

June 2008

## From the EDITORS

It's Ebox time again and an opportunity to get stuck into a rather complex and pressing topic — climate change! It seems wherever you are — at home listening to the radio or watching TV, or by the water cooler at work — climate change is being discussed. It is no longer a topic just for climatic experts; we are all struggling to come to terms with what it means and how it will affect the way we live now and in the future.

As always, your thoughts and comments are welcomed. Please contact us for further information. Our contact details are below:

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## A changing climate

Hot and sunny one moment, cold and wet the next, living in New Zealand requires a keen eye for forecasting and a diverse wardrobe! Our weather is changeable at the best of times but now we must add the phenomenon of global warming to the equation. Climate change is related to an increase in "greenhouse gases", which causes an enhanced greenhouse effect.

The greenhouse effect is a natural occurrence where gases in the atmosphere, such as carbon dioxide (CO<sub>2</sub>), allow the Earth's atmosphere to retain the sun's heat. In recent years, climatic experts have recorded changes in the concentration of these gases and global temperatures over and above natural trends. The primary reason for the rapid increase in greenhouse effect has been put down to human activities.

In this issue of 'Your environment, Canterbury', we delve into the hot topic of **climate change**.

We discuss the facts behind this phenomenon and explore its global implications before coming home to the land of the long white cloud to look at what will it mean for New Zealand and Canterbury, and how will it affect you, your family and friends, and the natural environment. More importantly, we look at what we can do about climate change and how we can prepare ourselves for its effects.



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## Change is in the air

Experts from around the world are detecting changes in the Earth's climate and its natural weather patterns, changes now referred to collectively as climate change.

"Climate change" is a phrase used to describe changing climate patterns that:

- are beyond natural climate variations observed over comparable time periods
- can be attributed to human activity that alters the composition of gases in the Earth's atmosphere.

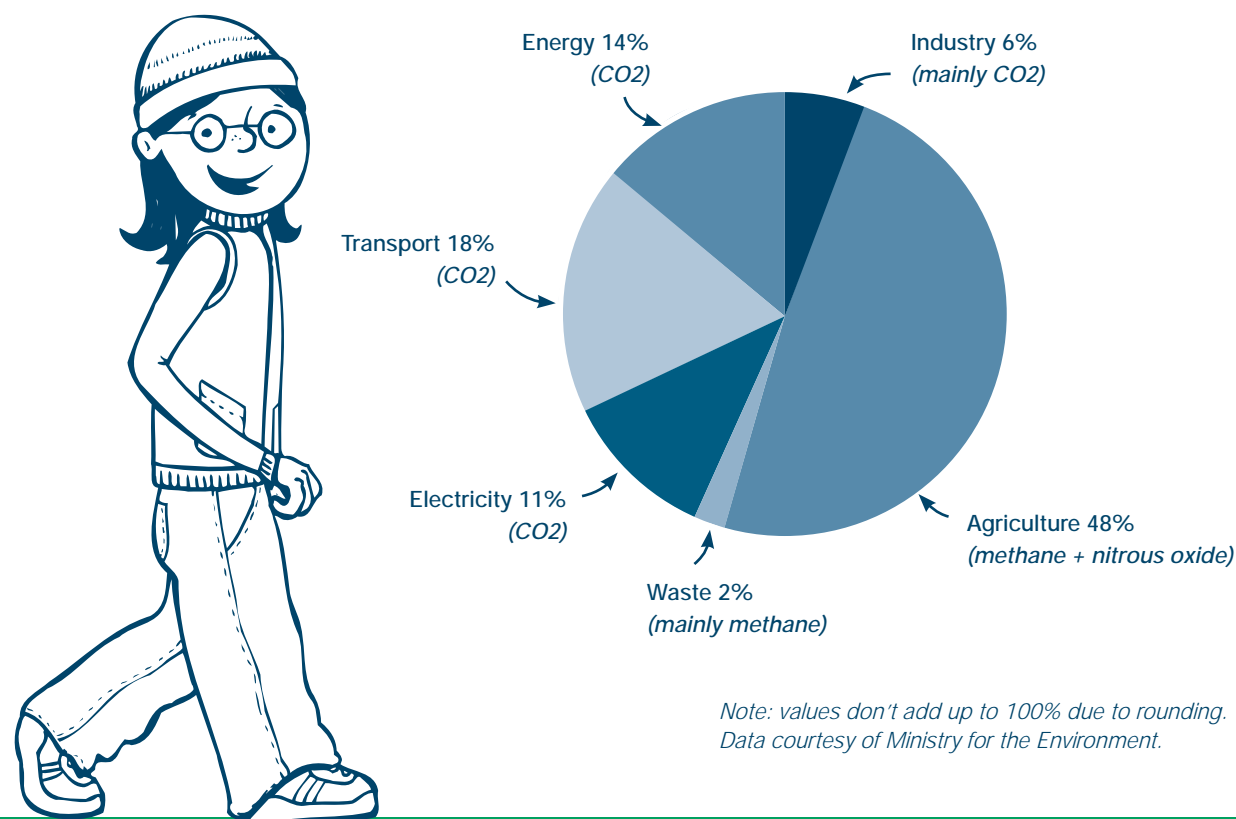
The main reason for these changes is the increase of greenhouse gases being released into the atmosphere (air), particularly CO<sub>2</sub>, methane, and nitrous oxide. High concentrations of these greenhouse gases remain in the atmosphere for years, decades in some instances, and trap heat that would otherwise disperse into space.

### Things are heating up

CO<sub>2</sub> is the most important greenhouse gas emitted into the atmosphere. Further increases in CO<sub>2</sub> levels will continue to heat the planet and change our climate. These changes could reach a "tipping point" and become irreversible.

However, climate change isn't just about the world getting gradually warmer. It's also likely to cause more extreme weather events, such as storms, floods, and droughts, and may also increase sea levels. All these changes have high economic, social, and environmental costs.

### Where do New Zealand's greenhouse gases come from?



### Did you know...?

Greenhouse gases absorb and re-radiate the sun's heat, increasing the temperature of the atmosphere. This is called the greenhouse effect.

### What's in the air?

## A hot topic - what's up with greenhouse gases?

Greenhouse gases are produced naturally from plants and animals, as well as from human activity. Greenhouse gases that occur naturally in the atmosphere make life on earth possible. Without them, too much heat would escape from the atmosphere and the Earth's surface would be about minus 15 degrees!

However, in too high a concentration, greenhouse gases hold in excessive heat, causing the Earth's climate to become more and more unstable.

The greenhouse gases that have increased most due to human activity are:

- carbon dioxide (from burning fossil fuels and deforestation)
- methane (from farm animals and waste)
- nitrous oxide (from soil).

We call these gases "greenhouse gases" because they let in the sun's warmth to heat the ground and prevent it from escaping back into space, rather like a cosy on a tea pot.

As the concentration of greenhouse gases has increased, due to human activities, so has the Earth's average temperature. The gases trap more heat, warming the Earth at a much faster rate than ever before and changing the Earth's natural weather patterns.



### Activity

### The Greenhouse Effect

**Materials:** 1 empty 2L plastic drink bottle with a cap, a nail, two thermometers.

**Method:** Place the thermometers and drink bottle on the ground outside, in full sunlight.

Using the nail, make a hole near the top of the plastic bottle. Place one of the thermometers in the hole. Place the other thermometer on the ground next to the bottle. Make sure both thermometers get the same amount of sunlight.

**What happens?**  
Do both thermometers register the same temperature? If not, which one is higher? Why do you think this happened?

The warming process in this experiment is similar to what happens in the Earth's greenhouse effect.

Experiment from: [www.epa.gov/climatechange/wycd/ORWKit.html](http://www.epa.gov/climatechange/wycd/ORWKit.html)



