

# PROCEEDINGS

## Third Early Career Researchers National Forum & Workshop

Griffith University, Gold Coast Campus

19 - 21 April 2010

## Australian Climate Change Adaptation Research Network for Settlements and Infrastructure



## Day 1 : Monday 19 April 2010

8.30	Tea & Coffee on arrival	
9.00	Welcome	
9.10	<b>Introduction Node 4 - Infrastructure</b>	
9.30	<i>Urban water supply in an energy-constrained Australia: The water-energy nexus</i>	Eytan Rocheta
9.50	<i>The challenge of climate change adaptation - perspectives from the urban rail sector</i>	Jane Scanlon
10.10	<i>Water Management in Aflaj system under changing climate</i>	Salim Al Mamary
10.30	<i>Single objective versus multi-objective optimisation of water distribution systems accounting for greenhouse gas emissions by carbon pricing</i>	Wenyan Wu
10.50	Morning Break - 30 mins	
11.20	Discussion - 20 min	
11.40	<b>Introduction Node 2 Urban Management, Transport &amp; Inclusion</b>	
12.00	<i>Understanding critical systemic barriers for better planning and management of Australia's coastal zone.</i>	Chiara Danese
12.20	<i>A walkable city to combat global warming</i>	Jianqiang Cui
12.40	<i>The adaptive capacity of settlements affected by climate change and environmental degradation: A case study of the Coorong and Lower Lakes</i>	Melani Gale
13.00	LUNCH - 50 mins	
13.50	<i>Trends and prospects of indigenous transport in the area of climate change adaptation</i>	Iderlina Mateo-Babiano
14.10	<i>Voluntary travel behaviour change and its potential implications for climate change mitigation and adaptation</i>	Michelle Philp
14.30	<i>Vulnerable people and places: Enhancing social and institutional resilience under climate change</i>	Kara Rickson
14.50	<i>Incorporating travel time reliability metrics for emergency service and evacuation process in relation to climate change adaptation</i>	Susilawati Susilawati
15.10	<i>A comparison of Neural Network approach performance in estimating passenger trip number distribution by using Backpropagation, Variable Learning Rate and Lavenberg-Marquardt Algorithms</i>	Gusri Yaldi
15.30	Guest Prof Paul Burton	
15.50	Discussion - 40 min	
16.30	Close	bus back to hotel
19.00	Dinner Omeros Bros Restaurant – information to be provided	

## Day 2 : Tuesday 20 April 2010

8.30	Tea & Coffee on arrival	
9.00	Morning Greeting	
9.10	<b>Introduction Node 1 – Coastal Settlements</b>	
9.30	<i>Adopting climate change for coastal communities within local level planning practice</i>	Reazul Ahsan
9.50	<i>Policy response to sea-level rise in NSW Australia: An institutional discourse</i>	Alicia Bergonia
10.10	<i>Risk perception and adaptation to climate change in coastal communities : Case study analysis</i>	Christopher Button
10.30	<i>Climate change and changes in land management practices</i>	Stefani Daryanto
10.50	Morning Break - 30 mins	
11.20	Discussion - 20 min	
11.40	<i>Planning and protection for sea level rise caused by global warming in coastal communities</i>	Merinda Edwards
12.00	<i>Planning for unavoidable climate change: what are the assumed benefits of public participation? A case study from urban South East Queensland, Australia</i>	Johanna Mustelin
12.20	<i>Community resilience to coastal hazards in the Asia-Pacific: Ensuring sustainable early warning systems through disaster risk reduction and climate change adaptation linkages</i>	Natasha Udu-gama
12.40	<i>Moving Boundaries: Assessing applications for coastal development.</i>	Anne Weckert
13.00	LUNCH - 50 mins	
13.50	Discussion - 40 min	
14.30	Depart - Coastal field trip	
17.30	Return - Coastal field trip	

## Day 3 : Wednesday 21 April 2010

8.30	Tea & Coffee on arrival	
9.00	Morning Greeting	
9.10	<i>Risks, impacts and responses of sea-level extremes in Port Adelaide, an investigation into human-environment interaction</i>	Dangong Zheng
9.30	<i>Human dimensions of climate change in South Australia: Developing a tool for socio-economic risk and vulnerability analysis</i>	Vigya Sharma
9.50	<i>Shining a spotlight on methodology: A problem-oriented approach to focus on feasible adaptation solutions</i>	Carolina Roman
10.10	Discussion - 20 min	
10.30	Morning Break - 30 mins	
11.00	<b>Introduction Node 3</b> <b>Built Environment, Innovation, and Institutional Reform</b>	
11.20	<i>Harmonizing climate change adaptation and mitigation policy objectives through carbon market rules and incentives</i>	Graham Ashford
11.40	<i>Examine the climatic indices and their influences on rainfall in the Murray-Darling Basin</i>	Mohammad Kamruzzaman
12.00	<i>The role of urban green-spaces in adaptation to climate change in Australian cities</i>	Martin Ely
12.20	<i>Climate of Uncertainty - Is a new approach to building regulations required to address climate change?</i>	Lawrence Yu
12.40	<i>Integrating affordable housing in the transit-oriented development</i>	Sue Irvine
13.00	LUNCH - 50 min	
13.50	<i>South East Queensland Climate Adaptation Research Initiative (SEQ-CARI) Griffith University Human Settlements Component</i>	Marcello Sano
14.10	Final discussion, Wrap up & Thank you	
14.30	CLOSE - bus departs for airport	

Air link Express collecting from Griffith University transferring to Gold Coast Airport

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**Research Area** Infrastructure  
**Title** ***Urban water supply in an energy-constrained Australia:  
The water-energy nexus***

Increasing population pressure, natural climate variability and susceptibility to projected climate change impacts are placing ever-increasing strain on existing water infrastructure in Australia. Historically, water infrastructure has focused on meeting urban water demand via a range of 'low-energy' approaches predominantly based on the capture and storage of surface runoff; however, this approach is proving to be no longer sufficient to satisfy the increasing urban water demand.

