# Options for Estimating Effects of Proposed Freshwater Water Policies on Māori Land Use Potential

**for Ministry for the Environment**

March 2020

Infometrics

Economics put simply

# Authorship

This report has prepared by Adolf Stroombergen

Email:

adolf.stroombergen@infometrics.co.nz

# Table of contents

# 1. Introduction

The objective of the Ministry for the Environment is to obtain estimates of the change in potential financial returns to Māori land caused by proposed clean water standards.

From data supplied by the Ministry's we estimate that at present (before the application of the proposed clean water reforms):

1. About 10% of Māori land is under-utilised in the sense that it could be used more profitably for something else.
2. Significant types of under-utilisation occur where land is currently covered in pre-1990 planted forest on Class 4 land.
3. If the general effect of the proposed clean water reforms is to render dairying and sheep & beef farming less profitable than currently, it seems likely that the current opportunity cost of under-utilisation will fall.

At this stage we cannot place a dollar value on the effect of the reforms, but we explore some options for doing so.

# 2. Analysis of Data from MfE

From the data provided by Ministry for the Environment I have produced some tables and graphs relating to Treaty settlement land and MLC land that show:

- % utilisation by LUC
- % utilisation by region
- % utilisation by LUCNA 2016. (LUCAS layer and land use name)

Table 1 shows the scale of the issue. Over 2000 km$^2$ of Māori land is potential under-utilised. Utilised land is interpreted to mean fully utilised in terms of its most profitable use given its LUC classification, as set out in Figure 1. Table 2 spits the data in Table 1 by LUC class. Proportionally, most under-utilised Māori land is in LUC classes 3 and 4. Further detail emerges from the graphs below.

**Table 1**

**Land Use of Māori Land (km$^2$)**

| | Treaty Settlement Land | MLC Land | Total | % |
|---|---|---|---|---|
| Total under-utilised area | 1603 | 526 | 2129 | 10.5% |
| Total utilised area | 7394 | 10677 | 18071 | 89.5% |

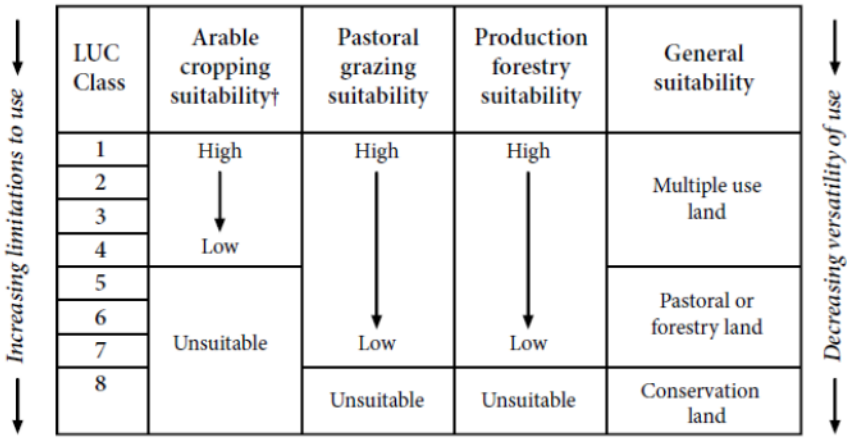
**Table 2**

**Land Use by LUC of Māori Land (km$^2$)**

| | Treaty Settlement Land | | MLC Land | |
|---|---|---|---|---|
| | Under-utilised | Utilised | Under-utilised | Utilised |
| 1 | 0.0% | 0.0% | 0.3% | 0.5% |
| 2 | 0.4% | 0.1% | 4.9% | 2.0% |
| 3 | 15.1% | 0.4% | 22.6% | 4.6% |
| 4 | 79.9% | 2.3% | 61.8% | 6.1% |
| 5 | 0.0% | 0.7% | 0.7% | 0.5% |
| 6 | 0.1% | 40.3% | 0.2% | 38.2% |
| 7 | 0.4% | 42.6% | 0.7% | 35.0% |
| 8 | 3.1% | 13.7% | 6.2% | 13.0% |
| Other | 1.0% | 0.0% | 2.6% | 0.0% |
| | 100.0% | 100.0% | 100.0% | 100.0% |
| Total km$^2$ | 2129 | 18071 | 526 | 10677 |

