

Accounting for the enhanced greenhouse effect



Research shows that Australia is likely to become warmer and wetter as we continue to release more greenhouse gases into the air.

About 100 years ago a Swedish scientist announced that a rise in the amount of carbon dioxide in the atmosphere would cause temperatures to rise around the world. Now, scientists have announced that the planet's warming is the sort of change that would be expected as greenhouse gases rise due to human activities. But we're not waiting another hundred years before doing anything about it.

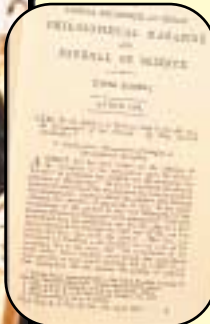
THE SITUATION TODAY

The time lag between the suggestion and evidence of global warming stems from the nature of science — it's much more difficult to obtain concrete proof than it is to obtain initial observations. On 11 December 1895, Svante Arrhenius presented results

to the Royal Swedish Academy of Sciences showing that a doubling of carbon dioxide (CO_2 — referred to in those days as carbonic acid) would increase the amount of heat trapped in the atmosphere, leading to a rise in temperature of 5 degrees Celsius.

Today, the concentration of CO_2 in the atmosphere is about 30 per cent greater than before the beginning of the Industrial Revolution in the 18th century. Levels of other greenhouse gases such as methane, nitrous oxide and chlorofluorocarbons have also

Carbon dioxide concentrations in the atmosphere are increasing around the world as we burn fossil fuels, such as in cars.



Svante Arrhenius and the scientific paper published on his calculations 100 years ago, which predicted that an increase in CO_2 in the atmosphere would lead to a warmer world.



increased because of human activities. The question is: what do these increases mean for the world's climate?

Temperatures around the world have increased this century by 0.3 to 0.6 degrees Celsius, and similar rises have been measured in Australia. Scientists have calculated that global temperatures will increase over the next century by 1 to 3.5 degrees Celsius, depending on how much more we increase the concentration of greenhouse gases (the figure appears to be close to that calculated by Arrhenius 100 years ago).

As well as becoming warmer, it has also become wetter in many places. CSIRO research shows that since 1910 annual rainfall has risen by about 15 per cent in New South Wales, South Australia, Victoria and the Northern Territory, with a small change in the other states. Southwest Western Australia has become 25 per cent drier in winter. Australian rainfall has also become more intense, and there's been an increase in the number of days on which it rains.

The greenhouse effect is a natural process that keeps the Earth's surface

scene of a crime. CSIRO researchers collect air samples at Cape Grim, on the remote northwest coast of Tasmania. They then use computer models of the weather to trace its path: they know the time and place the air was collected, and they can follow the winds back to the source to see how the air flowed there. This way, they can determine where greenhouse gases are coming from and how much is in the air. Over many years, they can build up a picture of how the atmosphere is changing and the causes of the change.

ACCOUNTING FOR CARBON

Increases of the main greenhouse gas, CO₂, are primarily a result of burning petrol, coal, oil, and natural gas (such as in cars, industry, and electricity generation) and of activities on the land (such as clearing trees and ploughing the soil). So, to reduce the enhanced greenhouse effect we need to cut back on burning fossil fuels and manage our land better.

As well as these sources that release CO₂, there are also 'sinks' of CO₂ — these absorb the greenhouse



Taking measurements high in the atmosphere is a start to understanding Australia's sources and sinks of greenhouse gases.

1997. To achieve this, we need to know what our emissions are now and what our projected emissions will be in 10 years. This will help us direct our attention to those activities where reductions can best be made. These estimates are reported internationally each year through the National Greenhouse Gas Inventory, and will help determine how we can increase our sinks and reduce our sources to meet our international commitment to reduce the total amount of CO₂ emitted.

A large part of Australia's emissions and sinks come from land based activities. The extent of that contribution and how rapidly the gases are released to the atmosphere through things such as land clearing and soil disturbance, or removed from the atmosphere through forest growth, depends on many different things. It depends on how we manage the land as well as on environmental factors such as temperature and rainfall, and even the amount of CO₂ in the air.

Recognising the large uncertainties associated with estimating land based sources and sinks, the Australian Government has set up the National Carbon Accounting System. The system will use measurements and computer modelling to improve estimates of past, present and future emissions and sinks.

For more information about the National Carbon Accounting System and other programs, visit the Australian Greenhouse Office Website (www.greenhouse.gov.au). PUBLICATIONS HOTLINE: 1300 130 606



Air measurements at Cape Grim provide clues about where carbon dioxide is coming from.

at a comfortable temperature thanks to the presence of an atmosphere. In fact, it keeps the planet's surface about 30 degrees Celsius warmer than if we had no atmosphere, so if it weren't for the greenhouse effect we'd all be dead. But the *enhanced* greenhouse effect is the increase in the amount of CO₂ and other greenhouse gases, resulting from human activities, that has led to an atmosphere that radiates more energy. It's this that is likely to lead to global warming (and for that matter, wetting).

Some aspects of tracing where CO₂ is coming from is a bit like detective work that traces a clue back to the

gas from the atmosphere. Plants remove CO₂ from the air during photosynthesis and the oceans also absorb CO₂. Again, to improve the global warming situation we need to ensure we take care of these sinks and increase them where we can.

Australia and many other countries have agreed to reduce the total amount of CO₂ and other greenhouse gases they emit. Australia needs to account for all our carbon sources and sinks in a scientifically accurate way to ensure we're on track to meet the target of reducing our emissions to 8 per cent more than 1990 levels, as set at an international meeting in Kyoto, Japan, in