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# Local Actions, National Frameworks: A Dual-Scale Comparison of Climate Adaptation Planning on Two Continents

Elisabeth M. Hamin, *University of Massachusetts - Amherst*

Nicole Gurran, *University of Sydney*



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**Elisabeth M. Hamin  
Associate Professor, Regional Planning  
109 Hills North  
Landscape Architecture and Regional Planning  
University of Massachusetts, Amherst  
Amherst MA 01003  
emhamin@larp.umass.edu  
1-413-577-4490**

**NICOLE GURRAN  
Associate Professor  
Urban and Regional Planning | Faculty of Architecture, Design and Planning  
THE UNIVERSITY OF SYDNEY  
546, Wilkinson G04 | The University of Sydney | NSW | 2006  
T\* +61 2 351 7729 | \*F\* +61 2 9036 0000  
nicole.gurrán@sydney.edu.au**

## **"Local Actions, National Frameworks: A Dual-Scale Comparison of Climate Adaptation Planning on Two Continents"**

### **Abstract**

This study explores emerging approaches to local climate change adaptation planning in the United States and Australia, and seeks to explain why some local authorities have begun to take action despite weak national and state level directives. We compare strategic documents from 13 local authorities across the two nations, representing the “first generation” of adaptation plans. Our focus is on potential explanations for early engagement in adaptation planning – size, location and risk level of the municipality, the existence of national or state mandates and access to supra local resources or support. We also explore the nature and type of adaptation-planning practice emerging and its relationship to climate change mitigation efforts.

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### **Introduction**

Generally, one anticipates that higher levels of government will set major policy agendas, and local governments will follow (or not). When it comes to climate change planning, this is the situation in many European countries, where climate planning is being undertaken with guidance from national, and in some cases, transnational, government bodies, through the European Commission . In contrast, in countries where climate seems lower on national agendas, what planning is occurring originates at the local level. This is particularly true for adaptation actions – while greenhouse gas reduction is widely considered a normal national-level concern, planning for potential climate events is typically handled at more local levels. Thus, the question arises – in countries where local adaptation responses emerge despite limited higher level government mandates, is there an identifiable locus of initiative for these plans? To explore this question, in this research we focus on two countries – the United States and Australia – where federal support for climate action (mitigation or adaptation) has been quite limited, and examine communities that have nevertheless undertaken adaptation planning. Using two countries allows us to compare the supra-local roles, as well as increase our sample size. Focusing on adaptation, we undertake an initial exploration of the roles of State or Federal government support; engagement with international non

government environmental organisations (using membership in the International Council for Local Environmental Initiatives (ICLEI) as the main focus); local context in terms of population size and geography; and a qualitative assessment of the plans' defined level of risk/exposure to climate change relative to other locations, to begin to develop a theory of adaptation enthusiasm, and the role of upper levels of government in that.

## Climate Planning

Climate change began to emerge on the planning policy horizon in the mid 1990s, following the passage of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. The Convention established two main categories of climate change responses: mitigation -- actions designed to reduce emissions of greenhouse gases, and adaptation -- approaches that reduce the vulnerability of communities and the built and natural environment to the impacts of now-unavoidable climate change. There is a growing international body of work on local spatial and land use planning approaches for mitigation, ranging from national, and transnational planning policy frameworks and legislation, to non government organization guides for local authorities (see particularly , and more scholarly research and debate (see for a review of the field).

Organised local action on climate change extends from the first Local Agenda 21 (LA21) arising from the 1992 Rio UN meeting previously described. Through LA21, municipalities worldwide agreed to promote public engagement in local

sustainability planning, shifting at the subsequent 2002 World Summit held in Johannesburg, more explicitly to local sustainability 'action'. Climate change has become an increasing theme in the local initiatives that followed. Since 1993, ICLEI's Cities for Climate Protection (CCP) campaign has provided an organizing focus for local government carbon mitigation initiatives. By 2010, over 1200 cities, towns, counties, and their associations worldwide had joined ICLEI.<sup>i</sup>

If mitigation initiatives seem relatively widespread (notwithstanding concerns about their quality and depth, see , adaptation planning has been far slower to take off. Reasons for this slower uptake are complex, and include a fear that adaptation will supplant mitigation, and that it implies accepting climate change as inevitable – a pessimistic view, to some . It also can be quite technical, relying on downscaling of global climate models to provide defensible projections for local or regional future climates . There is no shortage of practical guidance on adaptation planning, as a number of publications have emerged over the past five years. In the US, the Pew Center on Global Climate Change, for instance outlines five basic steps for local and regional adaptation efforts . ICLEI outlines a similar process, extended to a final stage of implementation, monitoring and evaluation .

