



Climate Change and Health: Impacts on Remote Indigenous Communities in Northern Australia

Donna Green
Climate Change Impacts and Risk

CSIRO Marine and Atmospheric Research Paper 012

November 2006

Enquiries should be addressed to:

Dr Donna Green
CSIRO Marine and Atmospheric Research
PMB #1, Aspendale, Victoria 3195
Tel: 0417 455 920
Fax: (03) 9239 4444
donna.green@csiro.au

Green, Donna Lisa.

Climate change and health : impacts on remote Indigenous communities in northern Australia.

ISBN 1 921232 31 5.

1. Climatic changes - Health aspects - Australia, Northern.
2. Aboriginal Australians - Health and hygiene - Australia, Northern. I. CSIRO. II. Title.

613.110899915

Important Notice

© Copyright Commonwealth Scientific and Industrial Research Organisation ('CSIRO') Australia 2006

All rights are reserved and no part of this publication covered by copyright may be reproduced or copied in any form or by any means except with the written permission of CSIRO.

The results and analyses contained in this Report are based on a number of technical, circumstantial or otherwise specified assumptions and parameters. The user must make its own assessment of the suitability for its use of the information or material contained in or generated from the Report. To the extent permitted by law, CSIRO excludes all liability to any party for expenses, losses, damages and costs arising directly or indirectly from using this Report.

Use of this Report

The use of this Report is subject to the terms on which it was prepared by CSIRO. In particular, the Report may only be used for the following purposes.

- this Report may be copied for distribution within the Client's organisation;
- the information in this Report may be used by the entity for which it was prepared ("the Client"), or by the Client's contractors and agents, for the Client's internal business operations (but not licensing to third parties);
- extracts of the Report distributed for these purposes must clearly note that the extract is part of a larger Report prepared by CSIRO for the Client.

The Report must not be used as a means of endorsement without the prior written consent of CSIRO.

The name, trade mark or logo of CSIRO must not be used without the prior written consent of CSIRO.

CONTENTS

- ABSTRACT..... 1**

- 1. CLIMATE CHANGE AND HEALTH: IMPACTS ON REMOTE
INDIGENOUS COMMUNITIES IN NORTHERN AUSTRALIA 3**
 - 1.1 Introduction 3**
 - 1.2 Regional climate change projections..... 4**
 - 1.3 Health impacts..... 5**
 - 1.4 Aspects of climate change likely to affect health..... 6**
 - 1.5 Socio-economic context affecting adaptive capacity 8**
 - 1.6 Conclusion..... 9**
 - 1.7 References..... 10**

LIST OF FIGURES

Figure 1 Map of remote Indigenous communities 5
Figure 2 Climate change and health: direct and indirect pathways 5

LIST OF TABLES

Table 1 Climate projections for regions in Northern Australia (2050).....4

ABSTRACT

Climate projections for northern Australia include higher temperatures, more extreme rainfall, sea-level rise and more intense cyclones within the next 50 years. Consequently, long sections of coastline, river deltas, wetland areas and off-shore islands will be susceptible to erosion and saltwater inundation, while inland areas are likely to have more bushfires, dust storms, extremes in temperatures, flooding and droughts. Many of these biophysical impacts have direct and indirect effects on the health and well-being of people living in affected regions, especially those who are sensitive to environmental change and who, for various reasons, have a low capacity to adapt. Such people include thousands of Indigenous Australians living in outstations scattered across northern Australia from the Kimberley, through to Arnhem land, the central deserts, far north Queensland and the Torres Strait. These communities are disproportionately vulnerable to the impacts of biophysical change due to a number of factors. Many Indigenous people living in remote areas have a heightened sensitivity to ecosystem change due to the close connections that exist for them between the health of their 'country', their physical and mental well-being and the maintenance of their cultural practices. A biophysical change manifested in a changing ecosystem has, for example, the potential to affect their mental health in a way not usually considered in non-Indigenous societies. A lack of basic infrastructure, lower social and economic status and existing chronic health problems also contribute to many of these communities having lower adaptive capacity. Even though Indigenous Australians living in remote communities have been recognised as highly vulnerable in the international climate impacts literature, there is little domestic research that considers their specific vulnerability which could be used to guide policy makers. This paper reviews evidence of the likely health impacts for these communities and provides material to inform adaptation strategies.

