



Australian Climate Change Adaptation Research Network for Settlements and Infrastructure

2nd National Forum and Workshop for Early Career Researchers

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NEW SOUTH WALES



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Research Area: Coastal Settlements
Title: *Climate Change and Education: A Preliminary case study*

The Queensland coastline will be vulnerable to increasing sea level coupled with increasing storm intensity under climate change. The Gold Coast, in particular, has not experienced an extreme event in over 30 years. In addition to this time frame and the transient nature of the population, there appears to be a lack of knowledge and acceptance of the coastline's vulnerabilities. As storm events increase in intensity, it is imperative that the coastal communities are aware of the risks and adaptation measures. To assist in this, the community needs to understand the environment that they live in.

The CoastEd Program provides a vehicle for increasing the awareness and understanding of the local community in regards to the coastal environment and its management. The program is primarily school based which provides access to a diverse group within the population. Moreover, today's prep students are the senior managers of the future. They are going to have to live with and manage many of the decisions that are made today. Therefore introducing climate change and adaptation to school students will assist in building a foundation of their understanding of our local environment and vulnerabilities.

This investigation is a preliminary case into the introduction of climate change into the school classroom and the use of an education program, such as CoastEd, as a vehicle to initiate, supplement and support this process. Within the case study, both primary and secondary school programs were assessed to develop an understanding of the teacher's knowledge of climate change and their student's perception and comprehension of the topic.

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Title: *Holding back the tide: what can past policies for coastal management tell us about the adaptive capacities of Australian local governments?*

Although policies described specifically as for adaptation to climate change are relatively new, local governments have for many years been developing policies that address similar issues including flood mitigation, heat island effects, vegetation cover maintenance and coastal erosion. Coastal management plans and policies represent one of the most developed areas of policy of this type and this paper starts from the assumption that there is much to be learned from a critical review of policy development and implementation in the field of coastal management.

The review focuses on the city of the Gold Coast in South East Queensland, an area facing substantial challenges in adapting to various manifestations of climate change in the future. The focus is on the possibilities and constraints on anticipatory adaptation decision-making in coastal areas as these become affected by climate change impacts. The review asks whether the existing policies and management structures are able to incorporate such complex forms of decision-making or whether these needs to be adapted to the new and multifaceted challenge of climate change adaptation. Moreover, public participation and the legitimisation of coastal policies are discussed as these will become crucial parts of sustainable decision-making if we are to respond to climate change in efficient and equal manner.

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Title: *Estimating Storm-surge Risks to Coastal Settlements in Port Adelaide*

There are growing concerns along Australian coastal areas with respect to the risks associated with sea-level extremes, ranging from catastrophic tropical cyclones in North Queensland, to wide-spread storm tides in South Australia. These are in terms of the effects of increasing numbers of severe weather events and the evidenced sea level rise at accelerated rates due to global warming. As coastal population grows and the developments increase in scale and density, these risks become more threatening. Accommodates key infrastructure and proposed major industrial and residential developments, Port Adelaide's position and its coastal nature subject the area to a great deal of risk from storm surges impacted by sea level rise.

This PhD research examines the comprehensive impacts of sea-level rise with focuses on demographic aspects, including the issues of discrepancy between adaptation policy and public perceived interests. It has employed a mixed methods approach, consists of spatial and numerical modelling techniques and probability statistics to tackle problems arising from multi-disciplinary dimensions. An on-going component, site-specific study in Port Adelaide consists of risk assessments of storm surges to coastal settlements, providing detailed baseline data for a further in-depth investigation of the sea-level rise impacts on potentially affected stakeholders.

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Title: *Climate change and impacts on population mobility in Bangladesh: policy lessons for coastal settlements*

The presentation will be based on a project titled ‘Climate change and impacts on migration in the Asia Pacific’ that I have recently finished work on. While the project examined the complex nexus between climate change, environmental degradation and socio-economic development in a number of regions/countries in Asia and the Pacific, I will focus my presentation on coastal settlements in Bangladesh. It is expected that a number of key findings from the study will provide valuable lessons for Australia with regard to developing and strengthening climate change adaptation strategies for coastal communities regionally as well as nationally.

Abstract

As one of the most densely populated coastal regions in the world, Bangladesh is expected to face multiple stresses from various environmental disturbances, particularly those which can be both directly and indirectly attributed to changes in local and regional climatic conditions. The presentation will firstly explore the complex link between climate change, environmental degradation and migration in the context of coastal communities. In doing so, it will examine how changes in the frequency and intensity of climate change-induced environmental hazards may impact population displacement patterns in developing coastal communities in a number of ways. It then highlights some of the most serious climate change impacts that are either currently being felt in Bangladesh or are predicted to occur in the near future. Based on a comprehensive study of these climatic changes and past and present internal and international population mobility patterns, the presentation will identify climate change ‘hot spots’ in the region. Hotspots will comprise a specific area or location that may be at relatively high risk of adverse impacts from one or more natural hazards which result from climate change. Deteriorating environmental and resource conditions will negatively impact socio-economic and infrastructure development in the region, which would in turn, lead to population displacement within and outside national boundaries.

It is expected that findings from this research will contribute knowledge towards improved regional and sub-regional cooperation. The latter will, in turn, guide policymaking for enhancing climate change adaptation measures not only in developing coastal communities but also in those such as Australia.

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Title: *Promoting Resilience to Disasters and Climate Change in Coastal Cities in Indonesia*

This research addresses the following overarching question of how resilience to climate change and disaster in coastal cities in Indonesia can be achieved by linking theoretical approaches and policy processes for climate change adaptation (CCA) and disaster risk reduction (DRR). The need for CCA and DRR convergence is strong because there is significant overlap between the theory, policy and practice of DRR and climate change adaptation. The underlying idea of the proposed method is the importance of communication and information sharing between researchers, policymakers and practitioners of the two communities (Schipper, 2009; Sperling and Szekely, 2005; Mitchell and Aalast, 2008).

