



Ministry for the
Environment
Manatū Mō Te Taiao

Understanding climate change.

**Get a grasp
of the facts.**

Our climate is changing.

It will take a global effort to reduce the greenhouse gases heating up our planet. Tackling climate change is the most important task facing us as a nation.

How we respond now will determine the shape of our future – our economy, environment and communities.

Protecting New Zealand

As New Zealanders we have a great deal worth protecting: our precious natural resources, unique flora and fauna – our tāonga, world-renowned scenery and way of life. At the same time we need to continue to grow our economy, improve living standards, and enhance our reputation as a country that consistently punches well above its weight.

Fortunately, the actions we can take to tackle climate change make environmental as well as economic sense. Using energy more efficiently means we pay for less electricity, gas and petrol. Tuning our cars improves air quality and health. And better insulation of our homes means they are warmer and we get sick less often.

Climate change may seem a complex issue, but one thing is sure: it will be the small steps taken by individuals supported by the bigger steps of governments and businesses that will make all the difference.



The science of climate change

What is climate change?

The greenhouse gases in our atmosphere help make the planet a warm and habitable place. They act like the outside covering of a greenhouse, trapping heat from the sun.

Greenhouse gases – such as carbon dioxide, methane and nitrous oxide – are emitted naturally from trees and animals, as well as from human activity.

An increase in human activities like driving cars, farming, burning coal, and cutting down trees, is in turn increasing the greenhouse gases emitted into the atmosphere each year.

These gases are trapping even more heat, causing the planet to warm up and our natural weather patterns to change.

This process is often called **'global warming'** but it is better to think of it as **'climate change'** because it is likely to bring about more extreme events – floods, storms, cyclones, droughts and landslips – rather than an increase in temperature alone.

Every country will be affected differently but the one constant is a changing climate.

Natural climate changes in Earth's history

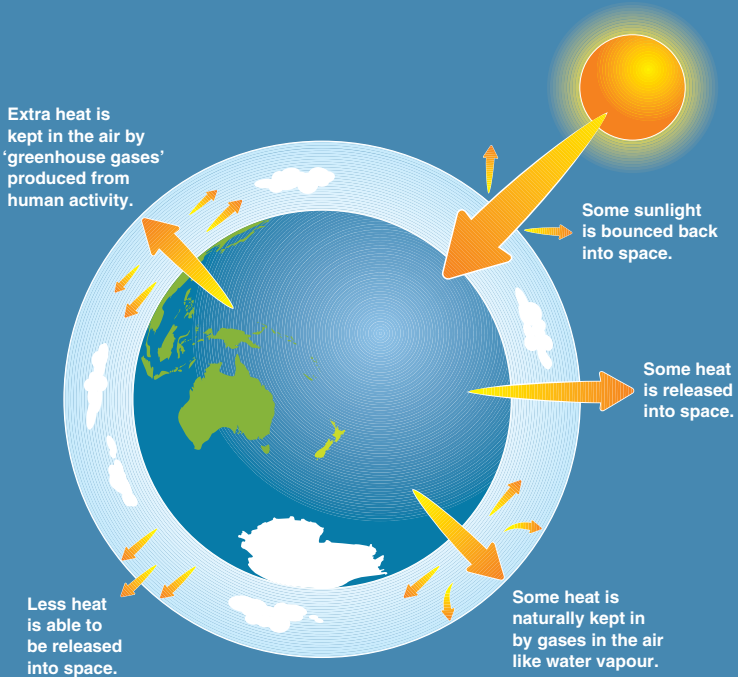
The planet Earth has gone through massive changes in its 4.5 billion-year history. Its climate has naturally fluctuated between being very cold and covered in ice, or very hot.

In the past 10,000 years the planet's climate has become much more stable, leading to flourishing flora and fauna, and the subsequent population explosion of humankind.

Despite this relative stability, scientists are now detecting changes which suggest the climate is becoming hotter on average, and more variable.

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Let's take a look at the Earth



This variability is being attributed in part to increased levels of carbon dioxide in the Earth's atmosphere. According to scientific studies, in the past 400,000 years the planet has never had so much carbon dioxide in its atmosphere as it does today, and the levels are continuing to rise¹.

Further increases in carbon dioxide levels will continue to heat up the planet and change the climate. These changes could even be irreversible.

¹ CDIAC data center. Petite et al., Nature 399: 429-436

The science of climate change

Our changing planet

The effects of a warming planet and disrupted climate patterns are already becoming evident.