Extra heat is kept in the air by 'greenhouse gases' produced from human activity

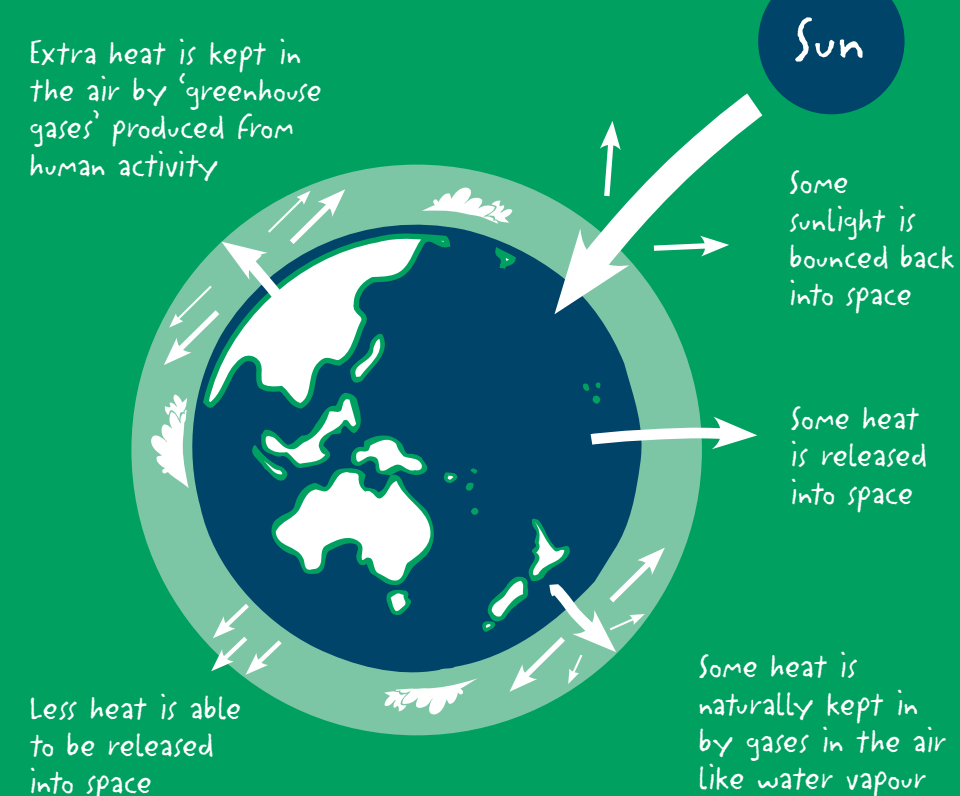


Image adapted from Ministry for the Environment.



# Canterbury

## Carbon, carbon everywhere

### Did you know...?

In the atmosphere, one atom of carbon is attached to two atoms of oxygen in a gas called carbon dioxide (CO<sub>2</sub>).

All growing things absorb carbon. Carbon is part of the ocean, air, and even rocks. Because the Earth is a dynamic place, carbon doesn't stay still, it's always on the move!

### Under the microscope – the Carbon Cycle

CO<sub>2</sub> doesn't stay in the air. It gets recycled!



CO<sub>2</sub> in the air comes from lots of different places, such as our lungs (through breathing), dead and rotting wood, as well as burning fires and the burning of fossil fuels (through transport and industry).



Plants use CO<sub>2</sub> and sunlight to make food and to grow. They take CO<sub>2</sub> out of the air and into their leaves. The carbon then becomes part of the plant and is stored in its leaves, branches, and trunk.

Plants and animals that die and are buried may turn, over millions of years, into fossil fuels such as coal and oil.

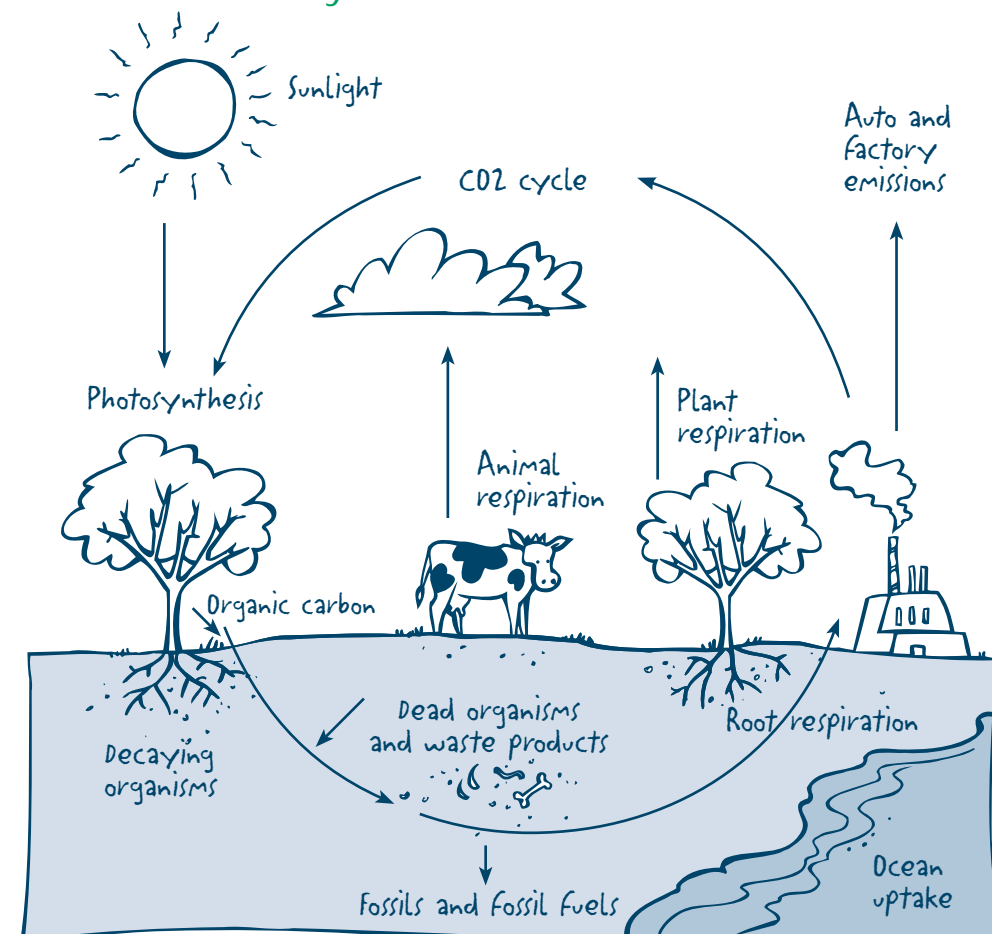
CO<sub>2</sub> is also released back into the air when plants and animals respire or exhale, and when they decompose after dying.

### What the...?

Plants breathe through tiny holes in their leaves, called stomata. They take in CO<sub>2</sub> and let out oxygen, which humans then breathe in!



### The Carbon cycle



### Fact...!

As trees grow, they absorb CO<sub>2</sub> from the atmosphere and store it in their wood. When forests are harvested, some of the carbon they once stored is released back into the atmosphere.

Image adapted from <http://eo.ucar.edu/kids>

### A balanced diet?

In the natural order of things, the carbon cycle is balanced – the amount of carbon being stored is about the same as the carbon being released into the air. Now, because of human activities, the amount of carbon being stored is much less than the amount of carbon being released into the air.

### Where's it all coming from?

Our use of ancient fossil fuels is extensive. From flying to driving, from production to demolition, we use fuels such as oil and coal. The CO<sub>2</sub> stored in these ancient fossil fuels is now being released into the air in huge amounts. On top of this, an increase in activities like land clearing means there is more CO<sub>2</sub> in the air. The natural carbon balance has tipped!

### Did you know...?

When humans burn fossil fuels made of carbon, most of the carbon quickly enters the atmosphere as CO<sub>2</sub>. Some of it gets absorbed by the ocean, increasing the sea's acidity.

### Fact...!

Humans have burned so much fuel that there is about 30 percent more CO<sub>2</sub> in the air today (about 220ppm) than there was 150 years ago (about 380ppm).



Image courtesy FreeDigitalPhotos.net



### What the...?

Fossil fuels are just that, fuels from fossils! A long time after a plant or animal dies, it turns into a fossil in the ground. Over thousands of years, the fossils turn into oil, coal, and natural gas.

### A numbers game

Over the past 10,000 years, the climate has become more stable, leading to an increase in biodiversity and a growing human population. It is this ever-growing population and its activities that are believed to have influenced and shaped our current climate.



### Activity

### People, people everywhere

The world's population is growing at an ever increasing rate, putting more and more pressure on the Earth's natural resources. Put the information below into a graph.

- 1908 - 2 billion people
- 1958 - 3 billion people
- 1988 - 5 billion people
- 2008 - Approaching 7 billion people

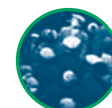
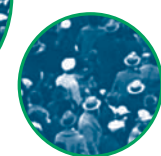
- Can you see any patterns here?
- What will it mean for Planet Earth if the population continues to grow in this way?
- What impact will this kind of population increase have on natural resource use (including energy), the existing population, travel and communication, housing, and lifestyle?

Discuss these questions in pairs for several minutes then report back to the rest of the class for a class-wide discussion.



### Did you know...?

Today (2008), the world's population is approaching 7 billion!



## What on Earth affects

The rise in greenhouse gases is strongly linked to the burning of fossil fuels, such as oil and coal. This has increased dramatically since about 1850. Activities like farming, driving cars, and cutting down trees increase the amount of greenhouse gases released into the air.

### Did you know...?

Almost 50 percent of New Zealand's greenhouse gas emissions are made up of methane and nitrous oxide, the two gases most closely associated with farming.



As farm animals, such as cows and sheep, digest their food, they release methane (a greenhouse gas) into the atmosphere.

### Moving and making

Factories usually burn fossil fuels in the manufacturing and transport of their products. This releases greenhouse gases like CO<sub>2</sub> into the atmosphere. They may release gases from the fuel they use directly, that is in the production and transport of products, or indirectly, such as using electricity that is produced from thermal power (burning coal or gas), for example, from Huntly power station.

