



Chapter 4: Climate Change



CONTENTS

Briefly	79
In depth	81
How might Marlborough be affected?	81
Drought Risk for Marlborough	82
Responding to Climate Change	84
Carbon Emissions Trading Scheme	84
Starborough/Flaxbourne Soil Conservation Project	85

Climate Change

Briefly

Over the past 50 to 100 years, increasing industrialisation and human activity (from industry, agriculture and transportation) have begun to affect the natural climate balance. These activities are increasing the amount of greenhouse gases in our atmosphere and causing Earth not only to heat up, but to heat up at an unprecedented rate. It is now generally accepted worldwide that human activities have accelerated climate change.

ISSUES

- A degree of uncertainty of the exact effects of climate change.
- Likely increase in the number of droughts for eastern Marlborough.
- Possible heavier rainfall, more flooding, increased fire risk and global sea level rise.

PRESENT AND FUTURE MANAGEMENT

There are two aspects to addressing climate change. First, in order to reduce the impact of climate change, society must reduce greenhouse gas emissions. Because New Zealand is part of international efforts to do this, there is little that the Council can do, other than to support central government initiatives in this regard.

The second aspect is managing the inevitable effects of climate change. The effects include the direct changes in climate (e.g. increases in temperature, changes in rainfall patterns), but also the range of flow on effects (e.g. sea level rise). The Council has a responsibility to consider these effects under the Resource Management Act.

Assessing drought risk

The Climate Change Office of the Ministry for the Environment and the Ministry of Agriculture and Forestry investigated likely future changes in drought risk in New Zealand under climatic change. Five key findings from these investigations were:

- Drought risk is expected to increase during this century in all areas that are currently already drought prone.
- Under a "low-medium" scenario (lower global temperature projection with a small west/

east rainfall change), by the 2080s severe droughts are projected to occur at least twice as often in many eastern regions, including Marlborough.

- Under the "medium-high" scenario (higher global temperature projection with greater change in west-east rainfall distribution), the frequency of severe droughts are projected to occur more than four times as often in many eastern regions, including Marlborough.
- Water deficits, as measured by potential evapo-transpiration deficit, are projected to increase by between 50 millimetres and 250 millimetres depending on scenario and location.
- The projected increase in potential evapo-transpiration deficit would probably produce an expansion of droughts into the spring and autumn months.

Local responses to climate change

Farmers in the Seddon and Ward areas started the Starborough/Flaxbourne Soil Conservation group in 2005 to look at a range of issues, including challenges from the potential impacts of climate change. This part of Marlborough is already very dry and when for 12 years, the area failed to achieve its 576 millimetre long term rainfall average, the future of farming wasn't looking very good.

The farmers, with help from the Council, New Zealand Landcare Trust, and Ministry of Agriculture and Forestry's Sustainable Farming Fund, looked at how they could turn a profit while looking after their land. The outcomes of this work culminated in a national field day entitled "Beyond Reasonable Drought; adapting dryland farming to climate





change". The field day brought together all of the information relevant to the project, including soils work, plant trials, climate change work and landscape and farm systems analysis. A series of brochures and a booklet summarising the research and conclusions of the project have been produced, setting out suggested best practice guidelines for landowners to consider.

Drought



Climate Change



In depth

The Earth's climate has undergone many changes over millions of years. For the most part these changes have been gradual, allowing plants and animals to adapt or move to other areas. Some prehistoric climate changes though, such as those experienced during the Ice Ages, may have been abrupt and are likely to have led to mass extinction of species.

Over the past 50 to 100 years, increasing industrialisation and human activity (from industry, agriculture and transportation) have begun to affect the natural climate balance. These activities are increasing the amount of greenhouse gases in our atmosphere and causing Earth not only to heat up, but to heat up at an unprecedented rate.