Studies on local government engagement in climate change planning both in the US and in Australia suggest a strong preference for mitigation rather than adaptation planning . If one works only from a rational benefits model, this preference for mitigation over adaptation does not make sense. Local mitigation primarily brings global benefits in reducing future climate change; costs are typically born locally. There are certain co-benefits in health from locally lower

emissions, but the primary goal of mitigation programs is prevention of global warming. Adaptive actions, on the other hand, have a better allocation of costs – local actions bring local benefits – although such actions may be considerably more expensive to undertake. Increasing urban tree canopies, for instance, provides cooler sidewalks and buildings which can be appreciated very rapidly and directly on hot days. Thus, as adaptation becomes more commonly understood among communities, some suggest that localities should prefer adaptation to mitigation, all other things being equal

The IPCC has long recognized the potential for conflicts between adaptation and mitigation efforts . Beyond some fairly straight-forward conflicts, such as cooling on heat wave days with residential air conditioners which use great amounts of domestic energy, and similar issues , the primary issue is spatial form. Laukkonen, Blanco et al (2009), working from Shaw, Colley and Connell , find:

While high densities in urban areas minimize commuter distances and provide opportunities to incorporate common energy schemes that can reduce emissions; they also contribute to urban heat island, can increase the likelihood of urban flooding, and additionally, a dense-built environment can reduce the incorporation of urban green or tree cover which helps reduce the need for cooling aids.

Mitigation tends to be supported by higher density spatial arrangements, while adaptive actions tend to be supported by open space which generally reduces density . This suggests the need for care in designing policies and plans to support

both mitigation and adaptation goals – the nexus of benefits and costs are different, and the spatial and policy implications may be competitive. For this reason in this study we treat adaptation planning as a fairly separate activity from mitigation planning, while exploring the ways in which these policy goals intersect.

### **National Frameworks**

Not surprisingly, when federal policy provides leadership for local action on adaptation, localities tend to follow. In some nations, national level governments have played a leading role in climate change planning, particularly through national law and policy, but also resources and funds for research, education, and local initiatives. Most notably, for some years now many European Union countries have been actively engaging in mitigative and adaptive planning . In the United Kingdom (U.K.) planning consideration of potential vulnerability to climate change along with the carbon performance of new planned settlements are required when new plans are made or developments assessed . It seems this guidance, combined with national planning policy, has resulted in a high penetration of climate change planning in the U.K. ; Tompkins et al found 300 different instances of adaptive action, broadly construed, already underway in the U.K. .

In an Oceania example, the New Zealand Government amended national planning legislation in 2004 to introduce climate change as an “other matter” to be considered when developments are assessed and plans prepared (the Resource Management (Energy and Climate Change) Amendment Act 2004), focusing not only on potential mitigation (associated with the use of renewable energy) but also the potential impacts of climate change. Regionally specific guidance has been prepared



for local governments, alongside manuals to assist in managing coastal hazards exacerbated by climate change . These examples suggest the efficacy of federal leadership in encouraging local climate change planning.

By comparison, some suggest that ambivalent Federal level action on climate change, such as the U.S. non-participation in the Kyoto Protocol, might actually stimulate greater local and regional level engagement in climate mitigation activities (Vadas, Fahey, Sherman, & Kay, 2007). A study examining the diffusion of local programs for greenhouse gas reduction across the U.S, Canada and Australia, found that while national level support can be important, in its absence other factors, such as connections to international environmental associations (e.g., ICLEI and the CPP), might be equally significant . While the questions connecting local-regional-state-national approaches to climate change remain unsettled, it is fairly clear that multi-scalar approaches are necessary .

### Comparing climate change adaptation planning in the U.S and Australia

In both the U.S and Australia, Federal involvement in the environment and planning is limited, with primary responsibilities delegated to the States and semi-autonomous Territories in the case of Australia. Within policy and legal frameworks set by the States, local governments (including bodies of elected representatives) are generally responsible for preparing detailed land use plans, assessing development proposals, and managing local environmental and community policy and service functions, with varying levels of resources and autonomy.

Both nations have a political record of ambivalence in relation to recognizing, and responding to, the challenges of global climate change. In the U.S., Federal recognition of climate change is at a very early stage indeed. However, a number of State governments have begun to develop their own climate change policy frameworks. Similarly, quite a number of local governments have undertaken mitigation plans without state or federal leadership. By 2008, a review of state and municipal climate change planning across the U.S found that around 29 States and many more cities and some counties had developed climate change plans of some kind, although climate change considerations in land use decisions remain far from mainstream (Wheeler 2008)(Wheeler, 2008)(Wheeler 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008)(Wheeler, 2008). Adaptation has not spread as far. According to the Pew Foundation only six U.S. states have begun adaptation plans: Alaska, California, Florida, Maryland, Oregon, and Washington; since the time of that report, Massachusetts has also begun an adaptation planning process.<sup>ii</sup>

management strategies for greenhouse gas reduction, such as low emitting lights and hybrid fleets .

