

Assessing climate change risk and its implications for Local Government in Queensland

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Abstract

For the Local Governments of Queensland, climate change represents a major suite of risks and challenges that will influence and change the way many issues are approached and managed. For example, climate change is expected to impact on the liveability and lifestyle of communities and townships and affect industry productivity; it will also represent a key concern for infrastructure development and investment, land use, coastal management and zoning into the future. In addition to these challenges, the level of understanding of Local Government on how to assess the risks, vulnerability and identify new business models and opportunities presented by climate change appears to be highly variable. To address this, the Local Government Association of Queensland commissioned the Institute for Sustainable Regional Development (ISRD) to conduct a series of climate change impact risk assessment and adaptation focus group workshops. These workshops were designed to address the perceived shortcomings in Local Government's knowledge and preparedness to respond to the challenges of climate change. The workshops targeted the assessment of risk and the exposure of local government and planning instrumentalities to climate change over a range of social, economic and environmental considerations. The workshop series was conducted in 2007 and was attended by over 50 Local Governments of Queensland. Supplementary workshops were also held at the Local Government Association of Queensland's 2008 annual conference.

This paper describes the workshop outcomes, including some of the regional climate change impacts that were expected under IPCC predictions, and the subsequent key risks, issues and implications that were identified. The paper also defines and explores the adaptations required of Local Governments to respond to climate change; as well as the policy and institutional issues that require action; and the support programs needed by Local Government in Queensland to achieve a proactive approach to climate change.

1.0 INTRODUCTION

Climate change is becoming more accepted as a phenomenon which is already happening and impacting on the economy, society and the environment (IPCC, 2007). It is undeniable that the global climate has changed over the last century: since 1900, the average surface temperature of the globe has risen by 0.8 °C (IPCC, 2007) and in Australia by 0.8 to 1.3 degrees (BoM 2008 met station data). In addition, there has been an increase in the number of heat waves (i.e., Adelaide 2008), warming of the oceans, a retreat of glaciers and sea-ice, a sea-level rise of 30 cm, an increase in heavy rainfall in many regions, and fewer frosts (IPCC, 2007). On average, global rainfall deficits (the excess of evaporation over rainfall) are expected to increase by about 40-120 mm per degree of temperature rise. This corresponds with expected increased rainfall deficits of 15 to 160 mm by 2030, and 40 to 500 mm by 2070. There is also evidence that tropical cyclone intensity (not frequency) and other extreme rainfall events have increased globally (Walsh and Ryan, 2000). Furthermore, since sea levels are affected by storm surges and cyclone activity, any changes in the intensity and frequency of cyclonic activity will, in turn, influence sea level changes (CSIRO 2001). What is perhaps most concerning, however, is that with increasing greenhouse gas emissions into the atmosphere, further climate change is forecast (IPCC 2007). This represents a very real and difficult challenge for managers and planners across the globe.

1.1 Trends and predictions for Australia

A recent report from the Intergovernmental Panel on Climate Change (IPCC) noted that Australia will continue to be affected by global climate change as the 21st century progresses. Australia is already experiencing more “unseasonal” events: in 2005, Australia was subjected to its “hottest April on record” (BOM, May 2005), eclipsing the previous 2002 event (BOM, May 2002). The eastern seaboard of Australia is expected to get hotter and dryer, with more extreme events, coupled with increased spatial and temporal variability in rainfall (IPCC, 2007). Surface temperature increases are also likely to co-occur with increased fire frequency and severity. These statements reaffirm earlier projections for Australia (IPCC, 2001). Australia’s future climate predictions have also been made by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) using global climate model simulations. These models indicate an increase in the average number of extreme hot days, together with a decrease in the average number of extreme cold days. The models also predict that much of Australia will warm by a further (1990) 0.4 to 2.0°C by 2030, and by 1 to 6°C by 2070. Changes in Australian rainfall patterns will be accompanied by an increase in potential evaporation rates across all seasons of the year. Hence, an overall drying trend is expected for Australia, resulting from a combination of increased temperatures, increased evaporation and changes to rainfall patterns. In summary, the CSIRO models support the trends suggested by the IPCC; indeed, based on the CSIRO data, it appears that the IPCC projections have, in fact, been quite conservative.

