

# EnviroTEACH

An environmental education resource for teachers

Term 2 – 2019

## From the editor

**K**ia ora! Sustainability is a significant theme within New Zealand's national curriculum and many schools have sustainability as one of their core values. In Southland, interest in sustainability is growing and our environmental education team is receiving many requests from teachers looking for assistance with planning inquiries or units of work focusing on sustainability.

In the past, concerns about water and waste have been the most popular starting points for school inquiries or programmes focusing on sustainability. Recently however, schools have been exploring other aspects including biodiversity, food, energy and climate change. Right now, the attention of the world is sharply focused on climate change and this creates an opening for schools to learn about something that is very topical and incredibly important.

Fortunately, the NZ curriculum provides opportunities in most learning areas for students to learn about climate change and this issue of Enviroteach aims to demonstrate a range of ways that teachers can structure students' learning around this topic. It also provides information about how climate change could affect Southland, what various people and organisations are doing about it, and ways schools can get involved and make a difference.

You are welcome to contact the environmental education team at Environment Southland ([education@es.govt.nz](mailto:education@es.govt.nz)) for information and advice, or for assistance with teaching and



▲ Schematic of the effects of climate change on ecosystems. (Used with permission from the Royal Society of New Zealand.)

learning about climate change or any other environment-related topic.

**Pat Hoffmann**  
Environmental education officer





# What is climate change?

▲ Coastal erosion of Papatotara Coast Road along Te Waewae Bay (2007)

## The greenhouse effect

The earth's atmosphere naturally contains gases such as water vapour, carbon dioxide and methane that trap heat from the sun and prevent it from radiating back out into space. These gases act like a blanket or a greenhouse around the earth and are often referred to as greenhouse gases. They are essential for life on earth. Without them, the earth would be too cold and life as we know it would not exist.

Over the past 150 years there has been an increase in human activities that produce greenhouse gases – particularly in industry, agriculture and transportation. These activities are increasing concentrations of greenhouse gases in our atmosphere. As a result, the earth is heating up more and the climate is changing.

## Evidence for climate change

There is plenty of evidence to show that the earth's temperature has increased over the past 150 years. Evidence includes: temperature changes on land; changes in the amount of heat stored in the ocean; changes in the dates when lakes and rivers freeze and their ice melts; a reduction in the extent of snow cover; a reduction in the size of glaciers; and changes in rainfall patterns. Biological changes have also been observed, including: changes in the growing seasons of plants; shifts in the ranges of some plant and animal species; and earlier timing of seasonal events such as leaf-unfolding, bird migration and egg-laying.

## How could Southland be affected by climate change?

Scientists at NIWA have made a number of predictions about how Southland's climate could change in the future. These predictions are presented as a range of values depending on whether we will have a low emissions future or a high emissions future. Climate change is expected to increase the risk of flooding in Southland. Droughts are likely to become more severe and last longer in some parts of the region. There will likely be increased risks to coastal roads and infrastructure from coastal erosion and flooding. Warmer temperatures may provide new opportunities to grow new crops, but may enable pests and weeds to spread into new areas. Refer to the schematic on page 1 for a summary of likely effects on ecosystems.

## Further information

- ▶ **Ministry for the Environment** – [www.mfe.govt.nz/climate-change](http://www.mfe.govt.nz/climate-change)
- ▶ **Royal Society of New Zealand** – [www.royalsociety.org.nz/assets](http://www.royalsociety.org.nz/assets)
- ▶ **NASA** – [www.climate.nasa.gov/evidence](http://www.climate.nasa.gov/evidence)
- ▶ Video commissioned by the **International Geosphere-Biosphere Programme** and funded by the UN Foundation (3 mins) – <https://vimeo.com/79771046>

# Learn about climate change through...the science learning area

Most scientists agree that the earth is getting warmer, that our climate is changing, and that there are serious consequences to these rising temperatures. But there are still some people who do not accept that the earth is warming.

