits are also imposed (AgFirst, 2017).

Re-emerging opportunities associated with the Emissions Trading Scheme (ETS) and carbon price have resulted in forest investors coming into the market for land. The below graph shows the Carbon Unit (NZU) spot price over the last two years. As shown, the price has increased significantly from $25/NZU in 2019 to $61/NZU as of September 2021.

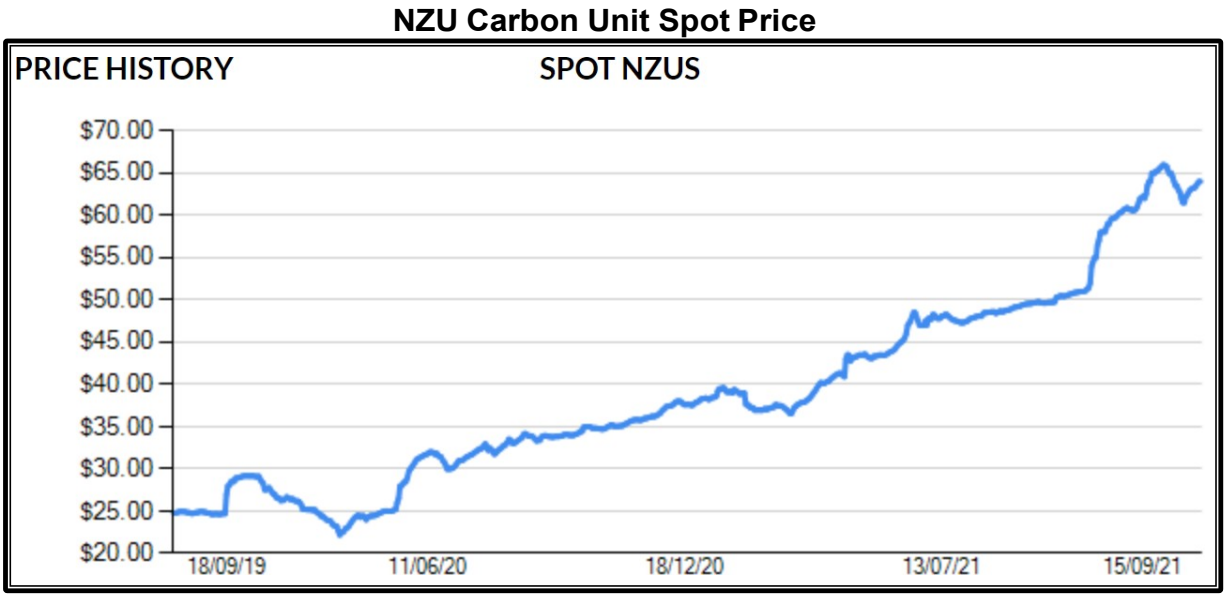


Figure 13: NZU Carbon Unit Spot Price. Source: Jarden Comm Trade, 2021

We have seen forestry investors prepared to pay more than farmers for land in high LUC classes (and often remote areas) because of a combination of good carbon revenue streams and projected strong long-term returns on investment from forestry in general.

There has also been a strong uptake of the Crown Joint Venture fund and the One Billion Trees Programme (1BT) grant by existing landowners. This provides evidence that many farmers are beginning to assess the long-term benefits associated with putting part of their farm in trees, planting 'the right trees in the right place' – where the right place is one which increases overall farm profitability, reduces net farm emissions and may also confer other sustainable environmental and social benefits (BakerAg, 2021).

A BakerAg report on independent validation of land-use change from pastoral farming to large-scale forestry, completed and summarised in the table below, shows whole farms purchased for forestry or partial farm plantings between 2017 and 2020 across New Zealand.