1. CLIMATE CHANGE AND HEALTH: IMPACTS ON REMOTE INDIGENOUS COMMUNITIES IN NORTHERN AUSTRALIA

1.1 Introduction

The Intergovernmental Panel on Climate Change's *Third Assessment Report* (TAR) nominated Indigenous peoples as one of the two most threatened groups (along with small island state populations) likely to suffer adversely from climate change (Intergovernmental Panel on Climate Change 2001). Principal factors leading to this vulnerability relate to Indigenous people's exposure to climate hazards and their high reliance on natural systems to sustain their traditional livelihoods and cultural practices. Within the Australian and New Zealand chapter of the TAR, as well as in the federal government's guide on impacts and adaptation (Allen Consulting Group 2005), Indigenous Australians living in remote communities are similarly identified. Many of these communities have significant vulnerability to climate change due to their sensitivity to the direct and indirect impacts of climatic change on various aspects of their lives, in combination with their low adaptive capacity.

Over 100,000 Indigenous people live in remote areas of Australia, the majority in settlements in the north of the country. A large number of these communities have inadequate 'health hardware' (water and power supplies, rubbish and sewage removal) and frequently have dilapidated housing, a lack of meaningful employment opportunities and inappropriate or insufficient health services (AIHW 2006). The shortage of doctors and nurses for Indigenous communities (Ring & Brown 2002) provides a level of stress on the public health system that will be compounded by the health impacts caused by climate change. This problem is likely to be further exacerbated by the high population growth rates of the Indigenous population in the north (Taylor 2003). Any increase in the number of people living on floodplains and in coastal areas is likely to proportionately increase the number of people exposed to climate risks unless adaptation strategies are effectively implemented.

Indigenous health concerns and needs are somewhat different to mainstream health service requirements (Braaf 1999; NTG 2005; Pittock 2003). Many Indigenous Australians living 'on country' have heightened sensitivity to environmental change due to its impacts on their mental and physical well-being via disturbance of their cultural practices (Jackson 2005; Smith 2004). This relationship suggests that biophysical changes are likely to have a range of indirect health impacts that need to be considered in addition to the various well-discussed impacts attributed to the changing climate on urban-based non-Indigenous populations. Therefore, when considering the likely health impacts from climate change on Indigenous Australians living in remote communities it is crucial to explicitly address the interconnections between the health of 'country', culture and mental and physical well-being. For example, environmental change could affect traditional activities including ceremonial practices, hunting and bush tucker collection – impacts that have implications for mental health as well as nutritional intake (Rose 1996). Pre-existing physical and psychological diseases caused by dispossession and poverty further challenge the ability of Indigenous communities to cope with the health impacts of climate change (Reid 1982) (Braaf 1999; IGWG 2004; Ring & Brown 2002). As yet there is little research published about the specific nature of this situation that could be used to guide policy for anticipatory adaptation strategies (Ellemor 2005).

1.2 Regional climate change projections

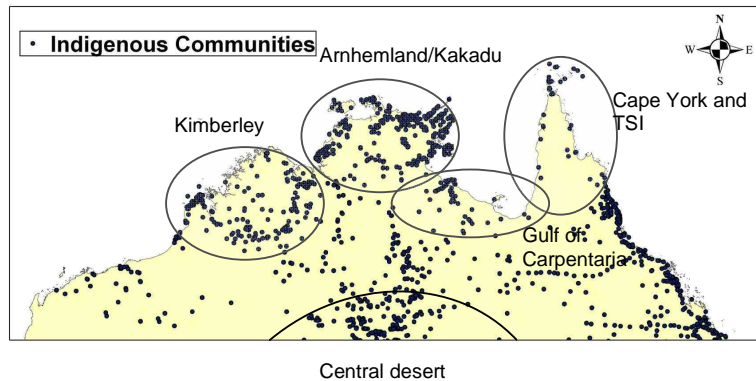
What are the patterns of climatic changes that may occur and affect Indigenous communities' health and well-being in northern Australia for the next 50 years? Recent work that specifically focuses on regional (rather than state) based assessments include (Green & Preston 2006) and is summarised in Table 1. The regions in this assessment include: Kimberley, Kakadu/Arnhem land, Central desert, Gulf country and Cape York. Projections were estimated using the OZCLIM climate scenario generator (Page & Jones 2001), and results from a range of climate models and emissions scenarios were averaged to yield a central estimate of future climate change.¹ In addition, historical cyclone track data from the Bureau of Meteorology were analysed to estimate the relative risk of cyclone exposure across various regions of northern Australia. Prior to this work, climate projections and/or impact studies for Australia have tended to use state-based boundaries or natural resource management areas (Hennessy et al. 2004; Preston et al. 2006; Walsh & Mitchell 2002).