1.2 Evidence of climate changes in Queensland

Queensland’s climate is changing. The Australian Bureau of Meteorology (BoM) have confirmed that, due to global climate change, temperatures in Queensland are increasing; that rainfall is spatially and temporally more variable and that rainfall is declining rapidly in most parts of Queensland. Evidence of increases in rainfall variability and storm intensity in Australia by up to 20% have been recorded (QCCA, 2006; Love, 2005). The number of extreme weather events has also increased significantly. El Niño weather patterns (which, in Queensland, correspond with below average rainfall) are already ‘more frequent, persistent and drying during the past 20 to 30 years compared to the previous 100 years’, and this trend is expected to continue (IPCC, 2001). In fact, the predicted range in annual average rainfall for Queensland is a further (1990) 10% reduction by 2030 and a

further 35% reduction by 2070, although the rainfall projections modelled for Queensland have a high level of uncertainty in many regional areas. The modelling by the Queensland Centre for Climate Applications suggest these figure may in fact be as high as a 20% and 40% respectively based on the 1990 figures which as indicated earlier (BoM) have already recorded significant reductions in rainfall of up to 25 to 35% in some coast areas of Queensland and Northern NSW between 1950 and 2005.

The CSIRO models predict that by 2030, most of Queensland can expect an annual mean temperature of between 1 and 2°C above those increases already recorded up until the 1990s. Moreover, by 2070, the increases in annual average temperatures in Queensland are likely to range from 1.5 to 6°C. One of the major factors in the increase in mean temperature is the increase in the number of 'hot' days (those exceeding 35°C). These are expected to increase across Queensland; for example, by 2070, Brisbane will shift from an average of 4 hot days per year to an average of 35, whilst Cairns will increase from 3 hot days up to 76 hot days (CSIRO, 2001).

Sea level rises are expected to vary considerably between geographic locations. Mitchell *et al.* (2000) suggests that while the Australian east coast will experience sea level rises, they will be below global predictions. Nevertheless, studies conducted in Cairns suggest that the 1-in-100 year sea level rise may be 0.5 to 0.7m higher by 2050 (CSIRO 2001); whereas on the Gold Coast, planning groups are anticipating an increase of 0.3m (Betts, 1999).

1.3 Implications for Queensland (and Queenslanders)

There are multiple issues stemming from the combination of higher temperatures, fewer rainfall events and increased intensity of rainfall events that Queensland will experience under future climate patterns. These include management implications for both natural resources and human settlements. For example, climate change with greatly impact on the quantity and quality of available water resources. Analysis of the Queensland Department of Natural Resources stream discharge data and the BoM rainfall records by the authors for catchments east of the Great Dividing Range in Queensland show that for a 25% reduction in long term rainfall a consequent 50% reduction in stream discharge has occurred. These data are supported by similar response curves measured for Perth's water supply. Groundwater and run-off will be less reliable resources than in previous decades, due to (a) the decrease in rainfall and (b) the projection that rainfall will occur over shorter time periods, especially when one considers the current capacities to capture run off during intense rainfall events.

Increased evaporation rates due to the increased temperature conditions will also impact not only water quantity, but also water quality (for example, increases in the frequency of toxic algal blooms) (Gabriel *et al* 2004). Sea level changes (including more intense storm surges) and changed wind conditions will result in increased in wind velocities along the coast; consequent increased rough sea conditions will increase erosion rates along vulnerable and iconic coastal areas (Pittock 2005). Limited rainfall, increased irrigation, changed fire risk, zoning, changing ecosystems and biodiversity will all impact on current and future land uses and the infrastructure that sits on these landscapes (Pittock *et al* 2003). The possibility of coastal population migration from hot and dry inland regions is another concern: impacts will include increased demand for energy for cooling, reduction in liveability and lifestyle, changes in land values, and even increased death rates in the aged and infirm during extreme temperature events (Pittock *et al* 2003).