### Power it up

Fossil fuels are often burned to make electricity so that people can turn on lights, computers or TVs. However, many countries, including New Zealand, are switching to power that doesn't burn fossil fuels, such as solar, wind, and hydropower.

### Did you know...?

New Zealand gets approximately sixty five percent of its electricity from water (hydropower), wind, and steam (geo-thermal) and only thirty percent from thermal power (burning coal or gas).

### Tricky transport

Vehicles powered by fossil fuels (petrol and diesel) also release greenhouse gases like CO<sub>2</sub> and nitrous oxide into the air.



## climate?

### Precious energy

All of these activities (transport, farming, and so on) use energy; as does industry, food, power, and housing. The list goes on! The more developed a nation becomes, the more energy it uses and the more greenhouse gases are released into the atmosphere. The key is to become more energy efficient.

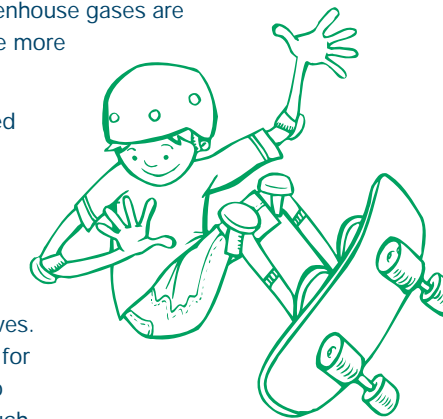
Energy is the capacity to perform work. Humans need to eat and drink to give them energy – food fuels our bodies. The energy from oil, coal, and gas fuels machines, giving them the capacity to work!

### Radically reduce!

Electricity and transport are important parts of our lives. As the world's population grows, so does our need for oil-based fossil fuels and electricity. But we need to reduce our reliance on non-renewable fossil fuels, such as oil, coal, and gas and look at more renewable sources of energy to power our future. We also need to learn to use our energy efficiently.

Renewable energy sources are those that can be made again in a short amount of time, for example, solar (sun) and wind.

Non-renewable energy sources are those that can't be made again or that take a much longer time to form, for example, oil and natural gas.



### Did you know...?

Energy comes from many different sources. We can get energy from the sun, wind, water, fossil fuels, and plants, such as trees for wood and crops for oil.

### Fact...!

Wind turbines help turn wind into energy we can use. Wind power is used to generate a small amount of New Zealand's electricity (approximately 1.5 percent in 2006).



### Activity

### Word unscramble

Unscramble the following words and match them with their meaning.

#### ismsinsoe

the greenhouse gases that are released into the air, including CO<sub>2</sub> and methane

#### altmeicagnceh

changes to the Earth's climate and its natural weather patterns

#### rabcnoodiidx

a greenhouse gas found in the atmosphere

#### ngryee

the capacity to perform work

#### seeugnhruefeetfco

warming of the Earth by trapping heat from the sun

#### bneearlww

source of energy that can be replenished (made again) naturally in a short period of time

#### bwannn-rleoee

source of energy that can't be replenished (made again) in a short period of time

*This list can also be used as a glossary – add more words and their meanings as you find them!*



## What does it mean for...



Countries across the world will be affected in different ways but all will experience a change in climate.

## Did you know...?

By 2050, 97 percent of coral in the Great Barrier Reef, Australia, could be bleached as a result of climate change.

## Phew, what a mouthful...!

The IPCC is a group of climate change scientists and researchers from around the world.

IPCC stands for Intergovernmental Panel on Climate Change).

The effects of a warming planet and a changing climate are already taking place.

- Eleven of the last twelve years have been the warmest on record.
- Arctic sea ice is showing signs of increased melting. Fast-melting Arctic ice could cause coastal erosion and impact on indigenous peoples' livelihoods as well as affect marine life.
- Glaciers in Peru and Greenland are retreating.
- Parts of the Larsen Ice Shelf in Antarctica have disintegrated, increasing glacier flows of ice into the sea.
- In warmer countries like Australia, droughts and water shortages are causing problems.
- Meteorologists are observing an increase in the strength of storms, rainfall, droughts, and floods across the world.



Climate scientists predict that the Earth's average temperature will increase by between 1 and 6°C. This may not seem like much but even a 1 or 2°C increase can have a big impact!

If this warming continues, it is likely that sea levels will rise and flood many low-lying regions of the world, such as some Pacific Islands, Florida (USA), and Bangladesh, and affect large parts of cities like London, New York, and Tokyo, to name just a few.

## Combining forces

Many countries are working together to take action against climate change. One of the ways they are doing this is through the Kyoto Protocol.

The Kyoto Protocol is an international agreement to tackle global warming and delay climate change. For the countries that choose to sign up, the Kyoto Protocol aims to reduce total greenhouse gas emissions to five per cent below the level they were at in 1990. This must take place between 2008 and 2012.

Different countries have set different targets. Thirty-six countries, including New Zealand, have greenhouse gas targets as part of the Kyoto Protocol. Countries are committed under the Protocol to meet their targets by reducing their own greenhouse gas emissions, and by reducing emissions in other countries.

For more information about the Kyoto Protocol visit the United Nations Framework Convention on Climate Change website: <http://unfccc.int>

## Fact...!

New Zealand also has climate change partnerships with Australia and the United States of America (USA).

## everything?



## In the classroom

## Where in the world?

- Make a list of all of the places listed on the previous page.
- Use an atlas to find and label them on a world map.
- Do an internet search and see if you can find out which countries have signed up to the Kyoto Protocol. Can you locate at least 10 on a world map?
- Are there any big countries on your map that aren't on the list? In a different colour, put them on your map. Use the internet to help you find out why these countries are not part of the Kyoto Protocol. Are these countries big emitters of CO<sub>2</sub>? If so, what could they do to reduce emissions?



## Activity

## Be the change!

There are many practical things you can do to reduce your emissions. A great place to start is in your home. Now that you know a bit about what energy is and how we use it, take a quick look around your house and write down all the different ways your family uses energy.

Look at your list. What can you and your family do to REDUCE your energy use at home?

Here are some ideas.

- Turn off the lights when you leave the room.
- Take a short shower instead of a bath.
- Unplug stereos, radios, TVs, and VCRs before you go to bed or on holiday.
- Turn off your video game machines and computers if you're not using them for a while.
- When upgrading any appliance, try to get a Minimum Energy Performance Standards (MEPS) one to replace it.
- Get rid of "seconds" – the second fridge, second TV, and so on.
- Above ALL, ask yourself "Do I really need it?"



## No time for procrastination!

It is expected that the amount of CO<sub>2</sub> already in the atmosphere will continue to affect and change the climate over our lifetime. Taking action now will only help prevent the more disastrous impacts of climate change.

How much we reduce our greenhouse gas emissions across the globe will affect how much the Earth's temperature rises. This is a reason to take action now, not some day in the future!

We need to live more sustainably today so that we use less non-renewable resources like oil and coal, which are rapidly being depleted.

## Did you know...?

Sustainability is about meeting the needs of today without adversely impacting the needs of tomorrow. It can be applied across a range of areas, such as the environment, society, and the economy.

## Whoa...!

Switching off your appliances at the wall can save you \$100 a year!



## On home ground – what does it mean for Aotearoa?

One thing is for certain, climate change will affect different parts of New Zealand in different ways. Our coastal areas, roads, cities, towns, waterways, and farms are all likely to be affected.

### We may be small...

While New Zealand's contribution to global greenhouse gas emissions is relatively small, on a per-person basis our level of emissions ranks us 12th in the world! For a small country, our rate of consumption is also right up there. As a nation, we often want more than we need! This is reason enough to start taking action.

There is little doubt that the way we respond to climate change now will influence what happens to New Zealand in the future.

One of the major impacts of climate change would be an increase in extreme weather events, such as droughts, storms, and floods. These events can have disastrous effects on the environment and the communities living in these areas.



### Some other examples

- Under moderate projections, sea levels are likely to rise 18 to 59cm by 2100. Such a rise would lead to problems of more coastal erosion, salinisation of freshwater, inundation, and drainage problems.
- It's likely that New Zealand would experience more periods of heavy rain and more westerly winds. There is an increased risk of very strong winds and storms.
- It's also likely that there would be a decrease in the number of frost days in the lower North Island and South Island. Fewer frosts could mean less energy is needed for heating, as well as a more favourable climate for certain crops.
- Heat waves are almost certain to increase in frequency and intensity.
- More rain is likely to fall in the west of the country and less in the east.



Changes in climate will have a serious impact on our day-to-day life as well as our cultural heritage and the things we treasure about New Zealand – our beaches, homes, and land.

### What the...?

*Our climate is affected by emissions produced by the rest of the world.*



### Did you know...?

Since 1950, there has been a 0.3 to 0.7°C warming across the Australia/New Zealand region, with more heat waves, fewer frosts, and a sea level rise of 7cm.

### Fact...!

The average New Zealander is responsible for about 8 tonnes of CO2 emissions, from general day-to-day activities, such as commuting to work and school by car and heating the home.

