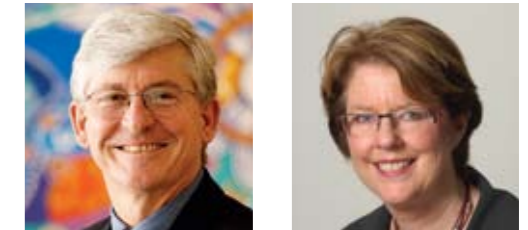


Research Australia

An alliance for discoveries in health

Healthy Planet, Places and People





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Research Australia is a national alliance of over 190 member and donor organisations with a common mission to make health and medical research a national priority. Our aim is to create a society that is well informed and values the benefits of health and medical research. Investment in health and medical research will not only improve the health and quality of people's lives now and in the future, it will also generate new businesses and knowledge-based jobs, strengthening Australia's position in a growing global knowledge economy.

There is, today, an expanding range of influences on the health of communities and populations as we globalise, inter-connect, and increase our impacts on the natural environment. Climate change and the rapid growth of cities are two important examples of this rapidly changing world and its consequences for health.

There is little doubt climate change is real. Australia's climate is changing and there is broad scientific consensus that further change will occur. Since the mid 20th century, Australian temperatures have risen by about 1°C on average, with an increase in the frequency of heat-waves and changing rainfall patterns. Average rainfall will increase globally, while many mid latitude and lower latitude land regions are expected to become drier. Extreme weather events, such as flooding, bushfires and storms, will become more severe.

There has been considerable focus in recent years on the economic and environmental implications of climate change. Little attention has been given to climate change and health. Modern health and medical research is making great advances in our fundamental understanding of disease and how to translate that knowledge into health services. We must, however, better understand the health implications of a warmer world.

To improve our understanding of the health risks of climate change, Research Australia has turned to some of our leading scientists for advice about the evidence and what is yet to be discovered. Research into climate change and health is relatively new, but is showing that climate change will affect our health in many ways – including increases in the incidence of asthma, deaths due to heat-waves, the spread of various infectious diseases, and mental health problems. The rise of obesity, reflecting energy use (e.g. urban design, transport and recreation choices), is also linked to climate change. Finally, emissions from any one country contribute to health risks worldwide.

The good news is that, thanks to this new research, we will have a better understanding of these health problems so that we can develop adaptation strategies to lessen a range of risks to health. The research will also extend our understanding of the now-urgent need to reduce emissions. We are indebted to our scientists whose research contributes to a healthy planet, healthy places and ultimately a healthy people and in particular Professor Tony McMichael for leading this project, and Dr Stephanie Williams for guiding it to fruition.

Dr Chris Roberts
Chairman
Research Australia

Rebecca James
Chief Executive Officer
Research Australia



Acknowledgements We most gratefully acknowledge Professor Tony McMichael for leading this report and chairing the report's steering committee. We deeply appreciate the invaluable input and guidance of the steering committee; Professor Tony McMichael, Professor Tony Capon, Professor Michael Good, Gayle McNaught, Rebecca James and Dr Stephanie Williams. Many thanks to the Research Australia team, particularly Kandy Musgrave and TYD PR Consultant Julie Sheather. Sincere thanks to all our contributors whose work provides a vital insight in to the impact of climate change on our health.

Research Australia thanks the National Health and Medical Research Council and MBF Australia for generously supporting this report.

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our social, physical and biological environments are **changing** – but today they are doing so at ever-faster rates and on an enlarging **scale**



Global climate change is now a major focus of public and policy discussion.

This remarkable consequence of intensified human activity underscores the crossroads that we have reached in our relations with the natural world. Climate change, along with various other global environmental changes and the proliferation of cities as our dominant habitat, have great consequences for our wellbeing, health and survival. That, in turn, points to a research domain that needs increasing attention and support.

Modern medical research is making great advances, especially at molecular-biological and genetic levels, in understanding disease processes, individual susceptibility, vaccine design, and the efficacy of new treatments. Modern epidemiological research has identified many important individual-level factors that influence personal risks of disease – including smoking, alcohol consumption, dietary fat intake, sexual practices, hormone therapy and work stress.

This important laboratory, clinical and epidemiological research, seeking explanations and applications at the personal ('healthy people') level, continues to improve our health and lives. Meanwhile, as always, our social, physical and biological environments are changing – but today they are doing so at ever-faster rates and on an enlarging scale. It is those changes at the levels of 'place' (e.g., whole communities) or 'planet' (whole regions and the globe) that account for most of the changes in disease rates in populations.

This has great significance for health and medical research needs. Researchers in Australia, and elsewhere, should seek to understand how the mix of influences across those three levels (planet, place and person) affects patterns of health and disease – and what, then, are the effective prevention options. This will require broadly collaborative and ecologically-attuned research – as illustrated by the following research examples in this report.

The recent rise in overweight/obesity underscores the role of 'place'. It reflects changes in how communities live: the foods they produce and advertise, consumer behaviour, labour-saving options at work and home, and motorised mobility. That is, when society's 'energy in versus energy out' budget is out of balance, an increasing proportion of persons will become overweight. Also reflecting 'place', changes in land use, climate, water engineering, intensity of food production, trade and travel increasingly influence patterns of infectious diseases. This is well illustrated by the recent emergence of SARS, Nipah virus disease, and the H5N1 strain of bird 'flu.

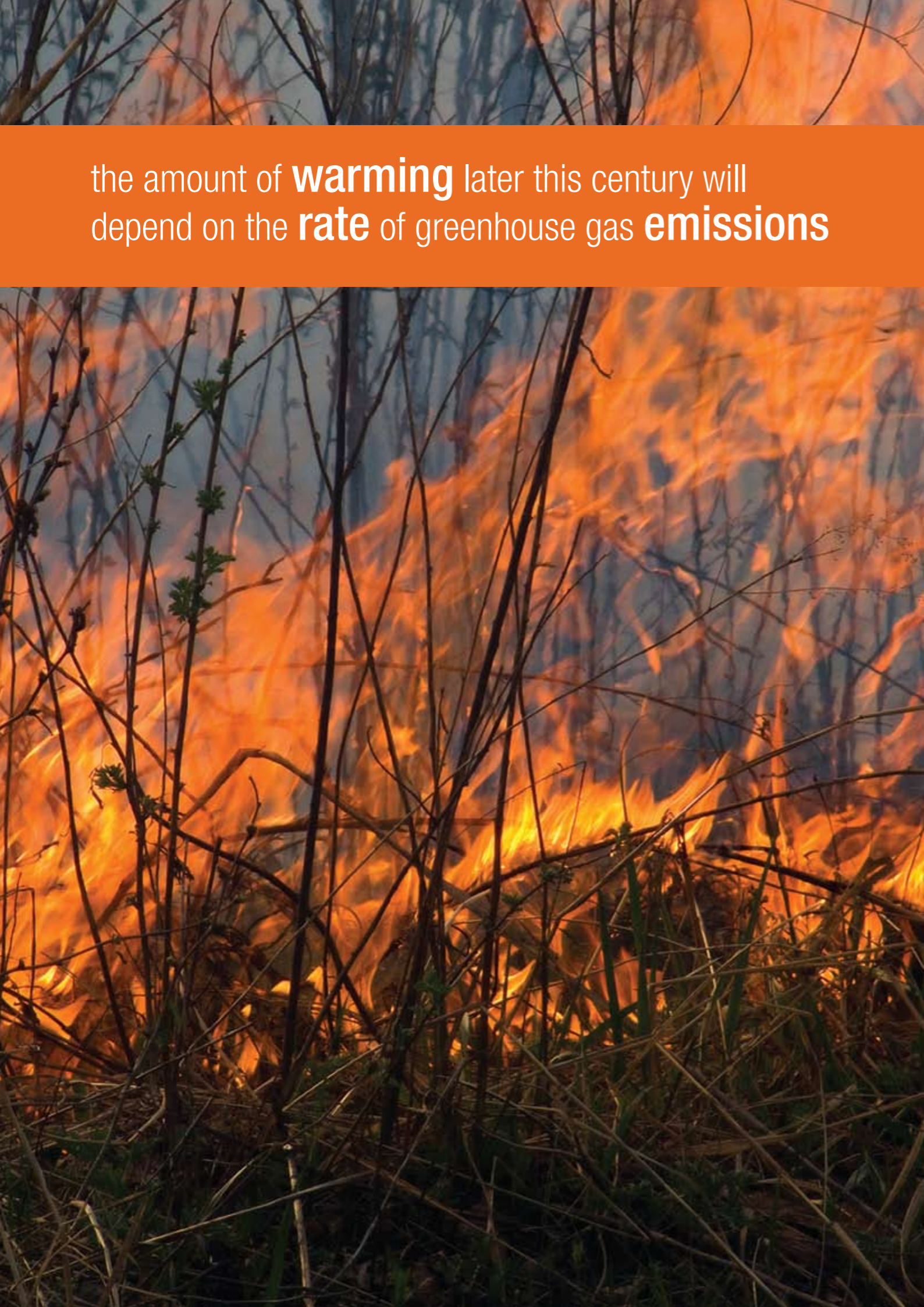
At 'planet' level, various environmental and social changes are increasingly important. Human health is now being influenced by climate change, worldwide dispersal of persistent chemical pollutants, depletion of ocean fisheries, widespread freshwater shortages, and escalating pressures on fertile soils. These large-scale environmental changes generally endanger most the health of poor and vulnerable populations with limited resources for self-protection. These systemic problems also underscore the crucial need for achieving a sustainable way of living that maintains the environmental resource base for the health of future generations.