On adaptation, the Council of Australian Governments (COAG), which promotes collaboration across the Australian states and territories has articulated a National Climate Change Adaptation Framework 2007-2014, which focuses on understanding and managing climate change risks to water resources, biodiversity, coasts, agriculture, fisheries, forestry, human health, tourism, settlements and infrastructure. A new government in 2007 initiated several climate change policies, including Australia's ratification of the Kyoto protocol, and the establishment of a national "Climate Change Adaptation Program" involving research, planning, and educational activities. The jurisdictions of New South Wales (NSW), Victoria and the Northern Territory have policy frameworks or initiatives in place for developing adaptation plans in the near future, while South Australia has already adopted adaptation policies within its overarching climate change plan. Queensland is the sole state to have completed a stand alone 'Climate Smart Adaptation Plan' (2007-2012), which identifies the impacts of climate change and priority actions to increase community resilience. While a full planning framework is still pending, the Victorian Government initiated a comprehensive Climate Change Adaptation Program, to coordinate the work of different government departments involved in climate change programs, and sponsor collaboration at local and regional levels across the priority areas of natural hazards, coastal erosion and flooding, agriculture, infrastructure, homes, and health.

Additionally, several Australian states have established planning guidance for managing sea level rise, and enhanced their flood management requirements in response to the potential of more intensive floods and coastal water inundation from storm surge.

### **Mitigation and Adaptation Planning at the Local Level**

A small but growing body of research identifies the characteristics of communities most likely to undertake mitigation planning. Vasi examined the take up of CCP plans in three countries – the U.S., Canada, and Australia, and tested these into organizational hierarchies. He finds that in the U.S., the cities most likely to undertake greenhouse gas emissions reduction plans are those with a strong link to ICLEI, those with a preexisting environmental experience, and those with comfortable socio-economic situations. Notably absent is a federal role – reasonable, as there is no U.S. federal role. In Australia and Canada, by contrast, linkages between ICLEI and local governments were less important, and instead the activities and connection to a federal change agent encouraged CCP adoption. Focusing on the level of interaction, Vasi (2007) argues that motivation can be found locally (existing environmental experience), nationally (federal agencies dedicated to encouraging action) or internationally (ICLEI and similar organizations), and that these constitute a nested field within which local action occurs.

In a cluster of closely related articles, Brody, Zahran and others looked at map-able characteristics among U.S. communities adopting CCP plans. They find

that U.S. cities and counties that adopt CCP plans tend to be those with high levels of environmental risk from climate hazards, stronger socio-economic characteristics, and less reliance on carbon-based industry; being in a geographic cluster with others doing CCPs also helps. A logical problem was not resolved however--reductions in local emissions have virtually no effect on likelihood of suffering from global-warming related weather events, so the connection between experiencing climate events and local mitigation action is very unclear. There is, unfortunately, little information to date on who does adaptation planning – or which characteristics tend to encourage it.

In summary, the small body of research has begun to review, evaluate, and compare emerging local practice. This work establishes that despite relatively widespread local government engagement in non government organizations such as ICLEI, the number of non-European Union or U.K. local authorities with completed climate plans or equivalent appears relatively low but increasing; that the motivation for such plans comes from a variety of sources; and that local efforts have primarily focused on reducing greenhouse gas emissions (climate change mitigation strategies) rather than adaptation. The research suggests that adaptation and mitigation are best considered separately, at least at this stage in the policy and planning process. Nevertheless, the ultimate alignment of mitigation and adaptation strategies is an important framework concern - a point to which we will return.

## Research questions and method

Given the above framework, we sought to answer the following questions:

1. To what extent have local governments in the U.S and Australia begun to undertake specific climate change adaptation planning initiatives?
2. Which policy / contextual factors seem to coincide with the adoption of adaptation planning measures?
3. What general policies are being encouraged, and do adaptation initiatives seem to align with, or undermine, mitigation strategies?

Our approach was twofold. Firstly, we sought to gain a sense of the state of practice of local adaptation planning in both the U.S and Australia, within the broader context of national and State level policy and/or support for climate change adaptation. We then focused on a sample of local climate change adaptation plans (or equivalent) from both nations as a basis for comparison. These plans did not need to be stand-alone adaptation plans, but needed to at least be separate, adaptation-identified chapters in documents that recommend specific policy choices and formulate a local adaptation strategy, perhaps within a larger climate change or environmental planning context.<sup>iii</sup> In terms of policy content, we looked for and focus on spatial, or land use planning actions.

To identify climate change plans for the US sample, we reviewed the American Planning Association's (APA) June 2010 list of cities and towns<sup>iv</sup> that have undertaken climate planning. We reviewed each community's underlying documents, and categorized these as mitigation only or adaptation and mitigation, and selected those with significant adaptive elements or free-standing plans. We tested this against previous work on US adaptation planning and broader web

searches, and did not find any examples that were not included in the APA list. An outlier is New York City, which has incorporated climate change planning into its newest comprehensive plan and infrastructure criteria. This seems to us the direction that all towns and cities likely should be going, but the lack of a separate chapter or section makes it more difficult for this particular analysis since we cannot separate out climate actions from other actions. For this reason we did not include New York City in our analysis. With these parameters, we found five clear examples of towns or cities with adaptation plans (Table 1).

