



National Climate Change
Adaptation Research Plan

Emergency Management and Climate Change: An Updated Review of the Literature 2009-2012



EMERGENCY MANAGEMENT AND CLIMATE CHANGE

National Climate Change Adaptation Research Plan

An Updated Review of the Literature 2009-2012

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The role of NCCARF is to lead the research community in a national interdisciplinary effort to generate the information needed by decision-makers in government, business and in vulnerable sectors and communities to manage the risk of climate change impacts.

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GLOSSARY OF ACRONYMS

AEMVF	Australian Emergency Management Volunteers Forum
AFAC	Australian Fire Authorities Council
AJEM	Australian Journal of Emergency Management
AEMC	Australian Energy Market Commission
APEC	Australian Pacific Economic Cooperation
ARN's	Australian Research Networks (NCCARF)
AusDIN	Australian Disaster Information Network
COAG	Council of Australian Governments
CSIRO	Commonwealth Scientific & Industrial Research Organisation
DRM	Disaster Risk Management
ECA	Economics of Climate Adaptation
EMA	Emergency Management Australia
EMQ	Emergency Management Queensland
ICA	Insurance Council of Australia
ICT	Information & Communication Technologies
IFRC	International Federation of Red Cross and Red Crescent Societies
IPCC	Intergovernmental Panel on Climate Change
IP's	Implementation Plans
JCU	James Cook University
NARP	National Adaptation Research Plan
NCCARF	National Climate Change Research Facility
PPRR	Preparedness Prevention Response Recovery
UNISDR	United Nations International Strategy for Disaster Risk Reduction

Australian Emergency Management Glossary (EMA):

<http://www.ema.gov.au/www/emaweb/emaweb.nsf/Page/RWPC01BDEA47E52744ACA25750B00053C0B#ReferenceSeries>

United Nations International Strategy for Disaster Risk Reduction Terminology:

<http://www.unisdr.org/we/inform/terminology>

1. INTRODUCTION

This review of recent literature on climate change adaptation and emergency management is a background document supporting the updating of the National Climate Change Adaptation Research Plan (NARP) for Emergency Management for the National Climate Change Adaptation Research Facility (NCCARF) Adaptation Research Network for Emergency Management. The original NARP was produced in 2009 following extensive consultation. For details please see the NARP, which is available on the NCCARF website.

The objective of the Emergency Management NARP is to identify priority research to enhance community and organisational resilience to the risks posed by climate change from the perspective of emergency management. Four overarching strands of research are identified as necessary to meet this objective:

- I. Understanding risk
- II. Community and organisational resilience
- III. Adaptive strategies
- IV. Regional implications

This review provides a brief commentary and recent literature for each of these areas and where appropriate for the specific research questions within each theme. Note that the update is indicative rather than comprehensive, and that it has benefitted from suggestions made during the consultation for the revision and update of the NARP.

One overarching trend is the increasing volume of literature examining the overlap and interactions between emergency management and climate change adaptation. This generally argues for a close connection (eg Mercer, 2010; Romieu, Welle, Schneiderbauer, Pelling, & Vinchon, 2010; Schipper & Pelling, 2006; Thomalla, Downing, Spanger-Siegfried, Han, & Rockström, 2006). There is a growing emphasis internationally on supporting climate change adaptation through disaster risk reduction (Birkmann & von Teichman, 2010; IASC & UNISDR, 2008). One reason for this is that the function of emergency management is to deal with uncertainties and the residual risk regardless of what their source may be – while climate science continues to work on providing better climate and weather risk profiles. Another issue is that emergency management provides the conceptual basis and institutional arrangements for the task of dealing with increasing uncertainty and complexity.

2. UNDERSTANDING RISK

Setting the baseline: assessing current risk and climate change-induced risk

A thorough review of the state of the science is being coordinated by the IPCC (forthcoming) with a summary update in a special report published in 2012 (*Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (SREX, 2012)). Ross Gaunaut has released his 2011 update on climate change in Australia. At the global and regional level the evolving risk from climate change and disasters has recently been examined in the *Global Assessment Report on Disaster Risk Reduction* (UNISDR, 2011).

Further changes in climate are inevitable, regardless of any future success in controlling global greenhouse gas emissions. Importantly for emergency management, we also know that small changes in average temperatures are likely to lead, and in many parts of the world have already led, to substantial changes in extremes, with fewer frosts, more heat waves, droughts, bushfires and storms. A significant scientific literature exists for each type of climatic phenomenon and its negative impacts (this is being summarised in the IPCC's Special Report on *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation* (SREX) which is in the final stages of preparation (publication date early 2012.).

The major gap in climate change knowledge for adaptation policy and practice concerns the specifics of changes in location and likelihood (or frequency) of extremes, and the extent to which further science will reduce these uncertainties in useful ways. This gap remains although increasingly sophisticated modelling is helping to reduce it. For example; CSIRO is developing an Australian Community Climate Earth System simulator (ACCESS) in collaboration with the Bureau of Meteorology.

3. COMMUNITY AND ORGANISATIONAL RESILIENCE

What does community resilience mean in a changing climate?

The concept of resilience is now accepted in most sectors in Australia including emergency management. This shift is illustrated by, among other things, state committees or round tables on the subject, by the ICA policy on resilience, by the surge in research programs and groups claiming expertise in the area and by the release of the National Strategy for Disaster Resilience adopted by COAG, February 2011 (COAG, 2011).

Are there particular features of a 'climate-resilient community'?

Since 2008, a number of studies have sought to identify the particular features of a 'climate resilient community'. In 2010 NCARF produced a series of seven historical case studies of extreme climatic events or conditions to examine their impacts, how they were managed and the lessons that could be learned for adaptation to climate change. The case studies examined the following events:

- Cyclone Tracy which destroyed Darwin on Christmas Day, 1974 (Mason & Haynes (2010).
- Drought in two rural communities (Kiem *et al.*,2010).
- The February 2009 heatwave in Melbourne and Adelaide (Reeves *et al.*,010).
- The 2008 Queensland floods (Apan *et al.*,2010).
- Storm tides, coastal erosion and inundation at the Gold Coast, Byron Bay and Collaroy-Narabeen (Hellman *et al.*,2010).
- The Pasha Bulker grounding in a storm that struck Newcastle in June 2007 (Verdon-Kidd *et al.*, 2010).

- The 2010/2011 Queensland floods (King *et al.*, 2012).

In a synthesis report of the case studies, Kiem, Vernon-Kidd, Boulter, and Palutikof (2010) propose that a resilient community is likely to be:

- Convinced about the reality for action
- Informed about what is likely to happen and realistic about the uncertainties
- Prepared to respond to climate change
- Responsive to new knowledge about risks for climate change and the potential for response.
- Connected to, knowledgeable about and supportive of its vulnerable members.
- Flexible and willing to take on board new ways of doing things, even transformational changes.

Other research identifying the particular features of a 'resilient community', primarily through the frames of vulnerability and adaptive capacity, includes:

- A theoretical exposition of the disaster resilience of place (DROP) model, which is designed to improve comparative assessments of disaster resilience at the local or community level. A candidate set of variables for implementing the model are presented and include ecological, social, economic, institutional, infrastructure, and community competence factors (Cutter *et al.*, 2010).
- A case study of adaptation to flooding Charleville, Queensland (Keogh *et al.*, 2011).
- A case study of vulnerability to and adaptive capacity for bushfires in south-east Gippsland with a focus on macro-level root causes (Whittaker, 2008).
- A preliminary assessment of which Australian rural communities are vulnerable to climate variability and change (Nelson *et al.* (2010).
- A qualitative study of the experience of community members after the Canberra bushfires aimed at extracting the factors that are important in creating a competent, resilient community (Pooley, Cohen & O'Connor, 2010).
- A guidance note that sets out the characteristics of a disaster-resilient community and provides information on how government and civil society organizations can foster these characteristics at the community level (Twigg, 2009).

Does resilience and adaptive capacity depend on the hazard to which people are exposed? Is it different in a changing rather than a static climate?

No research addressing these questions was located in either the disaster risk reduction or the climate change adaptation literatures.

Do changes in exposure have a bigger impact on community resilience than changes in natural hazard intensity and frequency?

Several Australian studies have modelled the relative impacts of exposure and natural hazard intensity/frequency on community resilience, primarily in terms of the building damage and fatalities caused by major bushfires (Crompton & McAneney, 2008; Crompton *et al.*, 2010). Crompton *et al.* (2010a; 2010b) contend that the increases in building damage due to bushfire in Australia is largely being driven by increasing dwelling numbers which means that exposure is having a bigger impact on disaster losses than hazard frequency or intensity. However, Nicholls (2011) has argued that this position does not take account of possible reductions in vulnerability due to increased building regulations or improved emergency preparations and response, such as improved fire-fighting equipment and management, and therefore, increased damages resulting from more frequent and intense fires might be offset by a decrease in vulnerability.

Is there a critical number of same-hazard or different-hazard events which result in a 'tipping point' for a community or population? How will climate change affect this (e.g., by bringing communities closer to the 'tipping point')?

Whilst an expanding body of literature has focussed on the identification of tipping points within ecological systems (c.f. Scheffer et al., 2009), there is a lack of empirical research that describes or quantifies the critical number of same or different hazard events that result in a tipping point for a community or population. Renaud *et al.* (2010) and the Resilience Alliance (2009) both contend that because of the complexity of social-ecological systems involved, tipping points are difficult to determine even when a demonstrated shift has occurred. Thus, questions concerning the critical number of hazard events which result in a tipping point remain addressed. There is also a lack of empirical research examining the role that climate change will play in bringing communities closer to their respective tipping points. Again, this type of research is impeded by the complexity of the systems involved. Indeed, researchers focussing solely on tipping points in large-scale physical systems (e.g. Greenland icesheet, Atlantic Thermohaline Circulation) which lack the higher levels of complexity associated with social-ecological systems, have questioned whether it is possible to identify a critical tipping point before it has been reached (Lenton *et al.*, 2008). Yet, as Renaud et al. (2010) argue, despite the difficulties in characterising thresholds, it is critical that decision makers have an understanding of when a community will reach its tipping point *before* this occurs and therefore, the question of tipping points as posed in the original NARP remains important.

What is the success and efficacy of hazard awareness and preparedness strategies in specific cultural communities and in a range of demographic and socio-economic groups?