Vulnerability and resilience concepts have been widely used to analysis impacts of climate change and disaster (Adger; 2000, Klein et al, 2003, Thomalla et al, 2006, Wisner et al, 2004). Resilience concept and various resilience building frameworks will be applied to examine how governance dynamics and interplays work synergistically in coastal cities in Indonesia.

The questions guiding the research will include; How can DRR and CCA be conceptually linked to create synergies?, How can resilience to climate change and disasters be promoted in coastal cities?, How is DRR governed in Indonesia?, How is CCA to coastal hazards governed in Indonesia?, What are the current Indonesian government's strategies and policies in implementing DRR and CCA?, What are the roles of international and local NGOs and CBOs in framing DRR and CCA in Indonesia?, How can climate and disaster resilient coastal cities in Indonesia be achieved through linking climate change adaptation (CCA) and disaster risk reduction (DRR)?

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Title: *Climate adaptation for exposed jetties*

Coastal defence structures, as well as coastal infrastructure such as jetties, follow a number of design standards and guidelines that have been developed on the basis of surf zone dynamics research. In a changing climate the design requirements for coastal infrastructure, such as exposed jetties, are in need of review due to changes in local surf zone dynamics around the world. Large scale jetties are key components of bulk transport and are vital in supporting the mineral export industry that contributes significantly to the Australian economy. These jetties can span hundreds of meters and are exposed to a range of surf zone dynamics such as wave crest profile levels and wave overtopping volumes. Current design standards provide guidance on the selection of design levels for such maritime structures, however they rarely allow for wave overtopping of such structures. It is well known that wave crest levels in the surf zone are understood poorly and are difficult to estimate. Research into an improved numerical model of wave crest profiles is to be undertaken with special consideration given to state-of-the-art laser measurement technology. The influence of sea level rise on bathymetry changes is also to be studied to develop climate change scenarios. The numerical model will be applied to each scenario to determine the potential surf zone wave crest profile. The results will lead to the development of jetty design guidelines and tools for practical engineers.

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Title: *Pilot Study and Critique: Social Vulnerability and Community Adaptation – perceptions of, and willingness to adapt to, climate change*

PhD research currently in progress aims to investigate the social dimensions of vulnerability, including adaptive capacity and the perceptions of risk. Case studies were applied to investigate these social dimensions, as such, survey work utilising questionnaires and representative samples of portions of two local government areas to compare and contrast the regions is being undertaken. Due to the method of distribution (mail-out) and sample sizes (1,050 total), the first stage of the research required that there be a pre-test of the structured questionnaire to ensure it could be effectively disseminated to large populations and gather the required information. A joint local government and South Australian NRM Board day-long symposium provided this opportunity. A key factor noted in the study was that over one-third (38.5%) of respondents considered communities in the area as highly vulnerable to the impacts of climate change and over one-half (53.9%) considered that it will cause a fair to high amount of disruption in the community, however, they indicated that it would cause little or no disruption to their own income, health or home (77.0%, 69.3%, and 61.6% respectively). This supports optimism bias theory regarding the way individuals perceive the likelihood of good and bad things happening to them as opposed to 'others'. This paper presents an overview of the pre-test, the critical analysis of the questionnaire from stakeholder feedback, modifications and revisions to the survey, as well as the preliminary results of the pilot and hypothesis.

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Title: *Climate Change and Water Infrastructure – Embracing variability in planning and management*

Recent drought in the Murray-Darling Basin has been exacerbated by over-extraction of freshwater resources, leading to rapid depletion of water storages throughout the system. This rapid drawdown of supply has highlighted the failure of the prevailing assumption in the development of water infrastructure throughout the twentieth century – that variation within a natural system occurs within a defined and predictable range. Additionally, it has demonstrated our failure, thus far, to provide water delivery infrastructure that is capable of withstanding the types of variation predicted under climate change. As we face a future of increased variability of rainfall, evaporation and water consumption, we need a new focus on the development of the water infrastructure that supplies urban and rural needs. For instance, water infrastructure must be extended from the current dominance of large scale reservoir storages to include smaller, intermittent and interlocking sources of water such as stormwater harvesting, desalination and water recycling. These challenges to our water storage infrastructure under climate change will be discussed using the recent drought in the Murray-Darling Basin as a case study.

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Research Area: Infrastructure
Title: *Overcoming technical knowledge barriers to community energy projects in Australia*

Internationally, community energy projects have been an important mechanism for facilitating a transition to more sustainable energy systems in the light of climate change. This presentation will discuss the recent work undertaken to create an enabling tool for community energy projects. Specifically, community energy projects are defined as having three features:

Use renewable energy or low carbon technologies,
Distribute/localise supply; and
Democratize governance through community ownership and/or participation.

A barrier-benefit analysis of community energy projects identified that lack of technical knowledge in communities as a key constraint. To address this barrier the Community Energy Decision Assistance Tool (CEDAT) was developed based on a user analysis and reviews of: existing energy tools; sustainability decision making frameworks; and appropriate technologies. CEDAT uses an Excel platform to provide users with a multi-criteria decision analysis process for five energy technologies (wind, mini-wind, solar photovoltaics, agricultural biomass and cogeneration), based on community specific inputs.

To evaluate the usefulness of CEDAT it was applied to a case study – the Sydney Coastal Ecovillage Project (SCEV). The aim of SCEV is to create an environmentally and socially sustainable village for approximately 300 people on the Central Coast of NSW. The results of this case study indicate that mini-wind could be an appropriate energy option for SCEV.

CEDAT has the potential to assist communities in the initial stages of developing a community energy project, specifically by providing an easy to use discussion framework, with technical, environmental and economic outputs that can become the basis for further investigation. It is limited due to the number of technologies and the simplicity of the energy modelling, which could be addressed with further development.

