APN Science Bulletin

Asia-Pacific Network for Global Change Research

Issue 5 | March 2015

Global Environmental Change

Citation: Boonjawat, J., Stevenson, L. A., & Tupas, L. (Eds.). (2015). APN Science Bulletin (5). Asia-Pacific Network for Global Change Research. ISSN 2185-761X.

Design and layout: Christmas de Guzman/APN
Cover images: ARCP2012-04CMY-Salik (front), Taniya Koswatta/APN (back)

PREFACE

The Science Bulletin is an annual record of APN's accomplishments on previously funded and ongoing project outcomes. The first edition of the Science Bulletin was published in March 2011 and serves as an annual compilation of project outputs, reports and articles written by APN project leaders. This year, we feature completed projects covering a wide range of topics from rainfall and monsoon predictability to integrating local and indigenous knowledge to local cases of earth system governance.

Science Bulletin 2015 is a peer-reviewed publication that features 11 regionally-balanced scientific articles, 24 ongoing projects funded under the Annual Regional Call for Research Proposals (ARCP) Programme, 13 ongoing capacity development projects funded under the Capacity Development Programme (CAPaBLE), four continuing projects on low carbon development funded through APN's Low Carbon Initiatives Framework, and 15 ongoing projects on linking disaster risk reduction, climate change adaptation and loss & damage, which are new activities under APN's Climate Adaptation Framework.

The present Science Bulletin is intended for readers from both science and policy-making communities, as well as young scientists in the Asia-Pacific region who are keen on promoting global environmental change, sustainable development and the science of sustainability. We thrive to constantly improve the Science Bulletin to cater to the knowledge and information needs of Global Change researchers, decision makers and development practitioners in the region.

As we enter into a new strategic phase from April 2015 and celebrate 20 years of accomplishments, we are committed to improving the Science Bulletin so that it continues to be a crucial peer-reviewed knowledge product easily accessible to all. We have involved additional external reviewers as members of the Editorial Advisory Committee, and we are grateful for their input. Their technical expertise and experience has served as a major contribution to the development of this issue.

On behalf of the Scientific Planning Group (SPG), who advises the scientific programme of the APN to the APN's governing body, the Inter-Governmental Meeting; and of the SPG Co-Chairs, the Executive Editors of the present publication; we hope you find the information contained in this fifth issue of the Science Bulletin relevant in your work, and may the findings detailed in this publication lead to potential research and collaboration across the region.

Finally, for the young scientists who have always been our readers and source of inspiration, you will notice that as you leaf through the Featured Articles Section, towards the end is a joint article entitled "Youth Engagement on Global Change: Cultivating the Next Generation of Sustainability Leaders," which highlights the importance of outreach and capacity building in the context of activities related to global environmental change programmes and future mechanisms.

Linda Anne Stevenson (Head, APN Communication & Scientific Affairs Division)

CONTENTS

FEATURED ARTICLES

1

ARCP2011-07CMY-HAN

The Impact of Spatial Parameters on Carbon Dioxide (CO_2) Emissions: A Comparative Study between Cities in China and India

Sun Sheng Han[1], Yuan Qing Wang, T.V. Ramachandra and Bo Qin
[1]Corresponding Author
The University of Melbourne, Australia
Email: sshan@unimelb.edu.au

ABSTRACT: This project discovers the key determinants of CO_2 emissions associated with urban households in Xi'an (China) and Bangalore (India). Data was collected through household surveys in both cities. Descriptive statistics and multiple linear regression analysis were used to test the hypothesis that household CO_2 emission is a function of household attributes and the urban built environment. The findings show that ownership of motor vehicles and the use of electricity as well as income levels positively influence the level of household CO_2 emissions. The mix of job opportunities in a neighbourhood space has shown an inverse relationship with the level of household CO_2 emissions. The research calls for policy innovations in land-use and transportation planning for building low carbon cities.

KEYWORDS: *carbon dioxide emissions, low carbon city, urban planning, China, India*

Introduction

Rearranging urban spatial parameters, such as land-use mix and transportation, could reduce CO_2 emission because urban form influences the volume of CO_2 generated by households. This influence is felt in part through the design and density of residential buildings, which foster different energy consumption behaviour. Another part relates to lower transport energy use (Moriarty, 2002; Troy, Holloway, Pullen, & Bunker, 2003). The reduction could be more significant as the transportation sector alone contributes to a quarter of greenhouse gas (GHG) emissions in some cities (Stead, 1999). Despite the general recognition that land-use change can influence the use of certain transportation modes (Ewing & Cervero, 2001), and that the reduction of travel and modal split are relevant to GHG emission control (Department of Infrastructure, 2001), two major questions remain to be answered: (1) How do urban spatial parameters affect household CO_2 emissions?; and (2) What urban planning policies can be introduced to change these parameters?

Methodology

The central hypothesis is that household CO_2 emission is a function of household attributes and urban spatial parameters, expressed in the formula below:

» household CO_2 emission = f (household attributes, spatial parameters) (1)

Data was collected through questionnaire surveys of 1200 and 1967 sample households in Xi'an and Bangalore, respectively. These samples were selected using a stratified random sampling procedure (Figures 1 and 2). The analysis included a series of statistical procedures that identified and removed outliers, tested whether the assumptions about homoscedasticity, collinearity and multilinearity were met, and calibrated regression models that assessed the effects of the independent variables.

Results

Unique Spatial Patterns

A concentric ring pattern of CO_2 emissions is discernible among household samples in Xi'an, waving downward from the inner city then upward towards the outer ring. In Bangalore, the high level emission households are distributed sporadically, interspersed with low emission households in multiple clusters all over the space.

Distinctive Family Characteristics

Families in Xi'an are smaller than their counterparts in Bangalore. About 60% of the households in Xi'an are three-member families. In Bangalore three member families only account for 15% of the samples. Instead, almost half of the samples in Bangalore are four-person families. In Xi'an four-person families only account for 10% of the samples. The largest family reported in the Xi'an sample has 8 persons, while the largest in Bangalore has 33 persons. About 2% of the household samples in Xi'an have 6 persons or more, but in Bangalore about 13% of the samples have 6 members or more.

Distinctive Housing

The majority of the households in Xi'an live in walk-up apartments (64%) or high-rise apartments (32.5%), while in Bangalore a large proportion of the households live in single storey houses (41%) and walk-up apartments (42%). A larger proportion of households live in newer apartments in Xi'an than in Bangalore, and the unit size of housing is smaller but less varied in Xi'an as compared with Bangalore.

Modernisation as a Key Driver Towards High CO_2 Emissions

In both cities the ownership and usage of motor vehicles show positive influence on CO_2 emissions, though the ownership and usage vary greatly. About 20% of the family heads commute by car or motorcycles in Xi'an but in Bangalore the proportion is above 60%. However, among the families that use motor vehicles, the average

HIGHLIGHTS

» Household CO_2 emissions show unique spatial distribution patterns.
» There are distinctive household structure, housing form, neighbourhood environment and commuting patterns.
» Modernisation is a key driver of household CO_2 emissions.
» A 1 km spatial unit can be used in planning low carbon cities.

level of petrol consumption in Xi'an (149 litres per month) is higher than that in Bangalore (45 litres per month); this is due to the popular use of motorcycles in Bangalore. In contrast, more than half (52%) of the family heads and their spouses in Xi'an walk or cycle to work, while in Bangalore only about 11–20% of the family heads and their spouses walk or cycle to work.

The use of electricity is measured by the number of household appliances in Xi'an but the use of electricity for cooking in Bangalore. This choice of measurement reflects the different characteristics of on-site energy use in the two cities. About 56% of the families in Xi'an use six or more electric appliances such as refrigerator, microwave, TV, etc. In Bangalore, about 54% of the families use electricity for cooking.

In terms of income, the proportion of samples in each of the highest three bands (US$ 1668 and more) are quite similar between Xi'an and Bangalore. But the poorer households form a larger proportion in Bangalore (25%) than that in Xi'an (7%). According to the accumulative percentage values, there are 5% more samples that earned a monthly income of US$ 833 and less in Bangalore than that in Xi'an.

The 1 km zone as a Planning Unit to Reduce CO_2 Emissions

A rich mix of economic activities within a neighbourhood space (about 1 km radius from home) is associated with low household CO_2 emissions. This is confirmed by both the aggregate household emissions model and the commuting-related emissions model in Xi'an. A related finding is that a rich mix of services and facilities, such as kindergartens, primary and secondary schools, supermarkets, banks and hospitals, in the immediate vicinity (within 500 m radius) of a household is associated with higher emissions from the household. These results are not contradictory as they represent different aspects of the built environment. The provision of more services and facilities within the immediate zone contributes to the formation of a prestigious residential environment, thus higher house values and wealthier families are more likely to be found in the area – apparently, wealthier families are associated with higher CO_2 emissions.

Households in Xi'an are more likely to be surrounded by a richer mix of services, facilities and jobs than their counterparts in Bangalore. In the immediate vicinities of households in Xi'an, more than 60% of the samples are surrounded by eight or more service and/or facility types. This same measurement is much smaller in Bangalore (less than 30%). Less than 4% of the sample households in Xi'an are surrounded by one or two service or facility types, while the same measurement reads 20% in Bangalore. Within the neighbourhood space, more than 50% of the sample households in Xi'an are surrounded by four or more job types, while in Bangalore the same measurement is about 12%. About 30% of the samples in Xi'an are surrounded by one or two job types, while in Bangalore the percentage is as high as 73%. This same pattern is true for the extended neighbourhood defined by a 5 km radius from home.

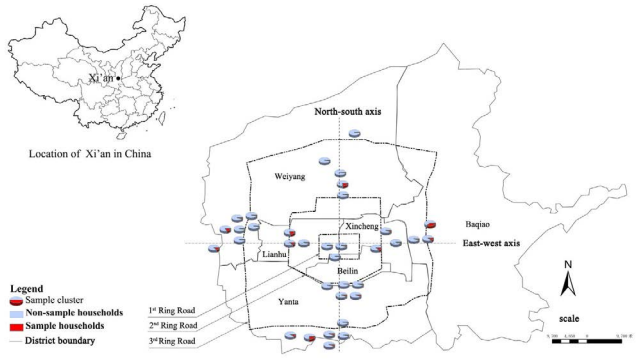


Figure 1. Sample households selected from housing blocks/groups including market housing, municipal housing and work-unit housing.

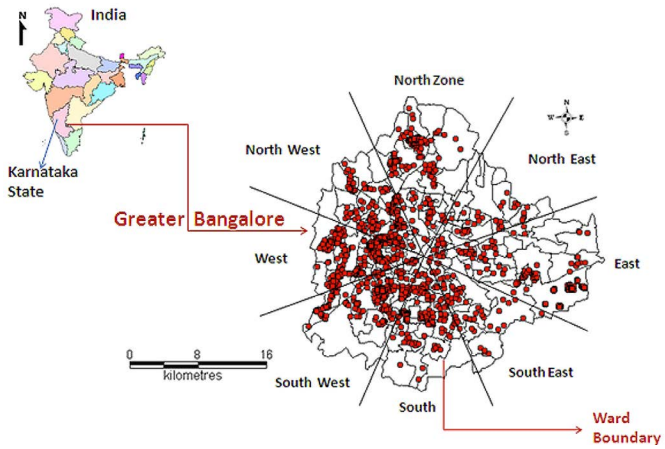


Figure 2. The spatial distribution of sample households in Bangalore.

Conclusion

This project pioneers the inquiry in comparative low carbon city research by examining the characteristics of urban households, their built environment, and the spatial distribution of CO_2 emissions in Bangalore and Xi'an. With the aid of statistical analysis, the research shows robust findings on determinants of urban household CO_2 emissions in both cities. The results not only confirm that modernisation is a common factor which drives the increase of CO_2 emissions, but also discover that the 1 km zone has emerged as an important planning unit in amending land-use schemes. Policy changes are required in order to promote low- or zero-carbon transport such as walking, cycling and public transportation. Functional separation of land-use zones needs to be reconsidered; incompatible land-uses need to be properly arranged but not at the expense of the formation of an improved land-use mix within the neighbourhood space.

References

Department of Infrastructure. (2001). Activity Centres Review, Tech. Report 8, Melbourne: Department of Infrastructure.

Ewing, R., & Cervero, R. (2001). Travel and the built environment: A synthesis. Transportation Research Record: Journal of the Transportation Research Board, 1780(2001), 87–114. doi:10.3141/1780-10

Moriarty, P. (2002). Environmental sustainability of large Australian cities. Urban Policy and Research, 20(3), 233–244. doi:10.1080/0811114022000005889

Stead, D. (1999). Relationships between transport emissions and travel patterns in Britain. Transport Policy, 6(4), 247–258.

Troy, P., Holloway, D., Pullen, S., & Bunker, R. (2003). Embodied and operational energy consumption in the city. Urban Policy and Research, 21(1), 9–44. doi:10.1080/0811114032000062128

PROJECT INFORMATION

Title:	The Impact of Spatial Parameters on GHG Emissions: A Comparative Study between Cities in China and India
Duration:	Two-year project
Total Funding:	US$ 80,000
Project Leader:	Professor Sun Sheng Han
Full address:	Faculty of Architecture, Building and Planning, The University of Melbourne, Parkville 3010, Victoria, Australia
Tel:	+61 3 8344 7055
Email:	sshan@unimelb.edu.au
Website:	www.unimelb.edu.au

CBA2012-01CMY-ABAWI

Predictability of Seasonal Rainfall, Monsoon Onset and Duration in Indonesia, Philippines and Bangladesh

Yahya Abawi[1], Simon White
[1]Corresponding Author
University of Southern Queensland, Toowoomba, AUSTRALIA
Email: yahya.abawi@usq.edu.au

ABSTRACT: Rainfall variability in the Asia-Pacific region is largely influenced by the El Niño Southern Oscillation (ENSO), the Interdecadal Pacific Oscillation (IPO), the Intertropical Convergence Zone (ITCZ), and the Indian Ocean Dipole (IOD). Of particular interest is the ENSO phenomenon, which provides the basis for seasonal prediction of rainfall using statistical methods employing atmospheric (Southern Oscillation Index or SOI) and sea surface temperature anomaly (SSTa) data as proxies for ENSO. In this paper, we used several derivatives of ENSO-based predictors to assess rainfall forecast skill across the study region and the impact of ENSO on the onset and duration of the monsoon. The results show that ENSO has a significant skill in predicting seasonal rainfall and monsoon onset (and duration) in the Philippines and Indonesia. The strength of relationship in Bangladesh was weak with little potential at present for developing an operational seasonal climate prediction model based on ENSO.

KEYWORDS: *climate variability, ENSO, southeast Asia, seasonal climate forecasts, monsoon onset and duration*

Introduction

Agriculture is important in the economy of the Philippines, Bangladesh and Indonesia with contributions of 11-16% to GDP. Rice is the main crop grown which provides food security for farmers and their families. However, with a three to four month wet monsoon season, rice can only be grown, once without irrigation. High climate variability coupled with inadequate water distribution systems in this region makes water security for cropping uncertain, which leads to frequent crop failures. ENSO phenomena has a significant impact on rainfall variability and on the timing of the monsoon in the region. In El Niño years, the onset of the monsoon is later than normal, causing delayed planting and reduced yields. Naylor et al. (2007) reported average losses of over 1 million tons of rice in central East Java and West Java from a 30-day delay in monsoon onset. Forecasting of rainfall including the onset and duration of the monsoon would enable better planning of water allocation and cropping decisions leading to less frequent crop failures and maximising planting opportunities during favorable seasons. A key objective of this study was to identify ENSO-based predictors with potential for developing an operational rainfall forecasting system in the region.

HIGHLIGHTS

- Impact of ENSO was strong in the Philippines with moderate to high forecasting skill through most of the year with lead times of up to 3 months. Niño 3.4 and SOI had the strongest relationship with rainfall variability across the whole region. Forecasting skill was poor during the peak rainy season (June–August).
- Onset and duration of monsoon in the Philippines and Indonesia was influenced by ENSO with later onset and shorter duration of monsoon during El Niño years and earlier onset and longer duration during La Niña years. On average, the onset of monsoon was up to 38 days later and up to 35 days shorter in El Niño years compared to La Niña years.
- Impact of ENSO on Indonesian rainfall is also strong with moderate to high forecasting skill from June to December, particularly in eastern Indonesia.
- There appears to be little influence of ENSO on the climate of Bangladesh in terms of the predictability of rainfall, onset and duration of the monsoon season.

Methodology

Prediction of Seasonal Rainfall

Rainfall data for several stations across the three countries were used in the SCOPIC (Seasonal Climate Outlooks for Pacific Island Countries) and FLOWCAST climate prediction software to assess the skill of various predictors (Niño 3.4, SOI and SSTa) in predicting seasonal rainfall. SCOPIC and FLOWCAST uses a linear discriminant analysis to calculate rainfall probability based on different predictor values. Monthly rainfall data ranging from 50 to 100 years were used in the analysis. However, the analysis was limited for SST predictors due to lack of predictor data prior to 1982. The principal measure of forecast repeatability or skill used in this study is a cross-validated hind-cast Linear Error in Probability Space (LEPS) skill score test. The skill of the forecast system is expressed in terms of the LEPS score that is described by Potts et al. (1996). Since forecasting skill depends on lead time, time of the year, predictor value and predictor averaging period, we have derived an overall measure of skill based on the average results of LEPS analyses incorporating:

- Twelve forecasting periods;
- Three lead times (0, 1 and 2 months); and
- Three predictor-averaging periods (1, 2 and 3 months for SST based systems and 2, 3 and 4 months for SOI based systems).

Onset and Duration of Monsoon

To assess the effect of ENSO on the timing and duration of the monsoon, daily rainfall data of at least 30 years across the study region were used. Due to differences in geography and agricultural practices, the definition of the onset and duration of the monsoon varied from country to country but was generally defined as the first (last) date where cumulative rainfall over a specified duration

(days) exceeded (not exceeded) a certain threshold. For the Indonesia monsoon, onset was defined as the first date (after October 1) when cumulative rainfall over 10 days exceeded 60 mm. End of the monsoon was defined as the first date (after the start of monsoon) where cumulative rainfall over 14 days was less than 25 mm. For the Philippines, the respective definitions were >25 mm over three days after April 1 for the onset and <25 mm over three successive days for the end of the monsoon. For Bangladesh, the start of the monsoon was defined as the first date (after 1 April) where cumulative rainfall over 15 consecutive days exceeded 60 mm. End of the monsoon was defined as the first date when cumulative rainfall over 10 successive days was less than 30 mm. After calculating these parameters for all years of data at each location, the probability distribution of onset and duration was derived for all years of data and then segregated based on El Niño and La Niña years. Significance testing was carried out using Kruskal–Wallis test at 0.05%. Classification of El Niño and La Niña years were based on Allan (1988).

Results and Discussion

The average annual LEPS scores for three predictor systems (Niño 3.4, SOI and SST1&2) for representative stations across the study region were derived. SST 1 and 2 represent sea surface anomalies in eastern Pacific and Indian Ocean (Drosdowsky and Chambers, 2001). The results show that both SOI and Niño 3.4 have a strong influence on rainfall prediction in the Philippines and eastern Indonesia. In western Indonesia and Bangladesh, the influence of ENSO is less pronounced. The LEPS scores for different predictor systems are not directly comparable due to different length of data used in the analysis. It is also important to note that the LEPS scores are averages of 108 separate analysis and provide an overall level of skill across the year for three lead times and three predictor-averaging periods. As resulted in three representative stations across the region, forecasting skill varies throughout the year and skills are higher with lead time of zero month and for certain parts of year. In Bangladesh, it was found that there is little influence of ENSO on rainfall throughout the year.

The effect of ENSO on monsoon onset and duration for several stations across the region is shown in Table 1. With the exception of Bangladesh, the impact of ENSO on the onset and duration of the monsoon is strong with a median delay of 14 to 35 days for the onset during El Niño years as compared to La Niña years. Duration of the monsoon is also shorter during El Niño years with the median values ranging from 15 to 37 days compared to La Niña years. These results are consistent with earlier studies that show a weak relationship between ENSO and monsoon variability over Bangladesh (Kripalani et al., 1996) but a significant relationship between ENSO and rainfall variability over southeast Asia (Kripalani & Kulkarni, 1997).

Conclusion

Impact of ENSO is strong in the Philippines with moderate to high forecasting skill through most of the year with lead times of up to 3 months. Niño 3.4 and SOI have the strongest relationship with rainfall variability across the whole region. Forecasting skill is poor during the peak rainy season (June–August) in some regions. Onset and duration of the monsoon in the Philippines is influenced by ENSO with later onset and shorter duration of the monsoon during El Niño years and earlier onset and longer duration during La Niña years. On average, onset of the monsoon is up to 38 days later and up to 35 days shorter in El Niño years compared to La Niña years.

Impact of ENSO on Indonesian rainfall is also strong with moderate to high forecasting skill particularly in eastern Indonesia. Over western Indonesia and Java, the effect of ENSO on rainfall variability is less pronounced. Results from eastern Indonesia showed that, on average, the onset of the monsoon tends to be delayed by up to 1 month and they have a shorter duration in El Niño years as compared to La Niña years. There appears to be little influence of ENSO on the climate of Bangladesh in terms of the predictability of rainfall, onset and duration of the monsoon season.

Acknowledgements

The contribution of Edna Juanilo, Ferdie Billones and Jovencia Ganub from the Philippines; Giashuddin Miah, Abdul Matin, and Abdul Mannan (Bangladesh); Adi Ripaldi, Surana, Dwi Protomo and Ahmad Suriadi (Indonesia) is greatly acknowledged.

PROJECT INFORMATION
Title: Building Scientific Capacity in Seasonal Climate Forecasting for Improved Risk Management Decisions in a Changing Climate
Duration: Two-year project
Total Funding: US$ 70,000
Project Leader: Professor Yahya Abawi
Full address: University of Southern Queensland, Toowoomba, Australia
Tel: +61 7 46 312675
Email: yahya.abawi@usq.edu.au

		Delay in onset (days)			Duration (days)		
	Probability of Exceedance %	25%	50%	75%	25%	50%	75%
Tagbilaran Philippines	El Niño	59	37	15	109	91	69
	La Niña	25	23	11	118	106	91
	Difference **	34	14	4	9	15	22
Zamboanga Philippines	El Niño	67	56	25	102	73	59
	La Niña	27	21	12	119	110	100
	Difference **	40	35	13	17	37	41
Cox's Bazar Bangladesh	El Niño	51	24	6	174	157	139
	La Niña	41	28	19	163	137	129
	Difference n.s.	10	-4	-13	-11	-20	-10
Ampenan Indonesia	El Niño	56	44	37	172	165	158
	La Niña	31	19	14	196	185	176
	Difference **	25	25	23	24	20	18
Mangkung Indonesia	El Niño	93	75	63	147	140	109
	La Niña	57	44	25	185	168	150
	Difference **	36	31	38	38	28	41

** significant at 0.05% n.s. not significant based on the entire distribution

Table 1. Delay in monsoon onset and monsoon duration at 25, 50 (median) and 75 percentiles for selected stations in the Philippines, Indonesia and Bangladesh.

CBA2012-15NSY-HIWASAKI

Process for Integrating Local and Indigenous Knowledge Related to Hydro-Meteorological Hazards with Science: Experiences from Coastal and Small Island Communities in Southeast Asia

Lisa Hiwasaki[1], Emmanuel Luna, Syamsidik and Rajib Shaw
[1]Corresponding Author
UNESCO Office Jakarta, Indonesia
Email: lisa.hiwasaki@alumni.carleton.edu

ABSTRACT: Communities living in archipelagic Southeast Asia face daily threats from impacts of hydro-meteorological hazards and climate change. A project focusing on local and indigenous knowledge was implemented in Indonesia, Philippines and Timor-Leste with the objective of increasing the resilience of coastal and small island communities against climate change and hydro-meteorological hazard impacts. Building the capacities of scientists, local communities and policy makers to integrate local and indigenous knowledge is important to enable them to fully harness this knowledge. This paper describes a process for integrating local and indigenous knowledge with science that emerged out of this project. We believe that such a community-led process is a practical and positive way to promote the use of local and indigenous knowledge. Moreover, by regularly undertaking this process of knowledge integration, it becomes possible for us to take advantage of the dynamic nature of local and indigenous knowledge. For such knowledge and practices to be an important component for climate change adaptation, they need to continuously evolve according to changes in the environment and climate. Finally, it is only when such knowledge is continuously transmitted to the younger generations that it can strengthen community resilience.

KEYWORDS: *local and indigenous knowledge, hydro-meteorological hazards, climate change, knowledge co-production, knowledge integration*

Introduction

Communities living in archipelagic Southeast Asia face daily threats from impacts of hydro-meteorological hazards and climate change. Research implemented in Indonesia, Philippines and Timor-Leste demonstrated that coastal and small island communities have amassed a wealth of knowledge and practices related to the climate, environment, and hazards through their extended histories of interactions with their coastal environment. We believe that harnessing local and indigenous knowledge is key to increasing the resilience of coastal and small island communities to the impacts of climate change and hydro-meteorological hazards. To fully harness this knowledge, it needs to be integrated with science and technology, through a process during which scientists, practitioners, and communities jointly undertake observation, documentation, analysis and validation of local and indigenous knowledge.

In this paper, we briefly describe a process for integrating local and indigenous knowledge with science, because we believe that such a process will: (a) enable promotion of the use of local and indigenous knowledge; and (b) allow recognition of the dynamic nature of local and indigenous knowledge. For such knowledge and practices to be an important component for climate change adaptation, they need to continually evolve according to changes in the environment and climate. Such dynamic knowledge needs to be transmitted to the younger generations so that it can strengthen community resilience.

Methodology

The APN-funded project was led by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) Office in Jakarta in close partnership with partners in Indonesia, Japan, Philippines and Timor-Leste. The project took place in the second phase of a large project that focused on local and indigenous knowledge related to hydro-meteorological hazards and climate change in coastal and small island communities. The term "local and indigenous knowledge" used in this project is defined as "understandings, skills and philosophies developed by societies with long histories of interaction with their natural surroundings. For rural and indigenous peoples, such knowledge informs decision-making about fundamental aspects of day-to-day life" (UNESCO undated).

The research component of the UNESCO project was implemented in two phases. In the first phase, knowledge and practices related to climate change adaptation and climate-related hazards were identified and documented in three communities in each

HIGHLIGHTS

- Knowledge and practices of local communities can increase the resilience of those living in coastal and small island communities against impacts of hydro-meteorological hazards and climate change.
- For this to happen, such local and indigenous knowledge needs to be integrated with scientific knowledge, using an appropriate, community-led process, such as the one developed out of our research that we call "LIVE Scientific Knowledge".
- After knowledge is integrated using "LIVE Scientific Knowledge", local and indigenous knowledge can then be popularised and used, by local communities as well as by scientists and policy makers.
- Local and indigenous knowledge needs to continuously evolve according to changes in the environment and climate, which can be an important component for climate change adaptation.

Country	Site name (province or district)	Impacts of hydro-meteorological hazards and climate change observed by communities	Research methods used and dates
Indonesia	Bedono Village, Sayung, Demak (Central Java)	Coastal abrasion and floods (since late 1990s, attributed to building of wave breakers); land subsidence (attributed to industrial land conversion); sea-level rise; strong winds.	Small group interviews to identify and document LINK; FGDs for community validation (December 2011 – Apr 2012; April 2013)
	Kendahe villages, Sangihe Island, Sangihe Regency (North Sulawesi)	Coastal abrasion (attributed to high waves); floods; strong winds and high waves (attributed to typhoons and sea storms).	Interviews and participatory mapping to identify and document LINK (December 2011 – April 2012)
	Lipang Village/Island, Sangihe Islands (North Sulawesi)	Drought and freshwater shortages (due to lack of freshwater source and rainfall), high waves and strong winds (attributed to monsoons), coastal abrasion (worsened since the 1980s, attributed to sea-level rise and westerly winds).	Semi-structured interviews with key actors, and participatory mapping to identify and document LINK (December 2011 – March 2012)
	Pangastulan Village, Buleleng Regency (Bali)	Coastal abrasion (attributed to high waves and heavy rainfall during rainy season); floods (attributed to storm surges and flash floods of nearby river after heavy rains).	Interviews and participatory mapping to identify and document LINK (January – March 2012)
	Pulo Breueh Island and Pulo Nasi Island, Pulo Aceh Islands (Aceh)	Sea storms and strong winds (from tropical cyclones); Coastal abrasion and salt water intrusion (attributed to strong winds and high waves).	Participant observation and interviews with key informants to identify and document LINK; FGDs and a workshop for community validation (November 2012 – March 2013)
Philippines	Angono Municipality (Rizal)	Floods have been observed as getting worse (attributed to more frequent and stronger typhoons, heavier rains, and heavy siltation).	Participant observation, interviews with key informants, and FGDs to identify and document LINK; key informant interviews, FGDs and a workshop for LINK validation (December 2011 – March 2012; November 2012 – February 2013)
	Perez Municipality, Alabat Island (Quezon)	Floods (attributed to regular and strong typhoons and torrential rains). Unpredictable and changing weather patterns have been observed.	
	Rapu-Rapu Island (Albay)	Floods and landslides (attributed to regular and strong typhoons, deforestation, and soil erosion). Changing weather patterns, including stronger and more frequent rainfall/ typhoons have been observed.	
Timor-Leste	Lau-Hata Village (Liquiça)	Floods and landslides (attributed to heavy rainfalls). Sea-level rise, extended dry season, and heavier rainfalls have been observed.	FGDs and key informant interviews to identify and document LINK; FGDs for community validation of LINK (December 2012 – April 2013).
	Maluru-Beaço Village (Viqueque)	Drought (caused by extended dry season), strong winds, and heavy rainfall. Sea-level rise has been observed.	
	Raimea Village (Covalima)	Floods (attributed to heavy rainfall), drought, and storms.	

Table 1. Research sites 2011-2013 (adapted from Hiwasaki et al., 2015).

country. Involved in the action research were community leaders and groups (such as youth and women's groups), traditional and religious leaders, local and national governments, local and national non-governmental organisations (NGOs) and local academics and experts.

In the second phase, local and indigenous knowledge went through a validation process by communities and scientists. Focus group discussions (FGDs) and workshops were organised for community validation and for establishing scientific explanations to the local and indigenous knowledge. In the Philippines, the results of the scientific explanations were taken back to the communities, and the communities compared the outcomes of their validation with the explanations provided by the scientists. Table 1 provides more information on research sites and research methods used.

Results and Discussion

Integrating Local and Indigenous Knowledge with Science

From the action research, we developed a process which we have termed "LIVE Scientific Knowledge: Local and indigenous knowledge and practices Inventory, Validation, and Establishing Scientific Knowledge". This community-led process involves identifying, documenting, and validating local and indigenous knowledge and integrating it with science.

Preparation

The first step in this process is choosing people from the local community to become researchers, and training them on the process, methodology and key scientific terms. The people chosen should be gender balanced and trained so that they are comfortable using the different research methods. Data-gathering forms can be used, one for each type of local and indigenous knowledge (e.g., observations of animal behaviour, observations of celestial bodies, observations of the environment, material culture, and traditional and faith-based beliefs and practices). It is important for all local researchers to use the same data-gathering form to enable both the systematic gathering of data and the standardisation of data collected.

Data Gathering

In this phase, local researchers identify informants, observe the local and indigenous knowledge that they have identified in their communities, and record observations in data-gathering forms.

Analysis and validation

Each documented local and indigenous knowledge undergoes the following six steps: (1) analysis and interpretation; (2) data analysis; (3) community validation; (4) scientific explanation; (5) taking back the results of the scientific workshop to the community; and (6) categorisation of local and indigenous knowledge (Figure 2).

I	II
LINK which can be scientifically explained/validated, and related to DRR and/or CCA	LINK which cannot be scientifically explained/validated, but related and relevant to DRR and/or CCA
III	**IV**
LINK which can be scientifically explained/validated, but not related to DRR and/or CCA	LINKs which cannot be scientifically explained/validated, and not related or relevant to DRR and/or CCA

Figure 2. Categorisation of local and indigenous knowledge (LINK) on disaster risk reduction (DRR) and climate change adaptation (CCA) and its relationship to scientific validation.

Science Integration

Local and indigenous knowledge with a scientific explanation (LINK Category I) is combined with empirical data from the field. This can be done by the community in close cooperation with scientists.

Popularisation and Utilisation

After local and indigenous knowledge is integrated with science, it can be disseminated through information, education and communications (IEC) materials to be used by communities themselves, by scientists for further research, and by practitioners and government entities for disaster risk reduction and management plans, etc.

The process described above is an integrated, community-led process of observing, documenting, analysing, validating and integrating local and indigenous knowledge, after which this knowledge can be widely disseminated, both within and outside communities. We believe this process can be easily adapted and implemented by other communities in island Southeast Asia or elsewhere.

The Importance of Integrating Local and Indigenous Knowledge with Science

We present this process for knowledge integration for two reasons: first, because we believe that this is a practical and positive way of promoting the appropriate use of local and indigenous knowledge. Secondly, regularly documenting and validating local and indigenous knowledge enables communities to identify local and indigenous knowledge that helps increase community resilience. Local and indigenous knowledge, just like science, has interacted with external forces and incorporated non-local information and practices (including scientific knowledge) over time and is thus dynamic and complex (Cruickshank, 2005). Such dynamic knowledge needs to be transmitted to the younger generations so that it can strengthen community resilience. Using a process such as this will also make room for the knowledge and practices to continuously evolve according to changes in the environment and climate, which would be an important component for climate change adaptation.

Recent discussions in the field of traditional knowledge stress the importance of considering "traditional knowledge as a process, rather than content" (Berkes, 2009). Combining traditional knowledge with science is now widely recognised as a possible way of solving problems that neither science nor traditional knowledge can solve by itself. In this regard, the process described in this paper is in line with the emphasis on "co-production of knowledge", defined as "collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem" (Armitage et al., 2011), which is now recognised as important in the relevant literature (see also Nakashima et al., 2012; Raymond et al., 2010).

Conclusions

Local and indigenous knowledge can play an important role in increasing the resilience of coastal and small island communities to impacts of climate change and climate-related hazards. To fully harness this knowledge, it needs to be integrated with science and technology, through a process during which scientists, practitioners, and communities jointly undertake observation, documentation, analysis and validation of local and indigenous knowledge. In this paper, we have presented a process for integrating local and indigenous knowledge on hydro-meteorological hazards and climate change with science, which we believe is key to enable communities themselves to make optimal decisions on dealing with the impacts of these phenomena. Knowledge integration will also enable practitioners and scientists to implement activities and research to increase resilience of coastal and small island communities, and will also make it possible for decision makers to make policies that support such activities.

References

Armitage, D., Berkes, F., Dale, A., Kocho-Schellenberg, E., and Patton, E. (2011). Co-management and the coproduction of knowledge: learning to adapt in Canada's Arctic. Global Environmental Change, 21, 995–1004.

Berkes, F. (2009). Indigenous ways of knowing and the study of environmental change. Journal of The Royal Society of New Zealand, 39, 151–156.

Cruickshank, J. (2005). The Stubborn Particulars of Voice. In: Do Glaciers Listen? Local Knowledge, Colonial Encounters, and Social Imagination, UBC Press, Vancouver, pp. 3–20.

Hiwasaki, L., Luna, E., Syamsidik and Marçal, J.A. (2015). Local and indigenous knowledge on climate-related hazards of coastal and small island communities in Southeast Asia. Climatic Change, 128:35–56.

Hiwasaki, L., Luna, E., Syamsidik and Shaw, R. (2014). Process for integrating local and indigenous knowledge with science for hydro-meteorological disaster risk reduction and climate change adaptation in coastal and small island communities. International Journal of Disaster Risk Reduction, 10, 15–27.

Nakashima, D., Galloway McLean, K., Thulstrup, H., Ramos Castillo, A., Rubis, J. (2012). Weathering uncertainty: Traditional knowledge for climate change assessment and adaptation. United Nations Educational, Scientific and Cultural Organization (UNESCO), Paris and United Nations University (UNU), Darwin.

Raymond, C.M., Fazey, I., Reed, M.S., Stringer, L.C., Robinson, G.M., Evely, A.C. (2010). Integrating local and scientific knowledge for environmental management. Journal of Environmental Management, 91, 1766–1777.

PROJECT INFORMATION

Title:	Capacity Building to Strengthen Resilience of Coastal and Small Island Communities against Impacts of Hydro-Meteorological Hazards and Climate Change
Duration:	Single-year project
Total Funding:	US$ 49,000
Project Leader:	Dr. Lisa Hiwasaki
Full address:	UNESCO House, Jl Galuh II no 5, Kebayoran Baru Jakarta, Indonesia
Email:	lisa.hiwasaki@alumni.carleton.edu

EBLU2012-02CMY(R)-TAKEUCHI

Critical Analysis of Effectiveness of REDD+ for Forest Communities and Shifting Cultivation Based on Lessons Learnt from Conservation Efforts in Lao PDR and Thailand

Kazuhiko Takeuchi, Luohui Liang[1], Narit Yimyam, Oroth Sengtaheuanghoung, K. G. Saxena and Jintana Kawasaki
[1]Corresponding Author
United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS), Japan
Email: liang@unu.edu

ABSTRACT: This study aims to assess potential and options to achieve co-benefits of REED+ for carbon sequestration, biodiversity conservation and livelihood improvement in shifting and settled cultivation landscapes. Biophysical survey inventoried carbon stocks and biodiversity in different land use-land cover types at three study sites in Lao PDR, India and Thailand. Socio-economic survey compared economic benefits across different land uses in the landscapes. The integration of biophysical and socio-economic data provided a basis for identification of potential land-use practices to enhancing carbon stocks, biodiversity and economic benefits simultaneously.

KEYWORDS: *REDD+, co-benefits, landscape, Lao PDR, Thailand, India*

Introduction

The United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity (CBD) and Intergovernmental Panel on Climate Change (IPCC) laid down a global strategy of saving mankind from the threats posed by climate change and loss of biodiversity. These changes are coupled with other global changes in the biophysical environment (e.g., changes in atmospheric composition, land cover/use, desertification and biological invasion) and socio-economic-political environment (e.g., globalisation, free trade, acculturation, intellectual property regimes and bilateral/regional/international cooperation/alignments). Simultaneous solution to the environmental, economic and social development problems is the frontline agenda dealt as sustainable development framework in Agenda 21 and ecosystem services and human well-being framework in Millennium Ecosystem Assessment. Climate change is a potential threat to biodiversity conservation in the future. Nonetheless, human capacity to mitigate and adapt to climate change can be substantially enhanced by managing biodiversity (Heller and Zavaleta, 2009; McShane et al., 2011; Sutherland et al. 2015). The International Platform on Biodiversity and Ecosystem Services (IPBES) is the major international initiative of the decade targeting biodiversity management as a means of meeting the challenges posed by global climate change and poor state of human well-being in developing countries. Since UNFCCC COP 16 in Cancún, co-benefits and safeguards of the international initiative "Reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks (REDD+)" on the integrity of forest functions for biodiversity conservation, climate change adaptation, poverty reduction and respect for indigenous knowledge and rights has been advocated.

Successful REDD+ strategies are those that not only justify economic rationale for forest conservation versus alternative uses, but also provide positive incentives to those who live around forests and are dependent on forests for their livelihoods. This requires integrating and complementing traditional forest management and agro-forestry practices of many local and indigenous communities unlike the conventional approaches to treat the two land use systems as independent ones. In this article, we present the highlights of a collaborative initiative supported by APN to: (1) assess the potential social, economic and environmental challenges and opportunities of REDD+ for selected communities in Lao PDR and Thailand by drawing lessons from past/ongoing forest conservation policies; (2) provide much-needed scientific evidence on the potential co-benefits of traditional forest management and agroforestry practices by comparing it with alternative land uses; and (3) develop participatory community-based MRV mechanisms for REDD+ contributing to the improvement of the well-being of forest-dependent communities, climate change mitigation and biodiversity conservation.

Methodology

Study Sites

The project covered three mountain village landscapes, one each in Thailand, Lao PDR and India, with Indian site included as an associate site during the course of project development. While all the three sites represented mosaics of agricultural and forest land use types, specificities of these land uses varied. The Thailand site (Tee

HIGHLIGHTS

- A landscape approach was applied to assess potential and options to achieve co-benefits of REED+ across different land uses in both shifting and settled cultivation landscapes.
- In shifting cultivation, well managed forest fallows may restore significant amount of carbon stocks and biodiversity. On the other hand, plantations may recover carbon stocks only.
- Settled cultivation may restore and maintain rich carbon stocks, especially below-ground through use of manure and development of agroforestry.

Cha village in Mae Hong Son Province in Northern Thailand) was characterised by both shifting cultivation and settled wet paddy cultivation, the Lao PDR site (Laksip village in Luang Prabang Province in Northern Lao PDR) by only shifting cultivation and the Indian site (Bhiri-Banswara, Uttarakhand) only settled cultivation on terraced slopes and flat valley lands. With increase in population pressure, length of shifting cultivation has been shortened from 20 years during the 1990s to seven years in 2012 and, if this trend continues, it will be reduced to two years by 2030 at the Thailand site. Plantation forests occurred only at the Lao PDR and India sites, with monoculture of teak established in shifting cultivation fallows in the former and mixed multi-purpose species plantations at the Indian site. Forests covered over 50% of the villages at the three sites but differed in terms of species composition, forest structure and management practices. More than 20% of forest as well as agricultural area were degraded in terms of biomass production. Only at the Indian site, a large amount of farmyard manure was incorporated in well-managed agricultural land and home gardens.

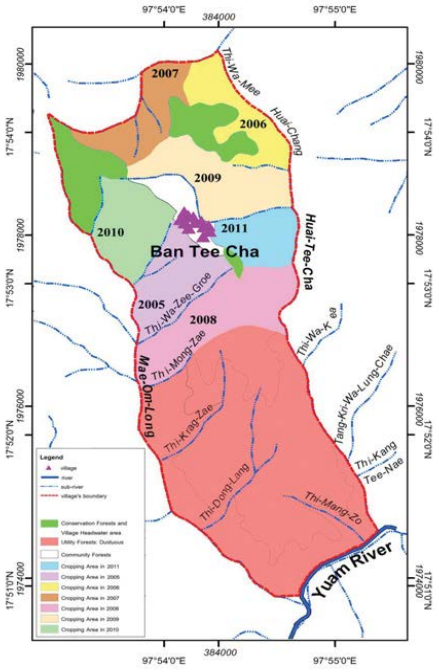


Figure 1. Existing land uses in Tee Cha Village in 2012, Thailand.

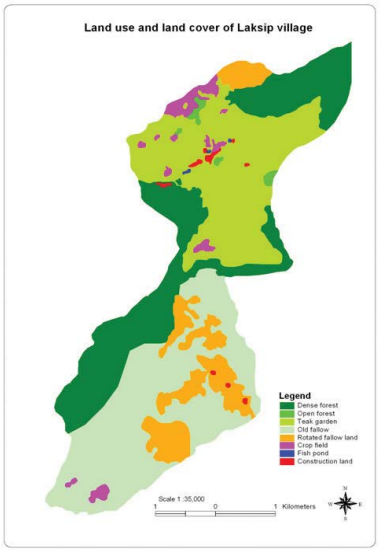


Figure 2. Land uses in Laksip Village in 2011, Lao PDR.