Table 1 Climate projections for regions in northern Australia (2050)

Region	Temp. increase	Precip. change	Low-lying areas potentially exposed to coastal erosion/salt inundation	Areas exposed to cyclone risk
Kimberley	1.5-2 ⁰ C	+/-2%	Fitzroy R, Stokes Bay, Beagle Bay, Pender Bay, Walcott In., & Cambridge Gulf.	High around Broome/Derby, elsewhere average/low.
Kakadu/Arnhem land	1.9-2.2 ⁰ C	+/-4%	Finniss R, Daly R, Hyland Bay, Keyling Inlet, Victoria R, Adelaide R, Chambers Bay, West Alligator R, South Alligator R, East Alligator R, Arafura wetlands, Maningrida, Milingimbi, Glyde R, Buckingham Bay, & Arnhem Bay.	Above average Melville Is. elsewhere average/low.
Central desert	1.3-1.7 ⁰ C	+/-4%	n/a	n/a
Gulf of Carpentaria	1.3 – 2 ⁰ C	+/-4%	Settlements around entire southern gulf shore inc. nearby settlement of Borroloola, Mornington Is., Roper River area, & Groote Is.	Low/average
Cape York & TSI	1.3-1.8C	+/- 2%	Mitchell river and coastal areas south (nearby settlement Kowanyama), Torres Strait Islands.	Low

¹ These central estimates of a range of change used to simplify the discussion of climate impacts, for details of projection methods, models used and data analysis techniques see: URL http://www.dar.csiro.au/sharingknowledge/files/regional_climate_projections2050.pdf

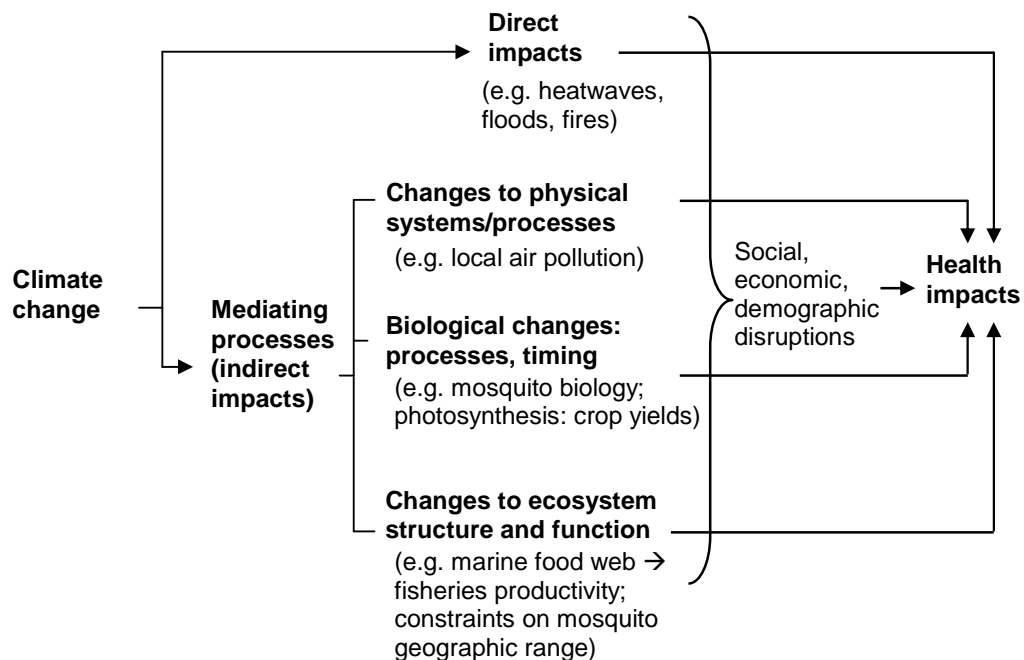
Figure 1 Map of remote Indigenous communities indicating climate projection regions



1.3 Health impacts

For Indigenous people living on country, climate change will have direct and indirect health impacts. These, of course, will overlay the existing poor health status of Indigenous people in this region – and some synergistic effects may arise (as with cardiovascular disease and susceptibility to heat waves). Existing chronic health problems include high levels of diabetes, heart and kidney diseases, respiratory diseases and infectious diseases (ECU 2006). A model of the direct and indirect pathways by which climate change can impact on health (after (McMichael 2006)) is presented in Figure 2.

