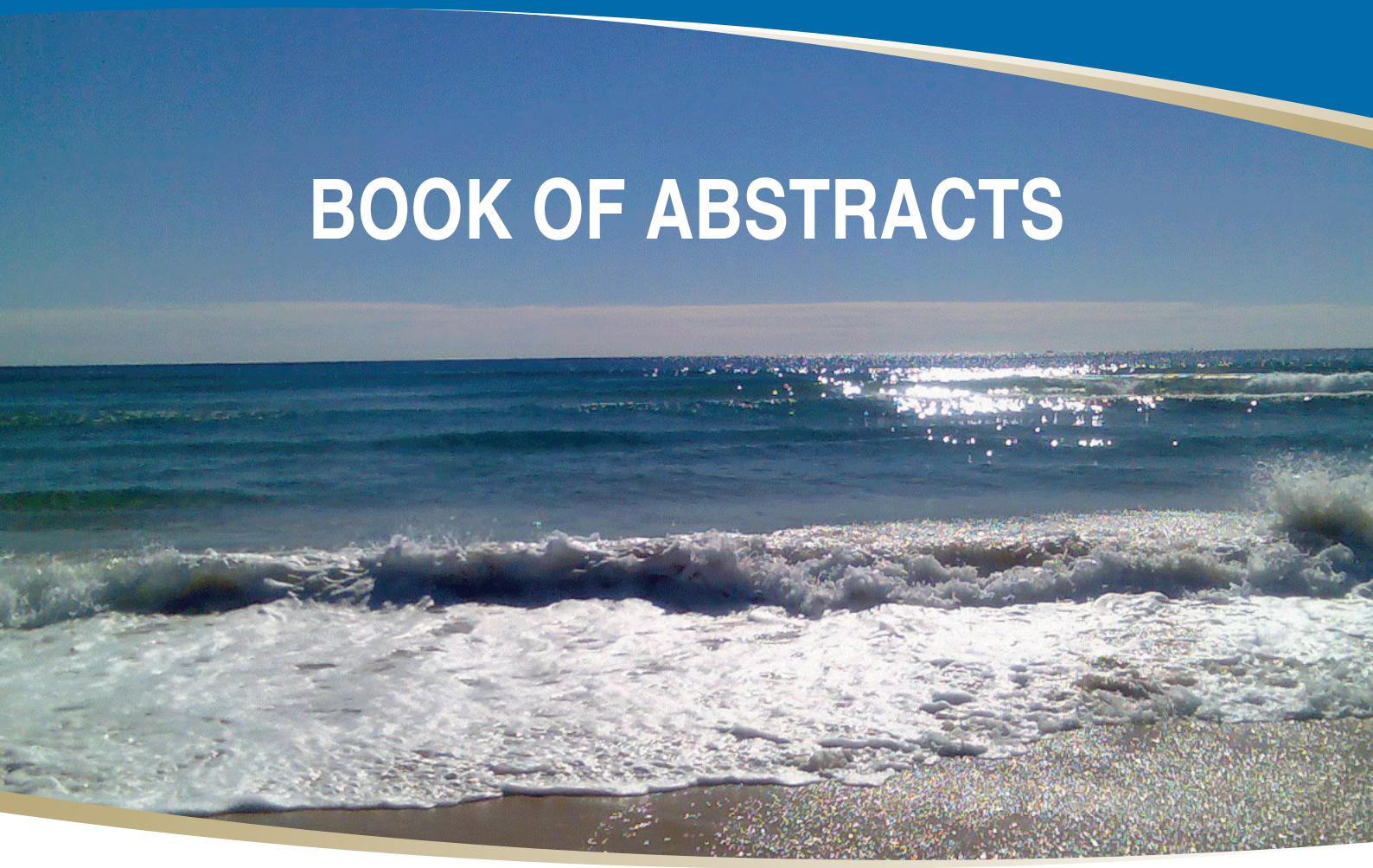
THE INTERNATIONAL SYMPOSIUM ON COASTAL ZONES AND CLIMATE CHANGE:
ASSESSING THE IMPACTS AND DEVELOPING ADAPTATION STRATEGIES

12 - 13 April 2010 Monash University Gippsland, Churchill, Victoria, AUSTRALIA



BOOK OF ABSTRACTS

MONASH University

APN
Asia-Pacific Network for Global Change Research

West Gippsland
Catchment Management Authority

State Government Victoria
Department of Sustainability and Environment

LatrobeCity
a new energy

TABLE OF CONTENTS

SYMPOSIUM SECRETARIAT

Irene Thavarajah
Manager
Conference and Events Management Office
Building 65A, Monash University
Clayton, VIC 3800
Telephone: (03) 9905 1344
Email: oce@adm.monash.edu.au

WEST GIPPSLAND CATCHMENT MANAGEMENT AUTHORITY (WGCMA)

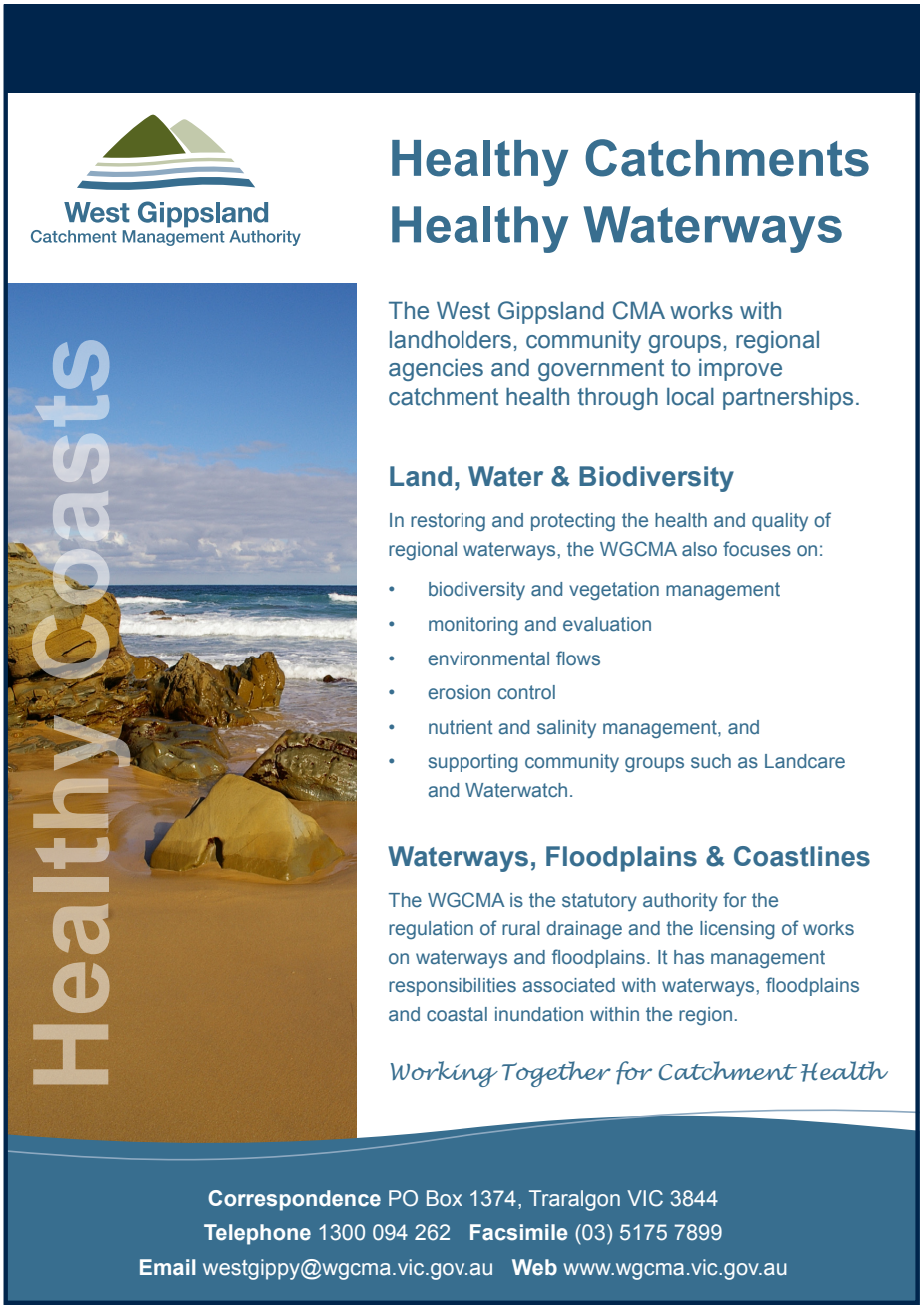
West Gippsland
Catchment Management Authority

The West Gippsland Catchment Management Authority (WGCMA) was established by the State Government in 1997 to provide integrated management of land and water resources in the west, central and south Gippsland regions.

In restoring and protecting the health and quality of the region's waterways, the WGCMA has focus in areas including biodiversity, vegetation management, monitoring and evaluation, environmental flows, erosion control, nutrient and salinity management, and supports community groups such as Landcare and Waterwatch.

The WGCMA is responsible development of the Regional Catchment Strategy and, along with planning and policy development, has a strong on-ground works commitment.

The WGCMA has management responsibilities associated with waterways, floodplains and coastal inundation and is the statutory authority for the regulation of rural drainage and the licensing of works on waterways and floodplains within the region.



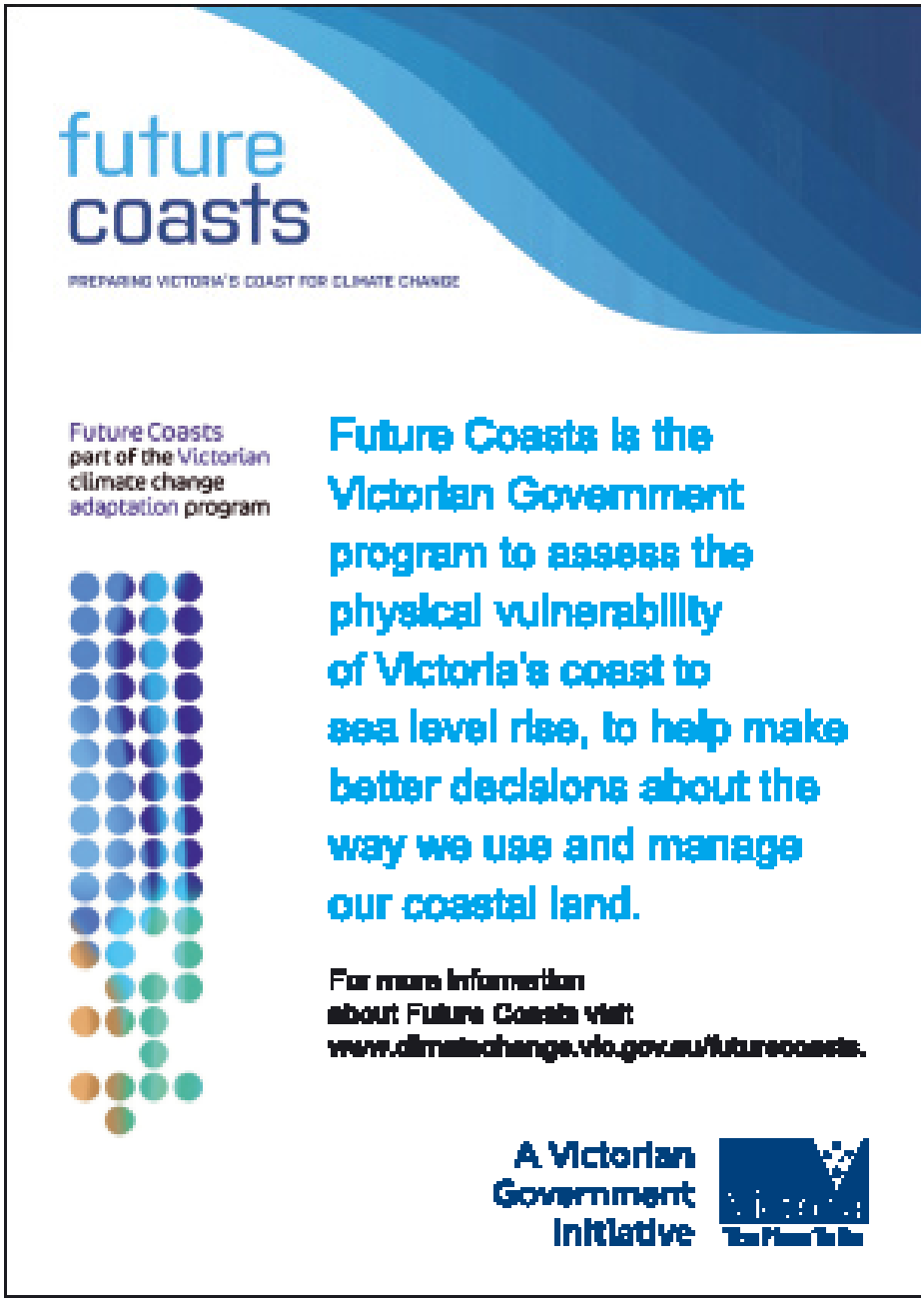
DEPARTMENT OF SUSTAINABILITY AND ENVIRONMENT - FUTURE COASTS PROGRAM

State Government Victoria
Department of Sustainability and Environment

The Future Coasts Program is led by the Department of Sustainability and Environment in partnership with the Department of Planning and Community Development.

The Program is designed to help Victoria better understand and plan for the risks associated with sea level rise along the Victorian coast. It is producing information and data, guidance material, and examining options for future government policy recommendations. This will be available to coastal land managers and decision makers to use when planning for and managing coastal areas.

Website; www.climatechange.vic.gov.au/futurecoasts



LATROBE CITY

Latrobe City is made up of four major urban centres: Churchill, Moe/Newborough, Morwell and Traralgon, with smaller townships of Boolarra, Glengarry, Toongabbie, Tyers, Traralgon South, Yallourn North, and Yinnar.

Latrobe City is less than two hours drive from Melbourne and boasts all the recreational and cultural facilities of a large diverse regional centre including the Latrobe Regional Gallery and Latrobe Performing Arts Centre with the added benefit of being nestled amongst some of the best tourist attractions in the state, such as the Morwell National Park, Hazelwood Pondage, Lake Narracan, Powerworks Museum, Victory Park and Moe Botanical gardens.

With a population of over 73,000, the beautiful and highly productive Latrobe Valley is located at the gateway to Gippsland in the South East corner of the state of Victoria. Only 70 minutes from the outskirts of Melbourne, it's surprising, it's diverse and it's substantial. Latrobe really is a new energy in regional Australia.

Latrobe City today is a culturally diverse and vibrant community with a proud history of innovation and visionary development highly innovative and creative; the Latrobe City has become the seedbed for many exciting projects.

The Latrobe City is today one of Australia's major provincial centres. Latrobe City is home to regional headquarters for significant government and private organisations.

The City has outstanding sporting facilities for tennis, athletics, swimming, and team sports, leisure centres and outstanding regional tourism attractions.

WELCOME

On behalf of the Organizing Committee, we would like to welcome you to the International Symposium on Coastal Zones and Climate Change: Assessing the Impacts and Developing Adaptation Strategies.