Research has sought to evaluate the efficacy of various hazard awareness and preparedness strategies in a range of different communities and groups including women (Eriksen, Gill & Head, 2010; Proudley, 2008), children (Dufty, 2009; Ronan, Crellin & Johnston, 2010; Finnis, Johnston, Ronan & White, 2010; Towers, 2011), indigenous groups (Becker *et al.*, 2008; Mercer, Kelman, Sutchet-Pearson & Llyod, 2009;), and people of low socio-economic status (Ojero, Moseley, Lynn & Bania, 2010). This research emphasises the importance of tailoring hazard awareness and preparedness strategies to the needs and perspectives of specific groups and incorporating principals of community engagement and participation. They also highlight the way in which specific groups can be marginalised from the emergency management practices and processes. Importantly, however, these studies demonstrate the tangible benefits that including these groups has for building resilient communities. This being the case, more research with these groups is needed.

Notable in its absence, is recent research on several vulnerable groups including the elderly, the disabled, and non-English speaking communities. Research examining the efficacy of hazard awareness and preparedness amongst these groups remains a priority.

What practices and processes promote community preparedness and preventive strategies in a changing climate?

In order to define what preparedness for climate change risk might mean, research needs to ascertain how unprepared people are for a range of climate-related hazards.

Several studies have examined the levels of preparedness for climate related hazards (e.g. fire, flood, and storm). The general finding to emerge from these studies is that levels of physical preparedness for climate related hazards (e.g. fire, flood, storm), are characteristically low:

- Results from the Australian Bureau Statistics surveys on household and community preparedness for natural disaster found that: only 15% of households had a written or

rehearsed emergency plan; 30% households did not keep emergency phone numbers in a location for ease of use; nearly 20% of all households had a least one member who would have difficulty evacuating in an emergency; nearly 30% of households lacked stored drinking water and 70% lacked seven days worth of food (Nicolopoulos & Hansen, 2009).

- In a study of bushfire preparedness amongst rural landholders in south-eastern NSW, Eriksen, Gill & Head (2010) found that only 43% of survey respondents had prepared a bushfire action plan and it became clear during follow up interviews that the majority of people with a plan had not written these plans or discussed them with other family members.
- In a retrospective study of preparedness following a bushfire on the east coast of Tasmania, residents were found to have undertaken preparations only once a fire warning had been received (Prior & Paton, 2008).
- A review of research following the Black Saturday bushfires found that whilst two thirds of residents reported having a bushfire plan, these plans varied substantially in their quality and usefulness as a component of fire preparedness. Many respondents living in more suburban areas had not done anything to prepare because they did not consider themselves to be at risk (Whittaker & Handmer, 2010).

Several reviews have also highlighted the importance of psychological preparedness for climate-related hazards (Clode, 2009; Reser & Morrissey, 2009). However, empirical analyses of the levels of psychological preparedness in the community are yet to be conducted.

With respect to hazard preparedness within the community, it is important to highlight the general finding that hazard knowledge and risk perceptions do not typically correlate with levels of preparedness. This has been convincingly demonstrated in two published reviews of the international preparedness literature (Sims & Baumann, 1983; Solberg et al., 2010) as well as two empirical investigations of bushfire preparedness in an Australian cultural context (Whittaker and Handmer, 2010; Eriksen, Gill & Head, 2010).

What is the level of understanding and acceptance of climate change and its implications for natural hazards?

Since 2008, a substantial amount of research has investigated the level of public understanding and acceptance of climate change (Brody, Zahran, Vedlitz & Grover, 2008; Gifford, Kormos, & McIntyre, 2011; Kellstedt, Zahran, & Vedlitz, 2008; Leiserowitz et al., 2011; Leviston et al., 2011; Maibach, Roser-Renouf, & Leiserowitz, 2009; Semenza et al., 2008; Swim et al., 2010; Weber & Stern, 2011; Wardekker et al., 2009; Whitmarsh, 2008). However, to date, only one Australian/British study has examined the public's understanding of the interrelationships between climate change and natural hazards or disasters (Reser et al., 2011). This study found that the evidence and projected consequences to which Australian respondents referred in the context of their belief and concern about climate change were often related to extreme weather events. The authors observed that "overall, public perceptions and understandings of the threat of climate change in Australia appear to be strongly influenced and informed by knowledge of direct or indirect experience with both chronic and acute natural disasters in the Australian environment" (Reser et al., 2011, p.3).

How are climate change and increased hazard risk portrayed? How is the general hazard risk portrayed? How are leadership attitudes portrayed in the media, literature and public policy?

Numerous recent studies have shown that climate change coverage in the media has perpetrated an informational bias by significantly diverging from the consensus view in climate science that humans contribute to climate change (Anderson, 2009; Boykoff, 2008a; Boykoff, 2008b; Boykoff & Smith, 2010; Doulton, 2009; Hulme, 2009; Nibett, 2009). However, these

studies have been conducted in an American or British context and studies and recent research investigating the portrayal of climate change in the Australian media is lacking.

There is also a lack of research addressing the portrayal of climate change and its implications for increased hazard risk. Indeed, there is a lack of recent research examining the portrayal of hazard risk in general. An extensive literature search also failed to locate recent research examining the portrayal of leadership attitudes in the media, literature and public policy.

What are the most appropriate trigger points for the commencement of the dissemination of emergency warnings and information to the community about climate related hazards and their impacts?

Whilst there is an extensive literature on the dissemination of warnings for hazard events, no research addressing warnings about potential climate change impacts could be located.

What is the ability for existing warning system coverage to be expanded and what infrastructure and technology will be required to permit expansion?

Cascading events

No research could be located on this topic.

What are the most effective strategies to ensure that individuals, governments and the private sector adopt better practices in preparing for the increased risk to communities, business operations or critical infrastructure arising from climate change?

Community education

- Although community education has achieved limited success in the past, recent research has identified several practices and processes that promote community preparedness and preventive strategies. These studies include:
- An evaluation of the NSW Fire Brigades Community Fire Unit demonstrated how a unique combination of top-down and bottom-up approaches engendered an overall sense of empowerment and increased capability, social capital, knowledge and preparedness among individuals involved (Lowe, Haynes & Byrne, 2008).
- An observational study revealed how situational characteristics of the community influence the interpretation of bushfire risk messages suggesting that it is necessary to couple mass communication techniques with community engagement to ensure the correct interpretation of risk communication messages and engender confidence and trust fire agencies (Prior & Paton, 2008)
- A new model of flood education that: 1) focuses on building resilience as well as raising awareness and preparedness; 2) includes learning related to preparedness conversion, mitigation behaviours, as well as adaptive capability and post flood learning; 3) requires community participation at every stage of the program including design and evaluation; and 4) encourages ongoing education through local education programs (Dufty, 2009).
- A review of evaluative studies of community bushfire education programs identified four causal processes that effectively promote the adoption of preparedness and preventive strategies: 1) engagement; 2) trust and self confidence; 3) confirmation and reassessment; and 4) community involvement and collaboration (Elsworth *et al.*, 2009).
- An investigation of the outcomes of the Black Saturday bushfire for different groups in relation to their location, level of training and level of involvement in the CFA Community Fireguard (CF) found that whilst house losses were strongly related to fire severity, the

mitigation of losses was related to participation in CF groups suggesting the value of this approach to preparedness and prevention (Clode, 2009).

- An empirical study of how pre-existing local knowledge influences the uptake of risk messages for bushfire hazards and how this knowledge can be used to complement existing community education practices and processes with engagement and social interaction techniques (both between emergency managers and residents and between residents) in a way that promotes preparedness for bushfire hazards (Eriksen & Prior, 2010).
- An examination of neighbourhood level wildfire mitigation programs Canada (FireSmart-ForestWise), Australia (Community Fireguard) and the US (Firewise Communities) demonstrating that participation in neighbourhood level wildfire mitigation programs helps to reduce wildfire risk, but also enhances both community resilience and relationships between residents and government agencies (McGee, 2011).

Financial incentives

In 2007, the Insurance Council of Australia (Tooth & Barker, 2007) released a report estimating that approximately 23% of Australian households do not have a building or contents insurance policy. These non-insured households tended to be: young or at later stages of life, living in cities and in particular parts of cities, born in non-western societies, with lower levels of education and without full time work. Moreover, the report found that households with weaker capacities to protect against loss (e.g. limited financial reserves) were less likely to have an insurance policy. To make insurance more accessible to these groups, Sullivan (2008) recommends that regulatory and policy making bodies remove taxes on insurance premiums as these are a major financial deterrent. He cites an analysis by Tooth (2007) which found that removing all NSW insurance premium taxes would see an additional 150,000 households take out home and contents insurance.

Land use regulation

Several recent studies have identified land use regulation as a key emergency management mechanism in a changing climate (Buxton *et al.*, 2011; Norman, 2008). Using the Black Saturday fire affected Shire of Murrindindi as a case study, Buxton *et al.* (2011) contend that the location of population growth, and associated regulatory failure, are contributory, yet under-researched, factors associated with life and property losses. They propose that the adoption of more robust planning tools which incorporate climate change considerations is essential to anticipating and minimising the impacts of disastrous natural events such as bushfires. They also draw attention to a recent Victorian Civil and Administrative Tribunal decision which is unprecedented in its use of the precautionary principle (O’Riordan & Cameron, 1994) to prevent dwelling construction in an ‘inappropriate’ location. In another Australian study, Norman (2008) argues that urban planning for human settlements in response to climate change will require both an intergovernmental and multi-disciplinary approach integrating science and urban planning. She proposes a set of principles that should underpin such an agreement including: regional planning, policy integration, financial incentives, and innovative regulatory mechanisms.

Whilst land use regulation represents a key mechanism for emergency management it is important to acknowledge that this is a future-oriented strategy (Birkmann, 2010). Whilst land use regulations might prevent the establishment of new settlements in hazard-prone areas, they are of little use where settlement has already taken place. Thus, many people are already living hazardous conditions and have already had to cope and adapt. Therefore, as Birkmann (2010) has argued, it is important to complement formal land use regulations with informal approaches that facilitate adaptation at the household level. However, this poses a significant challenge

because the financial costs and human resources for informal approaches may have to be borne by the households themselves which may impede effective adaptation.

Policies and processes that enhance information flows through public and private organisations

Pelling, High, Deering and Smith (2008) have identified the importance of social learning and institutional aspects of multilevel environmental governance in the flow of information and knowledge in both public and private sector organisations. They found that providing space within and between local organisations for individuals to develop both private and officially sanctioned social relationships supported a pathway to enable social learning. This approach to enhancing the flow of information is an important resource for adaptation because it requires minimal financial investment. It does, however, call for a new approach to the kinds of personal skills and working routines that are promoted and supported within organisations.