Alongside these planet-level environmental changes are various economic, technological and cultural changes, increasingly pervasive in a globalising world. Some confer health benefits. But many – such as the internationalisation of cigarette marketing, the promotion of private motor-cars, and the rapid rise in mass-produced animal food products – are detrimental to health.

The marvels of microscopes, metabolic pathways, molecules and the biomedical model have enriched our understanding of disease, and helped render our lives longer and healthier. But we will be 'penny wise and pound foolish' if we do not now, urgently, focus additional research attention on the strong, larger-scale undercurrents that are beginning to pull us from those hard-won shores.

Tony McMichael

Professor and NHMRC Australia Fellow
National Centre for Epidemiology and Population Health
College of Medicine and Health Sciences
The Australian National University, Canberra



the amount of **warming** later this century will depend on the **rate** of greenhouse gas **emissions**

australia's climate is changing

"If we focus on today, we may forget to look forward to tomorrow. While there is certainly controversy surrounding the threat of climate change, it would be foolish not to consider the effects a change in the climate would have on the health of Australia. There is much Australia can do in response to the threat of global warming, but the important thing is to think laterally and logically, considering all possible outcomes."

TESSA MOODY, Year 10
Toorak College

The CSIRO and the Australian Bureau of Meteorology released "Climate change in Australia: technical report 2007" on 2 October 2007 to update the assessment of Australia's changing climate.

The projections estimate that by 2030, Australia is likely to be 1°C warmer on average. The amount of warming later this century will depend on the rate of greenhouse gas emissions. If emissions are low, annual warming will be around 1.8°C by 2070, and for high emissions around 3.4°C.

As with temperature, rainfall projections are dependent on the level of greenhouse gas emissions. By 2030 decreases in annual average rainfall are likely in southern Australia. Rainfall is likely to decrease in southern areas during winter, in southern and eastern areas during spring, and along the west coast during autumn. There will be little change to annual rainfall in the far north by 2030. Under a low-emission scenario in 2070, annual rainfall will decrease in southern areas by up to 20 per cent, and up to 30 per cent under the high-emission scenario. The report indicates that although there will be more dry days, when it does rain, rainfall is likely to be more intense.

The report also found that:

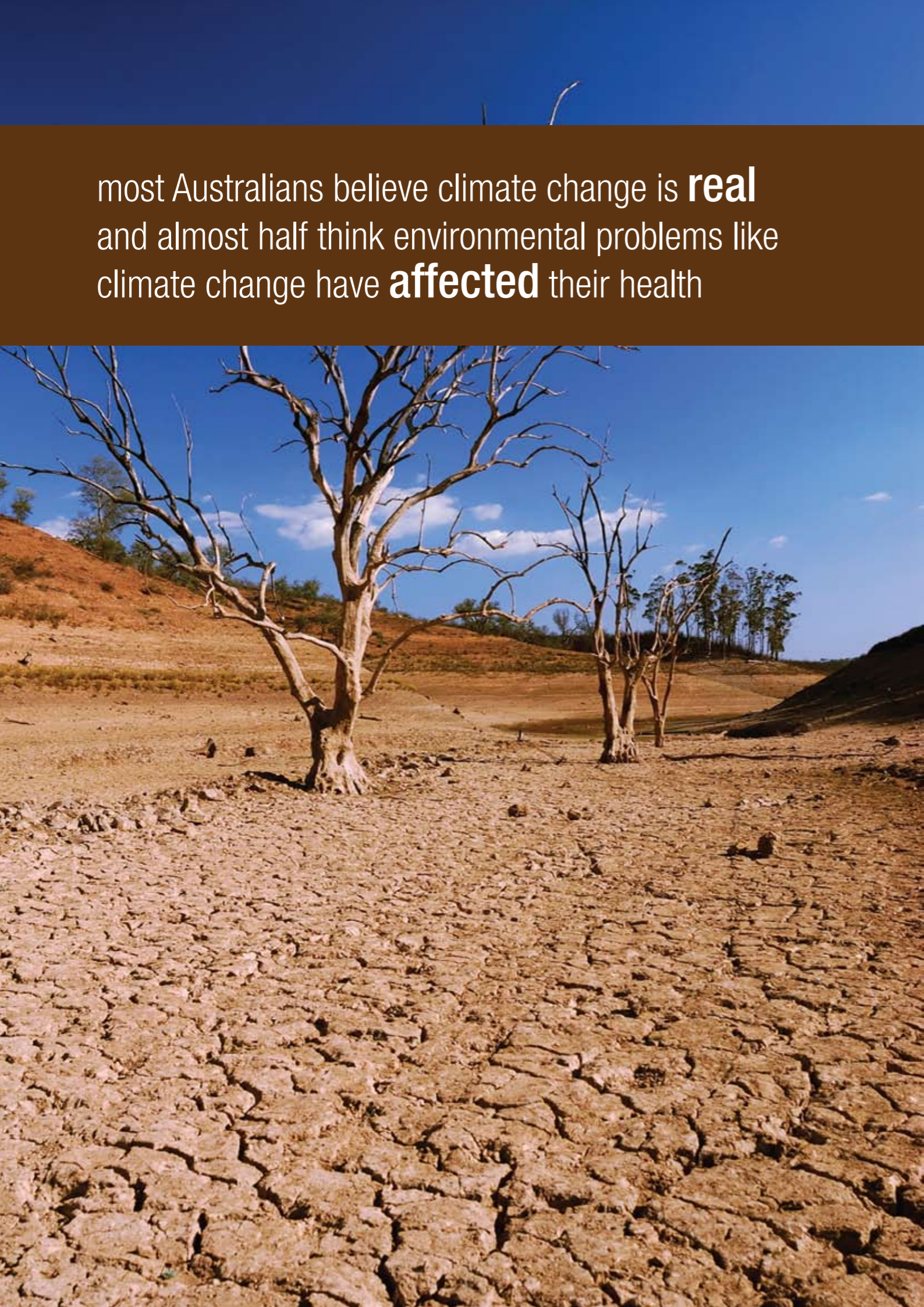
- droughts are likely to become more frequent, particularly in the south-west;
- evaporation rates are likely to increase, particularly in the north and east;
- high-fire-danger weather is likely to increase in the south-east;
- tropical cyclones are likely to become more intense;
- sea levels will continue to rise.