Figure 2 Climate change and health: direct and indirect pathways



The most recent assessment of the impacts of climate change on health for Australia is (Woodruff et al. 2005). This report identifies the effect on several health outcomes depending on various greenhouse gas emission mitigation strategies, but does not specifically assess impacts

for Indigenous populations. Currie (2001) highlights the potential impacts of environmental and climate change on infectious disease patterns in northern Australia. This paper suggests diseases affecting this region now, or in the future include: malaria, dengue, Murray Valley encephalitis, Japanese encephalitis, melioidosis, leptospirosis and scrub typhus.

1.4 Aspects of climate change likely to affect health

Changes in temperature, humidity, amount and timing of rainfall and sea-level rise all potentially affect morbidity and mortality via direct and indirect routes. Several demographic and socio-economic factors act to amplify or mitigate the impacts of the changing climate.

1) Temperature and humidity

Across the north, climate change is expected to bring warmer 'summers' and milder 'winters' with more frequent and intense heat waves (Green & Preston 2006; Hennessy et al. 2004; Kovats et al. 2001). In southern central arid regions the increase in temperatures is likely to result in less winter respiratory infections and deaths. However, the majority of impacts associated with elevated temperatures are likely to be negative. The rate of temperature change, the length of hot periods, and the increase in higher night time temperatures can all contribute to physiological heat stress (CSIRO 2006).

The average number of days above 35°C is expected to increase substantially in several sites in the Northern Territory. For example in Oenpelli there are presently 124 days over 35°C, by 2030 there are likely to be between 4 and 72 additional days over this temperature (Hennessy et al. 2004). For Alice Springs there are 90 days over 35°C currently, with an additional 6 to 35 per year projected. Similar increases are projected for continuous runs of three days of elevated temperatures in this modelling work. At these temperatures there are real risks that an increase in heat waves will cause an increase in incidence of heat rashes, heat exhaustion and even heat stroke - which can lead to death. Elderly people and those with poor cardiovascular health and low physical fitness are at highest risk (McMichael et al. 2003). The latter concerns are disproportionately prevalent in Indigenous communities.

Other health problems likely to increase include asthma (McMichael et al. 2003) and an respiratory problems associated with an increase in bushfires (caused by higher temperatures) due to higher levels of airborne particulates, as well as the direct health risk of the fire itself (Johnston et al. 2002). These respiratory diseases can be exacerbated by changing ecosystems that result in vegetation loss and increases in wind blown dust (McTainsh & Lynch 1996).

Indirect impacts of temperature change can also have significant impacts on health. The incidence of communicable diseases such as bacterial diarrhoea, which are more common in hot dry conditions, may increase, unless additional preventive actions are taken. Over 600 cases of diarrhoea cases were recorded in Alice Springs hospital a year. An increase in temperature of 1.0-3.5°C by 2050 would lead to an estimated 5-18 percent increase on these figures (McMichael et al. 2003) although caution is needed with this estimate of diarrhoeal disease increase as it is very likely to be modified by many other factors (for example a new vaccine is now being used which will decrease rates (Currie, pers. comm. Oct 2006)).

Mosquito-borne diseases, for example, malaria, are likely to be affected by various combinations of changing temperatures, humidity and rainfall. A key concern for the Torres Strait and Far North Queensland is an increase in infected people entering the region and infecting the local mosquito population (Currie, pers. comm. Oct 2006). Several deaths have occurred in the Torres Strait from malaria since 1990. Proximity to Papua New Guinea makes the inhabitants of the Torres Strait Islands vulnerable to malaria through wind-borne mosquitoes and potentially, the re-establishment of the disease if conditions become more favourable and preventative public health programmes are not in place (Currie 2001).

Japanese Encephalitis (JE) has been found on Badu (Torres Strait), along with evidence of widespread JE virus activity throughout the outer islands possibly brought by wind-blown

mosquitoes from outside the region, potentially Papua New Guinea given its proximity to the northwest islands² (Hanna et al. 1996).

Dengue presents an obvious climate-related risk to Indigenous communities in northern Australia. Although the virus is not currently endemic, there are sporadic epidemics introduced, with occasional cycles over winter in the local mosquito populations in northern Queensland. Public health vigilance has, in recent years, precluded its occurrence in the Northern Territory. Scenario-based modelling of the future transmissibility of dengue under conditions of climate change indicates its likely spread southwards along both the eastern and western coasts of Australia (Woodruff et al., 2005).

