

EnviroTEACH

An environmental education resource for teachers

Term 4 – 2019

From the editor

Kia ora! This is part two of our focus on climate change. In the previous issue we looked at how Southland is expected to be affected by climate change, what various people and organisations are doing to respond to climate change, and a range of ways that schools can learn, get involved and take action. In this issue, we focus on adapting to climate change, in other words, learning to do things differently in response to the effects of climate change.

We know that our climate is changing and we know that these changes are

already having an effect. Over the coming years, communities across Southland will be exposed to a range of physical, social, financial and emotional challenges relating to climate change. Every sector of society needs to be informed and well-prepared for the changes - especially those relating to water. We will all need to learn to live and work in ways that generate lower greenhouse gas emissions. Some communities and individuals may need to seek alternative or innovative new ways to produce food and generate incomes.

This issue will help you to think about how schools can support children and communities to develop the knowledge and capabilities they need to be able to adapt and thrive in a changing climate.

You are welcome to contact the environmental education team at Environment Southland (education@es.govt.nz) for information and advice, or for assistance with teaching and learning about climate change or any other environment-related topic.

Pat Hoffmann

Environmental education officer



▲ Students and members of the community gathered at Queens Park for the School Strike 4 Climate on 27 September.



How will Southland's climate change?

Scientists at NIWA have made a number of predictions about how Southland's climate will change in the future. These impacts will not be uniform across the region and there is still a lot of uncertainty around the timeframes. The predictions also vary depending on whether New Zealand and other countries succeed in reducing greenhouse gas emissions or continue to increase emissions.

Warmer temperatures

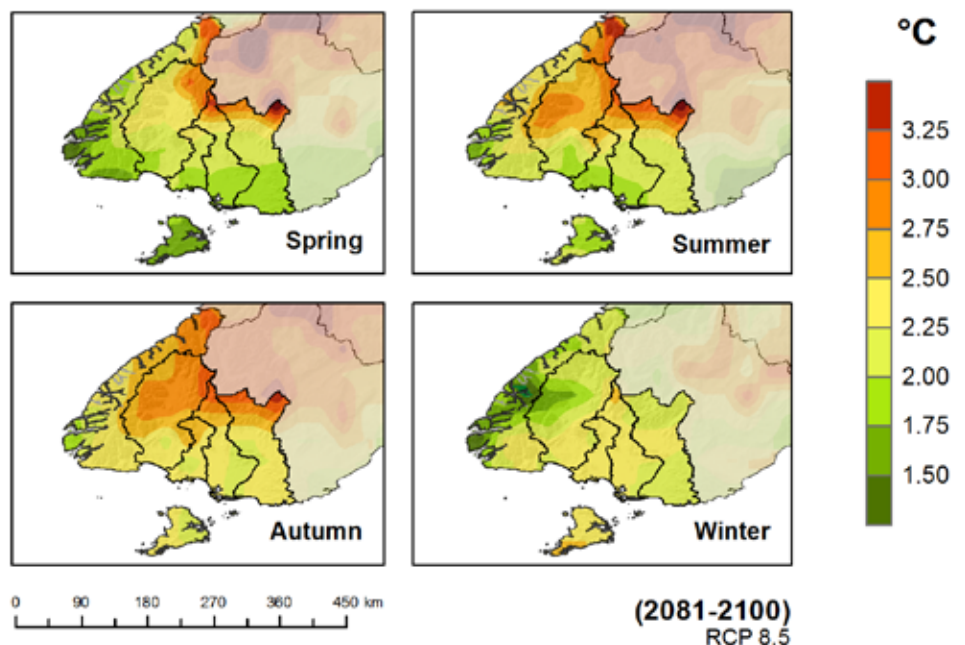
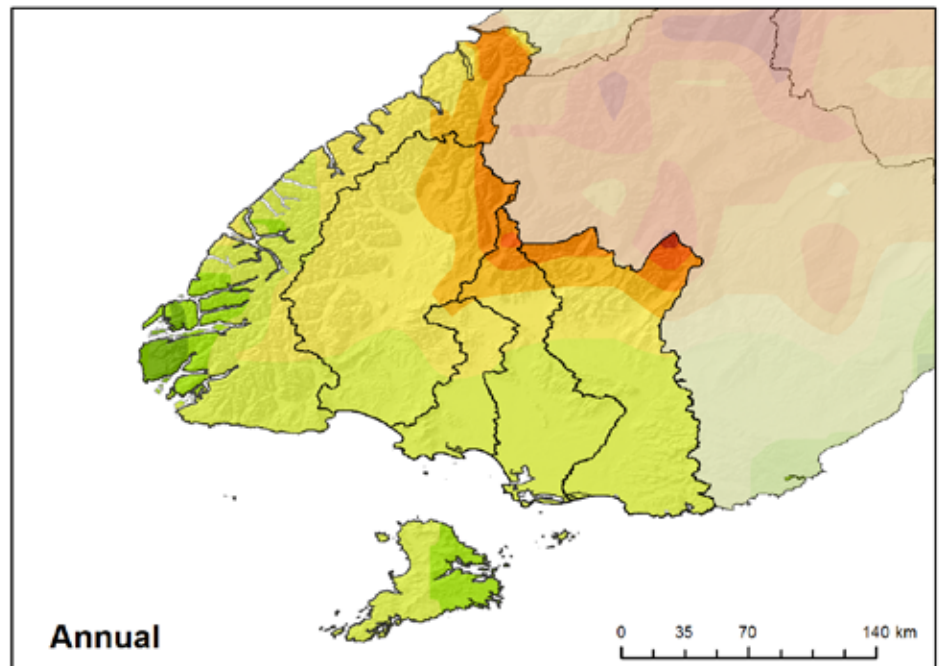
Southland will generally become warmer, particularly in autumn. The increases will be most significant in inland areas and at higher elevations. Summers will be hotter and winters will be warmer, meaning there will be more snow and ice melt, but less consistent snowfall and frost.