### Border control

There may also be new risks to New Zealand's biosecurity as tropical pests and diseases are able to survive and even flourish in our warmer climate. Pests and diseases that already exist here could also start moving southwards.



### On the move?

Because New Zealand's native species have adapted to the current climate, they could respond to increased temperatures by moving to places where the climate is more suitable.

### Sensitive kiwis

We are at risk of losing irreplaceable flora and fauna like the tuatara. Climate change is likely to affect how well our native species can survive and the types of crops we can grow.

A rising snow line, for example, could lead to the loss of some species.

Higher temperatures could cause problems for crops that are sensitive to climate, such as kiwifruit, which need cold winters.



### Where there's smoke...

An increase in forest fires in drier parts of New Zealand is also more likely.

### What this adds up to

Our economy relies heavily on a healthy environment and a stable climate. Our agriculture, horticulture, tourism, and forestry industries are already feeling the impacts of climate change.



The cost of weather-related disasters is also something to think about. Damage to infrastructure like our homes from extreme weather events, such as floods, droughts, and fires, can have a high financial cost.

Erosion and landslips from frequent and heavier rainfall (as well as floods) could increase road maintenance costs. A reduced snowfall could also save costs.

Changes in seasonal snow cover could affect the ski industry. Glacier shrinkage and retreat are likely, even with just a small temperature rise. This could reduce visitor flows through tourism-dependant areas such as Fox and Franz Josef. The white stuff is big business in New Zealand!

New Zealand also depends on a moderate climate for agriculture. Climate change is a major risk for this key industry and could dramatically affect the country's economy.

### Did you know...?

The cost of drought to farmers in 2007/08 was estimated at over \$1 billion!

### Tasman Glacier







## Sea Level Rise

Materials: Electric hot plate, heat-resistant drinking glass, cooking pot, water, ice cubes.

### Part One:

Water expands when heated. As the Earth's atmosphere traps more heat, the oceans will warm and expand, and sea levels will rise.



#### Method:

Fill the glass with very cold water. Make sure to fill the glass almost to overflowing so the water is at the rim's edge.

Place the glass in the cooking pot, put the pot on the hot plate, and turn the heat to the lowest setting. Wait several minutes. What happens to the water? Does it expand?

### Part Two:

Ice that is already floating on the ocean does not raise the sea level when it melts. However, melting glaciers do raise sea levels slightly.

#### Method:

Put two ice cubes in the glass and then fill with water almost to overflowing. Watch the water level as the ice melts. What happens? Does the water overflow?

After the ice has melted, put another piece of ice in the glass. What happens? Why would sea levels rise from a melting glacier but not from a melting iceberg?



Experiment from: <http://www.epa.gov/climatechange/wycd/ORWKit.html>

## Maori and climate

New Zealand's climate has varied significantly since Maori first arrived. Traditional Maori knowledge of weather and climate, and of associated activities, such as gardening and fishing, contributes to understanding of past climate variations.

Changes in Maori practices and customs that interact strongly with climate are a key to tracing climate back through the centuries.

Knowledge of how Maori coped with past climate extremes, such as floods and droughts, may also help us adapt to future climate changes.

### Change is in the air

Maori have a special relationship with the land, waterways, and other natural resources. This is expressed through kaitiakitanga.

Climate has always been important for Maori. It affects the winds, waves, and ocean currents, influences which plants, trees, and birds are found in various parts of the country, and impacts on the social, economic, and cultural wellbeing of individuals and communities.

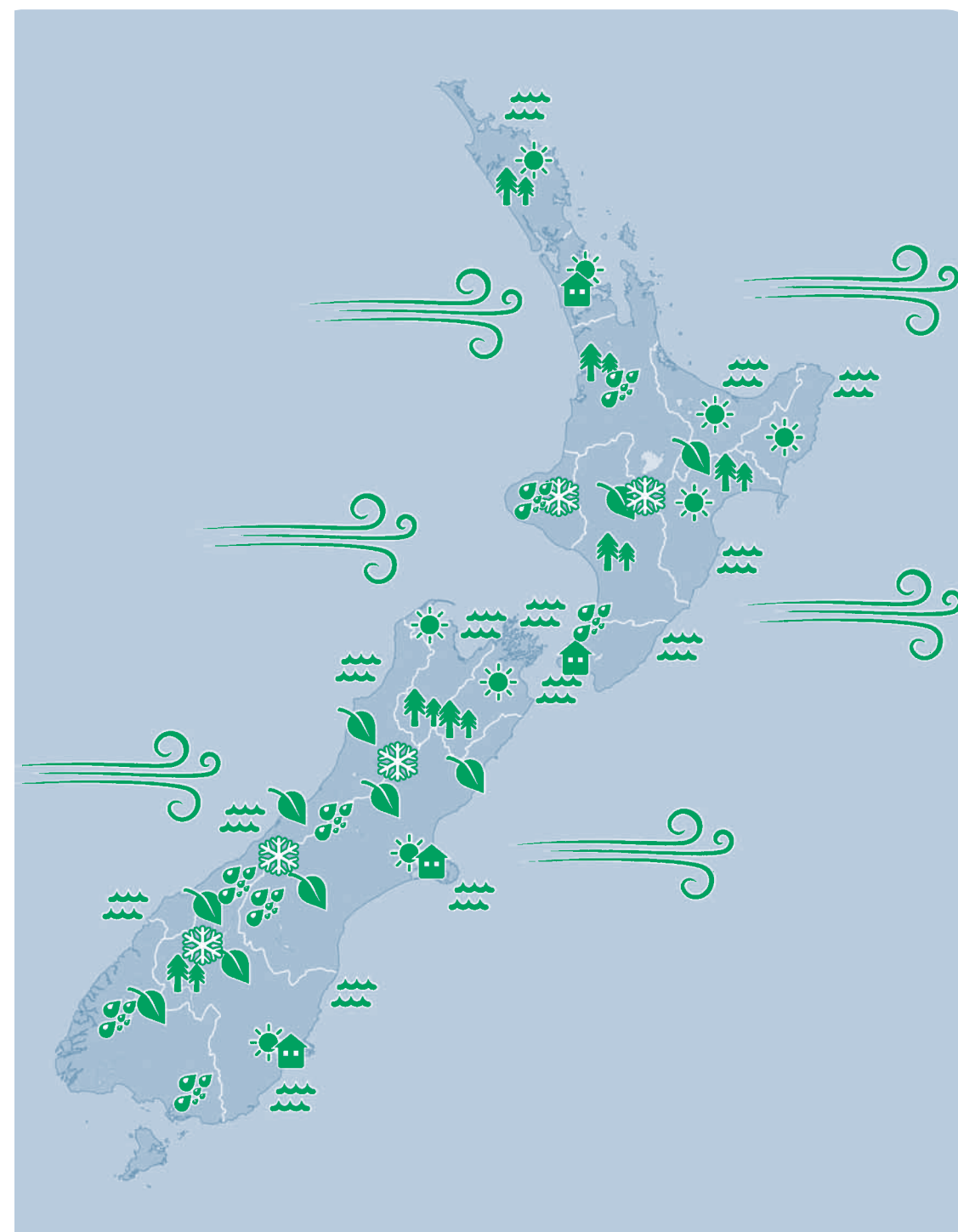
Through the generations, Maori have built up extensive knowledge of local climate, from the character of local winds and rain to the forecasting of drier and warmer summers. This knowledge has traditionally helped them make important decisions, such as when is the best time to plant, farm, harvest, fish, and navigate. Climate change could have an impact on all of these activities.

Information from [www.niwa.cri.nz](http://www.niwa.cri.nz)



## Climate change impacts on New Zealand

This is an overview of the likely impacts of climate change for New Zealand over the next century.



### Natural areas

- changes to species distribution
- changes to/loss of habitat
- increased pressure from pests, animals, and plants

### Coastal

- sea level rise
- increased coastal erosion

### Snowlines & glaciers

- changes to length and area of glaciers
- rise in snowline
- possible increase in snowfall and avalanches

### Drier

- less rainfall
- decreased run-off to rivers
- increased drought in drought-prone areas
- increased demand for irrigation
- increased evaporation

### Wetter

- increased precipitation
- increased flooding in flood-prone areas
- increased slips
- increased soil erosion
- increased intensity of weather events

### Urban

- warmer winters = fewer illnesses
- warmer summers = increased heat stress
- less need for heating = decreased electricity use in winter
- more air conditioning = increased electricity use in summer

### Commercial forests

- increased growth rates
- increased winds = increased damage to forests
- increased temperatures = increased pests

### Wind

- increased westerly winds

Image adapted from Ministry for the Environment.

For more information visit [www.climatechange.govt.nz](http://www.climatechange.govt.nz)

## Sunshine through the rain – pros and cons of climate change

It doesn't all have to be doom and gloom. There is no doubt that climate change (and its impacts) is a very serious business but there may also be an upside to a changing climate.

### Spotting opportunities

Opportunities for research and development may arise, such as in the growth of different crops and the development of new ways to produce renewable energy.