Whole farms purchased for forestry or partial farm planting

Whole of Farm Purchase	Year				Grand Total (Hectares)	Percentage by Conversion
	2017	2018	2019	2020		
Honey (Manuka)	3039	7340	1678	2281	14338	10.3%
NZ Sales	2510	11245	26198	11881	51834	37.2%
OIO	1455	8982	10626	4883	25946	18.6%
Total Whole of Farm	7004	27567	38502	19045	92118	66.0%
Partial farm plantings by Landowner through 1BT/JV						
1BT Landowner Grant		12,124 Indigenous + 13,434 Exotic			25560	18.3%
Crown Forestry JV		21822			21822	15.6%
Total Partial farm funded		47382			47382	34.0%
Totals					139500	100.0%

Figure 14: Whole Farms Purchased for Forestry or Partial Farm Planting. Source: BakerAg, 2021

- The gross land area of whole farms purchased for planting is estimated at 92,118 hectares.
- Between 2018 and 2020 an additional 47,382 hectares within existing farms was approved for planting, funded by the One Billion Trees programme (1BT) or as part of the Crown Forestry Joint Ventures scheme.
- Close to 26,500 hectares or 19% is likely to be planted with manuka or indigenous species between whole-farm purchases and partial plantings.
- In total, it is estimated that 139,500 hectares of land has been or will be planted soon, taking this land predominantly out of sheep and beef production.

Of the 92,118 hectares of total farms sold over the four years, approximately 5,375 hectares is in Northland. Analysis of the 2016 LUCAS layers suggests that 68% was in clear pasture, 6.8% in potentially reverting country, and 25% in exotic or indigenous forest species.

LUCAS 2016 Layer Summary

LUCAS 2016 Layer	Northland	Gisborne-Hawkes Bay	Rest of North Island	South Island	Grand Total (Hectares)	Percentage by Total
Cropland - Annual				75	75	0.1%
Grassland - High producing	3232	3624	13150	2280	22285	24.2%
Grassland - Low producing	427	7929	21646	8101	38103	41.4%
Grassland - With woody biomass	365	1064	2569	2204	6202	6.7%
Natural Forest	752	1154	8635	4259	14801	16.1%
Planted Forest - Pre 1990	267	293	1114	651	2325	2.5%
Post 1989 Forest	326	907	4221	2731	8185	8.9%
Other		31	0	0	32	0.0%
Settlements or built-up area				1	1	0.0%
Wetland - Open water	3	34	29	6	71	0.1%
Wetland - Vegetated non forest	4	1		34	39	0.0%
Grand Total	5375	15037	51365	20342	92118	100.0%

Figure 15: LUCAS 2016 Layer Summary. Source: BakerAg, 2021

Analysis of properties in the Northland region found that the majority (90.2%) of land being converted is land of LUC 6 and above. Some 9.6% of the area is in LUC 4, 66.6% in LUC 6 and 23.6% in LUC 7.

In terms of erosion susceptibility classification (ESC), the land in Northland falls into the four main ESC classes as follows:

- Low 11.3%
- Moderate 49.1%
- High 18.7%
- Highly erodible 20.8%

Forestry interests have historically purchased steeper land due to its availability and lesser interest from farming and for environmental reasons (BakerAg, 2021). Carbon forestry and manuka are two options that are now attractive in some of these most challenging ESC classes.

Distance to port is another factor to consider. This land might be considered remote and therefore of lower market value by farmers; in pre carbon/low log price days, this land was also less attractive as a forestry investment. However, with the now established carbon cashflows available, forestry is an attractive option in these more remote areas. Throughout the life of these more remote forests (if planted in radiata pine), there could be decision points that may result in the forests being managed for timber and carbon revenues or carbon only, depending on the relative values of timber and carbon. Forests closer than 150km to a port are those most likely to be managed for both timber and carbon revenues.

With a production forest, at the end of the first rotation, the carbon credits that have been claimed throughout the growth cycle are a liability attached to the land title. This means that the land can likely never be used for any other purpose than carbon forestry. This is because the carbon unit liabilities associated with the previous carbon credits would have to be repaid based on current value thereof.

Until recently, carbon credits were seen as a nice little cashflow earner during the growth cycle, but the main aim was still the harvest value of the logs. That is now all changing. At the end of the 28 years, the land can simply sit there, with its unharvested forest, with large carbon liabilities attached to it, providing no further income to anyone.

This is a significant hidden consequence, and future generations of New Zealanders need to consider that they will likely have some green trees to look at, but the land itself can no longer be used for anything because of the crippling carbon liabilities attached to the land title (Woodford, 2019).

The Climate Change Commission's advice to the Government, recommends a mix of native and exotic planting, planting for timber outcome (rather than permanent exotic carbon only forests) and targeting land that is more suitable to forestry than livestock farming.