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Title: *Fill in the Dams?*

Small dams in inland Australia are key farm infrastructure and are essential for the economic survival of rural business during sustained drought. However, harsh arid climatic conditions result in annual evaporation losses greater than annual water usage. The purpose of this study is to investigate the feasibility of replacing small farm dams with groundwater dams, constructed by filling the farm dams with gravel or sand. Water is then stored in the soil pore space, where evaporation decreases as a function of water depth below the surface of the soil, until at a depth of 0.9m, evaporation is negligible. Although storage volume is reduced, this method may be an efficient alternative to the current unavoidable evaporation losses from open surface waters. Daily evaporation data, and storage efficiency of representative farm dams has been compared to the computed evaporation and storage efficiency from equivalent dams filled with coarse material. Data has been taken for a number of sites in western New South Wales from 1966 to 2006. Results have shown that when the water level is below the surface, evaporation is significantly reduced and water saved, particularly from larger dams in arid regions rather than semi-arid regions. For the case of the largest farm dam considered at Mildura, the average annual volume of water available in the farm dam over the 40 years of data is 65 percent. Results for the corresponding groundwater dam give the average annual available volume calculated as 24 percent of the total dam volume (i.e. 61 percent of the porosity). The study concludes that the application of groundwater dams would be beneficial in arid areas of Australia for larger, deeper storages, however not much benefit is seen in their application in semi-arid regions. Groundwater dams reduce evaporation losses and appear to be an effective storage solution but more detailed simulations over longer climatic periods as well as field trials should be undertaken before they are implemented in Australia.

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Title: *Sewer mining as a climate-independent water resource for urban areas*

Sewer mining has the potential to provide a climate-independent, fit-for-purpose water source at a range of scales at or very near to the demand in Australia's urban areas. The majority of Australia's wastewater treatment plants (WWTP) are located on the coast in close proximity to the populations they serve, with the bulk of the treated effluent being disposed of by ocean outfall. In a drying climate this practice can be considered wasteful at best, negligent at worst. And while the percentage of effluent being recycled nationally is gradually increasing, the economic feasibility of this type of scheme (large-scale industrial reuse, etc.) will continue to diminish. This is due to the increasing distance between the source and new demands. Conventional coast-based large-scale WWTPs treating all of a city's wastewater can typically only provide treated effluent in a cost effective manner to demands of sufficient scale in close proximity to the WWTP due to the cost of pipes and pumping.

Sewer mining however can tap into the urban sewer network at virtually any point and, with the latest advances in treatment technology, provide cost effective recycled water of any desired water quality and at a range of scales. In Perth, WA, for example, the sewer network underlying the metropolitan area which services its three main WWTPs consists of over 10,000 km of sewers. This research is proposing to develop a three-pronged approach exploring the viability of sewer mining in urban areas through modelling technical, risk (health and environmental) and governance issues for increased uptake of this technology.

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Research Area: Infrastructure
Title: *Decision making considering climate change uncertainty*

Under climate change decision makers face new challenges from future climate uncertainty. This increases decision making complexity specifically when dealing with long-lived, irreversible investments like many infrastructure projects.

During the decision making process many questions should be assessed. For example, what are the specific causes of climate change uncertainty and can they be reduced? How do policy makers choose between multiple policy directions with climate change uncertainty? Should policies be implemented now or delayed until information gaps have been closed? What tools are available to help answer these questions?

This literature review delves into these questions and explains strategies, frameworks and tools for policy decision making, focusing on Australian infrastructure and in particular the water industry.

Currently, most of the time these decisions are made by attempting to explicitly define the probability distribution of different scenarios and choosing policy based on this. Where probability distributions cannot be determined, such as those related to the deep-uncertainty issues of climate change, they are typically characterised using consensus based subjective probability distributions. This approach's limitations are addressed and alternatives suggested. Further, methods for evaluating priorities in decision making are also evaluated.

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Research Area: Infrastructure
Title: *Theories of Change Workshop*

We all have ideas about how change is made, whether we articulate it or not. This engaging and participatory workshop invites participants to reflect on, converse about and debate ideas about how change is made in the face of climate change. As researchers we create new knowledge; but how do we translate this knowledge in order to create change in the world? Specifically, we will explore different elements of change creation, with the aim of helping you to start developing your own theory of how change is made.

This workshop was first developed by social change professional Natasha Verco and has been delivered by Nicky Ison over the past four years for academics, community organisers, students and more.

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Research Area: Built Environment, Innovation, Institutional Reform
Title: *Use of Constructed Wetlands as Climate Change Proof
wastewater/stormwater treatment systems*

Considering the importance of establishing sustainable, climate change proof, technologies for wastewater/stormwater treatment and recovery, the aim of this work is to emphasise the use of constructed wetlands as a long term alternative in treating wastewater and stormwater. Due to their effectiveness, low or no energy requirements, robustness and ecological values, constructed wetlands must be considered as alternative infrastructure to conventional energy intensive wastewater treatment systems in a changing climate. Over the past decade constructed wetlands have been increasingly used for treating a variety of wastewaters including municipal and industrial effluents. Our case study will focus on a constructed wetland treating wastewater at CSBP Ltd, a fertiliser and chemical manufacturer located in Kwinana, WA. The wetland included slag, a gravel-like by-product from the nearby Hismelt plant, in its drainage layer therefore reducing pressure on resources and incorporating value to a waste product. The hybrid design of the system provided habitat for native sedges and good removal rates for heavy-metals and nutrients prior to discharge into the Sepia Depression Ocean Outlet Landline four kilometres offshore. Another example of industrial synergy is the advanced nitrogen removal by using the sugar rich wastewater from a nearby soft drink factory as a source of carbon for denitrification in the wetlands. A plant scale trial is due to commence on site in 2009. The constructed wetlands have improved water quality prior to discharge to the marine environment with minimal energy requirements and ongoing costs while acting as a carbon sink and providing habitat for native fauna and flora in an industrialised coastal area.