Water service providers, therefore, have been seeking to minimise supply risk through the implementation of a diverse range of energy-intensive climate-independent solutions. To date, water service providers have investigated numerous options and implemented a range of alternative water sources, such as desalination, groundwater extraction, pipeline distributions and recycling schemes. These water sources, however, rely on technologies that are significantly more advanced and/or have much higher operational energy costs, and to date, many attempts to address emerging water supply problems in Australia have come at an increased economic and environmental cost.

Detailed assessments and understanding of the 'water–energy nexus'—the interactive relationship between water and energy—are crucial precursors to enable the water sector to reduce its operational energy costs and facilitate the design of water and energy systems capable of realising any synergistic benefits. Under the current acclimate, in which energy supply and pricing issues are becoming increasingly important in the public sphere, having an improved understanding of this linkage will allow water service providers to be more aware of the energy impacts of key water infrastructure and be more responsive to future changes in the cost of their energy supplies.

This literature review addresses the water–energy nexus in the context of urban water supply by assessing the current energy requirements and associated operational energy costs for a number of important water treatment technologies. Additionally, a critical review of various water supply options either currently implemented or being investigated by the water supply sector is presented from an energy perspective. Finally, system management approaches as well as other alternative low-energy water supply or savings options are discussed.

Keywords: Water–energy nexus; urban water resources management; urban water infrastructure; climate change adaptation



**Name** Jane Scanlon  
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**Research Area** Infrastructure (transport)  
**Title** ***The challenge of climate change adaptation - perspectives from the urban rail sector***

Many actors in the urban rail sector in Australia acknowledge that climate change will likely present significant challenges for the planning, delivery and operation of rail infrastructure. Various delivery authorities and asset managers are now considering climate change, engaging climate change advisors and creating internal positions dedicated to addressing climate change amongst other sustainability issues. This activity is largely occurring on a case-by-case basis and getting a clear understanding of what challenges are being faced by the rail industry is difficult. In recognition of this, interviews were conducted with individuals working on urban rail projects in Sydney in various stages of project delivery such as concept design and planning approvals as part of PhD research. Interview discussion centred on issues associated with implementing climate change adaptation initiatives, capturing the perspectives of those currently working 'on the ground' in project delivery. This presentation outlines key issues identified by the interviewees, further informed by a literature review and the presenter's professional experience working with proponents of urban rail projects.

Key issues to be discussed include:

- Integrating social-economic and climate change projections to better understand whole-of-life cycle risk beyond impacts to hard infrastructure.
- Embedding climate change adaptation thinking into key decision-making at early stages of project development including options analysis.
- Translating climate change policy and guidelines into the reality of an urban rail project.

Recommendations for further research will also be briefly outlined.

**Name** Salim Al Mamary  
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**Organisation** University of South Australia  
**Research Area** Built Environment  
**Title** ***Water Management in Aflaj system under changing climate***

The Aflaj systems are an indigenous engineering technique for an ancient irrigation system in Oman. These were created by the ancient Omanis civilisation hundreds of years ago to supply water for irrigation and domestic use and have become an important part of the Omanis social life and heritage. Climate change has had a profound effect on the Middle East and has led to a rise in temperature, a drop in rainfall and droughts and heat waves in recent years. The 2008 Stockholm World Water Week and the third Water WDR concluded that “The main impacts of climate change on humans and the environment occur through water”. The effect of climate change in the Aflaj system is reflected by a degradation of Falaj numbers and a noticeable reduction of water flow which is being seen as a warning and that it is time to commence taking steps to reduce the effect of climate change and save these systems from extinction. The research shows the effect of climate change on the Aflaj system and examines the risks associated with climate change and its impacts on the Aflaj system. Given the importance of the Aflaj system to the Omanis society, the research highlights the potential negative effects and recommends strategies to mitigate the risks. The strategy recommends better water management through improved water demand management, irrigation efficiency. The data analysis shows that rainfall in recent years takes storm type in most cases therefore; it recommended harvesting more runoff through constructing recharge dams. More efforts should be given for the use of water saving technology. With all of these measures, impact of climate change on Aflaj system can be reduced.

Key Words: Drought Management, climate change, water Management

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**Research Area** Urban management, Transport & Inclusion  
**Title** ***Single objective versus multi-objective optimisation of water distribution systems accounting for greenhouse gas emissions by carbon pricing***

Water distribution systems (WDSs) involve significant amount of expenditure associated with the construction and maintenance. In previous WDS optimisation research, attention has mainly focused on the minimisation of cost using a single-objective approach. However, the recent increasing awareness of climate change, especially global warming, has led to WDS optimisation research where greenhouse gas (GHG) emissions are considered. In one previous study, the minimisation of GHG emissions has been incorporated into the optimisation of WDS design as one objective together with the traditional objective of minimisation of cost using a multi-objective approach. This previous research has also demonstrated that there are significant trade-offs between these two competing objectives. If an emissions trading scheme is introduced for global warming mitigation, GHG emissions are likely to be priced at a particular level (e.g. a carbon price). Thus, a monetary value can be assigned to GHG emissions, enabling a single-objective optimisation approach to be used. This raises the question of whether the introduction of carbon pricing under an emissions trading scheme will make the use of a multi-objective optimisation approach obsolete or whether such an approach can provide additional insights that are useful in a decision-making context. In the research presented here, the above question is explored via one case study using both single- and multi-objective approaches. The optimisation results show that the single-objective approach results in a loss of trade-off information between the two objectives. In contrast, the multi-objective approach provides decision makers with more insight into the trade-offs between the two objectives. As a result, a multi-objective approach is recommended for the optimisation of WDSs accounting for GHG emissions when considering carbon pricing.