### Power hungry

Warmer winters will mean less demand for electricity and heating supplies. Increased rainfall in the Southern Alps could also mean an increase in electricity supply because hydro lake levels are higher.

Improving energy efficiency in our homes will also mean lower power bills, warmer homes, and less winter-related illness.

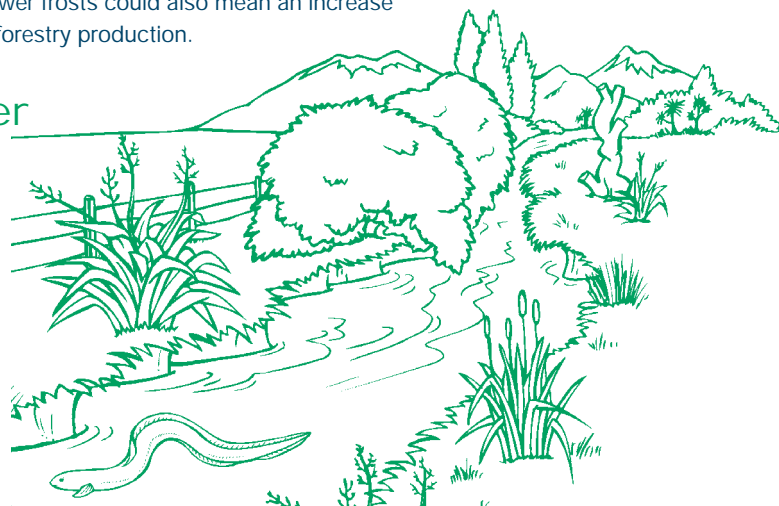
Stronger westerly winds mean that wind farms and wind turbines are likely to be increasingly common.

### Farms and Forests

A change in climate could lead to the growth of different crops. An increase in CO2 in the atmosphere and fewer frosts could also mean an increase in agricultural and forestry production.

### Wild water

Good planning could mean improved water quality and better management of limited resources.



### Activity

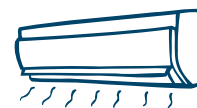


### Thinking outside the square

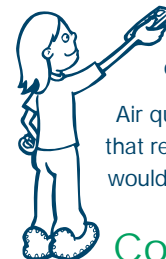
Tackling climate change is a challenge but it's also an opportunity to clean up the country and secure our quality of life for future generations!

Find out what environmental projects are happening in your local community or think about getting together with your friends, family, and school to start something. You could plant native trees, set up a walking school bus, start a waste-reduction project, or take an energy audit at home/ school to find ways to reduce energy use. Your local and regional councils may also have some ideas or projects that you can take part in.

## What does it mean for Canterbury?



### All about air



Winter air pollution in Canterbury is caused by using open fires and old wood and coal burners to heat homes. Changing to renewable fuels could improve Canterbury's air quality.

Air quality could also improve with increased wind and the warmer temperatures that require less home heating. Fewer frosty and still days would mean less winter air pollution in urban areas.

### Cost to the Coast

An increase in the number of storms and a rise in sea level are likely to cause more erosion to Canterbury's coastal environment.



### Did you know...?

90 percent of New Zealand's population lies within 50km of the coast. This puts us more at risk of climate change effects.

### Water worries

Storms may become stronger and more frequent, causing more flood events. This would bring significant costs for repairing flood damage.



It is likely that there will be less rainfall across the Canterbury Plains. This could mean an increase in demand for water as water supplies decrease. As a result, there could be a need for winter water storage schemes to provide water for drier springs and summers. Farming practices would need to adapt to this.

### Pesky pests

The colder, the better for keeping pests at bay! Therefore, rising temperatures could allow existing pest plants to spread further or new ones, such as phoenix palms, to establish themselves. The range of animal pests is likely to increase (a move from north to south) as they will have a better chance of surviving.

### Energising energy

Climate change is strongly connected with energy use. Canterbury is one of the fastest-growing regions in the country and energy use, especially transport, is continuing to increase. The need to reduce greenhouse gas emissions from transport is particularly important for Canterbury.

### Fact...!

Cars are powered by oil, a fossil fuel. More than a third of all energy use in Canterbury is from cars. Using the car less helps reduce the amount of energy you use.



### Opportunity knocks!

As a result of climate change, Canterbury could become more energy efficient and utilise more sustainable sources of energy.

### Did you know...?

Environment Canterbury is part of Communities for Climate Protection – New Zealand. We are working to reduce greenhouse gas emissions from council activities and communities.



### Out of the classroom

### Getting out and about

The effects of climate change will have an impact on all aspects of our day-to-day life.

Brainstorm what aspects of life you think could be affected by climate change. Think about your family, friends, home, and school. You could draw up a table and record your ideas.

Think about this further when you get home.

Choose one aspect of your life that would be affected and record this by taking photos or quick sketches to capture what climate change will mean for you. You could post these images on the classroom wall or school hall, incorporate them into a poster to use for discussion, or talk to other classes about issues related to climate change.

Explore your 'area' further. Think about what you can change and what action you can take. Discuss this as a class or with your families for homework.

You could come up with one or two actions you can take to tackle climate change both now and in the future. These actions could also be incorporated into a poster display at school or in the local library.



## Solution snapshot

Below is an introduction to two possible solutions for issues associated with climate change.

### Biofuels – a good alternative to petrol?

Biofuels are fuels made mainly from animal or plant material. If produced sustainably, they are a renewable fuel source and produce less CO<sub>2</sub> than petrol or diesel. The two main transport biofuels are biodiesel and bioethanol. Biodiesel is a diesel substitute and bioethanol is a petrol substitute.

New Zealand's main source of biodiesel is tallow, a by-product of the meat industry. Bioethanol is currently produced in New Zealand from whey, a dairy by-product. There is some work being done to look at alternative sources of bioethanol.

Caution! Biofuels are only a good alternative when produced by reusing a waste product, such as tallow. If biofuels are produced from virgin crops, that is from land that has been cleared just for biofuels, they become less attractive. Crops harvested in this way reduce the

land available for food production. Precious ecosystems are also destroyed when areas like rainforests are cleared to make way for biofuel crops.

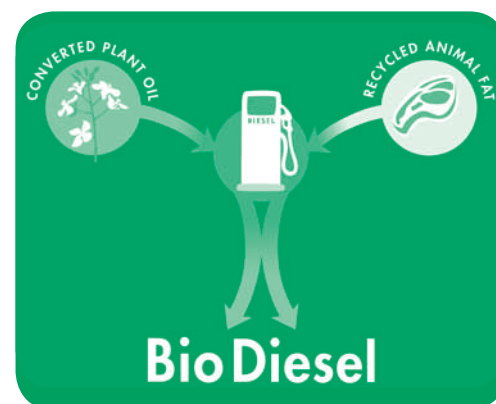
The amount of water and energy (and associated CO<sub>2</sub> emissions) needed to harvest, process, and produce biofuel is also significant.

It is important to carefully consider all of these aspects when looking at biofuels as a viable alternative to fossil fuels.

#### Something to think about

*It takes approximately 230kg of corn to fill a family-size vehicle once.*

*This same amount of corn would feed a family for a year!*



#### Did you know...?

Biofuels have been in use overseas for nearly 20 years. Countries that currently produce and use biofuels include Brazil, the United States, Canada, China, and Australia.



### Oil – at its peak?

Oil products are linked to almost every aspect of urban and rural day-to-day life. Oil supplies about 85 percent of New Zealand's transport energy needs. It is also important for meeting our food requirements. Oil is used in virtually all aspects of food production – growing, harvesting, transport, processing, storage, and disposal of waste. It is also a major component of everyday items, such as plastic bags and cosmetics. Worldwide consumption of petroleum products is a major factor in rising CO<sub>2</sub> emissions and corresponding warming climate.

The term "peak oil" refers to the point at which worldwide production of conventional crude oil peaks in volume and starts to decline. It does not mean that the oil supply has run out – this is unlikely. But what oil remains will be more technically and politically difficult to source. Shortages may become more common as supply fails to meet demand and world oil prices will rise considerably. We are already seeing this happen in New Zealand as our prices at the pump soar. There are flow-on effects to all parts of the community.

### Emissions trading scheme

An emissions trading scheme (ETS) could play an important role in tackling climate change.

Emissions trading schemes usually operate on a "net" basis, that is, there may be an increase in emissions from one source or even one country but this increase is offset by emission reductions elsewhere.

Under an ETS, polluting sectors must, over time, cover the cost of their greenhouse gas emissions. The idea is that if you charge polluters for their emissions they will be more likely to take action to reduce them. In the New Zealand emissions trading scheme, there will not be an absolute limit of emissions in New Zealand. Participants will be able to buy emission reductions from overseas through the Kyoto Protocol.

For more information about an ETS in New Zealand visit [www.climatechange.govt.nz](http://www.climatechange.govt.nz)



### In the classroom

## Debating the issues

There are many different issues and possible solutions associated with climate change. Now it's time for you to delve deeper into some of these.