**Table 1: US Local authorities with climate adaption planning frameworks**

<b>Local authority</b>	<b>Plan Name</b>	<b>State</b>	<b>Population Category</b>	<b>Location</b>
Keene	Adapting To Climate Change: Planning A Resilient Community 2007	New Hampshire	0-50K	Inland
Olympia	Olympia's Response to the Challenge of Climate Change 2007	Washington	0 - 50K	Inland
Berkeley	Berkeley Climate Action Plan 2009	California	50-300k	Coastal
Chicago	Chicago Climate Action Plan 2008, Especially Chapter 5: Adaptation	Illinois	1-3M	Inland
King County	King County Climate Plan 2007, Especially Section 6B On Adaptation	Washington	1-3M	Inland

To draw the Australian sample of local adaptation plans, we initially focused our search on the over 60 local councils or regional organisations of councils that received funding under the Commonwealth's Local Adaptation Pathways Program to undertake adaption assessments and or adaptation plans , not all of whom had completed plans. We also undertook a broader search of local government

adaptation planning activities (following references contained on each State / territorial government responsible for climate change; and the NSW Local Government & Shires Association websites, which includes a directory of case study climate change policies and plans . This resulted in the following list of eight local government areas (see Table 2) with full adaptation plans in place or exhibited drafts that have specific spatial or land use policies, however, this initial list is likely to expand in the very near future as federally funded adaptation projects near completion.

**Table 2: Australian Local authorities with climate adaption planning frameworks**

Local authority	Plan Name	State	Population Category	Location
Hornsby	Climate Change Adaptation Strategic Plan 2009	New South Wales	50-300K	Coastal
Gold Coast	Gold Coast Climate Strategy 2009	Queensland	300K – 1M	Coastal
Sunshine Coast	Sunshine Coast Climate Change and Peak Oil Strategy 2010		300K – 1M	Coastal
Brisbane	Brisbane's Plan for Action on Climate Change and Energy 2007		1 – 3M	Inland
Darebin	Climate Change and Peak Oil Adaptation Plan 2009	Victoria	0-50K	Inland
Melbourne	Climate Change Adaptation Strategy 2009		0-50K	Coastal
City of Port Phillip	Draft Climate Adaptation Plan 2010		0-50K	Coastal
Mandurah	Coastal Zone Climate Change Risk Assessment and Adaptation Plan 2009	Western Australia	50K-300K	Coastal

Source: The authors, ABS 2010

With both our samples in place we undertook a basic comparative analysis of each climate plan, focusing on: the identification of climate threats and impacts; key



goals and recommendations; the relationship between the adaptation plan and other local climate change mitigation strategies or plans; and any potential conflict with existing mitigation goals. An inductive analysis was used to identify patterns, themes, and commonalities in relation to our overall research questions. This analysis provided a set of qualitative, baseline insights across a range of first generation, emerging practice adaptation planning initiatives. We deliberately avoided any systematic, comparative evaluation of plan quality, on the basis that such assessment would be premature given the nascent state of practice in the field.

The approach also provided a basis for tentative explanations for relative early adoption of adaptation planning practice in these communities – taking into account four criteria identified in previous studies of engagement with climate mitigation planning from literature described above: 1) the existence of State plan mandates for climate adaptation planning, or other government support (such as Federal funding); 2) support from other non government sources (such as affiliation with an international environmental organization); 3) geographic / locational context, determined by population size; and 4) level of risk / exposure to climate threat (determined by risk articulation statement in plans).

### **Research Limitations**

A limitation to our research is that we focus on explicit climate adaptation plans. A broader inquiry would also include sectoral approaches integrated into national policies and how those translate into local outcomes, such as changed infrastructure specifications that reflect future climate, rather than past climate. Halsinaes, for instance, identifies significant opportunity in national policies to

encourage local adoption of transportation and water supply infrastructure that provide resilience against climate variability and climate change. . Some have argued that this integration into policies at all levels of government and civil society is a major sign of successful adaptation implementation , and thus to focus on free-standing plans may be a misdirection of energy. While acknowledging the validity of this for countries where climate planning is fairly advanced, in our two example countries (and by extension other countries where planning for climate is fairly new or low on the agenda), the existence of free-standing plans seems to us the appropriate first step toward raising the profile of climate change in local and national action, and thus appropriate for study.

Similarly, an effective national action could be capacity building for local action , and this would be invisible in the local plans and thus the research approach we have taken. Our review of national policies for U.S. and Australia suggests that in the U.S. there has been very little capacity building, but it is a significant part of the current Australian adaptation initiatives. Another limitation is that we are not attempting to evaluate the outcomes of the policies. As noted by Adger et al the implementation and the evaluation of adaptive actions will involve new and challenging institutional processes.; for the moment we are happy towns have plans, but evaluation of implementation once the plans have had a chance to take effect will be an essential practice. Overall, we acknowledge the tentativeness of our findings and the small sample size.