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**Research Area** Urban Management, Built Environment, Innovation,  
Institutional and Reform, Infrastructure  
**Title** ***Understanding Critical Systemic Barriers for Better  
Planning and Management of Australia's Coastal Zone.***

A substantial amount of research about coastal vulnerability and assessment of risks associated with potential impacts of climate change has been carried out for populated coastal nodes such as the Gold Coast, Sydney and Perth where the combined effects of development growth, outdated government approaches, inadequate policies and management have already caused considerable loss of key ecosystem services and functions. Comparatively there are many coastal regions within Australia that due to relatively lower population, as well as politically constrained and financially under resourced, are yet to experience the same degree of impacts on private and public infrastructure and property loss. Key stakeholders of the Northern Agricultural Region (Western Australia) recently commissioned a Regional Framework to assess coastal vulnerability to climate change and to identify potential risks and hazards to existing coastal infrastructure and natural resources under a range of future climate change scenarios. The Coastal Vulnerability and Risk Assessment Framework which at date includes 12 interrelated projects (e.g. Assessment of the structure and function of coastal infrastructure, Information storage, analysis and retrieval, Shared risks assessment and Community awareness and engagement).represent a first step towards adaptive coastal management and science uptake in decision-making. This PhD study will investigate factors that promote or inhibit the mobilisation of regional resources and engagement of decision makers in coastal adaptation and climate change knowledge as well as identifying approaches that might be relevant for the integration of such information into coastal planning and management decision-making processes in regions which are experiencing rapidly increase in population.

**Name** Jianqiang Cui  
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**Research Area** Urban Management, Transport & Inclusion  
**Title** ***A Walkable City to Combat Global Warming***

Social activity in the urban environment includes working, shopping, recreating, communicating and travelling. A walkable urban environment can encourage sustainable transport which has the effect of achieving healthy, viable and safe community whilst decreasing car dependence that to date has been implicated as having played a significant part in carbon emissions induced climate change.

This research aims to develop an understanding of how planners can achieve a walkable city. In order to achieve this purpose, the reasons why cities should focus on pedestrian-oriented transport are first addressed in a threefold manner: firstly, the knowledge learned from a historical review of dominant transport modes, secondly, the effects of car-oriented transport and pedestrian-oriented transport and thirdly, analysis of policies, targets and benefits of pedestrian priority transport. The findings emerging from a review of pedestrian-oriented transport will help to advance knowledge on how to use different pedestrian strategies to build a walkable city. The review will explore the features, advantages and limitations of walking as a transport mode as well as problems of pedestrian transport systems, thereby forming a basis for developing optimal future pedestrian strategies. Strategies of vertical separation of pedestrians and vehicles, especially underground pedestrian systems will then be focused on. Secondary data from 20 cities worldwide and primary data of Shanghai case study will be combined to develop a clear understanding of the influence of underground pedestrian systems in achieving an environmentally sustainable city. The findings of this research will contribute to accelerating knowledge of how urban pedestrian transport can contribute towards a sustainable city.

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**Research Area**        All  
**Title**                      ***The adaptive capacity of settlements affected by climate change and environmental degradation: a case study of the Coorong and Lower Lakes***

This research explores the social and planning implications of the degradation of the Coorong and Lower Lakes in South Australia. It primarily focuses on the social impacts that will occur if the Coorong and the Lower Lakes area is environmentally degraded by climate change and the over allocation of water resources. Economic and environmental implications are explored to gain an understanding of the interdependencies as is the issue of whether current government policy and legislation addresses the potential impacts of extreme and gradual climate change.

This research provides a case study of the adaptive capacity of settlements in the Coorong and Lower Lakes area and how they respond to the stresses caused by climate change.

Focus groups and semi-structured interviews were conducted with community members and planners affiliated with the Coorong and Lower Lakes district and with academic researchers who have studied the problems of the Murray, Coorong and Lower Lakes.

Results suggest that tension exists between the government and the local community over planning for climate change mitigation and adaptation with potential for conflict. Contributing factors include divisions in the community, health problems related to environmental degradation, lack of communication between the community and government, lack of empathy from the government, economic issues, declining services and facilities and the implementation of engineering concepts of contestable value.

**Name** Iderlina Mateo-Babiano  
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**Research Area** Urban management, Transport & Inclusion  
**Title** ***Trends and prospects of indigenous transport in the area of climate change adaptation***

While indigenous knowledge systems have been extensively utilised in the field of environmental management and ecological research, its wider application of looking at indigenous transport as a means of climate change adaptation has remained elusive and has not yet been well-established. Recent international progress in the field has also been sparse. The study is an exploratory attempt to identify the potential role of indigenous transport and document its presence within Asia-Pacific. It also aims to examine the value of indigenous knowledge on transport in climate change mitigation and adaptation strategies within the region. The initial scope seeks to collate and assess existing materials on the topic (i.e. literature survey, experts interview, focused group) such as but not limited to transport issues of indigenous communities, indigenous transport modes native to a particular contemporary context, indigenous modes/vehicles (i.e. Philippine *jeepneys* or Thailand's *tuktuks*), traditional knowledge on transport or local transport history of original inhabitants in a particular area, among others. It then becomes imperative to document and profile such information and consider this as a project of its own prior to its incorporation into another scientific undertaking. The anticipated outcomes will identify trends and prospects of indigenous transport in the area of climate change adaptation, advance the knowledge base in transport planning, contribute to preserving local transport knowledge and provide link to past, present and future generations. This will help in establishing identity, better understanding, preserving culture, and contribute to cultural-awareness and sensitive planning and transport policies. In the longer perspective, the project will place the school, university as well as Australia.