Meteorologists are seeing an increase in the severity of storms, rainfall, droughts and floods around the world.

Eleven of the last twelve years have been the warmest on record.

In the Arctic, sea ice is showing worrying signs of increased melting, and, further south in countries like Peru and Greenland, many glaciers have retreated significantly in the past few decades.

Antarctica, too, is showing similar impacts. The Larsen B ice sheet on the eastern side of the Antarctic Peninsula is breaking up, leading to increasing glacier flows of ice into the sea.

If these processes continue, sea levels will rise and inundate many low-lying regions of the world, including Florida, Bangladesh, and the Pacific Islands. This could have a devastating flow-on effect to all parts of the world.

The Intergovernmental Panel on Climate Change (IPCC) – an international body of independent climate change scientists and researchers – predict that this kind of sea level rise could happen within this century² if action is not taken to reduce emissions.

Droughts and resulting water shortages are causing problems in warmer countries. In Australia, drought has had severe impacts on the whole country. Twenty-seven areas within Australia were declared areas of “exceptional circumstance” for drought in July 2006.

Farmers – who rely heavily on the availability of water – were particularly hard hit, with the government offering farmers social and financial assistance.

In New Zealand, scientists cannot yet say whether the extreme storms and flooding that have occurred in some regions are a direct result of climate change – but they do say it highlights how climate change might affect us.

It was once believed that climate change would happen far off in the future, to our grandchildren, or their grandchildren. However, the rate of change means we are at risk *in our lifetimes*.

This is a cause for action. We can still avert the more catastrophic impacts of climate change. Taking action now is like taking out an insurance policy for our future.

² Intergovernmental Panel on Climate Change.
Climate Change 2001: Working Group I: The Scientific Basis

Can we stop climate change?

Complex climate systems

Earth's climate systems are very complex but we do know the world will get warmer as more and more greenhouse gases are pumped into the atmosphere. How much we reduce our emissions globally will influence the level of temperature rise we can expect.

Climate scientists project that the Earth's average temperature will increase by between 1.1 and 6.4°C. This might not seem like much but even a 1 to 2°C increase can have a big impact. For example, a temperature increase like this could lead to less frosts, reducing the ability of kiwifruit to be grown in some areas, or, in Australia, it would bleach 81 percent of the Great Barrier Reef³.

Despite any measures we take to reduce greenhouse gas emissions now, the levels of carbon dioxide already in the atmosphere are expected to continue to affect and change the climate over our lifetimes.

However, if we act now and work together to reduce our emissions, the catastrophic effects of climate change may be avoided. We should also put in place plans to prepare for climate change and adapt to its impacts.

The effects of a warming planet and disrupted climate patterns are already becoming evident.



³ CSIRO Marine and Atmospheric Research (Preston, BL and Jones, RN). 2006. *Climate Change Impacts on Australia and the Benefits of Early Action to Reduce Global Greenhouse Gas Emissions*

New Zealand's changing climate

Climate change could have significant impacts on our economy, environment and society.

Average temperatures are projected to increase about 1°C by around 2040 and about 2.1°C by around 2090 (compared to 1990 levels).

Under moderate projections, it is likely that sea levels will rise 18 to 59cm by 2100. Such a rise would lead to increased coastal erosion, flooding from storms, salinisation of freshwater and drainage problems.

New Zealand can also expect more extreme events to happen in the future, including more droughts in already drought-prone areas, and more floods in regions already vulnerable to flooding.

More rain is likely to fall in the west of the country and less in the east.

We can also expect more episodes of heavy rainfall and for westerly winds to become more prevalent with a greater risk of severe winds and storms.

Studies by New Zealand's National Institute of Water and Atmospheric Research (NIWA) predict that in some regions, droughts occurring every 20 years at the moment may occur as often as every five years by the 2080s.

These kinds of changes to our climate will affect many of the things we cherish and depend on, like our native species' ability to flourish or the kinds of crops we grow. We may also experience new biosecurity risks, such as tropical pests and diseases.

New Zealand's economy is particularly vulnerable to climate change because our reliance on biologically-based industry (such as agriculture) means we depend on a temperate climate.

Extreme events have a huge cost associated with them. The drought in 1997–98 cost the economy a billion dollars; and the floods of February 2004 are estimated to have cost well over \$300 million.