## ***Results: Local adaptation planning practice in Australia and the U.S***

With this context in place, we turn now to our findings. Our first research question was the extent to which local governments in the U.S and Australia have begun to undertake specific climate change adaptation planning initiatives. It is clear from tables one and two above that local adaptation planning is not widespread in either nation. Even if our method for identifying such practice has resulted in under-representation it seems apparent that climate adaptation planning is nascent rather than established, in Australia and the U.S at least. It is also very recent, with all identified plans being prepared between 2007 and 2009. The length of the plans, or plan components, relating to adaptation, varies enormously, from a few pages in the larger Chicago Climate Action Plan to over 100 pages (Keene) (US) and Melbourne (Australia).

Our second research question regarded the policy frameworks and contextual factors that seemed to coincide with municipal adaptation efforts. To explain these early efforts at local climate change adaptation planning, we sought to explore the relative influence, if any, of several factors: State or Federal government support; engagement with international non government environmental organisations (using membership of ICLEI as the main focus); local context in terms of population size and geography; and a qualitative assessment of plan defined level of risk/exposure to climate change relative to other locations. Table 3 summarises the ways in which each of the local areas in our sample relate to these criteria.

**Table Three: Contextual factors, local climate change adaptation planning**

<b>City/Local Authority</b>	<b>State plan</b>	<b>Federal support</b>	<b>ICLEI</b>	<b>Mitigation Plan</b>	<b>Population Size</b>	<b>Geography</b>	<b>Risk / exposure</b>
Keene, NH	✓		✓	✓	Small	Inland	Low/ Medium
Olympia, WA	✓		✓	✓	Small	Inland	High
Berkely, CA	✓		✓	✓	Medium	Coastal	Medium / high
King County, WA	✓		✓	✓	High	Inland	Medium
Chicago, IL			✓	✓	High	Inland	Medium
Hornsby Shire Council, NSW			✓	✓	Small	Coastal	Medium
Gold Coast City Council, QLD	✓	✓	✓	✓	High	Coastal	High
Sunshine Coast Regional Council, QLD	✓	✓	✓	✓	Medium	Coastal	High
Brisbane City Council, QLD	✓		✓	✓	High	Inland	Medium
Darebin City Council, VIC			✓	✓	Medium	Inland	Medium
City of Melbourne, VIC		✓	✓	✓	Medium	Coastal	Medium
City of Port Phillip, VIC			✓	✓	Small	Coastal	Medium
City of Mandurah, WA		✓	✓	✓	Medium	Coastal	High

Population size: Small = less than 100,000; Medium = 100,000 – 500,000; High = over 500,000

As shown in the table, there are two very consistent patterns. First, all the communities undertook mitigation plans before they moved to considering adaptation. Second, all of the local authorities engaged in climate adaptation planning are also involved in the ICLEI network, highlighting the importance of international non-government networks in promoting environmental initiatives.

This appears particularly so in nations where Federal government climate change policy involvement is limited – as in the US. However, State government mandates for climate change adaptation planning seem important, as well; cities in states with climate plans are over-represented in our sample. Somewhat surprisingly, federal government funding support for climate initiatives appears less significant. This appears so despite the existence of a strong funding program for local government climate planning in Australia – however, this will likely change as work underway is completed. This supports the finding of Vasi (2007), that leadership can come from a variety of governmental levels. Our broad risk assessment, based on the self assessment of risk factors identified in the reviewed plans shows a coincidence of federal support for adaptation initiatives in local areas judged to be particularly vulnerable – which may, sensibly reflect federal funding priorities. It does not necessarily appear that very high risk is associated with likelihood to undertake adaptation planning – many communities with adaptation plans can only be considered medium risks. This runs counter to some literature on mitigation, even though logically the connection between climate risk and adaptation is much closer.

We were surprised to observe no real trend in terms of the size or geographical locations of local authorities and their propensity for engaging in adaptation planning, aside from a bias towards exposed coastal areas in Australia, which reflects its particular settlement pattern. However, we do observe a potential tendency for regional clusters of adaptation plans to emerge, at least across the Australian sample that includes three inner city Victorian councils; and three South

