Maximising synergies between disaster risk reduction and climate change adaptation: potential enablers for improved planning outcomes

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Abstract

Recent extreme weather events worldwide have highlighted the vulnerability of many urban settlements to future climatic change. These events are expected to increase in frequency and intensity under climate change scenarios. Although the climatic change may be unavoidable, effective planning and response can reduce its impacts. Drawing on empirical data from a 3-year multi-sectoral study of climate change adaptation for human settlements in the South East Queensland region, Australia, this paper draws on multi-sectoral perspectives to propose enablers for maximising synergies between disaster risk reduction and climate change adaptation to achieve improved planning outcomes. Multi-sectoral perspectives are discussed under four groups of identified enablers: spatial planning; cross-sectoral planning; social/ community planning; and strategic/ long term planning. Based on the findings, a framework is proposed to guide planning systems to maximise synergies between the fields of disaster risk reduction and climate change adaptation to minimise the vulnerability of communities to extreme weather events in highly urbanised areas.

Key Words: adaptation planning, risk, pre-disaster planning, betterment, urban settlements, Australia

1. Introduction

Climate risks in urbanised areas are increasing with significant impacts on urban populations, economies and ecosystems, including extreme weather events leading to disasters (Revi and Satterthwaite, 2014; Wamsler, 2014). Urban planning and management (hereafter referred to as planning) plays a critical role in reducing climate risks through both spatial and strategic plan making and plan implementation (Berke and Campanella, 2006; Olshansky and Chang, 2009; Olshansky, 2006). Typically, planning policies have focused on minimising risks through prohibiting development in high risk areas and applying appropriate development controls (Harman et al., 2013; Wamsler, 2014). However, economic damages associated with disasters caused by extreme weather events have increased over time due to both social vulnerabilities and changes to physical hazards (Adger et al., 2005; Crompton and McAneney, 2008). As climate change is likely to escalate the frequency and intensity of extreme weather events (IPCC, 2014) increased pressure is being added to planning systems to implement more holistic measures to address future climate risks.

This paper argues that one lens through which planning can improve its ability to deal with forecast climate change impacts is by maximising synergies between strategies seeking disaster risk reduction and climate change adaptation. Arguments are based on empirical findings from the South East Queensland Climate Adaptation Research Initiative (SEQCARI), a three-year multi-sectoral study of climate change adaptation options for the South East Queensland (SEQ) region in Australia. Section 2 introduces the latest discussions on the interconnected fields of disaster risk reduction and climate change adaptation, followed by two key emerging concepts: betterment and post-disaster planning in the pre-disaster phase. Section 3 reports on the research approach and methodology along with a typology of enablers for maximizing synergies between disaster risk reduction and climate change adaptation based on multi-sectoral stakeholders' perspectives identified by the SEQCARI project. These enablers are described in section 4 and form the basis for the proposal of a framework for planning systems to reduce current and future vulnerability of highly urbanised areas to extreme weather events presented in section 5.

2. Conceptual underpinnings: (re) connecting disaster risk reduction and climate change adaptation

There is an increasing understanding that climate change adaptation and disaster risk reduction are interconnected fields that deserve investigations seeking their overlaps and synergies (Birkmann and von Teichman, 2010; Gero et al., 2011; Howes et al., 2014; McBean and Ajibade, 2009; Schipper, 2009; Schipper and Pelling, 2006; Solecki et al., 2011). In the last decade there has been an increasing demand to integrate these two fields, especially within the international development arena, yet progress has been slow and examples of effective integration, especially at the national and local levels, remain limited (Birkmann and von Teichman, 2010; Gero et al., 2011; Mitchell et al., 2010). Despite calls for exploiting the synergies and identifying signs of convergence, there is very little guidance on how to integrate disaster risk reduction and climate change adaptation, as the relationship between both fields remains unclear. For example, Birkmann and von Teichman (2010) note how on the one hand it is argued that climate change adaptation needs to be mainstreamed into disaster risk reduction, while on the other disaster risk reduction is seen as a sector or cross-cutting theme within adaptation. In addition, both fields have different theoretical and cultural origins and are supported by different sets of institutions, methodologies and policy frameworks (Mitchell et al., 2010; Schipper, 2009; Tearfund, 2008).

Nevertheless, recent studies have identified some of the synergies as well as key challenges to the integration of these two fields (Birkmann and von Teichman, 2010; Mercer, 2010; Mitchell et al., 2010; Tearfund, 2008). Birkmann and von Teichman (2010) reviewed the literature and noted that the integration of the two fields is subject to challenges related to mismatch of temporal, spatial and functional scales as well as mismatches in norms and knowledge. These mismatches result in missed opportunities for integration and effective long term vulnerability reduction. For example, the recovery phase provides a window of opportunity for implementing long term disaster risk reduction measures yet this opportunity is often neglected and remains unused. In addition, the opportunity to rebuild in an adaptive way and to consider future climate

change is in most cases not considered, as recovery tends to focus on building back as quickly as possible to pre-disaster conditions (Birkmann and von Teichman, 2010).

Integrating disaster risk reduction and climate change adaptation will demand ‘greater collaboration between communities of policy makers, practitioners and researchers’ (Howes et al., 2014:3). Additionally, Howes et al. (2014) suggest that integration could be interpreted as joined-up government efforts focused on eliminating policy trade-offs, improving use of resources and improving exchange of ideas and cooperation between stakeholders (Pollit, 2003 cited in Howes et al., 2014). In parallel, Wamsler (2014) argues that such integration can only occur, at least from a planning and theoretical perspective, if both fields are considered cross-cutting issues embedded in planning systems through a series of seven mainstreaming strategies. Such strategies should target three realms: (i) the implementation of specific programmes aimed at reducing climate and disaster risk; (ii) the modification of intra- and inter-organisational operational procedures such as management, policy and working structures to improve coordination in the implementation of programmes and reduce spill-over effects; and (iii) education and training of practitioners and policy makers on disaster risk reduction and climate change adaptation (Wamsler, 2009).