**Name** Michelle Philp  
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**Research Area** Urban Management, Transport & Inclusion  
**Title** ***Voluntary travel behaviour change and its potential implications for climate change mitigation and adaptation***

Mounting scientific evidence identifies climate change as a serious global risk requiring immediate response from the global community (Stern 2006; Chapman 2007; IPCC 2007a, 2007b, 2007c; Aitken 2009; Ball 2009). Fossil fuel use is the primary source of increased atmospheric concentration of greenhouse gases since the pre-industrial period (IPCC 2007a). Australia has the highest greenhouse gas emission levels per capita worldwide and the third highest output from the transport sector, which represents the fastest growing source of emissions (AGO 1998; Taylor and Ampt 2003; Taylor 2007). Climate change must be addressed using a multi-pronged approach focussing on infrastructure, policy, technical improvements, and voluntary individual behaviour change (James and John 1997; Baudains et al. 2001; IPCC 2007c). Voluntary Travel Behaviour Change (VTBC) programs attempt to shift travel choices to more sustainable options by providing appropriate information, assistance, motivation or incentives, such that people will voluntarily choose to travel in ways which can benefit themselves, the community and the environment (Stopher and Bullock 2003; Chatterjee and Bonsall 2009).

This review:

- identifies the impact of VTBC schemes on transport mode choice, reduction in private car use and the related impact on emissions
- identifies the methods for implementing and evaluating VTBC programs
- identifies the short and long term impacts of VTBC including the residual nature of VTBC
- identifies best practice case studies
- identifies the transferability of VTBC principles to other disciplines
- identifies knowledge gaps and priority research areas.



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**Research Area** Urban management, Transport & Inclusion  
**Title** ***Vulnerable people and places: Enhancing social and institutional resilience under climate change***

Growing recognition that climate change poses a range of immediate and longer-term threats to the welfare and wellbeing of Australian communities and settlements has drawn increasing attention to imperatives and opportunities for adaptation. Acknowledging that climate change affects people and places *differently*, not only as a function of geography or ecological diversity but also in relation to specific cultural, socio-economic, institutional, and political contexts, highlights the need for both integrated and contextual assessment of adaptive options, processes, priorities and potential to minimise adverse impacts.

Within this context, South East Queensland's urban environments have been identified both as highly vulnerable to the effects of climate change and the site of considerable population growth and development, making it a priority to address attendant vulnerabilities and to design and implement appropriate adaptation strategies. Such an agenda necessarily brings issues of social equity, economic security and ecological viability into sharp relief, and suggests a need for suitably broad, integrative, and inclusive measures to enhance social and institutional 'resilience'.

To help meet such a challenge, this Doctoral study will investigate social, structural and spatial vulnerabilities, and adaptive constraints, capacities and opportunities, within South East Queensland's urban settlements. The research will centrally address how differential access to various resources, exposure to costs and benefits associated with different adaptive strategies, and participation in related decision making affects the adaptive response within a selected community.

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**Research Area** Urban management, Transport & Inclusion  
**Title** ***Incorporating travel time reliability metrics for emergency service and evacuation process in relation to climate change adaptation***

Transport networks are one of the lifeline systems that serve the community by providing essential mobility for personal travel and goods movement, as well as for access by emergency services. The performance of transport networks are threatened by the increased frequency and severity of floods, cyclones and bushfires as an effect of climate change, and therefore we need to adapt our networks and service provision to cope with new climate regimes and human settlement patterns. Given a definition of travel time reliability which accesses the probability of finishing a trip before a specified time (travel time threshold), we propose a travel time reliability metric for the emergency and evacuation process which considers demand and capacity uncertainties as well as other behavior related factors that are of concern in evacuation planning.

This metric measure the additional travel time during the evacuation process based on one a specific distribution, the Burr distribution that has been found to represent the distribution of variations in journey travel times. The three parameter version of the Burr distribution is a continuous distribution with tow shape parameters and one scale parameter. It can be used to generate refined travel time reliability metrics that reflect the observed characteristics of positive skew and long upper tails in travel time variability. The new travel time metric can be used as a performance measure in emergency service and evacuation planning processes. We conclude that this metric can play a vital role as a decision support tool for more robust and reliable evacuation process in order to plan and provide more resilient transport systems.

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**Research Area** (2) Urban Management, Transport & Inclusion  
**Title** ***A comparison of Neural Network approach performance  
in estimating passenger trip number distribution by  
using Backpropagation, Variable Learning Rate and  
Lavenberg-Marquardt Algorithms***

Spatial movement modeling is a fundamental part in transport planning. It is an estimation of the current and future number of people making their journey from origin to destination zones. The estimation result will be used in the strategic planning such as road development and public transport provision. Traffic impact studies also require reliable estimation of daily number trips, by which mode and which route is taken. Inaccurate and imprecise estimation of trip distribution numbers, such as overestimate or underestimate prediction, may lead to negative outcomes. For examples are congestion, and ineffective transport services. Transport sector is recognized as the third largest contributor of Green House Gases (GHG). Congestion and ineffective transport service provision could increase the amount of pollution emitted by motor vehicles, and increase transport sector contribution to the climate change problem. Therefore, a tool that can accurately and precisely forecast the number of trips made from specific origin and destination area is required. This presentation will describe the results of people movement distribution forecasting by using Neural Network approach, with three different Training Algorithms (TA), namely Backpropagation (BP), Variable Learning Rate (VL), and Lavenberg-Marquardt (LM). The experiments were conducted 30 times for each TA. The results suggest that the BP tends to have overestimated trip numbers, while VL generates underestimate results. Only LM produces statistically the same results as the observed trip numbers. The estimation of trip number in the past was based on the BP and VL algorithm, which empirically have unreliable results. Therefore, findings from this study are expected to improve the drawback of NN approach performance in people movement forecasting.