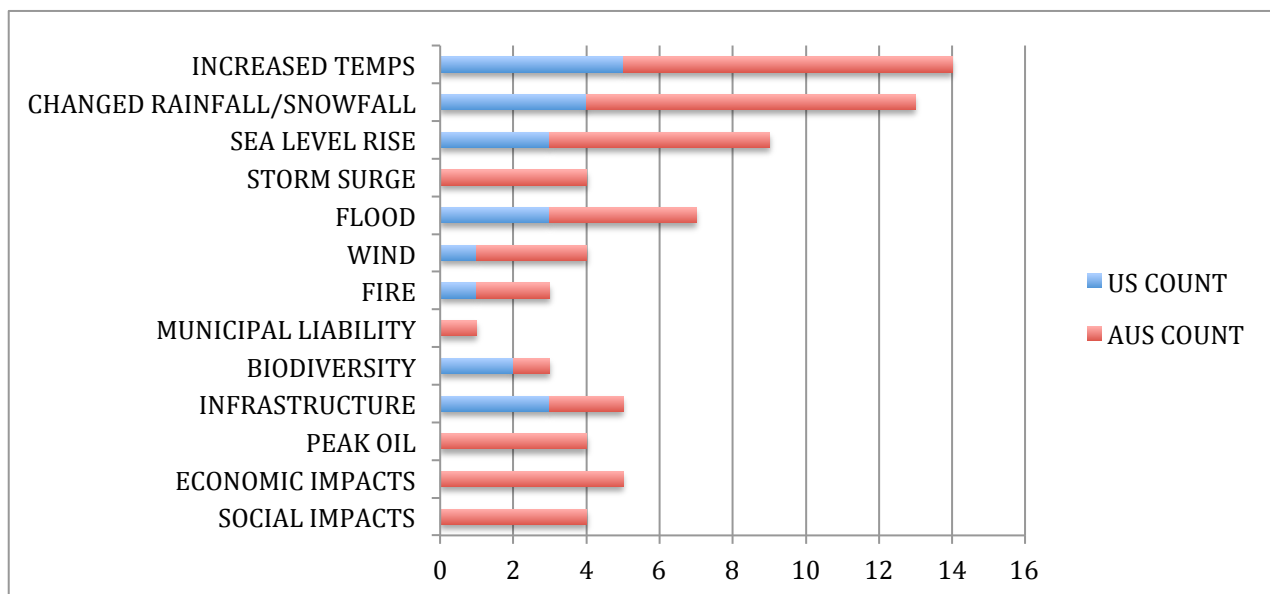
East Queensland areas. This suggests some regional diffusion of knowledge and practice, a finding similar to that for mitigation plans (Zahran et al. 2008).

In the U.S, the presence of a state plan for climate change adaptation appears helpful -- there were no cities/towns/counties with adaptation plans that were in states without one as well, with one exception: Chicago has a substantial climate change plan addressing both adaptation and mitigation, while the state of Illinois has not made any climate plans that we could find.

Our findings on the role of state mandates are similar in Australia. The only one of the eight States and Territories with a defined adaptation plan in place (Queensland), is over represented in terms of local adaptation plans. Nevertheless, State engagement in adaptation planning beyond a full plan may affect local policy diffusion too. Victoria is characterized by a substantial program of state initiatives, and also has several local authorities engaged in climate adaptation planning.

Identifying likely threats or impacts associated with enhanced climate change is an important first step for assessing vulnerability, and developing an adaptation response (Tang et al 2010). As shown in Figure 1, all plans identified major threats related to temperatures, precipitation, sea level rise and flooding, and associated environmental and socio economic consequences. Despite these generic categories of threat, most of the U.S plans reviewed were highly specific in identifying particular local and regional ecosystems to be affected, and some plans, such as that for Chicago, included a qualitative assessment of risk relative to other, more exposed coastal locations.