Despite the long history the disaster risk reduction community has in addressing hazards and vulnerability (Solecki et al., 2011), there is limited research available that can inform urban and regional planners to better address disaster risk reduction (Blanco et al., 2009a; Olshansky et al., 2012; Wamsler, 2014; Wamsler et al., 2013). In parallel, there is limited empirical analysis of effective climate change adaptation strategies that can be implemented through spatial and / or strategic planning (Hurlimann and March, 2012; Wamsler, 2014; Wamsler et al., 2013; Wise et al. 2014). Nevertheless, the core business of planning systems has to deal with a legacy of past decisions that potentially place many people as well as private and public assets at an increased risk of harm from current and future extreme weather events (Burby et al., 2000; Hurlimann and March, 2012; McDonald et al., 2010; Stevens et al., 2010a; Wamsler, 2014). For example, the impact of Hurricane Katrina on New Orleans is an exemplar of the vulnerability of communities

falsely protected by hard infrastructure devices, such as coastal defence structures (Colten and Giancarlo, 2011; Heazle et al., 2013). Additionally, using the example of Melbourne's peri-urban area that was savaged by the 2009 Black Saturday fires, Buxton et al. (2011:11) highlight that despite the risks there has been continuous development in areas of 'increased and extreme bushfire threat from climate change'.

Nevertheless, planning responses aimed at better dealing with future climate change impacts could learn from past disaster recovery experiences, particularly from the windows of opportunity created in the post-disaster phase. In particular, Schipper (2009) argues that addressing risks before and after disasters occur comprises one of the synergies between climate change adaptation and disaster risk reduction. Recovering from the impacts of disasters involves multiple layers, including housing needs, restoration of infrastructure and facilities, restoration of economic activities as well as improved coping mechanisms of affected communities and individuals (Olshansky et al., 2012). While there is a trend toward immediate reconstruction and rebuilding of damaged structures to enable communities to recover more rapidly and return to pre-disaster normality (Kates et al., 2006; Schipper, 2009), rebuilding it back quicker can often lead to the amplification of the economic, social and environmental vulnerability of affected areas (Ingram et al., 2006).

Two emerging concepts could offer scope for the implementation of much needed robust planning measures seeking to better deal with impacts from current and future extreme weather events: betterment and post-disaster planning in the pre-disaster phase. In particular, changes facilitated by both concepts may include enabling long term recovery from disaster impacts and reducing the vulnerability of places and their communities to climate risks (Adger et al., 2009). Hence, taking urban and regional planning outcomes as the background context, there is potential to explore whether the synergies between disaster risk reduction and climate change adaptation could be maximised through both betterment and post-disaster planning in the pre-disaster phase (see Figure 1).

The concept of betterment has emerged as an approach that questions the trend of rapid reconstruction and rebuilding of affected communities after being stricken by disasters (Kates et al., 2006). While reconstruction post-disaster is often seen as an opportunity to build better and more resilient structures, under a betterment approach reconstruction must also add ‘value beyond what existed before the disaster’ (Olshansky et al., 2006:357). Hence, under a betterment approach to reconstruction there are opportunities for considering future spatial and societal impacts caused by climate change. However,

Figure 1. Conceptual underpinning

reconstruction usually happens at a fast pace and conflicts arise between groups and institutions because different goals are not given sufficient attention in time, resources and values (Kates et al., 2006). Additionally, Kates et al. (2006) outline that the concept of betterment needs to be extended beyond physical structures, including improved urban planning practices, greater social equity and economic development focused on the strength of local industries.

In parallel, the concept of post-disaster planning in the pre-disaster phase is also emerging as an alternative approach for disaster risk reduction that can be coupled to climate change adaptation. In essence, this approach calls for recovery planning to be proactive and abandon the traditional reactive mode (Meyer et al., 2010). It also ‘recognises the importance of adjusting to new post-disaster realities’ that are conducive to resilient states that aim at improved pre-disaster conditions (Manyena et al., 2011:420). In fact, successful long term recovery may well require planning for post-disaster recovery in the pre-disaster phase. Planning before a disaster occurs, whether it has slow or rapid onset, can ensure that communities and government agencies are sufficiently well prepared to negotiate the complexities and time compression challenges of post-disaster recovery (Florida State Emergency Response Team, 2011). However, successful post-disaster recovery can be highly constrained by a series of barriers. These include limited availability of funds, absence of pre-agreed planning policies for future development and existing planning institutions, and absence of planning processes involving well-established networks of community groups, lines of communication and planning tools (Olshansky et al., 2008).

3. Research approach and methodology

3.1 The SEQCARI project

Focusing on the South East Queensland region (SEQ), the Human Settlements component of the SEQCARI project took a case study approach (Flyvberg, 2006) to explore and develop a range of sectoral and cross-sectoral adaptation options for better governance and management in response to the impacts of climate change. Similar to other urbanised areas worldwide (Burby et al., 2000; Hurlimann and March, 2012; McBean and Ajibade, 2009; McDonald et al., 2010; Stevens et al., 2010a), SEQ is particularly vulnerable to climate change impacts due to rapidly growing population along its highly urbanised coastal areas and floodplains (Crick et al., 2012; Hennessy et al., 2007). In particular, the region has a legacy of past planning decisions attributed to traditional planning systems which often lacked holistic approaches and a focus on future

conditions to implement land use strategies (McDonald et al., 2010; Oloruntoba, 2013). SEQ also has a history of being affected by extreme weather events such as the 2011 floods which resulted in the inundation of thousands of properties and significant damage to public infrastructure assets (The World Bank and Queensland Reconstruction Authority, 2011). Given its past and future climate related challenges, SEQ offers appropriate scope for exploring the synergies between strategies seeking disaster risk reduction and climate change adaptation.

SEQCARI was a 3-year multi-sectoral study involving the sectors of urban planning and management, coastal management, human health, emergency management and physical infrastructure at the local government scale. Data supporting this paper is based on 30 interviews carried out in 2011 with stakeholders from the five abovementioned sectors, including representatives from state government, local governments and non-government organisations (see Table 1). Interviews lasted an average of one hour and aimed to collect information related to existing and future climate change adaptation strategies across the region and sectors, including impacts and priorities, factors affecting policy development, barriers to effective action, opportunities for capacity building and integration of climate adaptation actions into other policy objectives. Data analysis involved in-depth content analysis (Bardin, 1977) followed by coding using NVivo software.