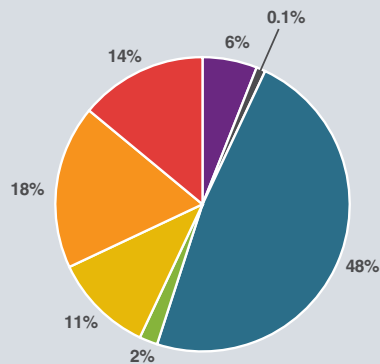
Understanding climate change and the likely impacts will help us to protect our communities and businesses. It will also help us identify opportunities arising from a changing climate. For example, changes in the climate may allow new kinds of commercial crops to grow.

There is also a rapidly growing market for technology that is energy efficient or produces less greenhouse gas emissions.

It will take both creativity and foresight to make the best use of these opportunities.

NZ greenhouse gas emissions

2005 emissions by sector (77 megatonnes of CO₂ equivalent)



Forest sinks
-32% (CO₂)

KEY

- Industrial processes (mainly CO₂)
- Solvents
- Agriculture (methane + nitrous oxide)
- Waste (mainly methane)
- Electricity (CO₂)
- Transport (CO₂)(of which air travel is 1%)
- Energy - other processes (CO₂)

Values do not add up to 100% due to rounding.

Our emissions

If no action is taken, it is predicted that energy-related greenhouse gas emissions may increase by 30 percent in the next 25 years, and transport-related emissions may increase by 35 percent.

Reducing our emissions without damaging the businesses that are the backbone of our country will be a challenging task. It will require ingenuity and innovation – something New Zealanders are good at.

The government, many councils and businesses are already exploring ways of innovatively reducing emissions. This work includes using renewable energy from sources like the wind and solar power, encouraging biofuel use instead of petrol, researching how methane from cattle can be reduced or captured, and encouraging improved energy efficiency at home and at work.

Many businesses have found that reducing emissions has other benefits, like improving their business practice or saving money on their power bills.

New Zealand and the world

Although New Zealand contributes less than half a percent of the world's overall emissions, there are many reasons why we should be part of global efforts to tackle climate change.

For a start, if we measure the average emissions produced on an individual basis (ie, per capita), New Zealand came in at 12th in the world in 2000.

We will all be affected by climate change; it is important that we all do our bit to protect our economy, environment and way of life. The cost of delaying action will come at a great cost to the way we live.

We might be a small country but we can still make a difference.

Climate change impacts on New Zealand



Natural areas

- Species distribution changes
- Changes to/loss of habitat
- Increased pressure from pests, animals and plants



Drier

- Less rainfall
- Decreased run-off to rivers
- Increased evaporation
- Increased drought for already drought-prone areas
- Increased irrigation demand



Urban

- Warmer winters → less illnesses
- Warmer summers → increased heat stress
- Decreased electricity use in winter (less heating)
- Increased electricity use in summer (more air-conditioning)



Coastal

- Sea level rise
- Increased storm surge
- Coastal inundation
- Increased coastal erosion



Wetter

- Increased precipitation
- Increased intensity in weather events
- Increased flooding for already flood-prone areas
- Increased slips
- Increased soil erosion



Commercial forests

- Increased growth rates
- Increased geographic range
- Increased winds → increased damage to forests
- Increased temperatures → increased pests



Snowlines and glaciers

- Changes in length and area of glaciers
- Rise in snowline
- Possible increase in snowfall
- Possible increase in avalanches



Ex-tropical cyclones*

- Increased intensity → increased wind, waves, storm surge and rainfall



Wind

- Increased westerly winds

* Tropical cyclones, in travelling to NZ, change their character becoming slightly less intense but causing damage over a much wider area.



These are the likely impacts of climate change for New Zealand over the next century, based on expert reports and peer-reviewed scientific studies, published internationally and in New Zealand.

It is not an attempt to provide a comprehensive summary of all impacts for New Zealand but to provide an indication of potential impacts.

International action

International agreements

Many countries are now taking steps to combat climate change.

The first major attempt to coordinate global action was an international agreement called the 'United Nations Framework Convention on Climate Change' (UNFCCC). The Convention was adopted in 1992. The UNFCCC's objective is to stabilise greenhouse gases in the atmosphere to prevent dangerous climate change caused by human activities.

The Kyoto Protocol – named after the Japanese city where it was finalised in 1997 – sets legally-binding targets for the greenhouse gas emissions from developed countries.

The Protocol aims to reduce the total greenhouse gas emissions of those countries to five percent below their 1990 levels over the period 2008–2012 (otherwise known as the First Commitment Period or CP1). Negotiations are also under way on further commitments after 2012.

