

Like it or not, our farming industry is a significant contributor to greenhouse gas warming, says **JUDY LAWRENCE**, director of the NZ Climate Change Office.

Climate change is arguably the world's most complex and wide-ranging global environmental issue. So it is no surprise that confusion often creeps in to public debate on the subject. New Zealand is unusual among developed nations in that about half of New Zealand's total emissions are produced by agriculture, predominantly methane from farm animals and nitrous oxide from soils and fertilisers.

Other nations rely more on industry, which tends to produce carbon dioxide rather than methane. In Great Britain, 94 percent of all human-induced greenhouse gas emissions are carbon dioxide and only 3 percent methane. Most of New Zealand's carbon dioxide emissions come from the energy sector, with transport producing the major share. Carbon dioxide makes up 45 percent of New Zealand's greenhouse gas emissions.

Greenhouse gases differ in their effectiveness in trapping heat in the Earth's atmosphere. Methane is a much more powerful greenhouse gas than carbon dioxide, but it has a shorter lifetime. Chemical reactions ultimately convert atmospheric methane into carbon dioxide.

To account for these different lifetimes and their effect on warming the atmosphere, greenhouse gases are rated on the total global warming effect they produce over a given time span. For example, over



GAS MASKS: Special backpacks collect and record the volume of methane emissions from sheep.

100 years 1kg of methane produces 21 times the global warming effect of 1kg of carbon dioxide. These differences have been taken into account in producing greenhouse gas reports, where the emissions of all gases are reported as "carbon dioxide equivalents" on the basis of their global warming effect over 100 years.

Atmospheric concentrations of methane are now more than twice what they were prior to the industrial revolution. Most of the increase has occurred over the past century, from 750 parts-per-billion (ppb) in 1750 to about 950 ppb in 1900 and 1750 ppb in 2000.

Agriculture is a significant contributor to the increase in methane concentrations in the atmosphere. Over the past century humans have transformed huge areas of land into pasture and vastly expanded the population and range of the main livestock species. The clearance of forests for agriculture has released CO₂ into the atmosphere.

About 87 percent of New Zealand's total methane emissions

come from farming and 97 percent of those farm emissions are from ruminant animals — primarily cows and sheep. Ruminant digestive processes ferment grass, producing methane in the animal's stomach that is mostly belched out.

Cattle and sheep produce the bulk of methane emissions. Horses, pigs and poultry produce only about 1 percent. The other major agricultural greenhouse gas, nitrous oxide, is produced by the addition of nitrogen to soil in the form of animal dung and urine, synthetic fertiliser, through use of nitrogen fixing plants such as clover and crop residues.

This gas is also a powerful contributor to global warming, with 310 times the warming potential of carbon dioxide. In one year, the average methane and nitrous oxide emissions per New Zealand sheep are equivalent to about 340kg of CO₂. For a dairy cow they equate to approximately 2500kg.

By comparison, burning 100 litres of petrol emits 230 kg of CO₂. A reasonably efficient car will

travel around 12.5 kilometres per litre, so it could drive about 1800km — almost from Kaitaia to Invercargill — and produce the equivalent emissions that a sheep puts out in a year.

We know that there are plenty of ways we can reduce energy consumption without compromising our standard of living. But unfortunately there are no immediately available ways to reduce emissions from livestock.

Reducing agricultural greenhouse gas emissions will require new technologies or farming practices, which can only be developed through research tailored to New Zealand conditions.

The most promising investigations at this stage focus on modifications to feed, ruminant digestive processes and farming systems.

An independent assessment of the research effort needed on agricultural greenhouse gases recommended expenditure of \$8.4 million a year. This level of expenditure would equate to approximately \$300 a year for the average farm.