Table 1: Attributes of Stakeholder Interviews

Stakeholder group	Number of Interviews	Predominant field of work	Position in organisation
Local Government	15	Planning, engineering, coastal management, health, emergency management	S, M, O&M*
State Government	7	Planning, engineering, coastal management, health, emergency management	E, S, M
Advisory Bodies	3	Planning, policy, capacity building	M
Non-Government Organisations (NGO)	5	Planning, engineering, coastal management, capacity building, health	S, M

*E, executive; S, senior management; M, middle management; O&M, operation and maintenance

Based on the content analysis and the emerging concepts of betterment and post-disaster planning in the pre-disaster phase, a typology of enablers is proposed to maximise synergies between disaster risk reduction and climate change adaptation by planning systems. Figure 2 outlines this typology along with enablers that range from themes associated with spatial planning, cross-sectoral planning, social/ community planning and strategic/ long term planning.

Figure 2. Typology of enablers and associated themes for maximising synergies between disaster risk reduction and climate change adaptation within planning processes based on multi-sectoral stakeholders' perspectives

4. Enablers for maximising synergies between disaster risk reduction and climate change adaptation

4.1 Spatial planning

Many scholars have noted the role of spatial planning in disaster risk reduction (Berke et al., 2012; Olshansky et al., 2012) and climate change adaptation (Blanco et al., 2009b; Bulkeley et al., 2009). Analysis of multi-sectoral stakeholders' perspectives on climate change adaptation pointed to seven themes associated with spatial planning that could be translated into enablers to maximise synergies between disaster risk reduction and climate change adaptation as shown in Table 2. These themes ranged from typical planning functions such as land use planning, planning controls and urban design through to more complex tasks such as land use capability, risk consideration, post-disaster phase planning and post-disaster reconstruction.

Specifically, the role of land use planning, planning controls and urban design was especially linked to reducing the vulnerability of areas at risk. In this context, examples of potential enablers include urban consolidation through infill development in existing urbanised areas that have lower risks and therefore are less vulnerable to disasters, and improved building design standards that incorporate design criteria that allow structures to resist future loads potentially caused by climate change impacts during their service life. In terms of more complex spatial planning tasks, examples of enablers include formal recognition and extensive communication of climate risks affecting coastal areas through a full hazards disclosure law containing erosion rates, storm history, inundation and / or sea level rise. Enablers could also involve the strategic reallocation of health and emergency services departments into low risk areas and their upgrade to appropriate building standards to withstand future risks to secure their operation during emergencies.

Table 2 – Example of enablers to maximise synergies between disaster risk reduction and climate change adaptation through spatial planning

Spatial planning themes	Stakeholders' perspective extracts	Potential enablers
Land use planning	Proper land use planning is probably the single most effective mitigation tool you've got. (EM)	<ul style="list-style-type: none"> • Consolidation of urban development through infill and redevelopment of existing urban areas to minimise the extent of development occurring in highly vulnerable areas.
Planning controls	Particular planning instruments, such as the coastal plan ...provides specific advice, guidance and requirements for local governments that relate to climate change risk, in particular obviously sea-level rise. (UPM)	<ul style="list-style-type: none"> • Coastal defence mechanisms are implemented to provide continuing flood and erosion risk management due to storm tides and sea level rise.
Urban design	The planning scheme can be used to encourage more effective design and better housing design than we have now, or more appropriate design for a place that's going to be inundated or is going to have more rainfall or hotter weather. (CM)	<ul style="list-style-type: none"> • Building codes are reviewed to incorporate design criteria for buildings to resist future loads that may result from the impact of climate change-exacerbated hazards during a minimum service life of 50 years.
Land use capability	If we could encourage occupancy of those areas in a manner that stretched out the life span of that land, then that I think would be a good adaptation mechanism. (CM)	<ul style="list-style-type: none"> • Scenarios for land use conversion are defined to accommodate future population growth and incorporate future projected climate change threats over the next 50-110 years.
Risk consideration	I guess going back to the best practice, a risk reduction – a sequential risk reduction approach is the process that we follow in every sphere. (CM) We've got to get them thinking about it in terms of their local risk profiles and hazard assessments to start the planning. (EM)	<ul style="list-style-type: none"> • Coastal hazards full disclosure law is implemented to alert buyers of coastal properties about current and future climate related risks such as erosion rates, storm history, inundation and sea level rise.
Post-disaster phase planning	There are things that can be done outside of the emergency period that will then assist much, much better than what we've done in the past and priority, resources, time and policy attention needs to be turned to it. (UPM) You should potentially develop those kind of post disaster recovery plans in pre-disaster phase, so that when you do get a major disaster you actually have some general guidance and plan in terms of how to rebuild or where. (EM)	<ul style="list-style-type: none"> • Emergency and health services departments are strategically relocated into low risk areas and upgraded to appropriate building standards to projected risks so they can continue to operate during emergencies.
Post-disaster reconstruction	We're trying to get that message across in the recovery doctrine and the recovery planning that they need to be thinking about how things are reconstructed again. (EM)	<ul style="list-style-type: none"> • Long term post-disaster recovery considerations are integrated into pre-disaster plans of government agencies leading recovery process.
Note: UPM (Urban planning and management sector); CM (Coastal management sector); EM (Emergency management sector)		

4.2 Cross-sectoral planning

Studies on climate change adaptation call for concerted actions by government, non-government, private and community sectors to enable the implementation and effectiveness of adaptation strategies (Birkmann and von Teichman, 2010; Low Choy et al., 2012; Taylor et al., 2013). Amongst these strategies are cross-sectoral adaptation options that result from improved integration of climate policy in decision-making processes to reduce policy trade-offs and subsequent maladaptation (Barnett and O'Neill, 2010; Serrao-Neumann et al., 2014a). The analysis of stakeholder interviews revealed seven themes associated with cross-sectoral planning as outlined in Table 3. Overall, themes relate to improved inter-agency collaboration, decision-making processes, regulatory frameworks and leadership.

Enablers for improved inter-agency collaboration and cross-sectoral policy implementation include the development of internal programs involving multiple agencies (such as emergency management, human health and planning agencies) to build capacity of state and local government practitioners for dealing with climate risks and associated impacts, as well as enhanced knowledge sharing across agencies. In particular, capacity building programs targeting practitioners from government agencies and other relevant organisations could involve risk management practices to facilitate the incorporation of risk allocation mechanisms into decision-making processes.