Greenhouse gases trap warmth from the sun and make life on Earth possible. Without them, too much heat would escape and the surface of the planet would freeze. However, increasing the concentration of greenhouse gases in the atmosphere, causes Earth to heat more and the climate to change. This process is often referred to as 'global warming'.

The main greenhouse gases created by human activity are carbon dioxide, methane, nitrous oxide and some synthetic industrial gases. In New Zealand, approximately 49% of greenhouse gases come from agriculture, 43% from energy, 6% from industrial processes and 2% from waste. Climate change is already affecting our climate and is likely to impact on agriculture and our other climate-sensitive industries, native ecosystems, infrastructure, health, biosecurity, society and economy.

It is now generally accepted worldwide that human activities have accelerated climate change. Central government's climate change policy notes *"the debate on climate change has moved beyond discussion of whether it is happening, to what must be done to reduce emissions and adapt to the inevitable effects of climate change"* (Ministry for the Environment, undated). This reflects a recent report by the Intergovernmental Panel for Climate Change who in 2007, in considering the findings on the last six years of research, stated that a *"warming of the climate is unequivocal"* and it is *"very likely due to the observed increase in anthropogenic greenhouse gas concentrations"*.

There are two aspects to addressing climate change. First, in order to reduce the impact of climate change, society must reduce greenhouse gas emissions. New Zealand is part of the international efforts to do this, initially as signatory to the Kyoto Protocol. As this is a global issue, responsibility for addressing the causes of climate change lie with central government. There is little that the Council can do other than to support central government initiatives in this regard.

The second aspect is managing the inevitable effects of climate change. The effects include the direct changes in climate (e.g.

increases in temperature, changes in rainfall patterns), but also the range of flow on effects (e.g. sea level rise). The Council is legally required to have regard to these effects in exercising its functions under the Resource Management Act 1991.

HOW MIGHT MARLBOROUGH BE AFFECTED?

A series of computer models have made projections of possible changes to Marlborough's climate as part of national initiatives to prepare for climate change. The models suggest that the effects of such changes could include:

- An increase in summer temperatures between 0 to 1.3 degrees by 2030.
- An increase in winter temperatures between 0.3 to 1.8 degrees by 2030.
- Anything between a 5 percent drop to 3 percent increase in annual rainfall.
- An increase in the frequency of extreme rainfall events.

Already temperatures have increased by about 0.9 degrees Celsius over the last 100 years, and Marlborough experiences about 20 fewer frosts than it did in the 1970s, according to statistics provided by the National Institute of Water and Atmosphere.

Temperatures are forecast to rise by about 2 degrees by 2090 for a mid range scenario, and rainfall is expected to become greater in western areas. However, this is predicted to vary seasonally, as can be seen from the projections in Figure 4.1. These predict that winter rainfall will decrease by about 5 to 10% in eastern

Weather station



Marlborough and that spring rainfall will decrease by about 2.5 to 7.5%. However, summer and autumn rainfall are both predicted to increase by about 5 to 7.5%, but with a net overall reduction in annual rainfall. This will lead to longer periods of soil moisture deficit in these already dry eastern areas.

By contrast, western and inland areas (Marlborough Sounds, Richmond Ranges, and the mid/upper reaches of the Wairau, Branch, and Waihopai catchments), may actually become wetter in all seasons, as they are closer to the main divide, and behave more like West Coast catchments.

Heavy rainfall is expected to get heavier, and/or more frequent. For a mid range scenario, what is a 1 in 100 year event now could become a 1 in 50 year event by 2090.

Changes in climate could cause:

- Reduced flows in rivers.
- An increase in the frequency and duration of droughts and water availability issue.
- Economic impacts through reduced agricultural production during times of drought, although the increase in temperatures may create the potential for the introduction of new crops.
- An increase in fire risk.
- An increase in the risk of flooding.
- The potential for increased soil and coastal erosion.

On top of these local effects, there is a projected rise in global sea level of between 30 and 80 centimetres due to thermal expansion. This will cause higher tides and possible inundation of coastal areas, especially if the tides coincide with storm events.