Study Components and Methods

The study took a landscape approach to assess carbon contents in all land use-land cover types in the study sites. The study comprised four activities: (1) biophysical survey and analysis through interviews, field mapping with the aid of remote sensing and collaboration with farmers determined land use-land cover types and investigated biodiversity. Carbon contents in different land use-land cover types were estimated, including above-ground, below-ground biomass through allometric equation or destructive method, and soil organic matter (at depth of 0-30 cm) through soil sampling and analysis. Land-use scenarios, carbon dynamics and reference levels were also analysed (the details of survey should be included: how the carbon content was measured, how many sample plots were laid, in which part destructive sampling was done, in which part allometric equations were used, etc.); (2) socio-economic survey through open-ended participatory discussions followed up by interviews and questionnaires assessed farmers' valuation of economic costs and benefits of different land use-land cover types, calculated Net Present Value (NPV), and estimated opportunity cost of REDD+ (focusing on forest conservation versus alternative land uses); (3) identification of good land-use practices to enhance co-benefits of carbon stocks, economic benefits as well as biodiversity through integration of biophysical and socio-economic assessments; and (4) good land-use practices were demonstrated to local farmers and officials, and relevant training programmes organised for local farmers and officials to appreciate, measure, monitor and manage forest carbon pools as a process of community-based MRV. The detailed methodology and results of the surveys can be found in the final report of the project (Takeuchi et al., 2014).

Results and Discussion

Forest degradation as well as deforestation from conversion of natural forests to agricultural land use resulted in loss of carbon stocks at both the Lao PDR and Thailand sites. However, the magnitude of these changes varied by site. At the Thailand site, community forests were more degraded than the protected headwater forests, with the former (172 Mg C/ha) having 37% lower carbon than the latter (273 Mg C/ha). Local farmers manage *Macaranga denticulata* to sustain their traditional shifting cultivation (Rerkasem et al., 2009). Carbon stock increased by 78% during the *Macaranga denticulata* dominant vegetation development during the fallow phase in shifting cultivation, but carbon stock in fallows (107 Mg C/ha) remained 38% lower than that of degraded community forests. Carbon stored in permanent mixed agroforestry systems or wet paddy lands (50-65 Mg C/ha) was almost equal to that in the crop phase of shifting cultivation (47 Mg C/ha) (Table 1).

At Lao PDR site, forest degradation resulted in around 47% loss in carbon stock, from 309 Mg C/ha in dense conservation forests to 128 Mg C/ha in open protection forests. Establishment of teak plantations in abandoned shifting cultivation land results in recovery of carbon stocks to degraded forest levels after 15-20 years of plantation, while stocks in the cropping phase of shifting cultivation (67 Mg C/ha) were slightly lower than that in 3- to 4-year old fallow fields (85 Mg C/ha) (Table 1).

Land cover-land use	Thailand site	Lao PDR site
Dense forest	273	308
Open forest	172	128
Abandoned shifting cultivation	-	90
5-year-old teak plantation	-	75
20-year-old teak plantation	-	109
Agroforestry system	65	-
Fallow fields in shifting cultivation	107	85
Crop fields in shifting cultivation	47	67
Wet paddy fields	50	-

Table 1. Carbon stocks (Mg C/ha) in different land cover-land use types differentiated in Thailand and Lao PDR village landscapes. "-" refers to absence of a given land cover-land use.

While land use in terms of relative coverage under agriculture and forest is stable at the Indian site due to policies like the ban on forest conversion since the 1950s and on cutting of green trees since the 1970s, deforestation continues at the Lao PDR and Thailand sites due largely to lack of effective conservation-development policies. In India, well managed agricultural land and home gardens resembling natural forests in vegetation structure but much smaller in size have carbon stocks equal to or greater than degraded forest land. At all the

three sites, the predominant agricultural systems had lower carbon stocks but several fold higher incomes compared to the moderately disturbed forests. Conversion of secondary forests to teak plantations at the Lao PDR site and to coffee plantations at the Thailand site through the intermediate stages of shifting cultivation enabled more income as well as higher carbon stocks compared to forest conversion to paddy fields.

Degraded forest land, with proper treatment, could serve as carbon sinks and habitats for useful species offering new opportunities of income from REDD+ Programme. Biodiversity conservation is a co-benefit from maintenance and enhancement of carbon stocks. At the Indian site, fodder from farm land (6 Mg C household^{-1} year^{-1}; average land holding size: 0.5 ha) meets hardly 30% of livestock (average holding: 3 livestock units) feed. If agroforestry system is developed on degraded lands under the control of local people (0.4 ha degraded land household^{-1}), an average family would earn US$ 37 family^{-1} year^{-1} from carbon market (considering financial compensation of US$ 10 Mg CO_2 year^{-1} and mean carbon sequestration rate of 2.5 Mg C or 9.2 Mg CO_2^{-1} ha^{-1}), US$ 400-900 family^{-1} year^{-1} from understorey food crops and would reduce pressure on forests for fodder by 27%. Redeveloped agroforestry system sequestered carbon as much as the exclusive forest tree plantations over a period of 20 years. In biodiversity hotspots like the Indian Himalaya, where farm holdings as well as area of degraded land are quite small, income from timber trade is prohibited, natural recovery of forest cover is quite slow and people remain economically marginal, objectives of biodiversity conservation, climate change mitigation and enhancement of local livelihoods can be addressed simultaneously by: (a) encouraging tree-crop mixed farming in degraded land; (b) linking development grants with rehabilitation of degraded land and forest conservation (presently government grants are determined based on socio-economic status, e.g., one member of each family is guaranteed employment in government works irrespective of its role in environmental conservation in India); and (c) orienting programmes for payments for ecosystem services such that economic compensation is guided by the sum of contributions in reducing emissions from deforestation, reducing emissions from forest degradation, enhancement/conservation of carbon stocks in both farm and forest land, and sustainable management of both agricultural and forest ecosystems (Semwal et al., 2013).

Reconstruction of forests or agroforestry systems in degraded land as attempted at present is an expensive task and hence the area covered as well as the rate of success is quite low. Planting of 'nurse species' or 'keystone species' could reduce the cost but knowledge of such species is meager. Given the multiple problems of developing mountain regions, keystone species would be those which are socially valued, economically valuable to local people and enhance biodiversity and ecosystem services from degraded land.

With enormous variation in environmental and socio-economic conditions, location specific participatory landscape development models need to be developed, demonstrated and continuously improved. At all the three sites, improvements in provisioning services and carbon stocks through land rehabilitation enhanced local scale species richness. However, cultural landscapes did not harbour any rare and endangered species highlighting the importance of improvement in such landscapes together with protected area management. Further, it was also evident that a 20-year period following treatment was insufficient to recover biodiversity and carbon stocks in degraded forest land emphasising the need of long term rehabilitation trials (Bhadauria et al., 2012). Due attention should be paid to "transformative restoration", i.e., reconstructing communities adapted to the future climate in present degraded land or developing ecosystems resistant and/or resilient to climate change need to be developed (Heller & Zaveleta, 2012).

Conclusion

The landscape level study found that conversion from forests to agricultural fields led to loss of carbon stocks. The natural forest fallows, if managed well in shifting cultivation, can help recover a significant amount of carbon stocks, almost equal to 15–20 years of plantation. However, natural fallows are rich in biodiversity compared to plantations. Proper selection of keystone species for forest rehabilitation will be critical to provide cultural and economical benefits to local people, and enhance biodiversity and ecosystem services. The settled cultivation can also enhance below-ground carbon stocks through use of farmyard manure, and above-ground through development of agroforestry.

Acknowledgements

We are grateful to APN for financial support, to our colleagues for their collaboration, and to local communities at the study sites in Lao PDR, Thailand and India for their cooperation and participation in the project implementation.

PROJECT INFORMATION

Title:	Critical Analysis of Effectiveness of REDD+ for Forest Communities and Shifting Cultivation, based on Lessons Learnt from Conservation Efforts in Lao PDR and Thailand
Duration:	Three-year project
Total Funding:	US$ 120,000
Project Leader:	Dr. Kazuhiko Takeuchi
Full address:	United Nations University 53-70, Jingumae 5-chome, Shibuya-ku, Tokyo 150-8925, Japan
Tel:	+81 3 5467 1212
Email:	takeuchi@unu.edu
Website:	http://gcs.isp.unu.edu/groups/gcs/wiki/e30d2/REDD_for_forest_communities.html

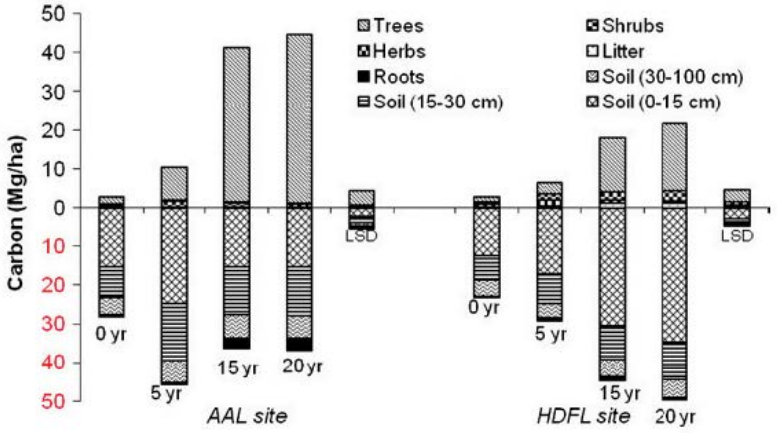


Figure 3. Carbon pools before (0 yr) and 5–20 years after tree planting with cropping at the abandoned agricultural land (AAL) site and without any cropping at the highly degraded forest land (HDFL) site in Bhiri-Banswara, Central Himalaya, India. The horizontal line crossing at '0' on y axis refers to the soil surface, with values above it depicting the aboveground biomass C pool (aboveground biomass C in trees, shrubs, herbs including crops at the AAL site and litter on ground) and below it is the belowground C pools (soil organic C in 0–15 cm, 15–30 cm and 30–100 cm soil layers and roots). Least significant differences (P=0.05) for carbon pools at different ages at the two sites are shown.

Developing Community-Based Forest Monitoring Systems through Action Research

Henry Scheyvens[1], Makino Yamanoshita, Taiji Fujisaki, Agus Setyarso, Saykham Boutthavong, Hoang Ngoc Y and Kimihiko Hyakumura
[1]Corresponding Author
Institute for Global Environmental Strategies, Japan
scheyvens@iges.or.jp

ABSTRACT: This APN project set out to test the ideas that communities can provide accurate forest measurements to estimate and monitor forest C stocks, and that action research is an appropriate approach to develop community-based forest monitoring systems. Research collaborators in Indonesia, Cambodia, Lao PDR, Viet Nam and Papua New Guinea trained local facilitators on forest monitoring and community engagement concepts and techniques. The facilitators in turn provided training and ongoing support on biomass assessment to participating communities. The monitoring systems were elaborated to reflect locational, cultural, institutional and other context-specific factors. Action research was found to be a suitable approach for developing the community-based forest monitoring systems. Community understanding of carbon and of biomass assessment protocols and techniques was built gradually over several years of their engagement in measuring their forests, recording the data and discussing the results with the facilitators. This resulted in some communities taking initiative to promote their forest monitoring within and outside their villages. The action research also provided strong evidence that with appropriate training and ongoing support, communities can provide accurate forest measurements for reliable C stock estimates.

KEYWORDS: *REDD+, community participation, forest carbon stock monitoring, action research*

Introduction

REDD+ is a global mechanism that is being developed by Parties to the United Nations Framework Convention on Climate Change (UNFCCC) for financing the management of forests in developing countries to protect and enhance forest carbon (C) stocks. REDD+ is a performance-based financing scheme, meaning that developing countries must demonstrate results to receive payments. This requires that forest C stocks and safeguards that have been agreed for REDD+ are monitored, reported and verified.

But, who should monitor forest C stocks? It is commonly assumed that forest biomass assessment can only be conducted by people who have formal training in forestry. This is because to produce accurate estimates of forest biomass requires expertise in forest sampling, mapping and stratification, sample plot sizing and silting, selection of C pools, use of measurement instruments, and on how to minimise errors and present uncertainties (Pearson, Walker, & Brown, 2005).

Because of this complexity, usually little thought is given to involving local people in forest assessments, beyond the menial tasks of carrying equipment, cutting tracks, etc. However, local communities often have traditional and local knowledge of the forests in their areas that is useful for biomass assessment, and some of the key tasks associated with C stock monitoring, such as the setting up and measurement of sample plots, seem well within community capacities. Further, being locally-based, communities can readily observe forest disturbance and removals, and how REDD+ actions impact safeguards such as biodiversity conservation. Engaging communities as forest monitors could be useful not only for biomass assessment and safeguard monitoring, but also for increasing local understanding of the REDD+ concept and how to ensure REDD+ actions and safeguards are sustained in the future (Scheyvens, 2012).

Based on these considerations, the APN project Participatory Approaches to Forest Carbon Accounting to Mitigate Climate Change, Conserve Biodiversity, and Promote Sustainable Development set out to develop and test participatory approaches to involve local communities in forest C monitoring. The basic research problem identified was that communities lack sufficient information about their forests to consider alternative/new management options, such as REDD+. The objective of community-based forest monitoring is to provide this information. The research questions included: (1) What is an effective strategy to develop community-based forest biomass monitoring systems? (2) Can community-based forest monitoring provide comparable C stock estimates to that of expert assessments?

HIGHLIGHTS

- With appropriate training and ongoing support, communities can provide accurate forest measurements for the assessment and monitoring of forest carbon stocks.
- Action research is a valid and effective approach for researchers and local communities to collaboratively identify problems associated with natural resources and ecosystem services and to propose and test solutions to these problems.
- Communities can play greater roles in forest management than is often thought, and their involvement in REDD+ will contribute to its success as a climate mitigation instrument.

Methodology

In conventional problem solving research, the researcher identifies the problem, gathers data, does the analysis and proposes solutions. If communities are involved, they may be the subject of the research and/or a source of information. Such an approach was considered ill-suited to this APN project for two reasons. First, community institutions and capacities vary widely, meaning that any community-based monitoring system needs to be tailored to local specifics. This tailoring can only be done through an interactive approach that embraces flexibility. Second, local communities may be able to provide ideas for improving the monitoring and they may wish to include additional forest values in the monitoring; hence, an approach that encourages their inputs into the design of the monitoring system is desirable.

With these points in mind, action research was selected as the methodological approach to be tested for developing community-based forest monitoring systems. Action research consists of a set of phases involving planning, acting, observing and reflecting in each research cycle. As a research paradigm, action research takes a markedly different stance from more conventional research approaches by recognising communities as research partners, rather than as research subjects. In action research, the communities contribute to defining the research problem, proposing the action to overcome the problem, conducting the action, reflecting on the results, and designing the next cycle of problem-solving research (Chatterton, Fuller, & Routledge, 2007; Greenwood, Whyte, & Harkavy, 1993). Figure 1 depicts how each of the action research phases was initially envisioned for this APN project.

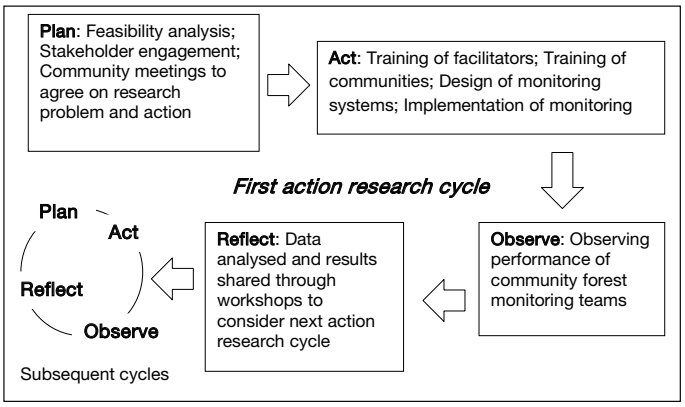


Figure 1. Phases initially envisioned for the action research.

Plan

In some of the research sites, project collaborators had built good working relationships with the communities through their ongoing activities. Where these relationships did not exist, feasibility assessments were conducted to ensure only local communities with a commitment to long-term forest management and some of the basic institutions required to achieve this participated. Key stakeholders at each research site were identified and were engaged through workshops and meetings to ensure their support for the action research. Workshops were then held in the candidate communities for researchers and the communities to agree on the research problem, i.e. that without knowledge on biomass, the communities would not be in an informed position to decide on management options, including REDD+, for their forests. To overcome this problem, the researchers and communities agreed on the "action", i.e. designing and implementing a community-based forest monitoring system, to be taken.

Act

Local level facilitators were foreseen as playing a key role in working with the communities to build the monitoring systems, and it was understood that the facilitators would have to be skilled in both biomass assessment and community facilitation. Recognising that there are few people who possess this combination of skills, building competent facilitation teams was understood to be a key part of the research process. Developing and conducting a training programme for local level facilitators in each country was thus the first step in the "act" phase of the action research.

The second step involved the local level facilitators training the participating communities on the fundamentals of biomass monitoring. For this, the facilitators had to produce an initial biomass sampling design. The local facilitators were instructed to use standard forest inventory manuals only as guides and to work closely with the participating communities to test various measurement protocols and instruments. From this, it was expected that they would produce inventory manuals best suited to forest characteristics and community capacities at the research sites. For example, the national guidelines for community forestry in Cambodia prescribe the use of large rectangular sample plots, but the researchers felt that variable radius circular plots would be statistically more efficient in estimating C stocks and hence proposed they be used for the monitoring.

The community trainings consisted of some "classroom" work on concepts, protocols, etc., but focused mostly on practical measurement exercises. During the training, the facilitators observed what measurement instruments the communities were able to use competently and adjusted the monitoring system accordingly. For example, some qualified foresters felt that the communities would not be able to use handheld Global Positioning System (GPS) devices and thus that they could not take on the responsibilities of locating sample plots and demarcating forest boundaries. However, it was found that after well thought out training exercises were conducted, the communities were able to use GPS competently and so could take on these roles.

Observe

The "act" and "observe" phases of the action research were interlinked insofar as the communities set up and measured some of the sample plots during the training and the facilitators were able to observe how well they conducted these activities. At some of the research sites the communities went on to set up and measure additional sample plots and the researchers were able to observe the quality of the monitoring from the field sheets submitted by the community teams.

Reflect

Reflection was conducted through workshops with the local communities and in some cases also at district level involving district governments, line agencies and other district level stakeholders. In some cases the reflection led to adjustments in the monitoring systems, e.g. in PNG a decision to increase the size of sample plots in order to increase sampling efficiency, and in other cases to an entirely new cycle of action research, e.g. in Indonesia the decision by researchers and the communities to begin preparing a project design document for the voluntary carbon market.

Results and Discussion

Appropriateness of Action Research as an Approach

Action research was found to be a suitable approach for developing community-based forest monitoring systems. Community understanding of carbon and of biomass assessment protocols and techniques was built gradually over several years of their engagement in measuring their forests, recording the data and discussing the results with the facilitators. The enthusiasm generated among the participating communities through this process can be seen in their initiatives to promote the forest monitoring within and outside their villages. For example, village leaders at the research sites in Indonesia used village radio to share lessons from their biomass monitoring activities and monthly women's group meetings to raise awareness on climate change and encourage more women to be involved in the monitoring.

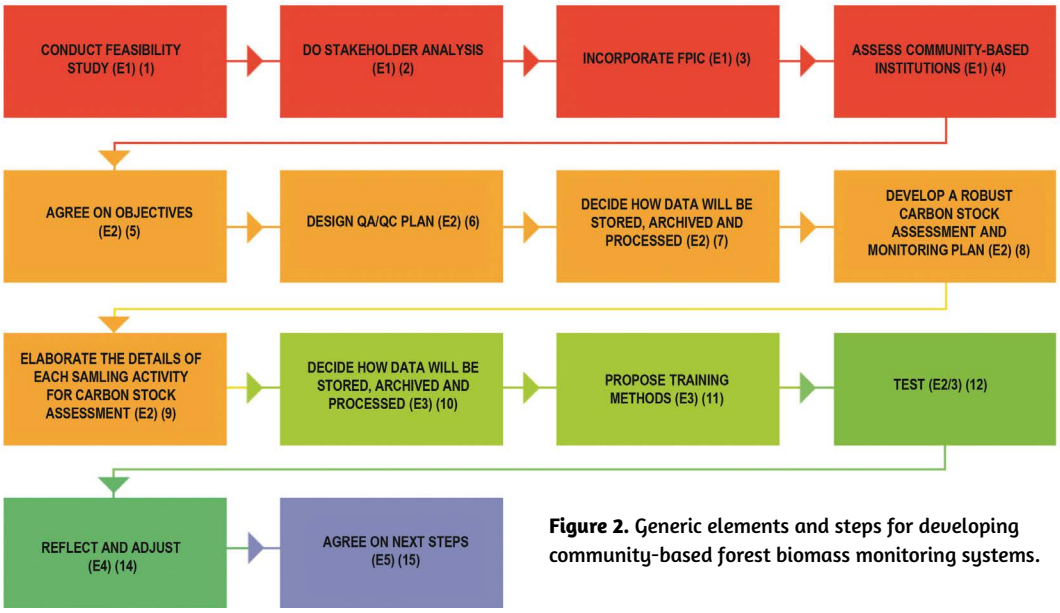


Figure 2. Generic elements and steps for developing community-based forest biomass monitoring systems.

Action research also enabled the communities to improve their forest management and explore new management opportunities. For example, in Indonesia the results of the forest monitoring were used by the facilitators and communities to discuss the idea of delaying the harvesting of trees to increase income as well as time-averaged C stocks. In Viet Nam, with support from the facilitators, the communities have begun planting indigenous tree species and are now monitoring their growth and quality.

Further, because the action research evolved in accordance with context specific factors, such as forest types, forest management and tenure arrangements, and community values, institutions and livelihoods, it generated a better understanding on the generic steps for developing community-based forest monitoring systems through action research. The process is more complex than was initially envisioned. These steps are depicted in Figure 2 and guidance on them is provided in a comprehensive training manual[1]. Figure 2 thus provides in summary form an answer to the first research question "What is an effective strategy to develop community-based forest biomass monitoring systems?"

Scientific Credibility of Community-Based Forest Monitoring

Observation is an important part of action research. Once the monitoring systems were established, the monitoring conducted by the communities was observed directly in the field by the facilitators and researchers as well as by reviewing the data generated. From these observations, and in answer to the second research question "Can community-based forest monitoring provide comparable C stock estimates to that of expert assessments?," the action research provided strong evidence that with appropriate training and ongoing support, communities can provide accurate forest measurements for the assessment and monitoring of forest C stocks. The reliability of the estimates was checked by comparing them with estimates for similar forest types in the literature, and in some cases by having plots re-measured by the trainers.

Table 1 shows that the project produced mean per hectare C stock estimates similar to those in the literature, when differences in C pools and measurement parameters are taken into account. The mean per hectare C stock estimates from the research sites in Cambodia and Indonesia are very close to published estimates for the same forest types. The estimate from the research sample plots in PNG are 20% higher than those from one published study, but this can partly be accounted for by sampling of a smaller minimum tree diameter and inclusion of the lying deadwood C pool (~7% of tree C pool).

Table 2 provides estimates of C stocks in Acacia mangium plantations in Cao Phong, Viet Nam from plots measured separately by the trained community teams and by the trainers. The mean of the differences in the C stock estimates is negligible (0.017%). The sign of the differences for each plot does not indicate any tendency by the community teams to underestimate or overestimate the C stocks; however, further checking of how communities are using the measurement equipment appears desirable, given that the difference is as much as 5% for some plots.

Communities at all sites were trained on tree height estimation using a variety of instruments. It was found out that there are considerable differences in tree height estimates from community teams and trainers using Blume Leiss and SUNNTO clinometers at research sites in Lao PDR. This is not surprising as tree height is a particularly difficult parameter to estimate consistently, especially in dense forest. At sites where tree height estimation is difficult, diameter-height relationships can be developed; this approach was adopted for the research site in Cambodia.

The data collected suggests that community-based forest biomass monitoring is just as reliable as monitoring by conventional teams. However, there are limitations to this concept that need to be recognised. First, when community institutions are not so strong and/or community experience with measurement protocols is limited, even after a well-designed training programme has been implemented, it may desirable that a qualified forester or similar expert continues to

Table 1. Carbon stock estimates from project sites compared with those in published literature.

Project sites	Forest type	Estimates from community measurements	Estimates in literature
Mondulkiri Province, Cambodia	Deciduous forest	75.5 ± 19.6 (SD) tC/ha (rectangular plots) 72.2 ± 23 (SD) tC/ha (circular plots)	73.8 ± 8.6 (SE) tC/ha (Vathana, 2010) Same forest patch
Yogyakarta & Central Java Provinces, Indonesia	Home gardens	34.2 ± 20.6 (SD) tC/ha	35.3 ± 21.2 (SD) tC/ha (Roshetko, Delaney, Hairiah, & Purnomosidhi, 2002) Different province
Madang Province, PNG	Lowland and montane primary moist tropical forest	127.7 ± 40 (SD) tC/ha Biomass estimate for living trees with DBH > 5 cm and lying deadwood	106.3 ± 22.7 (SD) tC/ha (Fox et al., 2010) Same province and forest type Biomass estimate for living trees with DBH > 10 cm

[1]The manual can be downloaded from http://pub.iges.or.jp/modules/envirolib/view.php?docid=4999

Table Header	Communities		Expert		Difference		
	Average DBH (cm)	Biomass (tC/ha)	Average DBH (cm)	Biomass (tC/ha)	Average DBH (cm)	Biomass (tC/ha)	% difference tC/ha
Ru3-01	8.84	7.18	8.81	7.2	0.03	-0.02	-0.3%
Ru3-02	11.09	13.11	11.17	13.55	-0.08	-0.44	-3.2%
Ru3-03	4.02	1.87	4.13	1.96	-0.11	-0.09	-4.6%
Ru4-02	8.75	15.44	8.66	15.16	0.09	0.28	1.8%
Ru4-03	4.92	3.92	4.8	3.73	0.12	0.19	5.1%
Ru4-05	5.84	3.96	5.8	3.91	0.04	0.05	1.3%
						Mean	0.017%

Table 2. Plot measurements by communities and experts, Cao Phong, Viet Nam.

guide the teams during future monitoring. Second, there are some aspects of biomass monitoring that require a high level of expertise that is beyond community capacities. Examples include setting out the sampling design and measuring/estimating soil and wood product C pools. Researchers, facilitators and communities thus all have important roles to play in community-based forest biomass monitoring.

Conclusion

This regional project spanning a number of countries, forest types and forest management arrangements as well as a variety of communities concluded that with appropriate training and ongoing support, communities can provide accurate forest measurements for the assessment and monitoring of forest C stocks, as is required for REDD+ results-based payments. Action research was found to be a valid and effective approach for researchers and local communities to collaboratively develop community-based forest monitoring systems. Action research evolves in a sometimes unpredictable manner in accordance with community institutions, capacities and expectations and according to a timeline that suits the communities. While for the researcher this means not having the comfort of working with a tightly defined research plan, it can provide a meaningful research outcome by engaging communities in defining research problems that affect them and testing solutions to these.

References

Chatterton, P., Fuller, D., & Routledge, P. (2007). Relating action to activism: Theoretical and methodological reflections. In S. Kindon, R. Pain, & M. Kesby (Eds.), Participatory action research approaches and methods: Connecting people, participation and place (Routledge .). London: Routledge.

Fox, J. C., Cossey, K. Y., Nimiago, P., Oavika, F., Pokana, J. N., Lavong, K., & Keenan, R. D. (2010). Assessment of aboveground carbon in primary and selectively harvested tropical forest in Papua New Guinea. *BIOTROPICA, 42*(4), 410–419.

Greenwood, D. J., Whyte, W. F., & Harkavy, I. (1993). Participatory Action Research as a Process and as a Goal. *Human Relations, 46*(2), 175.

Pearson, T., Walker, S., & Brown, S. (2005). Sourcebook for land use, land-use change and forestry projects. BioCarbon Fund, Winrock International.

Roshetko, J. M., Delaney, M., Hairiah, K., & Purnomosidhi, P. (2002). Carbon stocks in Indonesian homegarden systems: Can smallholder systems be targeted for increased carbon storage? *American Journal of Alternative Agriculture, 17*(2).

Scheyvens, H. (2012). Community-based Forest Monitoring for REDD+: Lessons and reflections from the field. Hayama: IGES.

Vathana, K. (2010). Carbon storage of tropical deciduous forests in Mondulkiri Province Cambodia. In International Conference on Managing Forest Resources for Multiple Ecosystem Services under Robust and Fragile Environments. Phnom Penh.

Acknowledgements

We are grateful to both the APN and the Ministry of the Environment of Japan for providing funding to support the action research. We owe a debt of gratitude to the APN team for their support and understanding, and for opportunities to promote the research results. We are also grateful to the local communities in Indonesia, Cambodia, Lao PDR, Viet Nam and Papua New Guinea who participated enthusiastically as research partners.

Project Publications

Edwards, K., Scheyvens, H., Stephenson, J., & Fujisaki, T. (2014). Community based forest biomass monitoring: A manual for training local level facilitators (Research Report 2014/3.). Hayama: IGES.

Ibarra, E. G., Scheyvens, H., & Lopez-Casero, F. (2012). Community Forest Management and REDD+: Opportunities and Challenges. In Greening Governance in Asia-Pacific: IGES White Paper IV 2012 (pp. 85–114). Hayama: Institute Global Environmental Strategies.

Scheyvens, H. (2012). Community-based forest monitoring for REDD+: lessons and reflections from the field. IGES - Policy Brief, (22), 10 pp. Retrieved from http://enviroscope.iges.or.jp/modules/envirolib/upload/4124/attach/PB_22_E_final.pdf

Scheyvens, H., Ibarra-Gene, E., Yamanoshita, M., & Hyakumura, K. (2012). Participatory approaches to forest carbon accounting to mitigate climate change, conserve biodiversity and promote sustainable development. APN Science Bulletin, 2012(2).

Scheyvens, H., Fujisaki, T., & Yamanoshita, M. (2012). Forestry: Importance of local participation in REDD+. In K. Koakutsu, K. Usui, A. Watarai, & Y. Takagi (Eds.), Measurement, Reporting and Verification (MRV) for low carbon development: Learning from experience in Asia (pp. 122–127). Hayama: Japan.

Scheyvens, H., Yamanoshita, M., Fujisaki, T., Avtar, R., Bun, Y. A., Winai, M., … Nhan, M. T. (2014). Community-based forest biomass monitoring: Action research in PNG, Cambodia, Indonesia, Laos and Vietnam (Research Report 2013/5). Hayama: IGES.

Scheyvens, R., Scheyvens, H., & Murray, W. E. (2014). Working with Marginalised, Vulnerable and Privileged Groups. In R. Scheyvens (Ed.), Fieldwork and Development Studies: A Practical Guide – 2nd Edition. Sage Publications.

PROJECT INFORMATION

Title:	Participatory Approaches to Forest Carbon Accounting to Mitigate Climate Change, Conserve Biodiversity and Promote Sustainable Development
Duration:	Three-year project
Total Funding:	US$ 120,000
Project Leader:	Dr. Henry Scheyvens
Full address:	Natural Resources and Ecosystems Area, Institute for Global Environmental Strategies, 2108-11 Kamiyamaguchi, Hayama, Kanagawa, 240-0115 Japan
Tel:	+81 46 855 3878
Email:	scheyvens@iges.or.jp
Website:	www.iges.or.jp/en/fc/activity_cca.html

LCI2012-01NSY(C)-MAEDA

Building Local Government Capacity to Account for GHG Emissions: The Case of Phitsanulok Municipality, Thailand

Shom Teoh[1]
[1]Corresponding Author
Programme Manager, Institute for Global Environmental Strategies (IGES)
Email: teoh@iges.or.jp

ABSTRACT: This project had the primary objective of building the capacity of local government officers in a medium-sized Thai municipality, Phitsanulok Municipality (approximate population size of 100,000–120,000 persons) to develop and implement a 'Measuring/Monitoring, Reporting and Verification' (MRV) framework for quantifying city-level greenhouse gas (GHG) emissions. In the process, a pilot global standard for city-level GHG accounting was tested. The outputs provide a crucial foundation for future research work and practical projects relating to sustainable, green, low carbon city development in Phitsanulok City. In addition, the findings may be helpful to researchers, policy makers and other supporting stakeholders involved in capacity building activities for local governments on the topics of local-level GHG accounting and MRV.

KEYWORDS: *capacity building, low carbon city development, MRV, local governments, city-level GHG accounting and inventory*

Introduction

It is widely asserted that a large share of global greenhouse gas (GHG) emissions may be attributed to activities in cities and urban areas. Hence, from a policy perspective, it is crucial to be able to measure/monitor, report and verify (MRV) GHG emissions in cities based on a globally consistent and comparable framework, which would cover methodologies for both GHG emissions inventory development as well as project-level mitigation action. While methodologies need be harmonised to a global standard, they also have to be sufficiently flexible and practical for application in diverse country governance contexts.

Furthermore, as local governments are relatively new to MRV exercises, it is critical to build capacity of local governments and domestic actors in a sustainable manner towards enabling local mitigation policies and action to contribute meaningfully to national and global goals.

This project collaborated with Phitsanulok Municipality (as a representative for a mid-sized Thai municipality with high motivation but limited experience in MRV) to collect baseline data for establishing a municipal- and city-level GHG inventory. The process allowed an understanding of local governments' responsibilities, institutional structures and governance factors.

HIGHLIGHTS

- This project demonstrated that it is possible for local governments to collect reasonably complete data for a municipal-level GHG inventory (which covers only activities within the organisational boundary of the local government) by giving careful consideration to: (i) role allocation; (ii) harmonisation of GHG data collection with existing institutional/organisational structure and processes; and (iii) appealing to the practical benefits of GHG data collection.
- Collecting data for a city-level GHG inventory, however, is more complicated than a municipal-level GHG inventory, and requires additional effort to obtain the cooperation and assistance from external parties.
- City-level GHG emissions inventory development could be pragmatically divided into two stages: Stage 1 on establishing a municipal-level inventory, which develops essential knowledge and skills on data collection. This provides a foundation to expand to Stage 2, which collects activity data within the municipality's geo-political boundary to cover the residential and private sectors.
- The level of guidance contained in existing global and national protocols (more details in 'Methodology') on local GHG inventory is insufficient to enable lower capacity and smaller-sized local governments to undertake MRV and GHG accounting independently.

Methodology

This project collected two sets of inter-related data and referred to the following standards/frameworks for both municipal- and city-level GHG inventory development:

- For municipal-level inventory (i.e., covering GHG emissions arising only from the activities of the local government organisation), 'ICLEI Local Government Operations Protocol for the Quantification and Reporting of GHG Inventories' (Version 1.1; May 2010) and Guidelines on Municipal Carbon Footprint developed by the Thailand Greenhouse Gas Management Organization (TGO).
- For city-level inventory (i.e., covering GHG emissions arising from all activities within the geo-physical boundaries under the local government's authority; a larger scope compared to a municipal-level inventory), the GPC Pilot Version 1.0 (http://www.ghgprotocol.org/city-accounting).

Primary and secondary data were collected by the Phitsanulok Municipality staff, which were reviewed by IGES as well as a third party expert. The data reported for municipal-level GHG inventory covered activities in calendar year 2013, while the data for city-level GHG inventory covered activities in calendar year 2012, due to data availability. Unless stated otherwise, all activity data reported are sourced from the staff of Phitsanulok Municipality.

Results and Discussion

The project first established the baseline circumstances of Phitsanulok Municipality's in terms of (i) its organisational structure as well as existing data and collection processes relating to energy consumption (mainly electricity use in buildings/facilities and fuels for vehicles and machinery), solid waste, water supply, wastewater treatment and other sectors; and (ii) familiarity of municipal staff with MRV.

Among Phitsanulok Municipality's staff, basic knowledge and awareness about climate change among local government officers is quite high, but capacity for systematic data collection, as well as for basic project management, which are essential for sustaining the process of developing and maintaining a city-level GHG inventory and MRV of mitigation projects based in cities, is weak.

Data for a Municipal-Level GHG Inventory

For example, initially, the municipality did not have a complete, unfragmented list of municipality-managed buildings/facilities, and the electricity meters associated with each building. Electricity bills are collected by each department and sent to the finance department every month, which only collates the financial (cost of electricity) but not activity (units of electricity consumed). Even when data is collected, the quality control is not assured. This is a general condition for other kinds of data, such as fuels purchased, vehicle fleet, refrigerants (air-conditioning in buildings and vehicles) and electric/electronic equipment inventory, etc.

Cross-department collaboration is a critical challenge in data collection. Existing data management systems and institutional structures within local governments do not support cross-departmental data collection, so a new working group, which is backed by a strong internal coordinator with high-level leadership was necessary.

Data for a City-Level GHG Inventory

In contrast, most of the data required for city-level GHG inventory are not easily available – they need to be derived from higher-level, provincial-level data (top-down approach), or special requests need to be made to particular organisations for sampling (bottom-up approach) data.

In the case of Phitsanulok Municipality, special efforts need to be exerted by the municipality to request information about fuel sales from the private sector (petrol stations and cooking gas providers). For electricity use in households and commercial buildings, such data had to be requested from the Provincial Electricity Authority (PEA). PEA's database system could not easily and quickly isolate consumption data for all buildings within the city boundary.

As for fuel consumption in the transport sector, the municipality had to request sales data from petrol stations operating within the city boundary as an initial step. However, not all petrol stations were willing, nor were they legally obliged, to reveal such data. Even when data is revealed, the quality is uncertain. There was also no good quality baseline data of the transport sector, such as the number and type of vehicles travelling within the city boundary, as well as travel patterns (e.g. travel distance of vehicles).

Practicality of Present National and Global GHG Accounting Standards and Protocols

Due to weak capacity (including English language capacity) and lack of incentives, Phitsanulok Municipality staff found it difficult to develop municipal or city-level GHG inventory merely by independently reading the guidelines issued by national and international agencies.

The data collection forms prescribed by both international agencies and national agencies request the summative data (total amount for the entire municipality operations, or the entire city). It leaves the question of how to collect scattered and fragmented subsidiary data to the municipality, which is actually the most challenging part of the process.

In particular, calculating citywide transport-related emissions may require the support of a third party expert, as the guidelines provided by the GPC is extremely complicated. Most municipalities in developing nations are unlikely to possess such capacity.

Recommendations

Unless there is guidance and support from a third party and high motivation, it is unlikely that a municipality, especially one with limited capacity and experience on GHG accounting, will be able to establish a systematic and sustainable process to collect such data on a regular basis.

In reality, there are also no direct incentives or legal mandate for local governments to undertake MRV action or establish either a municipal- or a city-level GHG inventory. So, the framing of co-benefits of MRV action to the municipality itself, as well as to the local environment, economy and society is important. Benefits that could appeal to the municipality include:

- Creating a more robust and modernised routine data management system to facilitate better local development planning and policy-making for sustainable development.
- The reputational benefits for the local government to be involved in a global and emerging issue such as climate change can also be appealed to (being a 'progressive' city with international reputation and projects). This may attract further attention from various international organisations who may provide resources to help develop the city.
- Increase 'readiness' to comply with eventual directives from central government when national policy on climate change is fully enforced, especially legally, following the lead of developed countries. For example, it is most likely that central government will mandate all local governments to report energy and electricity consumption regularly and to formulate low-carbon city development.

Based on the above, a pragmatic approach might be to divide the inventory development into two stages, and the case of Phitsanulok Municipality suggests the two stages can be eventually implemented in parallel:

- Stage 1 for developing municipal-level GHG Inventory (smaller scope), which helps to nurture basic capacity on data collection towards Stage 2.
- Stage 2 for developing city-level GHG inventory (larger scope covering emissions which are emitted within the geo-political administrative boundary of the local government).
- To aid in data collection for the above stages, awareness raising and capacity building activities on MRV organised by third parties should also be extended to relevant central and provincial agencies, such as Provincial Electricity Authority (PEA) and provincial authorities.
- The accuracy and quality of data needs to be improved over time and, for this, further measures other than setting up an ad-hoc project working group (which will not be active after project completion, since staff will be busy with their core duties) must be taken to formally institute GHG data collection work both as a routine and responsibility of relevant persons.
- Data management systems, both in the municipality and in external agencies collecting relevant data (such as PEA for electricity consumption), also need to be enhanced.
- The level of guidance contained in existing global and national protocols on local GHG inventory are insufficient to enable lower capacity and smaller-sized local governments to undertake MRV and GHG accounting independently. To encourage more local governments to undertake MRV-related work, supporting organisations may help by developing more detailed and local-language guidance on decentralised/micro-level data reporting forms to complement existing broad guidance provided by national/global GHG accounting protocols, especially for the transport sector at the city-level.

Category	Emission Sources	Total in FY2013	Unit	Remarks
Energy	Electricity - Stationary Sources (Buildings)	14,464, 110.89	kwH	
	Diesel	534,681.00	L	Off-road consumption needs to be differentiated from mobile consumption (vehicles).
	Benzene	3,873.00	L	
	Gasohol	31,376.00	L	
	CNG	77,151.00	Cu. Ft.	
Waste/ Wastewater	Solid waste landfilled	22,538.50	t	Based on methane commitment method (present year). Calculations still need to consider the MBT process which was initiated at full scale since October 2013.
	Biological Treatment/ Composting	9.00	t	Not including community-level composting
	Incineration	N/A		
	Wastewater Treatment & Discharge	180,291	m^3	Needs to be reduced based on an assumption of how much of supplied water is eventually discharged into septic tanks.
Others	Fertiliser Use (16-16-16)	0.6	t	Estimated from 50kg x 12 packs per month.
	Fugitive Emissions (N-22)	TBC		As there are no consumption-based purchase records, estimation needs to be done based on the number of fire extinguishers, vehicle fleet and air-conditioning units.

Table 1. Data Collected for Municipal Level GHG Inventory as of 23 June 2014, Phitsanulok Municipality, Thailand.

Conclusion

Due to a low baseline capacity and lack of practical incentives, it is challenging to build a local government's capacity on MRV actions, which starts with the development of local-level GHG inventory (both municipality- and city-level). Once an initial GHG inventory is developed, the long-term challenge is then to maintain a systematic/ routine accounting mechanism to compile relevant data within a city government, so that a good quality annual GHG inventory report can be produced.

It is hoped that the case of Phitsanulok Municipality will provide some ideas and insights to supporting stakeholders on the required capacity building approaches and guidance that will enable more local governments in developing countries to account for city GHG emissions in the future.

Project Publications

This project's findings will be published as part of an upcoming IGES policy report on Local-level MRV Action in 2015. The Municipality's 2012/13 Inaugural GHG Emissions Inventory will also be published separately as a public report in 2015 (Figure 1).

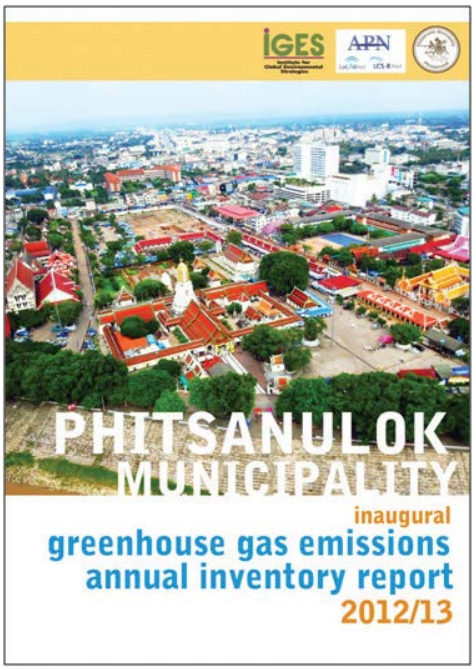


Figure 1. Draft of the Phitsanulok Munipality's GHG emissions annual inventory report.

Acknowledgements

Our appreciation goes to APN for financially supporting this research and capacity building project. We also deeply appreciate the essential guidance and contributions by Phitsanulok Municipality, Japan International Cooperation Agency (JICA), National Municipality League of Thailand and local volunteers in the municipality.