1.4 Implications for local government

Climate change is being increasingly recognised as a key challenge for Australia and elsewhere globally. Communities of interest are now attempting to understand what climate change will mean for them and what they need to do to manage the risks and exposure. While long term trends can now be identified with increasing confidence, the vagaries of climate are such that any given event is linked to great variability and uncertainty in timing. This uncertainty has resulted in considerable inaction and a direct lack of engagement by many of the major parties that have, historically, been expected to take leadership of such matters.

For the Local Governments of Queensland, key areas of concern include the impact of the expected increases in climate variability and extreme weather such as flooding, droughts and storms/cyclones. The importance of managing resources and communities for climate change cannot be underestimated: for example, even small shifts in climate averages such as extended dry periods, storm intensity and wind speeds may have significant implications for existing infrastructure, with respect to building foundations and overall longevity (AIG, 2005).

Local Governments in Queensland have already demonstrated leadership in the climate change debate and are involved in emission mitigation programs such as the Cities for Climate Protection (CCP)¹. To date, however, there has been little focus on adaptation and planned risk management by any of the three tiers of government in Australia. Planning bodies now need to consider, in detail, the implications and opportunities that are presented by climate change with respect to zoning, land use and planning. This paper describes a process undertaken by the Local Governments of Queensland, under facilitation by the Institute for Sustainable Regional Development, to understand, assess and adequately plan for the climate change risks and opportunities that will be experienced by the communities of Queensland over the coming decades.

2.0 METHODS

2.1 Climate workshops

In 2006, the Local Government Association of Queensland (LGAQ) commissioned the development of a practitioner's guide for local government to manage the risk and uncertainty of climate change (*"Adapting to Climate Change Queensland Local Government Guide"*). This guide was framed around a standard risk assessment methodology used by business and provided a practical, step-by-step process for Local Government to identify the risks associated with climate change and put in place adaptive plans to address them. However, it was also recognised that the level of technical understanding of climate change by Local Government was undetermined and highly variable.

A series of Climate Change Impact Assessment workshops were designed to address these gaps in local government knowledge of climate change. The workshops were conducted by the Institute for Sustainable Regional Development (ISRD) in late 2007, with Prof Bob Miles acting as the key facilitator. Participants included over 100 staff of Queensland's Local Governments, together with representatives from both State and Federal Government departments (e.g., Queensland's Department of Primary Industries and Fisheries and Department of Natural Resources and Water; the Commonwealth Department of Environment and Heritage, and the Great Barrier Reef Marine Park Authority). Focus group workshops were held in Brisbane, Toowoomba, Bundaberg, Mackay, Townsville and Cairns over a four week period from mid November to mid December 2007.

¹ More information available from <http://www.environment.gov.au/settlements/local/ccp/>

Attendees included the full spectrum of Local Government employees and Council representatives from mayors to environmental officers and shire engineers.

The workshop series had the agenda of assessing risk and exposure of Local Government and planning instrumentalities to climate change at the social, economic and environmental level. The strategies required for mitigating or managing the expected impacts of the risks, vulnerability and exposures of Queensland's Local Government with respect to climate change were also examined. Each meeting lasted approximately four hours, was interactive and workshop-based and utilised the AS/NZS 4360 risk assessment framework. Specifically, the objectives of the workshops were:

- to develop a shared understanding and knowledge by Local Government of the key challenges presented by climate change;
- to identify, through focus group work-shopped exercises, the areas of risk and exposure of Local Government to climate change;
- to identify practical processes and strategies to address or mitigate these exposures; and
- to identify the support needed by Local Government, and any policy and institutional impediments that should be addressed, before climate change risks could be adequately managed.

In all cases, the workshops were preceded by an introductory overview of current research on regionally relevant, as well as globally-based, climate change projections and the potential impacts as published by the IPCC, CSIRO and BoM. This overview covered the state of knowledge on climate change, the existing climatic trends and implications, and scoped some of the strategic issues and challenges for planners and business. This allowed an 'unpacking' of climate change into manageable issues. Following this initial 'framing', participants were asked to rate, on a scale of one to ten, the involvement of their respective organizations and/or departments on issues related to climate change.