The symposium addresses issues related to coastal zone management at a time of rapid change and increased pressure resulting from population growth, infrastructure development and climatic change. It is designed to provide a forum for decision makers, practicing professionals, academics, researchers and students to share their knowledge and expertise in the main themes of:

- the assessment of impacts of climate change in coastal zones,
- existing and new adaptation strategies and policies, and
- the engagement of relevant stakeholders in planning for the consequences of climate change impacts in coastal areas

The symposium program features two keynote speakers, approximately 40 presentations from international and Australian presenters. The international participants include decision makers, practitioners, academics, researchers and students from more than 15 nations. The two-day program includes 11 sessions comprising 2 plenary sessions, 8 technical sessions and one special project session, as well as several social events, to promote discussion and sharing of knowledge, information and ideas.

The symposium is generously sponsored by the Asia Pacific Network for Global Change Research (APN), Monash University the West Gippsland Catchment Management Authority, the Department of Sustainability and Environment, Victoria and the Latrobe City Council, Victoria.

The Symposium is held at Monash University's Gippsland Campus at Churchill, Victoria, Australia. The campus is the only non-metropolitan campus of Monash University. Located in the Central Gippsland town of Churchill, Victoria, 160 km south-east of Melbourne, it is set on 63 hectares of landscaped grounds in the foothills of the picturesque Strzelecki Ranges.

The Gippsland region is a friendly, multicultural and dynamic place with an extensive coastline including the world renowned Gippsland Lakes System.

Once again, we would like to extend our warm welcome to all participants and we hope the Symposium provides you the opportunity to share your knowledge and learn from others in this important area of coastal zone management.

We wish everyone a pleasant stay in Gippsland and our international delegates an enjoyable visit to Australia.

Dr. Dushmanta Dutta
Chair, Organizing Committee

Dr. Wendy Wright
Co-Chair Organizing Committee

KEYNOTE SPEAKERS

Mr Duncan Malcolm AM, JP
Gippsland Coastal Board, Australia

Duncan lives on a farm at Boisdale, in Gippsland. He has over 25 years professional experience with various organizations and has a strong interest in conservation and in natural resource strategic planning and management

Former positions held include; Chair of the Rural Water Corporation of Victoria, Chair of the Irrigation Association of Australia, Commissioner, East Gippsland Shire, Chair of the Gippsland Coastal Board and Member of the Victorian Coastal Council.

He is the current Chair of the Victorian Environmental Assessment Council and Deputy Chair of the Monash Gippsland campus Advisory Council.

In 2007 he was made a Member of the Order of Australia “For services to conservation and the environment through executive roles with a range of natural resource management organizations, and to the community of East Gippsland”

Dr Kathleen L. McInnes
CSIRO, Australia

Dr Kathleen McInnes joined CSIRO in 1990. Her research interests are the impacts of climate change on the coast and her research in recent years has been the modelling of storm surges under current and future climate conditions. She has undertaken numerical modelling studies of tides, storm surges and coastal flooding in various locations such as Cairns, the Gold Coast, the Victorian coast, the NSW coast, Tasmania, Tuvalu, and Fiji. She was involved in two recently completed coastal vulnerability studies for the Sydney Coastal Councils and the Western Port Region. These studies applied integrated approaches to addressing climate vulnerability at the regional scale to assist councils in managing and adapting to the risks posed by climate change. She also has an ongoing interest in how severe weather events such as cold fronts, east coast lows and tropical cyclones may be affected by global warming. She has been a contributing author to the IPCC second, third and fourth assessment reports and more recently a lead author on an IPCC Special Report on Extremes.

ORGANIZING COMMITTEE

Dr. Dushmanta Dutta (Chair)
Dr. Wendy Wright (Co-Chair)
Mrs. Irene Thavarajah (Manager)
Ms. Helen McLean (Conference Co-ordinator)
Ms. Olga Lipkin (IT Coordinator)
Ms. Charlotte Fisher

STEERING COMMITTEE

Prof. Samuel Adeloju (Australia)
Dr. Vu Thanh Ca (Vietnam)
Dr. Hemanta Doloi (Australia)
Dr. Dushmanta Dutta (Australia)
Ms. Helen McLean (Australia)
Prof. Keisuke Nakayama (Japan)
Dr. Mafizur Rahman (Bangladesh)
Dr. Uditha Ratnayake (Sri Lanka)
Dr. Dhirendra Thakur (Thailand)
Mrs. Irene Thavarajah (Australia)
Dr. Wendy Wright (Australia)

REVIEW COMMITTEE

Dr. Dushmanta Dutta (Chair)
Dr. Wendy Wright (Co-chair)
Dr. Hemanta Doloi (Co-chair)
Mr. Jahangir Alam
Mr. Jabed Bhuiyan
Mr. Aynul Kabir
Mr. Dilip Nag
Prof. Keisuke Nakayama
Dr. Satya Priya
Prof. Mafizur Rahman
Dr. Uditha Ratnayake
Dr. Philip Rayment
Dr. Dhirendra Thakur
Dr. Ca Vu Thanh
Dr. Jianfeng Xue

PAPER REVIEW PROCESS

All technical papers presented at the International Symposium on Coastal Zones and Climate Change: Assessing the Impacts and Developing Adaptation Strategies have been peer reviewed through a formal process, outlined below.

In response to the Call for Papers inviting abstracts, the organising committee received 65 abstracts of proposed papers. Members of the organising committee evaluated all of the abstracts with regard to their suitability for the symposium. The authors of accepted abstracts were then invited to prepare a full paper for peer review.

The Reviewer Committee consisted of experts in fields relevant to the symposium themes. All papers were peer reviewed by two independent reviewers according to a set of criteria. Reviewers were asked to assess the paper against these criteria and provide comments on the paper for both the author and the organising committee. The reviewers' comments were sent to the authors. For papers accepted subject to revision, authors were then requested to revise their manuscript in accordance with reviewers' comments for inclusion in the proceedings. A total of 45 papers have been accepted for publication in the conference proceedings.

The final proceedings were edited by Dr. Dushmanta Dutta and Dr. Wendy Wright.

SYMPOSIUM TIMES

Date	Registration Times	Symposium Times	Social Events
Sunday 11 April	6.00 - 7.30pm	Comfort Inn Cedar Lodge	6.00 - 7.30pm **Welcome Reception** Comfort Inn Cedar Lodge, 1 Maryvale Crescent Morwell 3840 Victoria
Monday 12 April	8.00am - onwards **Registration**	9.00am - 5.30pm **Plenary** followed by sessions	6.00 - 8.00pm **Traditional Australian BBQ Dinner** Monash University Gippsland Campus, Bistro, Building 2N
Tuesday 13 April	8.00am - onwards **Registration**	9.00am - 5.30pm **Plenary** followed by sessions	6.00 - 8.00pm **Symposium Closing and Symposium Dinner** Monash University Gippsland Campus, Bistro, Building 2N

ABSTRACTS

Efficiency of beach nourishment projects in preventing erosion on the east and west coasts of Florida

Luciano Absalonsen
Department of Coastal and Oceanographic Engineering
University of Florida - USA
Labsalonsen@Ufl.Edu

Nourishment of the beaches on the State of Florida commenced approximately 35 years ago. The advantages of nourished beaches include reduced erosional trends, recover recreational areas and also restore habitats. The aim of the present paper is to evaluate the efficiency of beach nourishment projects in helping to control and/or reduce the erosion rates in the beaches on the east and west coasts of Florida.

The historical shoreline data base provided by the Bureau of Beaches and Coastal System of the Florida Department of Environmental Protection consists of historic shoreline positions at 3,900 monuments spaced at approximately 300 m along 1,200 km of sandy beach shoreline. These data were analyzed to quantify shoreline change trends for two different periods. The first period was used to identify the behavior of the shoreline prior to the beginning of most beach nourishment projects. This period changes from each of the 24 counties in the state but in average it goes from 1867 to 1972. The second period commences with data from the end of the early period and concludes with the most recent data (usually 2007) and was used to characterize the anthropogenic actions that changed the behavior of the shoreline (mainly beach nourishment projects).

The difference between the recent and early shoreline change rates was calculated to evaluate if the beach nourishment projects are effective in reducing erosion of Florida's beaches. Differences in shoreline change rates greater than 0.5 ft/yr were considered improving, lesser than -0.5 ft/yr the shoreline were considered worsening and between the two values they were stable.

It was found that on the east coast of Florida 51.0% of the monuments improved, 31.5% worsened and 17.5% were stable. For the west coast it was found that 48.9%, 39.8% and 11.3% improved, worsened and were stable, respectively. However, the mean rate of change for the monuments that are receding on the east coast increased from -3.08 ft/yr in the early period to -5.22 ft/yr in the recent period and the monuments that are advancing decreased from 3.66 ft/yr to 3.42 ft/yr. In the west coast these results showed an increase from -3.46 ft/yr to -3.86 ft/yr in the receding pattern, but the depositional pattern also increased from 3.99 ft/yr to 5.64 ft/yr from the early to the recent period.

Even with the reduction of the total number of monuments that are worsening, the rate of recession in the recent period is larger than in the early period in the east coast. The areas that are worsening on the west coast (39.8%) are greater than on the east coast (31.5%), but the rate of recession on the west coast is almost constant in both periods and the rate of advancement increased. The difference in the east and west coast behaviors may be explained by the exposure of the east coast to more energetic waves with greater potential to erode the beaches and also by the location of the beach nourishment projects. These results will be interpreted further during the final paper.

Quantification of Climate Change Impact on Nutrient Pollution: Application of a Dynamic Model in Latrobe River Basin, Australia

Md. Jahangir Alam and Dushmanta Dutta
School of Applied Sciences and Engineering
Monash University, Gippsland Campus
Churchill, VIC3842, Australia
E-mail: Jahangir.alam@sci.monash.edu.au

The concern over diffuse nutrient pollution has increased due to rapid urbanization and population growth all over the world. In Australia this is one of the major issues in water resource management. Climate change is worsening this situation further by affecting the hydrological and nutrient processes. This has created much public awareness and looked for sustainable development plan that ensures future development of the society with natural ecosystem protected. For this purpose we first need to assess possible impact of climate change on nutrient pollution properly, however, this very much depends on the ability of the modelling tool in predicting realistic details of pollution characteristics and its occurrence under changing hydro-climatic condition. With this focus, this study has adopted integrated modelling approach and developed a robust modelling tool that has combined catchment generation process and dynamic modelling of in-stream process for prediction of nutrient in river flow. In this modelling approach soil moisture climate driven transformation process of different land use has been considered that generates inorganic form of nutrient and transported with runoff. A soil erosion and sediment yield model has been incorporated to determine release of soil bound nutrient in river water. Model has introduced a dynamic approach for in-stream modelling by incorporating physical and biogeochemical process and solving unsteady flow and solute transport equations. Temperature effect has been incorporated in all reaction process in soil and river water. The model has been developed in the platform of an existing distributed hydrological modelling tool called DHM. So the model has incorporated all the required components for modelling hydro-climate changed based scenarios. The model has been applied in Latrobe River basin in Australia. Due to climate change and its future growth the river is likely to affect the downstream Gippsland lakes and its coastal environment. In this study nutrient pollution level at the end of 21st century has been forecasted applying projection of future climate and land use change with population growth in model simulation. GCM model output has been used for scenario development downscaling to local scale. Higher temperature enhances nitrogen release from soil and increase the stream nitrate level, and lower river flows reduce the dilution capacity of the river. This quantitative assessment will help to devise future adaptation strategy and mitigation option.

Keyword: Nutrient pollution, dynamic model, climate change impact, river basin

A Geo-Morphological Status of Tuticorin Coast Thorough Geospatial Techniques

Arumugam Achari Muthukrishnan
Department of Geography, India

The Tuticorin Coast has well-developed geomorphological landforms on the land and sea side and is dominated by a variety of coastal landforms, reaching elevations of 2-28m. Tuticorin Coast, the area for the present study is located in the south eastern coastal zone of Tamil Nadu State

ABSTRACTS

in India. It lies between 8o4'49" N - 9o22'20" N latitudes and 78o3'56" E-79o26'6" E longitudes, covering an area of 1437.20Sq.km. Much of the study area is undeveloped and retains a wide array of coastal land forms in near natural condition. However, there are a number of residential communities, primarily on the very near to the coast, that have altered the landscape and geomorphological processes. The controlled inlets at either end of the coast are a type of interactive feature that have particular roles in the passage of land along the shore. Thus, the geomorphological characteristics and configuration of the coast are products of a suite of natural processes, complemented by human actions. This paper describes the geomorphic units were drawn from remotely sensed data and checked the doubtful areas in the field. Tuticoirn coastal zone has been classified into major landforms like Fluvial,(deep buried pediment, natural levee, river, alluvial plain, flood plain, deltaic plain and delta), Fluvio-Marine identified in the study area are estuary and shoal and Marine origin (sandy plain, coastal plain, beach ridge-swale complex, stabilized dune, coastal dune, sandy beach, marine terrace, spit, cliff, sand bar, creek, salt flat, mud flat, tidal flat/tidal inlet, tombolo, island, lagoon/paleo lagoon, and coral reef) based on theoretical explanations and image interpretation elements. The features were checked with existing literatures, topographical sheets and field checks. The observed geomorphic features identification, description and distribution are explained.

Public Preparedness and Participation for Disaster Management Programmes - A Case study from South Eastern Coastal Zone, Sri Lanka

N.W.B. Balasooriya
Faculty of Applied Sciences, South Eastern University of Sri Lanka, Sammanthurai, 32200, Sri Lanka

South Eastern coastal zone of Sri Lanka is a vast coastal belt and restricted to very narrow land strip (about 1.5km width) between sea and paddy lands. This coastal zone is facing severe socio-economic and environmental problems due to very dense population and it is often affected by natural hazards like surges to tropical storms, monsoon depressions, flash floods and tsunami etc… The tsunami 2004, affected two villages; Akbar village and Maligaikadu in the South Eastern coastal belt of Sri Lanka were selected for implementing of a public participating new disaster management programme to reduce the existing unsustainable management practices.

A baseline survey was conducted to find the benefits of the disaster management and subsequent waste management activities, attitudes and views of the stakeholders and problems of the project activities. Field surveys of the study area were conducted to record the extent of damage due to earlier disasters, identify safe areas and residents preferred evacuation routes. Locations were identified for both horizontal and vertical evacuation of people to safe places. The different types of sign boards were displayed in both villages.

Public preparedness through proper awareness programmes of education and training is one of our main tasks and pre-requisites for the success of a disaster management programmes. Disaster awareness programmes for the community and the school children were successfully conducted. Sharing the knowledge and experiences, sharing resources, communication among the neighbors, community participation in shared voluntary activities have significantly improved with the functioning of awareness programmes.

For the sustainability of the project, Disaster Management Committees at the village level was established with the help of District Disaster Management Center (DMC), Ampara agreed to conduct regular awareness programmes, maintain and to management of the sign boards to protect from corrosion and damaging.

The disaster management programme and disaster mitigation should be under the Emergency Action Plan (EAP) to be executed by government and non-government organizations during and after a disaster strikes a particular region. The Emergency Action Plan should include responsibility of all government authorities to build a communication link for reaching the warning to the affected people, activating administrative people for arranging evacuation, mobilizing and relief etc…Vulnerability and risk aspects of natural hazards to work out the disaster management implications can essentially follow. This can help in designing and implementing any infrastructure development project and making decision for techno- economically feasible land use utilization in such areas with due consideration to avoid future hazards on the specific locations in the south eastern coastal belt of Sri Lanka.