Several other climate-sensitive infectious diseases, including leptospirosis and scrub typhus, also pose potential hazards – although there has been relatively little research done on how these particular diseases are affected by climatic conditions and variations.

2) Precipitation

There are significant seasonal variations for all the regions in the north of Australia from climate change. More rain in the monsoon season increases the chance of drowning or injury from being hit by heavy objects (McMichael et al. 2003). Flash flooding can also indirectly create health impacts through damaging building, telecommunication and transport infrastructure.

The impact of precipitation changes, along with temperature changes, on a range of other infectious diseases transmission rates is complex because those rates tend to be very locally specific, depending on a combination of several physical factors and the presence of the necessary 'vector' host (for example: fleas, mosquitoes; or birds or mammals). Increasing temperature and humidity is also likely to impact on the time taken for the pathogens to develop to an infectious stage in the vector host (Currie 2001; Patz & Olson 2006). Murray Valley encephalitis (MVE) is endemic in northern Australia where humans become infected if bitten by infected mosquitoes. MVE has been shown to have significant association with heavy rainfall in Alice Springs and Tennant Creek (Whelan et al. 2003).

Storms and floods can facilitate the spread of infectious enteric diseases that cause diarrhoea in young children. More extreme rain could increase rates of melioidosis which is known to be associated with wet weather. Melioidosis is endemic to northern Australia and is associated with exposure to mud and pooled surface water. (Cheng et al. 2006) discusses several clustered cases that were found to be associated with extreme weather events and environmental contamination. (Currie & Jacups 2003) suggests that an increase in heavy rain may result in a shift towards inhalation as the mode of infection which would lead to more severe illness.

3) Coastal erosion, sea-level rise and cyclones

Many coastal communities in the north of Australia are vulnerable to storm surges due to relatively shallow coastal waters which affect the erosive properties of storm surges. Communities living on islands, such as those in the Torres Strait, are particularly vulnerable. Several of these communities are likely to be among the first Australians who will need to adopt radical strategies to adapt to climate change. Some of these changes are likely to impact their physical and mental health. Several TSI communities are located on low lying islands that are at risk from inundation due to sea-level rise and extreme weather events (ARUP 2006; Bessen 2005; Mulrennan 1992). Over the next century, middle-of-the-road estimates suggest a global average sea-level rise of about 50cm. However, averages conceal local short to medium variations (White et al. 2005), which can be of significance to the viability of coastal communities in low lying areas.

In mid 2005, the combination of high tides with strong winds caused waves to enter several houses on Mer Island (TSI), and in one case this inundation threatened a child's life who was asleep inside one of the flooded houses. Several other houses were inundated on Saibai, Boigu, Poruma, Iama, Warraber and Masig approximately six months later during the high tides in January and February of 2006 when water pooled on roads and in buildings for several hours until the tides receded (EPA Qld 2006).

² The closest point between the Torres Strait Islands and PNG is approximately three kilometres.

During inundation incidents such as these when there may be a disruption of the water supply, the short-term risk of communicable disease transmission increases (McMichael et al. 2003). Coastal erosion and storm surges also threaten infrastructure vital to emergency rescues, reducing the ability for emergency management agencies to act effectively. For example, some communities in the Torres Strait have airstrips that are currently being threatened by beach erosion.

In the long term, there are also significant cultural impacts caused by Indigenous communities' inability to feel able to maintain the health of their land and sea country. The psychological effect of such loss on individuals and families is likely to cause a heavy burden of distress and mental illness in many communities (Green 2006). In the TSI, many islanders are stressed because they do not know how they will maintain their cultural integrity if they need to relocate from their islands. This issue, despite being dealt with to some extent on other Pacific Islands where long term relocation strategies are being advanced (Preston et al. 2006) has not been discussed by Australian state or federal government to date.

Around much of coastal northern Australia, beach and mangrove areas are important habitats and nurseries for several significant species of marine animals. Turtles, dugongs, crocodiles, stingrays and sharks - amongst many other species - have a significant cultural roles for many Indigenous Australians; and for some, form a significant supplement to their diet. Changes in food yields from the marine environment are likely, although the causal processes are complex. Likely synergistic factors compounding reduced nutrition from changes in marine species include loss of livelihoods and community displacement (McMichael et al. 2006). For food-insecure communities, a change in the abundance of these animals may contribute to dietary imbalance or malnutrition. In combination with water shortages, this situation may become a potential ecological disaster for some isolated communities. In low-lying flood plain areas – including many areas of Kakadu and Arnhem land, communities are vulnerable to flash flooding as well as the more gradual effects of ecosystem change as wetland areas are encroached by brackish water and mangroves.