The next exercise was a high-level assessment of the possible risks of climate change using a social, economic and environmental perspective. The assessment approach used three scenario states (low, medium and high) for conditions of (a) reduced rainfall, (b) increased intensity/frequency of storms, cyclones and tidal surges and (c) increased temperature. Risks were assessed in terms of their likelihood and consequences, and were then prioritised and considered against the impacts on (a) planning and development, (b) infrastructure to support communities, businesses and essential services, (c) community health and wellbeing, and (d) the environment. The workshops closed by considering, from the perspective of Local Governments, the climate change support and services that would be required to manage climate change effectively. These needs were targeted toward support from the Federal and State Governments as well as Local Governments themselves.

In addition to the regional workshops series, two further climate change impact assessment workshops were conducted during the LGAQ's 2008 annual conference in Brisbane. This involved over 150 registered delegates who attended the conference; principally, the mayors and Local Government executive that had been newly appointed following Queensland's extensive LGA amalgamations process. The conference sessions focussed on providing an overview of the state of knowledge on climate change to the delegates, followed by a plenary discussion of the delegates on the implications of climate change for Local Government. Each workshop closed with an assessment by each individual delegate of (a) the major issues that climate change will present to Local Government, (b) the support needed by Local Government to address climate change issues, and (c) the impediments and blockages to adaptation at the policy and institutional level. This approach was deliberately targeted at securing insight from a statewide representation of Local Government at the mayor and senior executive level.

2.2 Data analyses

The focus group participants discussed and identified what they felt were key risks to local government based on three climate change scenarios (low, medium and high). The identified risks were then grouped by six risk categories: economic, environment, litigation, community and lifestyle, infrastructure and public safety. Risks were then prioritised and their likelihood of occurrence and their consequence determined following AS/NZS 4360 (see Figure 1 and Table 1). For example, some of the factors used by the participants to classify the risk included:

- what is the level of risk to the individual?
- was the risk manageable?
- was it a threat to essential services?
- what was the breadth of the impact, was it life threatening?
- was there a threat to property?
- what is scale and quantum of cost?
- did it require a behavioral change?
- what was the environmental impact?
- did it impact on human health or safety? and
- what was the cumulative effect?

Other factors considered includes those dealing with widespread public health issues, disease, level of education on the topic by business, industry or Government, level of impact and demand for services.

	Consequences				
Likelihood	Minimal (1)	Low (2)	Moderate (3)	Major (4)	Catastrophic (5)
Almost Certain (a)	Medium	Medium	High	Extreme	Extreme
Likely (b)	Low	Medium	High	High	Extreme
Possible (c)	Low	Medium	Medium	High	High
Unlikely (d)	Low	Low	Medium	Medium	Medium
Rare (e)	Low	Low	Low	Low	Medium

Figure 1 Likelihood consequences matrix following the AS/NZS 4360, as used in the assessment of climate change risks for Local Government in Queensland

Table 1 Data Analysis Method for Focus Groups

Identified Risk	Climate Change	Risk Categories
Identified Risk (under scenarios of Low, Medium and High)	Increased storm intensity	Economic
	Increasing temperatures	Environment
	Declining rainfall	Litigation
		Community & Lifestyle
		Infrastructure
		Public Safety

3.0 WORKSHOP OUTCOMES

3.1 Climate change awareness at the LGA level

Participants were asked to rate the 'climate change' activity of their organisations on a scale of one to ten (with one equaling very little activity and concern, and ten indicating significant activity and concern). With very few exceptions, most workshop participants scored this question between one and three: this indicated very little proactive action or activity was being undertaken by Local Government at a general level. Although all participants were aware of climate change issues, there was not a great deal of action or perceived understanding of the potential impacts. As a generalization, climate change issues were regarded by the participants as being on the 'lower end' of activity and understanding within their organisations.

3.2 Major issues identified by focus groups

Some of the key planning and management issues identified by the workshop attendees as being particularly problematic due to climate change are summarised briefly below.

3.2.1 Infrastructure

The main concerns identified for Local Government included the impact of the expected increases in climate variability and extreme weather such as flooding, droughts and storms/cyclones as well as expected water shortages. In particular, the Local Government participants recognised that the investments in infrastructure that are underpinning the business environment in most communities have, in almost all cases, been designed on past climatic conditions. Hence, current infrastructure design does not consider the risks and exposures generated through a changing climate. This was recognised as a key concern: given the climate changes expected into the future, historic conditions are no longer accurate indicators for planning, maintenance and upgrades. Land use planning and infrastructure location were also regarded as key climate change risk mitigation considerations that needed to be proactively imbedded into future planning strategies.