You can help your students to separate fact from fiction by giving them an opportunity to examine the data, build models, and test the science for themselves.



## ACTIVITY

### The nature of science

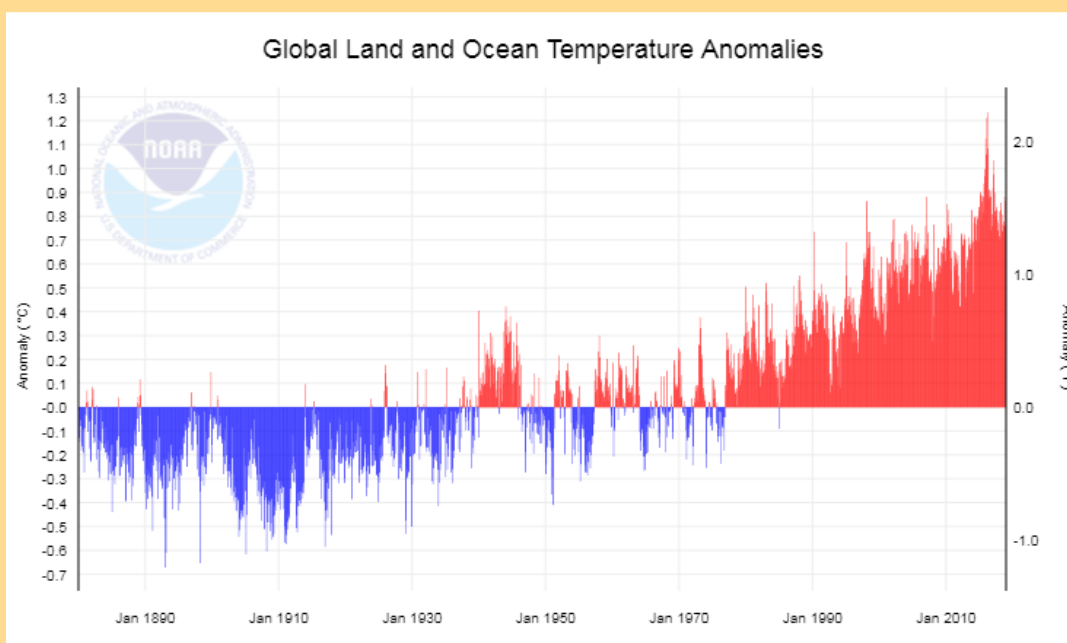
To complete this activity, students will need to know how to produce a graph using time series data. They will produce their graphs using publicly-available data e.g. global average temperatures, temperature anomalies, or New Zealand's national average temperatures.

- To download data on global land and ocean temperature anomalies visit the National

Oceanic and Atmospheric Administration's Climate at a Glance website ([www.ncdc.noaa.gov/cag/](http://www.ncdc.noaa.gov/cag/)). Select Global time series; Timescale all months; Month January; Start year 1880; End year 2019; Region global; Surface land and ocean.

- Visit the Ministry for the Environment website to download data on New Zealand's national average temperatures between 1909 and 2016 (<https://data.mfe.govt.nz/table/89453-new-zealands-national-temperature-19092016/>).

Get students to copy and paste the data into a spreadsheet (or download it in CSV format then open the file in a spreadsheet such as Excel). Show them how to plot the data points onto graph paper, with years on the x-axis and temperature on the y-axis, or create a graph using software (e.g. Excel). Get students to analyse the graph and describe any patterns that they can observe.



▲ Global land and temperature anomalies Source: NOAA National Center for Environmental information, Climate at a Glance: Global Time Series, published February 2019, retrieved on March 12, 2019 from [www.ncdc.noaa.gov/cag/](http://www.ncdc.noaa.gov/cag/)





## ACTIVITY

### The physical world

As part of a study of physics, get students to build a simple model to demonstrate the differing impacts of melting land ice and sea ice on sea levels.