All of the above is based on the best available information and the application of that information to make projections. However, there is still uncertainty over the exact nature of the effects, especially at a local level. This makes it challenging for the Council to respond.

New Zealand and Marlborough in particular, are well placed to adapt to climate change pressures as adaptation means business as usual in some respects. Our primary industry has been characterised by adaptive practices such as shelterbelts, planting to mitigate erosion, irrigation, water storage, frost protection measures etc. Our response to climate change will continue these themes.

It should be noted that there is still some degree of uncertainty of the exact effects of climate change. Many global models have been developed, and there are a range of scenarios predicted.

Drought Risk for Marlborough

The east coast of the South Island already experiences a dry climate and Marlborough is no exception. Against this background, the frequency of extreme climatic events, including droughts, does appear to be increasing. In the past ten years alone, Marlborough has experienced two droughts (i.e. 1997-1998, 2000-2001). These drought events have exacerbated existing problems of being able to get reliable supplies of water, because they resulted in low flows in rivers over a significant period of time, and resulted in reduced recharge of the aquifers. At the same time, the demand for water, especially for irrigation purposes, was very high.

An increase in the number of droughts experienced in eastern areas of New Zealand has been anticipated under various climate change scenarios for some time. The Climate Change Office of the Ministry for the Environment and the Ministry of Agriculture and Forestry commissioned the National Institute of Water and Atmosphere to investigate likely future changes in drought risk in New Zealand under climatic change. The subsequent report "Changes in drought risk with climate change" was released in June 2005.

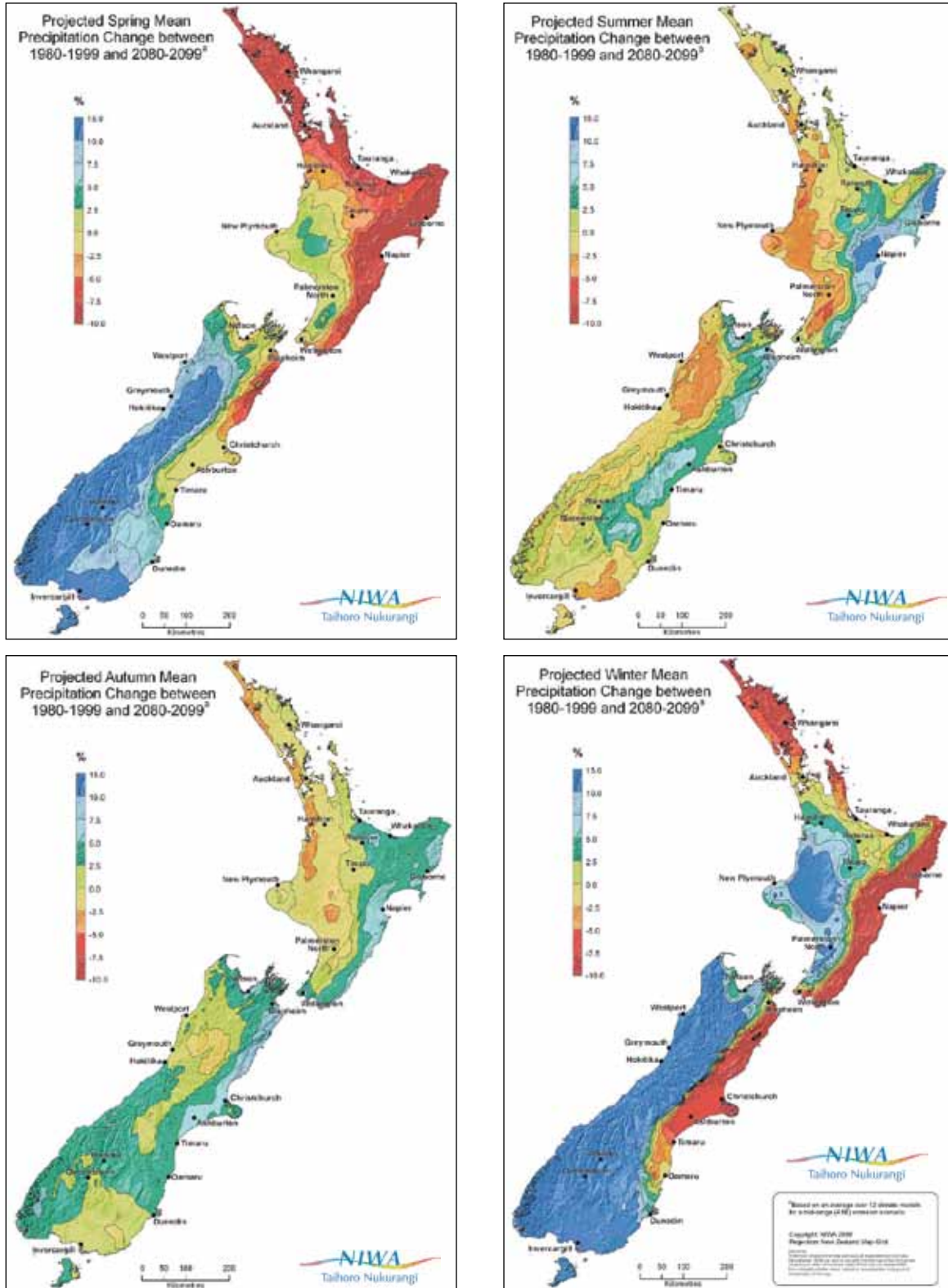
The National Institute of Water and Atmosphere used two different global average temperature projections and combined them with two regional patterns produced by climate models, to create four different scenarios. The report highlights only two of the four scenarios, "low-medium" (lower global temperature projection with a small west/east rainfall change) and "medium-high" (higher global temperature projection with greater change in west-east rainfall distribution). These two scenarios are considered in the report to be the most plausible projections. Potential evapo-transpiration deficit (PED), which incorporates rainfall, temperature and wind data, was used as a measure of drought.

