

Preparing to adapt to unavoidable climate change

Graham Readfearn

The terms ‘adaptation’ and ‘mitigation’ are fundamental to the public debate on climate change. Most efforts to address climate change so far have been almost entirely focused on mitigation – taking action to reduce greenhouse gas emissions and to enhance the world’s carbon ‘sinks’.



Credit: CSIRO

But the reality is that no matter how successful these mitigation efforts are, all of the Earth’s species and ecosystems are faced with the challenge of adapting to climate change. This is because the flow-on effects of higher levels of greenhouse gases take time to work their way through the Earth’s complex atmospheric, land and water systems.

One journal paper has estimated that if all human-caused emissions of greenhouse gases were to stop tomorrow, it would take about 1000 years for temperatures to return to their pre-Industrial Revolution range.¹ The implication is that while we need to continue making efforts to tackle the causes of climate change, we also need to understand how humans and other species might adapt (or not) to inevitable climate change impacts.

‘It’s an important problem that’s not been addressed in the past,’ says Professor Jean Palutikof, Director of the National Climate Change Adaptation Research Facility (NCCARF). ‘The whole of last year was dominated by thinking about mitigation – and not to any great purpose.’

In February, the Federal Government released a position paper that outlined the adaptation challenge for Australia. ‘The impacts of climate change will affect almost every facet of Australia’s economy, society and environment,’ the paper said. ‘Adapting to climate change will involve all levels of government, business and the community.’

The document highlights some of the impacts to which Australia and Australians will need to adapt, regardless of the

success or failure of global attempts to cut emissions of greenhouse gases – hotter and drier conditions, more heatwaves, more frequent bushfires and rising sea levels.

NCCARF has identified eight priority areas for adaptation research (see box), such as impacts on infrastructure and human settlements, biodiversity, and human health.

Many dimensions of the adaptation response

NCCARF will focus the nation's research on answering questions on eight key aspects of adaptation:

1. **Terrestrial biodiversity:** How will climate change affect Australia's unique and diverse flora and fauna? Would improvements to investment, governance and management practices help the natural habitats to survive and prosper – and by how much?
2. **Primary industries:** How will climate change impacts such as reduced rainfall and higher average temperatures impact industries such as horticulture, viticulture, livestock, cropping, intensive and extensive farming and forestry? Will some areas and industries be able to benefit from climate change? Which ones need to adapt to remain viable?
3. **Water resources and freshwater biodiversity:** What are the climate change risks to groundwater resources and freshwater biodiversity? Will current governance regimes still be effective in areas where rainfall is predicted to decline?
4. **Marine biodiversity and resources:** Fish, birds, reptiles reefs, algae, plankton and their ecosystems are already reacting to impacts such as increased temperatures and ocean acidification. What can be done to reduce the effects? What difference will reducing other pressures such as over-fishing and agricultural runoff make?
5. **Human health:** Extreme events such as bushfires, floods and heatwaves can cause physical injury and deaths. But how might social and economic disruption from events such as droughts also affect mental health?
6. **Cities and infrastructure:** How can governments, the private sector and vulnerable regions and communities reduce the effects temperatures increases, sea-level rise and extreme events on vulnerable cities and infrastructure?
7. **Emergency management:** If there is an increased incidence of cyclones, storms, drought, heatwaves, bushfires and floods, will there be enough volunteers to go around, and can communities be supported to become more resilient?
8. **Social and economic issues:** Understanding the complex social structures, behaviour patterns and the habits and rules of economic institutions will be critical.

The aim is to develop climate change adaptation plans for each of these areas – for example, what does a rise in sea level mean for development and infrastructure in coastal areas? What changes could be made to planning rules to manage the increased risk of flooding? What can industries such as agriculture do to adapt to rising temperatures? How will people's health be affected by increased temperatures? What can hospitals, emergency services and communities do to make services more effective?

Professor Lesley Hughes, of Macquarie University's Department of Biological Sciences, says that it is 'one thing to know that climate change is happening' but another to ask what to actually do about it. Professor Hughes, who has been researching the impacts of climate change on ecosystems for more than 20 years, is concerned about limited adaptation options in the natural world in the event of severe climate change.



Credit: CSIRO

'Ultimately it's [about] extinction of lots of species and destruction of ecosystem processes. There will simply be a lot of changes in the way that ecosystems function.'

'With terrestrial biodiversity, the adaptation options are limited compared to human systems. In agriculture we could change where we put dams or cattle. Yes, it's expensive, but they are do-able. But with terrestrial biodiversity, your options are far more limited.'

Using wallabies as an example, Professor Hughes explains that animal species in a changing climate could adapt via two mechanisms. The first, assisted migration, involves the physical relocation of a population to an area with a less hostile climate. The second involves the creation of natural migration corridors through protecting critical habitat linkages.

But there is also a third option, according to Professor Hughes. 'One of the most important things we can do for natural systems is to simply make them more resilient to change by promoting their current health.'

Professor Hughes warns that we also need to understand the knock-on effect elsewhere of our adaptation actions.

'For example if the northern part of Australia is getting wetter, then we could clear whole areas for agriculture. Now that's good for agriculture, but bad for biodiversity.'



Credit: Gregory Heath, CSIRO.

‘This is part of the complexity of adapting to climate change. One action might be good for one thing but it’s not always going to be good for another.’

In June, NCCARF, together with CSIRO, will host the world’s first international conference on climate adaptation, entitled ‘Preparing for the unavoidable impacts of climate change’. The conference has already created waves in the international research community, with more than 800 abstracts of scientific papers being submitted from researchers in 55 countries, many from developing nations.

‘Adaptation will be much more of a problem for people living in developing countries than in other developed countries,’ says Professor Palutikof. ‘Those countries are at the pointy end of the impacts of climate change, although Australia could be an exception to that rule.’

¹ Solomon et al. (2009). Irreversible climate change due to carbon dioxide emissions. *Proceedings of the National Academy of Sciences of the United States of America*, **106**, 1704–1709, doi: 10.1073/pnas.0812721106

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