In an Australian emergency management context, Bosomworth (2011) has also identified the critical role of both formal and informal social relationships in enhancing or restricting the flow of information both within and between emergency management organisations in the context of changing climate.

Clarity and coordination of organisational roles and responsibilities

A substantial body of research, conducted both in Australia and internationally, has addressed issues associated with organisational functioning in emergency management, including the coordination of organisational roles and responsibilities. Recent publications include an analysis of command and control networks on Black Saturday, an analysis of the collaborative activities and leadership strategies that underpin effective emergency management in the United States (Waugh & Streib, 2006), and an exposition of an operational framework for resilience in the United States emergency management sector (Kahan, Allen, & George, 2009).

4. ADAPTIVE STRATEGIES

How will climate change affect the emergency management sector's capacity to support preparedness, response and recovery?

What are the implications of increased demands specifically arising from climate change on full-time and volunteer emergency service personnel and non-government organisations? Is the current resourcing mix the most appropriate?

New research in this area has focused on volunteers, given their large role in the Australian emergency management sector (Howard, 2009). Studies have examined motivations for volunteering (McLennan, 2008), stress and pressure experienced by volunteers and their families (Cowlshaw, Evans, & McLennan, 2010; Cowlshaw, Lynette & McLennan, 2008), and challenges and approaches for retaining volunteers (Baxter-Tomkins & Wallace, 2009; Parkin, 2008).

Very little research has directly examined the resourcing mix needed by the sector to adapt and respond to climate change. However, resourcing needs are considered in a range of studies included in this review, including resourcing to support volunteers, the provision of critical infrastructure and resourcing through public-private partnerships, and decision-making tools that can support planning for future resource allocation.

What is the role of the private sector in adaptation through emergency management?

What role can the private sector play in supporting emergency management adaptive strategies and community resilience/adaptive capacity?

The absence of research on the role of the private sector in emergency management adaptation was noted in the original NARP. There has been some recent research but it is a relatively new area and there is a strong need for further research. Research to date has explored the role of insurance in reducing disaster risk and thus advancing adaptation (Schwarze *et al.*, 2010; Sullivan, 2008; Warner *et al.*, 2009) and provided recommendations for strengthening the role of insurance for Australian disaster resilience (Mortimer, Bergin, & Carter, 2011). Research has also begun to examine the role of public-private partnerships to support hazard mitigation and community resilience (Cutter, 2008; Committee on Private-Public Sector Collaboration to Enhance Community Disaster Resilience, 2010; MacManus, 2011; Stewart, Kolluru, & Smith, 2009; Tomkins & Hurlston, 2010). Importantly, research has also identified the ways in which the private sector benefits from reconstruction following extreme events which may undermine incentives for risk reduction (Handmer, 2008).

What will be the impacts of climate change on private enterprise?

Research on the impacts of climate change on the private sector has grown, however it is stronger in some sectors than others. A rapidly growing body of international research examines the impacts of climate change on the insurance industry. This research has investigated: the consequences of climate change for the insurance sector in the Netherlands (Botzen, van den Bergh, & Bouwer, 2010); the implications of climate change for insurers (Maynard, 2008; Mills, 2007); risk spreading by the insurance industry as a climate change adaptation measure in the USA (Sturm & Oh, 2010); and the challenges associated with adapting insurance systems in European countries to climate change (Schwarze *et al.*, 2011). Research examining the impacts of climate change on the Australian insurance industry remains limited to one study investigating the approach required by the insurance industry to respond to climate change (Wilkins, 2010). Research has also examined impacts and adaptation strategies in other private enterprise sectors including agriculture (Crimp *et al.*, 2008; Nelson, 2009), viticulture (Webb, Whetton & Barlow, 2008), fisheries (Allison *et al.*, 2009; Cochrane *et al.*, 2009; Brander, 2010; Jennings & Brander, 2010), and tourism (Hernandez & Ryan, 2011; Tulsi *et al.*, 2011).

5. REGIONAL IMPLICATIONS

How will the climate change adaptive capacity of other countries, particularly those in the Pacific region, impact upon the Australian emergency management system and Australian fire and emergency service organisations?

Recent Australian government initiatives have been reflected in regional activities, including: APEC Emergency Management CEOs' Forum Outcome Report 2009; and an APEC Workshop on Public Private Partnerships and Disaster Resilience Report, January 2011.

What is the potential for climate change impacts affecting our near neighbours to produce flow-on effects for Australia?

While there has been little if any research on the flow-on impacts of regional climate change for Australia, research investigating the potential impacts on Pacific Island countries and the flow on effects for Australia has been conducted. Barnett (2001) and King and Smithers (2009) both identify climate change and accelerated sea-level rise as a particular problem for Pacific Island countries, and the 'Small islands' chapter of the IPCC's 2007 assessment report (Mimura *et al.* 2007, p. 689) states that "Small islands, whether located in the tropics or higher latitudes, have characteristics which make them especially vulnerable to the effects of climate change, sea-level rise, and extreme events". To date, however, there is no evidence that this will have any direct flow-on effects for Australia. For example, Mortreux and Barnett (2009) present evidence

to challenge the widely held assumption that climate change will result in large-scale migration from Tuvalu. They interviewed 40 residents of Funafuti and found that, for most, climate change is not a great concern, let alone a reason to migrate.

Research suggests that at this stage most climate driven migration is internal. Locke (2009) Dupont *et al.* (2008) both found strong evidence that recent influxes to urban central islands from rural outer islands in the Republic of Kiribati and Tuvalu can be attributed to a combination of the adverse impacts of climate change and socioeconomic factors. However, Dupont *et al.* (2008) do acknowledge that whilst the flow of migration is likely to remain internal, the ripple effects will be felt beyond the borders of the states most affected, which will require cooperative regional solutions and Australian leadership. Yet, there is no indication what these ripple effects might be.

What level of strain is likely to be placed on Australia's emergency management capacity if it is increasingly called on to assist its near Pacific Island and South-East Asian neighbours?

Recent research on this topic focuses on the implications of climate change for regional security and stability (e.g. Dupont *et al.*, 2008) rather than natural disasters or emergency management per se. As Dupont *et al.* (2008) have argued, 'Should climate change coincide with other transnational challenges to security, such as terrorism or pandemic diseases, or add to pre-existing ethnic and social tensions, the impact will be magnified. State collapse and destabilising internal conflicts are more likely outcomes than inter-state wars'. The implications of climate change for regional security and stability are a major concern and research assessing the level of strain that this could place on Australia's emergency management capacity remains a priority.

The original NARP also identified the potential strain that climate change could place on broader regional relationships especially with California with whom there is an increasing exchange of personnel and equipment. It is likely that the partial dependence on fire-fighting equipment in the northern off-season will become increasingly untenable as fire seasons lengthen and overlap. Clearly, there is a need to consider how climate change may alter the current capacity and equipment-sharing arrangements that Australia currently enjoys, especially with the USA. However, no research has been conducted in this area and it continues to be a significant research gap.

How can Australian agencies enhance the capacity of nearby countries to deal with the increased challenges of climate change?

Whilst no research addressing this question directly could be located, there are several areas of research that appear to have some relevance to the issues raised therein. The first area of research relates to regional cooperation and partnerships. There are several papers and reports that look at regional cooperation and partnerships in the Asia Pacific. For example, Hughes (2005) argues that Australia and New Zealand have been strong financial and technical supporters of the Pacific Islands Forum and therefore wield a great deal of power, but haven't always engaged sensitively with Pacific Island nations. He identifies a number of constraints on regionalism:

- Regional isolation and economic marginality.
- Widely differing country sizes, capabilities and economic circumstances, separated by long distances, different cultures and historical experiences.
- Fragile physical environments in both the atolls and the high islands.
- Overweighting of population and land resources in Melanesia.
- Shortage of experienced bureaucrats, planners and managers.
- Generally weak government systems and capacity to deliver on policies
- Dependence on foreign aid for public sector development programmes

Each of these constraints would undoubtedly impede Australia's ability to enhance the capacity of nearby countries to deal with the increased challenges of climate change.

Roberts *et al.* (2007) examine the conceptualisation of governance in the Pacific Islands Forum's 'Pacific Plan'. They argue that:

'Governance, as presented in the Plan, is tamed, limited to the building of particular kinds of institutions that focus on rendering the economies of the Pacific recognizable to and disciplined for transnational capital, with a heavy emphasis on neoliberal prescriptions (such as diminished public sectors, expanded and secured property rights and the guarantee of enforceable contracts) and on security fixations' (p 971)

And perhaps more importantly:

'The particular modes of governance adopted and used in the Pacific are firmly embedded in a liberal and western way of seeing and doing, with strong links to the neoliberal project and to a fixation on security. Importantly, the governance agenda is being applied to/in the Pacific by major donors and development institutions with scant regard for indigenous ways of understanding and practicing governance' (p. 971).

The issues raised by research in the field of regional cooperation and partnerships are particularly important because the politics of engagement in the Asia Pacific region will be central to any regional approach to emergency management and climate change adaptation.

The second area of research with direct relevance to enhancing the capacity of nearby countries is centred on local and traditional knowledge. Over recent years, there has been substantial activity around local and traditional knowledge and its role in adaptation/resilience (Mercer *et al.* 2007, 2010; Kelman 2010). Campbell (2009) argues that although Pacific and other islands have historically been represented as sites of vulnerability, examination of traditional disaster reduction measures reveals considerable resilience. He argues that many of the vulnerabilities that do exist are a product of islands' exposure to a 'wider world'. Tapping into local and traditional knowledge via the kinds of participatory approaches advocated by Mercer and colleagues (2007; 2010) is one way in which Australia can work to enhance the capacity of its neighbours whilst avoiding many of constraints on regionalism identified by Hughes (2005) and Roberts *et al.* (2007).

Should available resources become depleted due to the increasing frequency of concurrent climate-driven emergencies occurring here and overseas, what is Australia's capacity to manage without international assistance?

No recent research addressing this question could be located.

6. KEY RESEARCH THEMES NOT INCLUDED IN THE ORIGINAL NARP

This updated review identified four key themes relating to climate change and the emergency management sector that were not included in the original NARP:

- Disaster risk reduction and links with climate change adaptation
- Good governance mechanisms
- Decision-making in the context of complexity and uncertainty
- Adaptation and emergency management in urban areas

6.1 Integrating disaster risk reduction and climate change adaptation

Disaster risk reduction is a key focus of international research and policy developments, as is evidenced by the adoption of the UN International Strategy on Disaster Risk Reduction in 2000. Disaster risk reduction emphasizes the need to move emergency management approaches beyond a response-oriented focus on hazard mitigation to consider vulnerability reduction and community resilience. More recently, connections and interactions between disaster risk reduction and climate change adaptation have been increasingly emphasised (Mercer, 2010; Romieu, Welle, Schneiderbauer, Pelling, & Vinchon, 2010; Schipper & Pelling, 2006; Thomalla, Downing, Spanger-Siegfried, Han, & Rockström, 2006). Along this line, an AFAC position paper on climate change and the fire and emergency services sector (AFAC, 2011) emphasized the role of the emergency management sector in community adaptation to and mitigation of climate-change, particularly through input to exposure mitigation efforts.