Name: David Goodfield
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Title: *Improving the Energy Efficiency of Mine Site Village Accommodation and its Role in Promote Carbon Minimization in Mining itself*

Improving the energy efficiency of the built environment is fundamental to slowing the current increase in atmospheric greenhouse gases and hence global warming. This also applies to the lightweight construction of mine site villages wherein research shows how poorly they perform. However, it is recognised that mine site villages only form a very small percentage of carbon emissions resulting from the overall mining operations. This paper connects the broad strategy of thermal performance improvement and energy efficiency in mine site accommodation and facilities with a broader strategy of overall energy efficiency in mining generally. Early stage research included onsite investigation of the mine site village at the request of a significant Pilbara mining company. This included several technologies and systems designed to improve the social benefits of education in sustainability as well as the built environment itself. The intention was to develop a low carbon sustainable site, but due to recent financial meltdown the recommendations still remain to be implemented. Research continues but is intended to extend to the mine itself by pursuing the link between the staff that live in the village and the experience of living in a sustainable working environment. Amongst other aims it is intended to show that technology transfer on a larger scale can be more effectively brought about by understanding it on a smaller scale – whether seen or experienced by corporate executives or by kitchen hands.

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Title: *The climatic variation in the Hume Dam areas*

Monthly rainfall and temperature time series were analyzed using data from the Hume Dam station in the Murray Darling River Basin (MDB) area. The climatic indicators Pacific Decadal Oscillation (PDO) and the Southern Oscillation Index (SOI) were calculated and compared using a correlogram and cross-correlogram. This provided evidence that SOI is serially correlated up to lag 12 (months) whereas the lower frequency PDO is serially correlated up to at least lag 24 (months). Our analysis provide evidence that rainfall is reduced during periods of negative SOI, and the interaction between PDO and SOI makes this effect more pronounced during periods of negative PDO. The autocorrelation of residuals and the Hurst coefficients indicate long-term dependencies. For rainfall Hurst coefficient H was 0.553. auto regressive process with second order (AR (2)) with parameters estimated by fitting to the residual series (P = 0.17) was not significantly greater than values of H. For temperature H=0.751, an AR (5) process with parameters estimated by fitting to the residual series (P = 0.01) was significantly greater than values of H. Using spectral analysis we explained the distributions of variance of rainfall pattern, and suggested the possible El Nino cycle is irregular but tends to be around four years on averages.

Keyword: Auto-regressive process, climatic indicators, correlogram and cross-correlogram, Hurst coefficients, spectral analysis.

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Title: ***WHERE TO NEXT? Promoting trans-sectoral change across the professions in tertiary education.***

Recently completed research by the author into the impacts of climate change on urban landscapes (home gardens) show that:

- Participants have clear preferences for getting ideas about gardening in times of climate change.
- Participants will look to themselves, friends, local nurseries and print media to gather ideas.
- Strategies focus strongly on **changes in plant selection, placement** and applying criteria for **drought hardy/ tolerant plants.**

Some 5 million Australians own homes with gardens and spent \$6.9 billion on them in 2007-08(Nursery & Garden Industries – Australia/ ABS statistics). Home owners represent a significant target for transformational change to address the impacts of climate change on the built environment. Innovation and reform must shift from positive individual practice to associated industries and institutions to promote change across a broad spectrum of practitioners through new design paradigms.

The industries and institutions involve landscape architecture, garden design, amenity and production horticulture, urban design and planning and would include associated educational and professional bodies.

The author proposes a design paradigm that will address the impacts of climate change by revisiting old frameworks of thought and reframing them in light of the emerging changes:

1. Landscapes and gardens as places of seclusion and recreation.
2. Gardens as extensions of the dwelling and as part of the living space.
3. Landscapes and gardens derived from prevailing natural conditions – the soil, the climate, the rains that fall.
4. Landscapes and gardens constructed with plants that have relevant survival characteristics.

Where too after the research is published? Seeking links across the disciplines to bring about trans-sectoral change in tertiary education in the professions.

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Research Area: Built Environment, Innovation, Institutional Reform
Title: *The role of the urban forest in adaptation to climate change*

Are urban trees a neglected tool in our strategies to adapt to changing climates? The sum of all public and private tree cover in the city is known as the urban forest. The urban forest is now being recognized as a form of ‘green infrastructure’ which can provide the city with a wide range of ecological services. The urban forest may assist in climate change mitigation through carbon sequestration and storage, and reduction in emissions due to reduced energy demands. However the urban forest can play an even more significant role in terms of climate change adaptation, primarily through reduction of the ‘urban heat island’ effect. Trees have a cooling effect on the climate of cities, their canopies shading buildings and other hard urban surfaces, and also through evapotranspiration. Urban trees can also provide a buffer to other impacts of changing climate, including more frequent and extreme climatic events such as storms (through reduced wind speeds) and flooding (through canopy interception.) At the same time, however, the urban forest faces significant threats from changing climates, including increasing temperatures and decreasing rainfall. Other climate change adaptation strategies may also conflict with the objective of increasing urban tree cover. Increasing tree canopy cover may conflict with objectives of increased solar access to building roofs. Urban densification, a possible climate change adaptation strategy, has reduced urban tree cover and is severely limiting opportunities for future tree planting. At the time when we need them most, it is becoming increasingly difficult to plant trees in our cities. This paper reviews current research on the role of the urban forest in climate change adaptation, including the use of online tools such as I-tree, which can quantify the net climate change adaptation benefits delivered by the urban forest to individual cities. It will also present strategies to reconcile potential conflicts between urban trees and other climate adaptation strategies.

Name: Nandana Jayasinghe
Email: nandana.jayasinghe@jcu.edu.au
Organisation: James Cook University, Townsville Engineering and Physical Sciences
Research Area: Infrastructure
Title: *Vulnerability of houses to Windstorms*

Windstorms are responsible for most of the damages sustained by structures worldwide from natural hazards. Recent reports suggest that there may be an increased risk of damage from windstorms as a result of climate change. Therefore, there is a need for understanding housing performance in windstorm and improved tools for predicting housing vulnerability to mitigate the wind damage.

My research assesses the likely failure modes and estimates percentage of failure, for representative populations of houses with increasing wind speed. Reliability methods incorporating probability theory and Monte Carlo simulation are being used for calculating probability of failure. The wind load and the component strengths are treated as random variables with appropriate probability distributions. These distributions will be derived from available test data, experiments, structural analysis, damage investigations and experience. This study will also incorporate progressive failures and considers the interdependency between the structural components in the houses, when estimating the failure modes and percentages of the overall failures.