<http://www.csiro.au/resources/ps3j6.html>

	Present average (1971-2000)	2030 average (mid emissions)	2070 average (low emissions)	2070 average (high emissions)
Sydney	3.5	4.4 (4.1-5.1)	5.3 (4.5-6.6)	8.2 (6-12)
Melbourne	9.1	11.4 (11-13)	14 (12-17)	20 (15-26)
Adelaide	17	23 (21-26)	26 (24-31)	36 (29-47)
Brisbane	1.0	2.0 (1.5-2.5)	3.0 (2.1-4.6)	7.6 (4-21)
Hobart	1.4	1.7 (1.6-1.8)	1.8 (1.7-2.0)	2.4 (2.0-3.4)
Perth	28	35 (33-39)	41 (36-46)	54 (44-67)
Darwin	11	44 (28-69)	89 (49-153)	230 (140-308)

Average number of days per year above 35°C at selected sites for present (1971-2000) climate and best estimate values for 2030 and 2070, with ranges of uncertainty in brackets.

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most Australians believe climate change is **real** and almost half think environmental problems like climate change have **affected** their health

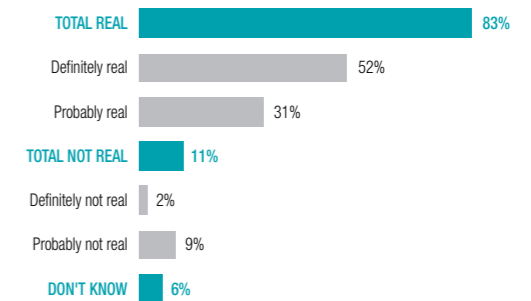
australia's climate is changing

Most Australians believe climate change is real and almost half think environmental problems like climate change have affected their health.

A Research Australia Public Opinion Poll of 630 people nationwide was conducted online by Crosby/Textor in August 2007. The survey found that 83% of Australians believe climate change is real and 45% believe environmental problems such as those that might be caused by climate change, have affected their health.

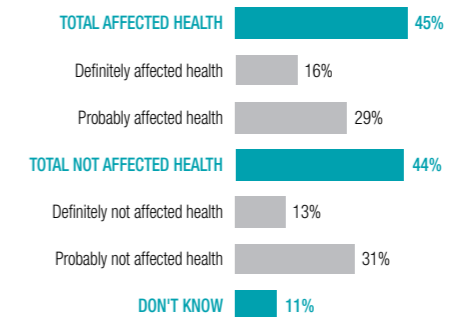
83% of Australians believe climate change is real

Question: As you may or may not know, some people believe that the earth's atmosphere is gradually getting warmer as a result of greenhouse gas emissions and that, in the long run, this global warming could have catastrophic consequences. From what you have heard or read, do you believe that global warming is definitely real, probably real, probably not real, or definitely not real?



45% of Australians believe environmental problems have affected their health

Question: Do you think that current environmental problems, such as those that might be caused by global warming, have actually affected your own health in any real sense, or do you think that your health is not affected by current environmental problems?

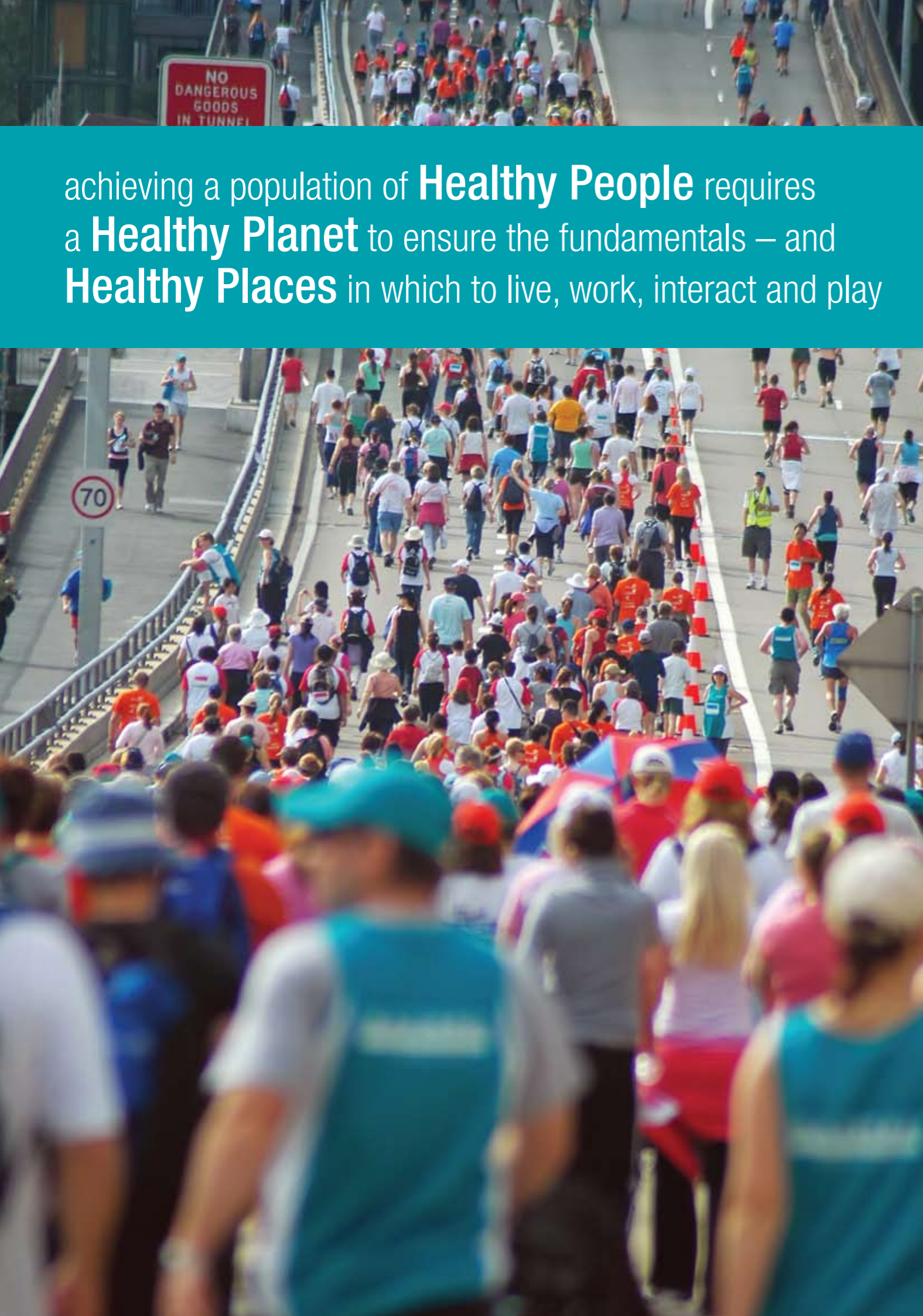


"Everything in the biosphere is affected by changes in our climate, so it's hardly surprising that human health will be strongly influenced by climate change. From water availability and quantity to temperature and food, our changing climate will influence all of the fundamentals of life. To ignore climate change in terms of human health would be a bit like treating the fish in a fishbowl, while refusing to change their ever more polluted water."