An increase in extreme events (created by high winds and cyclones) are likely to cause larger number of injuries and accidental death. Three Torres Strait Islanders were caught at sea for 22 days in the wake of Cyclone Monica, one of the most intense tropical cyclones ever recorded in Australia, which passed by the Torres Strait in April 2006. Although regional populations can adapt to local climate changes via a range of responses (including physiological, behavioural, cultural and technological), extreme events can stress populations beyond adaptation limits (McMichael et al. 2006). As previously noted, compounding this problem is the likelihood that in an emergency situation, high winds, floods or fallen trees may also reduce the ability for timely access to provide assistance. The existing problem of dilapidated housing, for example, will become even more serious if more frequent extreme weather events occur.

1.5 Socio-economic context affecting adaptive capacity

Numerous reports detail extreme socio-economic disadvantage of many remote Indigenous communities (ABS 2005; Altman 2000). Understanding this background is essential to contextualise any biophysical changes that may impact communities and individuals from climate change (Watson & McMichael 2001; Woodward et al. 1998). In comparison to non-Indigenous communities, indicators relating to education, employment, housing and access to water and electricity all show features of disadvantage in these communities (ABS 2005; Pittock 2003). For example, there were 1,882 temporary of dwellings in discrete Indigenous communities in 2001, and of the permanent dwellings, 31 percent needed major repairs or replacement. 153 of these dwellings had no organised sewerage supply (ABS 2005). The average size of Indigenous households in very remote areas is 5.3 persons. This level of overcrowding is thought to impact on children's health especially (eg respiratory conditions, skin infections and meningitis) as well as mental health of the whole community (Currie & Brewster 2001; ECU 2006).

The living conditions in many of these communities are characterised not only by overcrowding, but by inadequate washing facilities, poor sanitation and sewage disposal, limited food storage and sub-optimal food preparation facilities. Poor quality water can increase the prevalence of gastroenteritis, diarrhoea (McMichael et al. 2003), typhoid fever and hepatitis (ECU 2006) and potentially parasitic diseases (giardiasis, dysentery and diarrhoea) of which children are particularly at risk (Currie & Brewster 2001).

Survey research shows that one fifth of Indigenous communities with 50 or more residents who were not connected to town water had not had their supply tested within the previous year, and a quarter of the communities had drinking water of poor quality that had failed testing at least once within the previous year (Trewin & Madden 2005). With projections for increasing droughts and temperatures in these regions, additional electricity demands (for running air conditioners) and water requirements (deeper bores, and greater bore maintenance) will place further strain on already stretched financial resources in outback communities. (Marshall 2006) suggests that without major investment in some of these communities, their overall 'liveability' might be under threat.

Geographic remoteness will amplify climate change health risks and presents an additional challenge for developing anticipatory adaptation strategies. The availability of up-to-date information about forecasted disasters (e.g. extreme weather warnings) is limited to phone in many communities. Access to and from many remote communities during extreme weather conditions or following disasters is limited by a lack of all-weather roads and 24 hour operational airstrips: currently many remote airstrips are only functional in daylight hours. Frequently access to health care is compounded by language translation problems.

1.6 Conclusion

The health status of remote Indigenous communities is likely to be adversely affected by climate change in a number of direct and indirect ways. This reflects both the vulnerability of Indigenous communities to environmental change and their reduced adaptive capacity. This situation presents a challenge to state, territory and local governments to provide adequate levels of advance planning, management and care to reduce climate-related risks.

This paper has reviewed various initial areas of concern. However, strategies that seek to manage physical risks to health without taking account of the larger context of an Indigenous world view that may not necessarily separate the health of culture, country and physical and mental well-being may be of limited effectiveness.

The factors that make this situation more complex include the lack of public health infrastructure appropriate to the likely scale of the problem. There is need for more funding for primary health care programmes, more doctors and nurses in communities with cross-cultural awareness, more preventative facilities to lower existing burden of disease (thereby increasing resilience) improvement of infrastructure in outstations and communities (water supplies, telecommunication, electricity, housing, waste disposal) and greater education about how to reduce chronic health problems and the provision of resources to implement appropriate activities to do so.

Many thanks to Dr Anthony McMichael, Dr Bart Currie, Dr Rosalie Woodruff and Dr Benjamin Preston for helpful comments and revisions to this work.