Design details including types of structural components of houses are obtained from surveying houses and analysing engineering drawings. Standards are used for calculating the nominal design loads on components. Wind tunnel model tests are being conducted to obtain more reliable wind load data. The outcome of this project also provides data for developing a tool for assessing the vulnerability of houses to quantify building damage during a wind event. Therefore, this analysis can be used for a quantitative risk assessment of houses subjected to possible increases in wind hazards resulting from climate change.

Name: Xian Fang Lou
Email: x.lou@murdoch.edu.au
Organisation: *Murdoch University, School of Environmental Science*
Research Area: Urban Management, Transport & Inclusion
Title: *Anaerobic digestion of putrescible solid waste as a response to climate change adaptation in waste management*

Decomposition of putrescible waste results in the release of climate warming gases such as methane, carbon dioxide and nitrous oxide. In Australia, the majority of these gases are emitted into the atmosphere through the common usage of landfills. Faced with escalating pressure of adapting and mitigating climate change, the solid waste sector has been exploring alternative waste management strategies for the disposal of putrescible waste. Composting of putrescible waste has been the more familiar alternative to landfilling. However, as traditional composting operates in an open environment, operations can be limited by the climate. In addition, composting does not offer the opportunity to capture gases for energy generation as landfilling does. In response to the limitations of composting and landfilling, anaerobic digestion presents as an attractive climate adapting waste management strategy – they operate in a closed vessel, therefore is less sensitive to the climate as composting and the biogas produced can be captured for energy generation offering a potential source of renewable energy. In order to quantify the impact each waste strategy has on climate change, analysis was performed comparing the greenhouse gas emissions from landfilling, composting and anaerobic digestion activities. In my presentation, I will be discussing the potential of anaerobic digestion as a climate adaptive waste management strategy and present comparative results of the performance of anaerobic digesters and alternative waste strategies in term of greenhouse gas emissions.

Name: Susilawati
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Organisation: *University of South Australia, Institute for Sustainable Systems and Technology – Transport Systems*
Research Area: Urban Management, Transport & Inclusion
Title: *Transport network vulnerability approach for climate change adaptation*

Increased frequency and severity of floods and heat waves as an effect of climate change in Australia will have significant impacts on the performance of road networks. Given the road network vulnerability concept which assesses the weakness of a road network to incidents and indicates the level of adverse impacts to the community from the degraded road network, we propose a road network vulnerability metric based on an accessibility index. This metric measures the community loss as well as the emergency service reduction during incidents by quantifying the differences of the index values under normal conditions and during disruptions. It might be one of the tools that can assist transport planners to identify the critical and important locations in networks, in order to set priorities for safeguarding the critical elements and to find alternative routes to help reduce the severity impacts. After identifying the critical elements, the next assessment can be done with the purpose of strengthening the networks to lessen the degree of disruption from natural disasters such as floods, landslides, cyclones and bushfires. After modelling the different impacts on a road networks under different durations and magnitudes of incident scenarios, we conclude that this metric can play a vital role as a decision support tool for assessing the road network vulnerability in order to plan and provide more resilient transport systems.

Key Words: Road Network Vulnerability, Climate Change, Transport Planning

Name: Ivan Iankov
Email: ivan.iankov@unisa.edu.au
Organisation: *University of South Australia, Institute for Sustainable Systems and Technology – Transport Systems*
Research Area: Urban Management, Transport & Inclusion
Title: *Modelling Cold Start Effect on Vehicle Tailpipe Emissions*

Abstract (max 250 words): A vehicle's engine temperature has a significant effect on the tailpipe emissions of that vehicle. EMEP/CORENAIR Emissions Inventory Guidebook published by European Environmental Agency states that three-way catalysis vehicle, operated with cold engine, can have up to a 40% increase of Carbon Dioxide (CO₂) emissions, 11 times higher Oxides of Nitrogen (NO_x) emissions, and 6 times higher Methane (CH₄) emissions when compared to emissions from vehicle operated with a hot engine. Driving a vehicle with a cold engine is an everyday occurrence for a majority of Australians. Short trips have a considerable share of total trips. Therefore, the share of vehicle-km-travelled with a cold engine is significant. This presentation discusses how cold vehicle engine emissions should be considered when vehicle emissions inventory are conducted using vehicle emissions rates. The research conducted analysed second by second emissions data from chassis dynamometer tests performed on 347 light duty petrol vehicles during the Second National In-Service Emissions (NISE2) study. This is the best light duty petrol vehicle emissions database for Australia since it is based on the most updated and representative Australian (light duty petrol vehicle) sample and on the most realistic Australian drive cycles. In the study emissions rates from cold vehicles are compared to emissions rates from hot vehicles with the same speed time profiles used. The presented results show cold/hot ratios of emissions rates. In more detail the influence of following factors on cold/hot ratio are presented: different mode of driving – idle, acceleration, cruising, vehicle age, and engine size. Evolution of cold/hot ratio over time is also analysed. In conclusion the presentation recommends the development of Australian cold start emissions drive cycle which will ensure more accurate inventory estimates of vehicle emissions.

Name: Gusri Yaldi
Email: gusri.yaldi@postgrads.unisa.edu.au
Organisation: *University of South Australia, School of Natural and Built Environment*
Research Area: Urban Management, Transport & Inclusion
Title: *Introducing a simple and robust neural network technique for forecasting purposes*

An efficient and effective evaluation and planning activities requires a reliable tool that can predict the impacts of the changes to the systems of interest, either now or in the future, when certain changes applied to it. That tool is called as a model. This presentation will introduce a simple and robust technique in developing a model for forecasting or estimation purposes. It is developed based on the Neural Network approach. The mechanism of forecasting with this technique is designed so that it can be applied in different discipline areas. The model has been tested in travel demand modelling, especially in estimating the work trip distribution numbers as a case study. This artificial intelligent approach is found to be able to distribute the work trip numbers with a statistically higher accuracy than the well-known and widely used technique such as the gravity model. It is also found that the proposed approach predicts the trip numbers with the same level goodness-of-fit as doubly-constrained gravity model calibrated by using Maximum Likelihood method developed by Hyman. It is expected that this simple technique can be further developed as an alternative robust method in travel demand modelling and other disciplines as well such as in water catchment or flow modelling, and urban settlement impacts.