Acknowledgments: CIDA RESTORE PROJECT of South Eastern University of Sri Lanka

Adaptation Strategies for Sea Level Rise Impact on Coastal Cities: A Case Study, South Western Coastal Region of Bangladesh

Md. Jabed Abdul Naser Bhuiyan, Dushmanta Dutta
School of Applied Sciences and Engineering, Monash University, Northways road, Churchill, VIC 3842, Australia
E-mail: Jabed.Bhuiyan@sci.monash.edu.au

Climate change will possess risk including increased temperature and sea level rise. Coastal zones are particularly vulnerable to climate variability and change. Furthermore, the negative impacts of climate change on coastal zones are increasing. As a result, a number of changes have been observed, including the loss or reduction in productivity of certain forest and agricultural land, increased flooding and salinity intrusion. There is a need to enhance resilience to current climate and to be better prepared to respond and adapt to impacts of climate change. In some cases, though, these changes may occur gradually providing time for adaptation. Adaptation to climate change will therefore have very important social and economic implications. The potential for developing climate change adaptation measures has become a recent focus for research. Moreover, research is needed to establish the scenarios under which the process of mainstreaming can be most effective. Current land use policies can determine whether an area will be developed in the near future hence, officials should begin today to consider options for averting adverse consequences of sea level rise. The most important decision will generally be determining which areas should be protected with dykes and which should be allowed to flood.

The study aims mainstreaming climate adaptation into coastal zone management to facilitate policy development. Here adaptation has been limited to structural adjustment for the existing dykes against sea level

ABSTRACTS

rise (SLR). South west coastal region of Bangladesh has been selected as the case study area for the implication of adaptation measures. The topography of the area is flat and gently sloping towards the sea. The river system is very complex and is affected by the downstream tidal fluctuation. Moreover, the severity of the storm surge has increased because of climate change causing failure of existing flood control structures. Salinity intrusion is a major problem in this area and it may increase due to SLR. Most of the area is covered with dykes against river flood.

To evaluate the adaptation measures, hydrodynamic and newly developed river salinity transport model have been simulated with different scenarios for the coastal zone. The hydrodynamic model uses the one dimensional unsteady dynamic wave form of St Venant's equation for river flow simulation and two dimensional unsteady equations for floodplain flow. The river salinity model uses Advection Dispersion equation in the longitudinal case using explicit solution scheme. The scenarios include model simulation with and without existing dykes. Changes due to increased dyke heights have also been simulated as a future scenario. The existing flood scenario shows large area to be inundated from river flood. With sea level rise the flood situation will be worse and the existing dykes are not capable of protecting flood against sea level rise. The future scenario shows relation between the increased dyke height and the reduction in inundation area. The outcome of this study will help policy makers for policy making to adapt with the changed situation.

Climate Change: Assessing the Impacts And Developing Adaptation Strategies Using Application of Electronic Governance And ICTs For Rural Region in India

Kalpana Chaudhari[1], Dr.Upena Dalal[1], Dr.Kishor Kulat[2], Dr.Anand Govind Bhole[3], Prof.N.K.Choudhary[4] [1]Sardar Vallabhbhai National Institute Of Technology, Surat, India; [2]Visvesvaraya National Institute of Technology, Nagpur,India; [3]ISDR , India,[4]Global Forum For Disaster Management, Mumbai, India; isdrklc@hotmail.com

The Information and Communication Technologies plays an important role in rural development . The Empowerment of Rural communities is crucial for the development of the Rural region . Brining the rural people along the coastal region in to the mainstream of the digital technologies for the assessing the impacts of climate change and mitigation is a major concern now. Rural Development implies both, the economic development of the people and greater social transformation using electronic governance. In order to provide the rural people along coastal region with better prospects and opportunities for economic development ,agriculture development and management, marketing management; increased participation of rural people along coastal region in electronic governance through information and communication technologies are envisaged .This paper aims to explore the nature, role and relevance of the Electronic/Digital Governance using ICTs and wireless technologies for assessing the impacts of climate change and mitigation for agriculture and rural development along coastal region and its impacts to highlight approaches and methods for improving local environmental governance, having particular regarding to the range of interests and actors involved in e-governance, ICTs. The paper will examine the current status of electronic governance in India in different coastal regions and different technologies involved in e-governance process for the assessment of impacts of climate change and natural disasters along coastal regions. The paper will focus on development of the model for the e-governance using ICTs /wireless technologies for agriculture development in rural coastal region with respect to climate change and its impacts.

Kalpana Chaudhari is Post Graduate Student at SV National Institute of Technology, Surat, India working on the project-Studies on Application of Electronic Governance Using Information and Communication Technologies For Rural Development. She had obtained the B.E. in Electronics Engineering from DBAM University ,Aurangabad ,India and the Post Graduate Diploma in Urban Management from IHS, Rotterdam, The Netherlands. She is having 15 years academic and research experience. This research project aims to develop the e-governance model for social-economic development using ICTs. The study of this research project aims to explore the nature, role and relevance of the Electronic/Digital Governance using ICTs and wireless technologies for rural development, agriculture development, climate change and rural environment management and its impacts to highlight approaches and methods for improving local governance, having particular regarding to the range of interests and actors involved in e-governance, ICTs for risk management, climate change, agriculture and economic development and rehabilitation, social change using e-governance etc.

Climate Change Impacts in Coastal zones: Context Bangladesh

Md.Sazedul Karim Chowdhury, Bangladesh

Elevated co2 level has made vulnerable the entire planet and Bangladesh in no more exception, rather is extreme in its coastal zones in respect of sea level rise, intensified-long duration rain and frequent catastrophic cyclones. Though the sea level rise is not yet that much significant in Bangladesh coast, vulnerbility is lying with other climate induced impacts like erosion, salinity and repeated hit by cyclone with 5-10m high surge. 730 km long coast line is protected with dykes and may take care for a level of 20-30 years projection height according to IPCC. But during the cyclone when surges hit the coastal belt then its a total catastrophe and their increased frequency is changing the livelihood of the 30 mil people in coastal areas. Sidr, Akash, Bijili & Aila are the four storms in the last 2 years generated from Bay of Bengal and every time left their devastration through out the coast line causing huse loss of lives and properties. The country is located in the shadow of Himalayas and flashing 147000 sq km land every year with 14 billion m3 of water through three major rivers Ganges-Brahamaputtra-Meghna , initiated from different locations of Himalayas. Snow and glaciers are only the source of dry flow in these rivers specially in Ganges and Brahamaputtra. Climate posed impact already started decaying the glacier volume resulting decrease in dry flow. This phenomenon has invited the saline water far inside the coastal areas during the high tide in the sea as because upstream flow cannot push back any more the sea water and that is causing soil contamination on both banks of streams network. This has initiated the biodiversity loss and agriculture disaster. Again unprecedent flood which is also a climate induced event causes severe bank erosion more then before along the whole stretch and travelling long way from Himalayas, these rivers collect 1.1 billion ton sediments annually. Rivers are naturally wide in the coastal reaches and having less velocity sediment deposition is increasing gradually . As a result drainage congestion is a new dimension in the coastal areas causing many water hazards. In such a way climate change vulneabilities are increasing gradually in the coastal zones of this flood and cyclone prone country. Bangladesh has

ABSTRACTS

developed state of art technology both in cyclone and flood forecast with strong disaster Management policy SOD (standing Order of Disaster) and so far has achieved good progress for the mitigation of the disasters specially decreasing the loss of lives. Similarly NAPA (National Policy for Adaptation) for the climate induced disasters has been introduced. Mitigation and Adaptation are now working hand-in-hand and is a way for the regillience of climate Change impacts.

Impacts of Sea Level Rise and Climate Change on Waste Water Reticulation Systems in the Coastal Regions of Gippsland, Victoria

Joseph P Daniel
Dr.Dushmanta Dutta
Monash University, Gippsland Campus, Victoria Australia

Australia, being an Island continent is highly vulnerable to coastal erosion and infrastructure damage due to sea-level rises resulting from climate change. The sewer reticulation systems are not an exception. Increase in sea level will directly and indirectly affect the sewer reticulation system. Research needs to be carried out to quantify the impacts of climate change in the coastal regions and design criteria to be reviewed, to mitigate or adapt to the impacts of climate change in the waste water reticulation system. When the sea level rises, the ground water table in the coastal towns also increases. Although much of Australia is expected to dry because of climate change, increases in extreme rainfall are still expected in many regions. The most extreme events could increase in magnitude even where mean rainfall decreases. This will affect the sewer reticulation system in many ways, like increased infiltration, reduction of self cleansing velocity, and odour problems due to the longer time spent by the solids in the pipes. There is also the risk of ground water table being polluted by the sea level rise, leading to diseases and death. Hence the type of reticulation systems in the coastal towns must be water tight (like pressure sewer system and decentralised system) to avoid infiltration.

The aim of the research project is to quantify the impacts of sea level rise and climate change on sewer reticulation systems in the coastal zones and suggest mitigation methods or adaptation strategies to cope up with the changes. The specific objectives are to simulate the impacts of climate change in a working calibrated sewer model, analyse understand and quantify the impacts in an existing waste water reticulation system based on the modelling and suggest adaptation strategies or mitigation methods in future designs. The examples of impacts are, increase in rainfall intensities, reduction in rainfall, reduction in sewer flows due to grey water reuse and water restrictions, increase in population, increase in ground water table due to sea level rise or decrease in ground water table due to use of ground water to supply water to the reticulation system, change in the physical catchment characteristics, etc.

The model is used to simulate various scenarios individually and collectively to assess the impacts of climate change and quantify them. The simulated outputs give us a chance to quantify the impacts of the possible effects of climate change on the catchments and their characteristics. These results can help in designing the sewer reticulation systems in future to cater for the impacts of climate change. The solutions may vary from , “Do nothing”, or increase the slope of the pipes, or change the material of the pipe, increase or decrease the diameter of the pipes, Increase the capacity of the wet well and or emergency storage, special odour control systems etc. The paper presents the outcomes of the project with several case study applications in selected townships in Coastal zones of Gippsland Region.

Multicriteria Decision Modeling For Analysing Sustainable Management Strategy

Hemanta Doloi, Senior Lecturer
Faculty Of Architecture, Building And Planning
The University Of Melbourne, Australia

Protection of coastal regions due to changed climatic conditions has become a serious concern over recent years. According to many published research, vulnerability of the coastal structures and risks in social, environment and economic health in coastal regions due to climate change is at the highest stake. Sustainable decision making requires an assessment of impacts and consequences of underlying factors impacting development and operational of projects. An appropriate response strategy should be devised to achieve the desired project outcomes and long terms prosperity of the coastal regions. In order to devise sustainable management strategy, relative importance of the factor impacting social, economical and environmental concerns are investigated by using a structured questionnaire survey approach. Two separate survey questionnaires were conducted questions covering 22 criteria and 11 sub-criteria under three board impact areas: Social, Economical and Environment. Based on a brainstorming session with five country collaboration, five possible alternative strategies have been devised. By utilising the Analytical Hierarchy Process (AHP), relative impacts of the criteria on the alternative strategies have been analysed towards establishing the optimal strategy. The outcomes of this study should assist the management decisions among policy makers in determining the effect on diverse challenges due to climate change and suggest possible improvements to establish the appropriate management procedures for sustainable outcomes.

An Integrated Modelling approach for Assessment of Impacts of Climatic Changes on Coastal Zone Systems

Dushmanta Dutta
School of Applied Sciences and Engineering
Monash University, Australia

For comprehensive understanding the changes in the physical processes due to combined effects of climate and human-induced changes, a spatially distributed process-based integrated approach, is essential, which models the different inter-connected processes at appropriate spatio-temporal resolutions. A holistic approach that combines physical modelling with vulnerability assessment tool to coastal zone management is needed to resolve the conflicting demands of society for products and services, taking into account both current and future interests. Agenda 21 and in particular its Chapter 17 ‘Protection of The Oceans’ reaffirmed this need. Given these scenarios, the real challenge in achieving optimal sustainable management strategy in coastal zones relies on the ability to design, develop and implement an integrated management program that not only maximizes benefit to society and economy based on accurate understanding of the impacts of changes in physical processes, but that also ensures that the ecosystems are adequately protected or preserved.

ABSTRACTS

The paper presents an innovative integrated tool for accurately capturing changes in hydro-biogeochemical processes in coastal zone systems in the context of climate change and anthropogenic forcing, for identifying sound metrics for assessment of impacts of these changes for examining long-term adaptation and mitigation measures for sustainable management. The paper focuses on selected coastal zones in the Asia Pacific region.

Keywords: Climate Change, Coastal Zone System, Sea Level Rise, Triple Bottom Line

Ballast Water Management and Climate Change in the Coastling of Nigeria [Paranomic View]

Ediang Okuku. Archibong
Marine Division, Nigerian Meteorological Agency
Pmb1215 Oshodi Lagos, Nigeria. Ediang Aniekan Archibong, Ekhameye P.O, Akpofure R.Delugba T Search And Resue Division

One of the four greatest threats to the worlds ocean currently the most pressing marine environmental issue is the introduction of harmful aquatic organisms and pathogens into new marine environment via ships ballast water. At least one foreign marine species is introduced into a new environment every nine weeks.

Ballast water transfer of harmful organisms is an international problem needing international solution. In Nigeria, especially the Niger Delta area [coastline] which include Delta, Edo, Lagos, Akwa Ibom, Cross River, Rivers, Bayelsa States. The impacts of climate change events vary, the most devastating being the loss of life. Many of the impacts are long-lasting and complex especially when there is a rapid changes in climate will most likely alter the composition of ecosystem with some species benefiting while others unable to migrate or adapt fast enough may become extinct. The paper discusses the human health ecological and economic impacts can be severe, economic losses due to ballast water introduction in Nigeria coastline is currently running into billions of Nairas also the numbers of ships entering into Nigeria from 1980 to present is mention.

The paper conclude by the role ballast water can play especially in influencing pollution, introduction of alien marine life are threaten and have added to the list of the endangered species, specified proposal and available information and know how to provided through modern climate services. Also to provide forum policy makers in maritime,shipping association and water treatment specialists.

Issues of Groundwater Management in Asia Region

Gemunu Herath[1,2], Uditha Ratnayake[1], Shinichiro Ohgaki[2,3] and Yatsuka Kataoka[2] *(1-Department of Civil Engineering, University of Peradeniya, Peradeniya, 20400, Sri Lanka, 2-Institute for Global Environmental Strategies (IGES), 2108-11 Kamiyamaguchi, Hayama, Kanagawa, Japan 240-115, 3-National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba 305-8506, Japan)*

Over the years groundwater is considered a valuable water resource as it provides reliable, high-quality and low-cost water at all seasons. Thus many cities all-over the world has being depending on groundwater for most their water needs. Anyhow in recent years, as a result of urbanization/ industrialization, uncertain weather, increased waste discharges etc. have increased the stress placed on this precious resource. In many cases, in response to the growing demand for water, often groundwater has being haphazardly over extracted with no due consideration given to concerns further aggravating the problem. Hence in order to evaluate current status and future trends, the groundwater management practices adopted in seven Asian cities; Bangkok Thailand, HCMC Vietnam, Bandung Indonesia, Tianjin China and Colombo and Kandy Sri Lanka was compared during this investigation to highlight the groundwater management issues facing these cities.

The study shows that in many of the case study cities, groundwater has been a reliable source for drinking and for other purposes over the years. However, problems such as water table drawdown, decreasing yield, land subsidence, saline water intrusion created by over extraction, and coliform, nutrient, heavy metal contamination created by untreated waste disposals has reduced the usefulness of this resource affecting development activities in many of these cities.