Figure 1

**Land Use by LUC Class**




Figures 2-4 below relate to Treaty settlement land, while Figures 5-7 relate to MLC land. Percent utilisation is defined as: (Utilised Area) / (Utilised Area plus Under-utilised Area). Abbreviations for Figures 4 and 7 are as follows:

| | |
|---|---|
| Cropland – Annual | CA |
| Cropland - Perennial | CP |
| Grassland - High producing | GH |
| Grassland - Low producing | GL |
| Grassland - With woody biomass | GW |
| Natural Forest | NF |
| Other | OT |
| Planted Forest - Pre-1990 | F90 |
| Post 1989 Forest | F89 |
| Settlements | ST |
| Wetland - Open water | WO |
| Wetland - Vegetated non forest | WV |

For Treaty settlement land the key points from Figures 2-4 are that:

1. LUC Classes 3 and 4 are least utilised (most under-utilised), with a utilisation rate of only 11% in each case.

2. Bay of Plenty and Waikato are the two regions most affected, with utilisation rates of 70% and 54% respectively.

3. The largest single 'cell' of under-utilised land is LUC Class 4 land In Bay of Plenty. Its area is 766.9 km2 and it accounts for 48% of under-utilised land.

4. F90 (planted forest pre-1990) land is most under-utilised in terms of actual land use, with a utilisation rate of 72%.

5. The largest single 'cell' of under-utilised land is F90 land In Bay of Plenty. Its area is 808.7 km2 and it accounts for 50% of under-utilised land.