The impact of extreme events on infrastructure and assets was also of major concern as this will lead to an increased burden of the recurrent cost of repair/replacement, increased cost of community services, litigation and public safety. The cost of implementing changes to building codes and development standards was also seen as a key challenge as this needed to be done effectively and with due consideration of the burden of cost.

3.2.2 Liveability, lifestyle and health

Climate change was seen as a major issue that would impact on the liveability and lifestyle of communities and townships. The drying environment was seen as impacting on the attractiveness of communities, and to have the potential to significantly impact on some regional treasures or icons. In turn, this could affect the economic viability of business, the community and Local Government. The drying climate was also seen as a major impact on community health through dust and heat related problems. Health risks – including increases in the incidences of tropical diseases such as Ross River Fever and other ailments such as hay fever, asthma, skin cancers and dust and heat related illnesses – were noted as an emerging, but silent challenge, and one that is already being documented in some hospital records. Here, climate change represents a number of important implications for Local Government with respect to providing better community facilities of shade and shelter, as well as changed human resource and work practices. These were seen as substantive imposts for Local Government in Queensland.

3.2.3 Coastlines and estuaries

Storm surges and rises in sea level were recognised as a major concern for coastal management and zoning as well as the cost of an increase in the frequency of beach erosion and sediment levels causing loss of visual amenity and functionality of the coast line. Land uses were also seen as a major exacerbating problem with pollutant discharges from different land uses compounding climate change impacts.

3.2.4 Economic losses

The economic costs of climate change for Queensland's due to lost tourism (e.g., that resulting from coral bleaching on the Great Barrier Reef) was considered a very real and major concern to coastal communities in central and northern Queensland. Reduced water supplies were also considered to affect regional economics, including business continuity, social amenity and region aesthetics. Each of these aspects have flow-on effects to costs of living and general decline in liveability of the region.

3.2.5 Decision making

There was a recognised need to incorporate climate change into all levels of planning, regional development strategies and infrastructure development by all levels of Government and Industry. Of note was the requirement for greater devolved decision making capability at the local level as well as the need for education and programs to drive behavioural change to reduce impact and cope with change at the Government (three tiers), industry and community level.

3.2.6 Other

A number of less-obvious issues related to climate change were raised during the workshop series. For example, the social isolation and job losses that occur after extreme climate events, and the interruptions to the supply of goods and services, are likely to increase in frequency and severity due to climate change. Consequently, the cumulative effects of these events should be considered,

particularly in light of their ability to tax social services, and the available support from general emergency services and volunteers (e.g., leading to exhaustion and apathy).

4.0 Where to from here – how to prepare and adapt?

A retrospective analysis of the workshops generally, including a consideration of the skills, interests and capabilities of the participants, has made it clear that, in order for the Local Governments of Queensland to be able to apply risk management and adaptation strategies to climate change, three things must be recognised:

1. climate change is happening now;
2. adaptation is about changing behaviours and practices, not changing the climate; and
3. risk management, vulnerability and capacity are key issues in managing changing conditions and uncertainty.

Consequently, factors including (but not limited to) reducing greenhouse emissions are important in maintaining the global climate, as this is a long term strategy with substantial benefits. However, in the short term, there is no “silver bullet” that will halt climate change and see a return to previous conditions. It became clear in the workshops that since changing the conditions is not possible, adapting behaviours, practices and expectations is crucial to effective planning, sustainable development and resource management. Governments, industry and the communities need to be prepared for a range of impacts that may result from the changing climate. Risk management is a key tool in adapting to changed climate conditions. Using evidence-based scenarios to identify the risk factors, through scenarios, case studies and lessons from other regions, both in Australia and overseas, and incorporating this into risk management regimes will be needed.