The present groundwater dependency in these cities expect for Bangkok is in excess of 50%. Therefore, supplementing this heavy groundwater demand using the limited surface water resources available have been a major constraint for effective groundwater management. Therefore groundwater is still being over abstracted in many case study cities and problems such as rapid resource depletion and land subsidence are widespread. For example, the cumulative (observed maximum) groundwater level depletion recorded in Bandung during the last 50 years exceeds 84m and in Bangkok, the land subsidence of over 93cm was observed. Further, the recent data available show continuing water level depletions in most case study cities.

With respect to groundwater contamination, both natural and anthropogenic pollution is observed in many instances. Arsenic is a naturally occurring pollutant that has been identified as a serious in many Asian cities. However, in none of the case study cities, strong cases of arsenic contamination are reported. Instead, fluorine contamination is observed in Tianjin region. Of the anthropogenic pollutants, nitrate and coliform are the most commonly reported pollutants at the case study cities.

Analyzing all available information clearly shows that the groundwater overexploitation and pollution has already created many problems throughout Asia and lack of consistent and reliable data has made it difficult to ascertain main causative factors behind them. With very little emphasis given to monitoring and research, improvement in this respect in near future is very bleak. Moreover, inadequate policy options in place too have intensified this issue further. Anyhow, the recent policy changes happening in some case study cities (imposing groundwater taxation, encouraging alternative sources, strict implementation of laws, compulsory recycling etc.) can look forward to a better groundwater management in the region even with possible future water scarcities under anticipated climatic variations.

ABSTRACTS

Enhancing Coastal Resilience in Asia against climate change: Challenges and Measures

Srikantha Herath and Hidayat Rahman
Institute for Sustainability and Peace United Nations University, Tokyo, Japan

According IPCC WGII report (IPCC WGII, 2007) Asia has 11 mega cities covering more than 10,000 km2. Most of these regions are highly populated and are important production systems that also are home to unique bio-diversity. Climate change can seriously affect most of these regions due to increase in flood risk, intensifying typhoons and adverse impacts associated with sea level rise and loss of bio diversity. Vietnam, Bangladesh, Myanmar, China Thailand and Pakistan are some of the countries that are especially vulnerable. Sea level rise pose threats to both water security and food security as salinity intrusion can seriously affect food production in fertile agricultural areas such as Mekong. In addition to these mega deltas, there are a large number of small islands that are extremely vulnerable to sea level rise.

Response to UN's call for National Adaptation Programmes of Action (NAPA) from the Least Developed Countries (LDC), 13 projects on coastal zones and marine ecosystems have been prioritized, mainly by small island nations. In the national communications to UNFCC, the 3rd highest concern (after water and agriculture) was the effect of climate change in coastal and marine ecosystems, as reflected in the communications by 53 parties. How should Asia prepare against these potential threats? Increasing population, accumulation of assets and urbanization are already making serious negative impacts to coastal regions. At the same time, the large uncertainty of climate change predictions at spatial resolutions that are necessary to make risk assessment at local level makes it more difficult to divert investments from urgent immediate challenges. This paper examines a number of proposed and ongoing response plans in the region to discuss appropriate strategies that would improve the coastal resilience and support sustainable development.

Impacts of Sea Level Rise on Flood Characteristics in the Lower Mekong Basin

S. Hironaka[1], D. Dutta[2] and. M.J. Alam[2]
[1]NEWJEC Consultants, Inc, Japan
[2]Monash University, Australia

This paper presents the outcomes of flood inundation modelling in the Lower Mekong Basin. The main objective was to evaluate the impacts of sea level rise on flood inundation simulation characteristics in the study area. A fully hydrodynamic modelling system has been applied which is a combined one and two dimensional (2-D) flow modelling approach. In the model the floodplain area is modelled as separate two-dimensional surface girds that are connected to the main river by means of links (overflow structure). The model is quite capable in dealing with regional flood analysis. The link determines the flow exchange between the river and surface based on the dikes or embankment elevations in the river cross section. The terrain features like roads railways and embankments are considered in the model along with associated bridge and culverts. In the river flow model the boundary condition is discharge for the upstream, and water level in the downstream, which are based on the observed data. The downstream boundary conditions were adjusted to incorporate projected sea level rise by IPCC. The paper presents the outcomes of the flood modelling demonstrating the influence of sea level rise on flood inundation characteristics.

Meeting the Challenges of Climate Change Impacts on the Coastal Zone of Sri Lanka

Upali S. Imbulana. Sri Lanka

Sri Lanka's coastal zone is important as a natural resource as well as a zone of heightened economic activity. As a natural resource, it consist of several wetlands rich in biodiversity. As a zone of high economic activity, the zone accommodates industries, urban centers and a nationally important transportation network, while being an area of high population density. As a result, the consequences of natural and man-made disasters, including those due to climate change, are heavily felt.

The current driving forces influencing the sustainability of the coastal zone include economic activities in the coastal zone as well as those of inland. The relevant economic activities outside the coastal zone include irrigated agriculture. Over-exploitation of resources and pollution of water bodies from economic activities are some of the pressures created by these driving forces. Irrigated agriculture, though practiced outside the coastal zone has also created pressures on coastal ecosystems. Such pressures have created a state of vulnerability in the coastal zone as evidenced during the Asian tsunami of 2004. Recent studies carried out in the coastal zone, especially in the protected wetlands have revealed the impacts resulting from the current pressures.

The impacts of climate change on the coastal zone have been predicted to a certain extent by scientists, and action plans have been formulated to address them. However, the impact on water resources can create extra pressures and increase the vulnerability of the coastal zone. Conservation of natural resources can sometimes result in conflicts with maintaining livelihoods such as fisheries, agriculture and sand mining. Livelihoods are often associated with poverty. The emerging situation calls for integrated natural resources management, with adequate stakeholder participation.

There are several policies, legislation, and strategies that deal with the protection of Sir Lanka's coastal zone, and management of water resources. However, gaps and overlaps in the policy framework and institutional setup have been identified. Knowledge about climate change has not sufficiently influenced the national development policies. Therefore, improving on scientific assessment of the state of coastal zone, filling the policy gaps while ensuring the harmony between development policies and conservation policies, framing strategies and linking with existing strategies such as poverty alleviation, improving institutional coordination and filling the knowledge gaps are identified as the major responses to the emerging challenges. Improved security situation has provided access to the entire coastal zone and this can be considered as an opportunity. Recent technological advancements in management of disasters and impacts of climate change can be considered as under-exploited opportunities.

ABSTRACTS

Analyzing Impacts of Climate Change on Sediment Dynamics in River Basins using a Process-based Distributed Modeling Approach

Md. Aynul Kabir and Dushmanta Dutta
Monash University Gippsland, Australia

Sediment dynamics in a river basin e.g., soil erosion, sediment transport and deposition are accelerating in an alarming way due to the present climate change conditions such as increasing rainfall intensity and frequency, changing land use pattern, etc. The impacts of an accelerated sediment dynamics in a river basin are recognized as a global threat to sustainability of nature since soils are a major component of enormous environmental processes and on the other form, sediment controls lake and river pollution extensively and ultimately it would create an adverse impact on coastal region. In addition, further worsening impacts due to future climate change conditions are predicted to be inevitable. Thus, sediment dynamics under climate change conditions will provoke enormous social, environmental and economic impacts. An improved adaptive technology would be one of the best approaches to address future impacts. The global parameters (e.g. mean sea level, global temperature and rainfall, etc.) under future climate change conditions have already been satisfactorily and quantitatively estimated. The impact of global climate change processes at local scale will be entirely uneven. Many hydrological components are also expected to be changed adversely both spatially and temporally at local scale due to climate change conditions that would trigger a high soil erosion and sedimentation. Hence, quantitative estimation of a watershed sediment dynamics under climate change conditions by considering the change of mean sea level, temperature, rainfall and land use, etc. will help to adopt an appropriate adaptation system into conservation policy and management.

In fact, precise estimation of sediment dynamics under climate change conditions has now become one of the greatest challenges to engineers in devising environmental regulation and planning for sustainable natural resource management. Different hydrological processes govern sediment dynamics in a river basin which are highly variable in spatial and temporal scales. Thus, the study has undertaken several approaches and their integration strategies to estimate sediment dynamics under climate change conditions. This includes (1) to integrate sediment processes (soil erosion, sediment transport and deposition) with an existing process-based distributed hydrological model; (2) to model hillslope sediment micromechanics using high resolution spatial and temporal data; and (3) to simulate sediment dynamics with respect to climate change conditions. In this method, water flow and suspended sediment concentration at different surface girds and river nodes are modeled using one dimensional kinematic wave approximation of Saint-Venant equations. The amount of soil erosion is estimated by adopting suitable physical equations after a comprehensive review. The paper describes the modeling approaches and the outcomes of its application on Latrobe River basin, Australia. Elevation data from Shuttle Radar Topographic Mission (SRTM) has been used with spatial datasets (land use, rainfall and soil classification data, etc.) consistently using raster “Geographic Information System (GIS)” tools. To date, the model simulates runoff for historical flood events at the Latrobe River basin and its associated sediment dynamics reasonably well. Model application for climate change conditions is now underway.

Keywords: *sediment dynamics, climate change, process-based sediment dynamic model, kinematic wave, Latrobe River basin.*

Climate Change and Management of Coastal Lagoons in the Westland Region, New Zealand

Claire L. Kain
University of Canterbury, Christchurch, New Zealand

Coastal lagoons are dynamic and diverse systems, which respond rapidly to sea-level, tectonic, meteorological, anthropogenic and other synergistic drivers. The impact of climate change on coastal environments is a function of the balance and interaction between changes in sea level, wave energy, river flow and sediment supply. The Westland region experiences a high energy wave climate and high precipitation levels, and climate change has been predicted to result in increased storminess in the area. This paper examines the potential impact of climate change on two choked coastal lagoons (Totara Lagoon and the Shearer Swamp-Waikoriri Lagoon complex) in Westland, New Zealand and investigates the potential changes in these systems under different dominant forcing factors and management regimes. This is achieved by documenting the current geomorphology, hydrological processes and recent outlet migration, in order to predict how these lagoons may change in the future under varying sea level, catchment dynamics, and management regimes. Geographical Navigation Satellite Systems (GNSS) surveys and GIS analysis using *ArcGIS* software were used to map the current features and elevation of representative sections of each study site, producing a baseline for predictions of future morphodynamic change. Analysis of aerial photographs from 1948 to present shows changes in the position of the lagoon openings over time, of up to 1.5 km in the case of Waikoriri Lagoon, and up to 6 km for Totara Lagoon. These systems have been artificially managed at times. Short and long term records of water depth, salinity and water temperature taken at each site assess the relationships between outlet position, the waterbody and its dynamics. Totara Lagoon exhibited a significant degree of tidal influence up to 5 km from the outlet, and the hydrology of Waikoriri Lagoon changed dramatically in response to a sudden, artificial change in outlet position. Measures of conductivity are strongly influenced by the position of the outlet, which affects the tidal influence upon the system. Dramatic changes in land-use and management in the areas surrounding these sites and their catchment zones has occurred over the past 150 years, resulting in changes in the hydrology and sediment supply to the systems. Coastal erosion is already causing problems in the Westland region including loss of land and infrastructure. Sea level rise associated with climate change would exacerbate this problem, and in the case of these lagoons, would likely result in barrier rollback and lagoon system migration if natural processes prevail. If management strategies attempt to halt such natural processes to preserve farmland behind, then loss of the lagoons or significant changes in morphology are likely to result. However, if increased storminess was to lead to an increase in fluvial input and sediment supply, this may offset the erosional effect of sea level rise. These findings are applicable to other dynamic lagoon and estuarine environments in a management context, especially as concerns of climate change grow.

ABSTRACTS

Developing Climate Change Policy in Coastal Cities: Lessons Learned from Miami-Dade County

Liguang Liu
Department of Public Administration, College of Arts and Sciences
Florida International University (FIU), USA

Climate change has risen to dominate environmental and development agendas. Climate change will affect a vast number of human and natural systems. Due to the precarious location and unique geographic features, the coastal cities are particularly vulnerable to the effects of global warming, such as the increased flooding in low-lying areas, higher risk from extreme weather events, inundation and shoreline recession, saltwater intrusion into groundwater.

Although a consensus has been reached that all levels of government and society should involve in the global mitigation and adaptation efforts, however, the critical path from research findings to policy making, and eventually onto practice has been murky and rarely examine, which proves to be challenging for public authorities in the coastal cities. On the one hand, coastal cities need to participate in the global actions to mitigate the future greenhouse gas emissions; on the other hand, it is imperative for the coastal cities to implement policies to adapt to expected future changes. Given the reality of increased but spatially different climate change impacts, as well as the differences in capacity, economic costs and political will, it is of vital importance for the coastal cities to share experience and lessons learned from the other counterpart cities that have developed and implemented climate change policies in the local area.

Building on archival survey and interviews, this research seeks to have an in-depth study of Miami-Dade County's climate change policy development process in relation to its political and institutional context and provide some lessons that other local jurisdictions can learn from. In detail, the central aims of the research are to provide an historical overview and evaluation of Miami Dade County's climate change activities; to provide an explanation of the evolution of local climate change policy development; and to identify the driving forces that have influenced the effectiveness of the program activities.

Miami-Dade County is located in the southeastern costal part of the State of Florida, USA. The County's climate change action can be traced back to the early 1990s, when it adopted and implemented the Long Term CO2 Reduction Plan to control the local carbon emissions. Since 2006, with more evidence indicating the negative climate impacts on the local development, the County government has adjusted its climate strategies and sought to integrate the mitigation and adaptation activities.

Through the case study, the paper concludes that localizing global climate change is an important step in developing municipal response to global warming; however, to formulate and implement effective climate change policies for coastal cities, the local governments need to make greater efforts in developing local institutional capacity, promoting community engagement, improving governmental operations, and strengthening inter-governmental cooperation and collaboration.

Coastal Zones and Climate Change in Brazil Southeast

Roberto Luiz do Carmo - UNICAMP
César Augusto Marques da Silva - UNICAMP

Current global climate change will potentially increase environmental risks for population settled in low elevation coastal zones. According to the IPCC Report (2007), in the next decades those populations will face a growing number of extreme events such as landslides, floods and storm-surge floods, which could happen in association with the rising of the sea level. Brazil has 8.000 km of coastal zone, which are a locus of intensive urban use and economic activities, especially related to tourism, petro-chemical industries and seaport transportation. This paper focuses the relation between demographic and environmental changes on three coastal and metropolitan municipalities of São Paulo State, located on the Southeast of Brazil. These municipalities are representative of the most part of the processes that occur in the Brazilian coastal zone. These are Guarujá, São Vicente and Bertioga, all located in São Paulo State. The total resident population is around 650.000 inhabitants. These municipalities are part of the Baixada Santista Metropolitan Region, an important area for industrial activities and tourism. It contains the biggest seaport of Brazil - port of Santos - considering the total amount of containers transported and has an intensive summer-related tourism, with residences, hotels and structures for these services. This scenario is responsible for irregularities in space occupation, resulting in segregation and different exposures to environmental risks. In special, the municipalities considered in this paper have deep differences in their urban space, although they are geographically close. Bertioga has tourism as its main economic activity, with large luxury condominiums for second residences. It´s the smallest city in the region, but the one with the biggest population growth rate. It already experiences floods in isolated points. Guarujá is totally located on the Santo Amaro Island Santo Amaro, and even though it is primarily a touristic city, it partly contains the seaport of Santos. Most of their permanent dwellers live in places away from the sea, facing more serious floods and landslides. São Vicente, partially located on the São Vicente Island, has bigger commercial services and a smaller area for tourism, partly because of the minor expansion and the quality of its beaches. Their population copes with floods and problems related to the drainage system, mainly on the island portion. Considering this background, the main purpose of this article is to map environmental risks due to climate change, and evaluate how many people will be exposed to these risks, such as the characteristics of this populations and their capacity to face these risks. In this paper we consider the risks of sea level rising and floods, thinking that extreme events related to these risks will be a set of changes in rainfall and sea level. To achieve this goal we use georeferenced tools that map the distance of the population to the sea and to the rivers. We use census information, from year 2000 (census tract spatial level) and 2007 (municipality level). We examine data about changes in rainfall in the past 50 years (comparing average levels of rain in 1961-1990 with the ones in 1990 and 2000 decades). Then we analyze the characteristics of the populations exposed to these risks and how the local public policies are (or are not) being planned in concern with climate changes and demographic issues, at municipality and state level. This paper is part of

ABSTRACTS

an ongoing research, and the primary findings make possible to conclude that: 1) in different levels, all the local population will be affected by the environmental changes, due to the environmental specificities (flat land close to high slope mountains); 2) the economic activities, like tourism and port, can be affected and create problems for the local economy; 3) even the rich population groups, part settled in front of the shoreline, will be affected; but the largest problems, in terms of resilience, will be faced for the poor people, which live in some areas of the coastal zone.