Five key findings were detailed in the report as follows:

- Drought risk is expected to increase during this century in all areas that are currently already drought prone.
- Under the "low-medium" scenario, by the 2080s severe droughts are projected to occur at least twice as often in many eastern regions, including Marlborough.



FIGURE 4.1: PROJECTED MEAN PRECIPITATION CHANGES BETWEEN 1980 - 1999 AND 2080 - 2099



Reproduced courtesy of National Institute of Water and Atmosphere

- Under the “medium-high” scenario, the frequency of severe droughts are projected to occur more than four times as often in many eastern regions, including Marlborough.
- Water deficits, as measured by potential evapo-transpiration deficit, are projected to increase by between 50 millimetres and 250 millimetres depending on scenario and location.
- The projected increase in potential evapo-transpiration deficit would probably produce an expansion of droughts into the spring and autumn months.

Table 4.1 summarises changes in severe drought risk for Marlborough as highlighted in the report.

If these projections do become reality, then they will obviously have significant implications on water availability in Marlborough.

RESPONDING TO CLIMATE CHANGE

Carbon Emissions Trading Scheme

Over recent years the New Zealand government has acknowledged climate change as a serious issue and is one of 38 industrialised nations, which are signatory to the international Kyoto Protocol. This protocol commits countries to reducing carbon emissions to 1990 levels within a set of prescribed timeframes. The first commitment period is from 2008 to 2012 and with the current projected emission scenario for New Zealand still increasing, the country will be in a deficit situation during this commitment period.

At the time of preparing 2008 State of the Environment Marlborough the previous government had announced a series of policy initiatives to address climate change. The main initiative

is the “Emissions Trading Scheme”. This is a market based mechanism designed to move New Zealand towards being carbon neutral by reducing domestic emissions through a variety of measures. These include reduction and efficiency in energy use, use of new technologies and so on, and increasing the country’s ability to absorb or “sink” carbon through tree planting and forest maintenance and enhancement. The Emissions Trading Scheme is intended to change investment and consumption behaviours by integrating a price for emissions into decision making by producers and consumers so that there is an economically driven shift towards consuming, using and investing in goods and services with lower greenhouse gas emissions.