Name: Razieh Mosadeghi
Email: r.mosadeghi@griffith.edu.au
Organisation: Griffith University, School of Environment
Research Area: Built Environment, Innovation, Institutional Reform
Title: *Introducing MCDM (Multi-Criteria Decision Making) Techniques as a New Approach in Climate Change Adaptation*

Uncertainties associated with climate change have posed new challenges to land use planners. These challenges can be addressed more effectively by using new techniques and tools such Multi-criteria Decision Making (MCMD). This paper explores application of MCMD to land use planning under the impact of climate change. In MCDM process, the problem can be abstracted as how to derive weights, ranking or importance for a set of activities according to their impact on the situation and the objective of decisions to be made. Based on the fact that by using MCDM we will be able to put different importance weights on variable criteria, these techniques can be used as strong tools to put more emphasis on climate change events in future development planning processes. Furthermore, MCDM techniques have the capacity for bringing more experts' knowledge together with different views.

On the other hand, land use control is a well-known and cost-effective mean for reducing the adverse impacts of climate change events on future developments. This study introduces a new approach to improve land use control. In this approach MCDM technique is used to identify less vulnerable areas for future settlement and infrastructure placement. In this approach the impact of climate change on land use planning is taken into consideration by developing a mechanism that allows allocation of suitable weights to various aspects of climate change that could have impact on land use.

Key words: Multi-Criteria Decision Making, climate change events, land use controls, Geographic Information System (GIS).

Name: Martin Anda
Email: m.anda@murdoch.edu.au
Organisation: Murdoch Environmental Science (Environmental Engineering)
Research Area: Infrastructure (and Cross Cutting Issues)
Title: *Infrastructure Planning System for Climate Resilient Settlements*

Infrastructure planning in WA is based on traditional engineering concepts for energy, water, sewer and waste management facilities. A new model is proposed that will assist settlements better adapt to climate change and simultaneously provide an urban planning framework for decarbonising the economy. For example, the Water Corporation imposes charges for infrastructure called Standard Headworks Contributions for developers (Western Power uses a different charging system for power distribution infrastructure). These water headworks in new subdivisions will include header tanks on nearby hills, sewer pump stations in low-lying areas and large covered storage dams on other higher land. These prime sites, with water infrastructure typically having first call, could be used in a more integrated manner to achieve climate resilient settlements. A recent WA Economic Regulation Authority report has recommended that developers proposing Water Sensitive Urban Design receive consideration for discount on headworks charges if the design leads to permanent reduction in demand on infrastructure. Water efficient urban planning has recently become linked to the WA Planning system in a policy and regulatory reporting system called Better Urban Water Management. Developers are now required to report on how they will achieve water efficiency in the subdivisions. It is proposed that not only can energy and carbon management also be implemented through the WA Planning system in a similar manner to water but that other infrastructure components can be integrated into the planning system. The large covered storage tanks are also ideal for covering with solar PV modules. The hilltop header tanks are also ideal sites for wind turbines. The sewer pump stations where enough buffer land exists can be converted to 'resource recovery centres' where municipal organic waste is received, combined with the sewage sludge filtered from the pump station and converted to methane for power generation. The key will be to identify the sites that have a power transmission/distribution line or substation nearby and suitable access for local government. The paper outlines the proposed model based on a state, regional, district, local, urban planning structure and goes onto describe case studies in WA.

Name: Fiona Johnson
Email: Fiona.johnson@unsw.edu.au
Organisation: *University of NSW School of Civil and Environmental Engineering*
Research Area: Infrastructure
Title: *Assessing the suitability of climate models for water resources impact assessments*

It is well known that certain sources of water supply, such as groundwater stores and large reservoirs, are highly sensitive to low-frequency variability of precipitation and temperature. This issue is particularly pertinent for regions that are influenced by low-frequency climate modes such as the El Niño Southern Oscillation (ENSO) phenomenon, with the failure to account for such climate features potentially resulting in significant overestimates of water availability and security for any system with multi-year storage.

Despite this understanding, when assessing GCM performance the focus traditionally has been on measuring skill in terms of the annual or seasonal means of the simulated variables, rather than on measures of low-frequency persistence. We have developed several ways to assess climate model outputs that consider features important for water resources impact assessments. This presentation will summarise some of the important issues to be considered when using climate model outputs. I will firstly highlight which variables have the most uncertainty for the future and how uncertainty varies around the world. I will then present a wavelet based assessment of how well climate models represent low frequency persistence in different climate variables.

Name: Andrew Graddon
Email: Andrew.Graddon@studentmail.newcastle.edu.au
Organisation: *University of Newcastle Civil Engineering*
Research Area: Built Environment, Innovation, Institutional Reform
Title: *The Modelling of Urban Water Supply, Harvesting and Recycling Systems using Network Linear Programs*

The steady increase in urban populations and the possible onset of climate changes that may adversely affect the amount of water available in current water supply systems, makes the study of rainwater harvesting and recycling scenarios a high priority. It is suggested that any system of water supply that can reduce the amount of water drawn from main reservoirs has to be of benefit to the whole supply region especially in terms of drought and water supply security.

This presentation describes a versatile modelling framework which can simulate a wide variety of combinations of centralised and decentralised Integrated Urban Water Management schemes from the allotment to the estate or small suburb scale. The framework combines two modelling approaches. The first, called 'urbanCycle', simulates water supply, stormwater and wastewater using allotments as the basic building block. Although 'urbanCycle' can simulate processes in great detail, it assumes that the network forms a directed acyclic graph. This simplifies the connectivity logic but precludes investigation of systems with decentralized storage, feedbacks and multiple supply paths. To overcome this, a second model, based on network linear programming, is embedded in the 'urbanCycle' framework to enable the modelling of major recycling and harvesting scenarios, as well as on-the-fly supply and demand decision making, based on objectives rather than pre-set operating rules.