There are also the concerns about depopulation of rural communities and the loss of services, but this has an associated challenge in respecting property rights and meeting longer-term national interests such as how best to achieve a net zero emissions economy by 2050 (Williams, D, 2021).

Two main conclusions can be drawn concerning the amount of land-use change and diversification from pastoral to forestry and the reasons behind these:

- Whole farm purchases and planting, mainly by forestry investors, allowing good capital gain on land for existing farm owners, who can then continue moving up the farming ladder or into retirement. Forestry investors have been able to pay reasonable prices for land thanks to high log prices and a rise in the carbon price, with expectations that this will continue to rise.
- Partial planting of an existing farm. This allows diversity of farming operations, increasing returns from poorer performing land, expanding income streams, and strengthening the farm's environmental footprint.

Another option if a farmer does not have the free capital, expertise, or risk profile to plant forestry on their marginal land to diversify, companies around New Zealand will lease property and manage this for farmers. There are two main products:

<u>Carbon Lease</u>:

- The company leases the carbon in a forest that has been planted to harvest
- They pay an annual rental to the forest owner
- The company owns the carbon in the forest
- The company takes care of any ETS liabilities from that forest
- The forest needs to be planted after 2000 and ideally 100 hectares or bigger

<u>Planting Lease:</u>

- The company pays to plant and establish the forest
- The company pays the owner an annual rent
- The company owns the carbon in the forest as it grows
- The owner owns the trees and can harvest at the end or elect to turn it into a permanent forest

- Minimum of 100 hectares
  (New Zealand Carbon Farming, 2020)

By using this lease option, it delivers certainty and diversity of income for farmers without the risk. They will not need to outlay the capital for planting, source contractors, gain the expertise to fulfil compliance requirements, insurance, and manage price uncertainty or volatility of the carbon market. However, it does give them reliable cashflow for a set period, with many further options depending on the lease plan, whilst also improving their environmental footprint and getting a return from marginal land.

Overall, as Gordon Williams from Pāmu quoted “It’s not forestry versus farming. It’s the two working together on the right classes of land to do the environmental job on erodible, less productive hill country and allow the rest of the farm to focus on efficient livestock production. I think farmers should not close their minds to how to optimally integrate trees into their farms.”

7.2 Economic Considerations

A range of economic factors are often crucial influencers in deciding if a land-use change is warranted. Some critical economic parameters are profitability, access to capital, access to markets, and then more widely, infrastructure, access to labour or expertise, and technology.

The below table shows the average returns per hectare for the most common land-use industries in Northland. The metric is a valuable and easy-to-understand metric for comparing farm performance. As you can see, there is an extreme scale between sectors – ranging from Sheep and Beef at $183 per hectare to Gold Kiwifruit at $177,846 per hectare. Although, the initial capital outlay for each of these enterprises is an essential factor to consider in conjunction with farm profitability.

Table 6: Analysis of economic Performance

Enterprise:	Net return per ha:
Sheep and Beef	$183
Dairy	$1,894
Kiwifruit - Green	$76,722
Kiwifruit - Gold	$177,846
Avocados	$22,728
Forestry	$1,150

*Sheep and Beef/Dairy data is taken from the AgFirst modelled farms for the 19/20 season.
*Kiwifruit data is taken from Zespri Orchard Gate Return (OGR) for the 20/21 season.
*Avocado data is taken from NZ Avocado Orchard Gate Return (OGR) for the 19/20 season.
*Forestry data is taken from Farm Forestry New Zealand and is the average of 110 woodlots at 17/18 log prices. A further consideration in regard to forestry is the long hold period. Revenue is not received until optimum maturity age (~28 years) and there is no account for the cost associated to carry, use of money and at harvest, return is largely dependent on the log price at the time.

Note:
Farm profit before tax
Orchard Gate Return is the revenue received after post-harvest costs are deducted.
Forestry is the annual return, per hectare, per year, calculated from the net return per hectare divided by the age of the harvest.

Based on the above profitability figures and previous discussions throughout this report, there is a compelling interest in converting marginal sheep and beef land to forestry, or high quality, versatile dairy farming land to horticulture, based on the returns. However, it would be prudent

to consider the capital costs required to make these conversions, and payback period once converted.