More hot days and heatwaves

There will be an increase in the number of hot days (greater than 25°C). The increases will be most significant in areas of the upper Maitai and Oreti catchments, and in Milford Sound. Heatwaves (three or more days greater than 25°C) will happen more frequently, too. At present Riverton is likely to experience a heatwave less than once every two years, but this may increase to eight or more times per year. Riversdale may have as many as 24 heatwave days per year.

Changing rainfall patterns

Annual rainfall is likely to increase in southern areas – mostly in winter. In contrast, the number of wet days will decrease in the Waiau catchment. The average amount of water flowing in our rivers is expected to increase in autumn and winter, and this will increase the risk of flooding.



▲ NIWA has predicted how much hotter Southland will become by 2090 if we continue with business as usual (no mitigation and no significant action by anyone). Source: NIWA (2018) Southland climate change impact assessment.

More frequent and more intense droughts

In some parts of the region, droughts will become more severe and will last longer. There will be more dry days in summer and autumn, increasing the risk of wildfire. Some parts of the region, particularly the upper Oreti catchment, may experience very dry soils every summer.

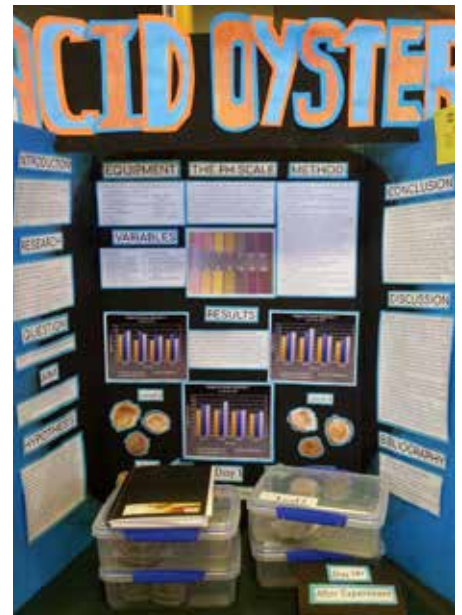
Rising sea level

Sea level is predicted to rise by least 0.3m by 2040 and by as much as 0.9m by 2090. There will be an increasing number of high tides that flood coastal infrastructure and increased risks to coastal roads such as Bluff Highway. In places like New River Estuary, Stead

Street, Bluff Harbour, Oreti, Omaui, Tiwai, and Oraka/Colac Bay there will be higher tides, and more incidents when storm surges or storm waves overtop sea walls and flood banks causing flooding, damage and increased coastal erosion.