PROJECT INFORMATION
Title: Capacity Building for Implementing a 'Measurable, Verifiable and Reportable (MRV)' Model in a Mid-Sized Thai Municipality
Duration: Single-year project
Total Funding: US$ 28,000
Project Leader: Mr. Toshizo Maeda
Full address: Institute for Global Environmental Strategies, International Village Center 2F, 1-1-1, Hirano, Yahata-Higashi-Ku, Kitakyushu City, Japan 805-0062
Tel: +81 93 681 1563
Email: maeda@iges.or.jp

AOA2012-05NSY-HERATH

Climate Change Downscaling Approaches and Applications Training Programme

Srikantha Herath[1]
[1]Corresponding Author
Institute for the Advanced Study of Sustainability, United Nations University, Japan
Email: herath@unu.edu

ABSTRACT: Climate change projections provide an important basis for development of future climate change adaptation strategies. However, since projections of future climate are very much subjected to assumptions made in the models, parameterization, model complexity, societal and economic development trends, etc., there are tremendous uncertainties in the projected future climate. The University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR) academic programme developed a set of training modules on Climate Projection Downscaling Methods in 2011 to inform the current status of methodologies, uncertainties and the appropriate use of projections. The modules provide training on two approaches to dynamic and two approaches to statistical downscaling methods, risk assessment and estimation of climate change impacts on floods and rice production. This third training was organised from 9–20 November 2012, at the Asian Institute of Technology, Thailand, in partnership with the Asia Pacific Network for Global Change Research (APN). Seventeen lecturers from ten institutions participated in the delivery of training for 48 participants. A new staggered approach was adopted to accommodate the high number of participants by dividing groups into two and staggering the programme by one day. Participants demonstrated high level of competency and could benefit from the training programme. A number of participants requested the use of the materials for their institutional capacity development activities.

KEYWORDS: *climate change impacts, downscaling, training programme, flood, rice production*

Introduction

The University Network for Climate and Ecosystems Change Adaptation Research (UN-CECAR) is a network of universities and research institutes in the Asia-Pacific region that collectively develops research and education programmes on climate change adaptation, ecosystems change adaptation, and sustainability. United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS) coordinates and supports the activities of UN-CECAR and acts as a repository for education programmes and research outcomes.

Through a series of workshops, UN-CECAR academic programme developed a set of training modules on Climate Projection Downscaling Methods and Applications in 2011 with the following specific objectives:

- To provide an overview of science of climate change and downscaling.
- To provide practical training in downscaling methods to derive weather and climate projections from global to local scale.
- To assess impacts of climate change on flood and rice production and practical training in using impact models in conjunction with Geographical Information Systems for adaptation planning.

Course Design

The downscaling programme was designed as two independent but interlinked courses. The first course deals with producing future weather series at local scale by downscaling global climate projections and the second course deals with using this information to assess impacts and design adaptation strategies related to flood mitigation and rice production.

Course I

Course I is composed of the following modules: (a) Science of climate and climate change modelling; (b) High resolution climate projections using physically based models; (c) Downscaling using statistical methods; (d) Selection of global models based on modelling skill; (e) Bias correction for extremes and for total rain; and (f) Risk assessment and extreme events.

» *Dynamic downscaling*

In this module, two different approaches to obtaining high-resolution climate projections are introduced. In the first approach, the National Center for Atmospheric Research (NCAR) introduces the nested modelling approach, where Weather Research and Forecast (WRF) model is applied progressively with increasing spatial resolution to smaller nested regions starting from the global model output to downscale model's global predictions to local scale. The session introduces the importance of validating climate model outputs using local observations and participants confirm the improvement of projections obtained from downscaling.

As a second approach, the Meteorological Research Institute (MRI) of Japan 20-km Atmospheric General Circulation Model is introduced where the model does not simulate ocean process, but uses the outputs from other models and observations as the boundary conditions, making it possible to model the whole world at 20-km resolution (Kitoh et. al, 2009). For many applications no further downscaling is required. The participants could get hands on training to use the 'grads' suite of tools to assess model output data and compare with observed climate variables at any location of interest.

» *Statistical downscaling and selection of GCM*

In the statistical downscaling procedure, a model is constructed for a local climatic variable such as rainfall or temperature from a number of variables from GCM predictands. Participants constructed such models using time series data of ground observation and GCM

projections. Selection of a particular GCM for a given region is an important issue due to the large differences in future climate simulated by different GCMs. University of Tokyo, Department of Civil Engineering, introduced a selection method based on model skill in reproducing major climatic signals of the past.

» *Bias correction*

Two different approaches to bias correction are introduced in this training. In the first approach, provided by the University of Tokyo, participants perform correction for extreme rainfall, normal rainfall and no rain days of GCM output by using observed areal average rainfall for 1981–2000. For the extremes, 20 annual maxima were fitted with Lognormal, Gumbel distributions with Weibull, Hazen and Cunnane plotting positions for choosing the best-fit distributions for the observed rainfall.

The second method of bias correction was introduced in the UNU, where first the rain frequency is corrected by truncating daily precipitation based on the non-exceedance of observations. Then, the intensity is corrected by mapping the cumulative distribution function (CDF) of the truncated series to the CDF of the observed series. The Gama distribution was used to map the observed as well as GCM data sets, and a hands-on exercise used MRI 20 km data sets to verify the methodology.

» *Risk assessment, extremes and rainfall-intensity-duration-frequency (RIDF) curves*

The risks and extremes session conducted by the United Nations University starts with definitions of risk, hazard and vulnerability and move to a discussion on resilience and extreme events. Climate change modifications to extremes and challenges are then introduced with special focus on; non-linear relation between extreme events and losses and infrastructure design implications under climate change uncertainty.

Course II

» *Impacts on flood magnitude*

The main emphasis of the training is on the appropriate use of future climate projections flood impact assessment. In general GCM data are not precise enough to make applications for urban flood analysis. The example selected was flood inundation in an urban area, which is located in the downstream area of a 2500 km^2 catchment. The modelling is carried out using a hybrid approach, where the inflow to the urban area is first estimated using a hydrological model and then this input is used in a hydro-dynamic model to compute the inundation (Herath et. al, 2003). For such applications, the 20 km^2 spatial resolution of the MRI data provide important input of rainfall with adequate spatial distribution in the mountainous upper catchment.

» *Impacts on rice production*

In the rice yield production stream, first an introduction to rice yield modelling is provided with a detailed description of the DSSAT model and its application to rice yield simulation. Then exercises are provided to set up the model to a case study and to calibrate and validate the model. An application is conducted where total rice production under different soil groups and rice varieties in a region are estimated. Then, future yield under climate change for these combinations are carried out. Finally, using GIS tools, appropriate spatial distribution of rice varieties to be planted in the region is determined according to given adaptation constraints.

» *Risk communication*

On the last day, a special session on communicating climate information was conducted by the Institute for Social and Environmental Transformations (ISET). The main objective of this interactive session was to engage the participants in appropriate roles for and communication of climate information in various stages of adaptation and resilience planning. The participants were given a number of climate change impact scenarios and were asked to develop a framework for planning and communicating an adaptation strategy.

Participants

Forty-eight applicants were selected based on their background and relevance to the programme. The composition of the selected participants is shown in Figure 1 that shows a good distribution among researchers and practitioners.

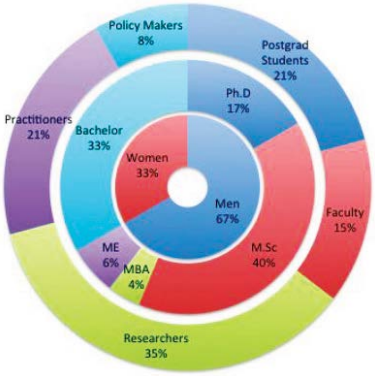


Figure 1. Composition of the participants.

Training Outcomes

The training proved to be an appropriate platform for interaction of researchers and practitioners as well as building teams and connections among various sectors in the Asia-Pacific countries. It is hoped that the participants will continue to build on these networks to develop joint programmes in the future associated with planning for climate change.

At the end of the programme, all participatns produced group reports for both course I and course II. For course I, the reports were a reflection on the training received during the course. For course II each stream produced results of the group activity in modelling and impact assessement related to case studies. In the following section, two group reports are introduced as samples of student submissions.

» *Group report sample: IDF curve derivation*

Intensity-duration-frequency (IDF) curves are essential in the conventional design of urban drainage infrastructure. Due to non-stationarity brought about by the climate change, the IDF curves derived from past data are no longer valid for future and it become necessary to derive them from the climate projections provided by the GCMs. One of the major difficulties here is the lack of high time-resolution (small time step) rainall observations in many part of Asia required for bias correction. During the training, application of simple scaling theory to address this issue was introduced (Mishra and Herath, 2011). The Singapore team used this method to (a) demonstrate that simple scaling theory holds for rainfall maxima in Singapore; and (b) used the method to assess the changes to IDF curve using MRI 20 km^2 data.

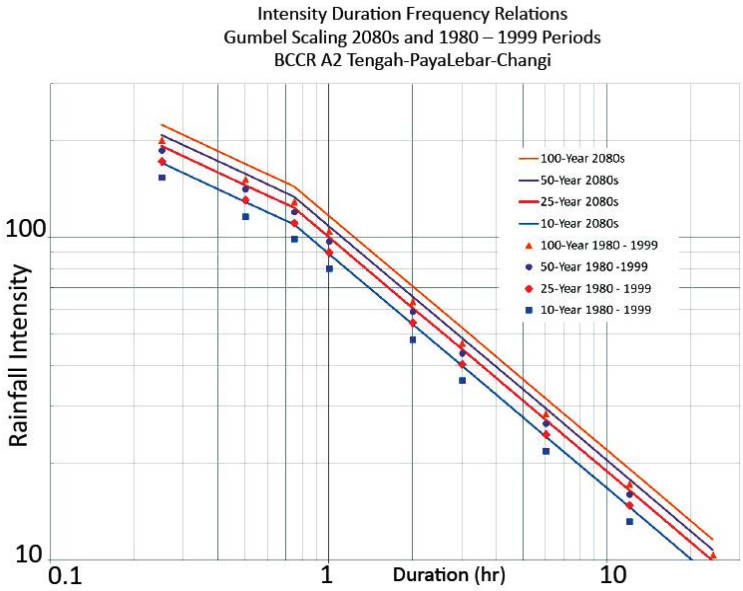


Figure 2. Comparison of current and future IDF curves.

The results obtained (Figure 2) shows that there is significant increase in rain intensities for all durations, and that 1:25 year current intensities (1980-1990) corresponds to 1:10 year probabilities by 2080's.

» *Group report sample: Rice yield estimation*

Some of the main parameters that affect rice yield for a given climate are the rice variety, soil type, fertiliser applicaton rate and irrigation management. Using the DSSAT simulation software, participants were trained on how to model rice yield under different future climate scenarios for different combinations of the above parameters. The assignment for the group was to select rice varieties for future climate under certain quantatitave constraints without incurring an economic loss to farmers at current price levels.

Summary

Representatives from the National Center for Atmospheric Research (NCAR), USA, the Japan Meteorological Research Institute (MRI), Japan, The University of Tokyo, Japan, the Indian Institute of Technology (IIT), India, the Asian Institute of Technology (AIT), Thailand, the University of Philippines, the Institute for Global Environmental Strategies (IGES), Japan, the Institute for Social and Environmental Transitions (ISET), UK and the Institute of Meteorology, Hydrology and Environment (IMHEN), Viet Nam, worked with UNU in developing the modules. The APN funded the present course delivery. The Ministry of Environment, Japan supported the course development as a collaborative activity of IGES and UNU.

A novel staggered training approach was used to accommodate the large number of participants for the training. For half the group, lectures were conducted from 9–13 November; and for the second group from 10–14 November. Each lecturer delivered the same contents on successive days, keeping the overall programme hosting costs low. The participants were requested to evaluate different aspects on a scale of 6 levels; excellent, very good, good, fair, poor and very poor. The overall impression was very good, with all evaluations generally in the range of excellent to good. The combined evaluation for both courses I and II are shown in Figure 3.

It is clear that there is a great demand for updated knowledge on downscaling and using climate change projections. If sufficient financing can be secured it is worthwhile to organise this programme in different countries annually. In order to make these materials readily used by the global community, it would be useful to organise a workshop for the trainers, so that they can conduct the programme at different institutes either locally or regionally.

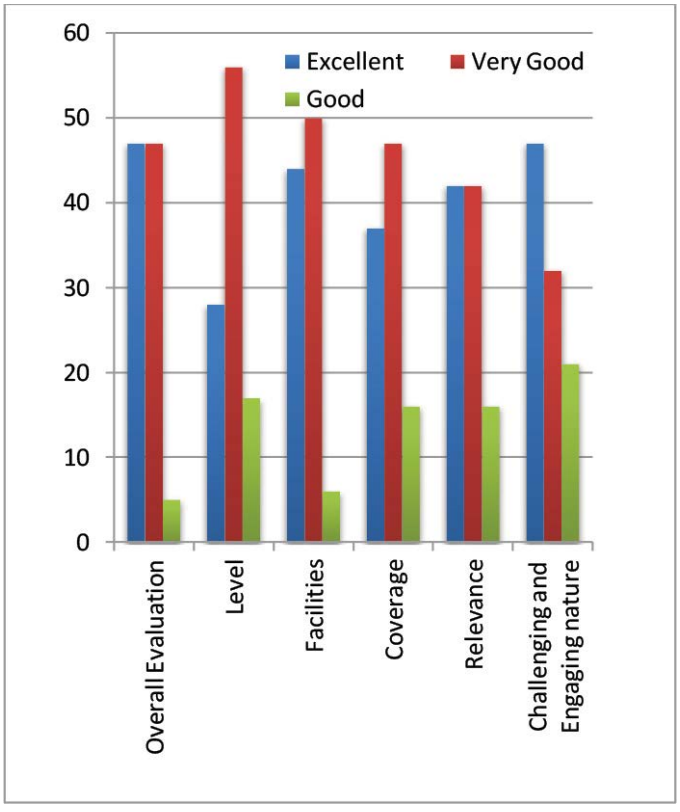


Figure 3. Sample of course evaluation.

References

Chang Chian Wui, Lee Zhang Er, Charoenkit Sasima, Noimunwai Watcharapong, Panpeng Jirawat, Sengkhammy Bounyaseng (2012) Report for the Training Programme on Climate Change Downscaling Approaches and Applications (CCDAA) GIS-Geoinformatics Center, Asian Institute of Technology, Bangkok, Thailand 9-20 November 2012, Course Flood, Group – 3

Dhage Pradnya, Rajwade Yogesh, Satapathy Sushree and Singh Ankita (2012) Report for the Training Programme on Climate Change Downscaling Approaches and Applications (CCDAA) GIS-Geoinformatics Center, Asian Institute of Technology, Bangkok, Thailand 9-20 November 2012, Course 2: Impact on Rice Production, Group - 2

Herath, S., Dutta, D. and S. Wijesekera, S. (2003). A coupled river and inundation modeling scheme for efficient flood forecasting, Geoinformatics,Vol. 14, No. 1, JSGI, pp.37 -41

Herath. S. and S. H. Teh (2012) "Handbook and Proceedings of First Training on Climate Change Projections and Downscaling: Approaches and Applications", CECAR series No. 8, UNU-ISP.

Kitoh, A., T. Ose, K. Kurihara, S. Kusunoki, M. Sugi and KAKUSHIN Team-3 Modeling Group (2009) Projection of changes in future weather extremes using super-high-resolution global and regional atmospheric models in the KAKUSHIN Program: Results of preliminary experiments. Hydrological Research Letters, 3, 49-53.

Kubota, T., S. Shige, H. Hashizume, K. Aonashi, N. Takahashi, S. Seto, M. Hirose, Y. N. Takayabu, K. Nakagawa, K. Iwanami, T. Ushio, M. Kachi, and K. Okamoto (2007) Global Precipitation Map using Satellite borne Microwave Radiometers by the GSMaP Project: Production and Validation, IEEE Trans. Geosci. Remote Sens., Vol. 45, No. 7, pp. 2259-2275.

Mishra, B.K. and Herath, S. (2012): Investigating potential climate change impacts on rainfall intensity duration frequency curves in Kathmandu, Nepal, Proceedings of 11th International Symposium on New Technologies for Urban Safety of Mega Cities in Asia, October 10-12.

Mizuta, R., K. Oouchi, H. Yoshimura, A. Noda, K. Katayama, S. Yukimoto, M. Hosaka, S. Kusunoki, H. Kawai and M. Nakagawa, 2006: 20-km-mesh global climate simulations using JMA-GSM model – mean climate states –. J. Meteor. Soc. Japan, 84, 165-185.

Swain D. K., and Thomas D. 2010.Climate Change Impact Assessment and Evaluation of Agro-Adaptation Measures for Rice Production in Eastern India. Journal of Environmental Informatics, 16(2):94-101.

Swain D. K. and Yadav A. 2009. Simulating the Impact of Climate Change on Rice Yield Using CERES-Rice Model. Journal of Environmental Informatics, 13(2):104-110.

PROJECT INFORMATION

Title:	UNU-CECAR/UNU-ISP/APN Training Programme on Climate Change Downscaling Approaches and Applications
Duration:	Single-year project
Total Funding:	US$ 50,000
Project Leader:	Dr. Srikantha Herath
Full address:	Institute for the Advanced Study of Sustainability, United Nations University, 5-53-70, Jingumae, Shibuya-ku, Tokyo, Japan 150-8925
Tel:	+81 03 546 7122
Email:	herath@unu.edu

ARCP2013-11CMY-YABE

Climate Change Impact Assessment on Water and Agriculture in Cambodia as Part of the Water-Climate-Agriculture Workbench

So Im Monichoth, Kumiko Tsujimoto, Shizu Yabe, and Petra Koudelova[1]
[1]Corresponding Author
The University of Tokyo, Japan
Email: petra@hydra.t.u-tokyo.ac.jp

ABSTRACT: Building resilience to climate change and variability is essential for achieving sustainable development. In Cambodia, the economy depends on agriculture, mainly rice production. As most rice fields are rainfed and most farmers rely on their non-science-based experience, they are unwilling to adjust to changing rainfall. The aim is to provide information related to the changing water cycle, which could be used by local governments and farmers to adjust crops, planting time and water resources management accordingly. In this study, a hydrological model and rice growth model were coupled into a "Hydro-Crop" model and used to integrate satellite and in-situ data and general circulation model (GCM) outputs of CMIP3 to generate the desired information. In this manner, the hydrological conditions, optimum planting dates and yield for present and future climate were obtained and the results were compared with the actual situation.

KEYWORDS: *climate change and food security - Cambodia, rice yield simulation, SAFE, AWCI, water cycle integrator*

Introduction

Building resilience to climate change and variability is essential for achieving sustainable development of Earth's societies and ecosystems. To accelerate the coordinated and integrated efforts towards this goal, the "GEOSS Water Cycle Integrator (WCI)" recognises fundamental linkages among water, land use, carbon cycle and ecosystem services, and food-, energy- and health-securities. In this context, WCI is aimed at developing effective means for sharing coordinated, comprehensive and sustained water cycle and related Earth observations and information for sound decision making. The GEOSS Asian Water Cycle Initiative (AWCI)—a regional collaborative framework of 18 Asian countries—adopted the WCI approach under the featured project (ARCP2013-11CMY-Yabe) and has initiated and advanced development of so-called workbench functions in AWCI countries. (A workbench is a virtual geographical or phenomenological space where experts and managers work together to use information to address a problem within that space). The pilot case of a fully functional workbench has been developed in Cambodia under cooperation among stakeholders, space agencies and science communities on water, climate and agriculture. The resulting integrated system provides on-line information on near-real time spatial precipitation, soil moisture as well as rice production to local communities and technically is supported by DIAS and the University of Tokyo. The presented study was carried out as a part of a Space Application For Environment (SAFE; http://www.eorc.jaxa.jp/SAFE/index.html) prototyping activity and a part of the AWCI activities in Cambodia and contributed to the workbench development. It was published in Monichoth et al., 2014.

The economy in Cambodia depends on agriculture with rice being a major agricultural product. However, no significant irrigation system is available and thus most of the rice fields depend on rainfall and streamflow, which makes the farms greatly vulnerable to climate change. Earlier studies have suggested that variability of rainfall and streamflow would be greater due to climate change. Accordingly, an assessment of climate change impacts on rainy season onset and hydrological regime in Cambodia is essential for farmers' consideration of future cropping activities (variety of crops and optimum planting and harvesting times). The target area of this study, western Cambodia, has the largest rice production and most land rainfed. For their cropping decisions, farmers rely on their experiences and thus would have difficulties to adjust to changing rainfall and hydrological patterns, which could cause severe food production losses in the region. At the same time, there is no operational system for climate and weather data collection, and thus it is difficult to obtain reasonable initial atmospheric conditions for the forecast and/or prediction of future atmospheric conditions. The aim is, therefore, to provide such information related to the changing water cycle, which could be used by local governments and farmers to adjust crops, planting time and water resources management accordingly. In this study, a hydrological model and rice growth model were coupled (resulting into a "Hydro-crop" model) and used to integrate satellite and in-situ data and general circulation model (GCM) outputs to generate the desired information. In this manner, the hydrological conditions, optimum planting dates and yield for present and future climate were obtained and the results were compared with the actual situation.

HIGHLIGHTS

- Workbench function establishment for Water Cycle Integrator (WCI) approach towards building resilience to climate change in AWCI countries.
- Water-Climate-Agriculture workbench in Cambodia through cooperation with stakeholders (Ministry of Water Resources and Meteorology, Cambodia, MOWRAM; Tonle Sap Lake Authority and local province authorities), AWCI–DIAS and JAXA–SAFE.
- River Management System development in AWCI countries.
- Capacity building for WCI approach (data integration, climate change assessment methods, river management system).

Methodology

The overall framework of the study is shown in Figure 1. The coupled distributed hydrologic and rice-growth model Hydro-Crop

(Tsujimoto et al., 2013) used in this study was developed by combining the Water and Energy Budget Distributed Hydrological Model (WEB-DHM; Wang et al., 2009) with a paddy-field scheme and the Simulation Model for Rice-Weather Relations (SIMRIW)-rainfed model (Homma and Horie, 2009). The Hydro-Crop model dynamically couples the modified WEB-DHM and SIMRIW-rainfed and was validated for the Sangker River basin, which is the target basin of this project (Tsujimoto et al., 2013). In this model, parameters such as planting date, irrigation amount and timing, soil characteristics and fertiliser amount may be fully distributed, temporally and spatially. The target rice type for obtaining the parameters and model analysis is IR64 (short-term rice).

Firstly, the forcing data for present and future climate were prepared for the Hydro-Crop model from the GCM output using the set of 24 GCMs of the of the World Climate Research Programme's (WCRP's) Coupled Model Intercomparison Project phase 3 (CMIP3; Mehl et al., 2007). Instead of using the output of all 24 models, only

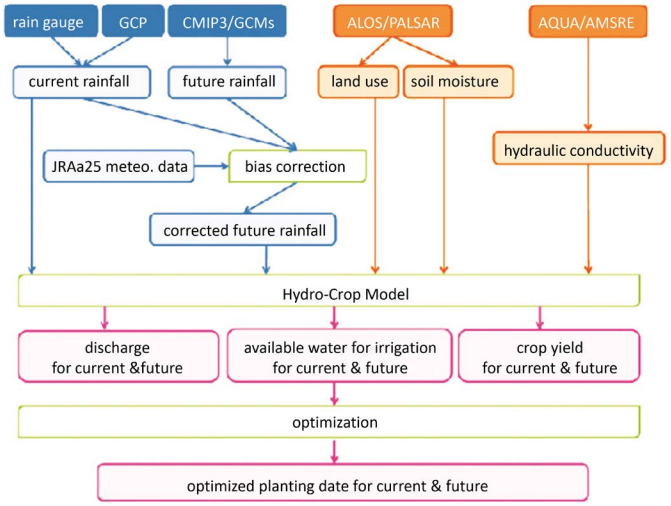


Figure 1. The overall framework of the study.

six models that could reproduce seasonal evolution of the monsoon in Cambodia (May to October) in the baseline period (1981–2000, i.e., present climate) were selected based on criteria described in Monichoth et al. (2014). The precipitation bias in the GCM output was corrected using the statistical method developed by Nyunt et al. (2013).

Secondly, the initial conditions and soil and land-related parameters (land use, soil hydraulic conductivity and initial soil moisture) for the Hydro-Crop model were prepared using the satellite data of ALOS/PALSAR (land use, soil moisture) and Aqua/AMSRE (hydraulic conductivity). The hydraulic conductivity was optimised by using Land Data Assimilation System developed at the University of Tokyo (LDAS-UT). Thirdly, the obtained initial conditions, model parameters and forcing data were inputted into the Hydro-Crop model and the model was run for the present climate (1981–2000) and the future climate (2046–2065) periods. Hydrological and rice production results were analysed and optimised planting dates for present and future climate conditions were calculated using the method of Ohta et al., (in preparation).

Data

The environmental data used in the study is presented in Table 1.

Results and Discussion

GCM selection procedure resulted in a set of six model outputs that were able to capture the rainfall pattern over the region of interest in May, June, July, August, September and October. These included: gfdl_cm2_0, gfdl_cm2_1, csiro_mk3_0, ingv_echm4,miroc3_2_hires, and miroc3_2_medres model outputs. Seasonal change of rainfall for the past and future are shown in Figure 2, which depicts bias-corrected, monthly-averaged future projected precipitation by GCMs and observed past precipitation.

The analysis suggests that monthly rainfall amounts do not change significantly in future but the six models have different trends. Two models – csiro_mk3_0 and gfdl_cm2_1 – provide greater amount of rainfall in future from February to September, i.e. rainy season would begin and end earlier than at present. The model gfdl_cm2_0 provides almost double the amount of rainfall in October but the rainy season ends in this month, i.e. as at present. The extreme increase in heavy precipitation at the end of the monsoon season indicates that larger floods may be expected. At the same time, the interannual variation is greater in future and thus we may also expect more severe droughts.

The simulation by the Hydro-Crop model for the year 2011 suggested that the best planting time for maximising crop yield was August (Monichoth et al., 2014), which is in agreement with the actual situation, i.e. the model gives reasonable results and may be used for future situation assessment. The results of future simulations are summarised in Figure 3. They revealed that some of the models provided a wide range of the best planting time, spanning the whole monsoon period in Cambodia (May to October). Three models – gfdl_cm2_0, ingv_echam4, and gfdl_cm_1 – indicated the best planting time at the end of September in 6 years over the 20-year period. In such cases, one more crop could be planted in May with the harvest prior to September. However, May planting carries a higher risk of low yield due to water shortage and thus irrigation would be strongly recommended. Depending on the irrigation possibility, farmers can decide to plant once or twice. The miroc3_2_hires and miroc3_2_medres models do not indicate any specific month as being the best for planting, only suggest planting from May to September, while the csiro_mk3_0 model indicates that July through September is optimal. In many cases, lack of sufficient rainfall from May through July causes significantly lower crop yield.

Data type or usage	Data source
GCM products	Coupled Model Intercomparison Project phase 3 (CMIP3), Mehl et al., 2007 (http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php); 1981 – 2000 & 2046 – 2065.
GCM selection reference data	Precipitation: Global Precipitation Climatology Project (GPCP), 1981 – 2000 (http://www.gewex.org/gpcp.html). Geopotential height: Japanese 25-year Reanalysis (JRA25), 1981 – 2000 (http://jra.kishou.go.jp/JRA-25/index_en.html).
GCM rainfall bias correction	Rain gauge data at Battambang (103.21°E, 13.09°N; western Cambodia), 1981–2000.
Land use mapping	Advanced Land Observing Satellite (ALOS)/Phased Array type L-band Synthetic Aperture Radar (PALSAR) at dual polarization (FBD); 4 paths synthesized, September – October 2010 (Path 481, 8 October 2010; Path 482, 25 October 2010; Path 483, 26 September 2013; and Path 484, 13 October 2010). Provided by JAXA under the SAFE framework.
Soil moisture	ALOS/PALSAR at full polarization (PLR), 8 April 2011. Provided by JAXA under the SAFE framework.
Hydraulic conductivity	Aqua Advanced Microwave Scanning Radiometer for Earth Observing System (AMSR-E) data (http://sharaku.eorc.jaxa.jp/AMSR/index.html January through March 2011, at 10.6 GHz and 36.5 GHz (vertical polarization).
LDAS-UT runs	AMSR-E (as above) Global Land Data Assimilation System (GLDAS) output (http://ldas.gsfc.nasa.gov/), 0.25° spatial resolution every 3 hours (GLDAS_NOAH025SUBP_3H), January through March 2011.
Hydro-Crop forcing	Six rainfall stations in the target, Sangker river basin JRA25 data (http://jra.kishou.go.jp/JRA-25/index_en.html)

Table 1. Data used in the study.

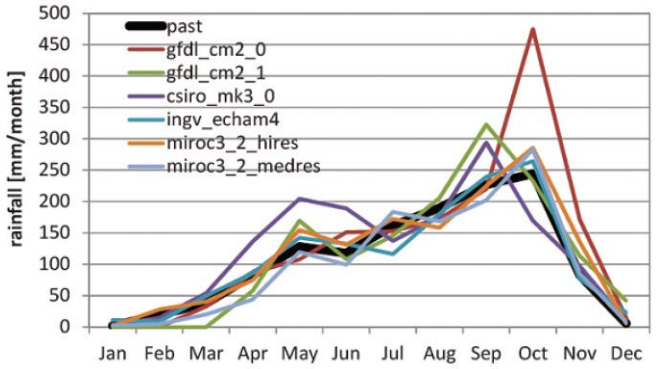


Figure 2. Bias-corrected future precipitation from selected GCM models (coloured lines) and past observed precipitation (Battambang station).

The analysis of planting at optimal times and assuming sufficient irrigation indicated that more than 3 t/ha may be produced (Figure 3). However, without irrigation there is a large yield variation, while with irrigation even planting at the worst times sometimes achieves yields as high as rainfed paddies planted at optimal dates.

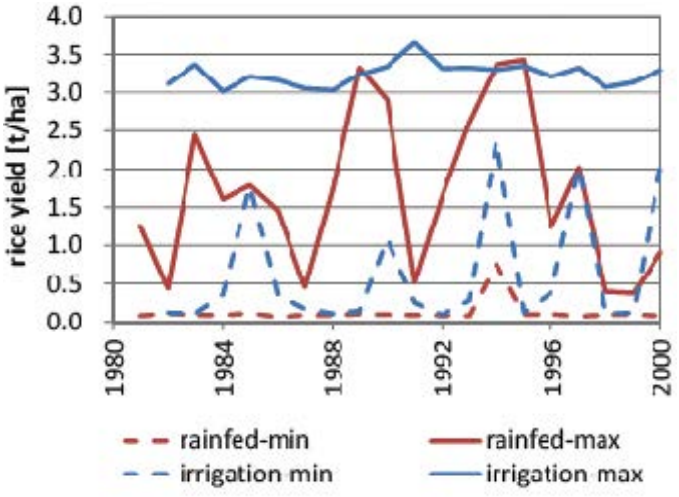


Figure 3. Expected rice yield for rainfed and irrigated paddies. Minimum and maximum yields vary with planting date.

Conclusion

The presented study investigated possible impacts of climate change on rice production in western Cambodia by using the CMIP3 GCM output to force the coupled Hydro-Crop model – a modelling system containing an advanced WEB-DHM hydrological model and SIMRIW-rainfed rice growth model. The use of satellite data was essential for the study, which was carried out by the SAFE project as a part of the Cambodia Water-Climate-Agriculture workbench establishment under the AWCI framework. The results demonstrated the potential of such a system to provide usable information for farmers. Assessment of the rainfall pattern change under future climate conditions showed increased variability of rainfall, i.e. more extreme events (heavy rainfall vs. insufficient rainfall), however results are different among the used GCM outputs. Subsequent analysis of future crop yield depending on planting time did not provide clearly conclusive results but indicated that double crops could be planted and the yield maximised if irrigation water is available at the beginning of the monsoon season. It must be recalled that the present results are based on GCM rainfall simulation capabilities, on which the reliability of the crop model depends.

This study used only a prototype that provides information on past and future rice production, with consideration of climate change. However, there are many uncertainties in CMIP3 GCM precipitation amounts, the bias correction method for obtaining future climate conditions, the algorithms estimating soil moisture from satellite, and the Hydro-Crop model. Their accuracies must be improved prior to becoming operational. For operational use in Cambodia, the Food and Agriculture Organization (FAO) standardised soil type and land use data will be used. More reliable rainfall and soil moisture, elevation at higher resolution, LAI/NDVI, flooded area/depth/duration, paddy field water depth, planting and harvest dates, are also needed. It is desirable to make these data accessible to the public, which is the next step.

References

Homma, K., Horie, T. (2009). The present situation and the future improvement of fertilizer applications by farmers in rainfed rice culture in Northeast Thailand. In: L.R. Elsworth, W.O. Paley (Eds.) Fertilizers: Properties, Applications and Effects. Nova Science Publishers, N.Y. 147-180.

Meehl G A, Covey C, Delworth T et al. 2007. The WCRP CMIP3 multi-model dataset: A new era in climate change research, Bulletin of the American Meteorological Society, 88: 1383-1394.

Monichoth, S.I., Tsujimoto, K., Aida, et al. 2014: Water and Food Security under Climate Change in Cambodia, Trans. JSASS Aerospace Tech. Japan, Vol. 12, No. 29.

Nyunt, C. T., Koike, T., Jaranilla-Sanchez, P. A. et al. 2013a: Bias correction method for climate change impact assessments in the Philippines, Annual Journal of Hydraulic Engineering, JSCE, 57.

Ohta, T., Tsujimoto K., Koike T. and Homma K.: Optimization of agricultural water management by using a dynamic hydro-rice-irrigation model, Water Resources Research, in preparation.

Tsujimoto K, Homma K, Koike T et al. 2013: Hydrological model and a rice growth model for grasping necessary information for rain-fed agriculture. Annual J. of Hydraulic Engineering, JSCE, 57: 511-516 (in Japanese).

Wang, L., Koike, T., Yang, K., et al. 2009: Development of a distributed biosphere hydrological model and its evaluation with the Southern Great Plains Experiments (SGP97 and SGP99), J. Geophys. Res., 114(D8), D08107, doi:10.1029/2008JD010800

Acknowledgements

The authors would like to acknowledge the great support of the JAXA SAFE programme to this activity. We are also grateful for support from Data Integration and Analysis System (DIAS) and the AWCI community. Special appreciation is extended to APN for their significant support of the AWCI framework and activities.

PROJECT INFORMATION

Title:	GEOSS/Asian Water Cycle Initiative/Water Cycle Integrator (GEOSS/AWCI/WCI)
Duration:	Two-year project
Total Funding:	US$ 80,750
Project Leader:	Ms. Shizu Yabe
Full address:	2-1-1, Sengen, Tsukuba, Ibaraki, 305-8505 Japan
Tel:	+81 50 3362 2064
Email:	yabe.shizu@jaxa.jp
Website:	http://www.jaxa.jp/index_e.html

CBA2013-11NSY-PAKHARKOVA

Earth System Governance: Local Cases, Global Options

Nina Pakharkova[1], Anton Shkaruba and Ruben Zondervan
[1]Corresponding Author
Department of Ecology and Environmental Study, Siberian Federal University
Email: nina.pakharkova@yandex.ru

SUMMARY: The "Scale in Earth System Governance: Local Case Studies and Global Sustainability" Summer School, held at the Siberian Federal University in Krasnoyarsk, Russian Federation from 15–29 July 2013, addressed challenges of scale in Earth system governance. It served as means for capacity building, and cross continental network development of early career researchers from the Asia-Pacific region and Central and Eastern Europe while undertaking research into local sustainability in the city of Krasnoyarsk and the beautiful nature of the Krasnoyarsk region. Participants brought case studies and experience from their own localities and context into the design and implementation of the studies in Siberia.

Introduction

Environmental researchers from neighbouring countries seldom meet, although field research and analysis are important to any regional collaboration. Summer schools offer a great opportunity to close this gap, helping researchers develop skills and build networks on one hand, and potentially benefiting local governance on the other.

A group of young researchers from Belarus India, Japan, Nepal, Russia, South Africa, Thailand and Ukraine made use of their vacation time to participate in the research Summer School "Scale in Earth System Governance: Local Case Studies and Global Sustainability" organised under APN CAPaBLE programme, in Krasnoyarsk, Russia, 15-29 July 2013.

The Summer School was held at the Siberian Federal University in Krasnoyarsk and started with lectures on theories and research methodology, presentations of case study projects and the preparation of field trips. The research groups then travelled to their respective case study locations and looked at the issues of sustainable urban planning and energy efficiency in Krasnoyarsk, development of mini-hydropower energy in the Krasnoyarsk Region, and human-wildlife conflicts and sustainable tourism in Southern Siberia. The case study reports were presented on the last day on the research seminar of the Department of Ecology and Natural Resource Management.

Developing Skills and Network in a New Setting

The most important outcomes of the Summer School were, of course, new research and analytical skills developed by the participants as became clear during the presentations and discussion of the field-work results at the end of the Summer School. For the participants from outside Russia, it was also an experience in an entirely new biophysical and governance setting. This School was as a great opportunity for researchers from the Asia-Pacific countries and former USSR to socialise and discuss their research and teaching—unfortunately environmental researchers from these regions do not meet often, especially for field research and analysis, and this APN School contributed to bridging this gap.

Impacts on Environmental Governance at the Local Level

The case study research also had an impact on environmental management in Krasnoyarsk and its region—long discussions with local architects and city planners gave them a new perspective on their work, and some of the echoes of those talks can be found in local media and blogs (e.g. http://krskdaily.ru/2014/03/architecture/downtown-unconscious, in Russian). The interactions between Summer School participants and practitioners could also have positive impacts on the new city master plan. Likewise, stakeholder talks organised by case study groups in natural protected areas are contributing to some positive moves, e.g. broader and more structured involvement of stakeholders to parks management, and new methods for evaluation of management efficiency piloted by regional biodiversity conservation authorities.

HIGHLIGHTS

- Implementation of local sustainability case studies on urban planning and energy efficiency, mini-hydropower energy, and human-wildlife conflicts and sustainable tourism that could be analysed in the context of the problem of scale in Earth System Governance.
- Bringing together a community of researchers and linking existing networks of early-career governance researchers in the Asia-Pacific region with such in Central and Eastern Europe working on governance for sustainable development and environmental management to jointly learn, stimulate dialogue and initiate new research endeavours.

Tangible Outcomes of the Summer School

Case study reports were prepared by the school participants for publication and two case studies, one on city-planning issues and green areas in Krasnoyarsk, and on the efficiency of biodiversity conservation in natural protected areas in Eastern Siberia, will feature in publications in preparation by participants. Many participants teach in under- and postgraduate students, and case study materials were used in their joint courses, a few of those already offered in the winter semester 2013/2014 in their home universities (including the course on Communication and Information Tool for Natural Resource Management offered at Siberian Federal University).

Some workshop participants especially from the Asia-Pacific region, who generally were more social science oriented than those from the other countries, have become Research Fellows in the Earth System Governance Project and thereby remain engaged in this field of research in a more structural way. This contributes to our conclusion that, despite rather fragmented future directions, this Summer School built well on existing programmes and has evolved from a one-off successful event to the start of many long-term research contacts and networks with a strong (and growing) regional presence in Asia and the Pacific.

Conclusion

The Scale in Earth System Governance: Local Case Studies and Global Sustainability brought together two distinct groups of early career researchers: One from Russia, Ukraine, and Belarus, and one from the Asia-Pacific region – two communities usually not interacting much but each working on the various dimensions of local sustainability, and each including researchers from various disciplines. With lectures on theory and methodology, the Summer School provided them with a common language and understanding, and the field work connected all participants and built networks for future collaboration—while even providing useful research-based policy options to local stakeholders.

Future Directions

The field-work, embedded in theoretical lectures and methodology tutoring has resulted in a significantly increased capacity for local environmental governance research by all participants. They have brought home these strengthened skills, the experience from the international and interdisciplinary work during the Summer School and will use this beneficially for the many courses they teach (as most participants are active teachers at universities). In case of the ReSET participants, the findings from the Summer School will, in line with the aims of that programme, also feed into their ongoing efforts to develop new and reform existing curricula in their home institutions and between their home institutions.

References

Biermann, F., Betsill, M., Gupta, J., Kanie, N., Lebel, L., Liverman, D., Schroeder, H. and
Siebenhüner, B., with contributions from Ken Conca, Leila da Costa Ferreira, Bharat Desai, Simon Tay and Ruben Zondervan. (2009). Earth System Governance: People, Places and the Planet. Science and Implementation Plan of the Earth System Governance Project. Earth System Governance Report 1, IHDP Report 20. Bonn, IHDP: The Earth System Governance Project.

Acknowledgements

The Scale in Earth System Governance Summer School was was organised in cooperation with the Open Society Institute's Regional Seminar for Excellence in Teaching (ReSET) project "Governance of Global Environmental Change" and EC Tempus "Environmental Governance for Environmental Curricula", and coordinated by Siberian Federal University in Krasnoyarsk, Russian Federation. We acknowledge APN's funding for the participation of early-career researchers from countries in the Asia-Pacific region.

Figure 1. Scale in Earth System Governance Summer School.

PROJECT INFORMATION
Title: Scale in Earth System Governance: Local Case Studies and Global Sustainability
Duration: Single-year project
Total Funding: US$ 38,000
Project Leader: Dr. Nina Pakharkova
Full address: Department of Ecology and Environmental Study, Siberian Federal University, Svobodny Prospect, 79, 660041, Krasnoyarsk, Russia
Tel: +7(391) 206 2134
Email: nina.pakharkova@yandex.ru

CBA2013-14NSY-MAITY

Assessing Bio-Economic Potential of *Enteromorpha instestinalis* for Sustainable Aqua-Farming in Climate Vulnerable Coastal Areas of Indian Sundarbans

Dipayan Dey[1], Ashoka Maity and A. Arunachalam
[1]Corresponding Author
Chair, South Asian Forum for Environment
Email: safeinch@gmail.com, office@safeinch.org

ABSTRACT: Algaculture in trapped waters of inundated coastal areas in the Indian Sundarbans can be a sustainable aquafarming practice for marginal farmers who have lost their land due to sea level rise and salt water intrusion. The present paper tries to assess the bio-economic potentials of algaculture as a sustainable aquafarming practice by analysing the biochemical components of one of the best grown macro algal species, *Enteromorpha intestinalis.* Perusal of results show that the species is rich in protein and has considerable amount of carbohydrates to deem it fit as an alternate source of food feed and fodder, whereas almost 95% of the available oil can be converted to biodiesel that confirms the standard specifications of EN-24124 in regard to fatty acid methyl esters and linolenic acid contents. This also qualifies the species as an alternative energy crop augmenting its bio-economic potentials.

KEYWORDS: *algaculture, sustainable aquafarming, bio-metabolites, climate impacts, coastal Sundarbans*

Introduction

Coastal Sundarbans in eastern India harbours natural resources of halophytic mangrove forest, rich biodiversity and ecosystem that form an extraordinary environment of the globe. It is also one of the most ecologically threatened areas of the planet (Choudhury & Choudhury, 1994). The available brackish water environment of Sundarbans provides favourable substratum for algal communities (Naskar & Naskar, 2010). *Enteromorpha intestinalis*, *Ulva lactuca* and *Catenella repens* are the dominant macroalgae found in the Indian Sundarbans of which Chlorophyceae (*E. intestinalis* and *U. lactuca*) are present in higher levels compared with *C. repens* (belonging to Rhodophyceae) zonation. It is noteworthy that in marine ecosystems, macroalgae are ecologically and biologically important and provide nutrition and an accommodating environment for other living organisms. There is mention of their polysaccharides being used in industries such as food, cosmetics, paint, crop, textile, paper, rubber and building industries. In addition, they are used in medicine and in areas of pharmacology for their antimicrobial, antiviral, antitumour anticoagulant and fibrinolytic properties.

Reports on studies on brackish water algae in and around the Sundarbans are available in the work of Naskar et al. (2008a, 2008b, 2008c), and Naskar (2011a, 2011b). Impact of seasonal variation on the biochemical compositional variation of the green weeds has also been reported by some authors (Mitra, 2009). However, there is a lack of information on research activities for the commercial exploitation on green algae of the Sundarbans. At the international level, research activities on the nutritional evaluation of the seaweed have been conducted and evaluation of the varied species for multiple industries reported (Wong, 2001).