Kushiro Wetland Restoration Project
Hiroshi Miyake
Kushiro Development and Construction Department,
Hokkaido Regional Development Bureau, Japan

In 1980, Kushiro Wetland is registered as the Japan's first Ramsar site, which is the largest wetland in Japan and whose area is about 200 km^2. Kushiro Wetland has more than 2,000 wildlife species and magnificent natural environment. Kushiro Wetland also plays a great role in flood control for people living around the coastal areas. The wetland provides the other essential functions for people, and the valuable asset must be conserved for the future. With the expansion of industrial and commercial activities (e.g. development of farmland and residential land, the straightening of rivers, the deforestation of the surrounding area) in recent years, however, the area of the wetland has decreased dramatically, and wetland vegetation has also changed significantly. Concretely, the area of the wetland decreased more than 30% and the area of alder forest, which grew in drier areas than reeds and was the index of the aridification, increased to fourfold in recent 60 years.

Therefore, the Kushiro Wetland Restoration Committee was established by local residents, NGOs, experts and the national and local governments in order to advance Kushiro Wetland restoration projects through cooperative efforts. The members of the committee and local residents are working toward the preservation of the precious wetland for future generations.
In March 2005, the Kushiro Wetland Restoration Committee formulated the Comprehensive Concept presenting the basic policies of nature restoration. This plan includes the goals of nature restoration, methods for achieving the goals, principles for the implementation and the role of the participants and local residents.

By 2009, 6 implementation programs based on the Comprehensive Concept were formulated and conducted by the national government, the local government, NGO and so on, and Ministry of Land, Infrastructure, Transport and Tourism(MLIT) is engaged in 2 implementation programs.

The one program is composed of recovering old meander channels and floodplains in order to conserve and restore the river and wetland ecosystem at Kayanuma District and the other is composed of developing sediment-retarding basins at the point where the river enters the wetland, stabilizing river channel, developing riparian forests and buffer zone and so on in order to reduce sediment discharge into the wetland at Kuchoro River.

In the symposium, we would like to introduce the present situation and problems of Kushiro Wetland and activities for conserving and restoring Kushiro Wetland.

Impact of sea level rise on inundation in Kushiro Wetland
Keisuke Nakayama, Kiyofumi Onishi and Yohei Sugawara
Kitami Institute of Technology, Japan

Climate change has been found to influence the occurrence of disaster and give damage on environment. Climate change has induced higher category typhoons and induces sea level rise, which increases disaster due to storm surges or flood events. In Japan, 46% of the total population is in the coastal areas which occupy 32% of the land only. Therefore, disaster due to flood or storm surge would cause much more serious damages in the coastal areas.

Kushiro Wetland has been registered by the Ramsar treaty, which is the largest in Japan and is highly developed. The population around the coastal area of the wetland is about 230,000. The main river flowing thought Kushiro wetland is Kushiro River whose river length is 154 km and river basin area is 2510 km^2. Kushiro wetland is revealed to have important ecological system, whose biodiversity has to be conserved. Therefore, Kushiro wetland is expected to have larger influence of sea level rise and is considered one of the most suitable areas to investigate the effect of sea level rise on flood events.

Regarding scientific contribution, there are so many questions left in the wetland which have to be solved urgently, like water circulation, mass transport, morphodynamics and so on. If the sea level rises, flood events would cause serious damages on the developed areas and the ecological system in Kushiro wetland. Therefore, it is needed to investigate the effect of sea level rise in the wetland. In this study, we thus make an attempt to understand the impact of sea level rise on ecological system. To investigate the influence of flood events when sea level rises, a simple distributed hydrological model was applied. All the necessary data are provided by the Ministry of Land, Infrastructure, Transport and Tourism. As the results, the effect of sea level rise on inundated area was evaluated.

Loch Sport - Planning For Climate Change
Penny Neumann, Geoff Taylor, Adam Dunn
West Gippsland Catchment Management Authority, Australia

Loch Sport is located on a sandy peninsula between Lakes Victoria and Reeve in the Gippsland Lakes, in eastern Victoria. The town ranges in elevation from 0.5m AHD to 25m AHD, with approximately 300 of 2800 lots subject to flooding from the surrounding lakes. The Gippsland Lakes are seperated from Bass Strait by an outer barrier dune, which currently provides protection from swells and storms.

The low lying part of town is highly susceptible to flooding under current climatic conditions, from a number of factors including catchment inflows, wind set-up, tidal influence and increased mean sea level as a result of low atmospheric pressure. Predicted changed climatic conditions will increase the risk of flooding in the town, including an increase in the 1 in 100 year flood level as mean sea level rises.

Pressure exists for intensification of both permanent residential and visitor accommodation within Loch Sport, however best practice floodplain management guidelines suggest that development in lower lying areas of the town is not compatible with the existing or future flood hazard.

ABSTRACTS

Under future climate conditions, assuming a mean sea level rise of 0.8 metres, it is likely that flooding will be more frequent, to greater depths and therefore impact upon an increased number of landowners. Survey data indicates that a number of parcels of land on the fringes of the lakes are below 0.8m AHD, and are therefore likely to be wholly and permanently inundated by 2100.

Development in low lying areas of Loch Sport needs to be addressed strategically rather than the current ad-hoc basis. Council, the community and the floodplain management authority need to work together to ensure that appropriate planning tools are put in place to manage the existing and future flood risk.

Floodplain management seeks to reduce the exposure of people and property to flood hazard, in order to reduce the likely damages associated with flooding. Development within low lying coastal towns often contradicts best practice floodplain management, in that it seeks to intensify development and maintain or increase population growth.

The floodplain management authority seeks to balance growth of the town with management of the flood risk, to ensure future development in Loch Sport is sustainable.

Government Policy has required the floodplain management authority to consider mean sea level rise. However no direction has been given on how this should be done. This exposes the floodplain management authority and the Community to uncertainty and further complicates floodplain management in the region.

The challenges we are facing are not unique to the Loch Sport community.

Adaptation to climate change will require a coordinated and strategic response, which acknowledges existing settlements, and prepares communities for the future.

Strategic planning is a key tool to ensure that sustainable development in towns such as Loch Sport continues, while acknowledging that some areas will not be suitable for development as our climate changes. However planning decisions are being made now by individual councils and floodplain management authorities without strategic direction from state and federal government on how to respond.

Low Income Coastal Economies and the Threat of Climate Change - A Study of the Northeastern Region of Peninsular Malaysia

Khairulmaini Osman Salleh and Fauza, A.G
Department of Geography, University of Malaya, Malaysia

Low Income Coastal Economies would continue to predominate many of Malaysia's coastal and island regions. These systems are usually managed by the household family unit with additional labour been utilized from outside the family and employed on a semi-permanent and seasonal basis. In Peninsular Malaysia these low income economies are often associated with small scale rural or cottage industries that are usually dependent on the use of manual labour and limited utilization of capital. These rural activities are very structured, needs certain level of skill and experience, follow a predetermined cycle of operations which in most cases are subjected to the conditions of the environment. This paper discusses part of an ongoing research findings of a study carried on the low income economies of the coastal regions of the Northeast of Peninsular Malaysia. The study identifies a number of low income coastal economies in this coastal region that are associated with fishing, agriculture and cottage activities and examines the socio-demographic profiles of the operators, the cycle of activities pertaining to each economies, and how the activities are being dictated to conditions of the environment. Low income coastal economies play a very important role in maintaining the wellbeing of the rural populace of the Northeast region of Peninsular Malaysia. However, changing environmental conditions affects the cycle of operations of the economies and has strong implications on the wellbeing of the coastal rural family unit. The study shows that the low income economies are very vulnerable systems and easily succumbs to changing environmental conditions, which could become much worst with the impending threat of global warming and climate change which could / or have influence the behavioural patterns of the Northeast Monsoons and Low Oceanic Pressure Cells of the South China Seas. In anticipation of these increasing threats from changing environmental conditions the low income coastal economies need to reinforce their ability to adapt to the changing conditions. The study also proposes a number of strategies on how to increase the resilience of the low income coastal economies to changing environmental conditions. The incorporation of a comprehensive early warning system is considered and effective measure to increase resilience to potential threats of climate change.

Keywords: low income coastal economies, climate change threat, vulnerability, adaptive capacities, early warning systems

Climate Change Adaptation Strategies of Selected Coastal Communities in The Philippines

Dr. Linda M. Peñalba
Institute of Agrarian and Rurban Development Studies
College of Public Affairs
University of the Philippines Los Baños
College, Laguna 4031 Philippines

The Philippines, being an archipelago, has a long shoreline that extends up to 34, 000 km. Much of its 7, 100 islands are at risk of inundation due to sea level rise. Other climate change impacts like coral bleaching, sea water intrusion, coastal erosion, and flooding of coastal zones have also been observed.

The local government units (LGUs) are in the forefront of disaster risk management (DRM) including climate risk management (CRM). Their enhanced capacity to cope with climate change impact is necessary to formulate effective and sustainable adaptation strategies to minimize risk and prevent the recurrence of disaster.

This paper presents the results of a study that aimed to analyze Philippine DRM policies, assess the adaptive capacity and adaptation strategies of LGUs and coastal communities to climate change impacts and draw policy implications for more effective and sustained adaptation.

The study covered five coastal municipalities located in three Luzon provinces. Three of these municipalities have an average elevation of 1.3-

ABSTRACTS

1.5 meters above sea level and are experiencing the impact of accelerated sea level rise and sea water intrusion. Two municipalities are exposed to storm surges that destroyed houses and fish pens along the coasts. Data were collected through key informant interviews and focus group discussions with LGU officials and community residents.
Results of the study show that the existing Philippine DRM policies were designed to address only the extreme climatic events such as typhoons, which require emergency relief and rescue response. Policies and protocols to address the problems associated with accelerated sea level rise and sea water intrusion have not yet been formulated. Moreover, the magnitude of these problems has not yet been fully assessed and decision makers are not yet aware or conscious of such problem.

Results of the study also show that: a) the adaptive capacity of the LGUs is quite low; b) their adaptation strategies are more reactive than pro-active; c) long-term solution to protect coastal communities from flooding have not yet been formulated; d) LGUs have limited capacity to institute long-term measures that could prevent the recurrence of disaster and e) their adaptation strategies are not based on scientific risk and adaptive capacity assessment. Only one LGU has long-term adaptation plan and climate change adaptation policies to redirect urban and business development away from risky areas and enforce local ordinances to regulate land use and ground water withdrawal. Some communities have developed simple adaptation strategies that merely accommodate and live with the risk.

Effective and sustainable adaptation strategies anchored on strong LGU and community partnership should be instituted to minimize exposure to risk and mitigate the impacts of climate change on coastal zones. Among the possible adaptation options are: a) construction of coastal zone protection system (e.g., dikes); b) regulation of settlements along the coasts; c) construction of flood control system; d) strengthening of LGU-community-private sector networks and linkages to expand their response capabilities; and e) institution of localized and community based early warning system.

Regional Climate Change Adaptation Knowledge Platform for Asia
Satya Priya
UNEP RRC.AP, UNEP ROAP, SEI, and SENSA

The Regional Climate Change Adaptation Knowledge Platform for Asia has been developed to respond to demand for effective mechanisms for sharing information on climate change adaptation and developing adaptive capacities in Asian countries, many of whom are the most vulnerable to the effects of climate change. The *Adaptation Knowledge Platform* supports research and capacity building, policy making and information sharing to help countries in Asia adapt to the challenges of climate change. The *Adaptation Knowledge Platform* will seek to facilitate climate change adaptation at local, national and regional levels and to strengthen adaptive capacity of countries in the region - while working with existing and emerging networks and initiatives.

The Adaptation Platform supports mainstreaming of climate change adaptation into regional economic and development policies, working together in partnerships, complementing and bridging existing and emerging networks and knowledge. Activities that are implemented by the Adaptation Platform fall under three main components:

- generation of new knowledge on climate change adaptation,
- translation of science to policy relevant knowledge, and
- Working towards an effective knowledge sharing system, at regional and national levels.

This initiative is established jointly by the Stockholm Environment Institute (SEI), the Swedish Environment Secretariat for Asia (SENSA), the United Nations Environment Programme (UNEP) Regional Resource Centre for Asia and the Pacific (UNEP RRC.AP) with support from the Swedish International Development Cooperation Agency (Sida).

In 2009 activities have been initiated in the five pilot countries, Bangladesh, Cambodia, Nepal, Thailand and Vietnam, with local partners mobilized and key knowledge and capacity gaps identified. While some working is still going on, however, key findings of 2009 activities of the platform will be presented in this conference.

Effect of climate change in coastal belt of Bangladesh
Md. Abdul Quadir
Dhaka City Corporation, Dhaka Bangladesh

Simply, climate change means any change in climate over time. Any change in climate would lead to destabilization of environmental and social conditions around the globe. These disturbances could jeopardize the conservation of natural ecosystems and sustainability of socioeconomic systems. The least developed countries like Bangladesh that is highly exposed to those disasters. The impacts of climate change on coastal areas in Bangladesh could be severe and in some areas catastrophic. It is estimated that a 1-m rise in sea level could displace nearly 15 million people from their homes in Bangladesh. The coastal areas of Bangladesh is different from rest of the country not only because of its unique geo-physical characteristics but also for different sociopolitical consequences that often limits people's access to endowed resources and perpetuate risk and vulnerabilities. Coastal areas include coastal plain islands, tidal flats, estuaries and offshore waters. It extends to the edge of a wide continental self. A vast river network, a dynamic estuarine system and a drainage basin intersect the coastal zone, which made coastal ecosystem as a potential source of natural resources, diversified fauna and floral composition, though there also have immense risk of natural disasters.

There are six seasons in Bangladesh which is disappearing due to climate change. Summer & rainy seasons are prolonging, whereas winter season is shrinking. In Bangladesh, natural disasters have occurred frequently. Cultivable land has damaged by saline water intrusion from Bay of Bengal and every year rivers engulf enormous agriculture fields and homesteads, makes the peoples homeless. About 75% area of mangrove forest, Sundarban will submerse if the sea level will increase 45 cm. If the sea level rise 1 m then the islands of Bay of Bengal and whole Sundarban will destroy including its fauna & flora. Low-lying non-embankment coastal area may be completely inundated. It will increase the risk of coastal salinity. Rainfall patterns are changed due to climate change - crops yields are expected to drop significantly. More droughts are decreasing food production and increase malnutrition. Scarcity of saline free drinking water will increase

ABSTRACTS

highly. Death rate and diseases of fish will be increased. Production of sweet water fish will shrink and extinct if the sea level rise. More floods are contaminating water. Increasing water borne diseases such as cholera, diarrhoea etc. High salinity in water will affect human health. Finally, if the global temperature rises by 2° Centigrade, 30% of all land species will be threatened by an increased risk of extinction.