Ocean warming and acidification

Projected changes in ocean temperature, pH and nutrient availability may alter marine foodwebs and productivity. This could have significant impacts on New Zealand fisheries and aquaculture into the future.

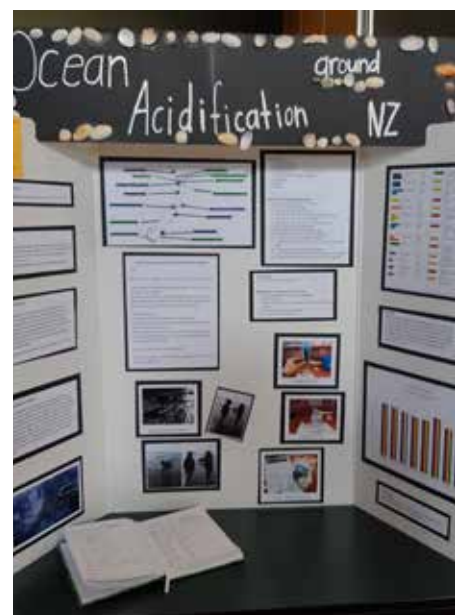


▲ Last year, Katie Melgren from James Hargest College submitted a project called 'Acid Oysters' for the NZAS Southland Science & Technology Fair. Katie was interested in ocean acidification, so she investigated how oyster shells are affected by different pH levels. Her results showed that oyster shells were weakened when they were exposed to acidic seawater. Environment Southland awarded Katie a prize for her project in recognition of the quality of the science and her obvious interest in the topic.

Action needed now

The global community needs to take urgent action to restrict global warming to a maximum of 1.5°C above pre-industrial levels. Mitigation options range from phasing out fossil fuels and switching to clean energy, to promoting low-emissions systems in agriculture, industry and transport, and planting trees to sequester carbon.

Refer to the previous issue of *EnviroTEACH* (Term 2 – 2019) for information on ways to investigate your school's greenhouse gas emissions, measure your energy consumption and understand your carbon footprint. It also suggests some actions schools can take to reduce their emissions.



▲ This year, Tai Simpson from Halfmoon Bay School investigated which parts of New Zealand's coast are most affected by ocean acidification. He tested seven water samples from around the country and found that seawater in the Coromandel was the most acidic and seawater in Halfmoon Bay was the least acidic.

How will Southland need to adapt to

“Our land and water, our cities and rural land uses, our housing and the infrastructure that supports our daily lives, and our natural environment, are all affected by climate change,” (Judy Lawrence, Co-chair of the Climate Change Adaptation Technical Working Group).

Warmer temperatures and changing rainfall patterns will mean that many of us in Southland will need to change the way we do things. This includes our agricultural systems and practices, the way we manage our land and water, forestry, fisheries, tourism, biosecurity, energy supply, fire prevention and even architecture. All of our systems will need to adapt and become more resilient to change.

Adaptation is about adjusting the way we do things in response to the effects of climate change.

Around the world, many communities are making adjustments and developing solutions to respond to the effects of climate change that are already being experienced, and to prepare themselves for future impacts.

New Zealand is in the early stages of planning to adapt to the impacts of climate change. In 2016, the New Zealand Government set up a climate change adaptation technical working group to provide advice. You can find their recommendations here: www.mfe.govt.nz/publications/climate-change/adapting-climate-change-new-zealand-recommendations-climate-change.

To prepare for the future, Southland's regional, district and city councils are considering climate change in their planning and decisions, including: land-use planning, water resource management, service delivery (e.g.



