

New Zealand is producing world's first national-scale carbon balance

Better carbon emission measures will help us work out how well we are fighting climate change and what impact government policies are having.

Over the past two years, GNS Science has been leading a collaborative project in Auckland using funding from SSIF to develop a full atmospheric carbon budget for the city. The project team comprises GNS Science, NIWA, Auckland Council, The University of Auckland, and Auckland University of Technology.

The Auckland Carbon Emissions (ACE) project is measuring total atmospheric carbon emissions less the amount of carbon being absorbed into the land, giving a net carbon value for the city. It is one of the few studies in the world using very precise radiocarbon measurements to quantify an urban carbon budget – the volume of fossil fuel emissions and the offsetting 'land carbon credit'.

Assessing the size of New Zealand's 'land carbon sink' will be crucial as the country considers how to get to net zero carbon emissions by 2050. The 'land carbon sink' is the exchange of carbon with the urban biosphere.

To gather the data needed, team members collected air samples at three-monthly intervals from 25 sites around Auckland to determine net carbon dioxide and fossil fuel carbon dioxide emissions. The samples underwent a range of analyses including radiocarbon measurements.

Methodology has been proved

The good news from our research to date is that Auckland's land carbon sink may be offsetting more carbon than was first anticipated.

The pilot project has been crucial to determining appropriate permanent continuous measurement sites. For example, our original idea was to have permanent sites at Musick Point near Bucklands Beach and on the Sky Tower in the central city. The pilot measurements showed that sites at Devonport and AUT were better choices.

The Auckland pilot project has proved the methodology and opened the way for permanent continuous measurement of carbon emissions in other New Zealand cities.

Research expanded to nationwide

The work in Auckland is being expanded in 2019 as part of the new nationwide CarbonWatchNZ project which will use atmospheric measurements to determine the carbon budget for all of New Zealand.

CarbonWatchNZ has received \$12 million from MBIE's Endeavour Fund, with GNS Science's portion being \$3 million. It is a collaboration between NIWA, GNS Science, Maanaki Whenua/Landcare, Auckland Council and the University of Waikato.

This five-year project will combine measurements of greenhouse gases in the air above New Zealand with high resolution atmospheric models that show where the gases have come from. New Zealand is the first country to develop a national-scale picture of a country's carbon balance.

The project will measure our two main greenhouse gases – carbon dioxide and methane – in the three landscapes that are most important to New Zealand’s carbon balance – forests, farmland and urban environments. There will be 17 continuous measurement sites around the country.

Contributing our expertise

GNS Science’s involvement is providing land carbon modelling to estimate the carbon exchange between the land and forests and measuring greenhouse gas emissions on the urban scale.

We have particular expertise in radiocarbon measurements. These allow us to separate the carbon dioxide from fossil fuel burning versus carbon dioxide from biogenic exchange (through photosynthesis and respiration).

Providing vital information to decision makers

It’s measurement information that we really need to make good decisions which will guide our carbon emission mitigation strategies both nationally and regionally. The project will enable more accurate carbon accounting to support New Zealand’s transition to a low-carbon economy.

Information from the project is being used in Ministry for the Environment reporting to the United Nations about New Zealand’s work to meet its obligations as a signatory to the Paris climate change agreement. And the Auckland Council is using the information in its carbon mitigation plans.

Both the national scale and urban scale CarbonWatchNZ components are being used by the World Meteorological Organisation as ‘exemplar’ studies for how atmospheric observations can be used to improve carbon emissions and budgets at these scales.