TIM FLANNERY
2007 Australian of the Year
Professor, Macquarie University

"As medical researchers concerned with the health and wellbeing of children we are facing very challenging times. The issues and illnesses affecting young people today are significantly different to 30 years ago - we're seeing unprecedented rates of mental health problems and continued high rates of complex diseases such as obesity, asthma and diabetes. We know that much of this can be attributed to changes in our physical, economic and social environments. And that's why I'm so concerned about climate change. The direct and indirect impact on children will be profound. They will suffer directly in terms of nutrition, UV exposure and in the rise of tropical infections. But the indirect effects will be just as devastating as our future generations struggle with the economic and social impacts of our changing landscape. We must act now."

PROFESSOR FIONA STANLEY AC
Director, Telethon Institute for Child Health Research; Executive Director, Australian Research Alliance for Children and Youth, 2003 Australian of the Year



achieving a population of **Healthy People** requires a **Healthy Planet** to ensure the fundamentals – and **Healthy Places** in which to live, work, interact and play

symptoms of an unhealthy planet

“ I believe with the right medical research, and with high priority, we can help create a better future. But, we can only do this if we start now.”

SHEJUTI HOSSAIN, Year 9
Mac. Robertson Girls' High School

“ Climate change and obesity are both consequences of our current way of life. A clear link between these two conditions is our increasing reliance on fossil fuels to propel ourselves around our environment (motor cars, escalators), resulting in increasing emissions of carbon dioxide. It also reduces the use of food energy in our bodies, so that this energy is stored as fat on our waistlines. Thus from a biological perspective, both climate change and obesity are to some extent the result of the same behavioural maladaptation.”

PROFESSOR STEPHEN BOYDEN AM
Previously, Professor in Human Ecology,
Centre for Resource and Environmental
Studies, Australian National University
Patron, Nature and Society Forum

As we venture into this new century, populations in Australia and elsewhere face some new and larger-scale risks to health.

These risks arise from our rapidly expanding impacts on the natural world – including extending our cities, transforming landscapes and disrupting ecosystems, escalating our energy use, generating wastes, and altering the planet's climate.

In Australia we have had recent scares from avian influenza and SARS. These and other viral infections appear to be emerging more readily, particularly within the Greater Asian region, and spreading more rapidly. This heightened tempo of infectious disease activity reflects the combination of increases in population density, people movement, commercial activity, trading patterns, land clearance and other and environmental pressures.

We are also afflicted, as are many other countries, by marked uptrends in obesity and diabetes. This, too, reflects wider environmental and social changes: altered living patterns are pushing populations towards caloric energy imbalance. Genes may make some individuals more prone than others, but it is environmental change that shifts the rates of disease in whole populations.

Similarly, the widely-reported recent rise in mental health problems, especially depression, seems to signal that something systemic is astray with our work-family-life priorities, our consumer behaviours, and our loss of community.

These current trends in health risks underscore the fundamental influence of the natural, physical and social environments on the health of populations. Health-care systems are, of course, essential: illnesses occur for many reasons, and prevention and treatment confer important health benefits. But, over the long haul, achieving a population of Healthy People requires a Healthy Planet to ensure the fundamentals – and Healthy Places in which to live, work, interact and play.



there is **growing** evidence that our escalating demands on the natural **environment** are no longer **sustainable**

symptoms of an unhealthy planet

Currently, though, the planet's health is showing signs of decline.

There is growing evidence that our escalating demands on the natural environment are no longer sustainable. We are living beyond Earth's capacity to continue to provide, replenish, regenerate and absorb. The symptoms of an unhealthy planet include climate change, freshwater shortages, impaired food yields, accelerating loss of species, and acidification of the world's oceans. Food, water, climatic stability, natural constraints on infectious agents and environmental buffers against natural disasters – these are the fundamentals of good health, indeed of survival.

Climate change illustrates well this new category of challenge. Climate change has consequences for health in Australia, the Asia-Pacific region and globally. These emerging health risks also cast long shadows over future generations. That unusual prospect underscores the need for health research leading to understanding that can better inform both policy decisions about slowing global climate change and the development of strategies to lessen health impacts.

On current trends, world average temperatures may increase by up to several degrees centigrade by later this century, weather patterns will become more variable, and many natural environmental systems will be disrupted. Around the world, the annual toll of injury, illness and death from climatic extremes appears to be increasing, along with warming. There have, this year, been repeated severe heatwaves in continental Europe and massive floods in England, India and elsewhere – following, earlier this decade, increasingly severe hurricanes in the US, amplified swings in winter temperatures, and unusually severe droughts in Australia, West Africa and elsewhere.

Heat-waves are often lethal, especially to the elderly, the frail and those who are poor and vulnerable, causing deaths from heart attacks, stroke and respiratory disorders. Each year around 1500 people die from heat extremes in Australia's main cities. Modelling studies indicate that warmer conditions would cause this number to double or treble by mid-century – further amplified by an ageing population. Over recent decades the annual number of very hot days has been edging upwards.

Many infectious diseases are sensitive to temperature, humidity and surface water. Gastroenteritis from food poisoning tends to increase with warmth and moisture. In Australia, infections such as Ross River virus disease, spread by mosquitoes, will be affected. Mosquito-borne diseases in Australia's more tropical north, such as dengue and (occasionally) Japanese encephalitis, may extend southwards.

Climate change will affect farm yields and food supplies.

Particularly in the world's poor and food-insecure regions this will impair nutrition and affect child growth and health. Researchers estimate that incipient global warming during 1981-2002 reduced the world's annual wheat, maize and barley production by around 40 million tonnes, a deficit of 3-4%. Meanwhile, the fish harvest from warmer (and, now, more acidic) oceans is also likely to be adversely affected.

Rural communities in much of southern and eastern Australia may already be experiencing the front end of climate change. Climate scientists anticipate that, in a warming world, rainfall zones will be displaced polewards, causing drier conditions in temperate zones. The health risks in affected parts of rural Australia include mental health problems, water shortages and hygiene, exposures to extremes of heat, dust and smoke, impaired local food production, and exacerbations of health-damaging personal behaviours.

For many decades the health of Australians has been improving (albeit unevenly between population subgroups and, especially, between indigenous and non-indigenous Australians). We have a wonderful national record of health and medical research, including two recent Nobel Prizes, and a high level of access to good health care. But the conditions of the modern world are changing more rapidly than we would have anticipated just a brief decade ago. Climate change poses risks to the Planet, to the Places where communities live, and to the People who live there.

Health and medical research effort has long focused on understanding how human biology and its organ systems are affected by local external factors, food intake, stress and so on, and thus how best to prevent and treat poor health. The underlying premise has been that the natural world around us is essentially constant. Indeed, this health research effort can be viewed as part of the greater "Science Project" that has long sought to understand the workings of the world and its living creatures. Today, human actions are inadvertently impairing the working of the world. Hence we urgently need, through research, to understand how human-induced changes to climate and global environment are affecting, and will affect, our lives, our health and our societies.