Cost Effective Adaptation Strategy for the Disaster Prone Areas of Coastal Areas of Bangladesh

Md. Mafizur Rahman
BUET, Bangladesh

Bangladesh is a disaster-prone country that is affected almost every year by some form of tropical cyclones. Among the 508 cyclones that have originated in the Bay of Bengal in the last 100 years, 17 percent have hit Bangladesh, amounting to a severe cyclone almost once every three years. Of these, nearly fifty three percent have claimed more than five thousand lives. As a low lying country, most of the southern regions of Bangladesh go under water during surge and face uncountable damage by destructive wind speed. Agricultural fields lose their fertility due to erosion, sedimentation, sea-spray and saline water intrusion. These also affect the availability of water and soil for all kinds of human activities. Damage of crops and vegetations affects national food production and security. Loss of lives, livestock, damage of crops, contamination of water sources, destruction of house, transportation system, embankment and other development structures not only stop the flow of livelihood at a sudden, these infirm the long term social, health care, economic development and policy of the country. Every year, government needs to allocate huge amount of budget for the relief, medication, subsidy and post-disaster phase of socio-economic recovery, reconstruction and maintenance works in coastal area. Adaptation capacity of people in this region is noticeable.

During the disaster, there is shortage of water supply and food apart from the loss of homestead, crop and livestock. Lack of infrastructure for suitable sanitation leads even to worse health condition of the victims. Loss of the rural roads leads to a missing link for the supply of relief and rehabilitation facilities at the quickest possible time. This paper aims at a conceptual adaptation strategy for the coastal population of Bangladesh at an affordable manner. The recommended strategy involves minimum intervention to the existing locality and thus a minimum of cost being involved with the maximum possible facilities to available at the end of the victims specially during and immediately after the disaster. The main theme of the adaptation strategy is the modification of the landscape to the smallest extent in order to facilitate the shelter for human being and livestock, storage of harvested crop, water supply, sanitation and the transportation network. This paper also proposes the saline water tolerant crops be considered for those areas. The paper proposes the minimum coastal zone that should be brought under the adaptation strategy at the initial pilot stage. The ecological balance of the affected locality is also considered in the adaptation strategy as well.

Coupling Rainfall Downscaling and Flood Modeling for Reliable Flood and Damage Forecasting

Uditha Ratnayake, D.A. Sachindra, K.D.W. Nandalal. Sri Lanka

Flood plains of coastal city, Matara, in Sri Lanka are a populated area owing to the expansion of the city. The flood plains are now protected with dykes and there are few occurrences where they failed to sustain the flood. Also there are instances where in very high rains the flood plains were inundated due to failed drainage system. Most of the settlers are unaware of any impending floods and there is no flood warning system. This paper presents a system for reliable flood forecasting system that can be used in general and its applicability to damage assessment is tested for Matara city.

The data available from Global Circulation Models were first downscaled to the basin level. Four nesting levels were used in the downscaling model. Gridded precipitation values covering the basin for selected past high rainfall events were thus derived. The downscaling used the WRF (Weather Research and Forecasting Model) version 3.0 running on PC. The observed rainfall at the rain gauging stations in and around the basin were converted to an equivalent gridded precipitation using distance weighted method and compared with the downscaled rainfall distribution from WRF. Various model schemes in WRF were tested to obtain the best combination of the schemes to predict the rainfall in monsoon affected tropical climates.

Most accurate rainfall distribution was then coupled with HEC-HMS model to obtain the event based rainfall - runoff relation. The model was first calibrated with the observed rainfall and runoff values and the same parameters were used in the flow prediction with the WRF outputs. The runoff contributions by the streams flowing to the flood plains were calculated and these were used in 1-D steady flow model to predict the runoff and water levels along the river. In this case HEC-RAS model is used.

The verification of the results is difficult as the flood inundation extents during the past events were not known. The levels remembered by the peoples in the area were used in this case to verify the results. The previous collected damage data in conjunction with the inundation results were used to calculate possible flood damage prediction.

Results indicated that the model is making slightly conservative inundation depth estimates. The reason was somewhat over prediction of the inundation depths. This can be attributed to the steady and 1-D nature of the model. The damage function depended only on depth of inundation and therefore damages were not well represented. Use of dynamic 2-D model may lead to realistic results and with such models the velocity of flow can also be incorporated in damage estimation.

ABSTRACTS

Barriers and Bridges to the Effective Engagement by Local Government of Key Stakeholders in Coastal Climate Change Policy and Plans

Neil Lazarow[1,2] & Stephen Dovers[1]
[1]Fenner School of Environment and Society, Australian National University, Canberra & [2]Griffith Centre for Coastal Management, Griffith School of Environment, Gold Coast Campus, Griffith University QLD 4222

Our understanding of the coastal environment, new participants and evolving dimensions continue to test institutional arrangements and the capacity of scientists, decision-makers, politicians and other coastal stakeholders. This begs new approaches. Where there is competition for space on the coast, hard decisions must often be made about how land is zoned and subsequently used. This is compounded by the likely impacts of climate change in many coastal areas. In an era of increasing emphasis of stakeholder engagement in environmental management, and of focus on the crucial importance of the marine and coastal zone, the actual and potential role of marine and coastal communities and stakeholders has been little documented or analysed. This paper describes the results of an investigation into the challenges and opportunities for public involvement in the management, use and conservation of coastal resources in Australia, with lessons from overseas, including through the development of coastal adaptation strategies for local government.

A study was carried out from 2004-2009, using a multi-discipline and multi-method approach based in the social sciences to investigate: the challenges for incorporating local or lay knowledge into planning and decision-making for integrated coastal management (ICM); the economic impact and value of coastal resources; and to understand how coastal communities compete politically. The research was progressed through seven Australian (three each in Queensland and Victoria and one in Western Australia) and three international (two in the United States and one in Chile) case studies and focused strongly on the drivers and responses to engagement in ICM. The investigation found a number of institutional challenges that hindered or prohibited the progression of effective community involvement in the public policy process. These include but are not limited to: inability to effectively coopt non-government actors; challenges to the concept of sustainability; high transaction costs relative to the scope, capacity and interest of government; lack of effective mechanisms; institutional marginalisation through the political process; loss of corporate knowledge, low internal capacity and capacity to develop meaningful policy; low capacity for institutional learning; and inadequate timeframes. At the local government level in particular a range of issues were identified as being significant barriers to good policy making. These include: challenges around infrastructure and asset management; scale; resources (e.g. knowledge, funding and capacity); legal issues; risk; conflicting roles; and unreasonable demands by funding agencies.

Coastal planning and management in Australia is characterised by complexity and is notable for flux within polices, programs, institutional arrangements and funding. Sustainability policy dictates a widening of the policy community and debate in order to help define problems. Further, there is recognition that solutions to complex environmental problems requires the 'long-term integration of economic, social and environmental policies' (Ross & Dovers, 2008, p. 245). This tests the policy making capacity of governments on a number of fronts, however, there are significant opportunities to improve practice and outcomes around: strategic planning; a clear articulation of responsibilities; improved capacity building; monitoring and evaluation; and the use of innovative tools to assist with the resolution of ICM conflicts.

Community Engagement in Analyzing their Livelihood Resilience to Climate Change Induced Salinity Intrusion in Sundarbans Mangrove Forest

Shibly Sadik
Junior Environmental Specialist,
SMEC Bangladesh Pty Ltd. Bangladesh.
Rezaur Rahman
Professor, Institute of Water and Flood Management,
Bangladesh University of Engineering and Technology, Bangladesh

The world heritage site 'Sundarbans mangrove' in the south-western part of Bangladesh is not only a biogenic coast rich in biodiversity but it also provides buffer for lives and livelihood opportunities to 3.5 million people living in its adjacent areas. Around 1.5 million people directly depend on the Sundarbans for their livelihoods that makes the Sundarbans a unique example of human-environment inter-relationship. Wood cutter (Bawali), honey collector (Mawali), fisher (jele), fuelwood collector, and snail and oyster collector are the major livelihood groups directly dependent on Sundarbans. Sundarbans is highly vulnerable to expected climate change and the climate change induced salinity intrusion is being observed distinctly. Coupled with the poverty, the changing status of the Mangrove ecosystem makes the livelihood dependent on it more vulnerable. Adaptive governance, and engagement of the community in policy research and strategy formulation is still awaited to practice. This study is aimed to analyze the livelihood resilience of the Sundarbans dependent community to climate change induced salinity intrusion with iterative engagement of the community in the research process. The resilience analysis of livelihood groups offers elements of adaptive strategy to the policy makers for mitigating the vulnerabilities.

The overall study has been conducted through participatory approach, based on capital based sustainable livelihood assessment (SLA) method. Each stage of the research process (hazard analysis, resilience analysis and formulate adaptation strategy) has been done with community participation through shared learning dialogue (SLD) that provided iterative transfer of information, knowledge and experience between community and researcher. The SLD provided opportunity of refining and verification of the research concept and process with the community engagement through series of iterative learning meeting with different livelihood groups (wood cutters, fishers and honey collectors) dependent on the Sundarbans mangrove forest. A capital based indicator framework was followed for resilience analysis. The indicator framework was made operational by developing word scenarios for each of the indicators that outlined best case to worst case. Weighing of indicators, development of word scenarios for each indicator and the employment of the indicator framework were done through series of iterative learning meetings with Sundarbans dependent livelihood group. This way, the SLD provided base of analyzing the contribution of each livelihood capitals (natural, financial, physical, social and human) to livelihood resilience that gives indication of what to be prioritized in formulating adaptation strategy. Through the study, it has been found that the livelihood resilience of the wood cutter is very low. The weightage of natural capital in contributing livelihood resilience is highest

ABSTRACTS

but its contribution score is lowest due to deteriorated forest health and high vulnerability to salinity intrusion, which gives indication of prioritization of natural capital in formulating adaptation strategy.

Resilience Planning for Coastal Zone Management
Fernando Teigão dos Santos | mail.fts@gmail.com
Faculty of Science and Technology, New University of Lisbon (FCT/UNL), Portugal

According to the Human Impact Report on Climate Change (Global Humanitarian Forum, 2009), the impacts of climate change are happening right now. Events like weather-related disasters and rising sea levels, affect individuals and communities around the world, especially those living in coastal areas where the human pressure over resources (land, water, food) is increasing. Coastal zone management is focusing on adaptive strategies in order to prepare those socio-ecological systems to deal with higher levels of disturbances, with planning processes moving towards resilience keeping.

Resilience has been described as the capacity of a system to absorb disturbance and re-organize while undergoing change, so as to still retain essentially the same function, structure, identity and feedbacks (Walker et al. 2004). Resilient coastal areas are more adaptable to change, are more able to learn and are less vulnerable to disturbance and external shocks (e.g. natural phenomena, human hazards). Planning for resilience is not to be seated waiting for disturbances to happen, in order to cope with their impacts. Planning for resilience is all about being pro-active, focusing on adaptation and learning processes (individual, organizational and social), being less dependent on laws, regulations, strategic goals and bureaucratic procedures, which can bring order and orientation but also inflexibility, inefficiency and conflict.

The paper will explore the potentialities of the resilience theories for planning and management of coastal areas, reflecting on the existing theoretical framework but will also present the example of a methodological proposal called SPARK - as the acronym of Strategic Planning Approach for Resilience Keeping. The key idea is that resilience can be enhanced through planning processes in order to prepare the coastal systems to adapt to challenges like the climate change and others.

Changes in Copepod Community in a Tropical Mangrove Estuary: An Approach to Climate Change
S. K. Sarkar and B. D. Bhattacharya, India

Decadal changes of copepod community in Indian Sunderban mangrove regions at the estuarine phase of Ganga River was recorded. On a regular one month interval basis zooplankton samples were collected using a Ring Trawl Net (Hydro-Bios No. 438 700, Germany), mouth area 0.78 sq. m, mesh size 200 µm. The volume of water filtered was measured by a calibrated Flow-meter (Hydro-Bios No. 438 110, Germany) mounted in the mouth of the net. The net was trawled on water surface for 10 minutes for each sampling. The zooplanktons was fixed with 4% buffered formaldehyde solution and taken to the laboratory for further analyses. Simultaneously, surface water samples were collected for the analyses of dissolved oxygen, biological oxygen demand (BOD), chemical oxygen demand (COD), inorganic nutrients (nitrate, phosphate and silicate), water temperature, pH, salinity, turbidity, transparency and chlorophyll pigments (a, b, c) by standard methods. Six copepod species (*Saphirella indica, Pontella andersoni, Pseudodiaptomus binghami, P. hickmani, Cladorostrata brevipoda* and *Laophonte sp.*) which were abundant during 1980s are absent in recent samples which make them sensitive beacons of climate-induced biological changes. In contrast, four copepod species, namely *Bestiolina similis, Acartia tortaniformis, Parvocalanus dubia and Canthocalanus pauper* dominated recent times suggesting a shift in the functioning of the pelagic ecosystem. A peculiar element of regularity in the structure of copepod assemblage was represented by temporal succession of species within the genera *Oithona* and *Paracalanus* suggesting ecological differentiation among the congeners. The positive correlation between any two pairs among the families Paracalanidae, Pontellidae, Eucalanidae, Oithonidae, Temoridae and Corycaedae provides evidence that these families combine to form a group by themselves while the family Pseudodiaptomidae showed negative correlation with other families. Sharp decline in the copepod diversity was observed during profuse bloom of a centric diatom *Hyalodiscus* sp., coinciding with exponential increase of chlorophyll a and chlorophyll c. High diversity index was associated with evenness reflecting the multidominance pattern in diversity. The multiple regression analyses show that the density of total copepods was controlled by water temperature and salinity. The data indicate the extreme flexibility of copepods in adapting to a fluctuating and hostile environment and thus acting as causal link between climate change and alteration in biodiversity in Ganga River Basin (GAB).

Adaptation Strategies and Policies of LGED of Bangladesh in the Coastal Areas
Momin Mozibul Haque Shamaji, Local Government Engineering Department (LGED), Dhaka, Bangladesh

Bangladesh is one of the most climate vulnerable countries in the world and will become even more vulnerable as a result of climate change. Climate change will severely constrain the country's ability to achieve the high rates of economic growth needed to achieve and sustain these reductions in poverty. Local Government Engineering Department as a major public sector nation building department has undertaken Adaptation Strategies and Policies on Climate Change in the coastal areas. Such investment has already put a positive impact on national economy by mitigating damages and losses of property and lives in the coastal area. LGED's experience need to be shared with the international community. This paper would mainly highlight the Adaptation Strategies and Policies on Climate Change in the coastal areas of Bangladesh with an assessment of the activities undertaken.

The main objective of this paper is to share the Local Government Engineering Department's Adaptation Strategies and Policies on Climate Change in the coastal areas of Bangladesh with an assessment of the implemented interventions.