Table 3 – Example of enablers to maximise synergies between disaster risk reduction and climate change adaptation through cross-sectoral planning

Cross-sectoral planning themes	Stakeholders' perspective extracts	Potential enablers
Conversation and communication amongst agencies	Local conversations about what is a risk for my community in an integrated way rather than say just from a health point of view. (HH) It's about making sure everybody hears those stories, gets together, uses the best soft options before they go for the hard options, and where the hard options really aren't appropriate and conveying that to the engineers, that, 'Hey, the softer option would be better in this case.' So making sure that those loops are all there. (CM)	<ul style="list-style-type: none"> • Agencies responsible for emergency management, human health and planning to develop an internal program for state and local government practitioners on emergency management issues and requirements with regard to climate change adaptation.
Cross-sectoral integration	So this whole notion of co-beneficial policy development is just so ripe for us to throw ourselves into but the silo mentality is just so entrenched. (HH)	<ul style="list-style-type: none"> • Capacity should be built/ improved through knowledge sharing, enhance understanding and awareness about climate change across sectors.
Improved knowledge and capacity	With our work we are endeavouring to improve the transparency about the risk so that there is more understanding amongst the councillors and the community about those risks in order to bolster our future support for resources to better manage those risks. (CM) I think the good opportunities that have happened have been in terms of the capacity of local government. So I said at the start local government is often well placed to have the most pragmatic implementation. (UPM)	<ul style="list-style-type: none"> • Build capacity of council officers and other relevant organisations to manage coastal hazard areas in a changing climate.
Better decision-making process	So I guess there has to be a decision across the - for the entire city that we're going to adapt to climate change in a specific way, a political decision, then we go about trying to implement that decision to ensure that we can adapt to climate change. (UPM)	<ul style="list-style-type: none"> • Risk allocation mechanisms are incorporated into decision-making processes
Rules and regulations	There is a state planning policy for the coastal plan. It sets out a whole lot of behaviours that need to happen at the local government level. (UPM)	<ul style="list-style-type: none"> • Councils establish and maintain agreements with each other to ensure coastal defence mechanisms have reduced spill-over effects.
Normalisation	It's understandable that it becomes normalised, because it's always hard to get additional funding and resources for a new project. It's better to actually have it embedded in your normal business so you would then say that, 'These adaptation practices have now become standard practice, and I will do it as part of my normal roll-out of this service or maintenance of these capital works.' (UPM)	<ul style="list-style-type: none"> • Cost estimation of climate change impact should be included in asset valuation and depreciation.
Higher-order government support	I want that guidance from the senior staff early, and those staff know early what we're talking about and let us know if we're totally going down the wrong road early so we're not six months – 12 months down the road. (UPM) I think there is that fear that they would like more support from state to be able to make those decisions and have them stand up in court and have that backing. (EM)	<ul style="list-style-type: none"> • Leadership must be developed by encouraging strong partnerships across governments, business and the community in order to improve communication of climate change risks to decision-makers and wider community.

Note: UPM (Urban planning and management sector); CM (Coastal management sector); EM (Emergency management sector); HH (Human health sector)

The effectiveness of regulatory frameworks seeking convergence of disaster risk reduction and climate change adaptation is dependent on the extent to which they cut across a range of government tiers and agencies. Specifically, effective cross-sectoral planning demands that rules and regulations are accompanied by inter-government agreements that ensure, for example, selected management options, such as coastal defence mechanisms, do not result in spill-over effects to other locations and therefore maladaptation. Additionally, disaster risk reduction and adaptation strategies need to be normalised in government businesses to ensure sufficient funding is allocated to deal with current and future risks. This type of normalisation is particularly important for infrastructure items which, in the Australian case, already face significant lack of funds for maintenance works without the extra burden expected to be added by more intense and frequent extreme weather events (Serrao-Neumann et al., 2011).

4.3 Social/ community planning

Individuals and communities play critical roles in disaster risk reduction. In particular, McBean and Rodgers (2010:878) note that educated individuals and communities that are aware of risks and vulnerabilities are able to produce strategies, such as ‘pre-arranged collaborative actions’, to both prepare for and recover from disasters. Additionally, these authors also highlight the importance of encouraging and enhancing changes in social and individual behaviour that are conducive to collective collaboration and cooperation, thereby improving their ability to respond to extreme weather events more effectively. Hence, social/ community planning offers an important compartment for enabling individuals and communities to better deal with current and future climate risks. Stakeholders identified themes related to social/ community planning that can be understood as enablers associated with capacity building, risk perception, disaster memory and community engagement (see Table 4).

Table 4 – Example of enablers to maximise synergies between disaster risk reduction and climate change adaptation through social/ community planning

Social/ community planning themes	Stakeholders' perspective extracts	Potential enablers
Adaptive capacity	<p>Part of our recovery work is also actually helping people to be better prepared for next time because that's what they're asking for. (HH)</p> <p>There are some opportunities for looking at behaviour change, and more of a social marketing of this, and I think that this question of understanding and communicating risk. (EM)</p>	<ul style="list-style-type: none"> Community education and awareness raising campaigns / initiatives targeted at vulnerable groups, including new residents and seasonal visitors, are developed and implemented. These campaigns will focus on natural hazards preparedness, response and recovery, and potential climate risks for the areas and communities to promote greater ownership of hazard risks and more self-reliant and empowered individuals and communities.
Change to public perception	<p>So you have to make some serious changes and you'd also not just make changes in terms of the law, but you actually have to alter people's idea about ownership of land and their right to be compensated and all that sort of stuff. (UPM/CM)</p> <p>Big one has to be headspace because a lot of people just don't have longer term view to EM. Emergencies happen here and now and we need to respond here and now. But problem is that response is contingent on good planning and planning happens at a point in time so we need to be aware that as underlying trends change then plans change which then impacts way response and recovery occur. (EM)</p>	<ul style="list-style-type: none"> Social networks and community organisations have greater access to information and avenues for collaboration around disaster risk reduction strategies for highly vulnerable areas, and are the recipient of improved communication about both future climate related risks and alternative solutions for risk minimisation.
Social memory	<p>So we aren't trying to frighten people just to be able to explain it's really important you – but then you've also got to give them, besides the frighteners, to be able to say, "People who have taken these steps, this is what's really – this is what's happened." So it's the positive as well. That you need to be able to show them the difference because people just won't normally just take action just by saying, "It's a good thing for you go to and do." (HH)</p> <p>The community is always crying 'ah, you alerting us and warning us about this, you're overdoing it, you're overdoing it, you're overdoing it'. I guess what some people have been saying is that you cry wolf too many times, but our message should be crying wolf or not don't ever slip, don't ever become complacent. (EM)</p>	<ul style="list-style-type: none"> Climate risks (e.g. floods, bushfires, heatwave etc) preparedness and awareness schemes are initiated to continuously inform communities about climate risks, including climate change projections, in hazard prone areas. Schemes encourage and provide support for residents of highly vulnerable areas to develop and maintain emergency plans, including evacuation procedures.
Community engagement	<p>It's a chance to actually do things and build those resources and doctrine and tools and then actually engage with people to get them an understanding of what's happening now in terms of severe weather and disaster events and what they can do and carry those messages down. (EM)</p>	<ul style="list-style-type: none"> Community leadership during and after disasters is supported by government agencies to promote improved disaster response and recovery. Support may include strategies to ensure volunteer retention and training.
Note: UPM (Urban planning and management sector); CM (Coastal management sector); EM (Emergency management sector); HH (Human health sector)		