Much recent, exciting, biomedical research has been at the micro-scale, exploring the molecular biology of metabolism, infectious processes and genetic susceptibility. We need now to extend our repertoire of health and medical research skills. We must understand better the health risks posed to populations by a changing climate and by other symptoms of an unhealthy planet.

Until we gain that knowledge we will not fully understand the consequences, the full significance, of these momentous human-induced changes. This knowledge from research is crucial if we are to aright these harmful changes quickly and thus restore a Healthy Planet – and if we are to take actions to create Healthy Places that help ensure that we are Healthy People.



understanding the relationship between **climate** and **asthma** in different areas would enable more **targeted** health service **planning**

what research tells us

Community design is linked to obesity

There is a global epidemic of obesity and overweight. About two thirds of Australian men, one half of Australian women and one quarter of Australian children are either overweight or obese. Researchers like Professor Billie Giles-Corti from the University of Western Australia suggest that this trend appears to be a physiological response to an environment that discourages physical activity and encourages overeating.

Community design contributes to our burgeoning waist lines in a number of ways. There is growing evidence that low density neighbourhoods with poorly connected street networks and with no-where to walk, affect how much time we spend walking, cycling and our ability to use public transport. Research has found for each additional hour spent driving, the odds of obesity increased by 6%. Another recent study found that people who drove to work, were more likely to be obese or overweight than people who used active modes.

Research also shows that there has been a rapid decline in children walking or cycling to school in the last decade. Parental concerns about traffic safety is cited as a key reason why parents drive their children to school, so much so that around 20% of all motor vehicle weekday morning rush hour journeys are parents dropping children at school. These high levels of peak-hour traffic make it less safe for children who do walk to school, and discourages other parents from allowing children to walk.

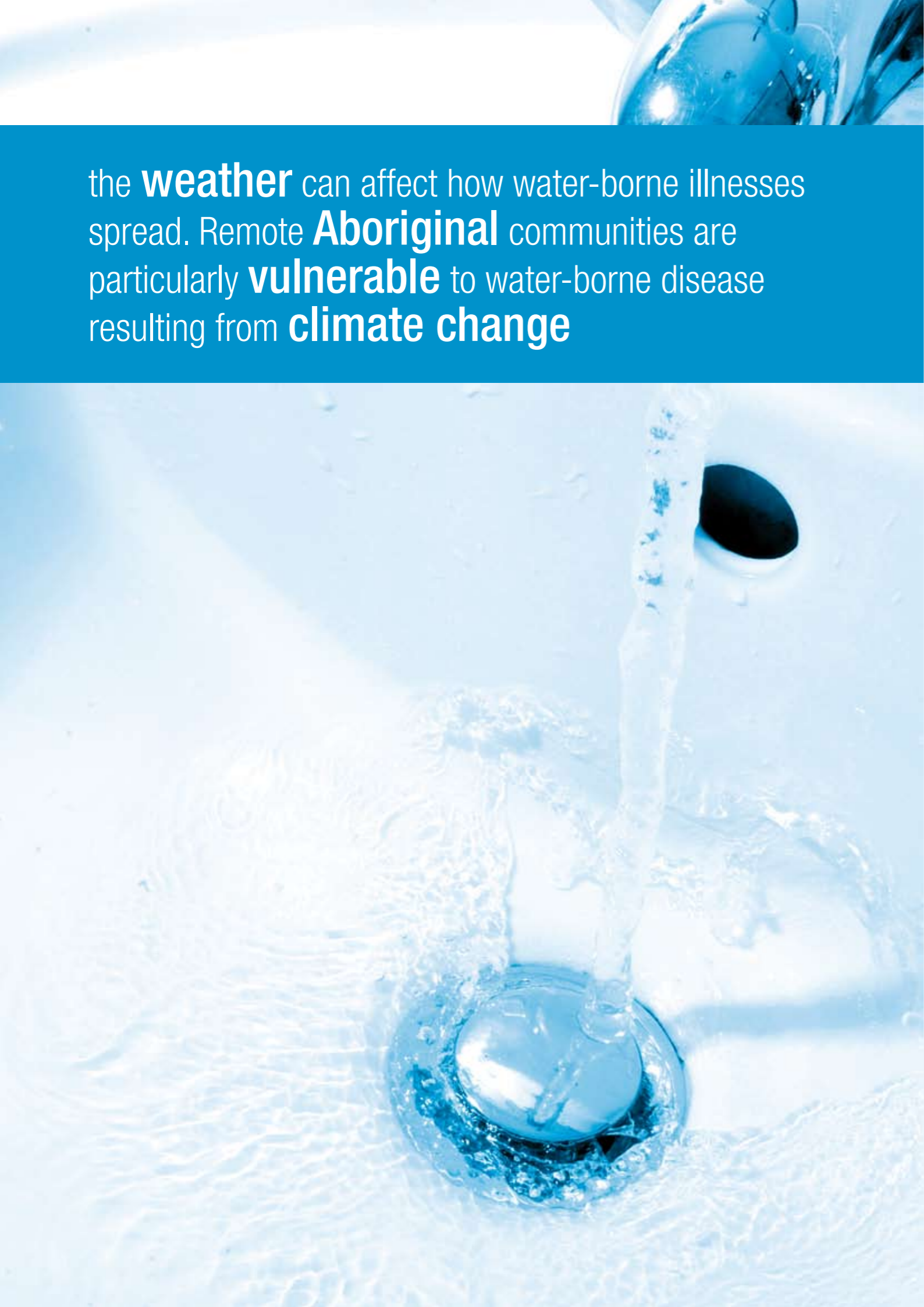
Climate change and asthma

Prevalence of asthma in Australia remains among the highest in the world, affecting about 3 in 20 children and 1 in 10 adults. Currently, it is estimated that asthma forces at least 2.6% of adult sufferers to take time off work in a given fortnight. Up to nearly 80% of asthma cases are thought to be related to allergy. Exposure to allergens is both a significant trigger of asthma episodes and also plays a role in causing asthma through sensitising individuals. There is also a substantial climatic component to the incidence of asthma. Climate affects plant growth and the production of pollen. It also affects the prevalence of aeroallergens from moulds, dust mites and cockroaches. Another asthma trigger is infection with some respiratory viruses, with seasonal cycles of infection related to local climate.

Research led by Dr Paul Beggs at Macquarie University is investigating how climate change has an effect on pollen production and therefore asthma. Dr Beggs and colleagues believe climate change is a plausible contributor to an increase in asthma cases around the world. They are planning experiments to show how, by growing allergenic plants in controlled environment chambers with different levels of atmospheric carbon dioxide. Increases in atmospheric carbon dioxide concentration and temperature result in increases in pollen suggesting a higher risk of asthma. Other research also suggests that increasing atmospheric carbon dioxide concentration and temperature increases the allergen content in pollen (the allergen in pollen is the actual trigger for asthma). Dr Beggs suggests that although further work is required in this

area, adaptive strategies like planting non-allergenic species in gardens and populated areas could help reduce the incidence of asthma from pollen.