Increasing international research examines ways to overcome challenges for linking disaster risk reduction and climate change adaptation, such as mismatches in spatial and temporal scales, knowledge bases and norms (Birkmann & von Teichman, 2010). There is a growing emphasis internationally on supporting climate change adaptation through disaster risk reduction (IASC & ISDR, 2008; ISDR, 2010).

However, there has been little policy and research attention to disaster risk reduction in Australia. According to Crompton there are “few disaster risk reduction policies explicitly developed to help Australian communities adapt to a changing climate” (p. 45).

6.2 Good governance mechanisms

“Good governance” mechanisms emphasize the need for accountability, participation, predictability and transparency in disaster risk reduction (Ahrens & Rudolph, 2006; Lewis & Mioch, 2005). Correspondingly, there has been an emerging focus in research on the use of participatory, inclusive disaster risk reduction and emergency management approaches. Such approaches are also examined as mechanisms for disaster management decision-making under conditions of uncertainty and complexity (Amendola, Linnerooth-Bayer, Okada, & Shi, 2008).

Examples of studies with this focus include:

- Studies of participatory approaches such as those used in Japan (Bajek, Matsuda, & Okada, 2008).
- Local level strategic planning (Prabhakar, Srinivasan, & Shaw, 2009) and local government engagement (King, 2008; Lewis & Mioch, 2005).
- Incorporating local and indigenous knowledge (Ellemor, 2005; Mercer, Kelman, Taranis, & Suchet-Pearson, 2010; Veland, Howitt, & Dominey-Howes, 2010).

6.3 Decision-making in the context of complexity and uncertainty

One of the most difficult issues arising from climate change for emergency management planning is the increase in uncertainty and complexity it brings. Tools to support decision-making under such conditions are therefore a fast growing area of research, both in Australia and internationally. In particular, there have been numerous studies published on modelling future risks, as well as some research on developing decision support systems and vulnerability assessment tools:

- Storm tide modelling (Harper, Hardy, Mason, & Fryar, 2009).
- Gold Coast City Council flood emergency decision support system (Mirfenderesk, 2009).
- Modelling the impacts of climate change on coastal areas (Sinclair, 2009).
- Bushfire evacuation modelling (Taylor & Freeman, 2010).
- Bushfire vulnerability assessment (Preston, Brooke, Measham, Smith, & Gorddard, 2009).
- Assessing the vulnerability of rural communities to climate variability and change (Nelson et al., 2010; Nelson, Kovic, Crimp, Meinke, & Howden, 2010).

6.4 Adaptation and emergency management in urban areas

Whilst rural and agricultural systems are in the front line to experience climate change impacts, urban areas and their functioning will also be heavily influenced by climate change. As Birkmann *et al.* (2010) have argued urban areas are 'hotspots of high risk given their concentrations of population and infrastructure; their key roles for larger economic, political and social processes; and their inherent instabilities and vulnerabilities' (p.185). The potential impacts of climate change on urban areas have been identified and described in a number of recent reviews, including the IPCC Third and Fourth Assessment Reports (Scott *et al.* 2001; Wilbanks et al. 2007), Lindley *et al.* (2006), McEvoy (2007), Wilby (2007), Klein *et al.* (2007), and Hunt & Watkiss (2011). The consensus view is that the most significant impacts of climate change on urban areas are likely to be:

- Impacts of sea level rise on coastal cities (including the effects of storm surges);
- Impacts of extreme events on built infrastructure (e.g. from wind storms and storm surges, floods from heavy precipitation events, heat extremes and droughts);
- Impacts of higher average temperatures and/or extreme events on human health (e.g. heat and cold related mortality and morbidity, food and water borne disease, vector borne disease)
- Impacts on energy use (heating and cooling, energy for water);
- Impacts on water availability and resources.

Therefore, the task of adapting cities to the impacts of climate change is of great importance and this is reflected in a rapidly growing literature as well as an increasing number of policy documents that specifically address issues surrounding climate change adaptation in urban areas. Key publications to date include:

- An overview of literature that addresses climate change impacts at the city-scale, and the formulation of adaptation strategies (Hunt & Watkiss, 2011).
- A review of recent climate change adaptation strategies in nine selected cities with a particular emphasis on visions and goals, types of baseline information used, direct and indirect impacts, proposed structural and non-structural measures, and involvement of formal and informal actors (Birkmann *et al.*, 2010).

- A review of how the fields of disaster risk reduction and climate change adaptation have contributed to the understanding of how cities are responding to climate change risks and hazards (Solecki, Leichenko, & O'Brien, 2011).
- An examination of vulnerability and adaptation to climate change in urban centres in low and middle-income countries in Africa, Asia and Latin America (Bicknell, Dodman, & Satterwaite, 2009).
- A detailed analysis of how climate science and socio-economic research can be used to map a city's vulnerability to climate hazards, and how cities can enhance their adaptive and mitigative capacity to deal with climate change over different time scales (Rosenzweig, Solecki, Hammer, & Mehrotra, 2011).
- An exposition of a multi-level governance framework for climate change adaptation in cities (Corfee-Morlot *et al.*, 2009).
- An analysis of climate change adaptation in the three coastal megacities of Manila, Ho Chi Minh City, and Bangkok.(Pillai *et al.* (2010).
- A discussion of the current arrangements for strategic and statutory urban planning in Australian cities and how these can be improved so as to minimise climate change impacts (Garnaut, 2011).
- A report detailing insights gained through the integrated assessment of climate change impacts on Australian urban settlements project (IACCIUS), an initiative which aims to provide information that decision-makers can use to make informed adaptation decisions (Li *et al.*, 2010).

7. THE INFLUENCE OF RECENT POLICY DEVELOPMENTS

Since the publication of the original NARP there have been a number of policy developments, at both national and regional levels, and these may influence future research priorities. National policy developments of note are:

- National Action Plan for the Attraction, Support and Retention of Emergency Management Volunteers released, September 2009
- AFAC Climate Change and the Fire and Emergency Services Sector position released, September 2009
- Final report of the Victorian Fires Royal Commission released, July 2010 (Teague, McLeod, & Pascoe, 2010)
- Queensland Floods Commission of Inquiry established, January 2011
- National Strategy for Disaster Resilience adopted by COAG, February 2011
- National Disaster Insurance Review launched by Treasury, March 2011
- National Climate Change Action Plan for the Emergency Management Sector endorsed, November 2009 (MCPEM-EM, 2009)
- Report on the Perth Hills bushfire released February 2011 (Keelty, 2011).

Regional policy developments include:

- APEC Emergency Management CEOs' Forum Outcome Report, 2009.
- APEC Workshop on Public Private Partnerships and Disaster Resilience Report, January 2011.

8. REFERENCES

- AFAC. 2011. *Climate Change and the Fire and Emergency Services Sector*. Paper prepared for AFAC.
http://www.afac.com.au/positions/Climate_Change_and_the_Fire_and_Emergency_Services_Sector
- Ahrens, J., & Rudolph, P. M., 2006. The importance of governance in risk reduction and disaster management. *Journal of Contingencies and Crisis Management*, 14(4). 207-220.
- Amendola, A., Linnerooth-Bayer, J., Okada, N., & Shi, P., 2008. Towards integrated disaster risk management: case studies and trends from Asia. *Natural Hazards*, 44(2). 163-168.
- Anderson, A. 2009. Media politics and climate change: towards a new research agenda. *Sociology Compass*, 3(2), 166-182.
- Allison, E., Perry, A., Badjeck, M., Adger, N., Brown, B., Conway, D., Halls, A., Pilling, G., Reynolds, J., Andrew, N., & Dulvy, N. 2009 Vulnerability of national economies to the impacts of climate change on fisheries. *Fish and Fisheries*, 10(2), 173-196.
- Apan, A., Keogh, D.U., King, D., Thomas, M., Mushtaq, S. and Baddiley, P. 2010. *The 2008 Floods in Queensland: A Case Study of Vulnerability, Resilience and Adaptive Capacity. Report for the National Climate Change Adaptation Research Facility, Gold Coast, Australia.*
- Au, A.T. 2011. [Analysis of command and control networks on Black Saturday](#), *Australian Journal of Emergency Management*, 26(3), 20-29.
- Australian Pacific Economic Cooperation (APEC), 2009. *Emergency Management CEOs' Forum Outcome Report*.
- Australian Pacific Economic Cooperation (APEC) 2011, Workshop on Public Private Partnerships and Disaster Resilience Report, January 2011.
- Bajek, R., Matsuda, Y., & Okada, N., 2008. Japan's Jishu-bosai-soshiki community activities: Analysis of its role in participatory community disaster risk management. *Natural Hazards*, 44(2). 281-292.
- Barnett, J. 2001. Adapting to climate change in Pacific Island countries: the problem of uncertainty. *World Development* 29 (6), 977-93.
- Baxter-Tomkins, T., & Wallace, M., 2009. Recruitment and retention of volunteers in emergency services. *Australian Journal on Volunteering*, 14, 39-49.
- Becker, J., Johnston, D., Lazrus, H., Crawford, G., Nelson, D. (2008). Use of traditional knowledge in emergency management for tsunami hazard: A case study from Washington State, USA. *Disaster Prevention and Management*, 17(4). 488-502.
- Bicknell, J., Dodman, D., & Satterthwaite, D. 2009. *Adapting Cities to Climate Change: Understanding and Addressing the Development Challenges*. Oxford: Earthscan.
- Birkmann, J., & von Teichman, K., 2010. Integrating disaster risk reduction and climate change adaptation: key challenges—scales, knowledge, and norms. *Sustainability Science*, 5(2), 171-184.
- Birkmann, J., Garschagen, M., Kraas, F., Quang, N. (2010). Adaptive urban governance: new challenges for the second generation of urban adaptation strategies to climate change. *Sustainability Science*, 5, 185–206.

