Adapting to a climate of uncertainty

The science of predicting climate change is clouded with uncertainty.

We can't foretell how human behaviour – policy decisions, technological advances and population growth – will effect greenhouse gas emissions in the coming century.

We don't yet know the sensitivity of the climate system to changes in carbon dioxide concentrations, or the cooling effect of sulfate aerosol emissions.

And we'll never accurately predict the inherent chaos of climate systems: small, random changes that can trigger a climatic 'butterfly effect'.

These and other sources of uncertainty affect the accuracy of global and regional climate change scenarios. Climate modellers acknowledge their existence by presenting climate change predictions as a range of possibilities, or projections.

For example, according to 1996 scenarios, global temperatures are projected to rise between 1.5 and 4.5°C by the end of next century. And by 2070, summer rainfall in south-eastern Australia could increase by 10% from today's average. Then again, it may fall by the same percentage.

Even these ranges are not final. Projections will be upgraded as climate models, and the equations that drive them, become better at simulating the climate system.

All this uncertainty presents a conundrum for politicians, managers and policymakers: the people responsible for the health, safety and economic wellbeing of our communities, and for the future of industries and businesses. How can plans be made when the evidence and magnitude of change are so, well, uncertain?

'For planning on a practical level you're left scratching your head,' says Dr Roger Jones of the Climate Impacts Group at CSIRO Atmospheric Research. Jones says that even if greenhouse gas emissions ultimately fall, and their concentration in the atmosphere stabilises, there will be a delay before the climate system responds.

'The gap between decreased emissions and reduced atmospheric temperature is decades,' he says. 'Sea level may continue to rise for centuries. Some climate change is therefore inevitable, so adaptation will be needed to reduce its harmful affects. A lack of scientific certainty should not be used as a reason for postponing adaptation if a substantial risk can be identified.'

In view of this need for action, Jones has spent the past two years developing a risk assessment framework which he believes has the potential to help industries and communities adapt to global warming, despite the uncertainties of climate prediction.

The framework encompasses a range of computer models, plus a step-by-step communication. Jones says it 'turns on its head' the traditional process by which scientific findings are taken up by governments and industries. 'We can't start a decision-making process with firm evidence of future rainfall or temperature change,' he says. 'But we can identify for each climate-related activity the hazards likely to result from changes in climate.'

Jones has applied the framework to his parents' irrigated-pasture beef enterprise in northern Victoria. In this simple example, the climate-related activity is beef production, and the potential hazards are higher temperatures and increased evaporation, conditions which could push the property's requirement for irrigation water beyond its licensed entitlement.

By modelling the farm's water use, Jones identified temperature and rainfall thresholds at which adaptations to climate change would be needed, and a critical threshold at which the enterprise would not be viable.

Once the potential hazards and thresholds have been established for each climate-related activity, the next step is to plot the thresholds against latest scenarios for climate change. The probability of each hazard occurring under the scenario will influence whether precautionary measures are needed.

The risk-assessment framework was tested on an irrigated-beef pasture enterprise. In this example, the climate-related activity is beef production, and the potential hazards are higher temperatures and increased evaporation which increase the need for irrigation.

It also enables 'dangerous' levels of climate change to be identified. 'The trick lies in recognising when a risk may exceed a critical threshold,' Jones says. 'The framework opens a 'window of adaptation' that gives us time to adapt and avoid that risk.'

In taking this approach, Jones has translated the potential effects of climate change into the language of statistical risk analysis, a process used in government and industry planning. He says its success relies on developing a trans-disciplinary approach. 'We need to take our research out of its narrow focus on modelling climate change, and involve climate economists and social scientists,' he says.

Jones is involved in a 12-month scoping study to determine how the framework might be applied on a broad scale, to the complex issues of regional planning in the New South Wales Hunter Valley.

The concept has been presented to a group of policy and management specialists from government departments. Key climate-susceptible activities will be selected as model examples of how risk analysis might be applied in the region.

'Many activities likely to be affected by climate change also have a long-term planning horizon,' Jones says. 'They include infrastructure development, planning for public health and safety, conservation and natural resource management.

'Bridges are planned to last for 100 years, but more intense rainfall can lead to failure; changes in water availability could create conflict among users; and modest changes in climate shift the habitat for some animals and plants beyond their current range of distribution.' (See story on page 15.)