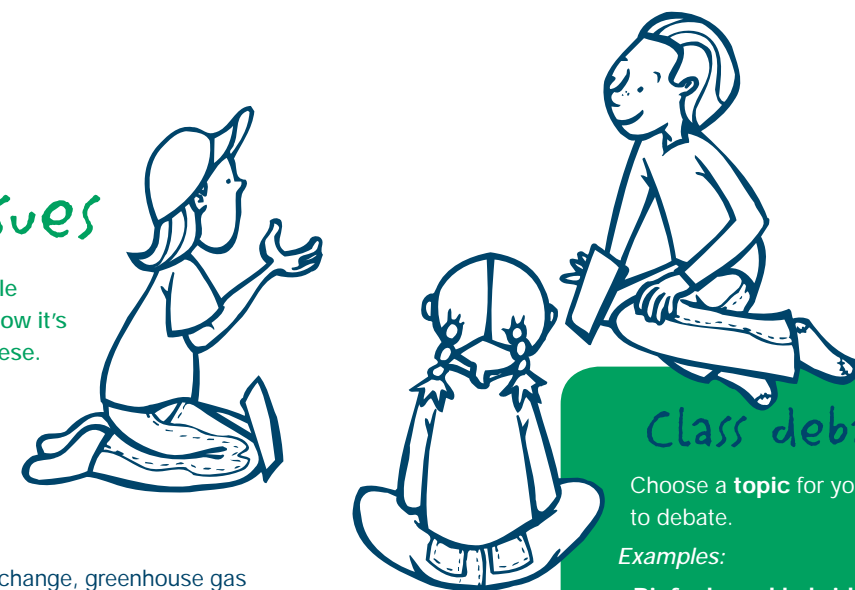
### Role play

Divide the class into small groups with each group taking one of the roles outlined below.

Each group discusses its position on climate change, greenhouse gas emissions, behaviour change, and so on, and maybe does some further research. One person from each group then takes part in the class role play. You will have to decide what the scenario is, for example, a demonstration or a council meeting, or a community gathering. The debate topics listed may also help with this activity.

#### Roles:

- **Scientists** – You monitor changes in the climate and greenhouse gas emissions in the air. Your main job is to make sure everyone knows what climate change is, what causes it, and why.
- **Environmentalists** – You want to increase awareness about the issues associated with climate change and think that behaviour change is the best way to tackle this. You are interested in renewable energy, such as solar power, and you want the council to take a lead role in this.
- **Concerned citizens** – You want the city to be a clean, safe place for your children. You like using your car around town but understand that change is necessary and that there are benefits to public transport and being more active by cycling and walking more often.
- **Low income representative** – You are concerned that many alternatives to fossil fuels are expensive, for example, installing solar panels, insulating your house, bus passes. You believe people on low incomes will be hardest hit and will need some kind of assistance to put things like this in place.
- **Business person** (for example, representative from an energy company or airline) – You are concerned that the messages being sent to people are that they should stop all driving and/or flying. You are aware of the issues relating to climate change and think that you can find a balance between reducing greenhouse gases and travelling.
- **Student** – You are concerned that climate change is going to impact on the things you and your friends enjoy like going to the beach but you also think it would be better if the winters were warmer.
- **Elderly person** – You are quite happy to use less power and get the bus around town. You feel that warmer winters would be much better for people's health but its not easy to compost and recycle where you live. You feel the council should do more to help with that type of thing.
- **Parent with children** – You are concerned about the impact that climate change may have on you and your family. You think it will cost more to get your family around using the bus (and it will take much more time) and it will be harder to fly and visit Granny and Grandpa in the school holidays.



### Class debate

Choose a **topic** for your class to debate.

#### Examples:

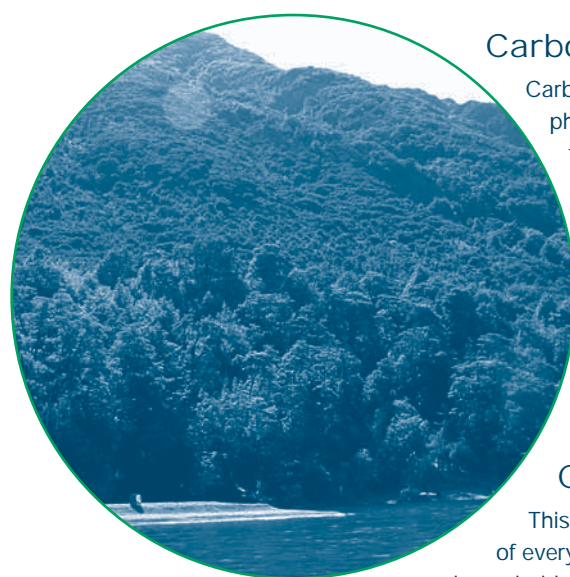
- **Biofuels and hybrid cars; feeding cars versus feeding people.** Are they really solutions to climate change or do they just swap one resource problem for another?
- **All just hot air** – is the current climate change simply the Earth doing its natural thing or is it something else?
- **The New Zealand Emissions Trading Scheme** will not have an absolute limit of emissions for New Zealand. Will this work? Is it worth all the effort?
- **What are the real costs of climate change** – economic, social, environmental, and cultural?
- **What other forms of environmental "taxes" are there?** Do some research and find out what other countries use them, for example, Germany and Sweden.
- **Why are the USA and China not signing up to the Kyoto Protocol?**
- **Offsetting greenhouse gas emissions versus behaviour change.**
- **Should there be more regulations and penalties** to encourage people to reduce their greenhouse gas emissions (for example, allowing people only one flight per year)?



## Activity

## A step in the right direction

There are many websites that will help you calculate your ecological footprint, whether as an individual, household, or school. Work with other students to calculate your household or school's footprint. Set up an action plan to reduce this over several months. Results could be presented at a school assembly.



## Carbon sinks

Carbon sink refers to the removal of CO<sub>2</sub> in the atmosphere, usually via photosynthesis in plants. Growing pasture to shrublands and shrublands to forest enables large quantities of carbon to be absorbed from the atmosphere and stored in these plants.

**Forests worthy of protection**

Only permanent forest, like New Zealand's protected native forests, can keep growing and storing carbon forever. Plantation forests (such as pine) produce wood that is used for timber-framed houses, paper, and other products. Some of these things are burned or thrown away and the carbon stored in the wood is released as CO<sub>2</sub>.

## Carbon footprint

This is a measure of the amount of greenhouse gases emitted as a result of everyday activities. Carbon footprints can be measured for individuals or households, as well as organisations, businesses, products, and services.

An ecological footprint measures the way we use the planet's natural resources and our impact on its ecosystems.

## Did you know...?

Offsetting refers to the process of compensating, counterbalancing or neutralising CO<sub>2</sub> emissions. This can be done by increasing carbon sinks, energy efficiency initiatives or sources of renewable energy. Offsetting emissions is just one option. There are many different aspects that need to be considered when thinking about this.

## Keep cool till after school

*There are many things you can do at school to reduce greenhouse gas emissions and become more sustainable. Here are just a few ideas:*

- *energy efficiency*
- *waste minimisation*
- *water conservation*
- *care codes for the environment, resources, and people*
- *green purchasing policies*  
(encouraging school-bought products to be environmentally and ethically sound)

## Carbon jargon

When it comes to climate change there's a lot of terminology out there. We have picked a few terms and have explained them below. There is much more detailed information available on all of them. Remember, this is just a taster.

## Carbon neutral

Businesses, households, organisations, and schools are being encouraged to become carbon neutral. Being carbon neutral involves calculating your total greenhouse gas emissions, reducing them where possible, and then balancing the remaining emissions (often by purchasing a carbon offset) so that what you put out equals what you have reduced and/or mitigated.

## Carbon credits

Carbon credits are awarded for sequestering (for example, having more trees available to absorb CO<sub>2</sub>) and avoiding or reducing CO<sub>2</sub> emissions to the atmosphere. This is like having positive "credit" in your carbon account. Activities that use fossil fuels and produce CO<sub>2</sub> emissions are on the negative side of the balance. A carbon credit is equivalent to one tonne of CO<sub>2</sub> emissions.

## It's up to us

Climate change might seem like a complex issue but one thing is certain; the small steps we all take as individuals can make a difference. There are a lot of things we can do every day to help reduce our emissions and live more sustainably.

What we do now to reduce our impact on the environment will not only help us today, it will bring us a better future.

## Why bother?

The actions we can take against climate change help both the environment and our pockets! Using energy more efficiently means paying less for electricity, gas, and petrol. Using cars less improves the air quality and our health, and using better insulation in our homes means we stay warmer and don't get sick as often.

The action we take to reduce emissions will help improve our air and water quality, help protect land from erosion and flooding, and maintain biodiversity.



So let's get started!

## It takes two

The two main ways we can take action on climate change are to reduce our greenhouse gas emissions and be prepared so that we can adapt to the changes that are likely to happen.

## Our mission with emissions

If greenhouse gas emissions are not reduced, levels in the atmosphere will keep rising and the speed and extent of climate change is likely to be worse. If we don't plan properly for this, we will be more at risk of the effects of climate change.