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

drinking water, stormwater and wastewater), flood risk management, biodiversity and biosecurity, roading, and emergency management. Having high quality information is essential. That is why Environment Southland and the other councils commissioned NIWA's Regional Climate Change Impact Assessment report which forms a vital base on which decision-making and future plan development can be made. In addition, LiDAR (an airborne, remote sensing method that provides critical information) will be used in Southland to provide high-quality data to support future decision-making around environmental changes. We also plan to improve the quality, type and accessibility of hazard information to the community.

Cropping farmers

To cope with the challenges of a changing climate, crop production systems will need to adapt and become resilient to changes. For example:

- Crops that currently grow in Southland are grown in specific areas because farmers know the rainfall and temperature patterns of that area and have chosen to grow species or varieties that are well-suited to those particular conditions. As the climate changes, farmers will have to adapt to the changing conditions. This could mean changing to a different crop or a more suitable variety, farming in a different area, or changing the time of year when they plant their crops.

the changing climate?



Livestock farmers

Some breeds of livestock don't perform well in hot weather. Farmers might need to develop strategies such as:

- Being prepared to assist animals that are struggling in a heatwave
- Changing the breeds of animals they work with
- Selecting bloodlines that cope better in hot weather

Livestock diversity is an important strategy and a source of resilience in the face of climate change.

Water management across the region

Water is a critical resource for Southland's primary industries. Crop yields will be affected by warmer temperatures and farms will require more irrigation. In summer, there will be an increasing demand for water from rivers, groundwater and rainwater tanks. Ask your students to consider how this could affect the productivity of farms and the profitability of business that rely on water.

We will all need to become better at conserving water – especially in summer. Things we can do include:

- Installing rain tanks to store water
- Reducing wastage
- Conserving soil moisture through practices such as mulching

You can find out more about adapting to changing water resources here: www.mpi.govt.nz/dmsdocument/27088-water-resource-impacts-and-adaptation-under-climate-change.

- Some fruit and nut crops rely on being chilled in winter. Apples, for example, need the winter chill for a synchronised bud burst in spring. Farmers who grow crops that rely on winter chill may find that they need to change to growing a different crop.
- The warmer climate may create new opportunities for farmers to grow crops that we don't currently have in Southland, or allow crops to grow in areas where they couldn't previously. For example, areas that have always been too wet for a specific crop may, in the future, become dry enough for that crop to thrive.



ACTIVITIES

Climate-smart agriculture is defined as “agricultural practices that sustainably increase productivity and system resilience while reducing greenhouse gas emissions”. Get students to research and make a list of CSA practices. Let each student select one of these practices to investigate in more detail. They might do a presentation or an experiment, and evaluate whether this practice could be effective in Southland contexts.

Use this calculator to help you estimate your total water use – www.watercalculator.org. The website offers lots of strategies for saving water.

What can schools do to support adap

- You can help students become better informed about how the climate is changing and what this means for us in Southland. Teachers play an important role in making this complex information more accessible and understandable.
- Help students to develop skills such as how to find credible sources of information, and how to use hazard maps and other tools to understand the local risks and effects of climate change.
- Help students to develop observational skills to notice and report what's happening in their environment. For example, people who depend on rainwater to fill their

household water tanks will quickly notice if their tank levels are lower than usual. In contrast, weather experts must rely on meteorological measurements to determine when a drought is occurring. Observations and reports from the community may provide forewarning of an approaching drought long before weather experts observe it in the meteorological data.

- Create opportunities for students to contribute to citizen science. There are many citizen science projects that are suitable for schools to participate in. Alternatively, you can borrow the best ideas from other projects to design your own school project.

For example, Auckland's King Tide initiative encourages people to visit and photograph the highest tides that naturally occur along the coastline each year (<http://auckland.kingtides.org.nz>). People are sharing these images and helping to create a record of changes to the shorelines.

“The best medicine for anxiety, fear and anger is to actually do something.”