Get students to design their own model, or follow the detailed instructions on the Science Learning Hub: [www.sciencelearn.org.nz/resources/2278-investigating-sea-level-rise](http://www.sciencelearn.org.nz/resources/2278-investigating-sea-level-rise)

### Planet earth and beyond

Get students to explore NASA's Images of Change (<https://climate.nasa.gov/images-of-change>) as part of a study of the interconnecting systems and processes of the earth. Here are some examples of images (located under the 'Ice' tab) relating to climate change:

- <https://climate.nasa.gov/images-of-change?id=602#602-shrinking-glaciers-in-new-zealand>

- <https://climate.nasa.gov/images-of-change?id=577#577-shrinking-glaciers-along-western-antarctica>
- <https://climate.nasa.gov/images-of-change?id=591#591-older-thicker-arctic-sea-ice-declines>
- <https://climate.nasa.gov/images-of-change?id=623#623-arctic-sea-ice-coverage-hits-record-low>

Select a few key images and get students to describe the changes they observe.



▲ Shackleton's Hut in Antarctica (Photo: Becky Goodsell)

## ...the arts learning area



## ACTIVITY

Watch Corey Baker's 5-minute film *Antarctica: The First Dance* on Youtube featuring Madeleine Graham of the Royal New Zealand Ballet. It highlights the threats of climate change through stunning choreography against the spellbinding backdrop of the Antarctic – <http://antarctica.coreybakerdance.com/>.

Ask students to reflect on the film. What did they think and feel while watching it? What ideas, feelings and stories did the film communicate? What do they think the artist's intentions were? Encourage students to describe and discuss how the filmmaker's intentions were expressed through the dancer's movements, the expressive qualities of the music, choice of props, camera work

and other visual elements.

Give students an opportunity to select a piece of music, and prepare and present their own drama, dance or visual artwork to convey ideas about climate change.

*You can read more about Corey Baker's work at [www.noted.co.nz](http://www.noted.co.nz).*

# ...the mathematics and statistics learning area

The United Nations Intergovernmental Panel on Climate Change (IPCC) has warned that we need to take urgent action to restrict global warming to a maximum of 1.5°C above pre-industrial levels. If the Earth warms any more than this, hundreds of millions of people could be exposed to the risks of drought, floods and extreme heat.

According to the Special Report on Global Warming of 1.5 °C, published by the IPCC in October 2018, meeting a 1.5°C target will require significant reductions in the emission of greenhouse gases and "rapid, far-

reaching and unprecedented changes in all aspects of society". In other words, we need to take urgent action to reduce our carbon footprint.

As a teacher, you can create an opportunity for students to put their maths and statistics skills into practice, by getting students to investigate where the majority of your school's greenhouse gas emissions come from. You can then use these findings to help your school make well-informed decisions about actions you can take to reduce your carbon footprint.



## ACTIVITY

Brainstorm all the ways in which your school consumes energy. This can include direct consumption (such as electricity for lighting and appliances, petrol/diesel for transport, or firewood for heating the school) and indirect consumption (such as energy during food production, or during the manufacturing and transport of paper, packaging and other products used at school).

Obtain or draw a map of your school. Send students out in groups to explore different parts of the property. They should look for any sources of energy, and anything that consumes energy, then return to class and mark those locations on the map.

Choose one of the energy types you have identified (e.g. electricity) and estimate the amount consumed by your school in a day, week, month or year. Then use the CO<sub>2</sub> emissions calculator ([www.eecabusiness.govt.nz/tools/wood-energy-calculators/](http://www.eecabusiness.govt.nz/tools/wood-energy-calculators/)

[co2-emission-calculator](http://www.eecabusiness.govt.nz/tools/co2-emission-calculator/)) to work out how much CO<sub>2</sub> is emitted as a result of that consumption. You can use this tool to help you to work out the running costs of various appliances: [www.energywise.govt.nz/tools/running-costs-calculator/#/](http://www.energywise.govt.nz/tools/running-costs-calculator/#/).