Dr Hilary Bambrick and her colleagues from Macquarie University and the Australian National University have conducted preliminary research which suggests there are likely to be more asthma attacks in older people because of more frequent and intense El Nino events that are likely to occur as a result of climate change. In research funded by the Fairfax Family Foundation and an NHMRC capacity building grant, Dr Bambrick found that an El Nino event may increase asthma hospitalisations in people over 65 years old by around 40% above average. Dr Bambrick believes understanding the relationship between climate and asthma in different areas would enable more targeted health service planning, and allow the development of long-range early warning systems for especially high-risk asthma seasons. The El Nino-Southern Oscillation (ENSO) could provide considerable notice of a relatively good or bad forthcoming asthma season. Dr Bambrick's analyses suggest there may be up to around 80% difference in hospitalisations for some ages in some regions between low and high ENSO periods. Currently, some cities provide forecasts of heavy air pollution days and advise susceptible people to remain indoors. These warnings are only given a few days ahead, and do not consider 'non-pollutant' aeroallergens such as pollen, which contribute significantly to the likelihood and severity of an asthma episode.



the **weather** can affect how water-borne illnesses spread. Remote **Aboriginal** communities are particularly **vulnerable** to water-borne disease resulting from **climate change**

what research tells us

Climate change and water-borne illness

The weather can affect how water-borne illnesses spread. Research conducted by Associate Professor Shilu Tong and colleagues at the Queensland University of Technology has looked at the transmission of cryptosporidiosis (an infection from a water-borne parasite) in relation to weather variability. Their findings suggest there may be 50 more cases a year for an increase of 1°C maximum temperature on average in summer in Brisbane.

Professor Ian Falconer from the University of Adelaide studies toxic cyanobacteria which live in fresh and marine waters. They grow in summer and are dormant or die-off in winter. Factors like food (phosphorus and nitrogen) and water temperature affect their growth. In large amounts the bacteria are a health hazard because they produce poisonous toxins that target the liver. The longer or hotter the summer, the more they grow and hence the greater risk to our water supplies. They present a risk to our drinking water supplies and a recreational risk for body-contact water sports. Human and livestock poisoning have resulted from cyanobacterial water-blooms.

One toxic species *Cylindrospermopsis raciborskii* appears to be moving from equatorial regions into temperate latitudes. This species was first described in Indonesia and has since been found in the USA, and northern Europe. Researchers believe the spread of this bacterium is due to climate change. In 1979 *Cylindrospermopsis*

raciborskii was the source of human poisoning on Palm Island in Queensland during a dry summer. Professor Falconer's research is funded by the Cooperative Research Centre for Water Quality and Treatment, Bolivar, South Australia.

Remote Aboriginal communities are particularly vulnerable to water-borne disease resulting from climate change. In central Australia, Aboriginal people living in remote arid communities already have a high number of diarrhoea admissions among children throughout the region. This is likely to increase with temperature. Given assumptions relating to future climate projections scientists are predicting an increase of 3-5% in diarrhoeal admissions by 2020, and of 5-18% by 2050 (Australian National University).

Climate change and food production

Climate change, combined with changes in how we produce and distribute food, and how we behave as consumers, have the potential to affect food-borne disease in the coming century. Currently, food-borne disease is a considerable burden on Australian society with 5.4 million cases annually, costing an estimated \$1.2 billion dollars. There are over 200 different types of food-transmitted illness, caused by a number of different viruses, bacteria and parasites.

Climate change may increase the incidence of infections, such as salmonellosis, and diseases caused by toxins, such as ciguatera. Australian research has shown that cases of salmonella increase with mean monthly temperature of the previous month. The lag of one month suggests that temperature might be more influential earlier in the production process rather than at the food preparation stage. This knowledge can help to guide policy on food preparation and distribution.

a number of **endemic** infections are likely to **increase** with increased temperature and more frequent severe **weather** events

what research tells us

An alert system to combat heat extremes

New research led by Professor Neville Nicholls at Monash University has developed a simple heat alert system for Melbourne, which will be particularly important for a future world with warmer summers. If the average of the predicted maximum temperature on one day and the predicted minimum temperature for the following morning exceeds 30°C, a heat alert would be issued to the public and/or local authorities, ambulance services and other health and welfare organisations. Professor Nicholls suggests that in the current climate about two heat alerts per year are needed in Melbourne. The alert would warn of serious health risks and advise simple responses to avoiding heat stress. These would include opening a window, drinking plenty of water, using a fan, light and loose fitting clothing and avoiding unnecessary exertion. The alert system could also include responses to assign increased ambulance and hospital resources during hot conditions. Professor Nicholls' research is partly funded by Victorian Department of Human Services.

Re-emergence of malaria in Australia, because of climate change, is unlikely

Scientists are confident malaria will not become re-established in northern Australia as a result of the more favourable environmental conditions likely to result from climate change. Although the mosquito vectors for malaria transmission are present, the ability of our health services to diagnose and treat cases and contacts will continue to prevent malaria transmission cycles resulting from those coming to Australia with malaria acquired overseas (Professor Bart Currie).

Dengue is on the rise in Australia

Dengue fever is an increasing threat to northern Australia, with several outbreaks occurring in north Queensland since the 1980s. Projected climate change in northern

Australia, especially wetter conditions, will favour expansion of the mosquito vector populations. Mosquito species responsible for transmitting dengue have been found breeding for the first time in 50 years in the Northern Territory and Torres Strait islands. Dengue is also a major problem in many urban centres in Southeast Asia and the Pacific, with predictions of increasing numbers with increasing urban populations. Travellers with dengue will therefore continue to enter an Australia that is increasingly receptive to local dengue virus transmission. How much additional risk there is from global climate change remains uncertain (Professor Bart Currie).

Extreme weather events are linked to some infectious diseases

The number of extreme weather events such as tropical cyclones is on the rise with climate change. Studies suggest extreme weather is linked to some infectious diseases. A 2001 study found mosquitoes infected with the Japanese encephalitis virus were blown from Papua New Guinea into the Torres Strait. Japanese encephalitis is one of the biggest known potential importation threats to mainland Australia.

A number of endemic infections are likely to increase with increased temperature and more frequent severe weather events. Professor Bart Currie from the Menzies School of Research in Darwin studies melioidosis, an illness caused by an environmental bacterium found in soil and surface water across the tropical north. Melioidosis is an important cause of blood infections. Professor Currie's work shows deaths are closely linked to the monsoonal season and especially to severe weather events. His melioidosis research is funded by the National Health and Medical Research Council and a grant from the Northern Territory Government Research and Innovation Fund.

Ross River virus is linked to climate

Ross River virus (RRV) is the most prevalent human disease spread by insects (vector-borne) in Australia and is likely to be an increasingly important health issue. There are more than 4,000 laboratory-confirmed RRV cases each year and the national economic impact of RRV disease is thought to be of the order of tens of millions of dollars annually.

Research led by Associate Professor Shilu Tong and funded by the National Health and Medical Research Council has looked at the impact of climate variability on the transmission of RRV. Climate, geographic region and even sea tides can affect the density of mosquitoes that transmit RRV. Climate and environmental factors also influence the breeding, development rate, nutritional status, survival, longevity, dispersal, host-seeking behaviour of the virus itself. Climatic and environmental changes also lead humans to migrate, to develop new lands, and to live in settings that favour the spread of the disease. Clearing and settlement of new lands disturbs an existing ecosystem and could increase the potential for outbreaks of RRV disease.