Figure 1: Key climate change threats identified in plans

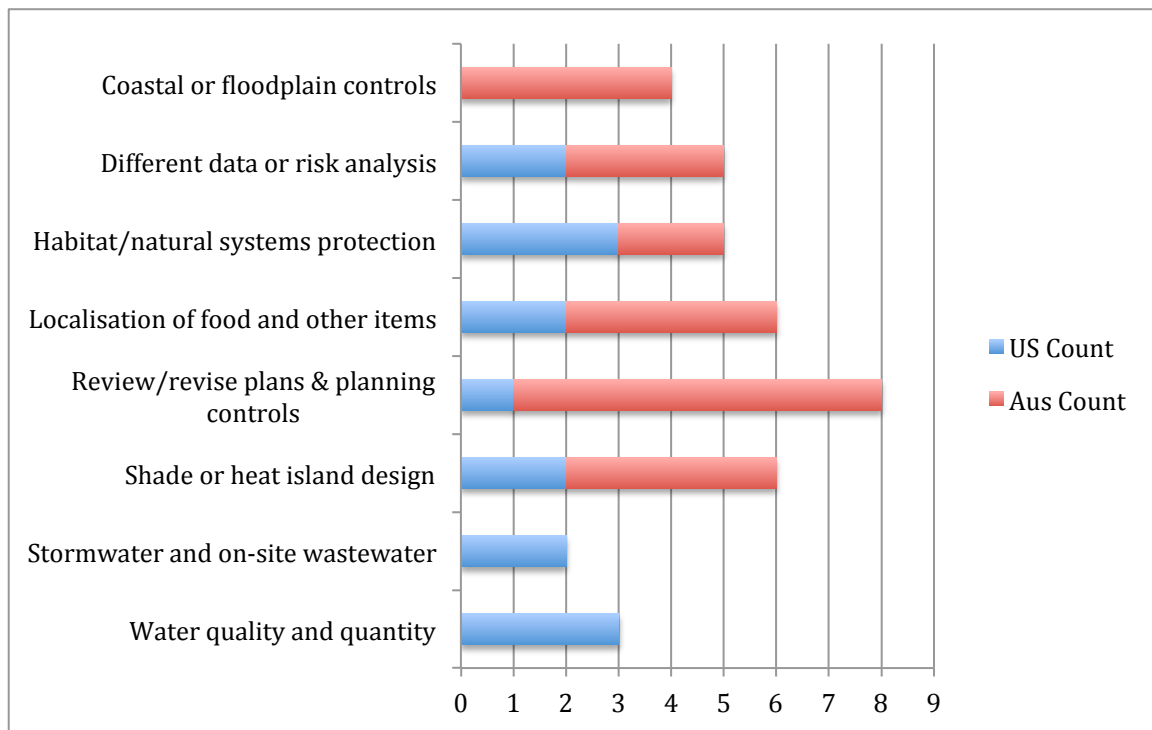


In the nine Australian plans, the major threats identified included more intense and frequent heat waves, increased severity of fires and floods, sea level rises and ecosystem damage. Several plans identified dual threats arising from peak oil and climate change. Many of the Australian plans also identified specific risks to local government arising from legal liabilities or infrastructure damage, and risks affecting particular social groups, such as the elderly or those on lower incomes, who are more exposed to price impacts associated with more expensive power or transportation. Generally, the concept of vulnerability analysis has seeped into the Australian plans more than the U.S., which may reflect emphasis of the Australian research and policy community .

In many of the plans reviewed, there was a logical connection between climate threats identified and priority areas for adaptation action, although with some exceptions, adaptation strategies were far less developed than threat identification.

Our third research question regarded the general policies being encouraged, and whether adaptation initiatives seem to align with, or undermine, mitigation strategies. We summarize the key land use planning and related adaptation actions identified in the plans in Figure 2 below; note that we counted each plan only once per category, no matter the number of recommendations within a plan that fit into that category. We provide more contextual information in Tables Four and Five at the end of the article.

Figure 2: Summary of recommendations in the plans



As shown in the tables, many of the actions identified depend on further investigation, plan review, and policy development, rather than representing specific actions for immediate implementation. Many of the concrete land use



planning strategies identified in the US plans relate to flooding and stormwater management through floodplain zoning and related codes. Steps to assure the quality or quantity of drinking water are also a popular concern. These matters are not considered in the Australian plans, probably because existing planning frameworks already manage water supply and natural hazards such as flooding, shoreline erosion, fire, in some depth, so the emphasis is more on revising such requirements in the light of changed and uncertain weather predictions, rather than on developing new regulatory tools. Therefore, a key focus of the Australian plans is on revising and incorporating climate change enhanced predications about sea level rise in the coastal zone. A second major focus is on the development of design codes for climate comfort, particularly in residential and civic design, with managing the urban heat island effect a theme in some plans. Thirdly, a number identify strategies to adapt to potential fuel poverty associated with peak oil through increased urban densification and transit orientation. Fourthly, a handful of plans commit to developing strategies to secure local food, energy and water. Finally, some plans actually present climate change as a new economic opportunity, and use their adaptation plans as a platform for developing strategies to exploit such chances:

“Climate change presents opportunities to Council and the community. National and international demand for energy efficient technology is developing as a climate change mitigation and adaptation response. The Gold Coast has the opportunity to participate in this emerging area and to be an attractive location for

business and innovative industry to prosper. This strategy considers how such opportunities may be realised... “ (, p. 1).

The effort to compare and contrast the cities’ adaptation and mitigation plans is made difficult by the lack of detail underlying most of the adaptation actions. At least theoretically, the adaptation plans sought to support mitigative actions. The plans reviewed tended to begin with assertions that adaptation actions are in addition to rather than replacements for, mitigative actions. Indeed, some plans overtly claim synergies between adaptation actions and mitigation efforts:

“Many of these actions to adapt to climate change serve a dual purpose: They also reduce greenhouse gas emissions. Green roofs, for instance, cool the city as temperatures rise and retain water during storms (adaptation), while they also help increase the energy efficiency of buildings (mitigation). Increasing the size of the Chicago urban forest canopy can provide shade to mitigate the urban heat island effect (adaptation) and reduce energy demand to cool buildings (mitigation). Rain gardens and permeable pavement capture stormwater onsite (adaptation) reducing the amount of stormwater that must be pumped and the energy required to pump it (mitigation) (City of Chicago 2008, p. 44.)

## **Conclusions**

Adaptation planning is highly technical, as an adaptation plan rests on projections of future climate and the risks that future climate entails. This sort of

local climate forecast is can be expensive, depending on the availability from federal, regional, or university sources, and the degree of downscaling required. In addition, once projections are developed and risks are assessed, policies tailored to address those risks in that specific location have to be developed. Done well, analyses of vulnerability, both social and physical, are combined with climate forecasts so that a fuller picture of likely impacts and ethical issues can be drawn. Mitigation planning has the benefit of a longer history of interest (e.g., the energy crisis of the 1970s), and better guidance from a non-governmental unit (ICLEI). ICLEI has now turned its attention to adaptation, but the technical challenges of adaptation – particularly the need for technically specific local data (and the capacity to interpret this data), are greater. However, adaptation planning has the advantage over mitigation in that adaptive actions taken locally provide local benefits. But for all climate planning, getting that message across requires overcoming the typically short time frame of politics and budgets, and considering instead a longer investment that matches climate that is to come, rather than climates past. Our results suggest that some cities and town can take a leadership role and undergo adaptation planning without significant support from upper government levels, particularly when the non-profit ICLEI appears to be stepping into the information and guidance role. However, having state support through an existing state level adaptation plan appears a far more reliable way to encourage local governments to make local adaptation plans.