GRETA THUNBERG

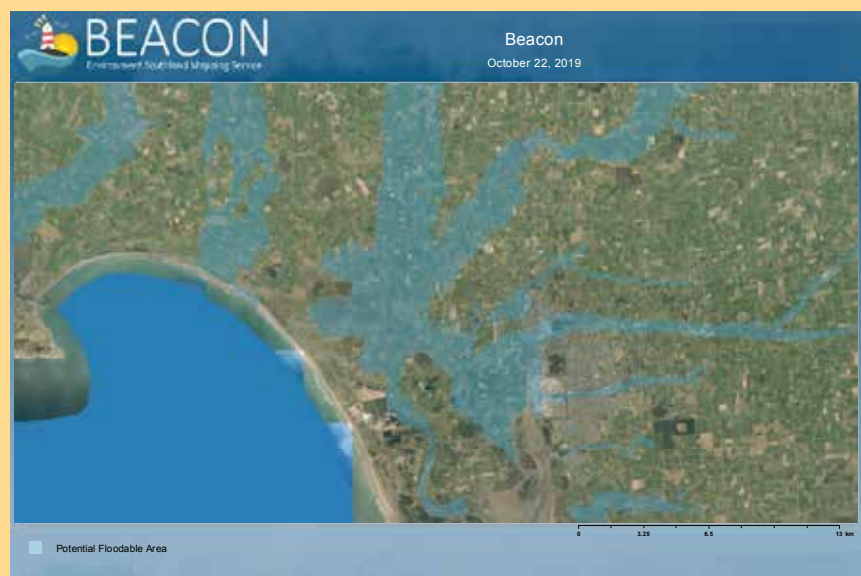
16 year old Swedish climate activist



ACTIVITY

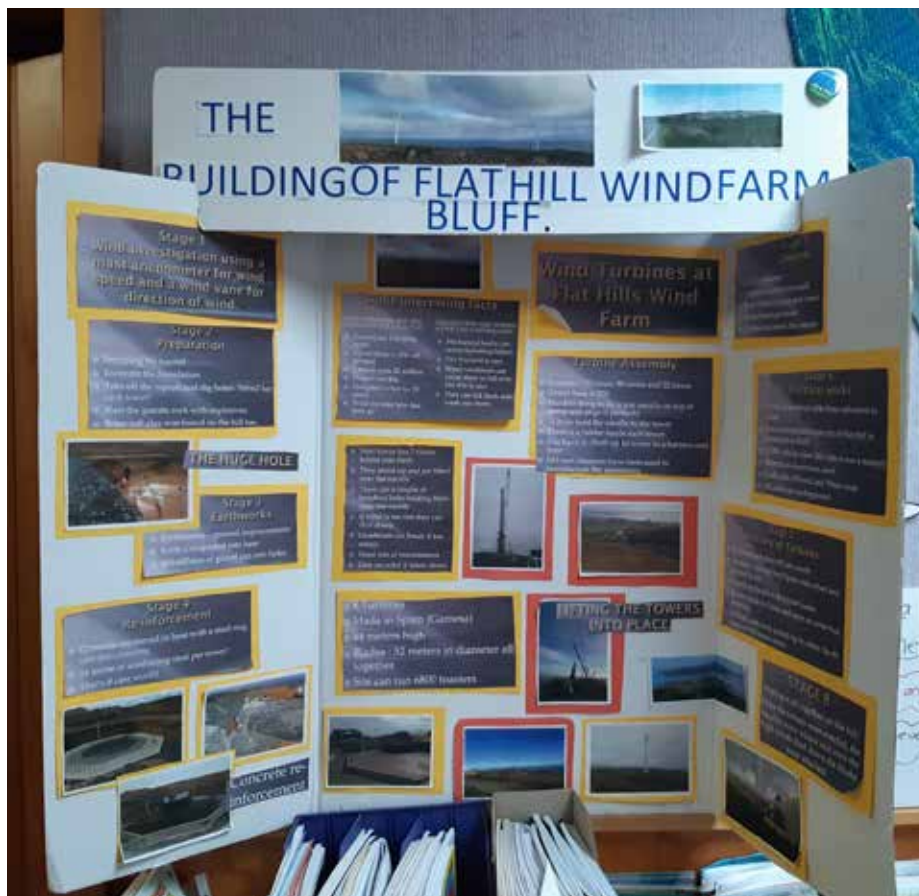
Beacon is an interactive map viewer hosted by Environment Southland. It includes a range of maps that can display different types of information including the location of significant flood plains and stopbanks, and historical flood photos. You can access Beacon via Environment Southland's website or by going directly to <http://gis.es.govt.nz>.