Under the aegis of APN's CAPaBLE programme, a community-based sustainable aqua-farming initiative was taken to promote alga-culture in three coastal villages of the Sundarbans. Through community capacity building, on-field demonstration and scientific interventions, it has now become a multi-stakeholder endeavour. Perusal of results from follow-up interventions show that *E. intestinalis* shows promising growth in saline water-infested inundated areas (Maity & Dey, 2014) and development of processes for commercial exploitation of this algal flora may not only bring relief to thousands of impoverished families living in the belt, but also might create a position in the global market. Hence, the present study involves determination of the bioactive components of *E. intestinalis* that has nutritional significance and as well as potential for alternative energy sources. An extension of this preliminary work would entail developing and establishing the production processes for a range of products in the food and pharmaceutical sector and create alternative sources for biodiesel.

Methodology

Algal samples were collected in each month in pre-monsoon (March to June), monsoon (July to October) and post-monsoon (November to February) seasons of the year, from 2012 to 2014, from their natural habitat of coastal beaches from Sagar ($21^0$48'N, $88^0$5'59.9"E), Jhorkhali ($22^0$13'20"N, $88^0$56"43"E) and Saatjelia ($22^0$8'39"N, $88^0$52'40"E) islands of the Indian Sundarbans. The samples were washed with water and prepared for spectrophotometric studies.

HIGHLIGHTS

- A native macro-alga of coastal Sundarbans, Enteromorpha intestinalis, shows excellent growth in saltwater inundated areas that has lost farmlands owing to sea level rise.
- The green algal flora is rich in nutrients and can be an alternative source of food feed and fodder for marginal farmers, showing a prospect in sustainable aquafarming.
- The alga also has bio-economic potentials as an alternative source for biodiesel as it conforms to the UNE-EN-12424 (2003) standards for the same.

Figure 1. *Enteromorpha intestinalis* (left); Collection of *E. intestinalis* using culture tray (right).

They were then sun-dried for a few days, since water inhibits transesterification. Afterwards, dried algae were crushed and extracted in n-hexane in a Soxhlet apparatus as per UNE-EN 734-1 (2006). The transesterification process was conducted simultaneously with the extraction in order to avoid the previous step of oil extraction and purification of obtained oil (Karaosmanoglu et al., 1996; Lang et al., 2001).

The protein and carbohydrate content of freeze-dried alga was determined spectrophotometrically following Bannerjee et al. (2009). Lipids were extracted from the samples following Yan et al. (2010) and Fatty Acid Methyle Esters (FAME) and Linolenic acid content was estimated using gas chromatographic (GC) methods conforming to the UNE-EN-12424 (2003) standards, using Bruker 450-GC. GC control and data handling were done using Bruker Galaxie™ Software.

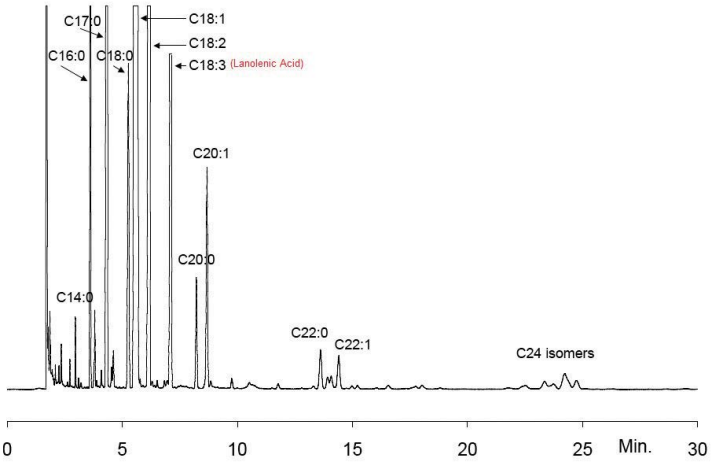


Figure 2. Findings of spectrophotometric and chromatographic analysis.

Results and Discussion

The results showed that in the post-monsoon season, when average salinity is 21.85 ppt, available oil in *E. intestinalis* was maximum ranging up to 0.37% which declined to 0.31% during monsoon, when average water salinity drops to 12.10 ppt, since vegetative growth rate decreases in this algal flora also during monsoon as found in recent studies (Maity & Dey, 2014). However, convertible biodiesel was as high as 93.27% and Linolenic acid content was 0.24%. Interestingly, the findings of spectrophotometric and chromatographic analysis (Figure 2) also showed that this particular variety of green seaweed is rich in protein, carbohydrate and omega fatty acids which are nutritionally significant. It has been found that the protein content of *E. intestinalis* is as high as 12.9-15.79%. Also, these species contains 53% carbohydrate on average, which does not show much variation across the seasons, as reported earlier (Mitra et al., 2009; Reeta et al., 2009). Thus, it is presumed that utilisation of this species as a part of the human diet after conducting toxicity tests may cater to the acute nutritional deficiency in the region. Its extensive utilisation can parallel and bring a radical change to the lives of Sundarbans inhabitants.

Conclusion

It is obvious that end users for algae are often found in the production of food supplements and biofuel. So, the greenhouse gas benefits from algae culture arise only as offsets when the algal use displaces the combustion of a fossil fuel or is used for the production of electricity. Earlier reports from FAO (2010) showed that it is possible to produce algal biodiesel at less cost and with a substantial greenhouse gas and energy balance advantage over fossil diesel. However, the economic viability is highly dependent upon algae with high oil yields capable of high production year-round, which has yet to be demonstrated on a commercial scale.

This paper substantiates the bio-economic potentials of aquafarming of the algae *E. intestinalis* as a place based climate adaptive intervention in climate vulnerable deltaic Sundarbans of India, since mangrove ecosystems in Indian Sundarbans are known sources for methane, having very high global warming potential (Jha et al., 2014). While higher optimistic carbonaceous biomass fixation capacity of *Enteromorpha* can be considered as a direct indication of carbon capture by this aquatic flora in inundated waters, as evidenced earlier (Maity & Dey, 2014; Kaladharan et al., 2011), perusal of results from the present study shows its estimable potential for being used as a source of both biodiesel and food supplement.

The relevance of this study finds its significance in the fact that the settlement areas of deltaic Sundarbans has unusually high emission footprints in power and transport sectors as reported by WWF (2012), since these desolate islands are not yet connected to the country's national power grid, whereas loss of agricultural land due to rapid coastal erosion and inundation (Rahman, 2012) has accentuated the need for alternatives in food, feed and fodder. This research has impending merits to find a local needs-based solution for combatting the impacts of global change.

Acknowledgements

We sincerely acknowledge the support from Asia-Pacific Network for Global Change Research (APN) and Ministry of Environment, Forest and Climate Change, Government of India, for sponsoring this study. We also acknowledge the support and resource sharing of our research collaborators: Central Inland Fisheries Research Institute (CIFRI) of Indian Council of Agricultural Research (ICAR) and the Indian Institute of Technology, IIT Kharagpur, West Bengal.

PROJECT INFORMATION

Title:	Promoting Algaculture in Trapped Waters as Sustainable Aquafarming and Adaptive Climate Mitigation in Inundated and Coastal Areas
Duration:	Single-year project
Total Funding:	US$ 35,000
Project Leader:	Ms. Ashoka Maity
Full address:	South Asian Forum for Environment, B 43 Survey Park, Kolkata 700075 WB India
Tel:	+91 033 24329699
Email:	ashokasafe@gmail.com, safeinch@gmail.com

CBA2013-04NSY-WCRP, CBA2013-12NSY-MAIRS, CBA2012-18NSY-PAGES

Youth Engagement on Global Change: Cultivating the Next Generation of Sustainability Leaders

Ailikun[1], Michel Rixen and Christmas de Guzman
[1]Corresponding Author
IPO of Monsoon Asia Integrated Regional Study (MAIRS)
Institute of Atmospheric Physics, Chinese Academy of Sciences
P. O. Box 9804, Beijing, 100029, China
Email: aili@mairs-essp.org, aili@mail.iap.ac.cn

SUMMARY: Over the last 20 years, the Asia-Pacific Network for Global Change Research (APN) has been instrumental in shaping climate research, capacity building, networking and training activities in the Asia-Pacific region. Since the late 1990's, APN has been a consistent supporter of relevant global environmental change initiatives such as the Regional Modelling Inter-comparison Project (RMIP) Asia, Monsoon Asia Integrated Regional Study (MAIRS), Coordinated Regional Climate Downscaling Experiment (CORDEX) and Past Global Changes (PAGES). By engaging young scientists and encouraging regional global change research, APN contributes to the success of various Global Environmental Change (GEC) programmes and is helping cultivate the next generation of sustainability leaders in the fields of paleo-monsoon climate, regional modelling, impact assessments and transdisciplinary studies.

KEYWORDS: *regional climate modelling, impact assessment, transdisciplinary study, capacity building, young scientists*

Introduction

The Asia-Pacific region is a hotspot for climate change and sustainability research because of its significant regional monsoon climate, interaction with the global climate system and greater economic activity in recent decades. The conflict between economic development and environmental degradation needs tremendous scientific support to regional sustainable development. To improve the research capacity of the regional scientific community, APN has been supporting cultivating regional young scholars by collaborating with regional and global environmental change research programmes, such as MAIRS, CORDEX and PAGES, in broader fields of paleo-monsoon climate change, regional climate modelling, impact assessments and cross-cutting studies.

The Monsoon Asia Integrated Regional Study (MAIRS) is a regional research programme focused on integrated studies across the monsoon Asian region. MAIRS was established in 2006 and is a core project under Future Earth. Its Regional Modelling Inter-comparison Project (RMIP) started in the late 1990s, led by a group of senior scientists from China, Republic of Korea, Japan, Australia and USA. RMIP was recognised as one of the modelling inter-comparison studies by the World Climate Research Programme (WCRP) and International Geosphere-Biosphere Programme (IGBP). In 2012, RMIP was merged with WCRP's Coordinated Regional Climate Downscaling Experiment (CORDEX) Asia through joint coordination of MAIRS and WCRP.

CORDEX aims to provide regional climate change projections to support impact and adaptation studies (http://wcrp-cordex.ipsl.jussieu.fr). For Asia, there are three CORDEX domains planned and designed covering South Asia, South East Asia and East Asia. Additionally, there is another domain that is focused in the southern hemisphere, specifically the Australasia region.

Meanwhile, IGBP has focused its work on the interactions between biological, chemical and human systems and is responsible for a number of major international projects and joint initiatives. Past Global Changes (PAGES), one of the core projects of IGBP, is an international effort to coordinate and promote past global change research. The project's primary objective is to enhance the understanding of past changes in the Earth system in order to improve projections of future climate and environment, and inform strategies for sustainability.

Building up Regional Modelling Networks in Asia-Pacific by Engaging Young Scientists

From 1999–2002, RMIP Asia activities aimed to encourage local scientists to lead the activity on regional climate modelling. With support from APN, RMIP leaders built up RCM networks, and designed and implemented climate modelling inter-comparison experiments in Asia. A WCRP regional-scale climate modelling workshop in Baltimore, USA, in collaboration with Climate and Ocean: Variability, Predictability and Change (CLIVAR) and WCRP groups was held in June 2004. In 2010, multi-model ensemble future scenarios from RMIP products were developed, while in 2012, a project aimed at supporting urban planning in Southeast Asia using RMIP products was piloted. In more than one decade, under APN's continuous support not only to senior researchers, but also to juniors, CORDEX Asia has built up interactive and stable networks by involving institutions, stakeholders and end-users on climate modelling, data sharing and capacity building.

Cultivating Leaders from the Young Generation

With support from APN, RMIP Asia promotes young scientists' engagement and capacity building. After a decade, junior scientists involved in RMIP activities are now becoming leaders of regional modelling research in Asia. These include Dr. Shuyu Wang (Nanjing University) who has led RMIP phase III experiments since 2010, Dr. Hyun-Suk Kang (NIMR-KMA), Prof. Xuejie Gao (CAS/China), Dr. Koji Dairaku (NIED/Japan), and Dr. Myoung-Seok Suh (Kongju National University)—all of whom are key scientists in the CORDEX Asia group.

Young Scientists Involvement in CORDEX Initiatives

In 2013, a project led by Prof. M. Manton (ARCP2013-15NMY-Manton) was implemented to promote cooperation between the climate downscaling communities and the vulnerability, impact and adaptation communities across the region, by way of collaboration between WCRP and MAIRS. This project not only coordinated joint actions among CORDEX Asia groups on simulation design, model validation and data sharing—more importantly, it facilitated a series of workshops intended for capacity building and involvement of young scientists. The first workshop was held in Kathmandu on 27–30 August 2013, wherein there were 40 young scientists among the 75 participants who attended the science and training workshop. The second science and training workshop was held on 17–20 November 2014 at Citeko Bogor, Indonesia, with 35 young scientists out of 65 total participants.

The International Conference on Regional Climate – CORDEX 2013, held in Brussels, Belgium on 4–7 November 2013, was jointly organised by WCRP, the European Commission (EC) and the Intergovernmental Panel on Climate Change (IPCC). The event brought together the international community of regional climate scientists and stakeholders with a particular emphasis on the production, assessment and use of regional climate information. From a total of about 500 participants from 97 countries, 19 early career scientists participated in the conference through support from APN's Scientific Capacity Building and Enhancement for Sustainable Development in Developing Countries (CAPaBLE) Programme (CBA2013-04NSY-WCRP).

The first day of the conference featured two important events: a High Level Session with the participation of the European Commissioners for Research & Innovation and for Climate Action, where the Intergovernmental Panel on Climate Change (IPCC) presented key findings from the IPCC Working Group I Contribution to the Fifth Assessment Report Climate Change 2013: The Physical Science Basis. This was followed by a Stakeholder Dialogue session focusing on how science-based regional climate information can best serve the needs of regional policy and decision-makers. This segment was intended to provide the global to regional socio-economic and policy context within which WCRP regional climate research activities and programmes operate.

The second segment of the conference, during the following three days, was organised around the key scientific outcomes from Phase I of the CORDEX project, encompassing results from all the participating regions worldwide. This segment was designed to deliver on the current status and needs of regional climate science and modelling; to strengthen collaboration and synergies between the various CORDEX regional activities; to outline the future priorities for regional climate science, in particular CORDEX phase II by collaboration with regional and global initiatives such as UN Global Framework for Climate Services (GFCS), Future Earth (FE) and IPCC. The breadth and depth of oral and poster presentations illustrated the relevance of CORDEX on the climate change agenda and the expected contribution to impacts, vulnerability and adaptation applications in areas such as water availability, agriculture and food security, health, and disaster risk reduction. The segment also featured a dedicated Early Career Scientist event to strengthen the CORDEX networking and collaborations in regional climate science. This important issue is being promoted more generally now within WCRP by leveraging the wider Young Earth System Scientists Community (YESS).

Providing Platform for Young Scientists' Work

The second Young Scientists Meeting (YSM) of PAGES was held from 11–16 February 2013 in Goa, India, as a prelude to the subsequent 4th Open Science Meeting (OSM). These two coupled meetings are PAGES's premier scientific events, held once every four years and geared toward helping the best young and established scientists advance their scientific skills and build international networks with peers and programme representatives.

The generous co-sponsorship of the APN (through CBA2012-18NSY-PAGES) enabled 25 early-career researchers from the Asia-Pacific region to participate in the YSM and afterwards mingle with their more established colleagues at the OSM.

The event was aimed at building capacity for young and established scientists in the Asia-Pacific region and fostering scientific exchange and collaboration internationally. Event highlights included scientific sessions on ongoing paleoclimatic and paleoenvironmental research; strategic debates on future research requirements and their implementation; dissemination and outreach through scientific publications and reports, videos, and downloadable materials; networking via poster sessions, breakout discussions, social events, and post-meeting projects; and knowledge transfer through scientific sessions, professional skill development, and presentation feedback.

Young Scientists' Involvement in Transdisciplinary Research

The MAIRS Open Science Conference from 7–10 April 2014 in Beijing (by support of CBA2013-12NSY-MAIRS) gathered 260 participants from 24 countries, half of which are young scientists. Scientists from agriculture, chemistry, climate, ecology, economics, energy, geography, hydrology, remote sensing and social science reported on the recent progress of their work on sustainability research. Many early career scientists were encouraged to give oral presentations as a part of the conference. MAIRS conference provided a good opportunity and platform for young scientists to meet various people from different disciplines and build networks with global change and sustainability research groups.

Acknowledgements

The CORDEX 2013 Conference was jointly organised by WCRP, EC and IPCC who express their sincere gratitude to the co-sponsors of the conference: APN, EUMESAT, ESA, SMHI and EGU. The CORDEX Asia workshop in Kathmandu was hosted by ICIMOD and supported by the APN, CAS, IITM, MAIRS and WCRP. All these contributions are greatly appreciated. The workshop in Indonesia was hosted by BMKG, and supported by APN, MAIRS, WCRP and BMKG. MAIRS Open Science Conference was jointly supported by Chinese Academy of Sciences, Chinese Association of Science and Technology, National Science Foundation of China, APN, RIHN, LOICZ and WCRP. All these contributions are greatly appreciated.

PROJECT INFORMATION

Title:	International Conference on Regional Climate CORDEX 2013 (CBA2013-04NSY-WCRP) Promoting Sustainability Science in Monsoon Asia (CBA2013-12NSY-MAIRS) The Past: A Compass for Future Earth - PAGES 2nd Young Scientists Meeting and 4th Open Science Meeting (CBA2012-18NSY-PAGES)
Duration:	All three projects are single-year projects
Total Funding:	CBA2013-04NSY-WCRP (US$ 50,000) CBA2013-12NSY-MAIRS (US$ 38,000) CBA2012-18NSY-PAGES (US$ 30,000)
Project Leaders:	Dr. R. Krishnan, Indian Institute of Tropical Meteorology, India, krish@tropmet.res.in; Prof. Ailikun, Monsoon Asia Integrated Regional Study, China; aili@mairs-essp.org; and Dr. Thorsten Kiefer, Past Global Changes, Switzerland, thorsten.kiefer@pages.unibe.ch
Websites:	http://www.tropmet.res.in/ http://mairs.csp.escience.cn/dct/page/1 http://www.pages-igbp.org

APN CORE PROGRAMMES 2

Annual Regional Call for Research Proposals (ARCP)

Capacity Development Programme (CAPaBLE)

ARCP2014-01CMY-MEINKE

Improving the Robustness, Sustainability, Productivity and Eco-Efficiencies of Rice Systems throughout Asia

Holger Meinke[1] and David Parsons
[1]Corresponding Author
Tasmanian Institute of Agriculture, Australia
Email: holger.meinke@utas.edu.au

Project Rationale

Rice is a major staple food in Asia. At present, Asia contributes to 95% of the world's rice production but, at the same time, Asia is also a region with the largest rice consumption. As a result, a large proportion of the anticipated future increases in production must also come from this region. These increases must be achieved without negatively impacting people and the environment. Advances in the understanding of rice systems have made it feasible to use simulation modelling to integrate disciplinary knowledge and evaluate possible technologies and policies.

The project aims to empower the next generation of scientists and policy makers in providing the most pertinent advice to make informed decisions when it comes to redesigning current approaches in resource allocation, agronomy and knowledge dissemination.

Project Activities

Since the project inception meeting in Sri Lanka in the first year of the project, research activities have been performed in collaborating countries. Country-specific project activities include the following:

Indonesia

Indonesian researchers are using modelling to examine the impact of climate change (particularly temperature and rainfall) on the production of rice in Indonesia. They are also exploring weather index-based crop insurance as an adaptive strategy.

Pakistan

Researchers from Pakistan are evaluating the potential for aerobic rice production as a method of adapting to water shortages during the rice growing season. Aerobic rice involves cultivating rice in unpuddled, dry, direct-seeded, non-flooded fields. The aerobic rice system aims to improve resource-use efficiency of rice-based cropping systems of, in particular, water, labour and energy.

India

Work in India is focusing on improving the resource-use efficiency of rice production, in particular nitrogen and water. APSIM and DSSAT models are being used to model the systems and study the trade-offs between yield and resource-use efficiency. Development of adaptation options aims to enhance production or reduce investment inputs in agriculture under a changing climate.

Viet Nam

Collaborators from Viet Nam are examining the effects of climate change and modelling the impacts of water shortages on rice production. Methods include spatial analysis and field-level modelling. Improved agricultural practices are being designed in collaboration with stakeholders to understand and adapt to the risk of drought.

Sri Lanka

Researchers from Sri Lanka are evaluating the performance of rainfed and irrigated rice-based cropping systems in the dry zone. Technologies being assessed include drought-resistant varieties, improved irrigation decision-making and improved soil water conservation methods.

The mid-term project meeting was held at The Centre for Climate Risk and Opportunity Management in Southeast Asia and Pacific (CCROM) at Bogor Agricultural University, Indonesia from 2-4 September 2014. The meeting discussed progress and provided training in the APSIM crop-soil-atmosphere simulation model.

HIGHLIGHTS

- The project aims to develop more productive and sustainable rice systems through simulation modelling.
- Country-specific activities address issues of national importance.
- Overall project activities focus on building a network and developing capacity in simulation modelling of rice systems.

Project Publications

Awan, M. I., van Oort, P. A. J., Ahmad, R., Bastiaans, L., & Meinke, H. (2015). Farmers' views on the future prospects of aerobic rice culture in Pakistan. Land Use Policy, 42, 517–526. doi:10.1016/j.landusepol.2014.09.006

Kadiyala, M. D. M., Jones, J. W., Mylavarapu, R. S., Li, Y. C., & Reddy, M. D. (2015). Identifying irrigation and nitrogen best management practices for aerobic rice–maize cropping system for semi-arid tropics using CERES-rice and maize models. Agricultural Water Management, 149, 23–32. doi:10.1016/j.agwat.2014.10.019

Acknowledgements

We thank the staff of Bogor Agricultural University CCROM for their efforts and hospitality in hosting the mid-term project meeting.

PROJECT INFORMATION

Title:	Improving the Robustness, Sustainability, Productivity and Eco-efficiencies of Rice Systems throughout Asia
Duration:	Year 3 of three-year project
Total Funding:	US$ 162,050
Project Leader:	Prof. Holger Meinke
Full address:	Tasmanian Institute of Agriculture 402 Life Sciences Building, Sandy Bay Campus Tasmania
Tel:	+61 3 6226 6368
Email:	holger.meinke@utas.edu.au
Website:	www.tia.tas.edu.au; www.apnriceasia.com

ACRP2014-02CMY-LI

Climate Change and Urban Adaptation: Science and Practice - Exploring the Challenges

Yinpeng Li[1], Peter Urich, Meng Wang
[1]Corresponding author
International Global Change Institute, New Zealand
Email: yinpengli@igci.org.nz

Introduction

The main objectives of this project are to:

- Develop high resolution climate change projections based on regional climate model (RCM) outputs from RMIP3 and CORDEX.
- Develop an integrated impact assessment system including major sectors in urban areas through working closely with urban policy makers and planners.
- Conduct training workshops, disseminate results and produce peer-reviewed publications during the latter stages of the project.

Work Undertaken and Results to Date

Workshop on Climate Change and Urban Adaptation: Science and Practice–Exploring the Challenges

The workshop was held in Raglan, New Zealand, from 9-11 December 2013 and provided a unique venue for scientists and practitioners to discuss emerging issues related to climate change and urban adaptation, where scientific, technical and practical issues are equally valued. About 30 scientists and practioners from New Zealand, Australia, China, Thailand, and Viet Nam attended.

Participants included climate science researchers, climate service providers, consulting practitioners, representatives of local government, government policy makers, legislative experts, adaptation project implementers and evaluators. Challenges, lessons learnt, and new opportunities for climate change adaptation action in different countries were discussed in great depth during and after the workshop. The workshop also allowed experts from different backgrounds to form a community of practice (CoP) for climate change adaptation.

Climate Risk Assessment Model Development for UrbanCLIM

In recent years, the number of adaptation projects and applications concerning climate risk implemented by public and private sectors in municipalities has increased. However, the gap between scientific research papers and practical information, as well as data needed by projects, still needs to be closed through customised and flexible methodologies and information packages that match existing design and assessment standards or conventions. We have come to realise climate risk assessment services cannot be satisfied with one piece of complicated and integrated PC software. Data and software as services are more preferable.

Inspired by stakeholders, we are developing climate risk assessment models for the urban sector, including for energy, transportation, asset management, water allocation and drainage management; and with add-on risks caused by heat, wind, precipitation and sea level extremes. These models and tools apply statistical downscaling methods and extreme values analysis and derive climate change information from CMIP5 GCM daily and sub-daily outputs. The models and tools are currently being trialled and applied in coastal cities in Asia, Australia and USA.

HIGHLIGHTS

» Workshop on Climate Change and Urban Adaptation: Science and Practice - Exploring the Challenges.
» Climate risk assessment model and dataset development for UrbanCLIM.

Building Historical Climate and RCM/GCM Projection Datasets

Dataset building is a continuous process to accommodate new and emerging demands. The datasets were built from basic monthly averages of historical climate data, and extended to daily and sub-daily data observations to multiple RCM/GCMs, multiple scenario data, from precipitation temperature variables to hazard weather patterns, including hurricane, tornado, hail and lightning data. Presently, we are in the process of building a data warehouse for backstopping UrbanCLIM systems services.

Project Publications

Zhan J., Dan L., (2014). Annual and diurnal variation of anthropogenic heat estimation in Guangzhou city. Climatic and Environmental Research. Advance online publication (in Chinese). doi: 10.3878/j.issn.1006-9585.2013. 13149

Yao M., et al. (2014). Sectoral Water Use Trends in the Urbanizing Pearl River Delta, China. Manuscript submitted for publication.

Acknowledgements

Monsoon Asia Integrated Regional Study (MAIRS), International Programme Office, partly funded the workshop and supported implementation of this project. The development of UrbanCLIM platform also has been supported with co-funding from the Asian Development Bank and the New Zealand government.

PROJECT INFORMATION

Title:	Development of an Integrated Climate Change Impact Assessment Tool for Urban Policy Makers (UrbanCLIM)
Duration:	Year 3 of a three-year project
Total Funding:	US$ 120,750
Project Leader:	Prof. Yinpeng Li
Full address:	International Global Change Institute, 9 Achilles Rise, Hamilton, New Zealand
Tel:	+0064 7 8342999
Email:	yinpengli@climsystems.com, yinpengli@igci.org.nz
Website:	www.igci.org.nz

ARCP2014-03CMY-QUYNH

Carbon Emissions and Fluxes from the Red River (Viet Nam and China): Human Activities and Climate Change

Le Thi Phuong Quynh[1], Josette Garnier, Gilles Billen, XiXi Lu, Thi Thuy Duong, Cuong Tu Ho, Thi Bich Nga Tran, Thi Mai Huong Nguyen, Thi Bich Ngoc Nguyen, Duy An Vu, Bich Thuy Nguyen, Quoc Long Pham, Cyril Marchand and Zhou Yue

[1]Corresponding Author

Institute of Natural Product Chemistry, Viet Nam Academy of Science and Technology, 18 Hoang Quoc Viet, Cau Giay, Hanoi, VIET NAM

Email: quynhltp@yahoo.com

General Introduction

The Red River (RR) (Viet Nam and China) is a good example of a Southeast Asian river system, strongly affected by climate and human activities. The proposed work aims to: i) provide a GIS georeferenced database for the long-term period (1960–present); ii) calculate carbon flux and emissions from the RR system and their controlling variables; and iii) provide an operational tool for the improvement of regional water management. The project has a 3-year duration (August 2012-November 2015) and this article presents the second year results of the project (August 2013–November 2014).

Work Undertaken and Results to Date

Water Sampling, Data Collection and Analysis

Monthly field campaigns were organised from August 2012 to December 2014 to analyse RR water quality related to agricultural and industrial wastewater (Figure 1).

Figure 1. In-situ measurement and laboratory analysis.

Measurement of Carbon Exchange

Dr. Cyril Marchand, a new participant with background expertise in carbon cycling, contributed to measurements at five sites selected from the RR upstream to downstream in wet and dry seasons in 2014. Two methods were used: calculation of CO_2 fluxes using a floating chamber connected to an Infrared Gas Analyser (IRGA) and determining pCO_2 within the water column using an equilibrator (Figure 2, next page).

Analysis of the data collected (river flows, sediments) were used in the revision of a submitted scientific paper in Geomorphology, revealing river channel changes from deposition to erosion and vice-versa, as affected by different constructed dams in the RR system. The annual sediment deposition varied between 1.9 Mt/yr and 46.7 Mt/yr, averaging 22.9 Mt/yr during the period 1985-2010. Effects of such changes on carbon flux and carbon burial are in progress.

Additional information (land use, population, agricultural development and hydrological management) from 1960s–2009 was used to publish a paper in Regional Environmental Change.

The RR system water quality and channel irrigation in an agricultural region in Hanoi was analysed for the Journal of Vietnamese Environment (Germany), Vietnam Journal of Biology and Vietnam Agriculture and Rural development.

Scientific Cooperation and Training

The project allowed new cooperation with international projects such as the Nutrient Cycles and Contaminants in Waters in Southeast Asia (NUCOWS, funded by University of Science and Technology of Hanoi, Viet Nam), the Evaluation Française des Ecosystèmes et Services Ecosystémiques (EFESE, funded by IRD, France) and the National Foundation for Science and Technology Development (NAFOSTED, funded by the Ministry of Science and Technology, Viet Nam), enlarging our scientific exchange network. Further, two PhD students joined the project, in cooperation with NAFOSTED project. In 2013–2014, 10 undergraduate students from Hanoi University of Natural Resources & Environment, Thanh Tay University and University of Science and Technology of Hanoi, benefited from the project topics for their respective theses.

HIGHLIGHTS

- Present statement of water quality of Red River.
- Long-term dataset of water quality and other constraints concerning land use, population, agricultural and industrial development and hydrological management of the Red River basin.
- Change of suspended solids fluxes and associated elements (P, N and C) of the Red River due to dam impoundment.
- Source and transfer of carbon in the Red River system.

Figure 2. Measurements of carbon exchange at the water-air interface.

The second workshop was held in Hanoi, Viet Nam (late December, 2014). During this workshop, the results, future activities (scientific papers, meetings presentations, student training, website construction, etc.) and future cooperation were discussed. Manuscripts will be prepared for peer-reviewed journals. The project website has been constructed and will be uploaded shortly.

Project Publications

International Peer-Reviewed Publications

Le, T. P. Q., Billen, G., Garnier, J., & Chau, V. M. (2014). Long-term biogeochemical functioning of the Red River (Vietnam): past and present situations. *Regional Environmental Change*. doi:10.1007/s10113-014-0646-4. ISSN 1436-378X.

Le, T. P. Q., Ho T.C., Duong T. T., Nguyen, T. B. N., Vu D. A., Pham Q. L., Seidler C. (2014). Water quality of the Red River system in the period 2012 – 2013. *Journal of Vietnamese Environment*. (Journal of Dresden University, Germany). Vol 6(1-3): 191 -195. http://dx.doi.org/10.13141/JVE. ISSN 2193-6471.

Duong, T. T., Vu, T. N., Le, T. P. Q., Ho, T. C., Hoang, T. K., Nguyen, T. K., Dang, D. K. (2014). Seasonal variation of phytoplankton assemblage in Hoa Binh reservoir (North of Vietnam). *Journal of Vietnamese Environment.* (Journal of Dresden University, Germany). Vol 6(1-3): 22-26. http://dx.doi.org/10.13141/JVE. ISSN 2193-6471.

Duong, T. T., Le, T. P. Q., Ho, T. C., Vu, T. N., Hoang, T. T. H., Dang, D. K. & Lu, X. (2014). Phytoplankton community structure and water quality of Red River (Vietnam). *Journal of Vietnamese Environment*. (Journal of Dresden University, Germany). Vol 6(1-3): 27-33. http://dx.doi.org/10.13141/JVE. ISSN 2193-6471.

Lu, X., Oeurng, C., Le, T. P. Q. & Duong, T. T. (2014). Sediment budget of the lower Red River as affected by dam construction. *Geomorphology*. (In revision).

National Papers Published/Submitted

Nguyen, T. B. N., Nguyen, T. M. H., Nguyen, B. T., Vu, D. A., Duong, T. T., Ho, T.C. & Le, T. P. Q. (2014). Preliminary monitoring results of total coliforms and fecal coliform in the Red river system, in the section from Yen Bai to Hanoi. Vietnam Journal of Biology., 36(2), 240-246. doi:10.15625/0866-7160/v36n2.5122

Nguyen, T. B. N., Le, T. P. Q., Nguyen, B. T., Nguyen, T. M. H., Vu, D. A., Duong, T. T. & Ho, T. C. (2014). Water quality of a vegetable growing area Van Noi Commune, Dong Anh District, Hanoi City. *Vietnam Agriculture and Rural Development*. Accepted.

Presentations in Conferences/Workshops

About 17 reports of the project participants (in poster and oral presentations) were introduced in different international and national conferences and workshops in different places in Vietnam (Hanoi City, Ho Chi Minh City, Da Nang City, Ha Long City), in China (Xi'an, Shaanxi City) and in France (Paris).

Acknowledgements

This work was performed under APN projects: ARCP2012-11NMY-Quynh and ARCP2013-06CMY-Quynh. The authors would like to thank the APN for financial support.

PROJECT INFORMATION

Title:	Carbon Emissions and Fluxes from the Red River (Viet Nam and China): Human Activities and Climate Change
Duration:	Year 3 of a three-year project
Total Funding:	US$108,000 (Year 1 US$40,000; Year 2 US$ 32,000; Year 3 US$ 36,000)
Project Leader:	Dr. LeThi Phuong Quynh
Full address:	1H building, 18 Hoang Quoc Viet, Cau Giay, Hanoi, Viet Nam
Tel:	00 844 3791 6621
Email:	quynhltp@yahoo.com

ARCP2014-04CMY-MIYATA

Toward CarboAsia: Integration and Synthesis of Ecosystem Flux Data in Tropics/Subtropics and Croplands in Asia by Activating Regional Tower-Based Observation Networks

Akira Miyata[1], Nobuko Saigusa, Joon Kim, Shenggong Li, Ma. Carmelita Alberto, Reiner Wassmann, Juliya Kurbatova, Lulie Melling, Guan Xhuan Wong, Md. Abdul Baten, Chandra Shekhar Jha, Ke-Sheng Cheng, Amnat Chidthaisong, Ab Latif Ibrahim, Muhammad Evri and Sawako Tanaka

[1]Corresponding Author

National Institute for Agro-Environmental Sciences, Japan

Email: amiyat@niaes.affrc.go.jp

Objective and Outline of the Project

Enhanced Eddy covariance terrestrial ecosystem flux measurement, with improved database access, is an essential component of Integrated Global Carbon Observing system (IGCO) (Ciais et al., 2010). Integration of standardised flux data from a variety of biome types is also essential for validating modelling and remote sensing (RS) to upscale the carbon budget. AsiaFlux, the flux monitoring tower network for carbon and water cycles in terrestrial ecosystems in Asia, is implementing a strategic plan, CarboAsia, to close critical gaps in tropical/subtropical forests and croplands in Asia. In the present project, we are undertaking workshops and training courses utilising the AsiaFlux framework to encourage and activate tower-based flux observation networks in Southeast and South Asia to promote the integration and syntheses in collaboration with investigators on terrestrial biosphere modelling and satellite RS. The current project will contribute to AsiaFlux's report on 'the Asian Carbon Budget and Implications for the Global Carbon Cycle'.

Progress: Toward Data Integration and Synthesis

In 2014, we held a training workshop and seminar to intensify our activities in Southeast and South Asia. The 12th AsiaFlux Workshop "Bridging Atmospheric Flux Monitoring to National and International Climate Change Initiatives" was held at the International Rice Research Institute, Los Baños, Philippines, with more than 110 participants from 19 countries (Figure 1).

During the workshop, we reviewed the current status of flux studies in tropics/subtropics and croplands in Asia and discussed how to promote inter-site collaboration. In the networking session attended by Dr. Dennis Baldocchi, leader of the global monitoring tower network (FLUXNET), we encouraged participants to share observation data obtained at their own sites.

A training activity and seminar on methane flux and carbon cycle was held earlier in February 2014 in Mymensingh, Bangladesh (Figure 2). A second training activity and seminar on tropical ecosystem monitoring was held in December 2014 in Cat Tien National Park, Viet Nam (Figure 3).

Figure 1. Group photo from the 12th Asia Flux Workshop, Los Baños, Philippines.

HIGHLIGHTS

- The 2014 AsiaFlux Workshop in the Philippines, and a training workshop and seminar in Bangladesh and Viet Nam were held to promote integration of observation data from Asian flux monitoring sites and to assist capacity development in South and Southeast Asia.
- The number of flux study sites registered in the AsiaFlux Database has been increasing steadily, and reached 100 sites with 125 site-year datasets from 34 cities. Monitoring of carbon and methane fluxes in tropical and subtropical Asia is expanding to capture comprehensive insight into ecosystem carbon budgets.

Figure 2. On-site training in Mymensingh, Bangladesh in February 2014.

Figure 3. Training activity and seminar on tropical ecosystem monitoring in Cat Tien National Park, Viet Nam, December 2014.

The number of datasets held in the AsiaFlux Database is expanding as is the monitoring of carbon and methane fluxes in tropical/subtropical Asia. Data from these study sites will enable us to capture comprehensive insights into the carbon cycles of these ecosystems. For example, in Nam Cat Tien, Viet Nam, and the Russia Tropical Center has been monitoring carbon and water exchange in the tropical monsoon forest since 2011 (Kurbatova et al., 2013), while at Cermat Ceria, Betong, Sarawak, Malaysia, Monitoring of carbon and methane fluxes in a tropical swamp forest has been ongoing since 2011. At Mymensingh, Bangladesh, the Bangladesh Agricultural University has been monitoring carbon flux in double-cropping rice fields since 2006, while at Sundarban Mangrove Forest, West Bengal, India, National RS Center (ISRO) has been monitoring carbon and methane fluxes since 2012. Data from these sets will be integrated into the CarboAsia project.

Upcoming Activity

A joint conference comprising the AsiaFlux Workshop 2015 and the meeting of the International Society for Photogrammetry and Remote Sensing (ISPRS) TC WG VIII/3: Weather, Atmosphere and Climate Studies, titled "Challenges and Significance of Ecosystem Research in Asia to Better Understand Climate Change" will be held on 22–29 November 2015 at the Indian Institute of Tropical Meteorology (IITM), Pune, India.

The conference, supported by APN, LI-COR, National Institute for Agro-Environmental Science (NIAES)–Japan, National Institute for Environmental Studies (NIES)–Japan, will cover not only flux research but also broader aspect of climate research. Having chosen India as the venue, it also aims to share new findings on flux monitoring in South Asian region which can lead to future development of potential studies and collaboration with other communities.

There will be various sessions and platforms for discussions which will be driven by the scientific community through an open call for session proposals and abstracts. For those interested to submit a proposal, the proposal should be submitted to asiafluxws2015@asiaflux.net before 28 February 2015. While the call for abstracts is open until 15 May 2015.

Further information about the conference is available through http://asiaflux.net/asiafluxws2015.

Project Publications

AsiaFlux. (2014). Abstracts of AsiaFlux training and seminar on methane flux and carbon cycle in Bangladesh, 23–27 February 2014. Bangladesh Agricultural University, Mymensingh, Bangladesh, 25p.

AsiaFlux. (2014). Bridging Atmospheric Flux Monitoring to National and International Climate Change Initiatives, 18–23 August 2014 (Proceeding). International Rice Research Institute, Los Banos, Laguna, Philippines. Retrieved from http://asiaflux.net/?page_id=19

AsiaFlux. (2014). Abstracts of AsiaFlux training & seminar on tropical ecosystem monitoring, 1–5 December 2014, Cat Tien National Park, Vietnam, 24p.

Acknowledgements

We acknowledge Mr. Dinh Ba Duy, Viet Nam-Russia Tropical Center, for supporting the training and seminar in Viet Nam, and LICOR Biosciences and Campbell Scientific Inc. for providing technical training courses in Bangladesh, Philippines and Viet Nam.

References

Alberto, M. C. R. (2015). 12th AsiaFlux Workshop 2014 Bridging Atmospheric Flux Monitoring to National and International Climate Change Initiatives - 19-24 August 2014. AsiaFlux Newsletter, (38). In press.

Ciais, P., Dolman, H., Dargaville, R., Barrie, L., Bombelli, A., Butler, J., Canadel, P., Moriyama, T. (2010). GEO Carbon Strategy, 48p. Retrieved 15 December 2014, from http://www.earthobservations.org/documents/sbas/cl/201006_geo_carbon_strategy_report.pdf

Kurbatova, J. A., Deshcherevskaya, O. A., Avilov, V. K., Novichonok, A. O., Dinh, B. D., & Kuznetsov, A. N. (2013). Establishment of eddy-flux site in Vietnam: first results. AsiaFlux Newsletter, (36), 16–20. Retrieved 15 December 2014, from http://asiaflux.net/?page_id=24

Talucder, M. S. A., Rumi, M. S., Miah, M.A., Baten, M.A., Ono, K. (2014). Report on AsiaFlux Training & Seminar on Methane Flux and Carbon Cycle – 23~27 February 2014, BAU, Mymensingh, Bangladesh. AsiaFlux Newsletter,(37), 3-5. Retrieved 15 December 2014 from http://asiaflux.net/?page_id=24

PROJECT INFORMATION

Title:	Toward CarboAsia: Integration and Synthesis of Ecosystem Flux Data in Tropics/Subtropics and Croplands in Asia by Activating Regional Tower-Based Observation Networks
Duration:	Year 2 of a three-year project
Total Funding:	US$ 108,000
Project Leader:	Dr. Akira Miyata
Full address:	National Institute for Agro-Environmental Sciences, 3-1-3, Kannondai, Tsukuba 305-8604, Japan
Tel:	+81 29 838 8207
Email:	amiyat@niaes.affrc.go.jp
Website:	http://www.asiaflux.net/

ARCP2014-05CMY-AILIKUN

Coordinated Regional Climate Downscaling Experiment (CORDEX) in Monsoon Asia

Michael Manton[1] and Ailikun
[1]Corresponding Author
Monash University, Australia
Email: michael.manton@monash.edu

Introduction

The Coordinated Regional Climate Downscaling Experiment (CORDEX) is a project of the World Climate Research Programme (WCRP) aimed at providing regional climate change projections to support impact and adaptation studies (http://wcrp-cordex.ipsl.jussieu.fr/). For the Asian region, three domains are planned covering South Asia, Southeast Asia and East Asia; there is another domain for the Australian region in the southern hemisphere. The present APN project aims to promote cooperation between the climate downscaling communities and the vulnerability, impact and adaptation communities across the region. The project funded by the APN involves a series of three workshops to be held in 2013, 2014 and 2015 in South Asia, Southeast Asia and East Asia.

CORDEX East Asia Workshop

The 3rd International Workshop on CORDEX East Asia (EA) was held from 11-12 August 2014 in Jeju, Republic of Korea, hosted by National Institute of Meteorological Research (NIMR). The major objectives of the workshop were to develop a consensus on plans for the next phase of CORDEX EA experiments. The final domain for EA is 0–50°N, 70–155°E. At the Jeju workshop, it was seen that potentially 14 RCMs could take part in the CORDEX EA Phase II (25-km resolution) experiments. This workshop was conducted under the framework of CORDEX Asia, with full support from MAIRS International Project Office (while no APN project funds were used for this project, all results will be collated with the APN-funded activities).

CORDEX Science and Training Workshop in Southeast Asia

Through the support of APN ARCP2014-05CMY-Ailikun, the first WCRP CORDEX science and training workshop in Southeast Asia was held from 17-20 November 2014 in the BMKG Training Center, Bogor, Indonesia. This workshop focused on four topics: evaluation of climate simulations in the Southeast Asia region from multiple climate models; assessment of downscaling techniques and their products; meeting the requests of end-users; and training on RCMs modelling, data analysis and applications for young scientists.