**Figure 2 Treaty Settlement Land**

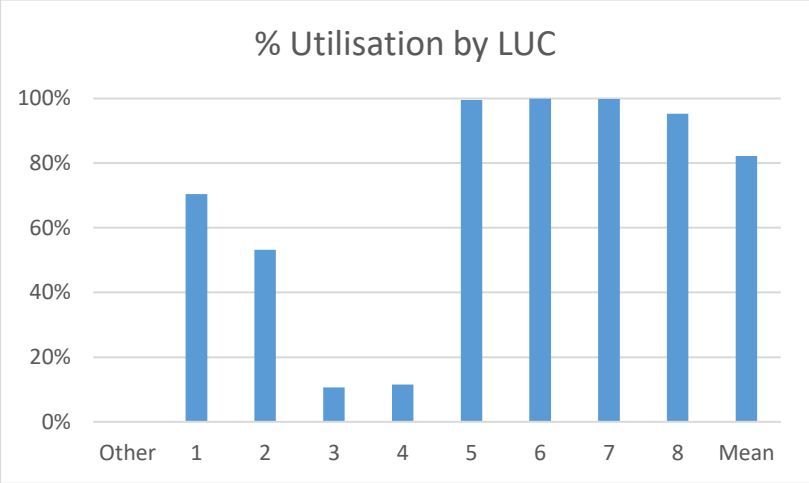



**Figure 3 Treaty Settlement Land**

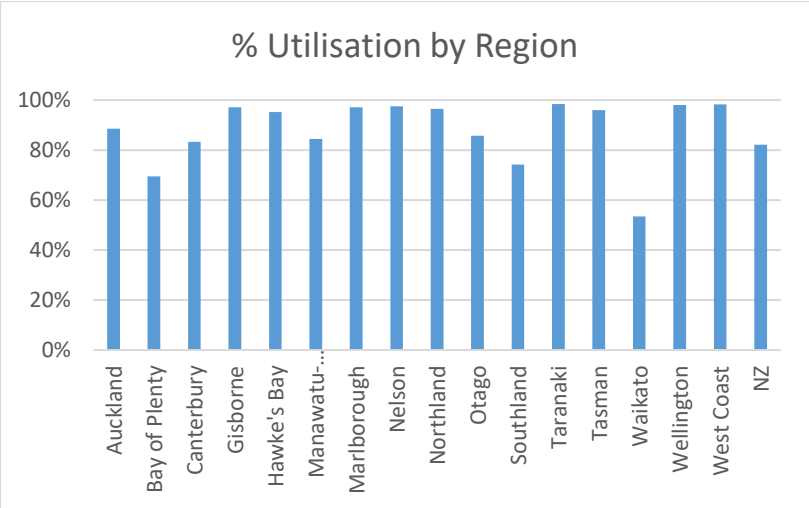
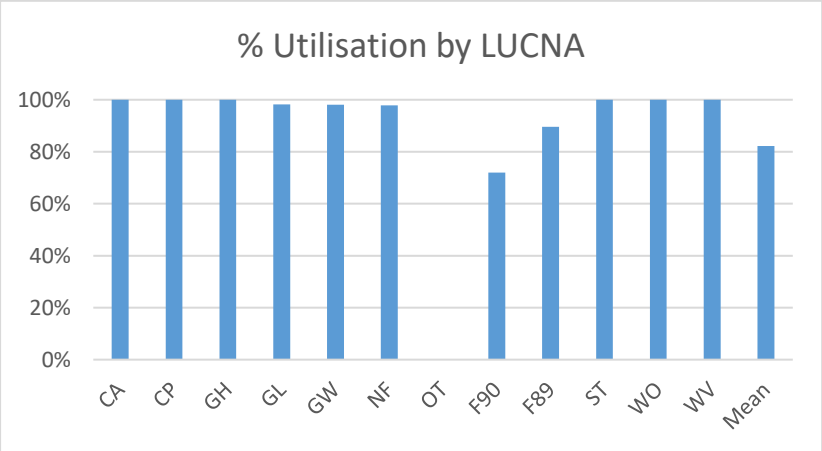



**Figure 4 Treaty Settlement Land**



For MLC land the key points are:

1. As for Treaty land, LUC Classes 3 and 4 are least utilised, 80% and 67% respectively.
2. Canterbury and Otago are the two regions most affected, with utilisation rates of 86% and 84% respectively.
3. However, the largest single 'cell' of under-utilised land by LUC is Class 4 land in Bay of Plenty. Its area is 89.1 km2 and it accounts for 17% of all under-utilised MLC land.
4. F90 (planted forest pre-1990) land is most under-utilised in terms of actual land use, with an utilisation rate of 88%.
5. The largest single 'cell' of under-utilised land is NF (Natural Forest) land In Waikato. Its area is 75.5 km2 and it accounts for 14% of under-utilised land.