Because of the levels of CO<sub>2</sub> that are already in the air, reducing greenhouse gas emissions won't stop climate change. But, if we act now and work together, we can try to avoid the disastrous effects of climate change.

## Being prepared

Being prepared for and adapting to climate change will minimise the risks to New Zealand's environment, communities, and individuals.

Preparedness is just as important as taking action to tackle climate change. We have already talked about what changes are likely to take place, now we need to make sure we are ready for these.

In the event of a hazardous situation it's up to you take steps to look after yourself as best you can.

"We ourselves feel that what we are doing is just a drop in the ocean. But the ocean would be less because of that missing drop."

Mother Teresa of Calcutta

## Did you know...?

The New Zealand Government has already implemented a number of policies and measures to reduce our greenhouse gas emissions and to prepare for climate change. These include improving fuel efficiency of vehicles and the environmental performance of appliances, increasing standards for building insulation, and encouraging renewable energy.

continues next page...



If a Civil Defence emergency is declared it means the hazard is threatening to become a natural disaster and Civil Defence headquarters will spring into action.

What can you do?

Civil Defence's job is made a lot easier when people are aware of and prepared for extreme events and natural disasters. You will feel most comfortable and safe by being prepared with survival kits and learning techniques for coping with different situations.

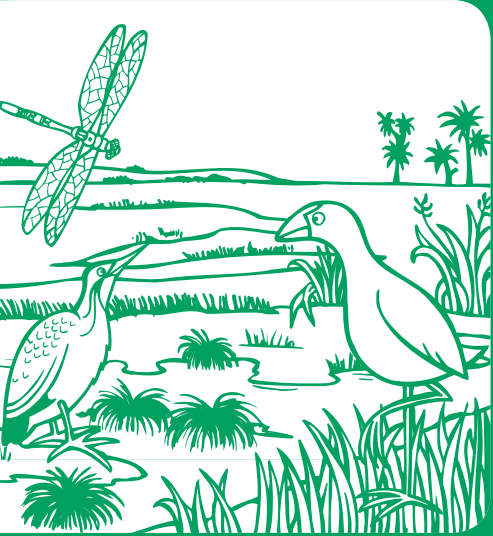
Good things come in small packages

Although New Zealand is a small country, it is a big emitter when measured per capita.

Reducing the greenhouse gases that are heating up our planet will require effort from New Zealanders and the rest of the world.

Our precious natural resources, unique flora and fauna, stunning scenery, and our way of life are all worth protecting – and are crucial to the survival of the planet!

Taking action against climate change is one of the most important things New Zealand can do. We need to work together to help protect our environment, our community, and our way of life.



Activity

Personal survival kit

Brainstorm with the class what you think you would need if a major climate change disaster did strike, for example, a major flood, storm, drought or cyclone. Think about essential survival items you would need if you had to leave your house in a hurry. Here are some items to get the discussion started:



List your top three items and tell the rest of the class why your chose these things.  
Would you take all of these items? Why/why not?  
What other things would be useful to include in your list? Why would you take these things?

So what now?

Are you ready for the challenge?

While there is little doubt that we need to reduce our greenhouse gas emissions, we should remember that enhanced climate change is just one part of the bigger issue of unsustainable living. Living sustainably means living smarter. We need to work together to reduce our emissions and our impact on the environment as a whole, as part of a more sustainable lifestyle.

The action we take every day counts – everyone can help make a difference.



In the classroom

Are you ready to take the test?

Whoa! There's a lot to think about when it comes to climate change and what action to take. Luckily, there are heaps of things that you can do to produce less carbon dioxide, use less energy, and save money at home! Do you know how? Test yourself on the following quiz and find out.

Your answer  
(A or B)

A	B	
1. Do you shower for a long time? (10 minutes?)	OR take a quick shower in 3 minutes?	
2. Do you walk, bike, or bus to school?	OR get driven by car to school?	
3. Does your mum or dad drive you and do you share the ride with friends?	OR your mum or dad drives you but you don't share?	
4. Do you refill your water bottle or drink water from the fountain?	OR buy drink in a bottle or can?	
5. Do you pack your lunch in your lunchbox?	OR use pre-wrapped food?	
6. Do you use clean paper to draw or doodle on?	OR re-use waste paper by using the clean side?	
7. Do you put paper, plastic, and glass in the rubbish bin?	OR put paper, plastic, and glass in the recycling bin?	
8. After school, do you usually play outside?	OR turn on the television?	
9. It gets cold. Do you turn on the heater?	OR put on a sweatshirt?	
10. It gets even colder. Do you turn up the heater?	OR check the windows are closed and draw the curtains?	
11. It gets dark. Do you turn on lots of lights?	OR only turn on the lights you need?	
12. You leave the room. Do you turn off the light?	OR leave the light on?	

Did you choose the answers which use the least energy and CO2? Check your answers below:  
1. B, 2. A, 3. A, 4. A, 5. A, 6. B, 7. B, 8. A, 9. B, 10. B, 11. B, 12. A

What was your score?

6 or less: Hmm...you're not there yet. Try and think of two things you can do to improve your score. In a week's time, try and change another two things and you'll be on your way!

7 - 9: Good on you, you are getting there! Now, just try and think of something else you can do to improve your score.

10 - 12: Fantastic. You are a climate change crusader! Keep up the great work and try to help at least one other person to reach this level.

Activity adapted from Kiwi Conservation Club magazine, Number 88, April 2007



## Your Guide to Sustainable Living

*Adapted from Greenpace NZ  
(Climate Change brochure).*

Insulate your ceiling and walls. This can stop heat from escaping and save you money!

Try to buy your fruit and veges locally and organically where possible. This will reduce the amount of energy used to transport your food, support local producers, and they will be much tastier!

Turn your hot water cylinder thermostat down so that the tap water temperature is 55°C. This not only saves energy, it's also much safer.

Avoid products made from PVC. PVC produces harmful toxic chemicals during its manufacture and disposal.

Check your hot water cylinder. If it's warm to touch it probably needs insulation wrap. Whatever you spend on insulation will be paid back in energy savings within a year. If you are replacing your cylinder, think seriously about replacing it with a solar water heating system or hot water heat pump system.

When washing your clothes, use cold water. A warm wash uses as much energy as drying your clothes in a dryer.

Use energy-efficient light bulbs. These light bulbs use five times less power than regular ones and can last up to nine years.

Compost your organic waste (food scraps and garden waste). This is great for your garden. Organic waste in landfill creates methane (a greenhouse gas) emissions.

Grow your own veges. They'll be the freshest and most environmentally friendly food you'll ever eat!

Turn off your appliances at the wall when you're not using them. Appliances left on standby use up to 10% of household electricity.

Installing a solar water heater could provide you with all the hot water you need and save a huge 75% off your hot-water bill!

By doubling glazing a window with clear glass, you can halve the heat lost through a single-glazed window of the same size and shape.

Dry your clothes outside as often as possible – it's free and efficient! Clothes dryers are among the most energy-hungry appliances.

Recycle as much of your household waste as you can. Check with your local council as to what kinds of things can be recycled.

When you do drive, make sure it's in a fuel-efficient car. Keep your tyres properly inflated and your engine tuned to maximise efficiency.

Cycle or walk for short trips instead of taking the car (a walk-able distance is under 2km and a cycle-able distance is under 6km). This will help keep you and the environment healthier! Public transport is a great alternative for longer trips.

Try to buy recycled paper (that hasn't been chlorine bleached) and print double-sided wherever possible.



### Activity

Look at this picture and write down:

- what you currently do
- what you could start doing now
- what you could start doing in six months' time
- what you can't do (give a reason for this)

Take a copy of this picture home to share with your family. Will they help you to do these things? Can they think of any others?



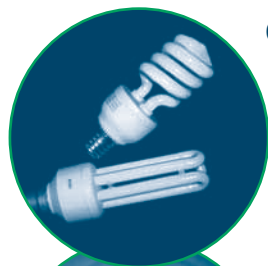
## Take action and cause a reaction!

### Everyday Super Heroes

There are many simple things we can do every day to reduce our impact on the environment, reduce our greenhouse gas emissions, and live more sustainably. You have the power to choose!

#### Fact...!

Using less electricity helps reduce the amount of CO<sub>2</sub> that is released during electricity production.



#### Get energy-wise

One way to reduce your energy use at home is to use energy-efficient light bulbs. They use less energy, last much longer than regular light bulbs, and can be found in any supermarket or DIY store!

#### The flick of a switch

You can reduce greenhouse gas emissions by turning off all your lights and electrical appliances when you're not using them (for example, your toaster, kettle, TV, stereo, phone charger). This can also save money on the power bill!



#### Shower power

Take a shower instead of a bath. This uses less hot water and thus reduces the greenhouse gases released through making electricity.



#### Let there be light!

A great way to make use of our amazing sun is to put solar panels on your house. This will change the sunlight directly into electricity and thereby heat your water and save you money!