Although horticulture has the highest returns, it also has the highest capital costs required to convert. Capital costs include all costs involved for the development of the new land use option, plus the operational losses accrued prior to the point where the enterprise first generates a positive revenue. The payback period refers to the amount of time it takes to recover the cost of an investment. The desirability of an investment is directly related to its payback period (AgFirst Waikato, 2020).

In addition to capital, farmers also found the time commitment required to carry out a due diligence exercise was often onerous while running an existing business.

7.3 Regulatory Considerations

Another critical factor to land-use change is 'urbanisation' or the 'carving up' of productive rural land into urban subdivisions or lifestyle blocks. Land fragmentation is an increasing concern, driven by urban expansion onto rural land on the fringes of urban areas and increased demand for food production. The most highly productive land (LUC classes 1, 2, and 3) is vulnerable to fragmentation for commercial, industrial, residential, and lifestyle block land uses (Statistics New Zealand, 2021).

A growing population also drives urban expansion and the development of rural residential areas. Urban areas currently cover only 1 percent of land in New Zealand, but 87 percent of the population lives in towns or cities (Ministry for the Environment, 2021). The concern is around urban expansion outwards onto productive land, creating tension between residential land use and agriculture.

The below graph measures change in highly productive land in Northland, defined by land in land use capability classes 1, 2, and 3. As shown, there has been a significant conversion of these land classes to urban and residential areas since 2002, increasing from just over 2,000 hectares to 6,000 hectares in 2019.

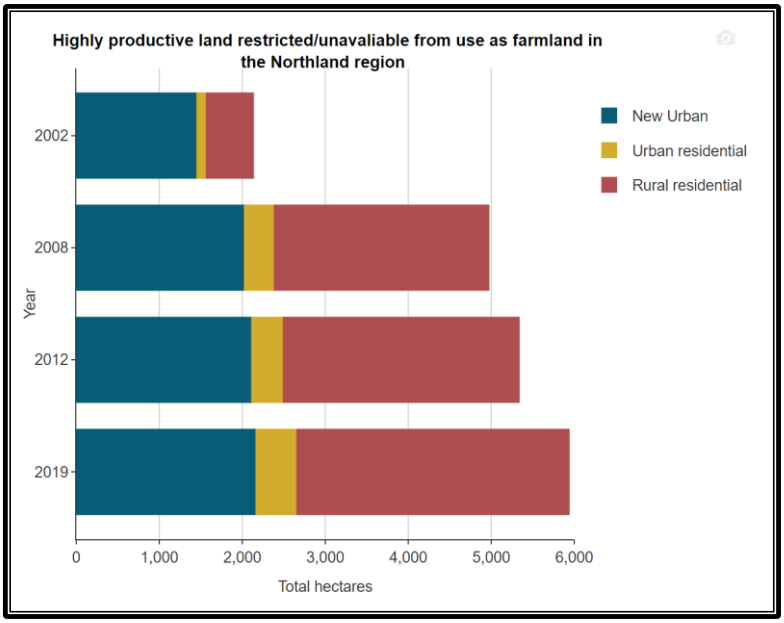


Figure 16: Highly Productive Land Restricted/Unavailable. Source: Statistics New Zealand, 2020

Rural land subdivision is primarily controlled by district and regional councils. Regulations are mostly aimed at preventing disaggregation of land parcels (i.e., endeavouring to maintain land parcels as economic units) or preventing the loss of high-quality soils to urban development (AgFirst Report, 2017). They also make zoning and planning regulations that dictate how land in specific areas can be used (Ministry for the Environment, 2021).

Although councils have these rules, we continue to see quality land and highly productive soils going into smaller urban or lifestyle subdivisions. An example of this is the very productive and fertile soils of Pukekohe, south of Auckland, where for many generations, these properties have been prime market gardening land. However, unfortunately, with Pukekohe's proximity to Auckland and national population growth, this productive land is being developed into housing estates to combat social housing and population issues. This was done without the thought of the consequences of losing this prime productive land that has been generating food production.

However, there are other examples where subdividing rural land into smaller blocks is beneficial—for example, splitting a farm into smaller parcels for horticulture use that does not require a large land area. The kiwifruit industry in the Bay of Plenty would not exist if the subdivision of existing farms did not occur.

Alternatively, it can also provide much needed capital or cash injection to existing farmers who have subdivided these 'lifestyle blocks' off their farms. We have seen in increase in landowners completing subdivision of these small blocks, which make minimal difference to their main farm platform, but provide a decent amount of cash proceeds in which they can use in debt reduction or capital improvement on their properties.