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**Research Area** Coastal Communities  
**Title** ***Adopting climate change for coastal communities within local level planning practice***

Increases in global temperature have accelerated the risk of extreme weather events, including destructive cyclones, flood and droughts. Different parts of the world will experience different levels of climate change impacts at different stages. For example many coastal regions may experience inundation, erosion and soil salinity, flood and high frequency of cyclones. Human settlement has long been settled around the coastal areas, which provides resource including fertile land and better trade opportunities. While those coastal areas and settlements are also most exposed to natural hazards and climate change process make the low-elevation coastal zones more vulnerable to natural disasters. Between 1994 and 2004 about 1200,000 people killed and 98 percent of 2 million low-elevation coastal zones communities (Ganges-Brahmaputra, Mekong and Yangtze) displace from their origin and get the status of “climate refugee” and a challenge for global built environment. By the year 2050 about 200 million people will be stated as climate refuge and 2/3 of them will be from low-elevated coastal communities from developing nations. Competent adapting mechanism for climate challenges become a key challenge especially for the low-elevation coastal zones in developing nations who are often the most vulnerable and lack behind of adaptation policies. The adaptation mechanism for the coastal settlement needs to be address within the planning policy and practice to safeguard the lives and livelihoods of the coastal communities. This research uses Bangladesh as a case study to describe the adaptation approach for coastal settlements. It then uses this analysis to suggest how those approaches might be applied for Asia pacific small islands and for Australian coastal belt.

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**Research Area**       Coastal Settlements  
**Title**                    ***Policy response to sea-level rise in NSW Australia: An institutional discourse***

Adaptation to sea-level rise and climate change is a complex and dynamic process that requires institutions and governance to respond effectively to changing environmental conditions and growing socio-economic needs. This paper analyzes the role of policy in shaping adaptive capacity of coastal communities in New South Wales (NSW). It argues that conflicts about sea level rise responses are outcomes of institutions in place (or lack of them) which fail to respond to the problems within the context of coastal environmental limits and social-cultural and economic development needs. Policies and regulations aiming to reduce risks of sea-level rise and climate change are more effective when integrated into existing sustainable coastal management goals.

Institutions define and influence how sea level rise and climate change issues and problems are interpreted and translated for policy and decision-making. Although current coastal policies and guidelines have required consideration for climate change, requirements of these policies are broadly stated and interpretation is largely constrained by lack of technical capabilities and mechanisms to translate information into specific guidelines. Existing institutions do not have the capabilities and flexibility to adjust and respond to increasing risk dynamics and development needs. As current institutions define sea-level rise and climate change merely as environmental problems, the classic response is heavily dependent on technological fixes with narrow consideration of the wide gamut of economic, social-cultural and environmental dynamics. For sea level rise and climate change responses to be effective, there is a need to create a proactive institutional system which facilitates appropriate responses to increasing risks and accommodates dynamic socio-cultural and economic development needs while sustaining ecological processes.



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**Research Area** Coastal settlements  
**Title** ***Risk perception and adaptation to climate change in coastal communities: Case study analysis***

Public risk perception is playing an increasingly important role in shaping environmental policy and management response systems, in part through the realisation that adaptation must seek to incorporate important social and cultural values and expectations. Several research priorities emanating from the National Climate Change Adaptation Research Plans detail the need to evaluate risk perceptions at the local level so as to assist in the development of site appropriate and socially acceptable adaptation strategies. Recent media coverage of the potential risks that climate change imposes on Australia's coastal populations, such as that detailed in the recent senate inquiry into coastal management and Department of Climate Change coastal risk assessment report, have contributed to an increased public awareness of such risks. Analysis of mail-out survey data distributed randomly to property owners within two Australian non-metropolitan coastal local governments shows an optimism bias and high levels of self-efficacy amongst respondents. This has implications for behavioural change, and hence, proactive adaptation and vulnerability reduction since adaptive capacity will not necessarily translate into adaptive action in the first place. Additionally, due to the presence of underestimations of personal risk and high self-efficacy in regards to autonomous adaptation, this may lead to a significant number of the population believing themselves to be exempt from future risks. This paper will present research findings and discuss the relationship between the demographic, attitudinal and social contextual variables associated with respondents' perceptions of climate change risk.

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**Research Area** Coastal Settlements  
**Title** ***Climate change and changes in land management practices***

The causes of shrub encroachment that occurred in semi-arid grasslands worldwide was thought to be the interaction among changes in land-use practices and climate change, such as variation in rainfall and increase in global CO<sub>2</sub>. Encroachment of woody plants in agricultural framework could present serious threats to the pastoral productivity and therefore, various attempts (e.g. ploughing and grazing) have been made to manage these woody shrubs. However, the results were inconsistent and the existing land management might exacerbate the already degraded condition. Attempts to convert shrublands to their original grassland–woodland communities using mechanical methods followed by grazing only reduced the number of vegetated patches, reduced plant diversity and prolonged the domination of woody shrubs without any increase in perennial grasses. Furthermore, the effect of either grazing or ploughing was species specific which might lead to the species extinction or domination. When soils under vegetated patches contain higher nutrients level compared to bare soils, it is important to maintain the existing vegetation to prevent further degradation. The absence of sustained increases in grass cover after ploughing, combined with long-term increases rather than reductions in shrub density, suggest that mechanical soil disturbance is not an effective way to manage shrub-encroached woodlands. In the context of pastoralism, alternative strategies such as grazing during productive (La Niña) seasons or the use of alternative grazing animals such as goats could be applied. An alternative perspective, which is gaining attention worldwide, is to value these encroached shrublands in terms of the ecosystem benefits that they can provide for communities such as animal habitat and carbon sinks.

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**Organisation** University of South Australia  
**Research Area** 1 (Coastal) & 3 (Built Enviro)  
**Title** ***Planning and protection for sea level rise caused by global warming in coastal communities***

There is mounting evidence from the scientific community that anthropogenic or cyclic climate change is associated with sea level rise. This paper discusses a case study of urban and regional planning for sea level rise in South Australian coastal communities. As the driest state, changes are already being felt in South Australia. Projections indicate that regardless of whether carbon emissions are reduced today sea level rises will still occur. South Australia's coastline spans over 5, 067 kilometres (Geoscience Australia, 2009) and contains more than 60, 000 buildings which will be affected by sea level rise, coastal flooding and erosion (Department of Climate change, 2009). Supported by a review of relevant coastal planning policy and literature, the research addresses the effects of sea level rise on coastal development, and the role of private enterprise and the three tiers of government and the private sector. Private agencies lack information on sea level rise issues, and are not involved early enough in the planning process. For property owners there are no regulations in place that necessitate notification when purchasing or developing a property on action to address sea level rise. It is concluded that planning for sea level rise in South Australia requires input from all sectors to achieve a sustainable coastal planning system and that State Government should take a greater role in coordinating the process. Lessons are drawn for planning in coastal communities nationwide.