#### A school bus with legs?



Use the power of your feet and try walking to school a few times a week; you can even pick up your friends along the way to make a walking school bus – a bus with legs! This is a project that the whole school community can take part in.

#### Did you know...?

Around 18 percent of New Zealand's greenhouse gas emissions come from transport so choosing another way to get around can make a big difference!

#### Sit back and relax

Take a family trip on the bus. You could visit the mall, take a picnic to the park, or just see the city from a different window! It can be a lot of fun, cheaper, and uses less energy.



### Baby you can drive my car

Car-pooling is also a good idea. Talk to friends or neighbours to see if you can share the cost of one car instead of five!

Another alternative is having community cars. A community car is a car that a community – rather than an individual – owns, maintains, and uses, saving on overall costs.

#### Fact...!

The average New Zealand family spends approximately \$7000 per year on transport!



### Pedal power

Canterbury is a great place for cycling. Not only does cycling use renewable energy (human power), it's also fun, cheap, and keeps you fit and healthy!

### What a waste!

Most of the things we do everyday create some sort of waste. All we need to do is think about how we can reduce this. Here are some ideas:



Try to buy products with less packaging, such as loose fruit and vegetables. The production of packaging releases greenhouse gases into the atmosphere.



Recycle paper, glass, tin, and plastics whenever you can. Recycling helps reduce emissions as it takes less energy to recycle something than to make it from scratch.



Compost your food scraps – at home and at school! This will help feed your garden as well as reduce the methane gas emissions from landfill waste.

Take your own recyclable or cloth shopping bags to the supermarket. That way you won't need plastic ones.

#### Did you know?

Composting allows more oxygen to get into food waste, which helps it to break down faster.





# Your environment Canterbury



## Neighbourhood watch

Find out if there are any projects in your local community to reduce emissions. If not, why not think about starting one? A project called "Transition Towns" is a great example of communities converting from high-energy to low-energy lifestyles [www.transitiontowns.org.nz](http://www.transitiontowns.org.nz).

### Fact...!

Sand dunes provide natural protection from coastal hazards and erosion.

## Dune bug

Sand dune restoration is an important task in preparing and protecting coastal areas from climate change events like floods and sea-level rise. Contact your local council to see if there are any dune restoration projects that you could get involved in.



## At home

## Spread the word

Raising awareness of environmental issues is also a great way to make a difference. Choose an issue that's relevant to you and your community, explore this further, and use key points to design a poster. Think of a catchy slogan and image for this poster. It could be put up in the school hall, staff room, or your local library.

You could also write a short story, poem, or play about tackling climate change. Include actions that people can take to make a difference. This could be shared with junior students at school.

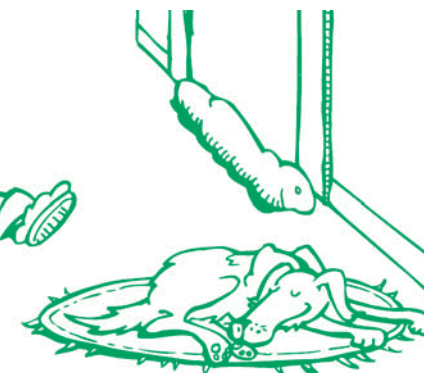


### Did you know...?

Around a third of New Zealanders are children and young people. This is a big part of our community so let's get out there and take action – be the difference!



## Activity



## Making door snakes

Draught stopping door snakes are a great way to help keep the heat in and stop cold air getting into your warm room!

### What you need

- 1 piece of funky material cut to 20cm x 110cm
- A sewing machine
- Sand or something similar to fill the snake
  - if filling with sand, choose a tightly woven fabric
- A funnel and/or container with a lip
- Needle and cotton

### What to do

1. Lay the fabric out flat and then carefully fold in half lengthways.
2. Pin the open edge and the bottom of the snake.
3. Use the machine to sew the long edge and the bottom of the snake.
4. Creative time – this is when you get the chance to make your snake look unique and cool. Sew on things that will make your snake look great, such as eyes and a tongue, maybe even shiny snake like patches. It's up to you!
5. Using a funnel or container with a lip, pour the sand (or something similar) into the open end of the snake. Make sure you leave 3cm of fabric unfilled. This will help when sewing up your snake.
6. When full, carefully hand sew the top together making sure the stitches are small, tight and close together so the sand will not escape.

## Want to know more?

For more information about climate change and other education resources visit:

[www.e4s.org.nz](http://www.e4s.org.nz)

[www.4million.org.nz](http://www.4million.org.nz)

[www.facingthefuture.org](http://www.facingthefuture.org)

[www.climatechange.govt.nz](http://www.climatechange.govt.nz)

[www.mfe.govt.nz](http://www.mfe.govt.nz)

## Curriculum Links (Level 4)

### Principals – Foundations of curriculum decision making

Future Focus

### Environmental Education

Key concepts: interdependence, sustainability, biodiversity, personal and social responsibility for action

### Social Studies

Understand how exploration and innovation create opportunities and challenges for people, places, and environments

Understand the events have causes and effects

### Science

Life processes; Ecology; Evolution

### Health

Rights, responsibilities, and laws; People and the environment

### Technology

Nature of technology

Characteristic of technology

### Mathematics and statistics

Statistics

- Statistics investigation; probability



# Canterbury

Your Environment – Canterbury is free to all schools/teachers in the Canterbury region.

canterbury mudfish

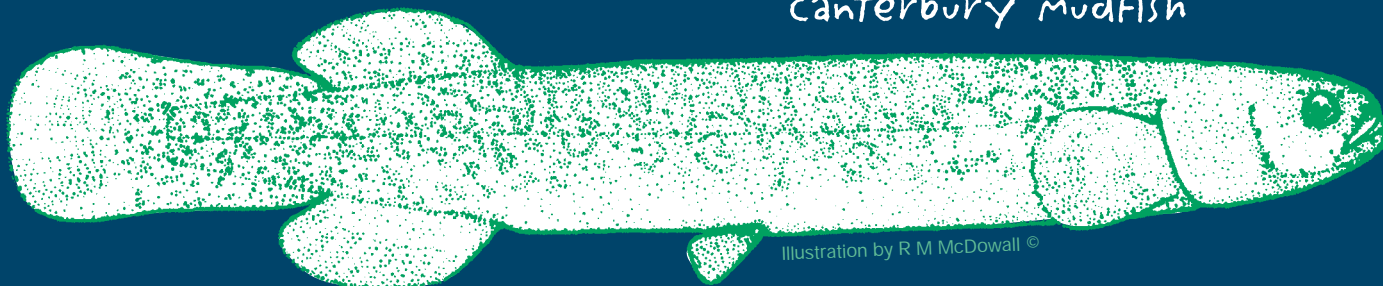
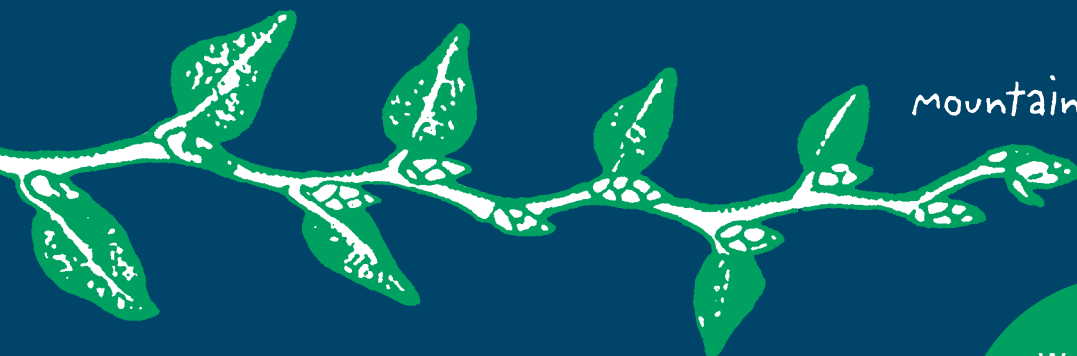


Illustration by R M McDowall ©

mountain beech



## Resources and education services

We offer a range of facilitated school programmes and environmental education resources on natural resources and their sustainable management. Environment Canterbury also produce general information and resource material, such as pamphlets, brochures and booklets, many of which are free.

If you would like to receive a 'Key to Canterbury' environmental education pack contact:

Environment Canterbury education staff on 03 365 3828  
or customer services on 0800 EC INFO (0800 324 636).

## Environment Canterbury: what we do

Environment Canterbury is your regional council.

We manage 12 activities for the Canterbury region.

- Air quality
- Coastal environment
- Emergency management
- Energy
- Hazards
- Land
- Navigation safety
- Pests and biosecurity
- Public passenger transport
- Regional land transport
- Waste, hazardous substances & contaminated sites
- Water quality, quantity and ecosystems

We welcome  
your comments or  
suggestions for what  
you would like to  
see in future  
issues.

If you are not on the mailing list  
for Your Environment, Canterbury,  
or you would like to receive  
extra copies of this resource,  
please contact Environment  
Canterbury education staff at the  
Christchurch office.

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