Overall, converting prime rural land into urban or lifestyle blocks is a balancing act. The amount of land we have seen lost to this fragmentation over the last two decades (as seen in the graph above) shows an apparent reduction in the most suitable land for food production. The loss of productive capacity from this prime land can be irreversible.

7.3.1 Significant Natural Areas (SNA)

A significant natural area (SNA) is an area of indigenous biodiversity that has been identified as having high ecological value using a set of criteria. The criteria are based on Appendix five of the Northland Regional Policy Statement, including representativeness, rarity/distinctiveness, diversity and pattern, and ecological context (Far North District Council, 2021). The Resource Management Act requires that SNAs are protected on both public and private land.

More than 280,000 hectares in the Far North have been mapped as potential SNAs (about 42 percent of the Far North district) and 80,000 hectares of the Whangarei district, about 28 percent of the district (RNZ, 2021).

The controversial new SNA classifications, which will add some restrictions on what use the land can have, would significantly impact Northland land use if enforced. The government has not yet finalised national legislation underpinning the new classifications, but this is a potentially significant issue affecting Northland landowners.

8.0 Examples of Land Use Change in Northland

Four unique and contrasting cases that are real life instances of the considerations required and the land-use change occurring in Northland.

Example A – Long term sheep and beef family farmers in Kaipara. First-generation elderly parents on the farm. Second-generation (two siblings, working on the farm) and third-generation not interested in farming. Small scale drystock property therefore, trying to support three families. Cashflow has always been an issue for clients, regularly requiring assistance, but very asset rich, with strong equity.

Numerous meetings were held to discuss future requirements and the long-term goals for each party. Long term, the business was not viable or profitable enough to continue as is. They discussed numerous land-use change options. The main focus was on the more unproductive rural land they had, and how they could capitalise on a better return from this land.

The avenues that best suited their goals were the two forestry scenarios (they had >100ha's, which mainly was LUC classes six and seven). One option is to sell the land to an individual or forestry company that would plant trees for carbon on the property or to look at a carbon farming lease arrangement. This would give them additional cashflow in the short-medium term, with the option to harvest the trees at the end of the lease.

Either one of these options were suited, but due to the family's age and stage, they decided to sell this land. This way, they got the capital out, which enabled them to repay all their debt and left them with additional cash to improve the rest of the productive land to maximise profits. It also aided as a succession tool to assist one of the siblings in getting off the farm and pursuing other ventures.

Example B – Second-generation dairy farmers in the Kaipara district, progressed into farm via 50/50 sharemilking position. Have grown wealth by purchasing additional land and diversification of assets both on farm and off farm. Now have further opportunities arising with the Redhill water storage reservoir nearby. These farmers have the equity and capital to change land use, depending on their goals and risk profile.

Next generation is interested in the farm and are in industry-related professions. The family aims to increase equity and diversify income streams and allow the second generation to step back. Many options have been considered, including avocados, kiwifruit, vegetables, sub-tropical crops, subdivision and alternative milking such as sheep or goats.

Is the handbrake to change that there are too many options? What is the balance between too much time spent researching viable options and the risks and capital required versus the rewards of the equity and capital gain and diversification of income streams?

Example C – First-generation dairy farmers who purchased their farm five years ago after working their way up through the industry. They have used subdivisions of 'unproductive' land to make capital gains. Three small lifestyle sections were subdivided off the farm, which has not affected milking platform. The sale of these has enabled them to use proceeds for capital expenditure on-farm to improve the profitability of the remaining productive land and enhance

environmental sustainability. Additional proceeds have also been used in debt reduction, further improving the equity and viability of the business.

Example D – A publicly owned business using forestry and trees to its advantage is state owned Pāmu (the trading name for Landcorp Farming). They have recently refined their strategy and will now see 10,000 hectares of plantation forestry planted over the next decade (up from their initial 2,000 hectare plan).

Pāmu has a significant amount of land in Northland and across New Zealand that is classified as either erosion prone or of lower productive value – over 60,000 hectares of class six or seven land. Pāmu considers some land is commercially, environmentally, and strategically better suited to forestry (Williams, D, 2021).

