Global warming in Australia

The Australian Climate Group (2004), which is a group of eight scientists and several representatives from the insurance industry and environmental movement, reported in 2004 that, based on 50 years of Bureau of Meteorology data, there has been a decline in average annual rainfall in the eastern and south-eastern regions of Australia, and particularly in the south-west, where there has been a 25% decline over the last 25 years. This is believed to be due to a shifting of the rainfall regime to higher latitudes to the south such that much of the rain that previously fell on the land is now falling on the ocean. This trend is expected to continue, which is why Western Australia is now taking extraordinary measures to ensure their fresh water supply over the coming decades.

Looking to the future, CSIRO Atmospheric Research modelling predicts an increase in temperature across most of the country. For example, it is estimated that by 2030 the north-east coast of Australia (Cairns region) would be around 0.5 to 1.5 degrees warmer, and a further one and a half degrees warmer by 2070 (McMichael et al. 2003).

A collaborative report, by ANU, CSIRO Atmospheric Research, the Bureau of Meteorology Research Centre and several New Zealand colleagues for the Commonwealth Department of Health and Ageing, estimates how those likely climate futures in Australia would impinge on human health. We intend to build on this work by modelling not just changes in average conditions in the future, but also the changing variability of climatic conditions in Australia. This is important for identifying where and when we might pass critical climatic thresholds.

Impact pathways

There is a range of pathways by which a change in climatic conditions can affect elements of human exposures that would then bear either directly on human health, or indirectly via perturbations of various environmental systems, ecological processes and social

We have been concerned over the last 15 years about the impacts of climate change on the economy, recreational amenity and biodiversity. More belatedly we have become aware that there are very serious issues for the wellbeing and health of human populations, particularly those that are vulnerable in the poorer regions of the world.

It is no longer disputed by mainstream science that average climatic conditions in the world are going to change. The consensus view is that we have begun to see human-induced change in recent years. Climate variability will very probably change, and in varying degrees around the world. We must also expect discontinuity in the form of abrupt climatic shifts and abrupt environmental consequences. This poses an unfamiliar, serious and increasing risk to population health.

Our existing knowledge, which is still incomplete, enables us to estimate at least some of the health impacts of model scenarios of future climate. These will vary in type and severity, reflecting local vulnerability as a function of geography, socio-economic circumstances and demographic characteristics.

Climate change health impacts have a particular significance—they signify that we are on a non-sustainable path of disruption to earth’s life-supporting systems. This is a very different environmental concern from our conventional environmental health hazards of local air pollution as a toxic hazard, the release of ionising radiation into the local environment, or pesticide residues in food that we consume. These we can study, directly estimate their effects, and take direct action to intervene and remedy them.

When we are talking about a change to the world’s climate system though, we are talking about something that is operating on a different scale and through a different type of medium that involves the disruption of very complex processes and a range of consequences.

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and demographic conditions (Figure 1). This includes disruption to regional food and water supplies, destabilisation of social and economic conditions in some parts of the world, and increased conflict situations and refugee flows with resultant adverse health consequences for both refugee and host populations.

Very many of these pathways are mediated by more complex disturbances which make quantification of the impacts difficult.

An actual example of climate change health impacts is the 2003 summer heat wave in Europe which led to around 26,000 excess deaths across the continent over a two-week period. France bore the brunt and Paris in particular, where there were an estimated 11,000 excess deaths. During this time, there was a quite marked increase in the maximum daily temperature, and importantly, the night time (minimum) temperatures, indicating lack of physiological relief overnight.

Most of the deaths were from heart attacks, strokes or respiratory failure. As always happens in heat waves, it tended to be the elderly and people with pre-existing cardiovascular or chronic respiratory diseases that were affected.

**Empirical studies**

Epidemiologists have three options in terms of understanding climate-related health risks better and for trying to foresee future risks: learning from the past; detecting the present; and predicting the future.