**Figure 5 MLC Land**

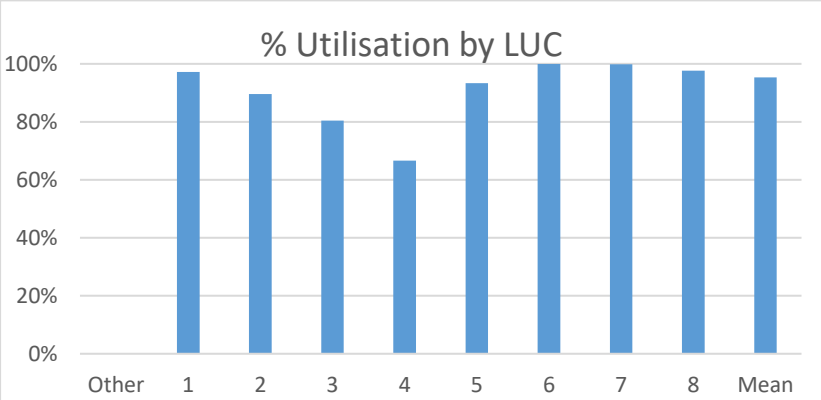



**Figure 6 MLC Land**

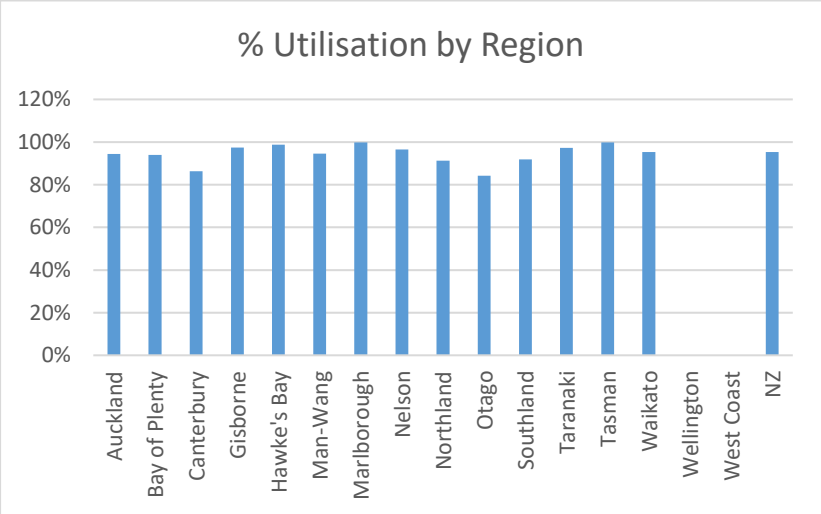
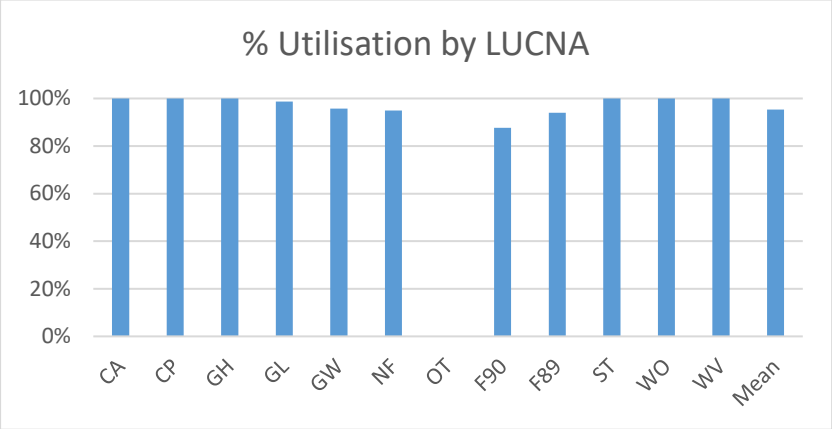


**Figure 7 MLC Land**




The table and graphs relate to the situation 'at present', that is before the application of the proposed clean water reforms. Thus we can only draw some broad inferences.

- About 10% of Māori land is under-utilised in the sense that the land could be used more profitably for something else. (Of course this is not a statement that such land should be in an alternative use).
- Significant types of under-utilisation occur where land is currently covered in pre-1990 planted forest on Class 4 land.
- If the general effect of the proposed clean water reforms is to render dairying and sheep & beef farming less profitable than currently, relative to other types of land use, it seems likely that the current opportunity cost of under-utilisation will fall.
- At this stage we cannot place a dollar value on the effect.

In the following section we explore three options for estimating the desired dollar values:

1. Merge the above analysis with other Infometrics data.
2. Merge the above analysis with output from a model being developed by Resource Economics.
3. Commission Landcare Research to use their land use models, merged with the data on Māori land ownership.

At this stage these options have not been costed, but it seems likely that option (2) would deliver the best value for money. Option 3 can always be pursued if necessary.

# 3. Options for Calculating Values

There are (at least) three options for estimating the change in potential financial returns to Māori land caused by proposed clean water standards.

## Infometrics

The easiest option, but also the least accurate is to use Infometrics' detailed database of economic statistics that includes (for the period 2000-2019):

- Employment of Māori by industry by local authority
- Earnings by industry by local authority

On the assumption that the average wage earned by Māori in any given industry (eg Forestry) is the same as for non-Māori in that industry, we can estimate total earnings of Māori by industry by region.

That can then be adjusted for the proportion of each region's area used in primary industries that is Māori land, by LUC or LUCNA – and in particular under-utilised Māori land.