Give students an opportunity to explore the natural hazards map on Beacon. Ask them to identify the main hazards in your school neighbourhood. Develop an action plan to minimise the effects of these hazards.



tation?

- Help students to develop the habit of forming opinions and making decisions based on best available evidence, including physical and social science, Mātauranga Māori, good data, local knowledge, and international best practice. Also help them to understand the concept of uncertainty and that decisions need to be flexible and responsive to evolving knowledge.
- Encourage students to enter projects focusing on climate change into the annual Southland Social Science Fair or the NZAS Southland Science and Technology Fair.
- Lots of young people are worried about climate change, and some of your students may be feeling anxious or overwhelmed. Teachers play an important role in helping young people to maintain a sense of optimism in the face of an uncertain future. It is important to balance information about the impacts of climate change with information about what can be done, what is being done, and ideas on how to adapt and keep ourselves safe.
- Help students to research and think critically about climate challenges, develop skills to identify solutions, consider ethical and moral perspectives, and understand that climate change is an evolving issue.
- Help students to develop a sense of empowerment by supporting them to use their voice and participate in the democratic process. For example, they could make submissions on how local government should invest public funds; they could voice their support for shifts in technologies and practices that reduce emissions and that are adaptive to changing climate risks. Encourage students to participate in public consultations.



▲ A research project about the Flat Hill wind farm completed by a group of Year 6 students from St Teresa's School in Bluff for the 2016 Southland Social Science Fair.

ACTIVITY

Read this article about a university student investigating the effects of climate change on Bluff oysters – www.deepsouthchallenge.co.nz/news-updates/climate-change-and-our-iconic-bluff-oysters. Get students to discuss the value of his research. Make a list of everyone (e.g. individuals, communities, organisations and businesses) that might be interested in his findings. Discuss the importance of climate change expertise in a range of career choices (e.g. agriculture, engineering, commercial fishing, architecture, real estate, law, scientific research, economics, resource management, planning, banking, insurance).

Mātauranga Māori

Mātauranga is the body of traditional and contemporary knowledge about the world – both physical and spiritual – held by Māori. In Aotearoa, Māori have developed extensive knowledge of local weather and climate by carefully observing daily, monthly and seasonal conditions. Indicators such as the behaviour of animals, blooming of flowers, formation of clouds, and appearance of the moon and stars all provide important clues about impending changes in the weather and potential natural hazards.

This close awareness of the natural world helped Māori communities to build resilience to changes in the weather and was essential for survival, as many decisions about daily and seasonal activities had to be carefully timed for success. Māori used this knowledge to create the maramataka – the Māori calendar – to guide the planning of activities such as planting, hunting and fishing, as well as travelling and cultural activities.



▲ Profuse early flowering of tī kōuka (cabbage tree) indicates a long, dry summer ahead, while late flowering tells you to expect a wet summer.

Visit NIWA's website to download a copy of their poster showing a selection of indicators used by Māori across Te Wai Pounamu (the South Island) to forecast

weather and climate (www.niwa.co.nz/sites/niwa.co.nz/files/Traditional-Maori-Weather-and-Climates-Forecasting-poster.pdf).



Resources on climate change adaptation

- ▶ TED talk – Climate change is happening. Here's how we adapt. www.ted.com/talks/alice_bows_larkin
- ▶ www.deepsouthchallenge.co.nz/programmes/impacts-and-implications
- ▶ www.abc.net.au/news/2019-07-17/how-climate-change-is-affecting-what-we-grow-and-eat/11303450
- ▶ 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
- ▶ **Envirochools programme**
All Envirochools in Southland should have a copy of the newly updated “Energy theme area” resource. This contains case studies as well as a booklet for teachers. Contact your Envirochools facilitator if you'd like some tips on how to use this resource.