Mechanism for Data Management and Sharing for CORDEX Asia

- 17 GCM datasets will be shared in CORDEX Asia.
- All the Asian ESGF nodes will share the information of RCM products in CORDEX Asia sub-regions.
- All the Asian ESGF nodes will share the information on IT support, data formats and data quality check.

ESGF Training Workshop for CORDEX Asia

The Earth System Grid Federation (ESGF) is an international collaboration with a current focus on serving the World Climate Research Programme's (WCRP) Coupled Model Intercomparison Project (CMIP) and supporting climate and environmental science in general. There was a strong consensus that ESGF nodes are an efficient way to share CORDEX outputs among not only the regional climate scientists but also among the impact assessment and vulnerability communities. A training workshop was proposed (around 10-15 participants) for CORDEX Asia groups from 4-5 December 2014 in Nanjing University of Information Science and Technology, China.

HIGHLIGHTS

- Finalised the domain for CORDEX EA experiments and prepared a detailed work plan for CORDEX EA Phase II experiments during the workshop in Jeju, Republic of Korea.
- Planned CORDEX science and training workshop for Southeast Asia in Indonesia.
- Established mechanism for data management and sharing for CORDEX Asia under the framework of WCRP Earth System Grid Federation (ESGF).
- Planned training workshop for ESGF in China.
- Established collaboration and joint workshops with SEACLID/CORDEX SEA group.

Other Activities

At the 2013 Kathmandu workshop (reported in APN's 2014 Science Bulletin), close collaboration was established with the "Southeast Asia Regional Climate Downscaling Project (SEACLID)" (ARCP2013-17NMY-Tangang), led by Prof. F. Tangang. Joint workshops were organised from 18-19 November, 2013 in Jakarta, and 9-10 June, 2014 in Bangkok. Through these workshops, the domain, scientific issues, detailed plans for high resolution (25-km) experiments, participating models and data sharing were considered.

Acknowledgements

The CORDEX EA workshop in Jeju was hosted by NIMR-KMA, and supported by MAIRS and KMA. The workshop in Indonesia was hosted by BMKG, and supported by APN, MAIRS, WCRP and BMKG. The ESGF training workshop for CORDEX Asia was hosted by Nanjing University of Information, Science and Technology, and supported by MAIRS, WCRP and NUIST. All these contributions are greatly appreciated.

PROJECT INFORMATION

Title:	Coordinated Regional Climate Downscaling Experiment (CORDEX) in Monsoon Asia
Duration:	Year 2 of a three-year project
Total Funding:	US$ 125,000
Project Leader:	Prof. Ailikun
Full address:	Institute of Atmospheric Physics, Chinese Academy of Sciences, Huayanli 40#, Chaoyang District, P.O.Box 9804, Beijing 100029, China
Tel:	+86 10 82995264
Email:	aili@mairs-essp.org, aili@mail.iap.ac.cn

ARCP2014-06CMY-LI

Assessing Spatiotemporal Variability of NPP, NEP and Carbon Sinks of Global Grassland Ecosystems in Response to Climate Change: 1911-2011

Jianlong Li[1], Renchin Tsolmon, Muhammad Mohsin Iqbal, Alim Salimovich Pulatov

[1]Corresponding author

The Global Change Research Institute, College of Life Science, Nanjing University, Nanjing 210093, P.R. China

Tel: +86-25-86214644; Fax: +86-25-83302728

Email address: jlli2008@nju.edu.cn or jianlongli@sina.com.

Introduction

The project addresses existing gaps in the field of global & land use and climate change research, which runs from September 2013 to September 2016. The focus of the project is to build and enhance scientific capacity in three developing countries and to explore the quantifying methods on assessing spatiotemporal variability's of NPP, NEP and carbon sinks of the global grassland ecosystem in response to climate change and human activity from 1911-2011. The project also aims to overcome critical gaps in knowledge of how to enhance and manage the global grassland ecosystem, which includes grassland production, biomass, NPP, NEP, carbon sinks and environmental goals in the face of climate change in the this time period.

Activities Undertaken and Results to Date

In 2014, our team conducted two activities. The first was participating in the summary session of the R2-04 workshop held during the MAIRS Conference in Beijing, China, from 7-12 April 2014. The second was conducting a workshop and field survey in inner-Mongolia from 19-29 June 2014. Our research project has accomplished the following:

On assessing the response of terrestrial ecosystems to climate change at different scales in the long term, the project team has conducted an assessment and comparison of the spatiotemporal variability of terrestrial carbon flux at global and continental scales during the period 1911-2000. The 30-year running mean value results indicated that the terrestrial biosphere was approximately neutral in the period 1911-1940. It also indicated that climate change and variability promoted absorbance of terrestrial carbon in 1941-1970 period with 0.482 PgC yr^{-1}, while in the period 1971-2000, the sink effect weakened with 0.239 PgC yr^{-1}. Ecosystems in Europe and North America were estimated to have been absorbing carbon in the last 90 years.

The project team has also analysed the distribution, extent and NPP of terrestrial ecosystems from 1911 to 2000 and came to the conclusion that consistently rising global temperatures and altered precipitation patterns have exerted strong influence on spatiotemporal distribution and productivities of terrestrial ecosystems, especially in the mid/high latitude. The area of tundra and alpine steppe reduced significantly (5.43%), and were forced to head northward due to significant ascending temperature in the northern hemisphere. In accordance, the global terrestrial ecosystems productivities increased by 2.09%. In general, effects of climate change on terrestrial ecosystems were deep and profound in the period 1911-2000, especially the latter half period. Key challenges for estimating grassland ecosystems vulnerability under varying temperature and precipitation changes lie in better recognising how and to what extent past climate change have affected grassland ecosystems. To better clarify this issue, in this study the distribution and shifts of grassland ecosystems as well as their NPP from 1910 to 2010 were evaluated. The correlation analysis between NPP dynamics and climate factors in the same period were also performed to reveal how climate changes have controlled grassland productivity.

HIGHLIGHTS

- Net Primary Productivity (NPP)
- Net Ecosystem Productivity (NEP)
- Grassland Ecosystems
- Grassland Carbon Cycle; Quantitative Assessment.

The outcomes of this study do not only shed light on how grassland ecosystems respond to climate change, but also provide a basis for better grassland management. In 2014, the project team published 8 papers in peer-reviewed international journals and 15 papers in Chinese journals.

Publications

Zhou, W., Gang, C., Zhou, L., Chen, Y., Li, J., Ju, W., & Odeh, I. (2014). Dynamic of grassland vegetation degradation and its quantitative assessment in the northwest China. *Acta Oecologica, 55*, 86–96. doi:10.1016/j.actao.2013.12.006

Sun, Z., Zhang, Y., Li, J., & Zhou, W. (2014). Spectroscopic Determination of Soil Organic Carbon and Total Nitrogen Content in Pasture Soils. *Communications in Soil Science and Plant Analysis, 45*(8), 1037–1048. doi:10.1080/00103624.2014.883628

Yang, H., Mu, S., & Li, J. (2014). Effects of ecological restoration projects on land use and land cover change and its influences on territorial NPP in Xinjiang, China. *CATENA, 115*, 85–95. doi:10.1016/j.catena.2013.11.020

Zhou, W., Gang, C., Chen, Y., Mu, S., Sun, Z., & Li, J. (2014). Grassland coverage inter-annual variation and its coupling relation with hydrothermal factors in China during 1982–2010. *Journal of Geographical Sciences, 24*(4), 593–611. doi:10.1007/s11442-014-1108-0

Gang, C., Zhou, W., Chen, Y., Wang, Z., Sun, Z., Li, J., … Odeh, I. (2014). Quantitative assessment of the contributions of climate change and human activities on global grassland degradation. *Environmental Earth Sciences, 72*(11), 4273–4282. doi:10.1007/s12665-014-3322-6

Gang, C., Zhou, W., Wang, Z., Chen, Y., Li, J., Chen, J., … Groisman, P. Y. (2015). Comparative Assessment of Grassland NPP Dynamics in Response to Climate Change in China, North America, Europe and Australia from 1981 to 2010. *Journal of Agronomy and Crop Science, 201*(1), 57–68. doi:10.1111/jac.12088

Zhou, W., Sun, Z., Li, J., Gang, C., & Zhang, C. (2013). Desertification dynamic and the relative roles of climate change and human activities in desertification in the Heihe River Basin based on NPP. *Journal of Arid Land, 5*(4), 465–479. doi:10.1007/s40333-013-0181-z

Sun, Z. G., Long, X. H., Sun, C. M., Zhou, W., Ju, W. M., & Li, J. L. (2013). Evaluation of net primary productivity and its spatial and temporal patterns in southern China?s grasslands. *The Rangeland Journal, 35*(3), 331. doi:10.1071/RJ12061

Figure 1. Photograph during the project's workshop held in Beijing, China, April 2014.

Acknowledgements

This work was supported by the APN Project ARCP2013-16NMY-Li. We also thank the China Meteorological Data Sharing Service System for providing climate datasets and data derived from each meteorological station. We also thank Prof. Liu Jiyuan from the Institute of Geographic Sciences and Natural Resources Research, CAS for their guidance and data provided. We also appreciate CRU and NOAA for sharing datasets.

References

Akiyama, T., & Kawamura, K. (2007). Grassland degradation in China: Methods of monitoring, management and restoration. *Grassland Science, 53*(1), 1–17. doi:10.1111/j.1744-697X.2007.00073.x

Bartholomé, E., & Belward, A. S. (2005). GLC2000: a new approach to global land cover mapping from Earth observation data. *International Journal of Remote Sensing, 26*(9), 1959–1977. doi:10.1080/01431160412331291297

Batjes, N. H. (2004). Estimation of Soil Carbon Gains Upon Improved Management within Croplands and Grasslands of Africa. *Environment, Development and Sustainability, 6*(1/2), 133–143. doi:10.1023/B:ENVI.0000003633.14591.fd

Gang, C., Zhou, W., Li, J., Chen, Y., Mu, S., Ren, J., … Groisman, P. Y. (2013). Assessing the spatiotemporal variation in distribution, extent and NPP of terrestrial ecosystems in response to climate change from 1911 to 2000. *PLoS ONE, 8*(11), e80394. doi:10.1371/journal.pone.0080394

PROJECT INFORMATION

Title:	Assessing Spatiotemporal Variability of NPP, NEP and Carbon Sinks of Global Grassland Ecosystem in Response to Climate Change: 1911-2011
Duration:	Year 2 of a three-year project
Total Funding:	US$ 101,200
Project Leader:	Prof. Jianlong Li
Full address:	The Global Change Research Institute, College of Life Science, Nanjing University, Nanjing City, P. R. China, 210093
Tel:	0086 25 8359 2715
Email:	jlli2008@nju.edu.cn or jianlongli@sina.com

ARCP2014-07CMY-TANGANG

The Southeast Asia Regional Climate Downscaling (SEACLID) Project

Fredolin Tangang[1], Liew Juneng, Gemma Narisma, Faye Abigail T. Cruz, Phan Van Tan, Ngo-Duc Thanh, Jerasorn Santisirisomboon, Patama Singhruck, Edvin Aldrian and Dodo Gunawan

[1]Corresponding Author

Universiti Kebangsaan Malaysia, Malaysia

Email: ftangang@gmail.com; tangang@ukm.edu.my

Introduction

The Southeast Asia Regional Climate Downscaling (SEACLID) project aims to develop multiple downscaled Climate Change Scenarios for the Southeast Asia region based on the latest IPCC Representative Concentration Pathway (RCP) emissions. These downscaled data products are crucially important for climate change impact assessments at the local and regional scales. Due to the multiple General Circulation Models (GCMs) and RCPs requirement for such assessments, regional climate downscaling can be a time-consuming and very resource-expensive exercise. In the spirit of regional collaboration, scientists from seven countries in Southeast Asia (Indonesia, Malaysia, Viet Nam, Thailand, the Philippines, Cambodia and Lao PDR) initiated this project. The project was later incorporated into CORDEX and has been renamed as SEACLID/CORDEX Southeast Asia (or CORDEX-SEA). In addition to the original SEACLID country members, a number of countries have joined the project as collaborators. These include Australia, UK, Republic of Korea, and Hong Kong SAR.

The main objectives of this project include:

- On a task-sharing basis, carry out joint regional climate downscaling for a common SEA domain with RegCM4 and a number of CMIP5 GCMs and RCPs;
- Collectively analyse model performances, create ensemble regional climate projection for the SEA region, and establish web portal and data centre for efficient data dissemination freely to users in the region; and
- Conduct a number of workshops and disseminate findings through peer-reviewed publications.

Work Undertaken

The project officially started in November 2013 and will continue for a three-year period. Overall, the activities planned for the first year of the project have been successfully implemented. The inception workshop was held from 18-19 November 2013 in Jakarta and hosted by the Indonesian Agency for Meteorology, Climatology and Geophysics (BMKG). The second workshop was held in Ramkhamhaeng University, Bangkok from 9-10 June 2014. Twenty sensitivity experiments selecting the best physics options of RegCM4 model were conducted on a task-sharing basis among the five main countries (Malaysia, Viet Nam, Thailand, Indonesia, Philippines). Some results were presented at the second workshop in Ramkhamhaeng University in Bangkok. These experiments, including the analyses, have been completed.

To facilitate the writing of scientific publications from these sensitivity experiments, the 1st SEACLID Manuscript Writing Workshop was conducted from 25-29 August 2014 at the National University of Malaysia. Currently three manuscripts are being finalised and will be submitted to an appropriate journal by end of 2014 or early 2015. Also, following a decision taken at the second workshop in Bangkok on the need to establish a pilot project on the assessment of climate change impact on rice in Southeast Asia using SEACLID products, a workshop targeted on user groups was held at Ramkhamhaeng University, Bangkok, from 22-23 September 2014. A proposal is being prepared for a pilot project on climate change impact assessment on rice using SEACLID/CORDEX Southeast Asia. The actual downscaling of CMIP5 GCMs on the newly approved domain by CORDEX has started. Results and analysis of baseline runs will be presented at the third SEACLID/CORDEX workshop scheduled to be held in May 2015 in Manila.

HIGHLIGHTS

- The project has been implemented as planned with four workshops successfully organised.
- ERAInt Sensitivity Experiments to select the best physics options for RegCM4 involving 20 runs have been completed and three manuscripts are being prepared for submission to appropriate journals.
- The actual CMIP5 GCMs downscaling has started and currently in progress.

Project Publications

The team members are in the process of finalising three manuscripts from the sensitivity experiments of RegCM4 physics options. These manuscripts are expected to be fully completed and submitted to appropriate journals by end of 2014 or early 2015.

- Sensitivity of the Southeast Asia Rainfall Simulation to Cumulus and Ocean Flux Parameterization in RegCM4 [Coordinated by Malaysia].
- Sensitivity of Temperature to the Physical Parameterization Schemes of RegCM4 over the CORDEX-Southeast Asia Region [Coordinated by the Philippines].
- Performance evaluation of RegCM4 in simulating Extreme Rainfall and Temperature Events over the CORDEX-Southeast Asia Region [Coordinated by Viet Nam].

Acknowledgements

We acknowledge the APN for providing the funding. We acknowledge BMKG, the Ramkhamhaeng University and the National University of Malaysia for hosting the respective workshops. We also acknowledge the National University of Malaysia for hosting the project and providing necessary assistance.

PROJECT INFORMATION

Title:	The Southeast Asia Regional Climate Downscaling (SEACLID) Project
Duration:	Year 2 of a two-year project
Total Funding:	US$ 125,000
Project Leader:	Prof. Fredolin Tangang
Full address:	School of Environmental and Natural Resource Sciences, Faculty of Science and Technology, the National University of Malaysia, 43600 Bangi, Selangor Malaysia
Tel:	+603 8921 4943
Email:	ftangang@gmail.com; tangang@ukm.edu.my
Website:	http://www.ukm.edu.my/seaclid-cordex

Assessing the Climate Change Adaptation and Disaster Risk Reduction Effectiveness of Risk Insurance Approaches

S.V.R.K. Prabhakar[1], J. Pereira, J. Pulhin, G. Srinivasa Rao and J. Cummins
[1]Corresponding Author
Institute for Global Environmental Strategies, Hayama, Japan
Email: prabhakar@iges.or.jp

Introduction

The evidence of insurance effectiveness on the ground in long term disaster risk reduction (DRR) and climate change adaptation (CCA) outcomes is sparse. The present project intends to address the gap by identifying barriers limiting penetration of risk insurance, assess CCA and DRR benefits and costs of risk insurance, and identify an enabling environment to scale up.

Insurance Effectiveness

Traditional understanding of insurance effectiveness revolves around delivery of payoffs as agreed in the contract. Effectiveness is mainly assessed based on the number of people insured, avoidance of moral hazards, and adverse selection and minimisation of basic risk (Figure 1). This is not sufficient criteria if insurance has to deliver DRR and CCA benefits and requires the following consideration: payoffs have to result in long term reduction of threat; payoffs should not continue business-as-usual practices; and payoffs should not result in promoting high risk and profit-seeking behaviour. Most of these factors are linked to insurance design and support services.

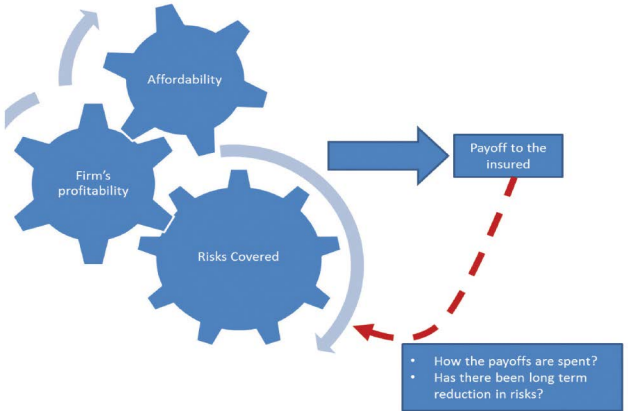


Figure 1. Closing the loop: Moving away from the traditional notion of insurance effectiveness (Prabhakar, 2014).

Insurance Effectiveness Indicators

The team has identified the insurance effectiveness indicators at various levels at a regional expert meeting on "Evidence for Disaster Risk Reduction and Climate Change Adaptation Effectiveness of Insurance: Challenges and Opportunities" held in Bangi, Malaysia from 4–5 July 2014 (Table 1).

Level	No of benefit indicators	No of cost indicators
Farmers	9	5
Community	6	2
Insurance Companies	5	11
Government	7	6

Table 1. Indicators for assessing costs and benefits of risk insurance approaches.

Figure 2 (next page) shows a relational diagram constructed from a limited literature theorising costs and benefits of insurance (Adopted from Solomon and Prabhakar, 2014). Both Table 1 and Figure 2 show higher benefits than costs. This needs to be further scrutinised and developed for quantifying the overall benefits and costs. Depending on how the insurance is designed, such as for example, subsidised versus unsubsidised, the net quantified benefits of insurance could even be negative. However, this assertion requires further research. Since this indicator framework draws on the conceptual causal model, the quantitative assessment of these costs and benefits only can discern the net benefits from insurance. Indicators for insurance effectiveness are difficult to identify largely due to the complex ways in which insurance can impact the wellbeing of the insured, insurance agencies and governments. There is a shortage of evidence-based literature on CCA and DRR impacts of insurance.

HIGHLIGHTS

- The research has revealed that the traditional criteria employed to assess insurance effectiveness often doesn't consider issues such as long-term risk reduction but rather are centred around administrative and operational aspects of the insurance delivery.
- There could be net fewer benefits of insurance based from the balance between number of accounted benefits and costs depending on how the insurance effectiveness is assessed for disaster risk reduction, climate change adaptation and development.
- There is only a very limited scope left for insurance to result in long-term risk reduction while still not conveying the price signal of the risk and without it being combined with risk mitigation measures.
- A comprehensive insurance effectiveness assessment framework is required to differentiate various forms of insurance products. Such a framework should look beyond the immediate 'insurance payoffs' but identify long-term and sustainable risk reduction benefits that insurance can provide.

Conclusion

The ongoing investigation on insurance effectiveness indicated that the notion of insurance effectiveness in terms of CCA and DRR are largely speculative than evidence-based. Bringing out evidence requires a robust approach than listing from a focused discussion partly due to the complexity of connections between CCA, DRR and sustainable development; complex ways in which stakeholders are impacted by insurance; and limited understanding among related professionals. There is a need to segregate insurance products more clearly than a one-size-fits-all way of defining insurance effectiveness. In subsequent years, the project will conduct field investigations to collect disaggregated evidence to various benefits that insurance can provide and costs incurred.

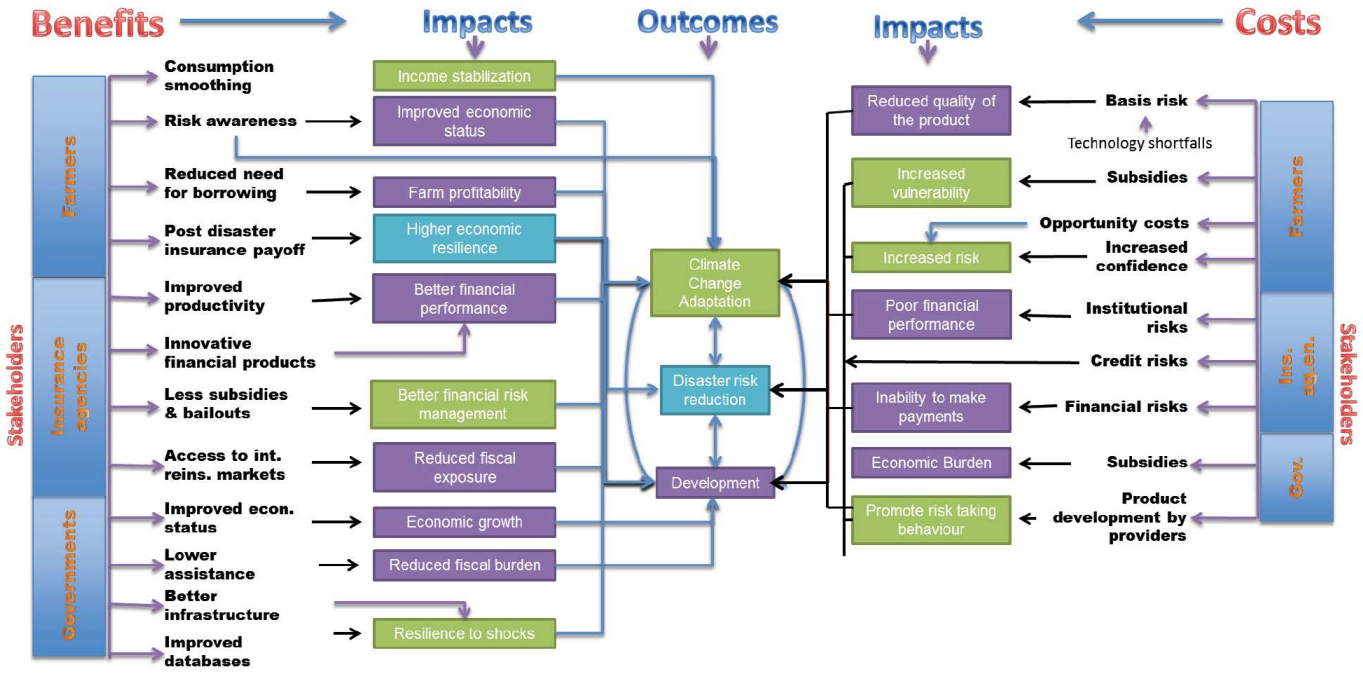


Figure 2. Cost-benefit analysis of risk insurance.

Acknowledgements

The authors acknowledge the researchers and practitioners that contributed to fruitful discussions at the regional consultation meeting in Bangi, Malaysia.

References

Prabhakar, S.V.R.K. (2014). Insurance effectiveness: Objectives and expectations. Presented at Regional Consultation Workshop on Evidence for Disaster Risk Reduction and Climate Change Adaptation Effectiveness of Insurance: Challenges and Opportunities, Bangi, Malaysia, 4-5 July 2014: IGES-SEADPRI-eeMausam-IAFD-UPLB.

Solomon, D.S. & Prabhakar, S.V.R.K. (2014). Assessing disaster risk reduction and climate change adaptation synergies of risk insurance: Employing Impact Pathway Framework for Assessing Risk Insurance (IPFARI). Poster presented at The Sixth International Forum for Sustainable Asia and Pacific, 23-24 July 2014, Yokohama, Japan.

PROJECT INFORMATION

Title:	Assessing Community Risk Insurance Initiatives and Identifying Enabling Policy and Institutional Factors for Maximizing Climate Change Adaptation and Disaster Risk Reduction Benefits of Risk Insurance
Duration:	Year 2 of a two-year project
Total Funding:	US$ 76,000
Project Leader:	Dr. SVRK Prabhakar
Full address:	Institute for Global Environmental Strategies, 2108-11, Kamiyamaguchi, Hayama, Kanagawa, 240-0115, Japan
Tel:	+81 46 855 3846
Email:	prabhakar@iges.or.jp
Website:	http://www.iges.or.jp/en/natural-resource/ad/riskspreading.html

ARCP2014-09CMY-GOMBOEV

Boreal and Tropical Forest and Forest-Steppes in East Asia: A Comparative Study on Climate Impacts and Adaptation

B. Gomboev[1], J.Tsogtbaatar, Dong Suocheng,. S. Puntsukova, D.Tsendsuren, M. Akhmetzyanova, Li Fei

[1]Corresponding Author

Baikal Institute of Nature Management Siberian Branch of Russian Academy of Sciences, Russia

Email: Email: bgom@binm.bscnet.ru

Introduction

The project identified two main goals:

- Estimation of the carbon budget in key areas of different forest ecosystems (boreal and tropical forests and forest-steppe) in East Asia (Russia (Buryatia), Mongolia and China), and comparative analysis of their contribution to the mitigation of global climate change.
- Development of adaptation strategy of these forest ecosystems to climate change, based on analysis of the carbon budget and estimation of "cost-benefit" from sustainable forest management, the development of recommendations for their implementation in a variety of regional programmes of studied countries.

The project team intends to achieve the first goal by investigating how global warming affects forests and, in turn, how forests affect climate. The work will be performed through a comparative analysis of response of different forest ecosystems to global climate change and economic activity. The most climate-dependent vegetation types (forest plots) will be revealed.

An inventory of sources and sinks of greenhouse gases in key areas will be compiled to estimate balance or accumulation of greenhouse gases (CO_2, CH_4, N_2O) in different forest ecosystems. The results will show the main reservoirs (pools) of carbon and the factors (logging, fires, forest pests, etc.) that contribute to climate change the most. Furthermore, different assessment methods for calculations will be used, depending on the availability of the necessary information for calculation (i.e., methods based on the use of forest inventory materials in areas where data is unavailable through remote sensing techniques).

The second goal will be achieved by learning how to adopt forest management practices that increase the contribution of forests in climate change mitigation. To develop a strategy for forest adaptation under changing climatic conditions, as well as recommendations in implementing forest management plans, the team considered a set of measures on the use of forests for carbon cycle management.

Work Undertaken and Results to Date

The following work has been completed to date:

- Comparative analysis on the response of different forest ecosystems on global climate change and economic activity;
- Study on the differences of the institutional framework of market instruments in the forestry sector, regulators and mechanisms for forest management in Russia, Mongolia and China;
- Inventory of anthropogenic emissions by sources and carbon sequestration in key areas of forest ecosystems in Russia, Mongolia and China; and
- Comparative evaluation of the impact of natural and anthropogenic factors on emissions and carbon sequestration in the forests in the short- and long-term.

In addition, three workshops were conducted during the first year of the project (Ulan-Ude, Russia, BINM SB RAS, 25-28 December 2013; Ulaanbaatar, Mongolia, IG MAN, April 17-18, 2014; Beijing, China, IGSNRR, June 15-17, 2014). Data was collected for the project and expeditions were carried out at key project sites, including an international expedition to the key project sites in the Yellow River Delta from 18-19 June 2014.

Project Publications

Wan, Y., Dong, S., Wang, F., Li, Z., & Li, F. (2013). Research on the Regional Economic Discrepancy of Eastern Russia. *Geographical Research, 10*. (In Chinese).

Dong, S., Tao, S., Li, F., Yang, W., Li, Y., Li, S., & Liu, H. (2013). Influences of Climate Change on Regional Development. In Climate and Environmental Change: 2012 (The First National Scientific Assessment Report of Climate Change in China). Meteorological Press. (In Chinese).

Li, F., Dong, S., Li, F., & Yang, L. (2014). Is there an inverted U-shaped curve? Empirical analysis of the Environmental Kuznets Curve in agrochemicals. *Frontiers of Environmental Science and Engineering*. doi:10.1007/s11783-014-0700-y

Li, F., Dong, S., Li, Y., & Huang, Y. (2014) Geographical Differentiation of Agriculture-Related Pollution Risk in Eastern Coastal China. Resources Science. (In Chinese).

Puntsukova, S. D., Gomboev, B. O., Akhmetzyanova, M. R., Jamsran, T., Tsendsuren, D., & Dong, S. (2014). Comparative analysis of different forest ecosystem response on global climate change and economic activity. In International Conference on Ecology, Environment and Sustainable Development of Silk Road Economic Zone, Beijing, 15–16 June 2014 (pp. 119–125).

Puntsukova, S. D. (2014). Economic value of the forest ecosystem of the region. In International Conference on Ecology, Environment and Sustainable Development of Silk Road Economic Zone, Beijing, 15–16 June 2014 (pp. 129–134).

Puntsukova, S. D., Akhmetzyanova, M. R., & Gomboev, B. O. (2014). Analysis of the impact of climate change on forest ecosystems in the Selenge River Basin. In Natural heritage objects and eco-tourism: Materials of International Scientific practical conference (Ulan-Ude - Gremyachinsk, 25–27 August, 2014) (pp. 146–153). Moscow State University Press. (In Russian).

Acknowledgements

The authors thank the APN and the US National Science Foundation (NSF) for financial and organisational support.

PROJECT INFORMATION

Title:	Boreal and Tropical Forest and Forest-Steppes in East Asia: A Comparative Study on Climate Impacts and Adaptation
Duration:	Year 2 of a two-year project
Total Funding:	US$ 85,000
Project Leader:	Prof. Bair Octyabrevich Gomboev
Full address:	Baikal Institute of Nature Management, Siberian Branch of Russian Academy of Sciences 6, Sakhyanova str., Ulan-Ude, Russia, 670047
Tel:	+7 (3012) 434227
Email:	bgom@binm.bscnet.ru
Website:	http://www.apngomboev.bscnet.ru

ARCP2014-10CMY-SHRESTHA

Hydro-Climatic Trends in Karnali River Basin of Nepal Himalaya

Madan Lall Shrestha[1], Kabi Raj Khatiwada, and Jeeban Panthi
[1]Corresponding Author
The Small Earth Nepal (SEN), Nepal
madanls@hotmail.com; madan@smallearth.org.np

Introduction

South Asia includes massive geographical features like the Himalaya and Tibetan Plateau and is considered to be very sensitive to climate variability and change. This region depends heavily on precipitation from the regional summer monsoon system as well as water derived from snow and glacier melts in the Himalayas; both of these are affected by climate change. The Himalayan region, as clearly noted in IPCC reports, is one of the major data-poor regions in the world. Due to the topographic and meteorological complexity of the region, the Himalayan belt provides an excellent avenue for climate change and glacial hydrology research, while the region also provides us with multifaceted challenges. These challenges are slowly being realised and now real opportunities are available to establish research sites with cutting edge instrumentation. It is extremely important to consolidate the observations made at these sites so that they can be used effectively by researchers, educators and policy makers.

The Himalaya region is the most vulnerable region to climate change due to its young and fragile geology and the lack of preparedness of its people for natural disasters. Climate variability and change in the climate system are expected to alter the hydrologic conditions of the region, which will have significant impacts on water resources. Potential impacts may include changes in hydrological processes such as stream flow volume, timing and magnitude of runoff, frequency and severity of floods and flash floods, soil moisture and drought.

Project Description

The project aims to understand the climate and its changing pattern in the region with particular focus on water resources and its consequences to people and society. Three case study basins have been selected from three countries: Ganges-Padma basin in Bangladesh, Karnali basin in Nepal and the Gilgit basin in Pakistan. Future river runoff scenarios in different time scales in sub-watershed levels will be developed using hydrologic models and potential water-based adaptation strategies will also be identified mainly on the basis of the climate and runoff scenarios and socio-economic dynamics. An attempt has been made to focus in those areas because they are less studied. This will provide an opportunity to look at the less explored areas in the region while, at the same time, present challenges due to insufficient literatures and data to work with. The project is also attempting to consolidate scattered available data in the region, which will be useful for future research.

Work Undertaken and Future Plan

The historical climate and hydrological data in each of the case study basins have been analysed to assess the past trend of climate and hydrology and their interrelationship. Future climate model data have been acquired to predict how the climate will look in the future, including its impacts in the hydrological regime. Different hydrological models have been identified for the case study basins: SWAT, UBC coupled with SRM and J2000. It is always a difficult task to identify the most appropriate model for this region with its rugged Himalayan topography and, therefore, applying these models in the selected river basins and assessing their performance is expected to provide good reference resources for future research.

The consolidated output of the research projects will be shared with policy makers in the study countries through policy briefs. Engagement of students and early-career researchers from the beginning of the project and effective science communications are key approaches of this project.

A poster entitled "Hydro-Climatic Trends in Karnali River Basin of Nepal Himalaya" was accepted for the International Conference on Climate Change Innovation and Resilience for Sustainable Livelihood, held in Kathmandu, Nepal, 12-14 January 2015.

HIGHLIGHTS

- Precipitation is decreasing in general but increasing in mountain regions.
- The dry regions and seasons are becoming dryer and the wet season is becoming wetter.
- Temperature is increasing but the warming rate is higher in high altitude regions.
- Yearly river discharge is increasing whereas annual precipitation is decreasing.

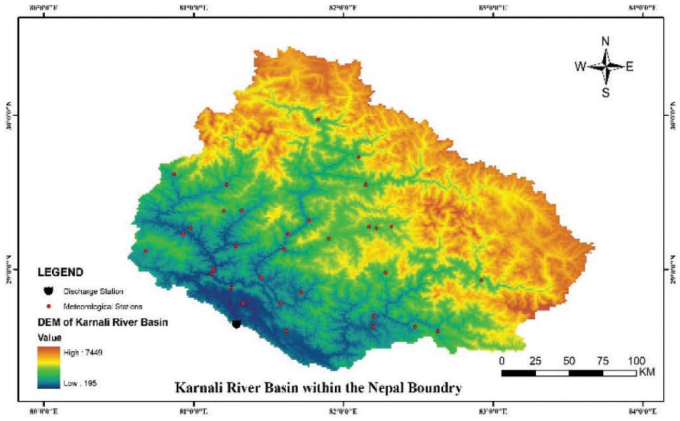


Figure 1. Karnali River Basin and weather stations taken.

Acknowledgements

The proponent and the collaborators would like to express thanks to APN for providing the opportunity to undertake this project. Similarly, we would like to express our sincere gratitude to the Department of Hydrology and Meteorology (DHM)-Nepal for providing the climate and hydrological data.

PROJECT INFORMATION

Title:	Runoff Scenario and Water-Based Adaptation Strategies in South Asia
Duration:	Year 2 of a two-year project
Total Funding:	US$ 77,000
Project Leader:	Dr. Madan Lall Shrestha
Full address:	626 – Bhakti Thapa Sadak, Naya Baneshwor, Kathmandu, Nepal, P. O. Box No. 20533
Tel:	+977 1 47827738
Email:	madanls@hotmail.com; info@smallearth.org.np
Website:	http://www.smallearth.org.np/detail.php?cid=160&id=6

ARCP2014-11CMY-YAMADA

Adaptation of Solid Waste Management to Frequent Floods in Vulnerable Mid-Scale Asian Cities

Masato Yamada[1], Sirintornthep Towprayoon, Chart Chiemchaisri, Pham Khac Lieu and Other
[1]Corresponding Author
National Institute for Environmental Studies, Japan
Email: myamada@nies.go.jp

ABSTRACT: Reduction of vulnerability is key for resilient solid waste management (SWM) systems. Small to medium sized cities in Southeast Asia are particularly affected by extreme flood due to the lack of technological and institutional capability of local governments and other stakeholders. This study attempts to foster the technological and institutional capacity of flood waste management at small- and medium-sized local governments in Thailand and Viet Nam through planning processes of flood waste management at respective local governments. Activities completed during the first year of the project included information gathering on the process of flood waste management. The team investigated how flood waste management has been conducted during extreme flood events via interviews with relevant stakeholders.

Progress of Field Surveys

We conducted two field surveys in Hue, Viet Nam and 3 field surveys in Ayutthaya and Bangkok, Thailand. From these surveys, we found that major issues during flood events: how to collect flood waste from households; and how to retain the collected waste in temporary storage sites. In some municipalities, before a flood occurs, community leaders gather and provide instruction on how to dispose of waste. During a flood event, municipalities through the assistance of community leaders, disseminate public announcements as regards the time and locations for waste collection.

A major problem on flood waste management in small to medium-scale cities in Southeast Asia is the administration and management of organisations in charge of waste management. From interviews with officers at various levels in local government, as well as residents, there seems to be confusion in communication and command systems at different levels of local government; yet clear communication and command systems and structures within local government is an essential factor for more resilient urban waste management systems.

We also reaffirm the necessity of vulnerability assessment tools for resilient SWM at the local government level in small to medium-sized cities in Southeast Asia. The survey findings suggest that vulnerability needs to be evaluated starting from the institutional management of SWM processes.

APN Collaborators' Progress Meeting in Bangkok

At the one-day meeting, which discussed key findings from the ongoing field surveys in Ayutthaya and Hue, it was agreed that the vulnerability assessment tool presented by NIES is interesting, and it was suggested that if all local governments use the tool, it will support efforts at the central/national level. A further recommendation was agreed in that the tool consider factors related to the local context and situation in each country.

Project Publications

Ishigaki, T., Kawai, K., et al. (2014). Flood-resilient Solid Waste Management in Vulnerable Asian Cities. Proceedings of 24th annual conference of Japan Society of Material Cycles and Waste Management.

HIGHLIGHTS

- Major issues on flood waste management in mid-scale Southeast Asian cities arise from problems in communication and command systems within local government.
- Flood waste management planning processes can be used as a means of fostering communication among the relevant department and officers in local government.
- Adaptive capacity can be found in some communities with frequent flood occurrence.

Figure 1. The project leader (left) during a field survey in Hue, Viet Nam.

PROJECT INFORMATION

Title:	Adaptation of Solid Waste Management to Frequent Floods in Vulnerable Mid-Scale Asian Cities
Duration:	Year 2 of a two-year project
Total Funding:	US$ 70,000
Project Leader:	Dr. Masato Yamada
Full address:	16-2 Onogawa, Tsukuba-city, Ibaraki prefecture, 305-8506, Japan
Tel:	+81 29 850 2837
Email:	myamada@nies.go.jp
Website:	http://www.waste-management.asia

ARCP2014-12CMY-SELLERS

Mega-Regional Development and Environmental Change in China and India

Jefferey M. Sellers[1], Bharath Aithal, Huang Jingnan, Uttam Kumar, Mingjun Peng, T.V. Ramachandra, Liu Yong
[1]Corresponding Author
University of Southern California, United States
Email: sellers@usc.edu

Project Summary

Urbanisation in Asia and elsewhere in the developing world represents one of the largest anthropogenic global shifts ever to take place, with major crosscutting implications for land use, biodiversity, greenhouse gas emissions and human welfare. This project examines the increasingly important dynamics of urbanisation beyond the largest urban agglomerations and their immediate peripheries, and the consequences for land use and the environment. Throughout the developing world, urban growth increasingly clusters in wider areas beyond the bounds of individual metropolitan regions. Reflective of long-standing trends in developed countries, diffuse or distributed patterns of urbanisation more have emerged across large scale regions or transportation corridors of 100,000 square kilometres (Florida et al., 2008; Seto et al., 2012). Dynamics at this wider regional scale are especially critical to the cumulative environmental consequences from urbanisation, such as land degradation, increasing greenhouse gas emissions and loss of biodiversity.

Mega-regional development is common to both India and China, but major national institutional, economic and social differences shape its dynamics. This project builds on an earlier APN project undertaken by this team that demonstrated how peri-urban land expansion and urban form have diverged systematically between the two countries (Ramachandra et al., 2012; Sellers et al., 2013a, 2013b).

This project employs remote sensing images and GIS to examine mega-regional dynamics and their consequences at the macro and the micro scale in four emerging Chinese and Indian regions. A nested research design combines region-wide spatiotemporal analysis of urban form and land use change with matched cases of urbanising corridors, and micro-level analysis of particular localities or districts within each mega-region.

Despite some delays, initial wok on the project has begun, and publications based on the research have appeared (Aithal et al., 2013; Ramachandra et al., 2014; Ramachandra et al., 2013; Ramachandra et al.). Initial papers examine the dynamics in paired regions of each country. Over 2015, the project will build on these analyses to develop a side by side comparison between the regions. The first project workshop is scheduled for May 2015. At least four or five papers will be prepared on the project results, along with a volume that will synthesise analyses and findings from this project and the previous one.

References

Aithal, B. H., Vinay, S., & T.V., R. (2013, December). Prediction of Land use Dynamics in the Rapidly Urbanising Landscape using Land Change Modeller. Paper presented at the International Conference on Advances in Computer Science, Delhi.

Florida, R., Gulden, T., & Mellander, C. (2008). The rise of the mega-region. *Cambridge Journal of Regions, Economy and Society, 1*(3), 459-476.

Ramachandra, T., Aithal, B. H., & Beas, B. (2014). Urbanisation Pattern of Incipient Mega Region in India. Tema. *Journal of Land Use, Mobility and Environment, 7*(1), 83-100.

Ramachandra, T. V., Aithal, B. H., & Sowmyashree, M. V. (2013). Analysis of spatial patterns of urbanisation using geoinformatics and spatial metrics. *Theoretical and Empirical Researches in Urban Management, 8*(4), 5-24.

Ramachandra, T. V., Bharath, A. H., & Sowmyashree, M. V. Monitoring urbanization and its implications in a mega city from space: Spatiotemporal patterns and its indicators. *Journal of Environmental Management* (forthcoming).

Ramachandra, T. V., Setturu, B., & Aithal, B. H. (2012). Peri-Urban to Urban Landscape Patterns Elucidation Through Spatial Metrics. International *Journal of Engineering Research and Development, 2*(12), 58-81.

Sellers, J. M., Huang, J., Ramachandra, T. V., & Kumar, U. (2013a). Agents of peri-urban change in China and India: Evidence from two cities. Paper presented at the American Association of Geographers Annual Meeting, Los Angeles.

Sellers, J. M., Huang, J., Ramachandra, T. V., & Kumar, U. (2013b). Patterns of changing peri-urban form: A comparison of Chinese and Indian cases. (Under review).

Seto, K. C., Reenberg, A., Boone, C. G., Fragkias, M., Haase, D., Langanke, T., . . . Simon, D. (2012). Urban land teleconnections and sustainability. Proceedings of the National Academy of Sciences, 109(20), 7687-7692.

HIGHLIGHTS

- First comparative analysis of large-scale regional dynamics of urbanisation in the two largest developing countries.
- Insights on consequences from national institutions and policies for local and regional dynamics of urbanisation and environmental change through matched transnational comparison.
- Remote sensing and GIS analysis at micro and macro scales.
- Assessment of the consequences of urban dynamics for land use and environmental change.