If one was willing make some assumptions about what alternative uses exist for under-utilised land (eg forestry to horticulture), an estimate of foregone labour earnings could also be derived. Admittedly foregone earnings are not the same as profit, but profit-earnings multipliers from farm statistics could be used to estimate profits, given earnings.

Various cross-check totals exist in SNZ's *Tatauranga umanga Māori* statistics on Māori-businesses.

The next stage would be to repeat the above calculations with the effects on land use of the proposed clean water reforms, using national estimates of changes in land use from modelling by Resource Economics and/or Sapere. (I have not seen the Sapere work so I am unsure of exactly what it contains).

## Resource Economics

Tim Denne of Resource Economics has developed a model (over 100MB) that estimates the costs of the proposed clean water standards. It estimates changes in land use and profitability by catchment. The results are disaggregated by region (SNZ definitions) and farm type (disaggregation to be verified, but at least five).

In principle the changes in profitability by region and farm type (and perhaps by catchment) could be merged with the data on Māori land use to estimate not only the effect of the proposed water standards on profitability, but also on changes in the potential profitability of currently under-utilised land – as define above.

We have a spreadsheet summary page of the model output, but at this stage the results are not final. Thus we cannot yet use the output to add values to the estimates of Māori land use derived above.

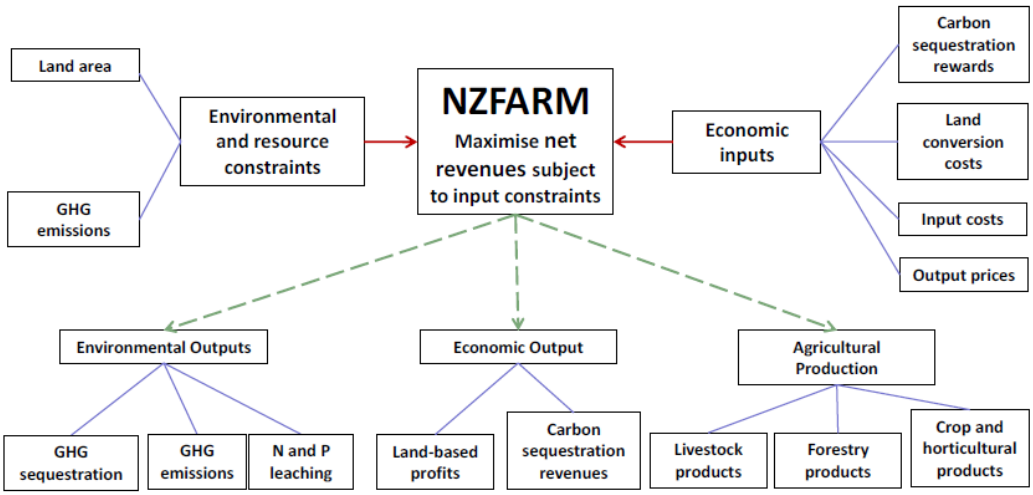
The largest impediment to merging the data may be how lands use is defined – both spatially and functionally (eg farm type). Hopefully this is matter that a GIS expert can resolve.

## Landcare Research

Landcare Research has a model of land use known as NZFARM. It maximises the profit from agricultural/forestry production subject to feasible land-use and land-management options. The options comprise pastoral farming, forestry and horticulture (although not 'unusual' activities such as lavender growing). It can address emissions pricing, and N and P leaching. Its unit of analysis is one hectare, which can used to characterise broader areas such as catchments.

**Figure 8**

**Schematic of NZFARM**




Source: *Land-use Change as a Mitigation Option for Climate Change,* Motu report to BERG December 2018.

Based on discussions with Suzie Greenhalgh of Landcare Research it is possible to use NZFARM and superimpose three layers of information:

- LUC (land use capability)
- Land use (LUCAS)
- Māori land ownership

Running the model with and without the clean water proposals would provide what is desired, namely the change in potential financial returns to Māori land consequent to the proposed clean water standards.

However, we are advised that databases need to be updated and that producing the desired output is not a trivial exercise.