Ultimately, our analysis of early generation local adaptation planning suggests that more sophisticated and detailed policy and practice innovation is needed to allow municipalities to translate potential impacts into a concrete

response framework, particularly in relation to land use planning. That adaptation actions are arising within the context of overarching mitigation planning efforts suggests strong potential for synergistic solutions to be devised. Nevertheless, when new information about likely sea levels, flooding, and fire risks comes to light, difficult decisions regarding land based adaptation measures will be needed, including potential quarantining of development opportunities. This implies a need for specific planning tools – such as planned retreat and transferrable development rights (enabling historical development entitlement to shift to more appropriate locations) – to provide a basis for offsetting some of the inevitable costs to individuals associated with such decisions. Vulnerability analyses need to become more common to assure that the least resourced are not the most affected. There is also a danger that in failing to clearly connect mitigation and adaptation decisions in new generation plans, mis-alignment may seep into the ellipsis. But our review suggests that we can take heart in the creativity, variety of approaches, innovation, and motivation of a set of pioneering municipalities. As more examples, technical/policy guidance, and non-governmental support become available, in part building from the experiences of these early adopters, it appears reasonable to expect adaptation planning to spread in both these countries, particularly with more explicit state and federal encouragement.

**Table Four: Climate Adaptation Plans and Land Use Planning Actions (US)**

<b>LGA</b>	<b>Key Land Use Planning Actions</b>
Keene NH, USA	Scientific staff to provide climate change information to policy makers for consideration in regulation and decisions; review comprehensive plan; hazard mitigation; and relevant building ordinances / design standards in light of potential climate change impacts; create flood control zone; protect and rehabilitate historic and cultural resources to reduce vulnerability; code and plan revisions for water quality protection
King County WA, USA	Develop new sustainability design standards (green building materials, energy conservation principles); design standards for greater resilience to severe weather, floodplain identification; identify alternative route options for movements of goods and people; sustainable transportation mode choices; promote locally generated; secure energy sources; increase protection of existing / future wetlands to enhance resilience of ecology and hydrology; increase water-storage capacity; increase food security – identifying and protecting prime agricultural soils
Berkely, CA, USA	Encourage water efficiency; expand and diversify water supply; increase urban tree cover
Olympia, Washington, USA	Refers to previous efforts in encouraging denser less car dependent development; introduction of stormwater regulations.
City of Chicago, Illinois	Update heat response plan – research into urban heat island effect; encouragements for innovative cooling / energy efficiency in properties; “Green Urban Design Plan” (permeable pavements; rooftop gardens; green alleys; onsite mechanisms to prevent flooding); amendment of landscape ordinance for climate tolerant plants.

**Table Five: Climate Adaptation Plans and Land Use Planning Actions  
(Australia)**

<b>LGA</b>	<b>Key Land Use Planning Actions</b>
Hornsby	Review planning controls to strengthen requirements in locations of increased vulnerability
Gold Coast	Designate climate sinks in local planning scheme; scope local food production opportunities and requirements; implement coastal planning measures
Sunshine Coast	Revised sea level rise projections Planning controls to improve resilience of natural systems Risk assessments in planning decisions Planning controls to encourage localisation
Brisbane	Planning controls to prevent flood / storm surge exposure; shade & weather protection Transit Oriented Development to address risks of Peak oil – maximise accessibility Reducing barriers to urban food production Improve resilience of natural systems – no net loss of natural vegetation
Darebin	Zoning flexibility – provision for local food production Assessing planning controls to remove impediments to resilience strategies Appropriate development in areas subject to climate risks
Melbourne	Revised planning controls for sea level rise; new building standards to manage heat island effect
City of Port Phillip	Revise planning controls to restrict building in areas of coastal vulnerability; require climate adaptive building design and vulnerability to be considered in planning decisions; amend planning controls and permit requirements accordingly
Loddon Shire Council	None identified.
Mandurah	Modifying planning process; amending standards; reviewing information requirements for decision making

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<sup>i</sup> From the ICLEI website: <http://www.iclei.org/index.php?id=global-members>, accessed 10/17/2010.

<sup>ii</sup> Regarding Massachusetts' new adaptation effort, see: <http://www.mass.gov/dep/public/committee/ccaac.htm>

<sup>iii</sup> Based on the desire for plans with actual content, rather than plans that outline plans for a process, we did not include the several plans that essentially said 'when our city does an adaptation plan, here is what we should think about' – for the research we selected only adaptation plans with clearly stated policies that could be implemented.

<sup>iv</sup> APA database is available at <http://www.planning.org/research/energy/database/>