- Bosomworth, K. 2011. *Exploring a capacity for adaptive governance in the (bush) fire management policy sector: the role of bureaucrats & reflexive learning*. Unpublished doctoral dissertation, RMIT University.
- Botzen, W., van den Bergh, J., & Bouwer, L., 2010. Climate change and increased risk for the insurance sector: a global perspective and an assessment for the Netherlands. *Natural Hazards*, 52(3). 577-598.
- Boykoff, M.T. 2008a. Lost in translation? United States television news coverage of anthropogenic climate change, 1995–2004. *Climate Change*, 86(1). 1-11.
- Boykoff, M.T. 2008b. The cultural politics of climate change discourse in UK tabloids. *Political Geography*, 27(5), 549-569.
- Boykoff, M.T. & Smith, J. 2010. Media representations of climate change. In C. Lever-Tracy (Ed.), *Routledge handbook of climate change and society* (pp. 210-218). Routledge: London.
- Brander, K. 2010. Predicting the effects of climate change on marine communities and the consequences for fisheries. *Journal of Marine Systems*, 79(3), 418-426.
- Brody, S., Zahran, S., Vedlitz, A. & Grover, H. 2008. Examining the Relationship Between Physical Vulnerability and Public Perceptions of Global Climate Change in the United States. *Environment and Behaviour*, 40(1). 72-95.
- Buxton, M., Haynes, R., Mercer, D., & Butt, A. 2011. Vulnerability to bushfire risk at Melbourne's urban fringe: The failure of regulatory land use planning. *Geographical Research*, 49(1): 1-12.
- Campbell, J. 2009. Islandness: vulnerability and resilience in Oceania. *Shima: The International Journal of Research into Island Cultures* 3 (1), 85-97.
- Clode D (2009) *Psychological preparedness for bushfires*. Country Fire Authority: Burwood.
- Cochrane, K., De Young, C., Soto, D. & Bahri, 2009. Climate change implications for fisheries and aquaculture. Overview of current scientific knowledge. *FAO Fisheries and Aquaculture Technical Paper*, 530. 217.
- COAG 2011, National Strategy for Disaster Resilience adopted by COAG, February 2011
- Committee on Private-Public Sector Collaboration to Enhance Community Disaster Resilience. 2010. *Private-public sector collaboration to enhance community disaster resilience: a workshop report*. National Academy of Sciences: Washington.
- Corfee-Morlot, J., Kamal-Chaoui, L., Donovan, M., Cochran, I., Robert., A., & Teasdale. P. 2009. *Cities, Climate Change and Multilevel Governance*. Paris: OECD.
- Cowlshaw, S., Evans, L., & McLennan, J., 2010. Work–family conflict and crossover in volunteer emergency service workers. *Work & Stress*, 24(4). 342 - 358.
- Cowlshaw, S. E., Lynette McLennan, Jim, 2008. Families of rural volunteer firefighters. *Rural Society*, 18(1). 17-25.
- Crimp, S, Howden, M., Power, B., Wang, E., & De Voil, P. 2008. *Global climate change impacts on Australia's wheat crops*. CSIRO: Queensland.
- Crompton, R.P. and K.J. McAneney. 2008. The cost of natural disasters in Australia: the case for disaster risk reduction. *Aust. J. Emergency Management*, 23:43-46.

- Crompton, R., McAneney, K.J., Chen, K., Pielke Jr., R., , & K. Haynes. 2010. [Influence of Location, Population and Climate on Building Damage and Fatalities due to Australian Bushfire: 1925-2009](#). *Weather, Climate, and Society*, 2, 300-310.
- Crompton, R., McAneney, K.J., Chen, K., Pielke Jr., R., , & K. Haynes. 2011. [Reply to the Nicholls \(2011\) comment on Crompton et al. \(2010\), "Influence of location, population, and climate on building damage and fatalities due to Australian bushfire: 1925–2009"](#). *Weather, Climate, and Society*, 3, 63-66.
- Cutter, S., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., & Webb, J. 2010. A place-based model for understanding community resilience to natural disasters. *Global Environmental Change*, 18. 598-606.
- Duffy, N., 2009. Natural Hazards Education in Australian Schools: How Can We Make It More Effective?. *Australian Journal of Emergency Management*, The 24(2). 13-16.
- Duffy, N., 2008. A New Approach to Community Flood Education. *Australian Journal of Emergency Management* 23(2). 4-8.
- Dupont, A., Lusthaus, J., Phipps, T., Pitman, A., Rayfuse, R., Thomson, M., and Pearman, G. 2008. *Climate change and security: managing the risk*. Paper prepared for the Garnaut Climate Change Review.
[http://www.garnautreview.org.au/CA25734E0016A131/WebObj/05Security/\\$File/05%20Security.pdf](http://www.garnautreview.org.au/CA25734E0016A131/WebObj/05Security/$File/05%20Security.pdf). Last accessed 27 April 2011.
- Doulton, H. 2009. Ten years to prevent catastrophe? Discourses of climate change and international development in the UK press. *Global Environmental Change*, 19(2). 191-202.
- Ellemor, H., 2005. Reconsidering emergency management and indigenous communities in Australia. *Global Environmental Change Part B: Environmental Hazards*, 6(1). 1-7.
- Elsworth, G., J. Gilbert, et al. Ibid. Community Safety Programs for Bushfire: What Do They Achieve, and How? , 17-25.
- Eriksen, C., Gill, N., & Head, L. (2010). Bushfire and everyday life: Examining the awareness-action 'gap' in changing rural landscapes. *Geoforum*, 41(5). 814-825.
- Eriksen, C. & Prior, T. 2011. The art of learning The art of learning: wildfire, amenity migration and local environmental knowledge. *International Journal of Wildland Fire*, 20(4). 612-624.
- Finnis, K., Johnston, D., Ronan, K. & White, J. 2010 Hazard perceptions and preparedness of Taranaki youth. *Disaster Prevention and Management*, 19(2). 175-184.
- Garnaut, R. 2011. *The Garnaut review 2011: Australia in the Global Response to Climate Change*. New York: Cambridge.
- Gifford, R., Kormos, C. & McIntyre, A. (2011) Behavioral dimensions of climate change: Drivers, responses, barriers, and interventions. *Wiley Interdisciplinary Reviews: Climate Change*, 2, 801-827.
- Handmer, J., 2008. Risk creation, bearing and sharing on Australian floodplains. *International Journal of Water Resources Development*, 24(4). 527-540.

- Harper, B., Hardy, T., Mason, L., & Fryar, R., 2009. Developments in storm tide modelling and risk assessment in the Australian region. *Natural Hazards*, 51(1). 225-238.
- Helman, P., Thomalla, F. and Metusela, C. 2010. *Storm tides, coastal erosion and inundation*. Report for the National Climate Change Adaptation Research Facility, Gold Coast, Australia.
- Hernandez, A. & Ryan, G. 2011. Coping with climate change in the tourism industry: a review and agenda for future research. *Tourism and Hospitality Management*, 17(1). 79-90.
- Howard, B., 2009. Feature story: Climate change and the volunteer emergency management sector. *National Emergency Response*, 22(3). 8-11.
- Hughes, A.V. 2005. Strengthening regional management: a review of the architecture for regional co-operation in the Pacific. Report to the Pacific Islands Forum.
[http://www.sopac.org/sopac/docs/RIF/06_AV%20Hughes%20Report_CONSULTATIVE_DRAFT\(1\).pdf](http://www.sopac.org/sopac/docs/RIF/06_AV%20Hughes%20Report_CONSULTATIVE_DRAFT(1).pdf) Last accessed 27 April 2011.
- Hulme, M. 2009. *Why we disagree about climate change: understanding controversy, inaction and opportunity*. Cambridge: UK.
- Hunt, A. & Watkiss, P. Climate change impacts and adaptation in cities: a review of the literature. *Climate Change*, 104, 13-49.
- IASC, & ISDR, 2008. Disaster risk reduction strategies and risk management practices: Critical elements for adaptation to climate change. *Submission to the UNFCCC Adhoc Working Group on Long Term Cooperative Action*, Inter-Agency Standing Committee; International Strategy for Disaster Reduction.
- ISDR, 2010. Strengthening climate change adaptation through effective disaster risk reduction. International Strategy for Disaster Reduction.
- Jennings, S. & Brander, K. 2010. Predicting the consequences of climate change on marine communities and the consequences for fisheries. *Journal of Marine Systems*, 79(3). 418-426.
- Kahan, J., Allen, A., & George, J. (2009). An Operational Framework for Resilience. *Journal of Homeland Security and Emergency Management*, 6 (1), 1-47.
- Keely, M. 2011. A Shared Responsibility: The report of the Perth Hills bushfire February 2011 review. Western Australian Government: Perth.
http://sharedservices.servicenet.wa.gov.au/bushfire/Perth_Hills_Bushfire_Report_Feb_2011.pdf
- Kellstedt, P., Zahran, S. & Vedlitz, A. 2008. Personal efficacy, the information environment, and attitudes towards global warming and climate change in the United States. *Risk Analysis*, 28(1). 113-126.
- Kelman, I. 2010. Hearing local voices from Small Island Developing States for climate change. *Local Environment* 15 (7), 605-19.
- Keogh Diane U., Apan Armando, Mushtaq Shahbaz, King David & Thomas Melanie (2011) Resilience, vulnerability and adaptive capacity of an inland rural town prone to flooding: a climate change adaptation case study of Charleville, Queensland, Australia. *Natural Hazards*, 59(2), 699–723.
- Kiem, A.S., Askew, L.E., Sherval, M., Verdon-Kidd, D.C., Clifton, C., Austin, E., McGuirk, P.M.