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**Title** ***Planning for unavoidable climate change: what are the assumed benefits of public participation? A case study from urban South East Queensland, Australia***

Public participation features in many policy fields as a requisite for the successful development and implementation of policy measures. The putative benefits of more rather than less public participation are many and varied and include better framed, more robust policies and more informed, articulate and engaged citizens. To date the empirical testing of these assumed benefits has lagged behind their articulation (Burton 2009).

In the field of climate change and in particular the processes of adapting to changes already locked into place, public participation appears to be at the lowest end of Arnstein's ladder of participation. Many adaptation policies focus on technological solutions but few set out to do more than raise awareness and educate citizens. Nevertheless, plans for future land use and urban form as an adaptation strategy within coastal settlements must secure social acceptance among the public if they are to be seen as legitimate.

This presentation shows how public participation sits within the governance of climate change adaptation and how its assumed benefits might be evaluated. This is done through an evaluation framework which investigates the types of assumed benefits of public participation in recently formulated climate change management strategies with a specific focus on coastal settlements in South East Queensland.

The preliminary results suggest that public participation plays a different role in different planning instruments and that any mechanisms for evaluating its possible impact are largely absent. Suggestions are made for how the benefits could be better understood and evaluated for efficient climate change adaptation planning.

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**Title**                      ***Community Resilience to Coastal Hazards in Asia-Pacific: Ensuring sustainable early warning systems through disaster risk education and climate change adaptation linkages***

The Indian Ocean tsunami of 2004 spurred various institutional and policy changes in strengthening disaster risk reduction (DRR) and developing early warning systems (EWS) to tsunamis and other coastal hazards in line with the priorities of the Hyogo Framework for Action 2005-2015. Recognising the failures in achieving a timely international agreement on mitigating green house gases, the need for climate change adaptation (CCA) is increasingly being emphasised. Adaptation funding is expected to be as much as hundreds of billions of dollars per year globally. Although governments and NGOs are reframing strategies to take advantage of the new funding opportunities, actors are struggling to define aims for adaptation, to design guidelines, methods and tools for implementation, and to develop mechanisms for monitoring and evaluating the success of adaptation responses. It is evident that DRR and CCA share common linkages such as addressing vulnerabilities, building resilience, and long-term sustainability but they are frequently treated as separate issues by implementing government agencies and NGOs.

The technological aspects of EWS have received considerable attention by donors and governments. But addressing community based disaster risk management in EWS development rarely receives the same attention and resources. We argue that technocratic approaches are ineffective without addressing the human context that includes cultural norms and religious doctrines, knowledge and perceptions of risk, the strength and trust in existing governance processes, and levels of active and sustained stakeholder engagement in disaster preparedness initiatives. We will address the ways in which existing EWS in the Asia-Pacific region address and integrate DRR and CCA, and whether these systems are sustainable and increasing resilience towards multiple hazards.



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**Title** ***Moving Boundaries: Assessing Applications for Coastal Development.***

Recent Government publications such as the 'Managing our coastal zone in a changing climate: The time to act is now' (2009) have highlighted the important role of local government in addressing climate change risks to coastal settlements. In addressing the compound effects of sea level rise and increased frequency in extreme weather events, adaptive management strategies are needed to accommodate the ongoing revision of climate change projections.

As migration to coastal locations continues, the development plan documents and development application assessors need to be equipped to proactively plan for climate change risks including the accommodation of the landward retreat of coastal ecosystems and erosion buffer zones. The emergence of key precedents from district councils including Yorke Peninsula, Byron Shire, Wyong Shire and Queensclife begin to reveal the minefield of issues that are arising in response to planning for climate change.

The case of Northcape Properties Pty Ltd versus the District Council of Yorke Peninsula in 2008 clearly highlights the importance of development plan objectives and provisions that allow developments that will be themselves at risk or will cause risk to coastal ecosystems, to be refused. The Wyong Shire precedent where development assessors refused to approve applications in at risk areas raised the issue of the conflicting pressures of current economic gain, and of future risk mitigation.

This presentation will detail the precedents for adaptation to climate change risks to coastal settlements at a local government level through development plans and the assessment of development applications.

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<b>Title</b>	<b><i>Risks, impacts and responses of sea-level extremes in Port Adelaide, an investigation into human-environment interaction</i></b>

Copenhagen Summit (December 2009) has revealed an apparent gap between the knowledge of climate change from mainstream scientists and the understandings of the risk from decision makers. This has highlighted an urgent need of investigation into human-environment interaction, not mainly rely on conventional risk assessments, but also seek empirical evidences relevant to the climate impacts, risk perception and responses from multiple dimensions.

PhD research currently in progress critically follows a methodology that combines the virtues of taxonomic analysis of perceived risk and spatial multi-criteria analysis on the response of sea-level extremes. Based on a refined risk assessment of storm surges to coastal settlements and infrastructure in Port Adelaide, an on-going survey has been developed to elicit the concerns from the residents and stakeholders of businesses, critical infrastructures and key industries, regarding risks of seawater floods. The most likely scenarios of sea-level rise under local context have also been incorporated into high resolution inundation models. The survey data is expected to reveal (hopefully in this Forum) the diverse risk perceptions, engaged adaptation activities and existing or potentially integrated development options, which are evaluated at local scale.

The follow-up analyses will focus on examinations of the interaction between urban developments and the adaptation of sea-level extremes under the pressure of a growing population. The outcomes from the case study, including the synergies and trade-offs between various adaptation measures and between adaptation and other development priorities, may be transferred to other sub-regional areas with comparable situations.