**Learning from the past**

We need to learn more about the relationship between climatic conditions and health. We are at the brink now of looking seriously for evidence of initial effects in at least some vulnerable populations around the world and we will use the information that we gain from these empirical studies to strengthen our capacity to predict the impact of future climate scenarios on human health.

As an example, we have modelled data from 1991 to 2001 of summer food poisoning from salmonellosis in Australia’s capital cities and found a clear relationship
of a two- to three-fold increase in the risk of food poisoning at the high end of the temperature range compared to the low end (D’Souza et al. 2003).

We have also learnt in recent times how death rates respond to heat waves, how vector-borne infectious diseases like malaria, dengue fever and Ross River virus in Australia respond to temperature increases, and about the impacts of extreme weather events like floods, storms and cyclones which depend greatly on the vulnerability of the population and their location.

An interesting overseas study is that of the International Rice Research Institute on the impact of temperature changes on rice productivity, which found that yields fell by 10% for every one degree Celsius rise in mean night time minimum temperature (Peng et al. 2004). Such a diminution of food production and nutritional status is a concern as it has a range of adverse health consequences.

Detecting the present

It is perhaps a little early to detect any evidence of change in health patterns around the world, but there is indication that we are starting to see a change in the pattern of heat wave-related deaths. A better, more systematic multi-country study is needed to confirm this. Extreme weather events data are starting to look persuasive in terms of infectious disease spread:

- malaria is rising to higher altitudes in parts of eastern Africa
- warmer winters over the last 15 years in Sweden are associated with a progressive spread of tick populations and increase in the rates and intensity of tick-borne encephalitis
- there has been an intensification of the relationship between cholera outbreaks and the El Nino system in coastal Bangladesh.

Modelling future impacts

With respect to thermal stress, we can repeat in Australia analyses like those of heat-related deaths in Paris and, using CSIRO model projections of climatic conditions to 2050, estimate the annual heat-related deaths attributable to temperature rises per se, and to ageing enhanced susceptibility. It amounts to an extra 4,000 deaths on top of today’s approximately 1,100 deaths per year attributed to heat stress (McMichael et al. 2003).

For vector-borne diseases like Dengue fever, climate change is important, but there are many other environmental and social changes that impinge on the breeding, behaviour and survival of the mosquito vector and therefore the risk of this disease.

Social changes include:

- post-1970 cessation of insecticide spraying
- decline in the public health system
- urbanisation and configuration of surface water
- intercontinental shipment of used tyres and other items containing mosquito eggs.

Environmental changes include:

- biodiversity loss, in particular, mosquito predators (e.g. birds, frogs)
- land use and forest clearing.

We are building up from a simple base towards having a better capacity to undertake fuller multi-varied modelling, but we are starting to get good estimates of how at least the climate factor will affect the transmissibility of dengue. In Australia, the disease could be transmitted by the vector mosquito, Aedes Aegypti, in the northern region of the country under current climatic conditions. Looking to the future for medium and high greenhouse gas emission scenarios, the region of potential spread of the disease would be increased (Figure 2, see next page).

Similarly with malaria, a one and a half degree Celsius rise in climatic conditions would increase the transmissibility of malaria around the world. In Zimbabwe alone, as we move to 2025, warmer conditions and changes in rainfall will see the spread of malaria into the central highlands, which are currently malaria-free, and by 2050 most of the country will be at risk. This will mean either a lot of disease, or a high cost to a tiny economy to control the disease.

Because of complex human culture and our limited capacity to buffer against change, few climate change-attributable health impacts are yet apparent, but impacts will inevitably increase over coming decades, especially in vulnerable groups. Health is the real bottom line of sustainability. If social, economic and environmental trends impair population health and survival, then we are on a non-sustainable trajectory.

References

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McMichael A et al. 2003, Human Health and Climate Change in Oceania: A Risk Assessment 2002, Commonwealth of Australia, Canberra, Australia


Figure 2: Estimated geographic region suitable for dengue vector—different climate scenarios at 2050 (McMichael et al. 2003)