- and Berry, H 2010. *Drought and the Future of Rural Communities: Drought impacts and adaptation in regional Victoria, Australia*. Report for the National Climate Change Adaptation Research Facility, Gold Coast, Australia.
- Kiem, A.S., Verdon-Kidd, D.C., Boulter, S. and Palutikof, J. 2010. Learning from experience: Historical Case Studies and Climate Change Adaptation. Report for the National Climate Change Adaptation Research Facility, Gold Coast, Australia.
- King, D., 2008. Reducing hazard vulnerability through local government engagement and action. *Natural Hazards*, 47(3). 497-508.
- King, D., Bird, D., Haynes, K., Box, P., Okada, T. & Nairn, K. (2012) Investigating Factors that Inhibit and Enable Adaptation Strategies Following the 2010/11 Floods. A Final Report Submitted to NCCARF, Griffith, Queensland.
- King D. & Smithers S. 2009. "Climate Change Migration from Low-Lying small Island Communities." In Asrar G. Editor *Climate Sense*. World Meteorological Organization, Published Tudor Rose, Leicester
- Klein RJT, Huq S, Denton F, Downing TE, Richels RG, Robinson JB, Toth FL (2007) Interrelationships between adaptation and mitigation. *Climate Change 2007: impacts, adaptation and vulnerability*. In M. Parry., O. Canziani., J. Palutikof., P. van der Linden & C, Hanson (eds), *Contribution of working group II to the fourth assessment report of the intergovernmental panel on climate change* (pp. 745–777). Cambridge: Cambridge.
- Leiserowitz, A., Maibach, E., Roser-Renouf, C. Smith, N. Hmielowski, J.D. (2011) *Climate change in the American mind; America's global warming beliefs and attitudes in November 2011*. Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change Communication.
- Lenton, T., Held, H., Kriegler, E., Hall, J., Lucht, W., Rahmstorf, S., Schellnuber, H. (2008). Tipping elements in the earth's climate system. *Proceedings of the National Academy of Sciences of the United States of America*, 105(6). 1786-1793.
- Leviston, Z., Leithch, A., Greenhill, M. Leonard, R. & Walker, I. (2011) *Australians' views of climate change*. Freemantle, WA: CSIRO, National Research Flagships: Climate Adaptation.
- Lewis, D., & Mioch, J., 2005. Urban vulnerability and good governance. *Journal of Contingencies and Crisis Management*, 13(2). 50-53.
- Li, G., Dovers, S., Sutton, P., Guillaume, J., Hutchinson, M., Dyball, R., Proust, K., Carroll, L. & Troy, P., 2010. *IACCIUS: Synthesis Report on Integrated Assessment of Climate Change Impacts on Urban Settlements*. Canberra: Fenner School of Environment and Society, The Australian National University.
- Lindley S, Handley J, Theuray, N, Peet E, & McEvoy D (2006). Adaptation strategies for climate change in the urban environment: assessing climate change risks in UK urban areas. *Journal of Risk Research*, 9(5), 543–568.
- Locke, J.T. 2009. Climate change-induced migration in the Pacific Region: sudden crisis and long-term developments. *The Geographical Journal* 175(3), 171-80.
- Lowe, T., Haynes, K., & Bryne, G. 2008. Resilience at the urban interface: the community fire unit approach. In J. Handmer & K. Haynes (Eds.), *Community bushfire safety* (pp.21-35). Melbourne: CSIRO.

- Maibach, E., Roser-Renouf, C. & Leiserowitz, A. (2009) *Global warming's six Americas 2009: An audience segmentation analysis*. New Haven, CT: Yale Project on Climate Change.
- Mason, M. and Haynes, K. 2010, *Adaptation Lessons from Cyclone Tracy*. Report for the National Climate Change Adaptation Research Facility, Gold Coast, Australia.
- Maynard, T. 2008. Climate Change: Impacts on Insurers and How They Can Help With Adaptation and Mitigation. *The Geneva Papers on Risk and Insurance*, 33. 140-146.
- McEvoy D. (2007). Climate change and cities. *Built Environment*, 33(1), 1-31.
- McGee, T. 2011. Public engagement in neighbourhood level wildfire mitigation and preparedness: Case studies from Canada, the US and Australia. *Journal of Environmental Management*, 92(10). 2542-2532.
- McLennan, J. B., Adrian, 2008. Why would you do it?: Age and motivation to become a fire service volunteer. *Australian and New Zealand Journal of Organisational Psychology*, 1(1). 7-11.
- MCPEM-EM, 2009. Climate change adaptation action plan. Canberra, Ministerial Council for Police and Emergency Management – Emergency Management.
- Mercer, J., Dominey-Howes, J., Kelman, I. and Lloyd, K. 2007. The potential for combining indigenous and western knowledge in reducing vulnerability to environmental hazards in small island developing states. *Environmental Hazards* 7, 245-56.
- Mercer, J., 2010. Disaster risk reduction or climate change adaptation: Are we reinventing the wheel? , *Journal of International Development*, 22(2). 247-264.
- Mercer, J., Kelman, I., Taranis, L., & Suchet-Pearson, S., 2010. Framework for integrating indigenous and scientific knowledge for disaster risk reduction. *Disasters*, 34(1). 214-239.
- Mills, E., 2007. Synergisms between climate change mitigation and adaptation: an insurance perspective. *Mitigation and Adaptation Strategies for Global Change*, 12(5). 809-842.
- Mimura, N., Nurse, L., McLean, R., Agard, J., Briguglio, L., Lefale, P., Payet, R, and Sem, G., 2007: *Small islands. Climate Change 2007: Impacts, Adaptation and Vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 687-716.
- Mirfenderesk, H., 2009. Flood emergency management decision support system on the Gold Coast, Australia. *Australian Journal of Emergency Management*, 24(2). 50-58.
- Mortimer, E., Bergin, A., & Carter, R., 2011. Sharing risk: Financing Australia's disaster resilience. (Vol. 37) Barton, Australian Strategic Policy Institute.
- Mortreux, C., and Barnett, J. 2009. Climate change, migration and adaptation in Funafuti, Tuvalu. *Global Environmental Change* 19, 105-12.
- Nelson, R., Kocic, P., Crimp, S., Martin, P., Meinke, H., Howden, S. M., & Nidumolu, U. 2010. The vulnerability of Australian rural communities to climate variability and change: Part II-Integrating impacts with adaptive capacity. *Environmental Science and Policy*, 13(1). 18-27.

- Nelson, R., Kovic, P., Crimp, S., Meinke, H., & Howden, S. M., 2010. The vulnerability of Australian rural communities to climate variability and change: Part I-Conceptualising and measuring vulnerability. *Environmental Science and Policy*, 13(1). 8-17.
- Nelson, G., Rosegrant, M., Koo, J., Roberston, R., Sulser, T., Zhu, T., Ringler, C., Msangi, S., Palazzo, A., Batka., M., Magalhaes, M., Valmonte-Santos, R., Ewing, M. & Lee, D. 2009. *Climate change: impact on agriculture and costs of adpatation*. International Food Policy Research Institute: Washington DC.
- Nicolopoulos, N. & Hansen, E. 2009. How well prepared are Australian communities for natural disasters and fire emergencies? *Australian Journal of Emergency Management*, 24(1). 60-66.
- Nicholls, N., 2011. [Comments on "Influence of Location, Population, and Climate on Building Damage and Fatalities due to Australian Bushfire: 1925–2009"](#). *Weather, Climate, and Society*, 3, 61-62.
- Nibett, M. 2009. Communicating climate change: why frames matter for public engagement. *Environment: Science and Policy for Sustainable Development*, 51(2). 12-23.
- Norman, B. 2008. "Principles for an intergovernmental agreement for coastal planning and climate change in Australia." *Habitat International* 33(3): 293-299.
- Ojero, Moseley, C., Lynn, K., & Bania, N. 2010. Limited Involvement of Socially Vulnerable Populations in Federal Programs to Mitigate Wildfire Risk in Arizona. *Natural Hazards Review*, 12(28). 28-36.
- O'Riordan, T. & Cameron, J. 1994. *Interpreting the precautionary principle*. Earthscan: London.
- Parkin, D., 2008. Future challenges for volunteer based emergency services. *Australian Journal of Emergency Management*.
- Pelling, M., High, C., Deering, J., & Smith, D. 2008. Shadow spaces for social learning: a relational understanding of adaptive capacity to climate change within organisations. *Environment and Planning A*, 40(4). 867-884.
- Pillai, P., Philips, B.R., Shyamsundar, P., Ahmed, K., & Wang, L. (2010). *Climate risks and adaptation in Asian coastal megacities: a synthesis report*. Washington: Worldbank.
- Pooley, J., Cohen, L. & O'Connor, M. 2010. Bushfire communities and resilience: what can they tell us? *Australian Journal of Emergency Management*, 25 (2). 33-38.
- Prabhakar, S., Srinivasan, A., & Shaw, R., 2009. Climate change and local level disaster risk reduction planning: need, opportunities and challenges. *Mitigation and Adaptation Strategies for Global Change*, 14(1). 7-33.
- Preston, B., Brooke, C., Measham, T., Smith, T., & Gorddard, R., 2009. Igniting change in local government: lessons learned from a bushfire vulnerability assessment. *Mitigation and Adaptation Strategies for Global Change*, 14(3). 251-283.
- Prior, T. & Paton, D. 2008. Understanding the Context: The value of community engagement in bushfire risk communication and education: observations following the East Coast Tasmania bushfires of December 2006. *The Australasian Journal of Disaster and Trauma Studies*, 2. Retrieved from <http://www.massey.ac.nz/~trauma/issues/2008-2/prior.htm>. Last accessed 25th July, 2011.
- Proudley, M. 2008. Fires, families, and decisions. *Australian Journal of Emergency Management*, 23(1). 37-43.

- Reeves, J., Foelz, C., Grace, P., & Best, P. 2010. *Impacts and adaptation response of infrastructure and communities to heatwaves: the southern Australian experience of 2009*. Report for the National Climate Change Adaptation Research Facility, Gold Coast, Australia.
- Renaud, F., Birkmann, J., Damm, M., & Gallopin, G. (2010). Understanding multiple thresholds of coupled social–ecological systems exposed to natural hazards as external shocks. *Natural Hazards*, 55(3), 749-763.
- Reser, J. & Morrissey, S. (2009). The crucial role of psychological preparedness for disasters. Report prepared for the Australian Psychological Society. http://www.psychology.org.au/inpsych/psychological_preparedness/ Last accessed 15th September, 2011.
- Reser, J., Pidgeon, N., Spence, A., Bradley, G., Glendon, A., & Ellul, M. 2011. *Public Risk Perceptions, Understandings, and Responses to Climate Change in Australia and Great Britain: Interim Report*. Report for the National Climate Change Adaptation Research Facility, Gold Coast, Australia.
- Resilience Alliance. 2009. *Assessing resilience in social-ecological systems: workbook for practitioners*. http://www.resalliance.org/index.php/resilience_assessment. Last accessed 25th July, 2011.
- Roberts, S.M., Wright, S. & O'Neill, P. 2007. Good governance in the Pacific? Ambivalence and possibility. *Geoforum* 38, 967-84.
- Romieu, E., Welle, T., Schneiderbauer, S., Pelling, M., & Vinchon, C., 2010. Vulnerability assessment within climate change and natural hazard contexts: revealing gaps and synergies through coastal applications. *Sustainability Science*, 5(2). 159-170.
- Ronan, K., Crellin, K. & Johnston, D. 2010. Correlates of hazard education for youth. *Natural hazards*, 53. 503-526. Rosenzweig, C., Solecki, W., Hammer, S., Mehrotra, S. 2011. *Climate change and cities: First assessment report of the urban climate change research network*. Cambridge: Cambridge.
- Scheffer, M., Bascompte, J., Brock, W., Brovkin, V., Carpenter, S., Dakos, V., Held, H., van Nes, E., Rietkerk, M., & Sugihara, G. 2009. Early-warning signals for critical transitions. *Nature*, 461: 53-59.
- Schipper, L., & Pelling, M., 2006. Disaster risk, climate change and international development: scope for, and challenges to, integration. *Disasters*, 30(1). 19-38.
- Schwarze, R., Schwindt, M., Weck-Hannemann, H., Raschky, P., Zahn, F., & Wagner, G. G., 2011. Natural hazard insurance in Europe: Tailored responses to climate change are needed. *Environmental Policy and Governance*, 21(1). 14-30.
- Scott M, Gupta S, Jáuregui E, Nwafor J, Satterthwaite D, Wanasinghe YADS, Wilbanks T, Yoshino M, Kelkar U, Mortsch L, Skea J (2001) Human settlements, energy, and industry. Climate change 2001: impacts, adaptation, and vulnerability. In J. McCarthy, O. Canziani, N. Leary, D. Dokken & K. White (eds) *Contribution of working group II to the third assessment report of the intergovernmental panel on climate change* (pp. 381–416). Cambridge: Cambridge.
- Semenza, J., Hall, D., Wilson, D., Bontempo, B., Sailor, D. & George, L. 2008. Public perception of climate change: voluntary mitigation and barriers to behaviour change. *American Journal of Preventative Medicine*, 35 (5). 479-487.