1.7 References

- ABS (2005) 'The Health and Welfare of Australia's Aboriginal and Torres Strait Islander Peoples' URL: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/4704.0>.
- AIHW (2006) *Australia's Health 2006*. (Australian Institute of Health and Welfare, Canberra).
- Allen Consulting Group (2005) *Climate Change Risk and Vulnerability: Promoting an efficient adaptation response in Australia*. (Australian Greenhouse Office, Canberra).
- Altman, J. (2000) *The economic status of Indigenous Australians*. (Centre for Aboriginal Economic Policy Research, ANU, Canberra).
- ARUP (2006) *Natural Disaster Risk Management Study*. (ARUP, Brisbane).
- Bessen (2005) *Land and Sea Management Strategy for Torres Strait*. Torres Strait NRM Reference Group, prepared by Bessen Consulting. www.tsra.gov.au/pdf/Torres%20Strait%20Land%20&%20Sea%20Mgt%20Strategy%202006.pdf
- Braaf, R. (1999) 'Improving impact assessment methods: climate change and the health of Indigenous Australians'. *Global Environmental Change* 9, 95-104.
- Cheng, A., Jacups, S., Gal, D., Mayo, M. & Currie, B. (2006) 'Extreme weather events and environmental contamination are associated with case-clusters of melioidosis in the Northern Territory of Australia'. *Int. J. Epidemiol.* 35, 323-329.
- CSIRO (2006) *Sharing Knowledge* URL www.dar.csiro.au/sharingknowledge/.
- Currie, B. (2001) 'Environmental Change, Global Warming and Infectious Diseases in Northern Australia'. *Environmental Health* 1, 34-43.
- Currie, B. & Brewster, D. (2001) 'Childhood infections in the tropical north of Australia'. *Journal of Paediatrics and Child Health* 37, 326-330.
- Currie, B. & Jacups, S. (2003) 'Intensity of Rainfall and Severity of Melioidosis, Australia'. *Emerging Infectious Diseases* 9, 1538-1542.
- ECU (2006) *Australian Indigenous HealthInfoNet*, Edith Cowan University <http://www.healthinfonet.ecu.edu.au/>
- Ellemor, H. (2005) 'Reconsidering emergency management and Indigenous communities in Australia'. *Environmental Hazards* 6, 1-7.
- EPA Qld (2006) *Fact Sheet: King Tides in Torres Strait* www.epa.qld.gov.au/publications/p01864aa.pdf/2006_King_Tides_in_Torres_Strait.pdf
- Green, D. (2006) *How Might Climate Change Affect Island Culture in the Torres Strait?* CSIRO research paper 011 (CSIRO, Aspendale).
- Green D, Preston B (2006) *Climate Change Impacts on Remote Indigenous Communities in Northern Australia*. www.dar.csiro.au/sharingknowledge/regions.html
- Hanna, J., Ritchie, S., Phillips, D., Shield, J., Bailey, M., Mackenzie, J., Poidinger, M., BMcCall & Mills, P. (1996) 'An outbreak of Japanese encephalitis in the Torres Strait, Australia, 1995'. *The Medical Journal of Australia* 165, 256-260.
- Hennessy, K., Pittock, A., Walsh, K., Suppiah, R., McInnes, K. & Bathols, J. (2004) *Climate change in the Northern Territory: consultancy report for the Northern Territory Department of Infrastructure, Planning and Environment*. (CSIRO, Aspendale)
- IGWG (2004) *Environmental Health Needs of Indigenous Communities in Western Australia. The 2004 survey and its findings*. www.dia.wa.gov.au/EHNCC/EHNS2004/EHNSReport2004.pdf
- Intergovernmental Panel on Climate Change (2001) *Climate Change 2001: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Third Assessment Report of the IPCC. J. McCarthy, O. Canziani, N. Leary, D. Dokken and K. White (Eds.) (Cambridge University Press, UK). www.ipcc.ch/pub/reports.htm
- Jackson, S. (2005) 'A burgeoning role for Aboriginal knowledge'. *ECOS* June-July 2005.
- Johnston, F., Kavanagh, A., Bowman, D. & Scott, R. (2002) 'Exposure to bushfire smoke and asthma: an ecological study'. *MJA* 176, 535-538.
- Kovats, R., Campbell-Lendrum, D., McMichael, A., Woodward, A. & Cox, J. (2001) 'Early effects of climate change: do they include changes in vector-borne disease?' *Philosophical*