Thirty-six countries have greenhouse gas targets as part of the Kyoto Protocol. Under the agreement, these countries can meet their targets by reducing their own greenhouse gas emissions, and by reducing emissions in other countries.

Countries are also working together outside of the United Nations through various international technology partnerships or other approaches – for example, the G8 and the Asia Pacific Partnership for Clean Development and Climate.

The Asia Pacific Partnership – formed in July 2005 by Australia, China, India, Japan, Republic of Korea and the United States – is a partnership between governments and industry which focuses on developing technologies to contribute to cleaner development.

New Zealand's international response

International engagement is an essential part of the New Zealand Government's climate change response. New Zealand is a Party to both the UNFCCC and the Kyoto Protocol. New Zealand is also involved in several international technology and research partnerships and the government is exploring how New Zealand industry might benefit from the work of the Asia Pacific Partnership.

Many countries are now taking steps to combat climate change.



New Zealand has bilateral climate change partnerships with Australia and the United States, and the government helps Pacific Island states in their efforts to address climate change.

As the world works on how best to tackle climate change beyond 2012, New Zealand is supporting efforts to cut global emissions, especially by the major emitting countries. The government is continuing to influence the shape of international action so we can limit the impact of climate change here at home.

If you walk, bike or carpool you'll be reducing the amount of carbon dioxide emitted through pollution from vehicles.

What you can do

The risks inherent in climate change mean we must act now. It is like taking out an insurance policy for our future. The risks of inaction will be far more costly to us than the costs of action.

A report released by former World Bank chief economist Sir Nicholas Stern⁴ in October 2006 estimated that *inaction* could be up to 20 times more costly to us. We can't afford *not* to act.

There are two main ways we can take action on climate change: reduce our greenhouse gas emissions; and be prepared so we can adapt to the inevitable changes and become more resilient to our current climate.

It is important that both kinds of actions are taken. Without reducing our emissions, carbon dioxide levels in the atmosphere will continue to rise and affect our climate. And without proper planning, we will be more vulnerable to the impacts of climate change.

Everybody has a role to play in addressing climate change, whether it is the government, businesses, communities, or individuals.

Taking action will require a shift in the way we are all accustomed to doing things but it may be easier than you think. Being truly sustainable doesn't mean sacrificing our living standards, but being smart and determined about how we do things.



Energy

Did you know that cutting back on energy use helps reduce the amount of greenhouse gases emitted during the production of electricity? Make your home more energy efficient, and save on your power bill. Buying energy efficient appliances, replacing bulbs with energy efficient ones, and buying an insulation wrap for your hot water cylinder are all easy ways to make a difference at home. In the long term, you might also think about insulating your whole house or installing a solar hot water system.

⁴ Stern, N. 2006.
The Stern Review: Economics of Climate Change

A little for a lot



Transport

Take a look at your regular mode of transport – what can you do to cut back the emissions generated from vehicle use? Driving more smoothly, keeping your tyres inflated at the right pressure, and regular tune ups and servicing can all reduce emissions and cut your fuel costs. If you can, walk, bike or take public transport to work. Next time you buy a car, look for a fuel efficient model. Check out:

www.fuelsaver.govt.nz



Waste

Did you know composting your food scraps helps to cut methane emissions? More oxygen can get into it to help break it down in the garden than at the local landfill. Recycling helps cut down overall emissions too – generally it doesn't take as much energy to recycle the raw materials as it does to produce them from scratch.



Community

Contact your local council or businesses to find out if there are any projects to reduce emissions under way in your community. You could also get involved in local environmental and community groups, or start your own. Keep informed: stay abreast of new climate change policies and initiatives.

For more tips on how to reduce your impact on the environment, check out another booklet in this series:

Taking action on climate change.
Small acts. Big impacts.

There are many easy actions you can take now to reduce your impact on the environment and get involved in New Zealand's climate change response.

The New Zealand Government's response

In February 2007, the Prime Minister outlined her vision for New Zealand to be the first country to be truly sustainable. In essence, this means meeting the needs of our communities without compromising the well-being of future generations.

To achieve a vision of a sustainable country, the government has developed several lead initiatives. The Household Sustainability Programme will help householders take simple steps to be more environmentally sustainable. Work is under way to move the public sector towards carbon neutrality along with initiatives to support eco-friendly goods and services. The government is also working to reduce waste and support business partnerships for sustainability.