PROJECT INFORMATION

Title:	Mega-Regional Development and Environmental Change in China and India
Duration:	Year 2 of a two-year project
Total Funding:	US$ 68,500
Project Leader:	Dr. Jefferey M. Sellers
Full address:	University of Southern California, Von KleinSmid Center 327, Mailcode 004, Los Angeles, CA 90089-0044
Tel:	+213 740 1684
Email:	sellers@usc.edu
Website:	http://www.usc.edu/dept/polsci/sellers/Urbanization%20Asia/urbanization_env_Asia.htm

ARCP2014-13CMY-STHIANNOPKAO

Developing Scientific and Management Tools to Address Impacts of Changing Climate and Land Use Patterns on Water Quality in East Asia's River Basins

Kyung Hwa Cho, Mayzonee Ligaray, Hanna Kim, Suthipong Sthiannopkao[1]
[1]Corresponding Author
[Department of Environmental Engineering, Dong-A University, Busan, Republic of Korea]
Email: suthisuthi@gmail.com

ABSTRACT: The Chao Phraya River is a major river in Thailand and its basin frequently experiences severe drought and flood due to climate change. The objectives of this study are to calibrate and validate water quantity in the Chao Phraya River basin using the Soil Water Assessment Tool (SWAT) model and to assess stream flow under hypothetical climate sensitivity scenarios. This study provides predicted responses of the basin to several climate change scenarios for improved water resource management. The Chao Phraya River basin has experienced extreme floods in the past, and the characteristics of the 2011 flood event caused 45.7 billion in economic loss and damage (Ziegler, Lim, Tantasarin, Jachowski, & Wasson, 2012). The flooding persisted in some areas until mid-January 2012, contaminated water for human consumption (Chaturongkasumrit, Techaruvichit, Takahashi, Kimura, & Keeratipibul, 2013), and resulted in economic loss on Thai Rice exports (Nara, Mao, & Yen, 2014). The Chao Phraya River basin is one of the world's major agricultural producers with a cultivated area of approximately 51% (cropland) of the basin (Thepent & Chamsing, 2009).

HIGHLIGHTS

- The hydrological system of Chao Phraya River basin is sensitive to climate variations.
- The model provides a new approach of water management under climate change.

Preliminary Results

We applied the dominant hydrological response units (HRUs) model option in the Map Window Soil Water Assessment Tool (MWSWAT) to select the largest unit of potential HRU properties in each sub-basin and changed the entire sub-basin. A total of 132 HRUs were then generated for the basin, which is occupied mainly by agriculture and broadleaf forest. Figure 1 illustrates the flow chart of the model process, which was divided into 3 sections. The first part was the SWAT model simulation. This includes sensitivity analysis, calibration, and validation of the model. The second part was the application of the model into different climate change scenarios; and the third was the assessment of hydrological responses.

The results found that the hydrological system is sensitive to climate variations on a monthly basis. Figure 2 shows the assessment results, which compare the predicted yield of different hydrological responses under each scenario to the baseline. The simulations yield acceptable performances of stream flow and sediment have Nash-Sutcliffe efficiency (NSE) values greater than 0.5 for calibration and

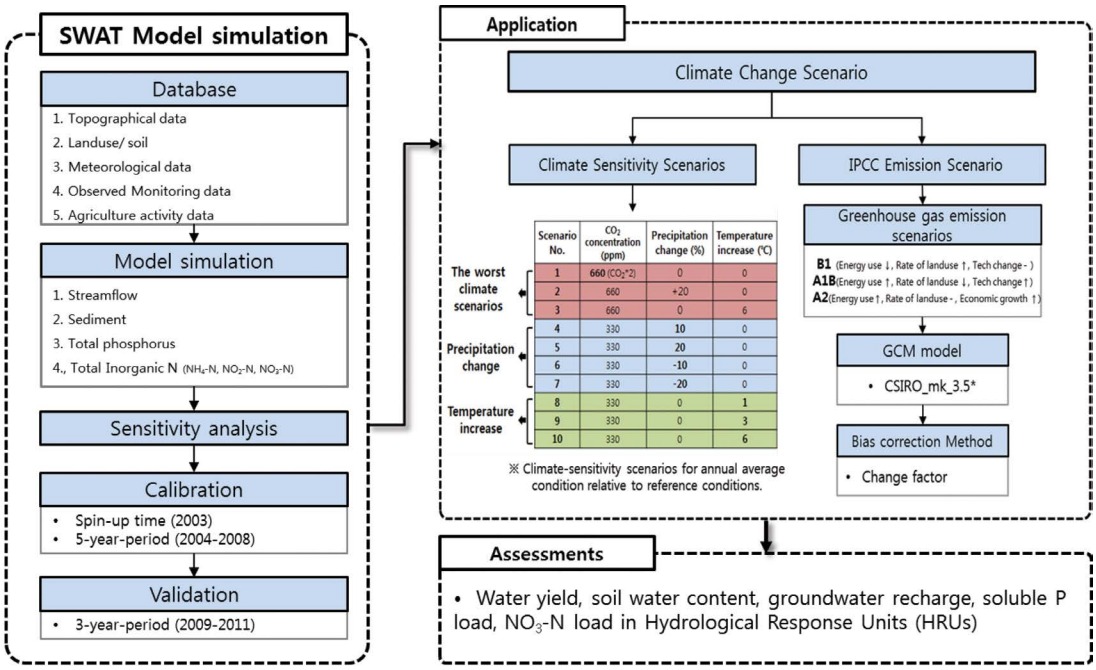
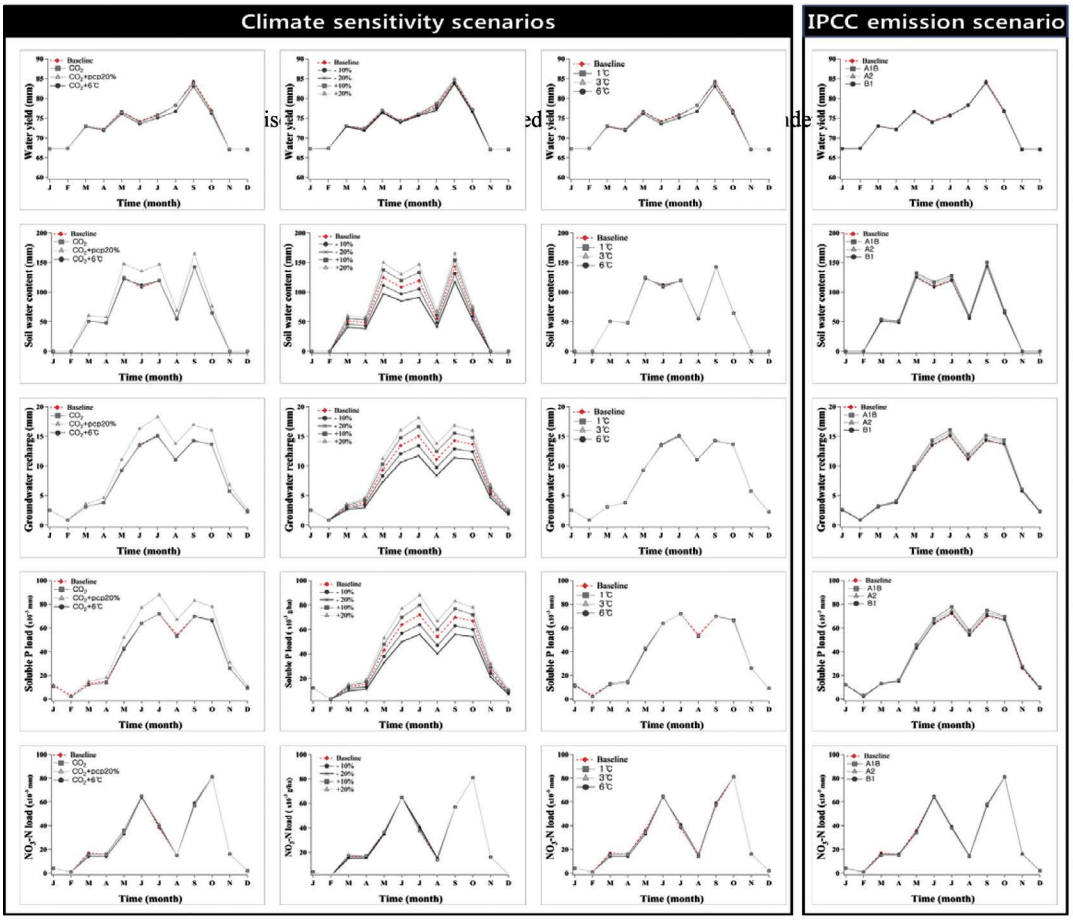


Figure 1. Flow chart of model process.



Water yield						p-value ($p < 0.05$)	
S1	0.72	S4	0.81	S8	0.81	B1	0.86
S2	0.68	S5	0.75	S9	0.77	A1B	0.95
S3	0.64	S6	0.81	S10	0.64	A2	0.95
		S7	0.70				

Soil water content						p-value ($p < 0.05$)	
S1	0.95	S4	0.63	S8	0.95	B1	0.57
S2	0.44	S5	0.44	S9	0.95	A1B	0.48
S3	0.90	S6	0.59	S10	0.90	A2	0.55
		S7	0.44				

Groundwater recharge						p-value ($p < 0.05$)	
S1	0.95	S4	0.60	S8	0.93	B1	0.52
S2	0.43	S5	0.38	S9	0.97	A1B	0.45
S3	0.90	S6	0.52	S10	0.90	A2	0.48
		S7	0.38				

Soluble Phosphorus load						p-value ($p < 0.05$)	
S1	0.86	S4	0.60	S8	0.95	B1	0.52
S2	0.48	S5	0.45	S9	0.84	A1B	0.45
S3	0.81	S6	0.50	S10	0.81	A2	0.48
		S7	0.34				

NO3-N load						p-value ($p < 0.05$)	
S1	0.95	S4	0.95	S8	0.93	B1	0.86
S2	0.81	S5	0.93	S9	0.86	A1B	0.95
S3	0.75	S6	0.93	S10	0.81	A2	0.75
		S7	0.79				

Figure 2. Assessment results comparing predicted yield of different hydrological responses under each climate change scenario.

validation. In climate sensitivity scenarios, those involving CO_2 concentration and air temperature (2059) did not change significantly from the baseline (2011); whereas precipitation scenarios showed changes in soil water, groundwater recharge, and soluble P. In the IPCC Special Report Emission Scenario (SRES) B1, A1B, and A2 scenarios, it was determined that the water yield was similar to the baseline of the representative HRU; however, the soil water content and ground water recharge increased due to the effect of precipitation variation.

This study can provide a new approach on peak flow rate management to control the nonpoint sources during the wet season. It also suggests a more intensive assessment of potential climate change impacts on HRUs and agricultural production in dominant watersheds.

Acknowledgements

This research project is fully funded by the APN.

References

Chaturongkasumrit, Y., Techaruvichit, P., Takahashi, H., Kimura, B., & Keeratipibul, S. (2013). Microbiological evaluation of water during the 2011 flood crisis in Thailand. *Science of the Total Environment, 463-464*, 959-967. doi: 10.1016/j.scitotenv.2013.06.071

Nara, P., Mao, G.-G., & Yen, T.-B. (2014). Climate Change Impacts on Agricultural Products in Thailand: A Case Study of Thai Rice at the Chao Phraya River Basin. *APCBEE Procedia, 8*, 136-140. doi: 10.1016/j.apcbee.2014.03.015

Thepent, V., & Chamsing, A. (2009). Agricultural Mechanization Development in Thailand. The Fifth Session of the Technical Committee of APCAEM.

Ziegler, A. D., Lim, H., Tantasarin, C., Jachowski, N. R., & Wasson, R. (2012). Floods, false hope, and the future. *Hydrological Processes, 26*(11), 1748-1750.

PROJECT INFORMATION
Title: Developing Scientific and Management Tools to Address Impacts of Changing Climate and Land Use Patterns on Water Quality in East Asia's River Basins
Duration: Year 2 of two-year project
Total Funding: US$ 76,000
Project Leader: Dr. Suthipong Sthiannopkao
Full address: 37 Nakdong-Daero 550beon-gil, Saha-gu, Busan 604-714, Republic of Korea
Tel: +82 51 200 1018
Email: suthisuthi@gmail.com
Website: http://www.apnseaclimate.com

ARCP2014-14NMY(B&ES)-SALMO

Influence of Mangrove Biodiversity on Accumulation of Carbon and Resilience to Sea Level Rise: A Comparative Assessment among Disturbed, Restored and Intact Mangrove Systems

Severino G. Salmo III[1], A. Aldrie Amir, Dan Friess, Catherine Lovelock, Richard MacKenzie and Frida Sidik
[1]Corresponding Author
Ateneo de Manila University, Philippines
Email: ssalmo@ateneo.edu

Project Objectives

The project aims to establish a regional network by collecting biodiversity data and enhancing our regional collaboration. A series of regional workshops with local mangrove managers will be conducted to build international collaboration and mutual understanding on the range of pressures on mangrove ecosystems over Southeast Asia.

The workshops will:

- Share regional insights into the state of mangrove biodiversity and the wide range of pressures on mangroves;
- Increase research capacity through sharing of technical knowledge;
- Train and educate partners from developing nations on the value of intact mangroves and effective mangrove sampling for resilience;
- Establish new sites, where vulnerability to sea level rise and carbon sequestration data is not available;
- Assess the variability in mangrove vulnerability to sea level rise; and
- Build a new regional picture of mangrove capacity to store carbon.

Work Undertaken and Results to Date

The first project meeting/workshop was held in the Ateneo de Manila University (AdMU) from 16–21 September 2014 and discussed sampling approaches and plans to realise the objectives of the project. At a symposium held on 18 September, each collaborator presented their respective research on carbon sequestration, vulnerability and adaptation to sea level rise, biodiversity assessment, and mangrove ecology and management.

The team proceeded to Bani, Pangasinan (northwestern Philippines) and installed the rod Surface Elevation Table (rSET; Figure 1). Initial installation was disrupted because of intense rainfall (100-200 mm in 24 hrs) from Typhoon Fung-wong. Six rSETs were completely installed in November 2014. Within this site, three rSETs were installed in planted mangroves and three in natural mangrove stands. These are considered the first rSET installed in the Philippines and will be monitored periodically—at least every four months. The site has 25-year old planted mangrove stands and has been declared as a 42-ha Mangrove Protected Area. The mangrove stands were damaged by Typhoon Chan-hom in May 2009. The project will investigate the post-typhoon regeneration of mangroves in terms of carbon stock and changes in surface elevation.

The project will also evaluate post-typhoon regeneration of mangroves in Leyte (southern Philippines) damaged by Super Typhoon Haiyan in November 2013. This study involves an undergraduate thesis student supervised by the Principal Investigator and aims to document and evaluate post-typhoon regeneration patterns in terms of root biomass and carbon stocks with different dominant species (*Rhizophora sp.* vs. *Avicennia sp.* and *Sonneratia sp.*), tidal inundation and soil depth. The mangroves in the study sites are made up of natural mangrove stands with high species diversity and with different dominant species.

Future Plan

The second rSET in the Philippines will be installed in Palawan in February 2015. Mangroves in Palawan are composed of natural stands with relatively minimal disturbance. It will serve as a good comparative site with the planted mangrove stands in Pangasinan. The second workshop will be held in Malaysia in March 2015 and will include a symposium and the installation of rSETs in mangrove sites in Matang in Malaysia.The project will focus on periodic monitoring of rSETs in the Philippines, Malaysia and Indonesia. Biodiversity and vegetation change from each site will be gathered and analysed. Lastly, the study on post-typhoon regeneration in the southern Philippines will be completed in May 2015.

Figure 1. Installation of rod Surface Elevation Table (rSET) in Bani, Pangasinan, northwestern Philippines.

PROJECT INFORMATION

Title:	Influence of Mangrove Biodiversity on Accumulation of Carbon and Resilience to Sea Level Rise: A Comparative Assessment Among Disturbed, Restored and Intact Mangrove Systems
Duration:	Year 1 of a three-year project
Total Funding:	US$ 85,000
Project Leader:	Dr. Severino G. Salmo III
Full address:	Ateneo de Manila University, Loyola Heights, 1108 Quezon City, Philippines
Tel:	+63 2 4264321
Email:	ssalmo@ateneo.edu
Website:	http://www.admu.edu.ph/ls/sose/environmental-science/

ARCP2014-15NMY-WU

Comparative Analysis of Pollution Sources at the Hangzhou Bay and Mekong River Mouths

Jiaping Wu, Charlie Navannugraha, Apisom Intralawan, Yoshio Inoue, Ho Long Phi, Mai Van Trinh, Vu Ngoc Ut, Thayone Inthayong and Jiaguo Qi[1]
[1]Corresponding Author
Michigan State University, East Lansing, MI 48823, USA
Email: qi@msu.edu

Introduction and Project Objectives

The majority of pollutants in marine ecosystems come from human activities of terrestrial ecosystems through discharge of rivers connecting land and ocean, and through direct discharges from coastal urban systems. Most urban systems have regulations in place to monitor and assess the level of pollutant discharge; however, pollutant discharge from riverine systems is difficult to control as it originates from non-point source pollutions. With increasing sea level rise and enhanced extreme climate events, the amount, timing and spatial distribution of pollutant discharge is uncertain and there is little information available for decision makers to develop and implement environmental science policies.

Another type of new emerging, non-point pollutant sources are the scattered small scale towns and villages, which expand widely as a result of rural development. Such widespread expansion of settlements is visible in China and other developing countries in Southeast Asia. These small urbanised areas are typically without adequate basic infrastructure to process waste materials, and waste is discharged directly into riverine systems. The impacts of pollutant discharge from these non-point sources can be further escalated by extreme climate events. These impacts are particularly significant in the monsoon Asia region.

The objectives of this project are to: 1) Quantify the spatial extent and rate of urbanisation in small towns and villages within two selected watersheds; 2) Estimate changes in nutrient discharge resulting from these land use changes; and 3) Conduct a comparative analysis between the two watersheds to assess management options for pollution control.

Methodology

A general framework has already been developed and prototyped for nitrogen analysis, but here it will be used to examine linkages between terrestrial processes and management options on nutrient discharge into coastal ecosystems.

The major components of the General Modelling Framework can be seen in Figure 1.

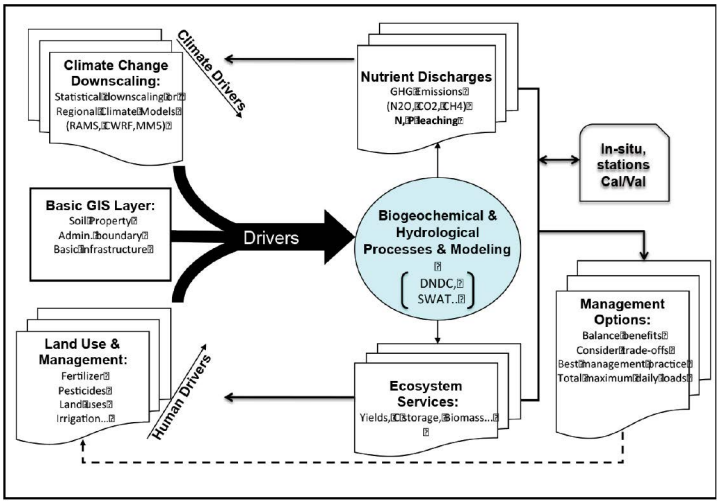


Figure 1. A General Modelling Framework.

HIGHLIGHTS

- A preliminary workshop was held in Shanghai, China, for project preparation.
- General modelling framework was developed and prototyped for nitrogen analysis.
- Data preparation took place with either new data collection or existing data processing for modelling exercises.

Work Undertaken

A preliminary preparation workshop was held in Shanghai, China, with investors from Viet Nam and Thailand to prepare data, models, workshops and fieldwork. Several issues were discussed, which include the following:

- Critical issues that local communities face include sea-level rise, enhanced and increased typhoons and extreme events in the Mekong River Basin.
- Strategies to conduct the research, including data requirements, information requirements and modelling requirements.
- A tentative collaborative effort to compare different study sites. The team felt that focusing on the upper reach, the mid-reach and the mouth of Mekong River would allow holistic understanding of the impact of climate change, particularly on the interactive nature of land use and climate change on the nutrient discharge into the Mekong River.

The team agreed to have the first workshop in Ho Chi Minh City, Viet Nam in February, 2015. In addition to the APN funding, matching funds for the workshop will be provided by Zhejiang University, China. Field work in Ho Chi Minh City, Viet Nam and Chiang Rai, Thailand is also planned in accordance with the workshop.

Project Publications

Suepa, T., Qi, J., Lawawirojwong, S., & Messina, J. P. (2014). Understanding Spatial-temporal Variation of Vegetation Phenology and Rainfall Seasonality in Southeast Asia. Manuscript submitted for publication.

PROJECT INFORMATION

Title:	Comparative Analysis of Pollution Sources at the Hangzhou Bay and Mekong River Mouths
Duration:	Year 1 of a three-year project
Total Funding:	US$ 110,000
Project Leader:	Prof. Jiaping Wu
Full address:	866 Yuhangtang Road, Hangzhou, Zhejiang, 310058, China
Tel:	(+86) 571 88982813
Email:	jw67@zju.edu.cn

ARCP2014-16NMY-BABEL

Developing an Operational Water Security Index and its Application in Selected Diverse Regions of Asia

Mukand S. Babel[1], Nguyen Mai Dang, Devesh Sharma and Victor R. Shinde
[1]Corresponding Author
Asian Institute of Technology (Water Engineering and Management), Thailand
Email: msbabel@ait.asia

Abstract and Objectives

Water security has many dimensions, which are different for various scales, and the major challenge in the present time is reflecting these into operational policy. This project will (a) establish a practical framework to develop a water security index (WSI), using appropriate dimensions and indicators at local and basin scales, (b) demonstrate the application of the index in diverse study areas in Asia (Rajasthan (India), Thailand and Viet Nam), and (c) assess the status of water security at past, present, and future temporal scales. Through interactions/feedback with/from relevant stakeholders throughout the duration of the project, policy guidelines for actual operationalisation of the index will be developed.

Comprehensive Review of the Literature

Water security has been the subject of increased attention in recent years. A number of researchers and organisations have defined and framed water security in various ways (e.g. ADB 2013; Cook & Bakker, 2012; Grey & Sadoff, 2007; GWP, 2000; Nikitina et al., 2009; Zeitoum et al., 2010; etc.). While much of the earlier work in water security was conceptual where the key focus was on establishing the scope of water security, it is only in the last few years that there have been attempts to measure water security using selected indicators. For example, Falkenmark and Molden (2008) quantified water security in terms of water stress and water shortage. Vorosmarty et al. (2010) used four classes of stressors (indicators): watershed disturbance, pollution, water resource development, and biotic factors. The ADB (2013) evaluated the water security of Asian countries with five dimensions: household water security, economic water security, urban water security, environmental water security, and resilience to water-related disasters.

However, all these studies were carried out at the national level and, as pointed out by Vorosmarty et al. (2010), water security assessments at national scales can mask significant variations in security at the local scale. Cook and Bakker (2012) also warn that while national scale analysis enables important and useful conclusions to be drawn, it precludes a fine grained analysis of sub-national spatial and social variation of water security. Further, some indicators developed for the national scale may not be suitable for the local scale and operationalising water security indices locally based on national scale assessments is fundamentally flawed.

HIGHLIGHTS

- Developing a water security index (WSI) to evaluate water security analysis at basin and local scales.
- Demonstrating the application of the WSI in diverse conditions of climate and socioeconomics in three countries—Rajasthan (India), Thailand, and Viet Nam.
- Depicting the dynamic nature of water security for each study area.
- Facilitating the uptake of water security into policy so that measures to reduce the water insecurity can be operationalised.

This project seeks to address this knowledge gap by developing water security indices with different dimensions, and for different scales, so that actual operationalisation of these indicators can be brought into effect. A comprehensive literature review related to existing frameworks of water security has been carried out in line with the project timeline. Through conference calls and email exchanges with the collaborators, the study areas in each of the three countries have been identified (which will be finalised soon) as presented in the Table 1.

Country	Basin scale assessment	Local scale assessment
Rajasthan (India)	Banas River Basin	Jaipur City
Thailand	Lower Chao Phraya River Basin	Bangkok City
Viet Nam	Red River Basin	Hanoi City

Table 1. Study areas identified for the project.

Acknowledgements

The authors acknowledge the kind support of the APN for funding this project.

References

ADB (2013). Asian water development outlook 2013: Measuring water security in Asia and the Pacific. ADB publication: ISBN: 978-92-9092-988-8.

Cook, C. & Bakker, K. (2012). Water security: Debating an emerging paradigm. *Global Environmental Change, 22*: 94–102.

Falkenmark, M. & Molden, D. (2008). Wake up to realities of river basin closure. *International Journal of Water Resources Development, 24*: 201–215.

Zeitoun, M., Allan, J.A.T. & Mohieldeen, Y. (2010). Virtual water 'flows' of the Nile Basin, 1998 – 2004: a first approximation and implications for water security. *Global Environmental Change, 20*: 229–242.

Vorosmarty, C.J., McIntyre, P.B., Gessner, M.O., Dudgeon, G., Prusevich, A., Green, P., ... Davies, P.M. (2010). Global threats to human water security and river biodiversity. *Nature*, 467: 555–561.

PROJECT INFORMATION

Title:	Developing an Operational Water Security Index and its Application in Selected Diverse Regions of Asia
Duration:	Year 1 of a two-year project
Total Funding:	US$ 80,000
Project Leader:	Dr. Mukand S. Babel
Full address:	Asian Institute of Technology, PO Box: 4, Klong Luang, Pathumthani, 12120, Thailand
Tel:	+66 2 524 5790
Email:	msbabel@ait.asia

ARCP2014-17NMY-DEY

Impacts of Crop Residue Removal for Biomass Energy on Soil Function: Studies to Recommend Climate Adaptive Agricultural Waste Management

Dipayan Dey[1], Tsering Gyeltshen, and Purisima P. Juico
[1]Corresponding Author
South Asian Forum for Environment, India
Email: office@safeinch.org

Abstract and Objectives

Agricultural waste management is beyond any traditional farming practices in South Asia where crop residues are usually burnt for biomass energy, leading to emissions pollution and loss of soil function & nutrients (Mitchell et al., 2000; Wood, 1991). This prompts for an impact assessment on removal and burning crop residues, since they perform positive functions to control surface erosion, retain soil organic matter, boost soil function and restore bio-ecology. Traditional practices contribute to climate change by releasing GHGs, forming tropospheric ozone, etc., whereas studies show that anaerobically-digested residues are beneficial in improving soil function (Inyang et al., 2010). Long-term effects have indicated increased ratoon crop yields, suppression of weed, increased soil moisture, organic matter and reduction in erosion.

However, the research findings are meagre and policy regulations are not in place for agro-waste management. Thus, the present research attempts to:

- Understand the roles of crop residues on soil functions and impact of its removal in varying cropping patterns;
- Compare the ecological and economic benefits of controlled residue removal in reducing emission footprints and enhancing soil function; and
- Articulate a sustainable crop residue management strategy towards climate adaptive agro-farming practices.

Methodology and Work Undertaken

The project spans around villages of Purulia district in India, where farmers grow sugarcane and use the bagasse for biomass energy, in villages growing rice near Central Luzon State University, city of Munoz, Philippines and villages in Trashigang districts of Eastern Bhutan, where tribes burn maize residue during Jhoom cultivation.

Randomised Experimental Blocks (REB) treated with raw agro-waste, biochar and ash in four grades (25%, 50%, 75% & 100%) in each along with one control experiment (0%) sets the experimental design. Change detection studies in physio-chemical properties and microbial biomass in soils with relative growth indices in crops are being carried out in all REBs. To understand the climate implications, measurements of Soil Carbon Sequestration rating in post and pre ante interventions, carbon stock estimation in crop residues and soil shall be compared with emission footprints of open burning crop residues. A simple correlation matrix will help understand the relationship amongst different soil properties.

Preliminary Results

Primary results from Purulia and Trashigang have shown interesting correlations to indicate that plant growth rate in raw bagasse was maximum, followed by biochar and 'control', while ash showed minimum growth. Values of pH, EC, soil moisture and WHC were maximum in raw bagasse REBs though no such trend was found in available NPK. It is primarily inferred that raw bagasse has some advantage over others and that ash-treated REBs might have deleterious effects as they had grown even less compared to the control. The present observation is in parity with the inferences of Chen et al. (2010) that bagasse charcoal increased soil moisture and, in addition, the residence time of nitrate in the crop root zone providing greater opportunity to absorb nitrate (Kameyama et al 2012). It is noteworthy that the carbon content in raw bagasse to charcoal, reduced from 43.89 ± 9.56% to 33.27 ± 18.30%, whereas in the ash, it reduced to 1.92 ± 0.89%. This data, suggests that if raw bagasse mulch can be used in the agricultural field, instead of burning as fuel, it can reduce emission of ~ 42%.

Project Publications

A scientific review communiqué entitled "Agricultural Waste Management Practices of Smallholders in South Asian Countries: Current Concerns and Strategies" is coming up in 'GREEN Interpreters' (ISSN 0975-9824).

Acknowledgements

The author sincerely acknowledges the support of APN in carrying out this research and also acknowledges the collaborative support extended by the Indian Council of Agricultural Research, Govt. of India, Department of Soil Sciences, Central Luzon State University, Philippines and Bhutan Trust Fund, Bhutan.

PROJECT INFORMATION

Title:	Impacts of Crop Residue Removal for Biomass Energy on Soil Function: Studies to Recommend Climate Adaptive Agricultural Waste Management
Duration:	Year 1 of a two-year project
Total Funding:	US$ 70,000
Project Leader:	Dr. Dipayan Dey
Full address:	SAFE; B 43 Survey Park, Kolkata 700075 WB, India
Tel:	+91 33 24329699
Email:	office@safeinch.org
Website:	http://www.safeinch.org

HIGHLIGHTS

» A transition from 'waste burning' to 'waste keeping' is suggested as green mulch has shown positive impacts in controlling surface erosion, retain soil organic matter & boost soil function.
» It is inferred from primary observations that raw bagasse has some advantage over other treatments and ash might have deleterious effect on soil function.
» Results show that use of raw bagasse as mulch in agricultural fields can reduce emissions by up to ~ 42%.

ARCP2014-18NMY-HEATH

Development of an Evidence-based Climate Change Adaptation Toolkit to Help Improve Community Resilience to Climate Change Impacts in Uttarakhand, India

Lance Heath[1]
[1]Corresponding Author
Australian National University Climate Change Institute, Australia
Email: lance.heath@anu.edu.au

Introduction

The state of Uttarakhand in India has recently experienced unprecedented flooding and loss of life on account of a serious climate-related extreme event. This has highlighted the importance of developing evidence-based adaptive response strategies to strengthen resilience and adaptive capacity to climate change impacts across the Himalayan region.

The aim of this activity is to use participatory approaches to identify the risks, vulnerabilities and opportunities arising from climate change impacts on small upstream communities in Nainital in the state of Uttarakhand, India. The project will facilitate capacity to help communities cope better with those risks and vulnerabilities identified. A key objective is the development of a transferrable climate change adaptation toolkit, which is based on a set of scientific and evidence based methodologies or tools to guide local planners and policy makers during the adaptive response planning process. Such tools include, but are not limited to, risk assessment scenarios, conceptual modelling, stakeholder identification, and adaptive management scoping studies.

ICLEI South Asia, in collaboration with ICLEI Oceania, with support from the Rockefeller Foundation's Asian Cities Climate Change Resilience Network (ACCCRN) programme, has developed a climate change adaptation toolkit, referred to as the ICLEI ACCCRN Process (IAP) to enable local governments to assess their climate risks and vulnerabilities, and to formulate adaptive response plans accordingly. To date, this toolkit has been tested in three Indian cities – Shimla, Bhubaneswar and Mysore – and has undergone further refinement. The ANU Climate Change Institute is working closely with ICLEI Local Governments for Sustainability to modify the IAP for the purpose of this project and to ensure that it is relevant for peri-urban and rural areas. The toolkit will incorporate bio-physical, socio-economic, and cultural data collected from the Ramgad Basin in the district of Nainital for the purpose of enhancing the relevance of the toolkit for peri-urban and rural areas.

Work Undertaken and Results to Date

The overarching strategy is to develop a source to sink approach to managing climate change risks. To ensure the effective uptake of the toolkit across the Hindu Kush-Himalayan (HKH) region, a road map was developed for the further expansion of the toolkit to include India and Bangladesh. To date, the IAP has been trailed in the Panchkhal region of Nepal as part of a capacity building project funded by Australian AID (Department of Foreign Affairs and Trade). The toolkit methodology will now be transferred to communities in Nainital, India as part of this new APN ARCP project. More importantly, the project will draw upon the experiences and lessons learnt from the Panchkhal work. The toolkit methodology will also be transferred to Bangladesh as a separate study to be conducted at a later date.

The first workshop on the development of the toolkit in Nainital was held in Kathmandu on 21 October 2014. This workshop established the context of the project and the selection of suitable study site.

Acknowledgements

The proponents of this project would like to acknowledge the APN and the Australian AID (Department of Foreign Affairs and Trade) for their support.

PROJECT INFORMATION

Title:	Development of an Evidence-based Climate Change Adaptation Toolkit to Help Improve Community Resilience to Climate Change Impacts in Uttarakhand, India.
Duration:	Year 1 of a two-year project
Total Funding:	US$ 85,000
Project Leader:	Dr. Lance Heath
Full address:	Australian National University Climate Change, C/O Frank Fenner Building Australian National University Canberra ACT Australia 0200
Tel:	+61 2 61254672
Email:	lance.heath@anu.edu.au
Website:	http://cci.anu.edu.au/

HIGHLIGHTS

- The project activity aims to promote research that informs adaptation decision making in the specific area of climate change and climate variability by using a multidisciplinary approach to global change research that draws on the bio-physical, socio-economic and cultural data collected in the field to develop a truly evidence based climate change adaptation toolkit.
- The toolkit will assist in the effectiveness of knowledge transfer to user communities through its simplicity and ease of transfer to other jurisdictions in other countries.
- To date, the toolkit methodology has been used in the Panchkhal region of Nepal as part of a capacity building project funded by Australian AID. The toolkit methodology will now be transferred to communities in Nainital, India as part of this new APN ARCP project. The project will draw upon the experiences and lessons learnt from the Panchkhal work.
- The first planning workshop on the development of the toolkit for a peri-urban region in India was held in Kathmandu on 21 October 2014. This workshop established the context of the project and the selection of suitable study site for the development of the toolkit.
- The activity will strengthen the interface of policy and decision-making processes.

ARCP2014-19NMY(B&ES)-LIANG

Coastal Forest Management in the Face of Global Change Based on Case Studies in Japan, Myanmar and the Philippines

Luohui Liang[1], Evonne Yiu, Bixia Chen, Leni Camacho, and Chaw Chaw Sein
[1]Corresponding Author
United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS), Shibuya-ku, Tokyo, Japan
Email: liang@unu.edu

Abstract and Objectives

Coasts are home to a high proportion of the world population, particularly in Asia. The tsunami-induced disaster following the earthquake in Japan in 2011 awakened the world to the limits and inadequacy of the conventional scope of coastal infrastructure for resilience to natural disasters. Coastal forests are recognised in mitigation of coastal disasters and should be included as part of an integrated approach to mitigate tsunami-induced disasters and climate change impacts. Nevertheless, there is little understanding of how the natural sub-system and the human sub-system interact and can be better integrated to adapt to climate change impacts.

The present joint research initiative will examine community-based forest management, including local knowledge in vulnerable communities to identify best practices and their integration with planning of human settlement and facilities to strengthen community resilience to climate change impacts. The research will also evaluate the effectiveness of and need for policy interventions through a bottom-up process and assess potential benefits of coastal forests in adaptation and mitigation to climate change.

Methodology and Site Selection

Three project sites, one each are selected in the Philippines (Bohol Province), Myanmar (Ayeyawady Delta) and Japan (Okinawa) experience frequent typhoons or tropical cyclones. The comparative perspective will explore how different countries and local communities manage coastal forests to cope with coastal hazards under similar bio-physical conditions but different socio-economic contexts, and draw on their experiences for developing context-based solutions.

The project will be carried out through three-interlinked phases: (i) field assessment phase and (ii) policy analysis phase in Year I; and (iii) synthesis phase in Year II. The field assessment phase will focus on:

- Analysis of the storm risk in the context of climate change in the project region;
- Mapping of land uses/land-covers and land areas vulnerable to storm damage at the project sites; and
- Investigation on coastal protection and other roles of forests, including traditional knowledge.

The policy analysis phase will facilitate development of community action plans for mainstreaming forests in coastal protection and integration with other infrastructure at the project sites, and policy dialogues on coastal forest management. The results of three country studies will be synthesised as a solid basis for policy recommendations and developing a wider assessment of coastal forest management beyond three participating countries.

Results to Date

The project inception workshop was held at the University of the Ryukyus in Okinawa from 15-17 September 2014 and confirmed the three project sites and finalised the project methodology and work plan. A field visit to the project site in Okinawa was also arranged. The workshop provided a good opportunity to network with experts from India, Indonesia, Japan and Taiwan, and share experiences on coastal forest management in Asia. After the project inception, project team conducted a review of secondary data and prepared questionnaires and other instruments to assess impacts of policies on coastal forest management as well as community-based forest management.

HIGHLIGHTS

- Assessed and advocated multiple important roles of coastal forests, including coastal protection.
- Acknowledged traditional knowledge in coastal forest management.
- Developed community action plans/strategies at the project site.
- Conducted policy review of coastal forest management for mainstreaming forests in coastal protection.

Project Publications

Chen, Bixia & Nakama, Yuei, Residents' preference and willingness to conserve homestead woodlands: coastal villages in Okinawa Prefecture, Japan (Under review of Urban Forestry & Urban Greening).

Chen, Bixia (2015). Function of traditional forests for disaster prevent-a landscape design perspective. In: Report of International Institute for Okinawan Studies (IIOS), University of the Ryukyus (forthcoming).

Acknowledgements

Support of UNU-IAS, University of the Ryukyus and FRI has been crucial. Contribution to this report has been also made by other team members from UPLB, UoR; FRI; and UNU.

PROJECT INFORMATION

Title:	Coastal Forest Management in the Face of Global Change Based on Case Studies in Japan, Myanmar and the Philippines
Duration:	Year 1 of a two-year project
Total Funding:	US$ 80,000
Project Leader:	Mr. Liang Luohui
Full address:	United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS)
Tel:	+81 3 5467 1212
Email:	liang@unu.edu
Website:	http://ias.unu.edu/en/research/agrodiversity-and-sustainability.html

ARCP2014-20NMY-MISHRA

Climate Change Adaptation through Optimal Stormwater Capture Measures: Towards a New Paradigm for Urban Water Security

Binaya Kumar Mishra[1], Srikantha Herath, Sutat Weesakul and Tran Thuc
[1]Corresponding Author
United Nations University – Institute for the Advanced Study of Sustainability, Japan
Email: mishra@unu.edu

Introduction

Dealing with climate change is a great challenge facing the world today and posing unprecedented multidimensional challenges for all countries and communities in the Asia-Pacific region characterised by uneven distribution of precipitation. With an energised global water cycle, future climate is expected to have increased rainfall intensities and longer non-rainy days. Thus, increased rain intensities and prolonged water scarcity periods are two of the most pressing problems associated with climate change. Water resources will be affected in both quantity and quality, and hence water, stormwater and wastewater facilities' infrastructure will face greater risk of damage.

The effect of the climate change will manifest from difficulties in operations to disrupted services and increased cost of water and wastewater services. Governments, planners and water managers have to re-examine development processes for municipal water and wastewater services and adaptation strategies to incorporate climate change into infrastructure design, capital investment projects, service planning, and operation and maintenance.

The expected climate change impacts of increased rainfall intensities, resulting increases in direct runoff, and hence quick rises in stream flow and depletion of groundwater levels are similar to urbanisation impacts on the water cycle. Therefore, experiences and methods adopted in coping with water management to urbanisation can also be used for adaptation to climate change.

Introduction of onsite stormwater capture measures have received greater attention in recent years to deal with flooding and groundwater depletion in urban areas. The present research aims to help improve urban water security in the Asia-Pacific region by optimising on-site stormwater infiltration and storage measures. This research will help address dual challenges of extensive urban flooding in the wet season and water scarcity during dry spells brought by climate change. The research will investigate the stability of the local water cycle as the target for sustainable urban stormwater management in Bangkok, Hanoi and Tokyo.

Inception Workshop

On 21 November 2014, an inception workshop was organised by Asian Institute of Technology (AIT), Bangkok and United Nations University- Institute for the Advanced Study of Sustainability (UNU-IAS), Tokyo, at Hydro and Agro Informatics Institute (HAII), Bangkok, Thailand. The objectives of the workshop were to: (i) discuss project objectives, necessary data availability and collection, and existing methodologies; (ii) plan future activities; (iii) discuss student involvement in carrying out the research; and (iv) discuss allocation of budget to the collaborators for coordination and student support to accomplish the research tasks. The inception workshop consisted of presentations/discussions on the research overview and latest developments, and a field visit to a pumping station for managing stormwater (Figure 1). One major concern was raised on suitability of some of the proposed measures in reference to combined drainage system. During the discussion, it was agreed that the first year will focus on (i) carrying out climate projections downscaling with focus on statistical approach in the study areas; (ii) assessing climate change impacts on rainfall intensity duration curves; and (iii) selection of locations/catchment in the study cities for modelling water capture measures for the next year.

HIGHLIGHTS

- Links established in the selected study areas for data collection and sharing.
- Different methods of statistical climate projections downscaling for their suitability at local/urban scale will be explored.
- Rainfall intensity duration frequency curves for urban stormwater management under present and future climate will be analyzed.
- Investigation on feasibility and effectiveness of onsite water capture measures towards flood reduction in densely populated urban areas will be carried out.

Figure 1. Participants during visit of BMA Waste water tunnel project at Makasol, Bangkok.

PROJECT INFORMATION

Title:	Climate Change Adaptation through Optimal Stormwater Capture Measures: Towards a New Paradigm for Urban Water Security
Duration:	Year 1 of a two-year project
Total Funding:	US$ 65,000
Project Leader:	Binaya Kumar Mishra
Full address:	United Nations University – Institute for the Advanced Study of Sustainability, 4-53-70 Jingumae, Shibuya, Tokyo 150-8925, Japan
Tel:	+81 3 5467 1212
Email:	mishra@unu.edu
Website:	http://ias.unu.edu/en/research/climate-change-adaptation-through-optimal-stormwater-capture-measures-towards-a-new-paradigm-for-urban-water-security.html#outline

ARCP2014-21NMY-SHARP

Integrated Solid Waste Management System Leading to Zero Waste for Sustainable Resource Utilisation in Rapid Urbanised Areas in Developing Countries

Alice Sharp[1], Sandhya Babel, Nguyen Thi Phuong Loan and Sonam Desel
[1]Corresponding Author
Sirindhorn International Institute of Technology, Thammasat University, Thailand
Email: alice@siit.tu.ac.th

Introduction

With rapid urbanisation and life style changes, proper solid waste management (SWM) is becoming a major issue in many developing countries. Mongar District in Bhutan and Ho Chi Minh City (HCMC) in Viet Nam were selected as study sites as both face many problems in SWM. This project will help to prepare guidelines for integrated SWM based on the nature of waste and learning from best practices in Thailand. The training of trainers in Thailand will help develop the capacity of local authorities to sustain and manage solid waste more effectively.

Activities Undertaken

In October 2014, the proponent visited HCMC and Mongar to meet with project collaborators and explain the project's overall framework and other requirements and regulations. During the trip to HCMC, field visits were made with partners to waste transport and transfer station, Vietstar Joint Stock Facilities (recycling facilities), and Da Phuoc solid waste treatment complex that include sanitary landfill and leachate treatment. A workshop on SWM in HCMC with stakeholders was carried out on 8 October 2014 to ensure the involvement of relevant stakeholders and their participation. The workshop was successful with more than 25 participants sharing their experiences and views on current SWM practices. A visit was also made by the proponent to the Department of Natural Resources and Environment (DONRE) to discuss problems and plans related to SWM in HCMC. After the visit of the Project Leader, the partner in HCMC started data collection on solid waste generation, volume, composition, characteristics, collection, transfer and disposal of MSW in HCMC from 2012–2014.