Adaptation is the prime need for Bangladesh in the short to medium term and the country is a global leader in adaptation research and implementation. Like other Government of Bangladesh (GoB) departments, LGED has

ABSTRACTS

Adaptation Strategies and Policies on Climate Change in the coastal areas of Bangladesh. The salient features of Strategies and Policies are to repair and rehabilitate existing infrastructure (e.g., rural roads, river embankments and drainage systems, urban drainage systems) including raising the Formation Level of the Rural Roads, paths, tracks and plinth level of the Buildings of the above the normal flood level, and ensure, effective operation and maintenance systems.

Plan, design and construct urgently needed new infrastructure (e.g., cyclone shelters, coastal and river embankments and water management systems; urban drainage systems, river erosion control works, flood shelters, flood proof roads, earthen mounds) to meet the changing conditions expected with climate change.

Undertake strategic planning of future infrastructure needs, taking into account the likely (a) future patterns of urbanisation and socio-economic development; and (b) the changing hydrology of the country, with climate change.

Undertake small-scale flood management schemes to raise the productivity of low-lying rural areas and protect them from the extremely damaging severe floods; Improve small-scale irrigation schemes to enable farmers to grow a dry season rice crop in areas subject to heavy flooding;

Carry out afforestation program in the coastal areas in order to promote Coastal 'greenbelt' projects.

These investments in 'climate proofing' the country have had a major impact on economic growth and poverty reduction. Over the last 10-15 years, the number of fatalities from natural disasters has declined, as the country's ability to manage risks, especially floods and cyclones, has evolved and improved and community-based systems have been put in place. We must scale up this work urgently. The resources currently available for adaptation are grossly inadequate to meet the needs of the country.

To do this we have already made climate change an integral part of our national development strategy and have started to build the country's capacity (communities, civil society, the private sector and government) so that we are able to tackle the impacts of climate change, in a routine way, as part of the development process. Any delay will increase the risks associated with climate change, which could be expensive to manage later on but, more importantly, the human costs will be immeasurable.

Impact of Climate Change in Coastal Zones of India and Adaptation Strategies and Policies for Environment and Food Security

U. C. SHARMA[1] and VIKAS SHARMA[2]
[1]Centre for Natural Resources Management , V.P.O. Tarore 181133, District Jammu, J & K, India
2S.K. University of Agricultural Sciences and Technology, Chatha-180009, Jammu, J & K, India

The coastal zone represents the transition from terrestrial to marine influence and vice versa. It comprises not only shoreline ecosystem, but also the upland watersheds draining into coastal waters, and the near-shore sub-littoral ecosystem influenced by land-based activities. India has a 8,129 km long coastline in the mainland, and major island ecosystems are Andaman and Nicobar group of island and Lakshadweep islands. The seas around India have rich fishery resources with an annual catch of 2.95 million tonnes against a potential of 3.90 million tonnes. The marine fishing industry consists of 2 million fishermen living in 2400 fishing villages, catching fish with about 180 thousand artisan crafts, 30 thousand mechanized boats, 1.5 thousand landing centres and about 40 fishery harbours. Annual production of shrimps is 75,000 tonnes. However, the coastal zone is very vulnerable to cyclones, currents and frequent tides. Sea level rise due to global warming has been predicted and its implication to coastal zone could be disastrous. Besides soil, climate and water related factors limiting crop productivity, the entire shoreline is extremely fragile, with an element of uncertainty to the life and property of the inhabitants.

Prudent policies and sound programmes are necessary to reverse the harmful effects of human activities and weather adversities. Erosion of land by sea in the coastal areas or by river waters has to be minimized by suitable cost-effective measures. The government of India has several strategies to develop coastal ecosystem which state, intra alia; the states and union territories should undertake the requisite steps to put a stop to indiscriminate occupation of coastal strips and their exploitation. Each coastal state should prepare a comprehensive plan, keeping in view the environment and ecological impacts, and regulate development activities accordingly. Water resources management for diverse uses should incorporate a participatory approach by involving not only governmental agencies but also users and other stakeholders in various aspects of planning, design, development and management of water resources schemes. A role for women should be envisaged. Private sector participation should be encouraged in all these aspects. The Indian Government has started Western Ghats Development Programme (WGDP) and Integrated Wasteland Development Project (IWDP) to develop coastal areas by investing huge amounts under five-yearly plans for resource conservation and enhancing crop productivity. The major development strategies for these areas include; development of fisheries, integrated watershed development programme, shifting cultivation to be replaced by integrated agriculture-horticulture programmes, improvement of cattle, strengthening marine and inland fisheries, reclamation of pokhali lands and maximizing crop productivity. In coastal ecosystem of India, diverse and sensitive nature of resources like soil, water, climate, flora and their interrelationships, are too delicately balanced to maintain ecology of the region. For optimal and integrated management of these resources, relevant strategies have to be further worked-out, taking all stakeholders into confidence, in order to improve environment and ensure enduring food security.

Keywords: Vulnerability, climate change, coastal zones, adaptation strategies and policies, environment and food security

Indian Fishery - A Victim of Climate and Technological Change

Dr. Kakoli Singh, India

It is an unfortunate but acceptable fact that the fisheries are on a decline in a world wide scale primarily because of two reasons: human greed in the form of over-fishing and coastal ecological changes resulting in declining fish stock. Indian fishery sector is no exception which over the last two decades has become victim of both climate change and modern

ABSTRACTS

western fishing techniques. Climate changes have altered the production and distribution of some commercially important pelagic fishes from Indian waters like the sardines and mackerels. Like many other tropical pelagic fishes, Indian mackerel and Indian oil sardine have shown population crashes The negative impact has been huge and the traditional fishing community has been worst hit.

The aim of the paper is to highlight the plight of these traditional fisher folk who are at the crossroads of climatic and technological change and lack adaptability to combat this crisis. The paper also aims to exemplify this case with some practical case studies.

Qualitative research technique with secondary literature survey substantiated by primary case studies.

Attempt to suggest some practical solutions to the problems of these traditional fishing communities.

Climate change is projected to cause massive changes in the environment which are on a scale unprecedented in the last 1,000 years. The causative factors of climate change are the greenhouse gases, viz., carbon dioxide, methane, ozone and nitrous oxide. The most confident projections on the fall-out of climate change are for the amount of warming and changes in precipitation.

Climate change has major impact on fisheries sector. The gradual increase in temperature could have had a critical effect on marine fisheries which calls for a detailed study. Lack of economic security often leads to indiscriminate harvest of resources resulting in irreparable damage to the sector. Stressing the need for increasing fish production through freshwater aquaculture is perhaps one solution.

Considering the enormity of the problem and the need to address the issues connected with climate change and marine fisheries including sea food security and livelihood, the paper attempts to highlight these issues and forward suggestive measures to policy makers for assessing the merits and demerits of these policies for implementation of a comprehensive, inexpensive and eco-friendly policy in the benefit of the Indian fishery sector in general and the traditional fishermen in particular.

Developing Adaptation Strategies Due to Climate Change: With Special Reference to the Vulnerable Small Scale Fisheries Sector in Central Java Province - Indonesia

Indah Susilowati, Tri Winarni Agustini**, Agus Hartoko***
**Faculty of Economics, Diponegoro University*
Jl. Erlangga Tengah 17, Semarang 50241, Indonesia
Phone 62-24-8442273, 8449211; Fax. 62-24-8442273
Corresponding Author: Email: indah-susilowati@rocketmail.com
***Faculty of Fisheries & Marine Science, Diponegoro University*

One of the densily populated province in Indonesia is Central Java. Population of this province is about 34 million persons. It shared for significant role in man-powering fisheries sector in Indonesia. The situation of vulnerable fisheries resource somehow made fishers and other parties (who engaged in fish production-chained) uneasy and uncomfortable. As of now, many parties might not prepared sufficiently for climate change. In Northcoast part of Central Java, there are several important landing places, e.g. Tegal, Pemalang, Pekalongan, Pati and Rembang, whereas Cilacap is the biggest landing place in Southern coast of Central Java. From those landing places signaling for changing in: fish production, season time, sea-tides and others indicators of climate change.Therefore, indeed need to outline the grass-root strategy on mitigation and adaptation for the climate change in fisheries sector.

The main objective of the study is to find out the evidence due to climate change shock toward the fisheries sector (with special reference to small-scalers) in Central Java, Indonesia. The specific objectives are: (1) to identify the climate change evidence in fisheries sector; (2) to analyse the socio-economic aspects on vulnerable fisheries sector; (3) to estimate the impact of climate change on fisheries sector using economic valuation approach in the selected pilot projects; (4) to formulate a strategy on mitigation and adaptation for the fisheries sector. Primary data are collected from fishers in the study area with suitable sample frame. In addition, discussion with key-persons and other competence persons also be carried out, while secondary data are used to enrich the analysis. The study employs economic valuation method (see www.eepsea.org) and other relevant techniques such as analysis of hierarchy process (AHP) and descriptive statistics as used by Susilowati et al (2004, 2005); Susilowati (2007; 2008) with necessary modification.

Several salient findings of the study, among others are: (1) evidence of climate change in some extents of small scale fisheries sector in Central Java, Indonesia; (2) evidence of the impact on vulnerable fisheries in the selected pilot projects and a change in socio-economic aspects relating to the climate change; and (3) a short term prescription on mitigation and adaptation strategy to cope the climate change in small scale fisheries sector in the study area.

Keywords: fisheries, impact, climate change, vulnerable, strategy, adaptation, mitigation, Java, Indonesia.

Climate Change Impacts and Community Level Adaptations: A Case Study on Marine Shrimp Farming in Thailand

Dhirendra P. Thakur, Wenresti G. Gallardo and Amrit N. Bart*
Aquaculture and Aquatic Resources Management
Asian Institute of Technology
PO. Box 4, Klong Luang, Pathumthani 12120, THAILAND
thakur@ait.ac.th

Aquatic food production has been Asia's strength contributing as much as 90% of the total world production. In Thailand, fisheries and aquaculture together account for about 3% of the GDP and similar situation is prevalent in many countries in Asia. Traditionally, aquaculture has played an important role in food security and economy of the region. Freshwater aquaculture is mainly for domestic consumption and is crucial in providing the rural poor with high quality animal protein, whereas coastal aquaculture usually produces high-value products for export. For example, marine shrimp farming is a key source of national foreign exchange earnings (over two billion US $ per year) in Thailand. Further to this, marine shrimp farming plays a major role in providing livelihood with more than one million people engaged in this activity; majority of them is rural community. Arguably, sustainable growth of the marine shrimp farming is highly

ABSTRACTS

desired for prosperity of the coastal community. Sustainable growth of the sector will depend on favorable climatic conditions. The major changes in climatic conditions likely to affect the coastal aquaculture are shift in weather patterns, higher temperatures, early rains, floods, saline water intrusion, erosion of shorelines and increase in frequency of extreme weather conditions. These changes could increase physiological stress on animals in aquatic food production system influencing animal metabolism, growth rate, productivity, seasonal reproduction, and susceptibility to diseases and toxins, which would not only affect productivity but also increase vulnerability to diseases. Communities dependent on aquaculture (producers, consumers or intermediaries) will be particularly vulnerable to the direct and indirect impacts of climate change through changes in physical environments, ecosystems or aquatic stocks, impacts on infrastructure, farming operations, livelihood options.

The extent of the impacts of climate change on coastal aquaculture in Thailand has not been studied, and neither have the coping strategies and adaptation measures of the community. We conducted shrimp farming sector appraisal in Nakhon Sri Thammarat province of Thailand to understand the changes in shrimp farming practices, such as species, water quality management, disease management and marketing of the produce. We found that the problem of coastal erosion has aggravated in the recent years and number of shrimp farms located along the coast had been lost to the sea. Shrimp farmers in the locality had the tendency to shift their farms to inland areas, which may lead to another complications associated with the salinization of freshwater resources. In order to have thorough understanding of the climate change impacts on coastal aquaculture and to understand/document ongoing community level adoptions the Asian Institute of Technology (AIT) has initiated a study, and has selected Nakhon Sri Thammarat, Thailand as a case study site. The paper discusses preliminary results of the study from a historical perspective to elucidate the climate change vulnerability to the marine shrimp aquaculture and community level adaptation.

Analysis of Shoreline Change of Senggarang Using Genesis

Dwi Tjahjanto[1], Sriyana[2], Abdul Aziz Abdul Samad[1],
Juliana Ashram Baharam[1] and Ab. Aziz Abdul Latiff[1]
[1]Universiti Tun Hussein Onn Malaysia (UTHM)
[2]Universitas Diponegoro Indonesia (UNDIP)
Email: dwi@uthm.edu.my

Study of Malaysian coast erosion in 2006 has observed that about 29% of 4,809 km of Malaysian coastline are facing critical erosion. One of worst areas affected by erosion is coastline of sub district of Senggarang in the State of Johore, Malaysia which may disappear from the face of earth very soon. About 30,000 residents who lived in 20 villages along the coastal area are terrified to lose their land and houses as they will be flooded by sea water due to gradual coastal erosion process. A study to identify the problem of coastline erosion and predicting the future condition has been carried out. The occurrence of coastline erosion was due to the soil that formed the beach is very soft which cannot withstand the powerful surge of wave energy especially during stormy seasons. The existence of mangrove along the coastline did absorb some of the energy but erosion still occurs because of the power of the wave. Results from simulation using Genesis of the current condition of eroded area shows that the coastline of Senggarang area will be eroded as much as 5.0 to 7.5 m a year by the sea water.

Keywords: coastline erosion, coastal modeling, Genesis

Monitoring of Long-Term Trends of Winter Weather In Hokkaido

Toshihito Toyabe, Shoji Yamashita And Atsushi Tanise
Civil Engineering Research Institute for Cold Region,
1-3 Hiragishi, Toyohira-ku, Sapporo, 062-8602, Japan
t-toyabe@ceri.go.jp

In Hokkaido and other cold, snowy regions, snowmelt is an important source of water. The accumulation of snow in winter greatly affects the amount of snowmelt runoff in spring, and is also an important factor in developing a safe river channel plan in terms of flood control. The impact of global warming has recently been considered as a factor behind changes in winter weather trends, and it is particularly likely that the recent changes in temperature and snowfall patterns are a result of this phenomenon. This paper on the trends of snow season weather in Hokkaido as summarized using weather maps and data from the prefecture's weather stations and the Automated Meteorological Data Acquisition System (AMeDAS) from the 1960s to recent years (as of 2006).

Community-Based Vulnerability and Adaptation Capacity Assessment to Flood Risks Under the Impacts Of Climate Change and Rapid Urbanization In Ho Chi Minh City, Vietnam

Tran Thanh Tu
Atmospheric and Thermal Environmental Engineering Laboratory,
Department of Urban and Environmental Engineering, Graduate School of Engineering, Kyoto University, Japan
thanhtulua@yahoo.com or tran.thanhtu@kt2.ecs.kyoto-u.ac.jp

This research focuses on assessing the vulnerability and capacity of coastal communities to flood risk under the impact of rapid urbanization and climate change, especially considering gender perspective when analyzing vulnerable groups in which the role of men and women should be analyzed in assessing their vulnerabilities and adaptive capacity in order to enhance resilience and reduce vulnerability. Two communities at two districts of Ho Chi Minh City (hereafter HCMC) were chosen as study areas in order to assess their different vulnerabilities to urban flood risk as well as their adaptation capacity to risks from flood and pollution. By applying Rapid Vulnerability Assessment (hereafter RVA) to assess direct and indirect vulnerability as well as the community-based adaptation capacity to flood, this research found that under same natural conditions, people living in more-urbanized community have to suffer more inundation and risks from polluted floodwater than those who live in less-urbanized district. Meanwhile, people in lower urbanized district are more vulnerable since they have low capacity to cope with flood and pollution due to flood-prone living conditions, poverty and lack of awareness on the changing variability and water pollution. This paper recommends that the climate change

ABSTRACTS

policy-makers should take into account the vulnerability and adaptation capacity assessment at community level for enhanced resilience of coastal communities to fulfill the knowledge gaps in understanding the physical, societal and environmental vulnerabilities subject to climate variability and assessing the adaptation strategies to support policy makers in integrative decision making process.