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**Title** ***Human dimensions of climate change in South Australia: developing a tool for socio-economic risk and vulnerability analysis***

This presentation is based on a recently funded larger project titled 'Adapting to climate change in South Australia: Human Dimensions of Transect Project'. The project is funded by South Australia's Premier Science and Research Fund (PSRF) and is a collaborative effort across three universities in South Australia – Flinders, UniSA and University of Adelaide. It builds upon the existing TREND (Transect for Environmental Decision-making) project to develop a Human Dimensions of Climate Change Spatial Decision Support System (HSDSS). HSDSS will bring together data from a wide range of fields that are critical to informing an improved adaptation policy tool: economic and agricultural activities, social and physical infrastructure, health and wellbeing, among others. The collected data will be stored in a GIS-based spatial repository that will play an important role in future planning and monitoring climate change adaptation across South Australia.

The presentation at the ACCARNSI workshop will particularly focus on one of the two key sub-projects: A socio-economic risk and vulnerability analysis tool that is an integral part of the wider project and will be undertaken at the Australian Institute for Social Research, University of Adelaide. The tool investigates existing capacities of governance and decision making structures across the following components at various scales:

- Awareness/ acknowledgment of climate change vulnerability and risks
- Preparedness to alleviate/ mitigate climate change risks
- Action to mitigate risks and/or adapt to changing climatic conditions over both short- and long-term

It is expected that the risk and vulnerability analysis tool will not only assist the TREND project by highlighting current challenges to climate change adaptation at the operational level but in so doing, will also add to the existing climate change knowledge in SA from a multidisciplinary standpoint:

- It will integrate existing tools and datasets to create a comprehensive conceptual framework that will use a social systems analysis approach to evaluate climate change risks and impacts both institutionally and at the community-level.
- Based on the risk and vulnerability assessment, the wider project will build strategic capacity to frame suitable adaptation responses to climate change across a range of social and economic sectors throughout the state.

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<b>Title</b>	<b><i>Shining a spotlight on methodology: a problem-oriented approach to focus on feasible adaptation solutions</i></b>

This presentation seeks to address the concept of innovation in adaptation research, by shining a spotlight on methodology and approaches used to characterise vulnerability and adaptation. Considerable research effort has sought to characterise vulnerability to likely impacts of future climate change through scenario or 'end-point' approaches<sup>1</sup>. However, few empirical studies complement this with 'start-point' approaches that address contextual vulnerability<sup>2</sup>. This broader context considers the complex and dynamic mix of interconnected biophysical and socio-economic issues that affect communities at various scales, pinpointing potential problems for adaptation in the long run.

Through an application of the policy sciences<sup>3</sup>, this presentation illustrates how factors that influence existing vulnerabilities were identified for a business community involved in the tourism sector in Alpine Shire, northeast Victoria. Results suggest that many threats, including the effects climate change, compete for the resources, strategy and direction of local tourism management bodies. The policy sciences approach proved a valuable and transferable means for identifying feasible adaptation options. Lessons from this application have direct relevance for high priority research questions identified by the Adaptation Research Network for Settlements and Infrastructure<sup>4</sup>, regarding vulnerability and barriers to adaptation.

<sup>1</sup> Kelly, P.M., & Adger, W.N. (2000). Theory and practice in assessing vulnerability to climatic change and facilitating adaptation. *Climatic Change*, 47, 325-352.

<sup>2</sup> O'Brien, K., Eriksen, S., Nygaard, L.P., & Schjolden, A. (2007). Why different interpretations of vulnerability matter in climate change discourses. *Climate Policy*, 7, 73-88.

<sup>3</sup> Lasswell, H.D. (1971). *A Pre-View of Policy Sciences*. Elsevier.

<sup>4</sup> National Climate Change Adaptation Research Plan: Settlements and Infrastructure (<http://www.nccarf.edu.au/>)

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**Title**                      ***Harmonizing climate change adaptation and mitigation  
policy objectives through carbon market rules and  
incentives***

Climate change mitigation policies are typically designed and implemented with little reference to adaptation objectives. The potential outcome is that mitigation activities could unintentionally lead to maladaptation, alter coping thresholds or otherwise constrain adaptive capacity. Examples could include locking into energy, transportation or infrastructure technologies that limit future adaptive potential; pursuing carbon sequestration through forestry and agricultural practices that do not take into account climate change projections on crop tolerances; promoting biofuel production at the expense of food production and so on. The potential for undesirable outcomes suggests the need for proactive processes that ensure the compatibility and synergistic effects of mitigation and adaptation activities, including in the emerging Australian domestic carbon market. Such an approach could lead to the evaluation of mitigation activities not only on the timing and volume of their emissions reductions, but also on their contribution to adaptation and sustainable development. The precedent for this approach exists in the design of the Kyoto Protocol's Clean Development Mechanism (CDM). CDM modalities are illustrative of the tools available to Australian policy makers and include: taxing the proceeds of emissions trades or offsets and allocating them to adaptation; developing standards and certification procedures to identify high quality projects so that they can attract a price premium; introducing multipliers to increase or reduce the number of credits granted to an offset project compared to actual emissions reduced in order to promote investment in preferred project types. Strategies to integrate adaptation objectives in to mitigation projects will be presented and discussed.



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**Title** ***Examine the climatic indices and their influences on rainfall in the Murray-Darling Basin***

The association between climatic indices which are calculated on a monthly basis, including the El Niño Southern Oscillation (ENSO), and monthly rainfall and temperature in the Murray Darling Basin during the period 1960 to 2009 is investigated. The indices considered are El Niño 1+2, Niño 3, Niño 4, and Niño 3.4, Dipole Mode Index (DMI), North and Southern Atlantic Oscillation, Global tropics, Southern Annular Mode (SAM), Southern Oscillation Index (SOI), and Pacific Decadal Oscillation (PDO). Definitions of these indices, in terms of ocean temperatures and pressures, are given. A regression model with periodic functions to allow for seasonal variation, and a linear trend is fitted to the climatic series. Generalized least squares is used to allow for the effect of autocorrelation when estimating the standard errors of the regression parameters. There is no evidence of trends and the regression residuals are analyzed as a stationary multivariate time series. Correlograms and cross-correlograms show serial correlation for ENSO indices for at least lag 3 (months), and the Southern Oscillation Index (SOI) is serially correlated for lag 12 (months).