Name: Anne Weckert
Email: anneweckert@gmail.com
Organisation: *University of Adelaide, Architecture, Landscape Architecture & Urban Design*
Research Area: Coastal Settlements
Title: *Identifying Adaptation Strategies through the analysis of Community Preferences*

The presentation will focus on the probable impacts of climate change and coastal subsidence on communities living within low-lying deltas in China. My current research seeks to ascertain the levels of community resilience in different socio-economic groups, and possible strategies for adaptation or migration. The presentation will detail information gained through a literature review, in preparation for the corroboration of existing quantitative information with primary qualitative research information gained through case studies conducted in China in 2010.

In 2010 information about community structure, perspectives, migration patterns and housing preferences will be gathered from community leaders in regions identified as of strategic relevance in China. The presentation will discuss the importance of understanding community lifestyle preferences in the study of adaptation responses to environmental degradation, climate change and coastal subsidence. A theoretical framework for the corroboration of qualitative research with quantitative information will be presented with the aim of increasing the effectiveness of policy created to address adaptation need.

Lifestyle preferences encompass housing, employment, social networks and environmental context. The factors that influence the choice of an adaptation response may vary significantly within different cultural and geographic context. In many cases in-situ adaptation may be preferable to communities over that of migration. Climate Change predictions indicate that the number of communities living within areas prone to significant climate hazards, or natural resource shortages will increase dramatically in the next 100 years. In understanding community lifestyle preferences and migration decision triggers, Governments will be better able to advise on or facilitate possible adaptation strategies for communities or regions.

Name: John Corkill
Email: johnr.corkill@gmail.com
Organisation: Southern Cross University, School of Law & Justice
Research Area: Coastal Settlements
Title: *Principles and Problems of Shoreline Law under Climate Change*

The paper outlines key principles of property law, relevant to lands bounded by water.

'Shoreline law' refers to the area of law relating to boundaries between land and water.

Shoreline law deals with the location of gradually moving water boundaries and the ownership of affected land. It sits within the complex legal framework of surviving common law and State & Commonwealth statute law, applying on the Australian east coast.

The paper draws upon relevant common-law doctrines of law, precedent decisions in English, Australian & US courts and NSW, Queensland & Commonwealth statute law.

Problems with current shoreline law are discussed in the light of predicted impacts of higher sea levels & increased storminess on coastal environments, land and property.

Property law is identified as only one area of law likely to be challenged by climate change.

The protection of private property is placed in context as one of a range of important competing priorities for public policy responses and public funding.

The paper asserts that landholders' attempts to use legal action to protect their properties from climate impacts, or to sue for damages and loss, may be unsuccessful, unhelpful and a dangerous distraction for local and state government.

A narrow focus on liability is not supported and the development of a sophisticated integrated response to climate change, which includes law, but is not skewed by a 'storm of litigation', is advocated.

A suite of policy and legal responses is posited as being necessary to respond to these challenges.

Name: Michael Short

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Organisation: *University of NSW, UNSW Water Research Centre*

Research Area: Infrastructure

Title: *Adapting water resources and infrastructure to Climate Change*

There are significant challenges confronting the water industry in relation to how it will ultimately adapt to the suite of anticipated future climate change impacts. Many of the predicted climate change-related impacts facing the industry are well known; however, there remain many gaps in current adaptation understanding and also numerous areas of uncertainty regarding how this adaptation outcome might best be achieved. As part of ACCARNSI Node 4 activities, a literature review was conducted in order to identify these knowledge gaps and also to highlight the pressing water-related climate change adaptation research needs specifically in the areas of water and wastewater infrastructure as well as water resource and supply management. This presentation contains a concise summary of these findings.

Australian Climate Change Adaptation Research Network for Settlements and Infrastructure Early Career Researchers' Forum and Workshop
9, 10, 11 November @ UNSW



PROGRAM

Day 1: Monday 9 November 2009

Venue: The Design Studio Room 501, Level 5, Civil Engineering Building (H20), UNSW

Time	Event	Name	Comment
8:30:00 AM	Tea & Coffee on arrival		
9:00:00 AM	Welcome	Ron Cox	
9:00:00 AM 9:30:00 AM	Research Area - Coastal Settlements Presentations	Rodger Tomlinson, Convenor, Node 1 - Coastal Settlements	Node 1: introduction to session
9:30:00 AM	<i>Climate Change & Education: A preliminary case study</i>	Sally Kirkpatrick	Griffith U
9:45:00 AM	<i>Holding back the tide: what can past policies for coastal management tell us about the adaptive capacities of Australian local governments?</i>	Johanna Mustelin	Griffith U
10:00:00 AM	<i>Estimating Storm-surge Risks to Coastal Settlements in Port Adelaide</i>	Dandong Zheng	Adelaide U
10:15:00 AM	<i>Climate Change and impacts on population mobility in Bangladesh: policy lessons for coastal settlements</i>	Vigya Sharma	Adelaide U
10:30:00 AM	Break coffee/tea/discussion		
11:00:00 AM	<i>Promoting Resilience to Climate Change and Disasters in Coastal Cities in Indonesia</i>	Riyanti Djalante	Macquarie U
11:15:00 AM	<i>Climate adaptation for exposed jetties</i>	Matthew Harry	Griffith U
11:45:00 AM	<i>Pilot Study and Critique: Social Vulnerability and Community Adaptation - perceptions of, and willingness to adapt to, climate change</i>	Christopher Button	Adelaide U
12:00:00 PM	DISCUSSION	Coastal Settlements	Chaired by Rodger Tomlinson
12:30:00 PM	LUNCH		
1:30:00 PM 1:45:00 PM	Research Area - Infrastructure Presentations:	Bill Peirson or Richard Stuetz, Co-convenors, Node 4 - Infrastructure	Node 4: introduction to session
1:45:00 PM	<i>Water Infrastructure under Climate Change - Coping with Variability</i>	Dominic Skinner	Adelaide U
2:00:00 PM	Overcoming technical knowledge barriers to community energy projects in Australia	Nicky Ison	UNSW
2:15:00 PM	<i>Fill in the Dams?</i>	Alexandra Bennett	Hyder Consulting
2:30:00 PM	<i>Sewer mining as a climate-independent water resource for urban areas</i>	Stewart Dallas	Murdoch U
2:45:00 PM	Decision making considering climate change uncertainty	Eytan Rocheta	UNSW
3:00:00 PM	DISCUSSION	Infrastructure	Chaired by Bill P/Richard S
3:30:00 PM	Break coffee/tea/discussion		
3:45:00 PM	Theories of Change workshop	Nicky Ison	for early career researchers only
5:00:00 PM	Return to hotel and then on to Restaurant		
6:00:00 PM	DINNER - CHAO PRAYA (BYO) 33 Perouse Rd, Randwick Ph: 02 9399 5509		Booked under Ron Cox for 37 + 1 people