- Transactions of the Royal Society of London Series B-Biological Sciences* 356, 1057-1068.
- Marshall, G. (2006) 'Desert houses, energy and water use: living with the climate'. Presented at the *Sharing Knowledge* workshop, Darwin, 30-31st March 2006.
www.dar.csiro.au/sharingknowledge/presentations.html
- McMichael, A. (2006) 'Climate Change and Risks to Health in Remote Indigenous Communities' presented at the *Sharing Knowledge* workshop, Darwin, 30-31st March 2006.
www.dar.csiro.au/sharingknowledge/presentations.html
- McMichael, A., Woodruff, R., Whetton, P., Hennessy, K., Nicholls, N., Hales, S., Woodward, A. & Kjellstrom, T. (2003) *Human Health and Climate Change in Oceania: A Risk Assessment 2002*. (Department of Health and Ageing, Canberra).
- McMichael, A., Woodruff, R. & Hales, S. (2006) 'Climate change and human health: present and future risks'. *The Lancet* Mar 11;367(9513):859-69.
- Mctainsh, G. & Lynch, A. (1996) 'Quantitative estimates of the effect of climate change on dust storm activity in Australia during the Last Glacial Maximum'. *Geomorphology* 17, 263-271.
- Mulrennan, M. (1992) *Coastal Management: Challenges and Changes in the Torres Strait Islands*. (Northern Australia Research Unit, ANU, Darwin).
- NTG (2005) Aboriginal health and families - a five year framework for action, NTG.
www.nt.gov.au/health/comm_health/abhealth_strategy/apact/apactoc.shtml
- Page, C. & Jones, R. (2001) 'OzClim: the development of a climate scenario generator for Australia'. Paper pres. *MODSIM 2001: International Congress on Modelling and Simulation*.
- Patz, J. & Olson, S. (2006) 'Malaria risk and temperature: Influences from global climate change and local land use practices'. *Proceedings of the National Academy of Sciences* 103, 5635-5636.
- Pittock, B. (2003) *Climate Change: An Australian Guide to the Science and Potential Impacts*. (Australian Greenhouse Office, Canberra, Australia).
- Preston, B., Suppiah, R., Macadam, I. & Bathols, J. (2006) *Climate Change in the Asia Pacific Region*. (CSIRO, Aspendale).
- Reid, J. (1982) *Body, Land and Spirit: Health and Healing in Aboriginal Society*. (University of Queensland Press, St. Lucia).
- Ring, I. & Brown, N. (2002) 'Indigenous health: chronically inadequate responses to damning statistics'. *Medical Journal of Australia* 177, 629-631.
- Rose, D. (1996) *Nourishing terrains: Australian Aboriginal views of landscape and wilderness*. (Australian Heritage Commission, Canberra).
- Smith, B. (2004) 'Some Natural Resource Management Issues for Indigenous People in Northern Australia'. Paper pres. *Arafura Timor Research Facility Forum*, ANU.
- Taylor, J. (2003) 'Population Futures in the Australian Desert 2001-16'. *Australian Geographer* 34, 355-370.
- Trewin, D. & Madden, R. (2005) *The Health and Welfare of Australia's Aboriginal and Torres Strait Islander Peoples*. www.aihw.gov.au/publications/index.cfm/title/10172
- Walsh, F. & Mitchell, P. (2002) *Planning for Country: Cross-cultural approaches to decision-making on Aboriginal lands*. (Jukurrpa Books, Alice Springs).
- Watson, R. & McMichael, A. (2001) 'Global climate change - the latest assessment: does global warming warrant a health warning?' *Global change and human health* 2, 64-75.
- Whelan, P., Jacups, S., Melville, L., Broom, A., Currie, B., Krause, V., Brogan, B., Smith, F. & Porigneaux, P. (2003) 'Rainfall and vector mosquito numbers as risk indicators for mosquito-borne disease in Central Australia'. *Communicable Diseases Intelligence* 27, 110-116.
- White, N., Church, J. & Gregory, J. (2005) 'Coastal and global averaged sea level rise for 1950 to 2000'. *Geophys. Res. Lett.*, 32.
- Woodruff, R., Hales, S., Butler, C. & McMichael, A. (2005) *Climate Change Health Impacts in Australia: Effects of Dramatic CO₂ Emission Reductions*: Report for the Australian Conservation Foundation and the Australian Medical Association.
www.acfonline.org.au/uploads/res_AMA_ACF_Full_Report.pdf
- Woodward, A. J., Hales, S. & Weinstein, P. (1998) 'Climate change and human health in the Asia-Pacific region: who will be most vulnerable?' *Climate Research* 11, 31-38.