During the visit to Bhutan, the proponent participated in the National Solid Waste Conference in Thimphu on 27-28 October 2014. The conference was organised by the Ministry of Human Settlement and Work and was joined by government officials all over the country. The presentations covered SWM practices and problems in different districts, including Mongar. The experiences from Thailand SWM practices were presented. A visit was also made to Mongar district and a workshop with stakeholders was organised at the district office with the Governor as a chairperson during the workshop. A field visit was made to see the existing landfill, recycling company (We Care Company), and local market as the waste generator. The responsible officers in Mongar have started their data collection in collaboration with the Ministry.

Future Plans

The project has been in line with the proposed timeline. Communications between the Project leader and collaborators are regularly done in order to ensure successful implementation of the project. Discussions are ongoing with partners to finalise the schedule a visit to Thailand to showcase good practices. As per plan, the baseline report for the two countries is supposed to be completed by the end of March 2015 so that SWM options can be finalised.

HIGHLIGHTS

- Project meeting was carried out to introduce project details, requirements and regulations to the partners in Bhutan and Viet Nam.
- Field visits were conducted to various solid waste management facilities and government offices in Bhutan and Viet Nam to understand existing waste management systems.
- Meeting with stakeholders was held to ensure their involvement and contribution from the beginning of the project.

Figure 1. Transportation and transfer station 2 in Ho Chi Minh City.

PROJECT INFORMATION

Title:	Integrated Solid Waste Management System Leading to Zero Waste for Sustainable Resource Utilisation in Rapid Urbanised Areas in Developing Countries
Duration:	Year 1 of a two-year project
Total Funding:	US$ 75,000
Project Leader:	Dr. Alice Sharp
Full address:	Sirindhorn International Institute of Technology, Thammasat University, PO Box 22, TU Rangsit Post Office, Klong Luang, Pathum Thani, 12121 Thailand
Tel:	+662 986 9009 Ext 1106, 1805
Email:	alice@siit.tu.ac.th
Website:	www.siit.tu.ac.th

ARCP2014-22NMY-ZHOU

Integrated Assessment of Climate-Induced Long-Term Water Availability in Ganges Basin and Impacts on Energy Security in South Asia

Xin Zhou[1], Bijon Kumer Mitra, Johnson Brian, Devesh Sharma, G.M.Tarekul Islam and Rabin Malla
[1]Corresponding Author
Institute for Global Environmental Strategies, Japan
Email: zhou@iges.or.jp

Brief Description of the Project

Water and energy are two fundamental elements for achieving sustainable development in South Asia, a region facing many challenges of achieving sustainable development goals under resource constraints. Water and energy are inherently inter-dependent, which requires a nexus perspective to address their synergy. However, sectoral approaches have been widely used to address these two interacting issues. It is, therefore, important to understand the quantitative linkages of water and energy and address the nexus at the planning stage of resource management. This study aims to provide an integrated assessment on water-energy nexus under the impacts of climate change up to 2050. A case study of the Ganges Basin will be conducted to help policy makers in India, Nepal and Bangladesh to address water and energy security from the river basin perspective through integrated resource management and regional cooperation. In this two-year project, The Institute for Global Environmental Strategies (IGES), based in Japan, is leading the project with three collaborators, the Central University of Rajasthan in India (CURI), the Bangladesh University of Engineering and Technology (BUET) and the Center of Research for Environment Energy and Water (CREEW) in Nepal.

Summary of Work Undertaken and Results to Date

- A comprehensive literature review on water and energy nexus including multi-national initiatives, policy processes, influencing publications, critical issues, major methodologies and findings was conducted for better design of the project to address knowledge gaps and identify the value added.
- Following several online bi-meetings coordinated by IGES with each of the three collaborators, a detailed work plan with each collaborator was drafted. A kick-off meeting through telephone conference system was successfully conducted in November to discuss the objectives, research content, methodologies, coordination for country case studies, work plan, project management issues and logistics.
- An analytical framework for the integrated assessment of the water and energy nexus was developed.
- Since its official start on 15 August 2014, the project has been implemented well so far which follows our original plan that was provided in the proposal.

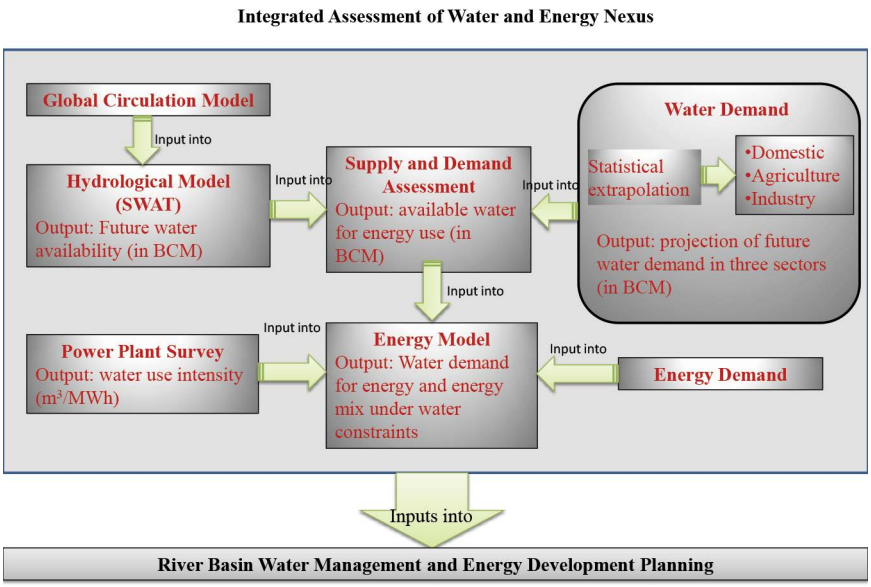


Figure 1. An analytical framework for the integrated assessment of the water and energy nexus developed for the project.

Acknowledgements

We would like to thank the APN for its financial support.

PROJECT INFORMATION

Title:	Assessment of Climate-Induced Long-term Water Availability in Ganges Basin and Impacts on Energy Security in South Asia
Duration:	Year 1 of a two-year project
Total Funding:	US$ 75,000
Project Leader:	Dr. Xin Zhou
Full address:	Institute for Global Environmental Strategies (IGES), 2108-11 Kamiyamaguchi, Hayama, Kanagawa, 240-0115 Japan
Tel:	+ 81 (0)46 855 3863
Email:	zhou@iges.or.jp
Website:	www.iges.or.jp

HIGHLIGHTS

» Water and energy are two fundamental elements for achieving sustainable development and South Asia is facing significant challenges in ensuring water and energy security.

» Until recently, water and energy, though interlinked with each other, have been mainly addressed using sectoral approaches which may cause conflicts in target setting and planning and be less effective compared to synergetic approaches.

» This study aims to gain in-depth knowledge on the inter-linkages of water and energy for the development of the Ganges Basin by using an integrated assessment approach.

» Better knowledge on the nexus issue will help decision makers to conduct integrated management and planning for achieving regional sustainable development goals under resource constraints.

ARCP2014-23NSG-HUANG

Scoping Workshop to Develop Proposal: Assessing the Health Effects of Extreme Temperatures and the Development of Adaptation Strategies to Climate Change in Asia-Pacific Region

Cunrui Huang[1], Adrian Barnett, Xiaoming Wang and Cordia Chu
[1]Corresponding Author
Centre for Environment and Population Health, Griffith University, Australia
Email: huangcunrui@hotmail.com

Introduction

Climate change is one of the biggest challenges of the century and is increasingly recognised as a public health priority (Costello et al., 2009; Patz et al., 2005). Research on climate change and human health is increasing, but is still relatively weak in relation to the complexity of the issue and the magnitude of the potential risks from inadequate or inappropriate responses (WHO, 2009). Countries in the Asia-Pacific region are already burdened with temperature-related deaths, yet every temperature-related death is, in fact, preventable (Ebi, 2012; Luber & McGeehin, 2008). The ability of health systems to adapt effectively to extreme temperatures and climate change is a key challenge worldwide. Until now, most analyses have focused on mortality in relation to heat in high-income countries, but very few studies have investigated the relation in low- and middle-income countries. Also, long-term strategies to address the health effects of temperature have not been sufficiently considered in public health practices and activities (Huang et al., 2013).

Project Objectives

A team of international researchers from Australia, Bangladesh, China, Indonesia, Thailand and Viet Nam have planned two scoping workshops in Guangzhou, China. The scoping workshops are intended to gather information among collaborators to further improve the research framework and methodologies of the full proposal to be submitted to APN's call for regional research proposals. Our full proposal aims to assess the health effects of extreme temperatures and climate change in major cities in Bangladesh, China, Thailand and Viet Nam and to formulate local adaptation strategies to deal with temperature-related health risks and reduce vulnerability.

In the countries considered in this project, systematic analysis which investigates the current and future burden of temperature-related health problems has not been investigated, nor have there been any national studies that consider public health adaptation strategies in existing programmes and activities for increasing future resilience. Once adaptation approaches are better defined by this project, it will be possible to make a significant contribution to protecting the health of present and future generations in the region.

Progress and Results

The first workshop was held in Guangzhou, China on 25–26 June 2014. A total of 25 participants attended the workshop and 12 people presented their research work during the workshop (Figure 1). Following the presentations, breakout sessions and a scoping workshop were conducted to address three questions:

- What are the main research questions in the area of climate change and public health?
- What expertise is required for meaningful results in the Asia-Pacific region?
- What are the data gaps and challenges in developing climate change adaptation strategies?

Figure 1. First scoping workshop at San-Yu Hotel in Guangzhou, China.

Acknowledgements

We would like to acknowledge Prof. Roger Street and Dr. Shannon Rutherford for their advice and guidance as well as their valuable contributions to the workshops. We would also like to show our appreciation to Guangdong CDC for providing generous support during the workshops such as room, food and transportation.

References

Costello, A., Abbas, M., Allen, A., Ball, S., Bell, S., Bellamy, R., … Patterson, C. (2009). Managing the health effects of climate change. *The Lancet, 373*(9676), 1693–1733. doi:10.1016/S0140-6736(09)60935-1

Ebi, K.L. (2012). High temperatures and cause-specific mortality. *Occupational and Environmental Medicine, 69*(1), 3-4.

Huang, Cunrui, Barnett, Adrian G, Xu, Zhiwei, Chu, Cordia, Wang, Xiaoming, Turner, Lyle R, & Tong, Shilu. (2013). Managing the health effects of temperature in response to climate change: challenges ahead. *Environmental Health Perspectives, 121*(4), 415-419.

Luber, G. & McGeehin, M. (2008). Climate change and extreme heat events. *Americal Journal of Preventive Medicine, 35*(5), 429-435.

Patz, J. A., Campbell-Lendrum, D., Holloway, T., & Foley, J. A. (2005). Impact of regional climate change on human health. *Nature, 438*(7066), 310-317.

WHO. (2009). Protecting health from climate change: global research priorities. Geneva: World Health Organization.

PROJECT INFORMATION

Title:	Scoping Workshop to Develop Proposal: Assessing the Health Effects of Extreme Temperatures and the Development of Adaptation Strategies to Climate Change in the Asia-Pacific Region
Duration:	Single-year project
Total Funding:	US$ 12,000
Project Leader:	Dr. Cunrui Huang
Full address:	Griffith University, 170 Kessels Road, Nathan Campus, Brisbane, Queensland 4111, Australia
Tel:	+61-7-3735 7485
Email:	c.huang@griffith.edu.au; huangcunrui@hotmail.com
Website:	www.griffith.edu.au

ARCP2014-24NSG-LOKUPITIYA

Scoping Workshop to Develop Proposal: Identification of the Best Agricultural Management Practices with Better GHG Benefits in Salinity-Affected Areas of South Asia

Erandathie Lokupitiya[1], Madhoolika Agrawal, Tofayel Ahmed, Naveed Mustafa, Divya Pandey, and Keith Paustian

[1]Corresponding Author

Faculty of Science, University of Colombo, Colombo 03, Sri Lanka

Email: erandi@sci.cmb.ac.lk

Introduction

Different agricultural management practices and land-use change makes agriculture one of the largest contributors to GHG emissions (Foley, 2012), in which soil plays a key role (Lokupitiya and Paustian, 2006). Salinity intrusion in low-lying agricultural areas is a common problem in South Asia mainly due to sea level rise caused by anthropogenic activities. Although countries in the region have adopted various adaptation practices and strategies to minimise impacts from salinity intrusion, certain adaptation practices could negatively affect the climate system if they yield increased GHG emissions. Most of the studies on the South Asian agricultural systems have evaluated GHG emissions under different management strategies involving fertilisers and manures, irrigation and flooding and different tillage activities (Pathak et al., 2002; Bhatia et al., 2005; Pandey et al., 2012); however, those GHG emissions due to salinity management practices in the affected areas have not been well studied. The aim of the present scoping workshop is to develop a proposal for a research project that will select best management practices for salinity-affected agricultural areas in South Asia considering their net GHG emissions and other climate benefits; and anticipating future promotion of those practices among the farmers while providing recommendations for policy makers.

A two-day scoping workshop was held from 19–20 January 2015 in Mount Lavinia, Sri Lanka. It gathered local collaborators and regional collaborators from South Asia, USA and Japan, whose valuable contributions were used in improving and refining the proposal.

Work Undertaken

Preparation of the workshop has been progressing in accordance with the timeline. Communications were made to finalise the workshop agenda and distribute to collaborators. We also confirmed participation on the agreed date, as well as collected background data/information related to areas affected by salinity intrusion for the workshop.

Expected Outcome

Compilation of Information under National and Regional Contexts

The scoping workshop will serve as a platform for sharing experiences among countries in South Asia, including Sri Lanka, Bangladesh, India and Pakistan; specifically on the extent of the problem, adaptation measures in place, and measurement/quantification of GHGs in relation to salinity intrusion. The experience and expertise from the participants from Colorado State University, USA; and the APN project for GHG Budgets of South and Southeast Asia, will also be utilised.

Journal Articles/Proceedings

The findings of the workshop may be published via journal articles or workshop proceedings, based on funding availability.

HIGHLIGHTS

- The scoping workshop in January 2015 will provide a valuable opportunity for information sharing among the South Asian countries in relation to adaptation measures and extents under salinity intrusion.
- The workshop will strengthen the capacity and regional collaborative ties for further research in the study area.
- The workshop findings are expected to highlight how certain adaptation measures could negatively impact the Earth's climate system and greenhouse gas (GHG) mitigation efforts.

Full Proposal to APN

A full proposal will be submitted to APN in October, 2015 under its regional research programme.

Acknowledgements

The financial support for the scoping workshop was provided by the APN, while the Research Management Unit (RMU) of the University of Colombo has provided support to manage the project funds.

References

Bhatia, A., Pathak, H., Jain, N., Singh, P. K., & Singh, A. K. (2005). Global warming potential of manure amended soils under rice–wheat system in the Indo-Gangetic plains. *Atmosheric Environment 39*, 6976–6984.

Foley, J. A., Ramankutty, N., Brauman, K. A., Cassidy, E. S., Gerber, J. S., Johnston, M., ... Zaks, D. P. M. (2011). Solutions for a cultivated planet. *Nature*. doi:10.1038/nature10452

Lokupitiya, E., & Paustian, K. (2006). Agricultural soil greenhouse gas emissions: a review of national inventory methods. *Journal of Environmental Quality, 35*(4), 1413–1427. doi:10.2134/jeq2005.0157

Pandey, D., Agrawal, M., Bohra J. S. (2013). Impact of four tillage permutations in rice-wheat system on GHG performance of wheat cultivation through carbon footprinting. *Ecological Engineering, 60*, 261–270.

PROJECT INFORMATION

Title:	Scoping Workshop to Develop Proposal: Identification of Best Agricultural Management Practices with Better Greenhouse Gas Benefits in Salinity-affected Areas of South Asia
Duration:	Single-year project
Total Funding:	US$ 12,000
Project Leader:	Dr. Erandathie Lokupitiya
Full address:	Deparment of Zoology, University of Colombo, Sri Lanka
Tel:	+94112503399
Email:	erandi@sci.cmb.ac.lk
Website:	http://www.science.cmb.ac.lk/scoping-workshop/

CBA2014-01CMY-D'ARRIGO

Atmospheric Circulation Reconstructions over the Earth (ACRE) Southeast Asia: a Regional Arm of the International ACRE Initiative

Roseanne D'Arrigo and Fiona Wiiliamson[1]
[1]Corresponding Author
University of Malaysia, Malaysia
Email: corresponding.author@institu.tion

Project Summary

ACRE Southeast Asia is a regional arm of the international ACRE initiative managed by Prof. Rob Allan at the UK's Hadley Centre. Like the main ACRE project, ACRE Southeast Asia aims to recover historic instrumental and observational weather data in an area where there is a current data lack prior to the 1950s. ACRE Southeast aims to recover observational weather data through research undertaken by project team members and, by acting as an umbrella to bring together disparate projects with similar aims of identifying, recovering, and using historical data within the region and, by generating collaborative partnerships, projects, and data-sharing strategies to improve and manage the records of known (and as yet unknown) data.

ACRE Southeast Asia also seeks to build capacity within Southeast Asian institutions, universities, agencies and National Meteorological and Hydrological Services (NMHS) to improve and extend historical, instrumental, documentary and palaeo databases of Southeast Asian weather/climate. The ultimate goal is to make this data available for the generation of high-quality, high-resolution historical weather reconstructions (reanalyses). These baselines will allow scientists and policy makers across the region to address weather/climate extremes, impacts and risks in ways and over time spans not previously possible. Thus, ACRE Southeast Asia is a collaborative partnership whereby all contributors will benefit from shared expertise and knowledge, international linkages, and the potential to apply for collaborative funding applications to research, recover, preserve and use historic records relating to the climate.

Though ostensibly grounded in science, ACRE also seeks to unite historians, archivists, geographers, agriculturalists, policy researchers, and environmental researchers who can find mutually beneficial shared ground and each, with their own subject-specific knowledge, contribute meaningfully to the dialogue.

ACRE Southeast Asia was granted two years funding for certain activities from the APN under their CAPaBLE programme to carry us through into 2015. All other work is undertaken on a volunteer basis.

Project Publications

F. Williamson, R. Allan, R. D'Arrigo, J. C. L. Chan, R. Gartner, A. Switzer and R. J. Wasson, 'New Directions in Hydro-Climatic Histories: Observational Data Recovery, Proxy Records and the Atmospheric Circulation Reconstructions over the Earth (ACRE) initiative in Southeast Asia', *Geoscience Letters* (Forthcoming, 2015).

F. Williamson, 'Weathering the British Empire: Meteorological Research in the early nineteenth-century Straits Settlements', *British Journal for the History of Science* (Forthcoming, 2015).

HIGHLIGHTS

- Established links with regional National Meteorological and Hydrological Services (NMHS) and agreements to work together on data recovery efforts.
- Highlighted new regional sources of early twentieth century data at regional NMHSs.
- Held two-day workshop which united scientists, representatives of NMHSs, historians, projects and archivists working on historic data and data recovery in the region.
- Established an ACRE SEA steering committee to manage future direction and funding.
- Developed a multi/cross/interdisciplinary approach to help to verify, enhance and extend the functionality of historical 3D dynamical reanalyses/weather reconstructions by developing stronger links with social sciences, humanities and the arts, in order to create a unified baseline for a more complete resolution of climate and climatic variability.

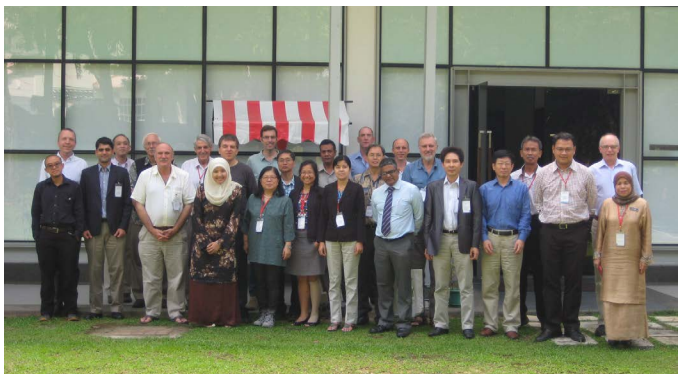


Figure 1. Participants of the workshop in Malaysia.

PROJECT INFORMATION

Title:	ACRE SE Asia – Towards New Weather and Climate Baselines for Assessing Weather And Climate Extremes, Impacts and Risks over SE Asia
Duration:	Year 2 of a two-year project
Total Funding:	US$ 36,000
Project Leader:	Prof. Rosanne D'Arrigo
Full address:	Lamont-Doherty Earth Observatory, Columbia University, Tree Ring Lab, 61 Route 9W - PO Box 1000, Palisades NY 10964-8000, USA
Tel:	+1 845 365 8617
Email:	rrd@ldeo.columbia.edu
Website:	http://www.met-acre.org/data-projects-and-regional-chapters/acre-se-asia

CBA2014-02NMY-SINGHRUCK

Strengthening the Adaptive Capacity of Local Agricultural Communities through the Development of Seasonal Climate Prediction System

Patama Singhruck[1], Atsamon Limsakul, Preesan Rakwatin and Anond Snidvongs

[1]Corresponding Author

Center of Excellence for Climate Change Knowledge Management (CCKM), Bangkok, Thailand

Email: patama@cckm.or.th

Introduction

Thailand depends on the agriculture sector, which is very sensitive to climate-related stressors. Recent evidence shows that the agricultural sector has already experienced various adverse impacts due to climate variability and change, and extreme weather events. This is resulting in tremendous loss and posing a great risk to socio-economic development and rural livelihoods. Local agricultural communities are one of the most vulnerable groups due to their heavy dependence on climate-sensitive sectors. Hence, the ability to anticipate climate fluctuations in advance and the capacity to incorporate adaptive management under the face of uncertainty is key to reducing climate risk and vulnerability of the most vulnerable farming communities.

The objective of this project is to build capacity on seasonal climate prediction that is tailored to meet the requirements of local agricultural communities in farm-level decision-making. To achieve the goal, a series of workshops will be organised including a scientific training workshop on seasonal forecasting and consultation dialogue workshops with end users. This is to ensure that the seasonal climate prediction system currently being developed has a sound scientific basis and, at the same time, is relevant to user needs. The participatory approaches will likely enhance the effectiveness of scientific knowledge transfer to non-science user communities and increase the uptake of climate information at local levels.

Work Undertaken

The inception workshop was held on 21 August 2014 at the Ubon Ratchathani University and involved 60 smallholder farmers from six communities in northeastern provinces. The main objective was to initiate a dialogue between climate information providers and user communities to co-design a seasonal climate prediction system. Farmers, who were placed in breakout groups according to their geographical settings, identified necessary content of climate information, dissemination strategies and the processes of information interpretation. Results from the dialogue show that farmers recognise potential benefits of using seasonal climate products in farm management. However, the main constraint preventing them from fully utilising the information was a lack of local context in the information as well as lack of access to the product. Hence, to make seasonal climate information more useful in decision-making and planning processes at the community level, the product must have detailed spatial resolution available in an accessible format (e.g. mobile phone SMS, radio broadcast, website, etc.), must be understandable to users, and provide sufficient lead time to be actionable. In addition to total seasonal rainfall, decision-making at the farm level also requires information on timing of rainfall and seasonal onset and length. The results from this consultation process will be incorporated into the seasonal climate prediction product.

In the next step, a training workshop on Seasonal Forecasting using the Climate Predictability Tool will be held. The training workshop will aim to enhance the capacity of climate information providers on scientific underpinning seasonal forecasting and the use of empirical methods as diagnostic and forecasting tools. The training will include forecast skill verification, which is very important in the development of the system. In the second phase of the project, systematic evaluation of the seasonal climate prediction will also be carried out.

HIGHLIGHTS

- The objective of this project is to build capacity on seasonal climate prediction tailored to support local agricultural communities in farm decision-making.
- The project adopts participatory approaches among climate information providers, end users and policy makers to ensure the relevancy and to minimise constraints to the successful application of the system.
- At the inception workshop held 21 August 2014, smallholder farmers were actively consulted on climate information needed, dissemination strategies and climate information interpretation processes.
- A training workshop on Seasonal Forecasting using the Climate Predictability Tool is planned from 12-16 January 2015 in Bangkok.

Acknowledgements

The authors sincerely acknowledge funding from the APN for this project. We gratefully acknowledge additional financial support from Thailand Research Fund for the training workshop. We thank Geo-Informatics and Space Technology Development Agency (Public Organisation) for in-kind support.

References

Goddard, L., Aitchellouche, Y., Baethgen, W., Dettinger, M., Graham, R., Hayman, P., Kadi, M., Martínez, R. and Meinke, H. (2010). Providing seasonal-to-interannual climate information for risk management and decision-making. *Procedia Environmental Sciences, 1*, 81-101.

Hansen, J. W., Mason, S. J., Sun, L. and Tall, A. (2011). Review of seasonal climate forecasting for agriculture in sub-Saharan Africa. *Experimental Agriculture, 47*, 205-240.

PROJECT INFORMATION

Title:	Strengthening the Adaptive Capacity of Local Agricultural Communities through the Development of Seasonal Climate Prediction System
Duration:	Year 1 of a two-year project
Total Funding:	US$ 75,000
Project Leader:	Dr. Patama Singhruck
Full address:	Center of Excellence for Climate Change Knowledge Management (CCKM), 5th Floor, Chulawich1 Building, Chulalongkorn University, Bangkok, 10330, Thailand
Tel:	+66 2218 9468
Email:	patama@cckm.or.th
Website:	http://www.cckm.or.th/CCKM/webpage/en.html

CBA2014-03NSY-CRUZ

Collaborative Monitoring System for Enhanced Watershed Management: The Case of the Baroro Watershed in La Union, Philippines

Rex Victor O. Cruz[1], Wilfredo M. Carandang, Vida Q. Carandang and Catherine C. de Luna
[1]Corresponding Author
University of the Philippines Los Baños, Philippines
Email: rexcruz@yahoo.com

Introduction

Watersheds in the Philippines are vital life support systems that provide invaluable services such as water supply for irrigation, biodiversity conservation, hydropower energy, and maintenance of river, lakes, wetlands and coastal ecosystems. To facilitate science-based watershed management in the Philippines, one needs to understand the physical, biological and socio-economic attributes of watersheds in relation to its vulnerabilities to climate change and other human and natural stressors and their impacts on watershed functions. This is ultimately expected to improve the responsiveness and effectiveness of watershed management decisions on climate change adaptation, disaster risk reduction, conservation of soil, water and biodiversity and other concerns. The Baroro Watershed is located approximately at 16.68°N and 120.45°E. The upstream is located in San Gabriel, La Union and drains to the Baroro River in Bacnotan, La Union.

The Present State of the Watershed

In order to understand the current conditions of the watershed, a forum and field reconnaissance of the watershed and the river systems were undertaken. During the visit, an assessment of the surface waters was conducted. On 18 September 2014, a Forum on the Management of Baroro Watershed was held at San Gabriel, La Union. All stakeholders within the watershed were represented during the forum including school teachers, community members, officials of the barangay, municipal and provincial Local Government Units, personnel of the Department of Environment and Natural Resources and the Water District of La Union.

The Forum was implemented to: identify key stakeholders of Baroro Watershed and their current and future roles; formulate a common vision for Baroro Watershed; identify problems, land-uses, programmes, best practices and opportunities in Baroro Watershed; and identify training needs of stakeholders for effective management of Baroro Watershed.

HIGHLIGHTS

- » Facilitating science-based watershed management with an understanding of the current state of the Baroro Watershed through the conduct of stakeholders' forum.
- » The watershed serves as sources of water, food, livelihood, power and recreation for the stakeholders in the four municipalities and a city in the Province of La Union.
- » In Bagulin, Santol and Bacnotan, the Baroro Watershed is envisioned to be the best watershed in the Philippines. While for San Gabriel, the vision is to have a protected watershed that is able to reduce disaster risk brought about by climate change. The Municipality of San Juan and the City of San Fernando envision the watershed as a source of sustainable, clean and safe water for all. Other stakeholders envision a community-led prototype/model for successful watershed management in the Philippines.

The participants were grouped according to municipality and geographical location within the watershed. The forum and training agenda focused on the following issues:

- Importance of the Baroro Watershed, which serves as sources of water, food, livelihood, power and recreation for the stakeholders.
- Formulation of a common vision for Baroro Watershed.
- Identification of problems, land use, programmes, best practices and opportunities in the Baroro Watershed.
- Training needs of stakeholders for the effective management of Baroro Watershed.

Like most watersheds in the Philippines, the Baroro Watershed faces problems like deforestation, extraction of wild plants and animals, water pollution, land-use changes, urbanisation, erosion, non-implementation of comprehensive land-use plans, policies and ordinances regarding the watershed, lack of public awareness and improper waste disposal.In terms of programmes that are currently being implemented in the watershed, tree planting was commonly identified by all the stakeholders.

The programmes proposed by the participants include continued greening of the watershed by tree planting, implementation of policies for the protection of the watershed, and creation of a watershed management council/committee that will oversee the development and management of the Baroro Watershed.

Perennial tree planting, rearing of fish or shrimp, and vegetable production were identified as potential livelihood opportunities. Other livelihood opportunities include ecotourism, biodiversity sanctuary and renewable energy source.

There is the need to create awareness on effective watershed management, waste management, pollution control from the household level, community organising, and health, safety and sanitation.

The team conducted two field reconnaisance visits to the headwaters of Baroro Watershed. The team members located the possible site for the installation of water monitoring instruments and the weather station. The water coming from the headwaters is clean and clear.

Capacity-Building Implementation

A training course entitled "Participatory Management of Baroro Watershed in La Union, Philippines" was implemented. A total of 25 participants from LGUs and communities attended.

PROJECT INFORMATION

Title:	Collaborative Monitoring System for Enhanced Watershed Management in the Philippines
Duration:	Single-year project
Total Funding:	US$ 44,950
Project Leader:	Dr. Rex Victor O. Cruz
Full address:	College of Forestry and Natural Resources, University of the Philippines Los Baños, College, Laguna, 4031 Philippines
Tel:	+63 49 536 5314
Email:	rexcruz@yahoo.com; rocruz@up.edu.ph

CBA2014-04NSY-DIVYA SHARMA

A Comprehensive Capacity Building Programme on Urban Climate Change Resilience in India

Divya Sharma[1], Rozita Singh
[1]Corresponding Author
The Energy and Resources Institute, New Delhi, India
Email: divyas@teri.res.in

Introduction

Lack of knowledge about climate impacts and measures to address them is one of the main reasons for not addressing climate change challenges in Indian cities. Moreover, the current vulnerability of urban areas like population pressure, inadequate infrastructure and services in India are so pronounced that decision makers are unable to prioritise climate change as one of their focus areas of action. Thus, awareness generation, capacity building and knowledge networks play a key role in building urban resilience across communities (Jabareen, 2011). Research studies in this direction point out that the communities who have access to timely hazard information are better able to respond to climate threats (Moser & Satterthwaite, 2010).

The practitioners and various stakeholders in the urban space not only need an understanding of climate science but also linkages to climate impacts on city systems, such that this information could be logically applied to decision-making processes and could be inbuilt into the development paradigm. If cities have to lead resilience building efforts, then it is essential to build the capacities of various stakeholders (Sharma et al., 2014). Recognising this, TERI's capacity building programme on "Urban Climate Change Resilience in India" aims to sensitise city stakeholders on the impacts of climate change on cities and the need for urban climate resilience planning. The training programme covers subject areas such as tools and techniques for climate proofing cities; role and functions of various institutions and public agencies in building urban climate resilience, policy and regulatory measures for mainstreaming urban climate change resilience, etc. Pedagogy will focus on video screenings, lectures, interactive sessions and group exercises.

Project Activities

Currently, the project team is preparing the training modules, which will be reviewed by an expert committee. As of now, the team has received consent from three states—Uttarakhand, Goa and Maharashtra. A three-day training programme will be organised in the capital cities of each of these states between January and March 2015. The team is now in the process of selecting the fourth state. The programme will target the following stakeholder groups:

- City Officials and practitioners. A two-day training programme for participants comprising Assistant Commissioners, City Engineers and officers from various line departments of the state; and State and city level government-owned agencies providing services to the cities.
- Elected representatives. A half-day training programme (on Day 3) for participants comprising Mayors/ Deputy Mayors and ward councillors of various cities in the state.

In addition to this, a two-day seminar on urban climate change resilience will be organised for students and early career researchers in the month of January 2015 (to be held in TERI University). The deliberations and feedback from the participants will help in identifying challenges and problems that the city officials face while addressing climate change issues. These will help in framing a policy brief which will be shared in a national conference in New Delhi in April or May 2015.

References

Jabareen, Y. (2013). Planning the resilient city: Concepts and strategies for coping with climate change and environmental risk. *Cities*, *31*, 220–229. doi:10.1016/j.cities.2012.05.004

Moser, C., & Satterthwaite, D. (2010). Towards pro-poor adaptation to climate change in the urban centres of low- and middle-income countries. In R. Mearns & A. Norton (Eds.), Social dimensions of climate change: Equity and vulnerability in a warming world (pp. 231–258). Washington, DC: World Bank.

Sharma, D., Singh, Raina and Singh, Rozita. (2014). Building urban climate resilience: learning from the ACCCRN experience in India. *International Journal of Urban Sustainable Development*, *6 (2)*, 133–153. doi: 10.1080/19463138.2014.937720

PROJECT INFORMATION

Title:	A Comprehensive Capacity Building Programme on Urban Climate Change Resilience in India
Duration:	Single-year project
Total Funding:	US$ 34,995
Project Leader:	Dr. Divya Sharma
Full address:	The Energy and Resources Institute (TERI), A-260, Defence Colony, New Delhi-110024, India
Tel:	+91 2433 9606; +91 4644 4500
Email:	divyas@teri.res.in
Website:	http://www.teriin.org

HIGHLIGHTS

» The project aims to sensitise city stakeholders in four states in India through training programmes on the impacts of climate change on cities and the need for urban climate resilience planning.
» A two-day seminar will be organised for students and early career researchers.
» A policy brief will be prepared drawing lessons from the training programmes.

CBA2014-05NSY(B&ES)-GOPAL

Capacity Building for Conservation of Biodiversity and Ecosystem Services of Wetlands in Relation to Global Change

Brij Gopal[1], A.P. Sharma and Subodh Sharma
[1]Corresponding Author
National Institute of Ecology, India
Email: brij44@gmail.com

Introduction

Human well being depends upon the benefits (ecosystem services) derived from various natural ecosystems. These benefits arise from the complex interactions among various components of the biophysical systems of which biodiversity plays a critical role. Our understanding of the complex linkages between biodiversity and ecosystem services is not yet satisfactory (APN, 2012) and the impacts of enhancing one service on other services are not yet realised (MEA, 2005).

Wetlands constitute an integral part of the hydrological cycle and provide a wide range of ecosystem services. Notwithstanding their rich biodiversity and ecosystem services, disproportionate to their areal extent, wetlands are the most threatened ecosystems as humans alter their hydrological regimes—main drivers of their characteristic functions—directly or indirectly. Changes in land use, atmospheric pollution and climate change impacts upon the wetlands are considered threats. An important factor causing their degradation and loss is that wetlands are still considered in most developing countries as wastelands and, hence, are not accounted for in policies and decision-making on development programmes.

Project Objectives

The project aims at using the ecosystem services approach to engage various stakeholders (such as early career policy makers, natural resource managers, members of civil society, NGOs and researchers) to build capacity on understanding ecosystem services and biodiversity of different kinds of wetlands; making rapid assessments based on simpler methods; and mainstreaming wetlands into land use and water resources-related policies and decision-making.

Activities Undertaken

An inception workshop at the end of July 2014 with the project partners and invited Indian experts discussed the modalities for various project activities. A common outline was agreed to the extent possible for preparing the guidelines (methods) for rapid assessment of biodiversity (major groups only) which would cover the identification of common taxa, their abundance, seasonality and ecological characteristics (e.g., relationship with hydrology and food habits of fauna). These guidelines are under preparation by the identified contributors. The guidelines for rapid assessment of ecosystem services will include their linking with biodiversity components and other physical habitat characteristics. The differences in provisioning and cultural services related to biodiversity between regions depending upon economic, socio-cultural and other factors will also be considered, and the biodiversity-ecosystem services linkages will be examined in consultation with local communities by following a participatory approach (cf. Peh et al., 2013).

Three field-based capacity building workshops will be organised in Kolkata, Guwahati and Kathmandu (Nepal) between February and March 2015, focusing on three different kinds of wetlands. The experience gained at these workshops will be utilised to revise and improve the guidelines and to formulate recommendations for policy makers and decision-making.

HIGHLIGHTS

- Inception workshop organised and guideline authors assigned.
- Capacity building workshops announced for February and March 2015.
- Database for Wetland Biodiversity and Ecosystem Services network designed and placed on the web.

A web-based network of individuals interested in wetlands, their biodiversity and ecosystem services both within South Asia has been developed (http://www.aquaticecosystems.org/network). It can be searched by geographic region, wetland type, ecosystem process, biodiversity components and/or ecosystem services.

Acknowledgements

We thank the APN for the financial support under their CAPaBLE programme, and Prof. P.C. Bhattarjee, Prof. Asad Rahmani, Dr K.K. Vass, Prof. K.S. Rao, Dr Suresh Rohilla and Dr Archana Chatterjee (IUCN-Delhi) for their valuable suggestions and academic support. We also thank Prof. V.P. Singh, Head, Botany Department, University of Delhi for extending facilities for holding the Inception Workshop.

References

APN. (2012). APN Biodiversity and Ecosystem Services Framework: Opportunity Paper - Appendix 2 APN Gap Analysis Report. Version: 2 (11 December 2012). Asia-Pacific Network for Global Change Research (APN). Kobe, Japan.

MEA (Millennium Ecosystem Assessment). (2005). Ecosystems and Human Well-Being: Synthesis. Island Press, Washington, D.C. 155 p.

Peh, K. S.-H., Balmford, A. P., Bradbury, R. B., Brown, C., Butchart, S. H. M., Hughes, F. M. R., Stattersfield, A. J., Thomas, D. H. L., Walpole, M. & Birch, J. C. (2013). Toolkit for Ecosystem Service Site-based Assessments (TESSA). Available at: http://www.birdlife.org/datazone/info/estoolkit

PROJECT INFORMATION

Title:	Capacity Building for Conservation of Biodiversity and Ecosystem Services of Wetlands in Relation to Global Change
Duration:	Single-year project
Total Funding:	US$ 40,000
Project Leader:	Prof. Brij Gopal
Full address:	National Institute of Ecology, 366 Metro Apartments, DDA Flats, Jahangirpuri, Delhi 110033, India
Tel:	+91 9414044283
Email:	brij44@gmail.com
Website:	http://www.aquaticecosystems.org/network/

CBA2014-06NSY-HIEN

Scientific Capacity Building in Climate Change Research Techniques for NGOs in Viet Nam

Than Thi Hien[1] and Ngo Cong Chinh
[1]Corresponding Author
Vice Director, Centre for Marinelife Conservation and Community Development – MCD Viet Nam
Email: tthien@mcdvietnam.orrg

Introduction

The project built scientific capacity of NGOs in Viet Nam in climate change (CC) research techniques via a short course, participants' project implementation, follow-up workshop and final dissemination seminar. The project's main objectives were to:

- Support national cooperation in CC research issues relevant to Viet Nam;
- Strengthen appropriate interactions among scientists and policy makers; and
- Improve the CC research capabilities of Viet Nam, including the transfer of knowledge.

Activities Undertaken

The project team selected 20 scientists and practitioners to attend a five-day training course in Climate Change Research Techniques from 7–11 October 2014. The training was delivered by scientific collaborators who used various methods to actively engage participants to ensure effectiveness.

CC Concepts and Research Skills

CC concepts were defined and included climate, weather, mitigation and adaptation. Lectures also updated policies on CC and sustainable development. Research skills, frameworks and research steps were introduced: selecting problems, building scientific theoretical points, then proving and presenting these points.

CC Modelling and Downscaling

Basic understanding of climate downscaling was introduced and participants learned how to use downscaling climate data for research and practical application. Climate projections are usually applied for specific climate change scenarios, using GCMs and RCMs and other detailed methods. However, as uncertain CC scenarios still remain, we should adopt the of use multi-models for more accurate results.

Climate Change Assessment Frameworks and Key Approaches

Concepts on CC adaption and assessment frameworks were introduced. It is important to build assessment frameworks and show how the results can be integrated into development plans for adaption. The lectures provided specific assessment processes and plans, and adapting frameworks according to local conditions.

Hypothesis Testing and Quantitative Data Collection and Analysis

The regression method considers many manifestations of CC, collecting data and analysing how those manifestations affect economy and society. Essential concepts were discussed along with calculation methods in order for participants to fully understand data collection and analysis. Finally, regression models were explained in detail. To aid illustration of assessment and results, an example of CC effects to rice productivity in Can Tho was provided.

Qualitative Data Collection Analysis

Participatory Rural Appraisal (PRA) method and various tools were discussed focussing on local knowledge, enabling participants to perform appraisals, analyse and plan. There were four steps: preparation, local information collection, information analysis, planning with disaster reduction and CC adaptation. Finally, an adaptation planning tool for mainstreaming CC into local social and economic development was discussed and shared by the trainees.

Writing for Scientific and Technical Publications

During the programme, selected participants presented case studies using key concepts and tools for CC assessment. Trainees were equipped with publication and article writing skills and learned the research process to producing publications with high scientific requirements.

Upcoming Activity

Five case studies by five organisations, namely MCD, AMDI, CARE, SRD, and DRAGON Institute (Can Tho University) will be conducted and completed by April 2015.

Acknowledgements

The project team sincerely thanks the APN for providing funding for the present project.

HIGHLIGHTS

» Twenty participants from 20 NGOs in Viet Nam received a five-day training programme on climate change scientific research techniques.
» Collaboration and network of NGOs and scientists in Viet Nam on climate change issues have been strengthened for exchange of knowledge.
» Applied scientific skills and knowledge helped NGOs participants particularly to conduct 5 selected case studies in Viet Nam; and improve NGOs' capacity and involvement in policy advocacy in response to the climate change impacts in Viet Nam.

PROJECT INFORMATION

Title:	Climate Change Scientific Research Techniques for Vietnamese Non-governmental Organisations (VNGOs) in Viet Nam
Duration:	Single-year project
Total Funding:	US$ 35,000
Project Leader:	Ms. Than Thi Hien
Full address:	Centre for Marinelife Conservation and Community Development (MCD), Suite 3104, Level 31, Building 34T, Hoang Dao Thuy Street, CauGiay District, Hanoi, Viet Nam
Tel:	+84 4 2221 2923
Email:	tthien@mcdvietnam.org
Website:	www.mcdvietnam.org

CBA2014-07NSY(B&ES)-JIA

Training Workshop and Science-Policy Dialogue on Ecosystem-Climate Interactions

Gensuo Jia[1], Hassan Virji, Howard Epstein, Rodel Lasco, Shaukat Ali
[1]Corresponding Author
START Regional Center for East Asia, Chinese Academy of Sciences, China
Email: jiong@tea.ac.cn

Introduction

Climate and ecosystem changes are highly heterogeneous over the globe, with strong regionality. Under combined pressure of climatic change and intense human use of natural resources, the natural environment in Asia has steadily degraded and ecosystem services are being affected. In the last several decades, Asia has experienced rapid changes in land use and land cover and, therefore, ecosystem structure and function, due to rapid economic development, increased population, industrialisation and urbanisation.