Any new climate change policies will also reflect the government's sustainable vision for New Zealand. New policies are being developed to help New Zealand cut back its greenhouse gas emissions and prepare for a changing climate.

Policies may involve putting a price on emissions to help reduce them, in line with the international community. Working with businesses, councils, non-government organisations and the public on the different options will be a key focus for the government.

It's a challenging road ahead but the government is committed to making a difference.

Examples of government initiatives already under way include:

- **Projects to Reduce Emissions, a programme that supports initiatives to reduce emissions of greenhouse gases**
- **the Permanent Forest Sink Initiative, which encourages the planting of more forests**
- **an agricultural technology and research programme**
- **a commitment to increase solar water heating in homes**
- **measures to improve the energy efficiency of buildings**
- **Govt³, a programme to help government agencies walk the talk by becoming more sustainable.**

Our future



If we can respond effectively, flexibly and with foresight, New Zealand's future is bright. By taking sensible action we will be able to protect our economy and way of life well into the future.

The challenge, of course, is how to balance actions that are achievable and in the nation's best interests with those that will significantly lower our greenhouse gas emissions.

Our economy will need to be transformed to meet the kinds of challenges the future will bring and to ensure New Zealand is a place we are all proud to be a part of.

The actions we take every day on an individual level count too – everyone can contribute to the solution.

Are you ready for the challenge?

The actions we take every day on an individual level count too – everyone can contribute to the solution.

Glossary

Here are the definitions for some words and terms that are commonly used in connection with climate change.

Adaptation	Planning and preparing for climate change to minimise the risks and maximise the opportunities arising from change.
Carbon neutrality	Reducing greenhouse gas emissions as much as possible and “offsetting” the emissions that can’t be easily reduced. Being carbon neutral means that the amount of greenhouse gases emitted is equivalent to that absorbed (see Emissions offsets below).
Emissions	The greenhouse gases that are released into the atmosphere, including carbon dioxide, methane and nitrous oxide.
Emissions offsets	Individuals and businesses are able to offset the emissions they produce through other activities that have a positive impact. This usually means paying a registered organisation to reduce CO ₂ in the atmosphere by the same amount that the activities add. For example, some airlines now offer travellers an option to offset the emissions generated through flying.
First commitment period (CP1)	This is the first period of the Kyoto Protocol (2008–2012), where member countries become liable for their greenhouse gas emissions.
Forest sinks	Forests are called sinks because of their ability to absorb carbon dioxide out of the atmosphere. Trees convert carbon dioxide from the atmosphere into carbon stored in the form of wood and soil organic matter.
IPCC	The Intergovernmental Panel on Climate Change, an international body which assesses scientific, technical and socio-economic information about climate change.
Kyoto Protocol	An international agreement to address global warming and delay climate change.
Kyoto-compliant units	Also called carbon credits. Each unit is equivalent to one tonne of carbon dioxide. The units are internationally tradable and can be used to pay for greenhouse gas emissions at the end of the first commitment period of the Kyoto Protocol (2008-2012).
Kyoto/liability provision	The anticipated liability, or cost, expected by countries in 2008–2012.
Mitigation	Actions to reduce greenhouse gas emissions and reduce the magnitude of climate change.
Net position	The level of greenhouse gas emissions countries are expected to be emitting in 2008-2012 relative to New Zealand’s Kyoto Protocol obligations.
Renewable energy	Energy obtained from sources that can be replenished, like water, wood, wind, geothermal or solar energy.
Sustainability	Meeting the needs of communities or countries without compromising the well-being of future generations.
UNFCCC	The United Nations Framework Convention on Climate Change, an international treaty for tackling climate change. The Kyoto Protocol is an addition to this treaty.

Find out more

Links

The New Zealand government:
www.govt.nz

Local government:
www.lgnz.co.nz

International Council for
Local Environmental Initiatives:
www.iclei.org

United Nations Framework
Convention on Climate Change:
www.unfccc.int

Contact us for more information about climate change or new initiatives.

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Websites: www.mfe.govt.nz, www.climatechange.govt.nz

This booklet is one of a series on climate change. Other titles include:

- **Taking action on climate change. Small acts. Big impacts.**
- **Preparing for and adapting to climate change. Look ahead to the future.**

We would welcome your feedback on our publications.

To provide input, please email: info@climatechange.govt.nz

To order copies of the publications, email: publications@mfe.govt.nz

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