- Sims, J. & Baumann, D. (1983). Educational programs and human response to natural hazards. *Environment and Behaviour*, 15, 165-89.
- Sinclair, M., 2009. The impacts of climate change. *Hydro International*, 13(5).
- Smith, T. F., B. Preston, et al. (2009). *Managing Coastal Vulnerability: New Solutions for Local Government*, Wiley-Blackwell.
- Solberg, C., Rossetto, T., & Joffe, H. (2010). The social psychology of seismic hazard adjustment: re-evaluating the international literature. *Natural Hazards and Earth Science Systems*, 10, 1663-1677.
- Solecki, W., Leichenko, R., & O'Brien, K. 2011. Climate change adaptation strategies and disaster risk reduction in cities: connections, contentions, and synergies. *Current Opinion in Environmental Sustainability*, 3(3), 135-141.
- Stewart, G. T., Kolluru, R., & Smith, M., 2009. Leveraging public-private partnerships to improve community resilience in times of disaster. *International Journal of Physical Distribution & Logistics Management*, 39. 343-364.
- Sturm, T., & Oh, E., 2010. Natural disasters as the end of the insurance industry? Scalar competitive strategies, alternative risk transfers, and the economic crisis. *Geoforum*, 41(1). 154-163.
- Sullivan, K., 2008. Policy implications of future increases in extreme weather events due to climate change. *Australian Journal of Emergency Management*, 23(4): 37-42.
- Swim, J., Clayton, S., Doherty, T., Gifford, R., Howard, G., Reser, J., Stern, P. & Weber, E. 2010. *Psychology and Global Climate Change: Addressing a Multi-faceted Phenomenon and Set of Challenges*. American Psychological Association: Washington DC.
- Taylor, M. A. P., & Freeman, S. K., 2010. A review of planning and operational models used for emergency evacuation situations in Australia. *Procedia Engineering*, 3. 3-14.
- Teague, B., McLeod, R., & Pascoe, S., 2010. *2009 Victorian Bushfires Royal Commission: final report*. Melbourne, Australia, State of Victoria.
- Thomalla, F., Downing, T., Spanger-Siegfried, E., Han, G., & Rockström, J., 2006. Reducing hazard vulnerability: towards a common approach between disaster risk reduction and climate adaptation. *Disasters*, 30(1). 39-48.
- Tooth, R. & Barker, G. (2007): "The Non Insured: Who, Why and Trends".
<http://www.insurancecouncil.com.au/IssuesSubmissions/Issues/NonInsurance/tabid/1299/Default.aspx> Last accessed 15th September, 2011.
- Towers, B. 2011. *Children's knowledge of vulnerability and resilience to bushfires*. Unpublished doctoral dissertation, University of Tasmania, Hobart, Australia.
- Tulsi, B., Delacy, T., Calgaro, E., & Jopp, R. 2011. Designing Robust Tourism Industry Responses to Climate Change Impacts on the Great Ocean Road Destination and Tourism System In M. Gross (Ed.). *CAUTHE 2011 National Conference: Tourism: Creating a Brilliant Blend* (pp. 932-937). Adelaide: University of South Australia.
- Twigg, J. (2009). *Characteristics of a Disaster Resilient Community: A Guidance Note (Version 2)*. University College, London.
<http://community.eldis.org/.59e907ee/Characteristics2EDITION.pdf> Last accessed 10th February, 2012.

- UNISDR. (2011). *Global assessment report on disaster risk reduction, revealing risk, redefining development*, Geneva, Switzerland, United Nations International Strategy for Disaster Reduction.
- Veland, S., Howitt, R., & Dominey-Howes, D., 2010. Invisible institutions in emergencies: Evacuating the remote Indigenous community of Warruwi, Northern Territory Australia, from Cyclone Monica. *Environmental Hazards*, 9. 197-214.
- Verdon-Kidd, D.C., Kiem, A.S., Willgoose, G. and Haines, P. 2010. *East Coast Lows and the Newcastle/Central Coast Pasha Bulker storm*. Report for the National Climate Change Adaptation Research Facility, Gold Coast, Australia.
- Wardekker, J.A., Peterson, A., & van der Sluijs, J.P. 2009. Ethics and public perception of climate change: exploring Christian voices in the U.S policy debate. *Global Environmental Change*, 19. 512-521.
- Waugh, W. & Streib, G. 2006. Collaboration and Leadership for Effective Emergency Management. *Public Administration Review*, 66, 131 – 40.
- Warner, K., Ranger, N., Surminski, S., Arnold, M., Linnerooth-Bayer, J., Michel-Kerja, E., . . . Herweijer, C., 2009. Adaptation to climate change: Linking disaster risk reduction and insurance. *United Nations ISDR (International Strategy for Disaster Reduction) Secretariat, Geneva, Switzerland*.
- Webb, L.B., Whetton, P.H. & Barlow, E.W.R. 2008. Climate change and wine grape quality in Australia. *Climate Research*, 36. 99-111.
- Weber, E. & Stern, P. 2011. Public understanding of climate change in the United States. *American Psychologist*, 66(4): 315-328.
- Wilbanks TJ, Romero Lankao P, Bao M, Berkhout F, Cairncross S, Ceron J-P, Kapshe M, Muir-Wood R, Zapata-Marti R (2007) Industry, settlement and society. Climate change 2007: impacts, adaptation and vulnerability. In: Parry ML, Canziani OF, Palutikof JP, van der Linden PJ, Hanson CE (eds) *Contribution of Working Group II to the fourth assessment report of the intergovernmental panel on climate change* (pp. 357–390). Cambridge: Cambridge,
- Wilby, R. (2007) A review of climate change impacts on the built environment. *Built Environment*, 33(1), 31–45
- Wilkins, M., 2010. The need for a multi-level approach to climate change - An Australian insurance perspective. *The Geneva Papers*, 35(2). 336-348.
- Whitmarsh, L. 2008. What's in a name? Commonalities and differences in public understanding of "climate change" and "global warning". *Public Understanding of Science*, 18. 401-420.
- Whittaker, J. 2008. *Vulnerability to bushfire in south-eastern Australia: a case study from East Gippsland, Victoria*. Unpublished Phd Dissertation.
- Whittaker, J. & Handmer J. 2010. Community Bushfire safety: a review of post-Black Saturday research. *Australian Journal of Emergency Management*, 25(4). 7-14.

9. FURTHER READING

Cottrell, A. and D. King (2007). Planning for more bushfires: implications of urban growth and climate change. *Queensland Planner* 47(4): 23-26

Daniell, K. A., M. A. Máñez Costa, et al. (2010). Aiding multi-level decision-making processes for climate change mitigation and adaptation. *Regional Environmental Change*: 1-16.

Fritze, J., L. Williamson, et al., 2009. Community engagement and climate change benefits, changes and strategies: report for Department of Planning and Community Development, Victorian Government Department of Planning and Community Development.

Jones, R. N., P. Dettmann, et al. (2007). The relationship between adaptation and mitigation in managing climate change risks: A regional response from North Central Victoria, Australia. *Mitigation and Adaptation Strategies for Global Change* 12(5): 685-712.

Kennedy, D., Stocker, L., & Burke, G., 2010. Australian local government action on climate change adaptation: Some critical reflections to assist decision-making. *Local Environment*, 15(9). 805-816.

Kjellstrom, T. and H. J. Weaver (2009). Climate change and health: impacts, vulnerability, adaptation and mitigation. *New South Wales Public Health Bulletin* 20(2): 5-9.

Linnenluecke, M. K., Stathakis, A., & Griffiths, A., 2011. Firm relocation as adaptive response to climate change and weather extremes. *Global Environmental Change*, 21(1). 123-133.

Mayner, L. and P. Arbon (2010). Climate change, health and the need to increase resilience and capacity. *Collegian* 17(4): 151-212.

Mayner, L., P. Arbon, et al. (2010). Emergency department patient presentations during the 2009 heatwaves in Adelaide. *Collegian* 17(4): 175-182.

McDonald, J. (2007). "A risky climate for decision-making: The liability of development authorities for climate change impacts." *Environmental and Planning Law Journal* 24(6): 405-416.

Mella, S. and P. Madill (2007). Climate Changes, Heat Illness and Adaptation in NSW. *Environmental Health* 7(3): 98-106.

Mills, E. (2005). "Insurance in a climate of change." *Science* 309(5737): 1040-1044, Michel-Kerja, E. O. and N. de Marcellis-Warin (2006). *Public-private programs for covering extreme events: The impact of information distribution on risk-sharing*. *Asia-Pacific Journal of Risk and Insurance* 1(2): 21-49.

Place, D., & Bellette, M., 2010. Opinion: Emergencies and land use planning. *Australian Journal of Emergency Management*, 25(4). 4-5.

Puig, J. (2009). "Climate change adaptation actions in northern Australian communities using scenario modelling." *IOP Conf. Series: Earth and Environmental Science* 6.

Saavedra, C. and W. W. Budd (2009). Climate change and environmental planning: Working to build community resilience and adaptive capacity in Washington State, USA. *Habitat International*, 33(3): 246-252.