Associate Professor Tong says an assessment of factors predicting RRV disease transmission will help local authorities identify periods of high risk, optimising the provision of additional mosquito control measures. "Climate data are inexpensive and relatively easy to collect. It is possible to improve the effectiveness of public health responses through the prediction of RRV disease epidemics with the integration of climate and disease surveillance data," he says.

the **decisions** we make individually and collectively when we choose our own homes have the **potential** to **affect** the quality of environment in which we live

what research tells us

Meeting the mental health needs of rural communities

The potential effects of drought and other issues on mental health is the focus of a major project funded through the National Health and Medical Research Council. Professor Brian Kelly from the University of Newcastle's Centre for Rural and Remote Mental Health is leading a research collaboration of rural research units in New South Wales. "In its broadest sense mental health encompasses individual social and emotional well-being, but also needs to include the wellbeing of families and communities," Professor Kelly says. Drought has had a major impact on rural communities – affecting economic stability and future hopes, and has placed a particular strain on farmers and the communities that support them. Other changes faced in some rural areas include population change, loss of infrastructure, and the impact of economic factors on primary industry. "Maintaining the mental health of rural communities is critical to the wellbeing of the people living through these difficult times, and to maintaining healthy and productive primary industries through the support of the people on whom such industry relies," says Professor Kelly.

Research is currently being conducted to find better ways of meeting the mental health needs of rural communities. A study funded by the Australian Rotary Health Foundation and conducted by the NSW Centre for Rural and Remote Mental Health is investigating ways of developing better mental health-related service networks in rural and remote areas. Another program led by the NSW Centre focuses on early intervention for mental health problems in farming communities. This study, funded by the National Suicide Prevention Strategy, aims to overcome barriers to mental health care for farming communities,

a critical issue in addressing the problem of suicide in farmers. This research is being conducted in partnership with the NSW Farmers Association, illustrating the benefits of health researchers working closely with community leaders and their organisations in work aiming to address these major issues in rural areas.

Indigenous cultural and natural resource management for healthy living

Preliminary health research led by Professor Stephen Garnett and Dr Paul Burgess at Charles Darwin University shows traditional lifestyle practices benefit Indigenous health. The "Healthy Country Healthy People" project was undertaken at the request of Traditional Owners in Arnhem land and involved a transdisciplinary collaboration of medical, ecological and social researchers. The research was funded by Land and Water Australia, the National Health and Medical Research Council and Pfizer CVL.

The study of 301 participants found that indigenous cultural and natural resource management (ICNRM) promoted a better diet and greater levels of physical activity, and consequently a substantial reduction in the risk of developing diabetes and cardiovascular disease. Cardiovascular disease and diabetes account for 40% of excess Indigenous mortality and more than 21,800 potentially preventable hospital admissions each year. This research suggests that significant health economic saving could be generated through an investment in ICNRM. The results also demonstrate higher levels of landscape health where Indigenous management was practiced, increasing its resilience to climate change.

While the researchers believe further work is needed to fully understand the implications of the data they obtained, they also believe

social determinants of health such as meaningful employment, education and the fulfillment of responsibilities to country form an important part of a healthier future for Indigenous Australians. However, investment in ICNRM means assisting people to stay connected to their traditional country, at a time when Indigenous Australians are subjected to increasing pressures to align with mainstream goals and aspirations which will potentially force them to move away from country. The implications of policies that encourage people to leave country need to be examined holistically.

Planning healthy cities for healthy living

Professor Billie Giles-Corti at the University of Western Australia carries out research into planning healthy cities that encourage active living. She is currently leading a five-year study of 1800 people moving into new homes in 74 new suburbs around Perth. The study found affordability was the top factor affecting their choice. Yet, over half of respondents said that having shops within walking distance and pedestrian-friendly neighbourhoods were also important. Professor Giles-Corti says a healthy context for a 'home' is one that has easy access to shops, schools, services, public transport, places to work and open spaces. She believes Australians need to re-think their views on living in medium density and consider smaller more sustainable housing in more densely populated communities. "Each of us can contribute to the change," says Professor Giles-Corti. "The decisions we make individually and collectively when we choose our own homes have the potential to affect the quality of environment in which we live." Her team's research is funded by the Western Australian Health Promotion Foundation (Healthway) and the Australian Research Council.

health benefits from reducing greenhouse gas emissions

responding to climate change

“ Few scientists doubt that the serious problems we now face on Planet Earth are due to human activities, the product of the enormous growth of the population in the last fifty years and the unexpected consequences of the application of science and technology to our way of life.”

PROFESSOR FRANK FENNER AC

Winner Japan Prize 1988
Previously, Director of the John Curtin School of Medical Research and the Centre for Resource and Environment Studies, Australian National University Patron, Nature and Society Forum

“ Ever notice how the sun makes the morning dew in the grass sparkle, creating a scene that lasts with you for the rest of the day? Al Gore once said; “Future generations may well have occasion to ask themselves: ‘Why didn’t they wake up when they had the chance?’” The chance to wake up is now.”

PAUL SESSAREGO, Year 10
Catholic Regional College

Health co-benefits resulting from emissions mitigation actions

There will be several health benefits from taking actions that reduce greenhouse gas emissions.

1. Reduced fossil fuel combustion (industry, power generation, transport fuel) will reduce deaths and hospitalisations from ambient air pollutant exposure.
2. A lower-emission urban transport system, with upgraded public facilities, will increase physical activity – walking, cycling. This will reduce over-weight, improve blood lipid and hormone profiles, and increase social contact and mental wellbeing. Road trauma should decline.
3. Reduced red (especially ruminant) meat consumption (the livestock production sector, globally, accounts for almost one fifth of greenhouse gas emissions) will help reduce the risks of some diseases associated with meat intake (e.g. large bowel cancer) and with meat’s saturated fat content (heart disease).
4. More energy-efficient housing will reduce family costs, and, especially for lower-income households, will reduce mental stress. Improved insulation and ventilation of homes, reducing the need for heating and air conditioning, and also reducing exposure to indoor air pollutants.

Other “global environmental changes” and human health

Climate change is one of a number of unprecedented environmental changes that are occurring at global and regional scales, reflecting the very great pressures that humans are now putting on the planet’s atmosphere, forests, soils, freshwater systems and oceans. All of these large-scale changes, often affecting the functioning of natural systems, have consequences for human wellbeing and health.

Examples of health effects from these changes, separate from those of climate change, include:

- Stratospheric ozone depletion (“hole in the ozone layer”): increased risks of skin cancer and eye disorders, from increased exposure at higher latitudes to ultraviolet radiation.
- Deforestation and other land clearance: human contact with new infectious agents, previously confined to non-human species (rodents, birds, monkeys, etc.).
- Depletion of natural freshwater supplies (river systems, aquifers): risks to domestic hygiene; impairment of local food production (nutrition, and livelihoods).
- Acidification of the world’s oceans because of build-up of carbon dioxide in atmosphere: threat to productivity of marine food-web, impairing yields of seafood.
- Marked increase in level of biologically active nitrogen compounds in global environment (mostly due to fertiliser and fossil fuel use): impaired crop yields – affecting food security and nutrition; increased algal blooms in waterways with more cholera transmission; possible risks of “blue baby syndrome” (methaemoglobinaemia) and stomach cancer.

Adaptation is an effective (though only partial) option for managing climate change

The Prime Minister’s Science, Engineering and Innovation Council (PMSEIC) met in Canberra on 22 June 2007 to present the report “Climate Change in Australia: Regional Impacts and Adaptation.” Key authors Professor Gerard Sutton, Chair of Universities Australia; Dr Chris Mitchell, Research Theme Leader, Climate, Weather and Ocean Prediction with CSIRO; and Dr Deborah Rathjen, CEO and Managing Director of Bionomics Limited highlighted the susceptibility of Australia’s economy to climate change, and the need for and benefits of adaptation. Specific mention was made of the need to protect the health of Australians.