Australian Climate Change Adaptation, Research Network for Settlements and Infrastructure Early Career Researchers' Forum and Workshop
9, 10, 11 November 2009 @ UNSW



PROGRAM

Day 2: Tuesday 10 November 2009

Venue: The Design Studio Room 501, Level 5, Civil Engineering Building (H20), UNSW

Time	Event	Name	Comment
8:30:00 AM	Tea & Coffee on arrival		
9:00:00 AM 9:30:00 AM	Research Area - Built Environment Presentations:	Peter Graham/Bill Randolph, Convenors, Node 3 - Built Environment	Node 3: introduction to session
9:30:00 AM	<i>Use of Constructed wetlands as Climate Change Proof wastewater/stormwater treatment systems</i>	Sergio Domingos	Murdoch U
9:45:00 AM	<i>Improving the Energy Efficiency of Mine Site Village Accommodation and its Role in Promote Carbon Minimization in Mining itself</i>	David Goodfield	Murdoch U
10:00:00 AM	<i>The climatic variation in the Hume Dam areas</i>	Mohammad Kamruzzaman	U South Australia
10:15:00 AM	<i>WHERE TO NEXT? Promoting trans-sectoral change across the professions in tertiary education</i>	Trevor Nottle	Adelaide U
10:30:00 AM	Break coffee/tea/discussion		
11:00:00 AM	<i>The role of the urban forest in adaptation to climate change</i>	Martin Ely	Adelaide U
11:15:00 AM	<i>Vulnerability of houses to Windstorms</i>	Nandana Jayasinghe	James Cook U
11:30:00 AM	DISCUSSION	Built Environment	Chaired by Peter Graham
12:00:00 PM	LUNCH		
1:00:00 PM	Bus to the Water Research Lab (WRL) Manly Vale - 110 King St Manly Vale		Pick up point: Gate 11 Botany St UNSW
2:00:00 PM	Energy and Water	Bill Peirson	Node 4: introduction to WRL
2:30:00 PM	Coastal Adaptation options	James Carley	
3:00:00 PM	Break coffee/tea/discussion		
3:30:00 PM	WRL lab tour	Bill Peirson	Sally must leave for flight DJ965 @ 1700
4:30:00 PM	Bus return to UNSW		
5:30:00 PM	Return to hotel - free evening		

Australian Climate Change, Adaptation, Research Network for Settlements and Infrastructure Early Career Researchers Forum and Workshop
9, 10, 11 November 2009 @ UNSW



PROGRAM

Day 3: Wednesday 11 November 2009

Venue: The Design Studion 501, Level 5, Civil Engineering Building (H20), UNSW

Time	Event	Name	Comment
8:30:00 AM	Tea & Coffee on arrival		
9:00:00 AM 9:30:00 AM	Research Area - Urban Management Presentations:	Michael Taylor, Co-convenor, Node 2 - Urban Planning, Transport and Inclusion	Node 2: introduction to session
9:30:00 AM	<i>Anaerobic digestion of putrescible solid waste as a response to climate change adaptation in waste management</i>	Xian Lou	Murdoch U
9:45:00 AM	<i>Transport network vulnerability approach for climate change adaptation</i>	Susilawati	U South Australia
10:00:00 AM	<i>Modeling Cold Start Effect on Vehicle Tailpipe Emissions</i>	Ivan Iankov	U South Australia
10:15:00 AM	<i>Introducing a simple and robust neural network technique for forecasting purposes</i>	Gusri Yaldi	U South Australia
10:30:00 AM	Break coffee/tea/discussion		
11:00:00 AM	<i>Introducing MCDM (Multi-Criteria Decision Making) Techniques as a New Approach in Climate Change Adaptation</i>	Razieh Mosadeghi	Griffith U
11:15:00 AM	<i>Infrastructure Planning System for Climate Resilient Settlements</i>	Martin Anda presented by David Goodfield	Murdoch U
11:30:00 AM	DISCUSSION	Urban Management	Chaired by Michael Taylor
12:00:00 PM	LUNCH	Stakeholders join for lunch	Stakeholders join for session
1:00:00 PM 1:30:00 PM	WELCOME TO STAKEHOLDERS Research Area: People safety, education, warning and evacuation as an adaptation option	Ron Cox, ACCARNSI Convenor	introduction to broad policy issues - abstracts that address more than one research area
1:30:00 PM	<i>Assessing the suitability of climate models for water resources impact assessments</i>	Fiona Johnson	UNSW
1:45:00 PM	<i>The Modelling of Urban Water Supply, Harvesting and Recycling Systems using Network Linear Programs</i>	Andrew Graddon	U Newcastle
2:00:00 PM	<i>Identifying Adaptation Strategies through the analysis of Community Preferences</i>	Anne Weckert	Adelaide U
2:15:00 PM	<i>Principles and Problems of Shoreline Law under Climate Change</i>	John Corkill	Southern Cross U
2:30:00 PM	<i>Adaptating water resources and infrastructure to Climate Change</i>	Michael Short	UNSW
3:00:00 PM	DISCUSSION and Wrap up/Thank you	Broad policy issues	Chaired by Ron
3:30:00 PM	Break coffee/tea/discussion		
4:15:00 PM	Air travellers need to leave for the airport		