Amongst these enablers is the need for improving the adaptive capacity of individuals and communities that have been previously affected by natural hazards. In particular, community education and awareness raising campaigns could be implemented to harness people's willingness to be better prepared for future disasters and to ensure the recovery process is less traumatic. These campaigns, as outlined in Table 4, could focus on climate risks preparedness, response and recovery to promote greater community ownership of and responsibility to address risks.

Additionally, cultivating social memory related to previous extreme weather events could be seen as an enabler of proactive action towards adaptation and disaster risk reduction. A strategy to maintain social memory of extreme weather events involves preparedness and awareness schemes which continuously inform communities about climate risks and facilitate the development and adoption of emergency management plans. Lastly, enablers could also entail community engagement strategies targeting the preparation of community leaders and networks, including volunteers, that are supported by government agencies to take active roles in preparing for, responding to and recovering from disasters.

4.4 Strategic / long term planning

Adapting to climate change impacts and reducing disaster risks demand proactive action from government agencies to minimise the vulnerability of human settlements (Heazle et al., 2013; Quay, 2010; Serrao-Neumann et al., 2013b). As future changes and uncertainties are inherent to climate change impacts, strategic / long term planning aimed at minimising climate risks needs to deal with the variability and unpredictability of extreme weather events and their consequences. Multi-sectoral stakeholders pointed to seven different themes related to strategic/ long term planning that could be translated into enablers, including responses to climate risks, such as planned retreat, decentralisation of services and no-regrets options, through to acknowledgment of actual climate risks and financial needs (see Table 5).

Table 5 – Example of enablers to maximise synergies between disaster risk reduction and climate change adaptation through strategic/long term planning

Strategic/ long term planning themes	Stakeholders' perspective extracts	Potential enablers
Planned retreat	People that have land in these low lying areas and they have an expectation that they can do something with the land regardless of the environmental sensitivities. These properties should be acquired and set aside – remediated and protected. But its a costly thing for the community to acquire these properties or the other way that the coastal plan is saying –it might be private property but its not to be developed for residential living and should instead be recreational uses or something else. (PI)	<ul style="list-style-type: none"> • Building structures, infrastructure and public facilities in high risk areas are sited landward and/ or relocated. Rebuilding of damaged structures in those areas are limited or prohibited.
Decentralisation of services	So when a major catastrophe comes through – you know, like Christchurch experienced – you lose the CBD [central business district] and key sort of service areas, but all the other suburbs can continue on, because they've got everything operating within them. (UPM)	<ul style="list-style-type: none"> • High priority buildings and services, such as disaster coordination centres, hospitals, essential government buildings and evacuation centres are decentralised and/ or equipped with back-up systems.
No-regrets options	Well, if you do something you should do it with the no-regrets approach, which is you should be doing good things and even if things turn out differently, you should be happy that you at least made decisions, put things in place, you know, and sought to get benefits from them. (UPM)	<ul style="list-style-type: none"> • A staging process is established to implement relocation and back-up schemes for essential services and buildings.
Hazard driven initiatives	I think in any sort of sphere of government a catastrophe tends to allow you to make a big - it's an opportunity. It's an opportunity to commit money. It's an opportunity to make a policy shift that would be much harder to do if the public's awareness had not been sharply brought to mind by the event. (EM)	<ul style="list-style-type: none"> • Long term post-disaster recovery considerations are integrated into pre-disaster plans of government agencies leading the recovery process. Communities are engaged in the development of pre-disaster plans.
Worst-case scenarios	Exercises for future scenarios would be useful. Let's run clock forward and imagine we're now 2070 and this is the new picture of [place x] and this is typical storm coming through, how are we going to respond to it. And then start identifying what our current shortfalls are in terms of resourcing or knowledge skills or whatever it happens to be. (EM)	<ul style="list-style-type: none"> • Emergency exercises (including recovery) based on worst-case scenarios (using best available science on climate change), including consideration of multiple events are conducted. Exercises involve the community and all agencies to test out emergency services arrangements under extreme cases.
Acceleration of impacts	I think it's an interesting comparison with the United States where on their east coast where they've had this subsidence and accelerated rates of sea level rise and they've had whole suburbs being eroded and being lost and it's just not feasible from an economic sense to try and stop that. It's only then that they're being forced into the proactive retreat where they basically save people, that if you're affected by erosion, if you're not you can't rebuild, and when your house is lost your house is lost. (CM)	<ul style="list-style-type: none"> • A coordinated response to sea level rise is initiated to develop measures related to coastal defence, accommodation and planned retreat. Response include policies and funds to facilitate easements for (a) development relocation; and (b) landward movement of coastal ecosystems impacted by sea level rise.
Financial capacity	Bringing forward these future constraints to now, so you've got cost implications now that you're not going to see the benefit of, or you may never see the benefit of because you just don't know what's going to happen until two generations' time. So that's a problem and it becomes a problem for the politics. So it's a problem for our economy. (CM)	<ul style="list-style-type: none"> • A state-wide plan is prepared to implement general policies and guidelines for identifying areas and infrastructure that may no longer be supported through public funds.