Use the data you have gathered to inform a discussion about your school's carbon footprint. Key questions to discuss include:

- How much energy does our school use?
- How much energy do we need to use?
- How much energy do we waste?
- How do we compare with other schools or businesses?
- How does New Zealand compare with other countries?
- How can we reduce our energy consumption and our carbon footprint?

## Footprint calculator

A 'carbon footprint' is defined as the total emissions caused by an individual, event, organisation, or product. It is expressed as 'carbon dioxide equivalent'.

The 'ecological footprint' is a broader concept. It measures the total human demand on nature.

Footprint calculators allow you to work out how many Earths would be required, if everyone lived the way you do. Calculate your ecological footprint at:



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



<http://myfootprint.org>



# ...the English learning area



## ACTIVITY

Get students to research some things that people can do to make a difference. Here are some websites to get them started:



**Ministry for the Environment**

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



**Ministry of Education**

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



**EECA**

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

Ask students to choose one action they could feasibly implement and think about how that action would reduce their carbon footprint.

Once your students have identified some practical things they can do to take action for climate change, get them to write them down as simple, clear messages that they can share with school management, teachers, other students at the school, and parents.

For example, they might like to design stickers, posters or covers for light

switches with a simple message to remind people to turn off the lights when they leave the classroom. They could even design a guide to good energy choices at school, e.g. a list of good practices and a list of unwise practices. They will need to identify the purpose of their text and the audience it is being written for. They will also need to think about the most appropriate way to organise, sequence and present their message. Before finalising their text, they should test it, obtain feedback and make changes to improve clarity, meaning and effect.

## Take action

Students taking informed action to address issues of sustainability and participate in creating a sustainable future is at the heart of education for sustainability. Students need to be given multiple opportunities to plan, implement, and carry out actions in response to what they know and understand about the causes of sustainability issues and possibilities for change.

At Fiordland College, a group of students discovered that the heat in their classroom was escaping due to poor insulation of the windows. They realised that the school boiler was burning large amounts of fossil fuels to keep the classrooms warm. They identified two possible actions they could take to reduce heat loss – sealing the windows and making curtains. After collecting data and undertaking some research, they decided that the best option

was to make curtains. Their research showed that their classroom was the coldest of the three they investigated. They completed their project by sewing

a set of beautiful curtains to improve insulation and reduce the amount of energy required for heating the school.



► A student at Fiordland College gives a thumbs-up for the new curtains.


# ? What's being done in Southland?

## Carbon Neutral Advantage

 [www.venturesouthland.co.nz](http://www.venturesouthland.co.nz)

This project is being coordinated by Venture Southland, working alongside a local steering group, Southland businesses, councils, and the wider community to support the adoption of low emission technologies and techniques in the Southland region. The project is being funded by the Ministry for the Environment and the Tindall Foundation and will help create a competitive advantage and healthy environment for current and future generations.

## Awarua Synergy

 [www.awaruasynergy.co.nz](http://www.awaruasynergy.co.nz)

Awarua Synergy is a local supplier and installer of cost effective, energy-efficient products for Southland homes, farms, and businesses.

## Environment Southland

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

Regional councils in New Zealand are required by law to reduce risks to communities. In Southland, many of our towns are built on flood plains. Not surprisingly, our most regular natural hazard is flooding.

Environment Southland is working with the other councils in Southland to prepare a Regional Climate Change Assessment. The assessment covers:

1. actions to reduce emissions;
2. planning and actions to keep the public safe and help communities to adapt to climate change; and
3. limiting or removing pressure on systems that are or will be affected by climate change.

## People working on climate change at Environment Southland

### GAVIN GILDER

Gavin Gilder is Environment Southland's senior policy planner. One of Gavin's roles is to provide information and advice to people who are thinking of subdividing or building in hazard-prone areas. He also provides information and comments on applications that people have submitted proposing developments in high risk areas.