Thomas, M. K., David Keogh, Diane U Apan, Armando Mushtaq, Shahbaz, 2011. "Resilience to climate change impacts: A Review of Flood Mitigation Policy in Queensland, Australia: Based on Case Studies of Flood Events in 2008." *Australian Journal of Emergency Management*.

Weaver, H. J., G. A. Blashki, et al. (2010). Climate change and Australia's healthcare system risks, research and responses. *Australian Health Review* 34(4): 441-444.

Possible further reading

R. Donangelo, H. Fort, V. Dakos, M. Scheffer and E. H. van Nes (in press). Early warnings of catastrophic shifts in ecosystems: Comparison between spatial and temporal indicators. *International Journal of Bifurcation and Chaos*.

V. Dakos, E. H. van Nes, R. Donangelo, H. Fort, and M. Scheffer (in press). Spatial correlation as leading indicator of catastrophic shifts. *Theoretical Ecology*, DOI: 10.1007/s12080-009-0060-6.

M. Scheffer, J. Bascompte, W.A. Brock, V. Brovkin, S.R. Carpenter, V. Dakos, H. Held, E.H. van Nes, M. Rietkerk & G. Sugihara (2009). Early-warning signals for critical transitions. *Nature*, 461: 53-59.

King D. & Smithers S. 2009. "Climate Change Migration from Low-Lying small Island Communities." In Asrar G. Editor *Climate Sense*. World Meteorological Organization, Published Tudor Rose, Leicester

King, D., Bird, D., Haynes, K., Box, P., Okada, T. & Nairn, K. (2012) Investigating Factors that Inhibit and Enable Adaptation Strategies Following the 2010/11 Floods. A Final Report Submitted to NCCARF, Griffith, Queensland

Boon Helen J. Cottrell Alison, King David, Stevenson Robert B. & Millar Joanne (2012) Bronfenbrenner's bioecological theory for modelling community resilience to natural disasters. *Nat Hazards* (2012) 60:381–408

Thomas, Melanie, King, David, & Fidelman, Pedro (2012) Climate Change Adaptation in Coastal Cities: Insights from the Great Barrier Reef, Australia. *The International Journal of Climate Change: Impacts and Responses*. Accepted for publication.

Thomas Melanie, King, David (2011) The social resilience and adaptive capacity of coastal cities vulnerable to climate change impacts: a case study of the 2008 Mackay floods, Queensland, Australia. (In press)

Cottrell, Alison, King, David and Dale, Allan (2011) Planning for Uncertainty: Disasters, Social Resilience and Climate Change. Paper Presented in Track 20 (Climate Change, Risk, Adaptation and Planning) at the 3rd World Planning Schools Congress, Perth (WA), 4-8 July 2011

Thomas, Melanie & King, David (2011) The adaptive capacity of coastal cities vulnerable to climate change impacts: A case study of the 2008 Mackay floods, Queensland, Australia. Conference on Environmental Health 2011 - Resetting our Priorities, Salvador, Brazil

Keogh Diane U., Apan Armando, Mushtaq Shahbaz, King David & Thomas Melanie (2011) Resilience, vulnerability and adaptive capacity of an inland rural town prone to flooding: a

climate change adaptation case study of Charleville, Queensland, Australia Nat Hazards (2011) 59:699–723

Thomas, Melanie, King, David, Keogh, Diane, Apan, Armando and Mushtaq, Shahbaz. (2011), Resilience to climate change impacts: a review of flood mitigation policy in Queensland, Australia. AJEM 29, 11 p 8-17

CSIRO Inclusions

Khoo YB and Wang X (2011). Assessment of Potential Inundation on Coastal Settlements and Transport Infrastructures of Selected Hotspots in Queensland. Published by CSIRO, Canberra. May, 2011. ISBN 978 0 643 10478 5.

Matthews S, Nguyen K, McGregor J L (2011). Modelling fuel moisture under climate change. *International Journal of Climate Change Strategies and Management* 3, 6-15.

McInnes KL, O'Grady JG, Hubbert GD (2009). Modelling sea level extremes from storm surges and wave setup for climate change assessments in southeastern Australia. *Journal of Coastal Research*, SI56, 1005-1009.

McInnes KL, Macadam I, Hubbert GD, O'Grady JG (2009). A Modelling Approach for Estimating the Frequency of Sea Level Extremes and the Impact of Climate Change in Southeast Australia. *Natural Hazards*, 51, 115-137, doi:10.1007/s11069-009-9383-2.

Stewart MG and Wang X (2011). Risk Assessment of Climate Adaptation Strategies for Extreme Wind Events in Queensland. Published by CSIRO, Canberra. ISBN 978 0 643 10431 0. Sullivan A L (2010). Grassland fire management in future climate. *Advances in Agronomy* 106, 173-208.

Wang C-H and Wang X (2011). Extreme wind gust hazard in Australia and its sensitivity to climate change. Submitted to Natural Hazard.

Wang X, Stafford Smith M, McAllister RRJ, Leitch A, McFallan S, Meharg S (2010). Coastal inundation under climate change: a case study in South East Queensland. CSIRO Climate Adaptation Flagship Working paper No. 6. <http://www.csiro.au/resources/CAF-working-papers.html>

Wang X and McAllister R (2011). Adapting to Heatwaves and Coastal Flooding, in *Climate Change: Science and Solutions for Australia*, edited by H Cleugh, M Stafford Smith, M Battaglia, and P Graham, CSIRO Publishing, Australia, pp73-84, 2011. ISBN: 978-0-643-10053-4.

References related to Psychology

Aspinwall, L.G. (2011) Future-oriented thinking, proactive coping, and the management of potential threats to health and well-being. In S. Folkman (Ed) *The Oxford handbook of stress, health, and coping* (pp 334-365).Oxford, England: Cambridge University Press.

Australian Psychological Society (APS) (2007, 2011) Psychological preparation for natural disasters: Information and tips. Melbourne, Australian Psychological Society.
www.psychology.org.au

Australian Psychological Society (APS) (2010) Psychology and climate change: A position statement prepared for the Australian Psychological Society. Melbourne, Australian Psychological Society. www.psychology.org.au

Bonanno, G.A., Brewin, C.R., Kaniasty, K. & La Greca, A.M. (2010) Weighing the costs of disaster: Consequences, risks, and resilience in individuals, families, and communities. *Psychological Science in the Public Interest*, 11 (1)1-49.

Brewer, J.F. (2008) *New directions in climate change vulnerability, impacts and adaptation assessment: Summary of a workshop*. Washington, DC: National Academies Press.

Dillon, R.L., Tinsley, C.H. & Cronin, M. (2011) Why near-miss events can decrease an individual's protective response to hurricanes. *Risk Analysis*, 31 (3) 440-449.

Fischhoff, B., Svenson, O. & Slovic, P. (1987) Active responses to environmental hazards: Perceptions and decision making. In D. Stokols & I. Altman (Eds) *Handbook of Environmental Psychology* (pp. 1089-1133).

Gifford, R., Kormos, C. & McIntyre, A. (2011) Behavioral dimensions of climate change: Drivers, responses, barriers, and interventions. *Wiley Interdisciplinary Reviews: Climate Change*, 2, 801-827.

Gow, K. & Paton, D. (Eds) (2008) *The phoenix of natural disasters: Community resilience*. New York: Nova Science Publishers.

Kasperson, R.E. & Stallen, P.J.M. (1991) (Eds) *Communicating risks to the public*. The Hague: Kluwer.

Morrissey, S.A. & Reser, J.P. (2007) Natural disasters, climate change and mental health considerations in rural Australia. *Australia Journal of Rural Health*, 15, 120-125.

Reser, J.P. (1996) Coping with natural disaster warnings: The nature of human response and psychological preparedness. In R.L. Heathcote, C. Cutter & J. Koetz (Eds) *United Nations National Disaster Reduction 1996 (NDR96)* (pp 126-136). Sydney: Institution of Engineers, Australia /EA Books.

Government Reports

Department of Planning and FESA (Edition 2, 2010) by WAPC, Planning for Bushfire Protection Guidelines <http://www.planning.wa.gov.au/publications/1125.asp>

The State Planning Policy 3.4 Natural Hazards and Disasters (April 2006) <http://www.planning.wa.gov.au/publications/1126.asp>

The Development Control 4.2 Planning for Hazards and Safety (June 1991) by the WA Department of Planning. <http://www.planning.wa.gov.au/publications/811.asp>

The Coastal Vulnerability Assessment Western Australia (CVA WA) Projects List <http://www.planning.wa.gov.au/674.asp>

Other Reports

The following reports are not Emergency Management based but incorporate Emergency Management considerations into regional development.

Dale, A., Vella, K., Cottrell, A., Pert, P., Stephenson, B., King, D., Boon, H., Whitehouse, H., Hill, R., Babacan, H., Thomas, M. and Gooch, M. (2011). *Conceptualising, evaluating and reporting*

social resilience in vulnerable regional and remote communities facing climate change in tropical Queensland. Marine and Tropical Sciences Research Facility (MTRSF) Transition Project Final Report. Reef and Rainforest Research Centre Limited, Cairns.

Seville, E., Brunson, D., Dantas, A., Le Masurier, J., Wilkinson, S., and Vargo, J. (2006). Building Organisational Resilience: A Summary of Key Research Findings. Resilient Organisations Programme. New Zealand, www.reorgs.org.nz.

Seville, E., Fenwick, T., Brunson, D., Myburgh, D., Giovinazzi, S., and Vargo, J. (2009). Resilience Retreat: Current and Future Resilience Issues. Resilient Organisations Research Report 2009/05.

Stephenson, A. Seville, E., Vargo, J., Roger, D. (2010a). Benchmark Resilience: A study of the resilience of organizations in the Auckland Region. Resilient Organisations Research Report 2010/03b: 49. URL: www.resorgs.org.nz

Twigg, J. (2009). Characteristics of a Disaster Resilient Community: A Guidance Note. Version 2. University College, London. ISBN 978-0-9550479-9-2.

lerland, E.C. van, K. de Bruin, R.B. Dellink and A. Ruijs (eds) (2006). A qualitative assessment of climate adaptation options and some estimates of adaptation costs, Routeplanner subprojects 3, 4, and 5, Wageningen UR.(available on www.programmaark.nl)

Pater, F. de and M.A. van Drunen (2006). Case studies and hotspots, Routeplanner deelproject 6, Klimaatcentrum Vrije Universiteit, Amsterdam, the Netherlands. (available on www.programmaark.nl)

<http://journals.ametsoc.org/doi/abs/10.1175/2010WCAS1063.1>



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