Note: UPM (Urban planning and management sector); CM (Coastal management sector); EM (Emergency management sector); PI (Physical infrastructure)

Enablers could be hazard-driven, focus on worst-case scenarios and assume the acceleration of impacts. For example, the reoccurrence of climate hazards offers opportunities for greater financial commitment to the emergency management sector and changing existing policies. Hence, enablers could involve the development of long term disaster recovery plans in partnership with affected communities. Additionally, the adoption of worst-case scenarios would be useful when running emergency exercises to test out emergency responses under extreme cases. In terms of acceleration of impacts, enablers include a coordinated response to climate risks affecting coastal areas, such as sea level rise, to determine the relocation of building structures and secure space for coastal ecosystems to shift landward.

5. Moving forward: known constraints

Maximising synergies between disaster risk reduction and climate change adaptation is critical to achieve improved planning outcomes in light of likely increases in the intensification and frequency of extreme weather events affecting highly urbanised areas. This section discusses how the emerging concepts of betterment and post-disaster planning in the pre-disaster phase could help maximise these synergies within planning processes by focusing on the four categories of enablers presented in section four: spatial planning, cross-sectoral planning, social/ community planning and strategic/ long term planning. In particular, based on a proposed framework (see Figure 2), the discussion highlights known constraints that need be considered by planning systems seeking to maximise these synergies through betterment and post-disaster planning in the pre-disaster phase. Constraints include considerations associated with: (i) compression in time and space for spatial planning; (ii) sectoral frictions for cross-sectoral planning; (iii) deficient engagement of communities for social/ community planning; and, (iv) reactive responses to climate risks for strategic/ long term planning.

5.1 Compression in time and space

Impacts from climate change are likely to be caused by known extreme weather events that can be exacerbated by the lack of preparedness of vulnerable human settlements.

Figure 2. Framework for maximising synergies between disaster risk reduction and climate change adaptation to achieve improved planning outcomes

Schipper (2009) argues that the primary goal of both disaster risk reduction and climate change adaptation has to focus on reducing the vulnerability of human settlements. Spatial planning strategies have a key role to play in facilitating and contributing to both disaster risk reduction and climate change adaptation, particularly by limiting the exposure of human settlements to increased risks (see Table 2).

Nonetheless, experiences from disaster stricken areas such as New Orleans highlight the challenges involved in advancing spatial planning strategies to incorporate trends put forward by emergent concepts of betterment and post-disaster planning in the pre-disaster phase, including improving the preparedness of human settlements to deal with future climate risks and reducing their exposure to such risks. For example, in post-disaster situations, Olshansky et al. (2012) stress that there is compression in time and space under which recovery activities such as reconstruction works need to occur. Such compression in time often impedes more robust solutions advocated by the betterment concept, such as rebuilding it back better, from being implemented due to a range of issues. These issues include, but are not limited to, re-installing the functionality of communities by repairing infrastructure, such as roads, as quickly as possible, and necessity of residents to return to affected places to re-connect with their family and friends and carry on with their lives. Unfortunately, once these functionalities are established it appears that opportunities to maximise improvements in disaster stricken areas to minimise future risks are not strongly pursued by planning authorities, thereby compromising betterment efforts. In particular, such efforts can be compromised due to both costs involved in improved reconstruction works and difficulty to offer residents alternative acceptable solutions that take into consideration their attachment to place.

On the other hand, the fact that the post-disaster phase requires sharp solutions due to compression in time and space to ensure communities return to function quickly presents the strongest argument for governments and communities alike to embrace post-disaster planning in the pre-disaster phase. For example, post-disaster planning in the pre-disaster phase offers communities the opportunity to improve their preparedness for future disasters by identifying priority areas, such as vulnerable neighbourhoods, that demand

urgent programs to boost their adaptive capacity, and services, such as health and emergency facilities, that require upgrades and therefore greater allocation of funds. In addition, developing a post-disaster plan before a disaster occurs means that resources can be allocated and decision-making processes put in place to ensure that when a disaster strikes short term recovery priorities and political pressures do not outweigh and replace long term needs. Developing a clearly defined strategy for long term recovery before a disaster occurs enables communities to be proactive in their management of and response to disasters and avoid becoming victims to their circumstances (Meyer et al, 2010).

5.2 Sectoral frictions

The need for cross-sectoral planning in both disaster management and climate change adaptation has long been recognised and called for (Boullé et al., 1997; Buxton et al., 2011; Pearce, 2003; Siembieda et al., 2004; Yates and Bergin, 2009) and yet practical examples of effective operationalization of cross-sectoral planning on environment-related policy arenas remain scarce (Jordan and Lenschow, 2010). The lack of government agencies' experience in carrying out cross-sectoral planning involving disaster risk reduction and climate change adaptation can certainly compromise effective management of climate risks, especially when policies need to be formulated and implemented under inter-agency agreements (Amundsen et al., 2010; Dovers and Hezri, 2010). This lack of experience in inter-agency collaboration and cross-sectoral planning can also lead to the emergence of conflicts between sectors as those may compete for scarce funds and setting sector-specific policy agendas. Additionally, even when cross-sectoral planning occurs at the policy formulation level, there is potential for delays in the policy implementation phase if appropriate mechanisms, such as legislation clarifying roles and responsibilities, are not in place to facilitate inter-agency collaboration. Hence, identified enablers for maximising synergies between betterment and post-disaster planning in the pre-disaster phase approaches through cross-sectoral planning (see Table 3) need to take into consideration potential conflicts between sectors, and time-lag involved in implementing cross-sectoral strategies.

Siembieda (2012) outlines that during the disaster recovery process agreements need to be reached by involved sectors to establish how recovery is to occur. For example, different tiers of governments may need to agree how the rebuilding of damaged infrastructures will take place and who will cover what costs. However, frictions between sectors due to conflict of interests can impede the achievement and implementation of such agreements. Siembieda (2012) emphasises two levels of frictions. On the one hand, frictions emerge across external sectors, particularly government tiers involved in the recovery/ reconstruction phase that only come together during this phase and do not have tradition in working collaboratively in the pre-disaster phase. On the other hand, frictions also emerge between what constitute the internal sector, including affected individuals and communities. In this case, existing community disputes can be exacerbated by disasters making it difficult for governments to take leadership and gain community support to implement more robust strategies (e.g. planned retreat) sought by betterment and post-disaster planning in the pre-disaster phase. Further, the author also highlights that the uncertainties between the two sectors greatly impede agreements to be reached in favour of improved actions/ strategies targeting risk reduction that would need to be implemented through partnerships between governments and the community.