The information Gavin provides is essential to help people understand what the risks are so they can either avoid or reduce them.

Sometimes, infrastructure has to be located within high risk areas, and in cases like this, Gavin recommends that more effort is put into protection.

The four councils in Southland are working on getting regional Lidar coverage to enable us to model flood events. Lidar is a surveying method that uses lasers to make high resolution maps that will improve our knowledge of risks.

### GAVIN McCULLAGH

Gavin McCullagh is Environment Southland's team leader – policy and planning.

#### ? What is Environment Southland doing in this space?

As a council, we are using the information obtained from monitoring of natural resources, the expertise of our staff and input from the community and stakeholders to build a better picture of our changing climate. We are working collaboratively with other councils in Southland to understand how climate change will impact Southland's people, environment and economy.














#### ? What does your job involve relating to climate change?

My job involves investigation, information and policy development. This means that I have been working with people from Environment Southland, Invercargill City Council, Southland District Council and Gore District Council to build a better understanding of how Southland's climate may change over the next 100 years and how we might need to respond to those changes. NIWA has done research and analysis to provide scenarios (sequences of possible changes) for differing levels of greenhouse gas emissions over time to 2090. I have been presenting these scenarios to councillors and council staff, as the first part of developing plans for wider discussion and more focused investigation. Over the next 2-5 years we will start to develop policies, considering goals, guidance and ultimately rules and resource allocations to ensure we are sustainably managing Southland's resources.



# Resources for teaching and learning

-  Climate classroom kids  
[www.climateclassroomkids.org/educators/climate-101/](http://www.climateclassroomkids.org/educators/climate-101/)
-  Energy Efficiency Conservation Authority  
[www.eecabusiness.govt.nz/schools](http://www.eecabusiness.govt.nz/schools)  
[www.eecabusiness.govt.nz/sectors/education/](http://www.eecabusiness.govt.nz/sectors/education/)
-  Energy-efficient schools – a guide for trustees, principals, teachers, students, caretakers and energy managers  
[www.enviroschools.org.nz/resources/resources-for-enviroschools/energy\\_efficient\\_schools\\_large.pdf](http://www.enviroschools.org.nz/resources/resources-for-enviroschools/energy_efficient_schools_large.pdf)
-  Envirochools programme  
[www.enviroschools.org.nz](http://www.enviroschools.org.nz)
-  Genesis school-gen programme  
[www.schoolgen.co.nz](http://www.schoolgen.co.nz)
-  NASA  
<https://climate.nasa.gov/educationalActivities/>
-  New Zealand Transport Association education portal  
[www.education.nzta.govt.nz/teacher-resources/primary-curriculum-resources/feet-first/](http://www.education.nzta.govt.nz/teacher-resources/primary-curriculum-resources/feet-first/)
-  Royal Society of New Zealand  
[www.royalsociety.org.nz/what-we-do/our-expert-advice/all-expert-advice-papers/climate-change-implications-for-new-zealand/](http://www.royalsociety.org.nz/what-we-do/our-expert-advice/all-expert-advice-papers/climate-change-implications-for-new-zealand/)
-  Science Learning Hub  
[www.sciencelearn.org.nz/resources/2639-climate-change-resources-planning-pathways](http://www.sciencelearn.org.nz/resources/2639-climate-change-resources-planning-pathways)
-  Vector's Be sustainable with energy programme for schools  
[www.vector.co.nz/personal/help-safety/school-programme/being-sustainable-with-energy/sustainable-energy](http://www.vector.co.nz/personal/help-safety/school-programme/being-sustainable-with-energy/sustainable-energy)
-  Information about the expected impacts of climate change on New Zealand  
[www.mfe.govt.nz/climate-change/likely-impacts-of-climate-change/how-could-climate-change-affect-my-region/southland](http://www.mfe.govt.nz/climate-change/likely-impacts-of-climate-change/how-could-climate-change-affect-my-region/southland)