4.1 Policy and institutional changes

Workshop participants emphasised a need for more proactive and stronger leadership on climate change at the local, state and national level. Policy and regulatory development was seen as required to provide planning certainty with considerable criticism levelled at the “policy on the run development” that Local Government had regarded as had occurred with the water shortages in the SEQ area.

The following recommendations on policy and institutional changes have been distilled from the information collected through the focus group workshops:

1. There is a need for more proactive and stronger leadership on climate change at the local, state and national level.
2. There is a need for research, planning and implementation at the regional level led by Local Government under a National and State coordinated and supported approach.
3. Policy and regulatory development is required to provide planning certainty for Local Government, business and the community.
4. There is a need to incorporate climate change into all levels of planning, regional development strategies and infrastructure development by all levels of Government and industry.
5. There is a need for greater devolved decision making capability and regional governance at the local level to allow more affective change management.
6. There is a need for the provision of practical and applied education and programs at the Government (three tiers), industry and community level to drive behavioural change to reduce impact and respond to with change.

4.2 Support required by local government

The following thirteen recommendations are based on the responses of workshop participants in relation to the support required achieve a proactive approach to climate change for Local Governments in Queensland. These recommendations are regarded as providing a pathway forward in address and or remove some of the key challenges confronting Local Government in proactively engaging and addressing the risks and issues associated with Climate Change.

1. There is a need to realistically assess the likely cost and resource requirements that will be incurred by Local Government, business and the community at a regional level.
2. There is a need to identify and promote the emerging business opportunities and encourage doing business differently to create win-win outcomes.
3. There is a need to secure support from senior level managers in all organisations and in particular the three levels of Government to accept climate change as issue and provide appropriate financial commitments to long term planning.
4. There is a need for greater regional networking between all stakeholders and the community to look at interrelationships and downstream consequences.
5. There is a need for the Federal and State Government to implement effective policies, procedures and information for catalysing climate change projects.
6. There is a need for Governments at all levels to proactively work in partnership with business and the community to manage climate change impacts and develop appropriate and proactive mitigations strategies.
7. There is a need for the State and Federal Governments to be more proactive in addressing the challenges presented to Local Government by Climate Change and in supporting Local Government to achieve the desired long term outcomes.
8. There is a need to provide technical and specialist support to Local Government and business to identify risks, adaptation and action planning and to develop effective mitigation programs.
9. There is a need for community and industry engagement to raise the awareness to progress the climate change issue
10. There is a need for Governments to think about leveraging off international investment to achieve the required changes.
11. There is a need for greater consistency across Local Government planning
12. There is a need to establish a fund to assist councils respond to critical infrastructure adaptation measures.
13. There is a need for sub-regional scale climate modelling to support local level planning responses to Climate Change.

5.0 CONCLUSIONS

Climate change will affect small and large Local Governments, both urban and rural, and will have positive and negative implications for land use planning, various Local Government infrastructure, community services, and natural assets.

From the focus groups and LGAQ conference group datasets, it is clear that the impacts of climate change need to be considered holistically by local government in Queensland. Climate change implications are multi-dimensional and interdependent, and need to be considered in terms of both

their socio-economic and environmental implications. It is also clear from the workshops that Local Government and planning instrumentalities should be the key stakeholders in ensuring a holistic approach.

From the survey and focus group meetings the interlinked issues of rising temperatures, reduced rainfall and the increased incidence in extreme climatic events such as cyclone and storm surges all have significant implications for Local Government. There will be a multiplier effect (flow-on implications) that will concern of land use impacts. While the survey work clearly indicated that Local Government will be affected and that there are many issues and implications for them, unfortunately the level of awareness and interest is not particularly high. Of note is that among the perceived consequences of climate change for Local Government there is a clear recognition that climate change will have both negative and positive impacts along with a potential range of alternative ways of doing business.

While this stage of the analysis should be regarded as qualitative scoping/exploratory research, it has provided an insight as to the complexity of the issues and identified the concerns and challenges confronting Local Government. There is a the need for more qualitative analysis on the opportunity costs, tradeoffs of the alternative land use practices and planning strategies. Mitigation measures also need to be considered as part of the long terms needs of the community and Local Government. The measure of the level of the impacts and resource needs on the business of Local Government is yet to be evaluated.

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