The report found adaptation is one of the most effective options open to Australia to help manage the risk of climate change. It will help us cope with our changing climate in the short to medium term, while other longer term mitigation measures can take effect and help reduce our greenhouse footprint. The report also found everyone needs to play a role in adapting to our changing climate. The responsibility for adaptation does not rest solely with any particular level of government or individual. Action must occur at all levels of the community. Adaptation is likely to be more effective where roles and responsibilities operate seamlessly.

The report found that we need to fill gaps in our knowledge about climate change so we can draw up effective adaptation plans.

Specifically, gaps exist in:

- Knowledge about both future regional climates and the impact of these changes on local communities, economies, industry and infrastructure
- Research into and knowledge of the economic, social and health implications of climate change.

The report recommended the following adaptation options for the health sector:

1. Public education and awareness
2. Early-alert systems: heat waves, other impending weather extremes, infectious disease outbreaks
3. Community/neighbourhood-based (“buddy”) support schemes (for the elderly, frail)
4. Climate-proofed housing design (insulation, mosquitoes etc)
5. Disaster preparedness, including health-system’s ‘surge’ capacity
6. Enhanced infectious disease control programs, food safety, vaccine programs, vector control, case detection and treatment – for example, 2007 Budget initiatives of \$2.1 million over three years for mosquito control operations in the Torres Strait and a further \$0.6 million over two years for mosquito control operations on Groote Eylandt island
7. Improved surveillance of:
 - Risk indicators (for example, mosquito numbers, aeroallergen concentration, species distribution)
 - Health outcomes (for example, infectious disease outbreaks, rural suicides, seasonal asthma peaks)
8. Appropriate healthcare facilities: ambulances, hospitals, trained health workers, including appropriate workforce training and mid-career development of health professionals

To reduce deaths from heat waves, preventive actions include:

- Early alert systems
- Public education about risks and appropriate behaviours (drinking, clothing etc)
- Improved housing insulation
- Better long term planning of urban layout, to reduce ‘heat island’ effect.

http://www.dest.gov.au/sectors/science_innovation/publications_resources/profiles/climate_change_in_australia.htm

finding solutions through further research

find out more

Some specific topics and issues that need further research

- Studies of how variations and trends in climatic and environmental conditions in Australia affect physical health (including risks of injuries), infectious disease occurrence and mental health

Specific issues relating to climatic conditions include: heatwaves and deaths (especially in vulnerable groups); effects of warmer temperatures on food-borne and water-borne infections; influences on allergic disorders (asthma, etc.); changes in the ecology of mosquito-borne infections (dengue, Ross River virus, etc.).

- Studies of the impacts of prolonged drought and unusual drying trends on wellbeing and health in rural Australia. The recent experience in much of regional Australia can provide important insights into vulnerabilities, health risks and ways of lessening impacts on health

In addition to research that identifies and quantifies the risks to health from environmental and climatic changes and from aspects of the urban environment, studies to assess the effectiveness of neighbourhood, community and regional strategies to lessen risks to health are needed. This would include research in the following area:

- Demonstration projects, in partnership with developers, showcasing improved urban environmental and health outcomes through innovation. Related to this is the importance of investing in evaluation of urban development, with a focus on environmental and human outcomes
- Strengthened capacity in the public health and urban management workforces, at local, state and national levels, and in the private sector. This will require the strengthening of teaching programs in public health and urban management, and professional development for the existing workforce

More generally, there is a need in Australia to cultivate and support a broader-based interdisciplinary approach to studying the ways in which the natural, built and social environments influence patterns of human behaviours, exposures and health outcomes.

This will require new, systems-based, approaches to studying, understanding and responding to these larger-scale influences on our patterns of health and disease – influences arising from the design of our cities and transport systems; from the types, sources and distribution of food; from climatic influences on the emergence and spread of infectious diseases in Australia and the surrounding region; and from the environmental and climatic stresses impinging on rural and remote Australia.

- **An Inconvenient Truth** premiered at the 2006 Sundance Film Festival and opened in New York and Los Angeles on 24 May 2006. The documentary won two Academy Awards, was directed by Davis Guggenheim and featured former United States Vice President Al Gore.
http://en.wikipedia.org/wiki/An_Inconvenient_Truth
<http://www.climatecrisis.net/>
- In May 2006 the Australian Academy of Science hosted a Fenner Conference on the topic **Urbanism, Environment and Health** at the Shine Dome in Canberra. The conference examined our urban way of life and the consequences for the health of people and the health of the environment. See:
<http://www.smh.com.au/multimedia/sickcities/start.html>
<http://www.publish.csiro.au/journals/phb>
<http://nceph.anu.edu.au/Fenner2006/index.htm>
- **The Stern Review on the economics of climate change** report was released on 30 October 2006 by economist Nicholas Stern for the British government and discussed the effect of climate change on the world economy.
http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
- The Prime Minister's Science, Engineering and Innovation Council (PMSEIC) met in Canberra on 22 June 2007 to present the report **Climate Change in Australia: Regional Impacts and Adaptation**.
http://www.dest.gov.au/sectors/science_innovation/publications_resources/profiles/climate_change_in_australia.htm
- The CSIRO and the Australian Bureau of Meteorology released "**Climate change in Australia: technical report 2007**" on 2 October 2007 to update the assessment of Australia's changing climate.
<http://www.csiro.au/resources/ps3j6.html>
- The **Nobel Peace Prize 2007** was awarded to the Intergovernmental Panel on Climate Change (IPCC) and Albert Arnold (Al) Gore Jr on 12 October 2007 for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change. Many Australian scientists have contributed to the work of the IPCC.
http://nobelprize.org/nobel_prizes/peace/laureates/2007/index.html



contributors



Professor Tony McMichael
National Centre for Epidemiology
and Population Health
The Australian National University



Professor Billie Giles-Corti
School of Population Health
The University of Western Australia



Professor Ian Falconer
The University of Adelaide and CRC for
Water Quality and Treatment



Dr Paul Burgess
Menzies School of Health Research
Charles Darwin University



Professor Tony Capon
Urban Systems Program
CSIRO Sustainable Ecosystems



Dr Hilary Bambrick
School of Medicine
The University of Western Sydney



Associate Professor Shilu Tong
School of Public Health and Institute of
Health and Biomedical Innovation
Queensland University of Technology



Professor Brian Kelly
Director, Centre for Rural and
Remote Mental Health
The University of Newcastle



Professor Michael Good
Director, Queensland Institute of Medical
Research and Chair, National Health and
Medical Research Council



Dr Paul Beggs
Department of Physical Geography
Division of Environmental and Life Sciences
Macquarie University



Professor Neville Nicholls
School of Geography and
Environmental Science
Monash University



Dr Stephanie Williams
Healthy Planet, Places and People
Report Editor
Business and Corporate Affairs Manager
Research Australia



Professor Bart Currie
Head, Tropical and Emerging Infectious
Diseases Division
Menzies School of Health Research
Charles Darwin University

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Research Australia visit
www.researchaustralia.org

Sydney

The Exchange Centre
20 Bridge Street
Sydney NSW 2000
t. +61 2 8298 8365
f. +61 2 9227 0636
e. enquiries@researchaustralia.org

Melbourne

Suite 2 Mezzanine
257 Collins Street
Melbourne VIC 3000
t. +61 3 9662 9366
f. +61 3 9639 4126

Research Australia Limited
ABN 28 095 324 379