The scheme includes all the major sectors of the economy in stages, starting with forestry in 2008, followed by transport, energy (coal, gas and geothermal) and industrial processes, agriculture and waste within the next five to ten years. Sectors will have to hold emission units that match the levels of greenhouse gases that they emit and if they exceed this level they will have to buy credits. Most sectors, including agriculture, are generally producers of excess emissions and will be looking for ways to reduce or offset emissions, while the forestry sector is generally in a credit situation in regards to emissions and can provide a carbon storage service for offsetting and and/or earn credits as a source of income.

The implementation of the Emissions Trading Scheme nationally, and similar programmes internationally, would have a significant impact on the way resources are managed, produced and consumed over the next few years. However, with a change in government occurring in late 2008, the Emissions Trading Scheme is to be reviewed.

TABLE 4.1: PROJECTED CHANGES IN SEVERE DROUGHT RISK FOR MARLBOROUGH (PED - POTENTIAL EVAPO-TRANSPARATION DEFICIT)

Location	Present PED (mm) 1 in 20 year drought	2080s low-med scenario PED (mm) 1 in 20 year drought	2080s med-high scenario PED (mm) 1 in 20 year drought	2080s low-med scenario Average return interval (years) for current 1 in 20 year drought	2080s med-high scenario Average return interval (years) for current 1 in 20 year drought
Blenheim (East Marlborough)	895	955	1035	12.0	7.0



Starborough/Flaxbourne Soil Conservation Project

The Starborough/Flaxbourne Soil Conservation Project was established in mid 2005 to address a range of issues on managing agricultural land in the Seddon/Ward areas of Marlborough, with a particular focus on the challenges of the potential impacts of climate change. Farmers in this drought-prone district once feared that they may no longer be able to farm their land. For 12 years, the traditionally dry area failed to achieve its 576 millimetre long term rainfall average, leaving hillsides cracked and bare and the future looking bleak.

With help from the Council, New Zealand Landcare Trust, and Ministry of Agriculture and Forestry's Sustainable Farming Fund, the farmers formed the Starborough/Flaxbourne Soil Conservation Group and gained funding to look at ways they could turn a profit while looking after their land. The project was funded for a three year period by the Sustainable Farming Fund and was concluded in June 2008.

The main concluding event was a national field day entitled "Beyond Reasonable Drought; adapting dryland farming to climate change", held on the Avery family farm "Bonavaree" at Grassmere on May 14th 2008. The field day brought together all of the information relevant to the project, including soils work,

plant trials, climate change work and landscape and farm systems analysis. A series of brochures and a booklet summarising the research and conclusions of the project have been produced, setting out suggested best practice guidelines for landowners to consider. These are available on the Council's website.

At Bonavaree Farm, the first steps have been taken towards an integrated and sustainable management scenario, where lucerne provides nutritious stock fodder on the most productive areas, shrubs including saltbush and tagasaste hold soils on erosion-prone slopes, natural biodiversity areas are protected and blocks and belts of trees offer shelter, shade and eventually maybe an income from hardwood timber.

The Starborough/Flaxbourne Soil Conservation Group was awarded a Green Ribbon Award by the Ministry for the Environment for their efforts and leadership shown to improve farmland affected by drought. (The awards recognise the outstanding contributions of individuals, community organisations, businesses, and local government to sustaining and enhancing New Zealand's unique environment and have been awarded for the past 18 years.)



Doug Avery and Kevin Loe (centre and right) accept a Green Ribbon Award on behalf of the Starborough/Flaxbourne Soil Conservation Group, from the Minister for the Environment, Trevor Mallard