ARMA models are fitted to the regression residuals and cross-correlation functions of the residuals from the ARMA models are shown. A factor analysis model is also fitted to the regression residuals, and possible interpretations of latent factors will be suggested. A variety of regression models, including principal components regression, will be compared for assessing the influence of climatic indices on monthly rainfall.

Keywords: cross-correlogram, deseasonalisation, ENSO, generalised least squares, factor analysis, principal component analysis.



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**Title** ***The role of urban green-spaces in adaptation to climate change in Australian cities.***

In the future our cities must adapt to a changing climate, including increased temperatures, reduced rainfall and more extreme weather events. Urban green-spaces will provide an important means of adaptation, most significantly through reductions of the urban heat island effect. However climate change adaptation strategies often call for more dense and compact forms of urban development. There are now also mandatory standards for more sustainable 'green' buildings, however green-spaces and other landscape elements beyond the building edge are rarely included in such green rating systems. Urban green-spaces can provide a wide range triple bottom line ecosystem services, including climate amelioration, improved air and water quality and reduced energy use. They will also support human health and well-being in increasingly harsh environments.

This paper will examine recent efforts to include urban green-spaces and landscapes in green building rating systems. In the United States these are based on the LEED Green Building Rating System. A recent initiative is the Sustainable Sites Initiative which has developed guidelines for sustainable landscapes including a set of National Guidelines which gives credits for the sustainable use of water, soils and vegetation. Such guidelines provide performance benchmarks to encourage sustainable design, construction and maintenance of landscapes. They could be applied in an Australia through the Green Building Council and through a wider 'sustainable cities' context.

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**Title**                      ***Climate of Uncertainty - Is a new approach to building regulations required to address climate change?***

From a regulatory perspective, there are major barriers to introducing adaptations in the built environment. The geographical variability of climate change impacts, the scientific uncertainty on the severity of impacts and the limited knowledge of adaptive capacity make mandating building requirements a challenge. However, instead of mandating minimum requirements, a holistic sustainability rating system can be used to encourage adaptations in new developments.

With a sustainability rating system, market forces will drive climate change adaptations in new buildings. By providing market differentiation, a rating system empowers consumers to decide the appropriate level of climate change adaptations for their dwelling. Importantly, this approach avoids the potential issue of the maladaptation driven by mandatory policies that is based on incomplete information. While it cannot supplant statutory policy-making on all climate change issues, such as planning controls regarding sea level rise, a rating system can be an effective tool in advancing more climate change resilient developments today.

This research aims to develop and trial a holistic sustainability rating system for single dwellings. The system includes seven categories and dwellings are given a rating in each of the categories. The seven categories are Building Design, Outdoor Design, Energy Responses, Water Responses, Indoor Living Quality, Cost Effectiveness and Climate Adaptations. Thus, this system will tackle climate change in two ways. Firstly, it encourages more sustainable designs and sustainable buildings are acknowledged to be more resilient to climate change. Secondly, this system assesses design strategies that will specifically mitigate the predicted impacts of climate change.

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**Title** ***Integrating affordable housing in the transit-oriented development***

In a world faced with energy, water and climate challenges Transit-Oriented Development, commonly referred to as TOD, is an alternative form of urban development on a rising star. The range of potential benefits of a well conceived and implemented TOD is appealing to governments, particularly those responsible for adapting sprawling, low density cities designed around car use to an uncertain future, as well as tackling a raft of existing major urban problems. While TOD has its critics and completed successful examples are still few, it is seen by its advocates as having the potential to address wide-ranging, pressing environmental and social issues.

The integration of lifetime affordable housing in compact transit-oriented locations with the potential to become viable, liveable, socially diverse and sustainable communities is the particular focus for University of South Australia research in to Lifetime Affordable Housing in Australia, an ARC funded linkage project. While many challenges to achieving this integration have been identified, the fundamental role of public/private collaboration across the whole TOD endeavour from its conception is under investigation. A shared vision and strong partnership among stakeholders has emerged as one of the most important elements of success, yet it is elusive. The research involves a focus group with experts who explore the multi-disciplinary challenge of integrating affordable housing in to an environmentally, socially and economically successful TOD.

The presentation will incorporate images captured by the researcher during the South Australian Government sponsored TOD study tour in the USA, Germany and France in May 2009.

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**Research Area** Cross-cutting issues  
**Title** ***South East Queensland Climate Adaptation Research Initiative (SEQ-CARI) Griffith University Human Settlements Component***

The human settlements component of the SEQ-CARI, led by Griffith University, consists of an integrated multi-sectoral study of climate change adaptation options for human settlements in SEQ. It will examine three interrelated sectors: urban planning and management, including coastal management, emergency management and human health. Taking a case study approach, the research will develop and improve the adaptation strategies, policies and practices in each sector and across sectors, for better governance and management in response to the impacts of climate change.

This study will provide detailed sectoral insights by examining the interrelationships between the sectors of interest and the ways in which governance and institutional factors affecting one sector can facilitate or hinder adaptation across human settlements as a whole. The project comprises five phases. The first phase involves a general vulnerability assessment of human settlements in SEQ. Phases two, three and four consist of the case study analysis and elaboration to develop and test adaptation options in consultation with stakeholders for each case study area. The final phase aims to develop adaptation plans and guidelines for each case study area and recommendations for the SEQ region as a whole.

This research will adopt a scenario planning methodology involving interviews and workshops with a broad variety of stakeholders. This methodology will enable the development of scenarios for each case study area, exploration of factors driving climate change adaptation and the development of sectoral and cross-sectoral adaptation options. The cross-sectoral findings will contribute to a broader adaptation plan for human settlements in SEQ.