Gordon Williams, Pāmu environment manager, says farmers are happy to sit down and work out their earnings per hectare across the whole farm, but many will not work out how much return they can get off parts of the farm. This is where land use capability can help them.

Between 2010 and 2016, Pāmu completed land and environment plans on all its farms. Farmland was classified by capability and versatility, taking into account variables such as slope, soil type, wetness, and climate and then classified using the LUC classes. On classes of land six and seven, the land can not be farmed as intensively, and this is where forestry can have a higher return.

“This means the poorer or difficult to manage livestock parts of the farm, can earn more than the average farm earns. Inputs can be used more efficiently and concentrated into the rest of the farm, increasing overall farm productivity and net returns” (Williams, D, 2021).

While Pāmu’s main focus is on exotic forestry, they are also exploring natives and other species.

9.0 Conclusions

The Northland Region of New Zealand is a vital province for agriculture, horticulture, and forestry and, with its subtropical climate and topography mix, offers a key competitive advantage.

There is a considerable opportunity for the region and its future success as food and fibre producers of New Zealand if sectors can work together to get the right land use in the right place. Collaboration from all industry bodies such as Dairy NZ, Beef and Lamb, Horticulture New Zealand, and New Zealand Forest Owners Association, as well as landowners need to hold discussions together around these topics.

Some former land uses limit how we use land today. For example, loss of rural productive land to residential housing. In the same way, the land-use choices we make today such as forestry can be irreversible and will affect future generations and the future production and profitability of our industry.

Five key factors were identified that influence land-use change (biophysical, economic, societal, regulatory, and environmental). These five factors are all interrelated. They are all equal in importance and in most cases, an aggregation of drivers will need consideration. An individual's risk appetite, as well as any future succession plans, will also influence these decisions.

Good land-use decisions depend on being well informed and understanding the trade-offs between profitability, physical land characteristics and environmental sustainability. To achieve all these aspects, a mosaic approach to land uses may be required across the rural landscape in Northland. These differing land uses can complement each other.

In this report I identified three main drivers of land-use change and diversification in the Northland Region that are prominent today. The three main aspects are environmental considerations (primarily availability of water and the use of forestry to reduce our impact on climate change and emissions), economic considerations (profitability and access to capital), and regulatory considerations (subdivision of rural land).

Water is one of the most critical resources required to shift to higher-value land uses in the future. With the proposed water storage reservoirs going ahead in three sites in Northland, landowners can consider more diverse and profitable land uses such as a range of horticulture opportunities as well as alternative sub-tropical varieties.

Along with water availability, climate change and lowering GHG emissions will mean a change in land use will need to have a lower environmental impact. As a mitigation strategy, land-use change to lower emitters such as forestry and horticulture is emerging. Diversification from pastoral to forestry is largely made up of either forestry investors, purchasing and planting whole properties or partial planting of an existing farm, by current landowners.

A range of economic factors are often crucial influencers in deciding if a land-use change is warranted. Based on economic returns there is a compelling interest in converting marginal sheep and beef land to forestry, or high quality, versatile dairy farming land to horticulture. However, it would be prudent to consider the capital costs required to make these conversions, and payback period once converted. In addition to capital, farmers also found the time

commitment required to carry out a due diligence exercise was often onerous while running an existing business.

Another critical factor to land-use change is land fragmentation. The concern is around urban expansion outwards onto productive land, creating tension between land use for housing and agriculture. Alternatively, it can also provide much needed capital or cash injection to existing farmers who have subdivided these 'lifestyle blocks' off their farms.

As identified in the examples provided, the land-use changes are already occurring throughout Northland at present and will continue to into the future. How we go about these land-use changes is important, and from my research, I have come up with the following recommendations.

10.0 Recommendations

From the research completed in this report and my professional experience, I make the following recommendations:

- I suggest further analysis and information on current land use is required to ascertain what enterprises are covering what land areas in Northland. Similarly, information on soil types is difficult to obtain and is generally high level. Statistics are primarily restricted and usually well out of date. Information at a district or regional level could assist in future land-use decision making.
- I suggest further investigation and research into different land uses, specifically for the Northland region, including new crops or subtropical varieties. We need to share our knowledge and experiences so others can make informed decisions regarding land use diversification.
- I propose the availability of specialist consultants who can be accessed easily by farmers to assist landowners in uncovering potential land-use change options and what would best suit them as people, their land, and the viability. Having previous case study examples would assist with this.
- I advocate that water storage investment for the Northland region remains a priority, and I recommend the proposed water storage sites continue to go ahead, as well as an investigation into other potential future sites.
- I suggest local councils continue to plan urban development and weigh up the requirement of residential housing versus products produced from highly productive agricultural land.