Nevertheless, post-disaster planning in the pre-disaster phase and betterment approaches offer some hope for cross-sectoral planning seeking disaster risk reduction and climate change adaptation as it brings together sectors that have not traditionally worked together, including urban and regional planning, human health and emergency management. Additionally, if the community is also involved in post-disaster planning in the pre-disaster phase their needs are captured by the process and better understood by authorities. In this case, when agencies have a track record of collaboration and improved understanding of the needs of each sector, including the community, at times of disaster this experience can expedite inter-agency agreements which are legitimised by communities; thereby facilitating the recovery process and supporting strategies that have a long term perspective focused on reducing future vulnerabilities.

5.3 Deficient engagement of communities

It is being increasingly recognised that communities should play an active role in improving their recovery and resilience to disasters (Norris et al., 2008). Accordingly, social / community planning offers important opportunities to bolster this active role if focused on building the community's capacity to deal with disaster risks (Zhang et al., 2013). Hence, greater community engagement and debate needs to occur to ensure strategies seeking both disaster risk reduction and climate change adaptation are not only socially acceptable but are also implemented in collaboration with communities (Hayward, 2013). However, a number of constraints need be acknowledged to maximise the potential of enablers related to social/ community planning (see table 4) for improving communities' capacity to deal with climate risks.

First, post-disaster circumstances also imply less time than normal for questions, decisions and actions to occur thereby limiting the engagement of affected communities in the decision-making process following disasters (Olshansky et al., 2012). Second, political barriers can impede the devolution of funds and power to communities and local governments alike as reconstruction works involving large costs tend to be controlled by central governments and rolled out to specialised temporary agencies and portfolios to guide post-disaster recovery and reconstruction (Hayward, 2013; Lyons, 2009; Serrao-Neumann et al., 2013a). Third, there are known social and cognitive barriers that can hamper efforts towards proactive adaptation (Lorenzoni et al., 2007; McBean and Ajibade, 2009). These include, but are not limited to, the 'lack of knowledge', 'uncertainty and scepticism', and 'distrust in information sources' as barriers at the individual level; and the 'lack of political action', 'social norms and expectations', and 'lack of enabling initiatives' at the social level (Lorenzoni et al., 2007: 450-1).

However, there are sufficient reasons to focus on social/ community planning through betterment and post-disaster planning in the pre-disaster phase as an enabler to maximise the synergies between disaster risk reduction and climate change adaptation. For example, Kates et al. (2006) argue that betterment approaches need to focus beyond

physical structures to also include improvements in urban planning and social equity as well as economic opportunities that enhance and strengthen existing industries and therefore the community. Additionally, post-disaster planning in the pre-disaster phase is critical as increased reoccurrence of extreme weather events will challenge both communities' ability to respond appropriately to and effectively recover from disasters (Gunderson, 2010). In particular, extreme weather events leading to disasters can trigger a range of long term and intangible social costs. While the physical recovery can take a number of years, other impacts associated with economic stagnation, the disruption of social networks and the phasing out of post-disaster health care and support can last for decades (Olshansky and Chang, 2009).

Giegengack and Foster (2006) based on the post Hurricane Katrina impact on New Orleans, stress that risks from future hazards can be reduced in the short term but there is no 'technological fix' in the long term. These authors suggest that the vulnerability of places would be better dealt with through social measures instead of hard infrastructure solutions. In particular, social/ community planning in areas vulnerable to disaster risks should give specific attention to creating strategies that will facilitate both the re-establishment of social networks as well as community support prior and post disasters (Serrao-Neumann et al., 2013a). These could include strategies that target community strength and social inclusion such as facilitating the creation of partnerships amongst community sectors and groups through to improving skills development and promoting volunteerism.

Furthermore, hazard mitigation plans are only effective under significant public engagement, particularly in terms of increasing their quality as well as chances of being implemented (Stevens et al., 2010c). Thus, decision-making frameworks concerning disaster risk reduction and climate change adaptation through betterment and post-disaster planning in the pre-disaster phase need to embed sufficient flexibility for the inclusion of public engagement not only at the consultation end but also at implementation end of strategies (Hayward, 2013; Heazle et al., 2013; Serrao-Neumann et al., 2014b). In doing so, strategies are likely to have greater ownership by the involved

communities as well as being socially acceptable. Such strategies need not only have a spatial planning nature to reduce and where possible mitigate climate change impacts but also take social aspects into consideration through improved social and/or community planning (Heazle et al., 2013; Serrao-Neumann et al., 2013b).

5.4 Reactive response to climate risks

While disaster management approaches have tended to focus more on reactive responses (Heazle et al., 2013) and on severe and sudden events rather than gradual and incremental changes (Davoudi et al., 2012), policy processes within disaster management need to address the future rather than respond well to the past (Handmer and Dovers, 2008). Additionally, one important aspect that needs to be accounted for in planning for disaster risk reduction and climate change adaptation is the ‘notion that natural hazards are going to occur’ (McBean and Rodgers, 2010:878). Hence, proactive action facilitated through strategic/ long term planning is needed to ensure governments and communities are better prepared to deal with the uncertainty of extreme weather events whether they are a consequence of climate change or not. In this context, strategic/ long term planning strategies seeking to maximise synergies between disaster risk reduction and climate change adaptation need to have a strong focus on the future, including how they are suited to address future vulnerabilities.

Nonetheless, identified enablers (see Table 5) for proactive action facilitated through strategic/ long term planning can be confronted by three key constraints: climate and institutional uncertainty, conservative choices, and scarce funds. First, there is significant uncertainty in terms of timing and intensity of climate change impacts as well as the response that needs to be adopted by different tiers of governments and communities to deal with such impacts (Dovers and Hezri, 2010). In fact, uncertainty related to climate science has been an impediment to proactive action in the planning sector (Camacho, 2009; Quay, 2010; Serrao-Neumann et al., 2013b). Uncertainty also challenges disaster risk reduction strategies as they may require some degree of flexibility that enables them to deal with the changing profile of risks under climate change to effectively enhance resilience and reduce vulnerability (Solecki et al., 2011). However, typically, flexibility

in decision-making has not been a trend in the planning sector (Quay, 2010). In fact, planning has been dominated by a 'command and control' approach to land use planning focused on 'certainties' that also played its part in providing people with a false sense of 'security' (Colten and Giancarlo, 2011; Manyena et al., 2011), accelerated development in areas at risk (Burby et al., 2006), and reduced opportunities for greater community engagement in decision-making (Hayward, 2013).