Keywords: Sea level rise, Flood risks, Rapid Vulnerability Assessment (RVA), Community-based, Adaptation capacity, Urban water resources management, Water pollution

Risk Based Approach to Adaptation to Climate Change and Sea Level Rise - a Pilot Study at a Coastal Site in Vietnam

Vu Thanh Ca
Research Institute for the Management of Seas and Islands
Vietnam Administration of Seas and Islands
28 Pham Van Dong, Hanoi, Vietnam

At present, natural hazards, such as coastal erosion and severe climatic events such as storms, floods and droughts have already affected very large numbers of people in Vietnam, and push many households back to poverty on an annual basis. Therefore, even modest climate change (CC) and sea level rise (SLR) are likely to intensify the problems. A modest SLR may increase coastal erosion, and augment storm surges and river mouth flooding to the extent that extreme flooding and breaching of sea dykes with existing design criteria may become more common. To understand the risks due to CC and SLR, a pilot study has been conducted at a coastal area Northern Delta of Vietnam. With results of the study of CC and SLR impacts, adaptation measures were proposed to reduce the risks to acceptable levels. The study area is located at the mouth of Van Uc River, a river of the Red - Thai Binh River system. This is a densely populated rural area with livelihood of people mainly relies on agriculture and aquaculture. The study area has low land surface, and thus is easily flooded if SLR in combination with storm surge and sea dike break. Present environmental problems include degradation of ecological system, both in the sea and inland, water pollution, un-planning aquaculture development, flooding during heavy rainfall, especially in combination with strong typhoons, coastal erosion, degradation of mangrove forests, conflicts between nearshore fishing an aquaculture etc. Risks, associated with CC and SLR, were evaluated for normal and extreme weather conditions. For normal weather conditions, impacts due to gradual increase in air and water temperature, sea water level, salinity intrusion were evaluated. For extreme weather events, probability of strong typhoons, storm surge, high waves, dike breaking and flooding was evaluated for different SLR scenarios; then damages due to flooding were studied. Numerical models were applied for the calculation of salinity intrusion and flooding due to SLR in combination with storm surge and dike break. Detailed risk evaluation was conducted for human life, agriculture, aquaculture, environment, and infrastructure. With results of the study, adaptation measures were proposed to reduce the risks to acceptable levels. WWF's climate witness community toolkit was also applied for the establishing community action plan to respond to CC and SLR. With representative features of the study area, results of the pilot study could be applied for building action plan to respond to climate change in the coastal areas of the Northern Delta of Vietnam.

Implementing Climate Change Policies consistent with Integrated Coastal Zone Management: a Case Study of Victoria, Australia

Geoff Wescott
School of Life and Environmental Sciences, Deakin University, Australia

Australia is an urban based coastal society. More than 80 % of its population live in coastal capital cities and other cities and towns in rural areas. Hence the impact of climate change on coastal communities has become an important policy area in recent years and played a significant role in determining the outcome of the 2007 Federal election.

So much so that a House of Representative standing committee spent over 18 months collecting submissions and data on the potential impacts. Their final report in November 2009 has set the stage for further coastal reforms at the national level.

Nevertheless coastal zone planning and management out to the three nautical mile limit is the responsibility of State and territory governments under the Australian constitution. Hence whilst the national government can and will deal with mitigation it is most likely that in Australia it will be State and local governments which have to institute adaptation.

This paper will describe how the state of Victoria has responded to the impact of climate change on the coastal zone through a series of policy and planning based responses.

Victoria coastal policy is implemented through the Coastal Management Act 1995. A Victorian Coastal Council oversees strategic policy development and advises the Minster for Conservation and Climate Change. The major implementation delivery vehicle is a statutory Victorian Coastal Strategy which once adopted by the government has a five year operating period. In Victoria's third Coastal Strategy (Finished in December 2008) climate change impacts were identified as one of the three top priorities for the State and a planning benchmark of 0.8 meters of sea level rise by 2100 was incorporated in the strategy. The full paper will discuss the implications of this decision and its origins in a test case that one of three Regional Coastal Boards in Victoria successfully ran in the previous year.

As a result of the previous Coastal Strategy (2002) 'flagging' climate change as a major coastal issue (not totally accepted at the time especially in federal Government circles) the State Government had established a program called "Future Coasts" which has since become the major focus for the development of Victoria's response to climate change on the coast. The full paper will describe how this program has been implemented including the recent (November) release of detailed mapping by CSIRO.

The potential impacts of climate change in Victoria has to be seen in parallel with the two other priorities identified in Victoria's Coastal Strategy: coastal development and preserving marine ecological integrity. As coastal development has rapidly increased development has moved onto areas that will come under threat from sea level rise and increased frequency and size of storm surges in southern Australia.

The paper will examine the various policies being developed and critically analyse their potential for assisting Victoria in adapting to climate change. These conclusions will them be discussed in terms of what lessons this case study might offer other coastal nations and states.

ABSTRACTS

Effect of Sea Water Level Change on the Management in the Lower Thachin River, Thailand

Sanit Wongsa Chaiwat Ekkawatapanit and Kriangkrai Treerittiwitaya, KMUT, Thailand

Climate change and an associated rise in sea level have affected the salinity level in many rivers around the world. The objective of this study is to evaluate the effect of sea level change on salinity level in lower part of Thachin River, one of the important rivers in Thailand. The study covers the area from Phophraya Gate, Suphanburi Province to the Thachin River Estuary, Samutsakhon Province.

By using MIKE11 model. Also divided the model for two parts as hydrodynamic module and advection-dispersion module, and is therefore used for calibration and simulation.

The comparison model is follow by adjusting important coefficient for two parts. And the study results, coefficient dispersion of mass and manning (M) are in range 100-1000 m2/s and 28.5-30.33 respectively, also the value of 1000 is suitable to factor distribution of mass. The comparison between model results and observation data has order of forecasting error (RMSE) in range of 0.15-0.20 m for water level and 0.10-1.80 g/l for salinity respectively.

It was found that sea water level at the Thachin estuary has tendency to rising and betake to intrusion of water level and salinity is in the same tendency. The results of this study will give guideline in water resources and environmental management in Thachin River Basin.

Keywords: Thachin River, Sea Level Change, MIKE11

Synthetic Impact Response Functions for Vulnerability Analysis and Adaptation Measures in Coastal Zones under Climate Change Conditions: A comparative analysis across six Asia-Pacific countries

W. Wright, D. Dutta & P. R. Rayment, Monash University

There is an increasing concern that the current management practices for many coastal regions are unsustainable. Very few countries have planned to deal with the exacerbation of problems of environmental decline in the face of sea level rise. It is therefore necessary to assess socio-economic and environmental impacts of sea level rises to better understand the vulnerability of the coastal zones, as part of devising adaptive and integrated management principles. The paper presents a systematic approach in which relevant stakeholders in six Asia-Pacific countries were actively engaged in identifying and prioritising flood impact issues. Predicted flood impacts were quantified using synthetic response functions and key issues of concern for flood impacts for coastal areas in Australia, Bangladesh, Japan, Sri Lanka, Thailand and Vietnam are compared.

Use of Synthetic Impact Response Functions for the analysis of vulnerability to flood damage in Gippsland coastal Zones.

Wendy Wright, Dushmanta Dutta, and Philip Rayment, Monash University

The paper presents an example of the development and use of synthetic impact response functions in the Gippsland Coastal region in order to prioritise flood impact issues and derive information for quantification of impacts for adaptation measures. We used this approach to identify key issues of concern for flood impacts in this region. The analysis also showed that some of the issues are considered not to be significantly affected by floods and thus may not require adaptation measures. The analysis did not provide high agreement on some issues. Different approaches would be required to assess the importance of these issues and to establish response functions for them.

Keywords: Synthetic Impact Response Functions, Floods, Coastal Zones, Stakeholders, Climate Change

The Future Coasts Program: Preparing Victorian Coastal Communities for the Effects of Climate Change

Nick Wynn
Project Manager West Coast, Future Coasts, Australia

As the interface between land and sea, the coastal zone is particularly vulnerable to the physical impacts of climate change. The vulnerability is exacerbated by the socio-cultural and economic importance of the coast.

Coastal land managers and decision-makers along the coast must continue to make decisions amongst a level of uncertainty and whilst the information base is continually being updated. Due to the life expectancy of structures such as roads and public facilities, land-use planning decisions which are made now will have long-term implications. The effects of climate change on coastal hazards must be incorporated into our decision-making processes now.

The Victorian Government's Future Coasts Program will advance the management of, and planning for, the impacts of climate change on the Victorian coastline by providing data and information to improve decision-making processes.

The key policy impetus for Future Coasts is the Victorian Coastal Strategy 2008, which amongst other things, directs that planning take into account a sea level rise of no less than 0.8 metres up to 2100 and allow for the effects of storm tides, coastal processes and local conditions (e.g. geomorphology and topography).
Future Coasts is working to better understand the physical vulnerability of the entire Victorian coastline through the investment of $13.5 million in the capture of bathymetric and topographic elevation modelling and the modelling of coastal processes such as extreme sea levels. These data sets have been amalgamated with coastal landform and geomorphology data to provide an indicative, state-wide assessment of the sensitivity of the Victorian coastline over a range of sea-level rise scenarios and timeframes. This assessment will be available to coastal land managers and decision-makers. The state-wide assessment will assist in the selection of high risk locations where Future Coasts, in collaboration with

ABSTRACTS

local government and project partners, will undertake detailed, site-specific vulnerability assessments.

In addition to assessing physical vulnerability, Future Coasts also acts as a platform on which the complex social issues associated with adaptation along the coast can be explored and discussed. To this end, Future Coasts has conducted a series of workshops along the coastline which have contributed to the development of a discussion paper to enable coastal communities to contemplate the challengers, opportunities and potential responses. The submissions received in response to the discussion paper will then be used to inform the Victorian Government's long-term adaptation responses.

Future Coasts is working to develop guidance material for the improved and consistent consideration of coastal hazards, such as coastal erosion and flooding, in decision-making processes through standard approaches to vulnerability and risk assessment. The guidance material will provide a framework to ensure that sea-level rise is factored in to land-use planning and land management decisions.

Managing and planning for the effects of climate change on the coast requires a coordinated response from all levels and arms of government and partnerships with industry and communities. Future Coasts will continue to work closely with its project partners to produce information and guidance to allow decision-makers make well informed decisions.

Assessment Of Rainfall Water Potential For Rain-Fed Crop Production In The Central Highlands Of Ethiopia: Case Of "Yerer" Watershed, Oromia Region

Fitsume Yemenu
Hramaya University, Ethiopia

This study was conducted to assess the rainfall potential of 'Yerer' watershed in the central highlands of Ethiopia, Oromia Regional State. Different models like FAO(1978), Reddy (1990), the NMSA (1996) and the Markov Chain were used to analyze and explain the thirty three years of weather record (1975-2007) and subsequently determine and estimate the onset and end of the growing season, the length of the growing period and the dry/wet spell lengths and distributions in the study area. The mean onset of the main growing season was found to occur during the second meteorological dekade and ended during the end of September. Similarly, though unreliable and only few occurred during the entire study period, the mean onset of Belg season was found to occur during the beginning of the first dekade of April. The length of the growing season during the main rainy season, Kiremt, ranged from 112 to 144 days with a standard deviation of 9.6 days and coefficient of variation of 7.5%. However, the mean growing length during the Belg season was found to be 22.4 days with a standard deviation of 27 days and coefficient of variation of 122%. The results of analysis obtained both from the Markov Chain model and Reddy indicated higher probabilities of dry spell occurrences during Belg but the occurrences of the same in Kiremt was very minimal. Like wise, the SPI model detected some drought events ranging from mild to severe classes in both seasons based on one and three-month time scale analysis.

AUTHOR

Absalonsen, Luciano
University of Florida, USA

Alam, Md. Jahangir
Monash University, Australia

Arumugam Achari, Muthukrishnan
Bharathidasan University, India

Balasooriya, Nanda Wipula Bandara
South Eastern University of Sri Lanka, Sri Lanka

Bhuiyan, Md. Jabed
Monash University, Australia

Chaudhari, Kalpana
Sardar Vallabhbhai National Institute of Technology, India

Chowdhury, Md.Sazedul Karim
Bangladesh Water Development Board, Bangladesh

Daniel, Joseph
Gippsland Water, Australia

Doloi, Hemanta
The University of Melbourne, Australia

Dutta, Dushmanta
Monash University, Australia

Ediang, Okuku
Marine Division, Nigerian Meteorological Agency, Nigeria

Herath, Gemunu
University of Peradeniya, Sri Lanka

Herath, Srikantha
UNU-ISP, Japan

Imbulana, Upali
Ministry of Agriculture Development and Agrarian Services, Sri Lanka

Kabir, Md Aynul
Monash University, Australia

Kain, Claire
University Of Canterbury, New Zealand

Liu, Liguang
Florida International University, USA

Luiz Do Carmo, Roberto
State University of Campinas, Brazil

Miyake, Hiroshi
Hokkaido Regional Development Bureau, Japan

Nakayama, Keisuke
Kitami Institute of Technology, Japan

Neumann, Penny
West Gippsland Catchment Management Authority, Australia

Osman Salleh, Khairulmaini
University Of Malaya, Malaysia

Peñalba, Linda
University of the Philippines, The Philippines

Priya, Satya
UNEP Regional Resource Centre, Bangkok, Thailand

Quadir, Md. Abdul
Dhaka City Corporation, Bangladesh

Rahman, Md. Mafizur
Bangladesh Univ of Engg. & Technology (BUET), Bangladesh

Ratnayake, Uditha
University of Peradeniya, Sri Lanka

Sadayuki, Hironaka
NEWJEC Consultants Inc., Japan

Sadik, Md. Shibly
Center for Environment and Geographic Information Services (CEGIS), Bangladesh

Santos, Fernando
New University of Lisbon, Portugal

Sarkar, Santoshkumar
University of Calcutta, India

Shamaji, Momin Mozibul Haque
Local Government Engineering Department, Bangladesh

Sharma, Uttam C.
Centre for Natural Resources Management, India

Singh, Kakoli
India

Susilowati, Indah
Diponegoro University, Indonesia

Thakur, Dhirendra Prasad
Asian Institute of Technology, Thailand

Tjahjanto, Dwi
University of Tun Hussein Onn Malaysia, Malaysia

Toyabe, Toshihito
Civil Engineering Research Institute for Cold Region, Japan

Tran, Thanh Tu
Kyoto University, Japan

Vu, Thanh Ca
Research Institute for the Management of Seas And Islands, Vietnam

Wescott, Geoff
Deakin University, Australia

Wongsa, Sanit
King Mongkut's University Of Technology Thonburi (KMUTT), Thailand

Wright, Wendy
Monash University, Australia

Wynn, Nick
Victorian Department of Sustainability & Environment, Australia

Yemenu, Fitsume
Ethiopian Institute of Agricultural Research, Australia

NOTES

NOTES

MONASH University

APN
Asia-Pacific Network for Global Change Research

West Gippsland
Catchment Management Authority

State Government Victoria
Department of Sustainability and Environment

LatrobeCity
a new energy