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Appendix

Appendix One: Land Cover by LUC Classification

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And based on analysis of:

LUCAS NZ Land Use Map 1990 2008 2012 (v016) - https://data.mfe.govt.nz/layer/2375-lucas-nz-land-use-map-1990-2008-2012-v016/

NZLRI Land Use Capability - https://lris.scinfo.org.nz/layer/48076-nzlri-land-use-capability/

Stats NZ regional boundaries - http://www3.stats.govt.nz/digitalboundaries/annual/ESRI_Shapefile_2017_Digital_Boundaries_High_Def_Clipped.zip

Appendix Two: Northland Reservoir Map (Kaipara)

Te Tai Tokerau Water Trust (2021). *Kaipara Water Scheme Map.* Retrieved from https://www.taitokerauwater.com/kaipara

Appendix Three: Northland Reservoir Map (Mid North)

Te Tai Tokerau Water Trust (2021). *Mid North Water Scheme Map.* Retrieved from https://www.taitokerauwater.com/mid-north

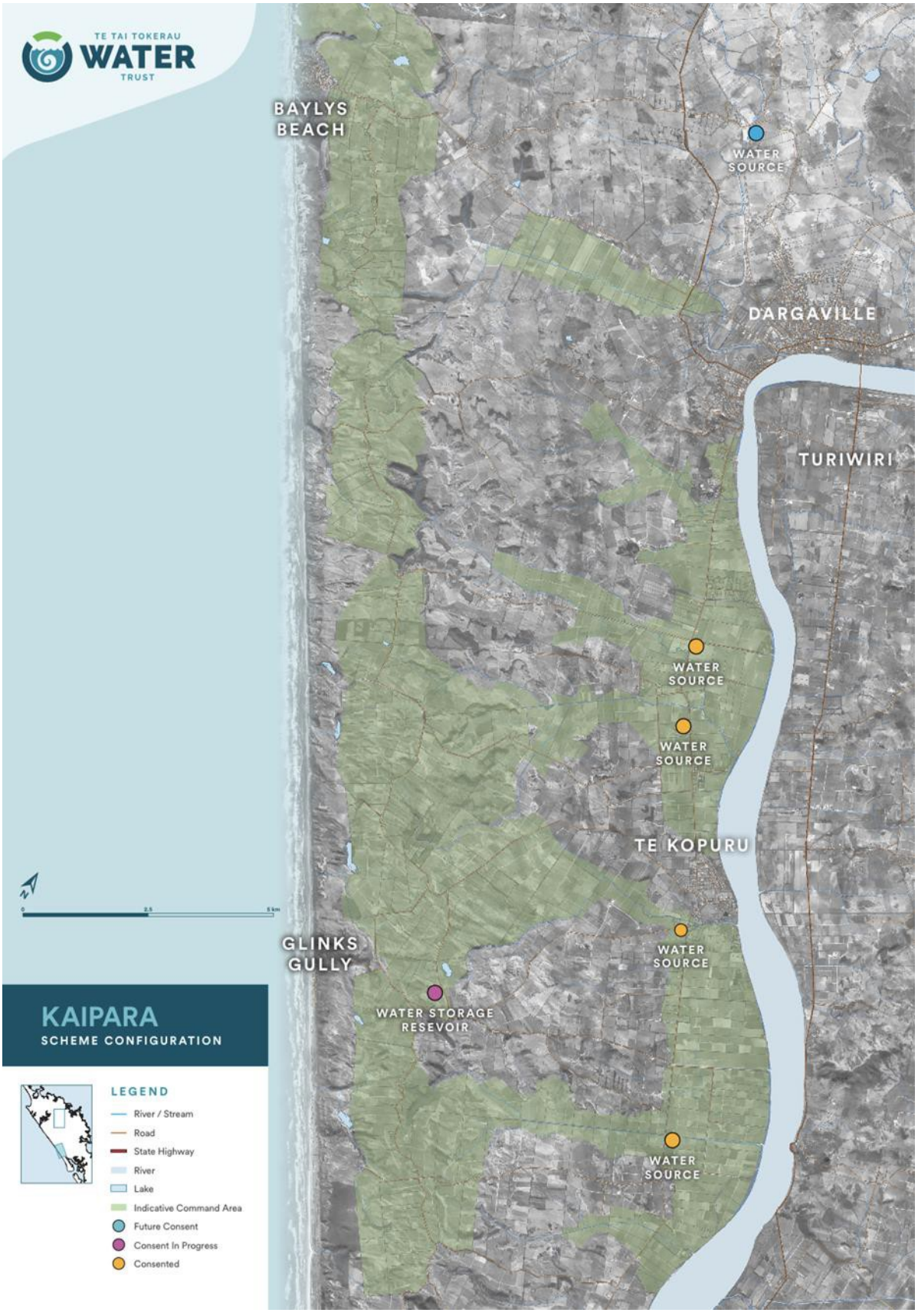
Northland (ha)