Second, despite the high level of uncertainty associated with climate change, thus far responses to forecast climate change impacts have been addressed through 'conservative' rather than more resilient choices (cf. Siembieda, 2012). Strongly associated with the command and control approach to land use planning, conservative choices are often supported by a combination of actions, including mitigation efforts, government interventions through financial support to mitigation works, and changes in building codes and disaster relief for individuals and businesses that promote development to continue to occur in areas at risk (Stevens et al., 2010b). Communities under uncertainty also prefer conservative choices that enable them to stay in the same location after disasters because they struggle to assess the value of relocating to unknown/ unfamiliar locations (Siembieda, 2012).

Third, barriers to proactive planning responses also include limited financial resources allocated to climate change adaptation (Wise et al., 2014). However, as more people inhabit risk areas, the financial costs associated with protecting them from current and future impacts being it sea level rise, floods or storm surges are likely to rise as the magnitude and consequences of disasters are directly related to people's and places' vulnerability (Wamsler, 2014). Additionally, as extreme weather events become more frequent and intense governments' financial capacity will be further stretched to effectively recover from and rebuild after disasters. Consequently, a larger percentage of costs associated with recovery may shift to citizens (Kwadijk et al., 2010). For example, Berke et al. (2009) note that citizens in countries such as the USA are already bearing the full spectrum of losses in disasters whilst governments are failing to be proactive in protecting their citizens.

Given this set of constraints to proactive responses facilitated through strategic/ long term planning, there are greater reasons for planning systems to adopt the approaches of betterment and post-disaster planning in the pre-disaster phase to maximise synergies between disaster risk reduction and climate change adaptation. In particular, to overturn the increased development of areas at risk, there have been calls for policies that mandate governments to prepare comprehensive plans that take climate risks into consideration, and to bear greater financial responsibility for the consequences of decision-making facilitating such development to occur (Berke et al., 2009; Burby, 2006). Such plans could be prepared through post-disaster planning in the pre-disaster phase. Additionally, while financial limitations to support disaster risk reduction and climate change adaptation are likely to continue in the future given the competition for more scarce resources, strategic / long term planning should aim for strategies that are strongly directed to building resilience and adaptive capacity of governments and communities, and setting priorities for action (Heazle et al., 2013). Further, disaster risk reduction literature points to windows of opportunities that emerge after disasters as catalysts for ‘social transformation’, including governance regimes (Pelling, 2010; Pelling and Manuel-Navarrete, 2011) and transforming barriers into enablers (Burch, 2010). For example, the financial constraint associated with the increase in the occurrence and frequency of extreme weather events may function as a catalyst for the prioritisation of adaptation and disaster risk reduction strategies as well as greater investment in building capacity and resilience of communities and governments.

6. Conclusion

Reducing communities’ vulnerability to extreme weather events comprises a critical challenge for planning systems in light of likely increases in intensity and magnitude of climate change impacts to affected urbanised areas. Despite calls for better integration between disaster risk reduction and climate change adaptation, to date, there have been limited examples of successful integration. This paper has highlighted that there are advantages in maximising synergies between the fields of disaster risk reduction and

climate change adaptation within planning processes to achieve improved planning outcomes in at-risk areas. The paper suggested that synergies between the two fields could be maximised through the emergent concepts of betterment and post-disaster planning in the pre-disaster phase, and identified four categories of potential enablers within planning processes: spatial planning, cross-sectoral planning, social/ community planning and strategic/ long term planning. Findings indicated that although there are promising opportunities offered by the concepts of betterment and post-disaster planning in the pre-disaster phase, attention should be paid to known constraints to their full operationalization.

For example, while betterment is not a new concept, its main focus has tended to be on physical infrastructure and it has not been fully applied in terms of the social dimension. Additionally, with the exception of few examples from the State of Florida, the concept of post-disaster planning in the pre-disaster phase is very recent and it is yet to be applied in other contexts or settings. This does suggest that there are many barriers that may need to be overcome in order to apply such approaches. However, with the increasing risks due to climate change it is now time for these two concepts to become more mainstream and be considered more fully by governments as a key way of maximising the synergies between disaster risk reduction and climate change adaptation and therefore helping to reduce long term vulnerability of communities to extreme weather events. Although this will not be a straightforward process, there are four key principles that can be drawn based on findings and discussion to guide future efforts within planning processes: (i) informed and confident political, private sector and community leadership; (ii) informed, engaged and prepared community; (iii) continuity of effort; and (iv) integrated and coordinated action.

First, a strong, positive and committed leadership at all levels in government, the private sector and the community is required to improve the communication about climate risks as well as establishing planning and decisions horizons that focus on addressing future vulnerabilities. These attributes of strong leadership should be informed through full community engagement processes and seek community partnerships for action.

Leadership of this nature requires the support of awareness, training, education and capacity building programs.

Second, an informed, engaged and prepared community, inclusive of all citizens, that compliments strong leadership to jointly and successfully implement strategies to achieve the overarching goal of disaster risk reduction and climate change adaptation is critical. A high level of community engagement should be positioned in a bottom-up approach that facilitates a highly consultative partnership supporting, rather than being replaced by, strong leadership. This requires a community with high adaptive capacity capable of managing the climate risk especially during the response and recovery phases and seizing opportunities that arise as a consequence of disasters. Informed and prepared communities need the support of awareness, training, education and capacity building programs.

Third, initiatives supporting successful long term disaster risk reduction and climate change adaptation, such as awareness, training, education and capacity building programs, need to be adequately resourced to maintain continuity of effort and message. The continuity and longevity of initiatives, especially awareness and capacity building programs and campaigns, need to be of high quality, cost effective, targeted to specific groups and audiences, inclusive of vulnerable groups and presented in non alarmist terms to avoid negative messaging.

Last, high degrees of collaboration will only be achieved if there is effective integration and coordination of actions that address horizontal and vertical linkages across a region or system. This calls for a 'whole of government' approach to the development and implementation of policies, programs and actions, which typically fall across a number of separate sectors. Efficient interoperability between agencies at all levels will be a key ingredient to achieving this intent.

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