	LUC													
Land cover	1	2	3	4	5	6	7	8	Lake	Estuary	Urban	Quarry	River	Total
[no land use data]	0	16	129	624	25	872	311	622	0	12,918	40	0	3,127	18,684
Cropland	46	2,291	1,177	463	11	24	2	0	0	2	3	0	3	4,022
Exotic forest	2	388	2,734	20,659	309	119,254	44,936	2,455	15	48	59	0	3	190,862
Grass and scrub	15	663	3,314	10,566	142	32,419	5,374	1,623	11	37	27	0	4	54,194
Grassland	230	28,845	71,283	222,363	5,479	221,277	19,763	7,079	60	384	650	3	149	577,564
Horticulture	78	1,707	2,237	889	14	392	10	0	1	0	3	26	0	5,355
Natural forest	19	1,207	7,337	38,640	2,271	235,773	74,650	11,973	25	287	285	3	15	372,486
Other	0	168	1,787	6,569	19	5,436	9,097	7,595	2,592	230	60	80	2,116	35,749
Urban	46	858	1,309	1,810	50	908	143	40	0	5	4,440	0	0	9,609
Total	435	36,143	91,307	302,583	8,320	616,354	154,287	31,388	2,702	13,911	5,567	112	5,417	1,268,526

Northland (%)

	LUC													
Land cover	1	2	3	4	5	6	7	8	Lake	Estuary	Urban	Quarry	River	Total
[no land use data]	0.00%	0.00%	0.01%	0.05%	0.00%	0.07%	0.02%	0.05%	0.00%	1.02%	0.00%	0.00%	0.25%	1.5%
Cropland	0.00%	0.18%	0.09%	0.04%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.3%
Exotic forest	0.00%	0.03%	0.22%	1.63%	0.02%	9.40%	3.54%	0.19%	0.00%	0.00%	0.00%	0.00%	0.00%	15.0%
Grass and scrub	0.00%	0.05%	0.26%	0.83%	0.01%	2.56%	0.42%	0.13%	0.00%	0.00%	0.00%	0.00%	0.00%	4.3%
Grassland	0.02%	2.27%	5.62%	17.53%	0.43%	17.44%	1.56%	0.56%	0.00%	0.03%	0.05%	0.00%	0.01%	45.5%
Horticulture	0.01%	0.13%	0.18%	0.07%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.4%
Natural forest	0.00%	0.10%	0.58%	3.05%	0.18%	18.59%	5.88%	0.94%	0.00%	0.02%	0.02%	0.00%	0.00%	29.4%
Other	0.00%	0.01%	0.14%	0.52%	0.00%	0.43%	0.72%	0.60%	0.20%	0.02%	0.00%	0.01%	0.17%	2.8%
Urban	0.00%	0.07%	0.10%	0.14%	0.00%	0.07%	0.01%	0.00%	0.00%	0.00%	0.35%	0.00%	0.00%	0.8%
Total	0.03%	2.85%	7.20%	23.85%	0.66%	48.59%	12.16%	2.47%	0.21%	1.10%	0.44%	0.01%	0.43%	100.00%

Appendix Two: Northland Reservoir Map (Kaipara)



Appendix Three: Northland Reservoir Map (Mid North)