Activities and Outcomes

The 2014 APN-START International Training on Ecosystem-Climate Interactions was held from 8–20 September 2014 at the Institute of Atmospheric Physics (IAP), Chinese Academy of Sciences (CAS), Beijing. It aimed to provide young researchers and practitioners from Asia with advanced knowledge and skills and to enhance the environmental capacity building for regional sustainable development. Training was delivered to 16 international young scholars from 14 Asia countries, including Bangladesh, Cambodia, India, Indonesia, Iran, Republic of Korea, Lao PDR, Malaysia, Nepal, Pakistan, Philippines, Russia, Tajikistan and Thailand, along with 10 domestic participants from CAS institutes and several universities. Experts from China, Australia, and USA gave lectures that addressed various issues related to interactive changes of ecosystems and climate.

The training programme addressed various scientific aspects of interactions between ecosystems and climate, and focused on coupled climate-ecosystem processes that are critical in the region. Key issues included:

- impacts of climate trends and extremes on natural and managed ecosystems, and their links to food security, water balance, and biodiversity;
- human-driven land-use and land cover changes and their effects on ecosystem services and regional climate; and
- science-policy interfaces that address ecosystem-society adaptation and mitigation of climate change.

HIGHLIGHTS

» The 12-day training programme and science-policy dialogue aimed to provide young researchers and practitioners from Asia with advanced knowledge and skills in interactive changes of ecosystems and climate.

» The training was delivered to 16 international young scholars from 14 Asian countries and 10 domestic participants from CAS institutes and several universities, with diverse background on science and policy dimensions.

» The training addressed various scientific aspects of interactions between the ever-changing ecosystem and climate, and focused on coupled climate-ecosystem processes and policy options that are critical in the region.

The programme was also designed to encourage active discussions between participants and instructors to ensure the prime issues that some of the participants face can be fully addressed in the training. Therefore, dialogue and report writing are also integrated components of the training. In the session of science-policy dialogue, each participant gave 15-minute presentations, which were followed by a very active discussion. They were also guided to write a report in their respective fields and focus on science-policy interface.

The science-policy dialogue brought science-oriented participants, policy-oriented participants, and invited experts and officers together to share knowledge and ideas on issues related to climate change adaptation and ecosystem management in the region and sub-regions. Researchers and policy makers were paired in break-up groups on each identified key issue in sub-regions of Temperate East Asia (TEA), Southeast Asia (SEA), South Asia (SA), and Central and West Asia (CA-WA). Through the dialogue, participants recognised that many climate and environmental issues in the region are closely inter-connected. One of the regional issues highlighted in the dialogue was spatial connection among black carbon pollutant, alpine glacier retreat, and climate and hydrological impacts on agriculture.

Through the training and dialogue, the APN-funded young trainees got the opportunity to update their knowledge and skills regarding the principal issues involved in developing strategies for climate change adaptation and ecosystem management. This also enabled them to establish contacts that will assist considerably in their daily work in their country of origin.

At her speech on behalf of all participants, Ms. Nok Inthavong from Lao PDR was very excited about her new knowledge and skills on the critical regional ecosystem-climate issues and policy implications gained from this training. Participants decided to continue their dialogue via web-based platform facilitated by START TEA.

Acknowledgements

The authors acknowledge the financial support from APN as the main sponsor and contribution from CAS Institute of Atmospheric Physics as the host and co-sponsor of the training programme. The authors also thank all training experts, namely Hsiao-ming Hsu, Shuli Niu, Howard Epstein, Gensuo Jia, Jason Evans, Xing Yuan, Li Dan, and Hanqin Tian for providing lectures and sharing knowledge with the participants. Further acknowledgement is extended to all training participants and invited guests for their important inputs at the science-policy dialogue. Meanwhile, the great efforts from Anzhi Zhang and other organisers are critical for the success of the events.

PROJECT INFORMATION

Title:	International Training on Regional Ecosystem-Climate Interactions
Duration:	Single-year project
Total Funding:	US$ 45,000
Project Leader:	Dr. Gensuo Jia
Full address:	START Regional Center for East Asia, Institute of Atmospheric Physics, Chinese Academy of Sciences, 40 Huayanli, Beijing 100029, China
Tel:	+8610 82995314
Email:	jiong@tea.ac.cn
Website:	http://green.tea.ac.cn

CBA2014-08NSY-KOSHY

WCRP-ICTP Summer School on Climate Change

Kanayathu Koshy[1] and Roberta Boscolo
[1]Corresponding Author
Professor of Sustainability, Centre for Global Sustainability Studies, Universiti Sains Malaysia, Malaysia
Email: kanayathu.koshy@gmail.com

Introduction

The Summer School was organised by the Abdus Salam International Centre for Theoretical Physics (ICTP), in collaboration with the World Climate Research Programme (WCRP), from 21 July to 01 August 2014 in Trieste, Italy. The Centre for Global Sustainability Studies (CGSS), Universiti Sains Malaysia facilitated the participation of the Asia-Pacific participants.

The school focused on three topic areas: (i) statistical theory underpinning extreme values analysis; (ii) detection and attribution of observed changes in the frequency and/or intensity of extremes; and (iii) event attribution, and the physical mechanisms that are involved in amplifying and/or extending the duration of some specific extreme events such as flooding. The organisers were convinced that there is a pressing need to educate future researchers in these techniques given the prominence and importance of societal and scientific questions about extreme events that are receiving increasing attention in the minds of the public and policy makers. For the two week duration of the school, lectures took place in the mornings, with occasional lectures in the evenings. The afternoons and remaining evenings were devoted to the practical application of the material covered in the lectures. For the 35 international students (of which 10 were from Asia-Pacific countries sponsored by APN), the school provided an exclusive opportunity, involving a variety of learning modalities such as self-study, group activities, oral and written presentations, etc., to be educated in the development of key data resources that are used to place current extremes into a historical context, thus providing insights into some near term prediction of the likelihood of flooding, drought, heat wave, etc.

Activities Undertaken

The school took place during the second half of July 2014, however, the research problems that the students addressed during the school under the guidance of the school steering committee, were further pursued remotely after the school. Each group nominated a leading author and the results of the research works will be published in a special issue of Weather and Climate Extremes (Elsevier).

Prof. K. Koshy, the Project Leader, was a member of the international Steering Committee, which in consultation with Roberta Boscolo (WCRP) and Anna Pirani (ICTP) selected the Asia-Pacific participants using a selection matrix that involved academic qualification, current position, research relevance to school, and an abstract. Prof. Koshy attended the summer school for three days and gave a presentation on "disaster risk management for sustainable development" on the last day, highlighting climatic extremes as a major development challenge, which according to the co-chairs was a fitting conclusion to the school. The overall feedback from the students is that the school was a very valuable capacity enhancement initiative, both for their professional work and future research.

Acknowledgements

Catherine Michaut (IPSL/France) for helping with the webpage, Petra Krizmancic (ITCP/Italy) for the secretarial support, Anna Pirani and Adrian Tompkins (ITCP/Italy) for the organisation. At USM, the Vice Chancellor, Prof. Dato' Omar Osman for institutional support, Director, Prof. Kamarulazizi Ibrahim of CGSS/USM for professional guidance, and the finance divisions of both CGSS and USM for handling monetary matters.

Figure 1. The Summer School participants.

PROJECT INFORMATION

Title:	WCRP-ICTP Summer School on Climate Change
Duration:	Single-year project
Total Funding:	US$ 29,378
Project Leader:	Prof. Kanayathu Chacko Koshy
Full address:	Centre for Global Sustainability Studies, Universiti Sains Malaysia, 11800 USM, Penang, Malaysia
Tel:	+6017 4868 330
Email:	kanayathu.koshy@gmail.com
Website:	http://www.wcrp-climate.org/index.php/ictp2014-about

HIGHLIGHTS

- A two-week summer school with the goal of mentoring international PhD students, postdoctoral researchers, and early-career scientists on the use of new computational tools to study climate extremes, and providing state-of-the-art research experience in understanding, predicting, and attributing extreme weather events.
- About 35 young scientists, selected from more than 200 applicants around the world, were able to address relevant research questions such as (Figure 1).
- The work programme was an excellent blend of theory and hands-on research where students worked in groups using open source data and software tools on research problems that were carefully prepared in such a way that they could lead to interesting results worth publishing in peer reviewed journals.
- With WCRP's reputation in climate science and ICTP's experience in providing international training, the partnership proved to be very successful in attracting sponsors for supporting the participants. Thanks to APN, about 10 students from the Asia-Pacific region participated in the climate change training, networking and capacity building initiative.

CBA2014-09NSY-MATHAI

Training Workshop and Edited Volume on "Green Growth: Political Ideology, Political Economy and Policy Alternatives"

Manu V. Mathai[1], Jose A. Puppim de Oliveira and Gareth Dale
[1]Corresponding Author
Azim Premji University, India
Email: manu.mathai@apu.edu.in

Project Summary

This project aims to help create and disseminate scientific knowledge on "Green Growth," an important strategy in contemporary global change and sustainable development policy and practice. The two outputs of the project are a training workshop and symposium for young researchers and an edited volume from a leading international academic publisher. The International Symposium on Green Growth and Global Environmental Change was successfully convened by the United Nations University Institute for the Advanced Study of Sustainability on 25th and 26th July, 2014 at UNU, Tokyo. A total of 30 papers discussing empirical evidence testing the claims of Green Growth, debating its ideological underpinnings and their implications as a response to modernity's environmental crisis and exploring alternatives – if not Green Growth then what else – were presented. Of these 19 were presented by young researchers. The symposium created a valuable space for critical scrutiny of the Green Growth project. The edited volume is on course for publication in 2015. The objective of Green Growth through the Green Economy is a rapidly advancing but inadequately studied policy agenda. This project fills a crucial gap in the training of young researchers and practitioners and the literature on the subject.

The symposium was in broad agreement that efficiency strategies while critical are inadequate for mitigating the unprecedented scale of resource and energy throughput at the root of the environmental crisis. This argument was built using case studies from Republic of Korea, the European Union, Brazil and India as well as a global survey of climate change mitigation measures.

The second line of discussion unpacked the ideological basis and political economy of Green Growth and asked if it could rescue capitalism from its contradictions. The cases discussed carbon markets in Australia, NGO activism in China, democratic deficit in the Philippines, counter-hegemonic movements in Thailand, the urban waterscape in Jakarta, rural development in India, the nature of the green wave in North Korea, the juxtaposition of scarcity and creativity in the built environment, the scope of international environmental law and the trade-offs in the Green Economy, among others.

Finally, the symposium discussed strategies for moving environmental governance beyond the technical and managerial approach, epitomised by the Green Growth discourse. It emphasised the importance of environmental governance also being a political project of empowering human-centred initiative and social movements where the normative is reclaimed as a sight of political contest and creativity through deeper reliance on commons' democratic resources to deliberate norms and negotiate a more equitable future on a shared and finite planet.

The symposium brought together scholars and policy practitioners from around the world and young researchers and policy practitioners from the Asia-Pacific region. This was designed to produce long-term gains by enhancing scientific and policy capacity regarding Green Growth and its link to global environmental change. The project has delivered an international symposium, and an edited volume is on course for release in 2015. Opportunities to build the network developed so far and further engage this important policy question in global environmental governance are being explored.

HIGHLIGHTS

- The central idea of Green Growth is that technological innovation supplemented by market allocation of resources and some state regulation can assuage the ecological and social impacts of open-ended economic growth.
- Such strategies whilst important and necessary are insufficient to mitigate the impacts of energy and material throughput – the "social metabolism" – arising from open-ended economic expansion.
- The dominance of the green growth discourse in environmental governance must be diluted by the politics of empowerment and participation.

Figure 1. Participants of the workshop.

Project Publications

The development of a co-edited volume tentatively titled Green Growth: Political Ideology and Political Economy is on schedule for publication in 2015, on contract with Zed Books.

Acknowledgements

We thank the APN and the United Nations University Institute for the Advanced Studies of Sustainability.

PROJECT INFORMATION

Title:	Training Workshop and Edited Volume on "Green Growth: Political Ideology, Political Economy and Policy Alternatives"
Duration:	Single-year project
Total Funding:	US$ 40,000
Project Leader:	Dr. Manu V. Mathai
Full address:	Pixel Park, A-Block, 10th Floor, PES Institute of Technology Campus, Hosur Road, Beside NICE Road, Bengaluru (Bangalore) – 560100, India
Tel:	+91 9986693410
Email:	manu.mathai@apu.edu.in

CBA2014-10NSY-CARANDANG

Capacity Development of Local Climate Change Communicators in Selected Communities in Southeast Asia

Wilfredo M. Carandang and Leila D. Landicho[1]
[1]Corresponding Author
Institute of Agroforestry, University of the Philippines Los Baños, College, Laguna, Philippines
Email: seanafe@yahoo.com

Project Background

This project is a collaborative undertaking among the member-institutions of the Southeast Asian Network for Agroforestry Education (SEANAFE). These include the Philippine Agroforestry Education and Research Network (PAFERN), Indonesia Network for Agroforestry Education (INAFE), Viet Nam Network for Agroforestry Education (VNAFE), and the Lao PDR Network for Agroforestry Education (LaoNAFE). This project will develop the capacity of at least 15 farmer-leaders as climate change communicators in selected upland communities in the four collaborating countries. Thus, training activities will be provided to local technicians and selected farmer-trainers around the science of climate change, its issues and impacts on agricultural production, health and the environment and appropriate climate change adaptation practices and strategies. The project team will also produce easy-to-learn and farmer-friendly information materials about climate change and organise a localised climate change awareness programme in the most strategic upland community in each collaborating country, with local climate change communicators as the lead persons. Finally, the project team will develop a policy brief addressed to the local policy-making bodies at the village level that will pave the way for scaling-up capacity building approaches in upland communities in the four collaborating countries.

Initial Project Accomplishments

Project Team Meeting-Workshop

The project team convened a two-day meeting in Indonesia to level-off the project objectives, methodology, activities, deliverables and administrative concerns. The project team formulated the selection criteria to be used by farmer-trainers and agricultural technicians for the National Training on Local Climate Change Communicators in their respective countries. This set of criteria serves as a guide to ensure that the project goals and objectives will be met.

» *Main criteria*

- Awareness about climate change
- Willingness to be trained and share gained knowledge to others
- Ability to speak in front of many people/Trainer/Farmer-trainer; Farmers with proven ability to communicate as a trainer
- Gender consideration – at least 30% should be female (in Indonesia) for APN-funded participants
- At most, 40% technicians and 60% farmers as participants
- Technicians are to be regular government employees/staff (field extension agents)
- Preferably technicians and farmers should be from the same place or area of work
- Commitment to share/echo the learning during the national training to subsequent local training activities
- Farmer as a recognised leader in their areas—with proven leadership skills or leadership potentials
- Good balance of age and gender among the participants
- For technicians – climate change related experience, or representing institutions/agencies who have climate change adaptation mandates

HIGHLIGHTS

» Project team gathered to discuss and finalise the project objectives, activities, methodologies, deliverables and administrative concerns.
» Agreed on the selection criteria for participants of the National Training of Local Climate Change Communicators and the Local Climate Change Awareness Programmes.
» Designed the National Training of Local Climate Change Communicators, which can be modified depending on conditions in the four collaborating countries.

National Training of Local Climate Change Communicators

The project team designed a two-day training workshop with the aim of: a) discussing issues on climate change, its indications/evidence and impacts; b) creating awareness on different climate change adaptation strategies; c) developing farmer-friendly climate change information materials; and d) developing the communication skills of the participants (presentation and facilitation) that will be tapped during the local climate change awareness programme.

Current Status vis-à-vis Target Activities

The National Training of Local Climate Change Communicators will be implemented between November 2014 and January 2015. The project collaborators are now at the coordination and participant selection stage; determining potential sites for field visits; and preparing training materials.

Acknowledgements

The project team acknowledges the institutions that they represent, namely: Tay Nguyen University (Viet Nam), Lampung University (Indonesia), National University of Laos (NuOL) and the University of the Philippines Los Baños (UPLB) for engaging their faculty members as project collaborators without additional remuneration. The technical and administrative backstopping of the SEANAFE and PAFERN Secretariat are likewise appreciated for their in-kind contributions.

PROJECT INFORMATION

Title:	Capacity Development of Local Climate Change Communicators in Selected Upland Communities in Southeast Asia
Duration:	Single-year project
Total Funding:	US$ 45,000
Project Leader:	Dr. Wilfredo M. Carandang
Full address:	2/F Tamesis Hall, College of Forestry and Natural Resources, University of the Philippines Los Baños, College, Laguna, Philippines
Tel:	+63 49 536 3809
Email:	seanafe@yahoo.com; wmcarandang@gmail.com
Website:	www.seanafe.org

CBA2014-11NSY(B&ES)-ZHANG

IMBER ClimEco4 Summer School – Delineating the Issues of Climate Change and Impacts on Marine Ecosystems: Bridging the Gap between Research, Assessment, Policy and Management

Lisa Maddison[1], Ingrid van Putten and Fang Zuo

[1]Corresponding Author

IMBER International Project Office, Institute of Marine Research, Bergen, Norway

Email: Lisa.Maddison@imr.no

Project Summary

Summer schools are an important capacity building activity for the Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) project. They provide training for students and early career researchers in techniques and methods in leading edge IMBER research. Young researchers are trained to work in interdisciplinary teams and address global issues in coastal and marine socio-ecological systems. The most recent in the ClimEco (Climate and Ecosystems) Summer School series, ClimEco4, focused on defining and constructing biophysical, social and economic indicators for evaluating marine ecosystems, and the use of indicators to inform policy and decision-making.

Live-streamed lectures were followed by group exercises in which various modelling and statistical techniques were applied to real-world socio-ecological datasets. Group projects brought together theoretical and practical learning and application. Students also had the opportunity to showcase their own research during a poster session.

In the first set of lectures, students were familiarised with relevant terminology and concepts. Subsequently, climate change issues and impacts on marine ecosystems from biophysical, socio-economic and governance perspectives were discussed. This was followed by a general overview of what indicators are, and how and where they are used. Next, the use of indicators to examine climate change and marine biogeochemistry at different time scales was outlined.

The next lectures focused on acquiring, accessing, and analysing data including quality control and nonlinearity exploration, such as detecting 'tipping points' and developing decision criteria. Statistical techniques, data sharing, and how to publish and reuse scientific data were also discussed. Case studies were used to illustrate how coastal communities and socio-economic indicators can be linked to marine ecosystems and socio-ecological models. The importance of assessing the performance of indicators, their precision and statistical power was also presented.

The Summer School lectures concluded by outlining the use of economic and social indicators for policy and decision-making and, in particular, fisheries management. The strength of knowing how to communicate the salient information the indicators provide to a range of different audiences, was addressed.

The week ended with presentations of the group projects. Using techniques and methods covered in the lectures, participants were tasked with analysing a real-world dataset comprising a socio-ecological system. Several participants brought their own datasets which were augmented with other data sourced from the internet to enable the group to undertake a socio-ecological analysis and report on the state of the system and the management tradeoffs. Project results, including potential entry points for system management, were presented to a panel of 'managers', who provided feedback.

By all accounts, the Summer School was informative and beneficial, as evident from some of the participant's comments: "I enjoyed the diversity of the group". "…an opportunity to learn knowledge from scientists in another research field". "… very useful and it helped me think from other perspectives". "The group work and presentations were amazing". "Great career advice". "Very well organised, very welcoming, great atmosphere". "Definitely the best Summer School I participated in".

HIGHLIGHTS

- ClimEco4 continued the IMBER focus on building capacity and fostering research at the interface of natural and human systems, by bringing together 50 participants and 10 leading researchers from a range of marine science and socio-economic disciplines.
- Live-streaming enabled many who were unable to attend to benefit from the lectures.
- Many different tools and techniques were presented on how to source, analyse and transform data into usable products, tools or advice.
- A poster session enabled participants to present their research and receive useful critique from the lecturers and their peers.
- Group work involved analysis of a real-world dataset comprising a social-ecological system in order to report on the state of the system and make management recommendations.

Acknowledgements

IMBER would like to take this opportunity to thank the APN for its very generous contribution to the IMBER ClimEco4 Summer School. This sponsorship was used, inter alia, to enable 10 participants and six lecturers from the Asia-Pacific region to attend.

We would also like to acknowledge the other ClimEco4 sponsors for their support. They are: the Climate Variability and Predictability (CLIVAR) project, the Ocean Carbon Biogeochemistry (OCB) programme, the Past Global Changes (PAGES) project, the Scientific Committee on Oceanic Research (SCOR), the Institute of Marine Research (IMR) in Norway, the Korean Institute of Ocean Science and Technology (KIOST), the North Pacific Marine Science Organization (PICES) and The World Academy of Sciences (TWAS), as well as our hosts in Shanghai; the State Key Laboratory for Estuarine and Coastal Research (SKLEC) and the East China Normal University (ECNU).

PROJECT INFORMATION

Title:	IMBER ClimEco4 Summer School - Delineating the Issues of Climate Change and Impacts to Marine Ecosystems; Bridging the Gap between Research, Assessment, Policy and Management
Duration:	Single-year project
Total Funding:	US$ 35,000
Project Leader:	Prof. Jing Zhang
Full address:	State Key Laboratory of Estuarine and Coastal Research, East China Normal University, 3663 Zhongshan Road North, Shanghai, 200062, China
Tel:	+86 21 62233009
Email:	jzhang@sklec.ecnu.edu.cn

CBA2014-12NSY-BORA

Capacity Building for Mitigation of Climate Change Using Precision Agriculture

Ganesh Bora[1], Manzul Hazarika, Deben Baruah, Md. Monjurul Alam, Le Thi Chau Ha
[1]Corresponding Author
Agricultural and Biosystems Engineering, North Dakota State University, Fargo, ND, USA
Email: ganesh.bora@ndsu.edu

Introduction

Climate change adds several conflicting pressures to agricultural production and will cause crop failure and reduced agricultural productivity. Agriculture, as an energy intensive industry, would face several impacts. Clearly, input costs would rise with higher energy prices. Climate change will affect agriculture directly through higher temperatures, greater crop water demand, more variable rainfall, and extreme climate events such as flood and drought. It will increase yields in some countries but lower them in most of the developing world, reducing global average yields.

Precision Agriculture (PA) is a management concept to recognise the variability of crop production potential of a field and apply chemicals, fertiliser and water at variable rates. It optimises the inputs through variable rate application with same or increased crop yield. This not only decreases the input cost but also reduces GHG emissions and in many cases sequester carbon. Precision farming practices also use auto-guidance systems in tractors and harvesters to reduce overlapping of machinery operation thus saving time and fossil fuel use, which directly contributes to mitigation of climate change.

Developed countries like USA, UK, Australia and Japan have adopted PA. But it is still not implemented due to unavailability of technology, unaffordability of most farmers and lack of knowledge about PA.

Objective of the Project

The objective of this project is to enhance the capacity of developing countries of Bangladesh, India Thailand and Viet Nam to adopt PA for mitigation of climate change. The project will focus on the transfer of technological knowledge from practising country like USA and customised to local conditions in these countries. This will not only enhance regional and international co-operation for global change but also develop a network of scientists, policy makers and progressive farmers of these countries.

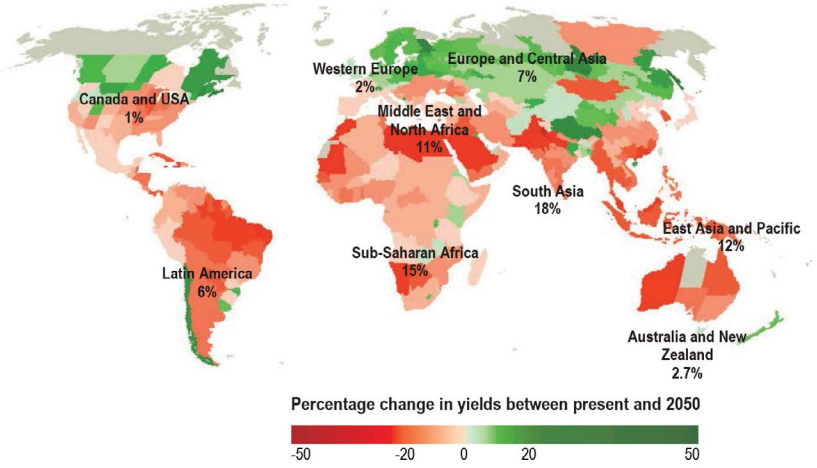


Figure 1. Map showing reduction of crop yields in most countries in 2050 due to climate change, with current agricultural practices and crop varieties (Source: Müller et al., 2009).

HIGHLIGHTS

- Production agriculture substantially contributes to climate change.
- Precision agriculture optimises crop inputs for the right amount at the right time and in the right place.
- Precision agriculture not only reduces production cost but also has positive environmental impact by reducing GHG emissions, water contamination and soil compaction.
- Precision agriculture is widely used in developed countries and should be encouraged in developing countries and locally modified for affordable technology.

Progress

The participants for the workshops in all four countries have been identified. Each participating university in Bangladesh, India, Thailand and Viet Nam has established a local organising committee. The participants are selected from academia, scientists, policy makers, agricultural officials, progressive farmers with an emphasis on the participation of women.

Participants are requested to bring the following information to the workshop:

- Present status of precision agriculture or advanced measures taken to increase the productivity and maintain good environmental impact;
- The information, including tables and graphs, should be in an electronic file and present in the workshop; and
- How they can influence the local sustainable farming practice and have positive impact on climate change.

The workshops in all the countries will be held in March 2015.

Acknowledgements

The project team sincerely thank the APN for providing the grant for this important work.

PROJECT INFORMATION

Title:	Capacity Building for Mitigation of Climate Change Using Precision Agriculture
Duration:	Single-year project
Total Funding:	US$ 35,000
Project Leader:	Dr. Ganesh C. Bora
Full address:	1221 Albrecht Blvd, Fargo, North Dakota 58102, USA
Tel:	+1 701 231 7271
Email:	ganesh.bora@ndsu.edu
Website:	http://www.ndsu.edu/aben/personnel/bora/

CBA2014-13NSY(AOF)-PARR

Collaborative Learning to Inform Action on Risk Reduction: The Pan-Asia Risk Reduction (PARR) Fellowship Programme

Katie Dietrich[1] and Hassan Virji
[1]Corresponding Author
START, USA
Email: kdietrich@start.org

Introduction

Asia is vulnerable to rapid and unprecedented global environmental change (GEC), coupled with large and rapidly growing population, significant demographic shifts toward urbanisation, increasing nutritional insecurity in rural areas and unprecedented developmental and industrial metabolism. Proactive approaches are needed that enable integrated and strategic understanding and management of the increasing complexities arising from these challenges. The expected degree of success in undertaking such approaches demands having a well-informed citizenry, responsive institutions, and knowledge generation that is problem-driven and solution-oriented. A priority component of such a strategy must be the creation of mechanisms to link researchers and practitioners with key decision makers in processes of co-learning.

The Pan-Asia Risk Reduction (PARR) Fellowship Programme offers unique research, training and educational opportunities to Asian researchers, practitioners, and policy makers to enhance their capabilities for advancing and applying knowledge on critical issues of GEC and risk in the Asia-Pacific. The 2014-2015 PARR Fellowship Programme provided Fellowships for scientific capacity development on the topic of urban disaster risk and vulnerability under global environmental change.

Project Activities

The PARR Fellowship Programme creates a collaborative network of Fellows and institutions through a series of integrative activities and a residence period at a Host Institution. This inaugural round of PARR supported 13 Fellows, comprising both Science and Policy-Practice Fellows.

Inception and Culmination Meetings

In July 2014, Fellows and representatives from their Host Institutions and institution in their home country (Home Institution) gathered for a two-day inception meeting for the 2014-2015 programme (Figure 1). Fellows and institutional representatives were able to meet each other, share expectations for the Fellowship, and begin to form a network of researchers and practitioners across Asia. These interactions will continue in March 2015 during the PARR Culmination Meeting where Fellows and institution representatives share their experiences from their Fellowship and identify follow-on activities for their own research and the formed network.

Fellowship Residence

Beginning in October 2014, the 13 Fellows visited for up-to one-month in residence at Host Institution for targeted training and partnership building. Fellows were expected to use the residence to begin original research, participate in trainings, give presentations at the Host Institution, and complete a deliverable, such as an academic paper or project proposal. Several of the Fellows travelled as two-person teams with a Science and Policy-Practice Fellow, which enabled collaborative and interdisciplinary research.

As an example of the Fellowship residence, two teams of Fellows, from Thailand and the Philippines, were in residence at the National Science & Technology Center for Disaster Reduction (NCDR), in Taiwan, where they participated in a training on post-disaster recovery hosted by NCDR, presented at the International Centre of Excellence for Integrated Research on Disaster Risk (IRDR) at Academia Sinica, and explored original research that addressed disaster vulnerability with integrated physical and social sciences.

Follow-on Grants

Based on a competitive call for proposals, four PARR Fellows will further develop the training, collaboration, and ideas from their residence for a three-month follow-on grant.

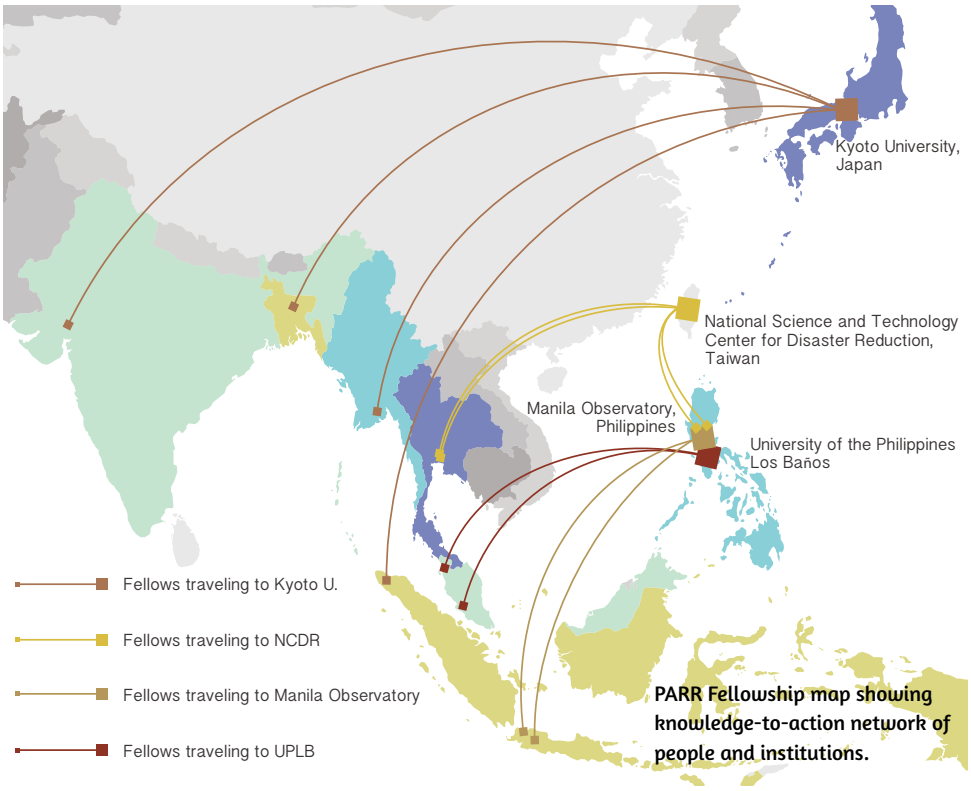
Figure 1. Photographs during the 2014-2015 PARR Programme's Inception Meeting held in the Philippines.

HIGHLIGHTS

- Thirteen Fellowships awarded from seven countries throughout Asia.
- Fellowship residencies at Host Institutions in the Philippines (2), Japan, and Taiwan.
- Successful Inception Meeting to introduce Fellows, meet Host institutions, and begin to build a collaborative network.
- Competitive call for proposals for Fellows to pursue follow-on project grants for exploratory research, trainings or workshops, or proposal and publication development.

"The Fellowship has provided the Fellows with an extensive opportunity to examine risk reduction concerns and issues from multiple perspectives… On top of these, both NCDR (Taiwan) and Academia Sinica (Taiwan) have set the bar higher and farther—so much so that they inspire action and passion… What sets this opportunity apart is having the privilege of time to study, witness the practice, engage in discussions in the spirit of solidarity and genuine intent to complement each others' work from a range of perspectives. This is Fellowship."

– Jessica Dator-Bercilla, Manila Observatory, Fellowship at NCDR (Taiwan)



PARR Fellowship map showing knowledge-to-action network of people and institutions.

Acknowledgements

We would like to acknowledge the PARR Alliance, a collection of science-focused, research, education and capacity building organisations that share a common goal for advancing resilience and sustainability in the Asia-Pacific region. In addition, we appreciate the financial and administrative support of the Oscar M. Lopez Center (Philippines), Kyoto University (Japan), Manila Observatory (Philippines), National Science & Technology Center for Disaster Reduction (Taiwan), University of Philippines Los Baños, and Thammasat University (Thailand). Finally, we recognise the financial support of APN, the United States Global Change Research Program, and the International Centre of Excellence for Integrated Research on Disaster Risk (IRDR-Taiwan).

PROJECT INFORMATION

Title:	Pan-Asia Risk Reduction (PARR) Fellowship Programme
Duration:	Single-year project
Total Funding:	US$ 30,000
Project Leader:	Dr. Hassan Virji, Executive Director
Full address:	START, 2000 Florida Ave NW Suite 200, Washington, DC 20008 USA
Tel:	+1 202 462 2213
Email:	start@start.org
Website:	http://www. start.org

APN FRAMEWORKS 3

Low Carbon Initiatives Framework (LCI)

Climate Adaptation Framework (CAF)

LCI2013-01CMY(R)-VASHIST

Identification of Policy and Institutional Gaps, Drivers and Strategies to Scale-Up Low Carbon and Energy Efficient Technology Application in the Construction and Infrastructure Sectors of South Asia

Sanjay Vashist[1], K. Vijaya Lakshmi, Hina Lotia and Manjeet Dhakal
[1]Corresponding Author
Climate Action Network–South Asia
Email: sanjay@cansasouthasia.net

Introduction

Construction, one of the fastest growing sectors, is a significant contributor to the development process in South Asia. However, it is one of the highest contributors to greenhouse gas (GHG) emissions and accounts for massive resource consumption. The need for improvement of the construction sector is obvious. However, despite continuous efforts, examples of successful initiatives can be observed only in a few clusters. It is extremely necessary to mainstream low carbon technologies in order to mitigate the impacts of increased GHG emissions. With this background, the Climate Action Network–South Asia, and their collaborators, has undertaken research to study the rapidly growing construction sectors in India, Pakistan and Nepal with a focus on social housing in small towns and peri-urban areas.

Project Activities

The regional comparative research looks at economic, technological, and regulatory and policy frames in the different country situations to strengthen regional global change research by identifying key gaps and areas for integrative research. The idea is to define the critical elements of the ecosystem for promoting low carbon development pathways in the identified sectors.

Bricks

As bricks form the backbone of the construction sector, Pakistan looked at energy-efficient brick production (Vertical Shaft Brick Kilns) technology. Nepal focused on hollow concrete bricks to understand the current scenario of public acceptability along with policy and market barriers that need to be overcome to adopt this technology. India focused on fly ash bricks to explore different drivers and barriers for uptake in two states of Odisha and Bihar. Market mechanisms have been the major driver in Odisha while policy push is the driver in Bihar.

Bamboo

Bamboo in Pakistan is used for interior as well as structural systems as an alternative to cement, steel and bricks. Thus, the second case study examines the construction process and discusses the various difficulties encountered during the building life cycle by an organisation pioneering the work on bamboo construction in Pakistan via the Green Karavan Ghar initiative. In Nepal, the concept of engineered prefabricated bamboo housing has been introduced by few projects. India faces a multitude of perception and technology barriers, but policy mechanisms at the centre and state are working hard to promote the material.

Lime

Pakistan is also documenting the use of lime to reconstruct damaged or destroyed houses in the most affordable, resilient and energy efficient manner. In India, prefabrication is increasingly becoming popular, especially in the commercial sector. The increasing acceptance and demand for modular units both in the public and private sector are the basis for this case study.

HIGHLIGHTS

- Technology and institutional mapping undertaken to understand the current status and gaps in capacities at different levels.
- Country case studies were developed on brick and bamboo-based construction.
- Regional consultation workshop held to share case studies with regional experts on low carbon development.

Regional Consultation

A regional consultation on "Low Carbon Options for South Asian Countries and Sectors" was held at Hotel Soaltee Plaza, Kathmandu, Nepal from 26–27 August 2014 in association with PGVS, Christian Aid, Heinrich Boell Foundation (HBF), Oxfam and the APN. The major objectives were to share country and sectoral case studies and build an understanding on a long-term regional low carbon development strategy. The workshop sought participation from across the region including Afghanistan, Bangladesh, India, Nepal, Maldives, Pakistan, Sri Lanka and Viet Nam.

Project Publications (published)

- Low Carbon and Resource Efficient Technology: Scaling-up of Fly Ash Brick Technology in India
- Bamboo: Green Construction Material in India
- Bamboo Construction: Low Carbon and Disaster Resilient Alternative in Pakistan
- Energy Efficient Brick Production: Vertical Shaft Brick Kilns in Pakistan
- Use of Hydraulic Lime and Earth in Disaster Risk Management in Pakistan
- Low carbon construction technologies in Nepal

Project Publications (upcoming)

- Three country reports on Low Carbon Construction: Drivers and Barriers
- Regional report on Low Carbon Construction: Drivers and Barriers
- Policy brief on the construction sector

PROJECT INFORMATION

Title:	Identification of Policy and Institutional Gaps, Drivers and Strategies to Scale-up Low Carbon and Energy Efficient Technology Application in the Construction and Infrastructure Sectors in South Asia
Duration:	Year 2 of a two-year project
Total Funding:	US$ 83,600
Project Leader:	Mr. Sanjay Vashist
Full address:	Climate Action Network South Asia, Bangladesh Centre for Advanced Studies (BCAS), House 10, Road 16A, Gulshan- 1, Dhaka-1212, Bangladesh
Tel:	+91 9910096125
Email:	sanjay@cansouthasia.net

LCI2013-02CMY(R)-DHAKAL

Water, Energy and Carbon Nexus in Cities: Case of Bangkok, New Delhi and Tokyo

Shobhakar Dhakal[1], Sangam Shrestha, Shinji Kaneko, Arun Kansal and Ashish Shrestha
[1]Corresponding Author
Associate Professor, Energy Field of Study, Asian Institute of Technology, Thailand
Email: shobhakar@ait.asia

Introduction

Water footprints in energy sectors and energy footprints in water sectors are increasingly becoming a concern in development and planning processes. Since both water and energy resources are becoming limited, it underscores the need to comprehensively and quantitatively understand this inter-relationship in a coherent way. The overall goal of understanding this nexus is to optimise energy and water use for maximum benefit and sustainable growth while reducing GHG emissions. As cities are major consumers of water and energy, it is significant to have specific emphasis on cities because of several reasons including increased urbanisation, complex agglomeration of infrastructures, economy, industries, technologies and its overall dynamics. However, there is limited understanding and research in the Asian Cities.

The objectives of the project are to characterise the nature of WEC Nexus through comparative case studies in Asian cities; quantify this nexus to explore barriers and opportunities for optimising the nexus, as well as study the significance and potential of this nexus towards low carbon development in cities.

Conceptual Framework and Research Protocol

The case studies follow common methodology capturing similarities and differences of issues in three cities. The research protocol aims to determine linkages, key indicators, drivers and implications of water, energy and carbon in every element of the urban water/energy cycle, as well as provide guidelines in scoping the research activities. In all three cities, energy infrastructure is located outside administrative boundaries transporting energy into the cities, while all the urban water/waste water utilities are within cities' boundaries; therefore, the energy footprint of water is more crucial than the water footprint of energy in a cities context.

Project Workshops

Three workshops were organised: The first two were in September 2013 to develop a conceptual framework and research protocol and to synthesise the cities, case studies between collaborative partners. The third workshop (Figure 1) in November 2014 discussed policies on water, energy and carbon in cities, among collaborative partners and local governments of Delhi, Bangkok and Tokyo.

Key Outcomes

The syntheses of case studies provided a comprehensive analysis of water, energy and carbon interactions in every element of urban water systems.

Figure 1. *Stakeholder workshop held in AIT, Bangkok.*

Different drivers such as climate change, urbanisation, technology choices, state of infrastructure and environmental regulations play a significant role in contributing to energy and carbon footprints. The second phase of the project will focus on application of different tools and methods for quantification of nexus to benchmark future and policy scenarios that will further provide opportunities in framing low carbon policies.

Acknowledgements

We acknowledge the APN for financial support to pursue this research.

PROJECT INFORMATION

Title:	Understanding and Quantifying the Water-Energy-Carbon Nexus for Low Carbon Development in Asian Cities
Duration:	Year 2 of a two-year project
Total Funding:	US$ 80,600
Project Leader:	Dr. Shobhakar Dhakal
Full address:	Energy Field of Study, School of Environment, Resources and Development, Asian Institute of Technology, Klong Luang, Pathumthani 12120, Thailand
Tel:	+66 2 524 5403
Email:	shobhakar@ait.asia, shobhakar.dhakal@gmail.com
Website:	http://www.wec-nexus.ait.asia

HIGHLIGHTS

- Case studies in three Asian cities focus on developing comprehensive understanding of water, energy and carbon nexus in urban context.
- Common conceptual framework and research protocol address drivers affecting the nexus, roles of policies, and options and linkages in optimising those drivers.
- Study focuses on key policy agenda of energy security, climate change mitigation and water security addressing the barriers and opportunities for low carbon development.

LCI2013-04CMY(R)-MACANDOG

Integrated Sustainability Assessment of Bioenergy Potential in Asia: Application of a Hybrid Approach on Trade-Offs and Pathways (PIC-STRAP)

K.S. Kavi Kumar, Damasa B. Magcale-Macandog[1], Lilibeth A. Acosta, Elena A. Eugenio, Paula Beatrice M. Macandog, Xuefeng Cui and K.S. Kavi Kumar
[1]Corresponding Author
Institute of Biological Sciences, University of the Philippines Los Baños (UPLB), College, Laguna 4031, Philippines
Email: demi_macandog@yahoo.com

Project Objectives

A better understanding of human perception on sustainability issues confronting bioenergy may help develop appropriate policies for promising renewable energy sources. The PIC-STRAP project aims to contribute to this challenging task through the application of an integrated assessment modelling approach called STRAP (Sustainability TRade-offs and Pathways), which highlights social perception and policy preferences. PIC-STRAP's specific objectives are to: (1) systematise existing knowledge on sustainability of bioenergy; (2) understand social perception on and policy preferences for different feedstocks; (3) determine society's sustainability trade-off decisions in the use of resources; (4) assess alternative pathways in bioenergy development and their effects on sustainable LCS transition; and (5) facilitate the integration and dissemination of the generated knowledge.

Project Results

Jatropha Cultivation – Ground Reality in Tamil Nadu

Six districts were covered in the field survey to assess the status of jatropha cultivation in Tamil Nadu. The field survey provided useful insights for policy in that:

- High initial investment requirements favouring larger land holders compared to small and marginal land holders.
- Government initiatives cast shadows on the notion of wastelands. For example, at the village level, wasteland is often Common Property Resources (CPRs) utilised by multiple stakeholders.
- Government agencies view jatropha cultivation broadly similar to several other tree plantation programmes.
- Lack of employment opportunities make jatropha less attractive, compared to prosopis, for example, where there are more employment opportunities for the landless poor.
- Land targeted for jatropha is occupied by prosopis, which is historically promoted by several governments.
- There is an ambiguous definition of wasteland and inadequate understanding of the use of wasteland causes concern in terms of its feasibility of achieving biodiesel production targets.

Bioenergy Sustainability Index in India

Figure 1 presents the sustainability index for bioenergy for different states in India covering decadal periods in the 1990s and 2000s. A total of 18 indicators were used to represent economic stability, social equity and ecological balance. These indicators were used as inputs to fuzzy logic analysis to generate a sustainability index. There were significant changes in the index for almost all states, some in an increasing trend (Himachal Pradesh, Tamil Nadu) and others decreasing (Bihar, Madhya Pradesh, Uttar Pradesh).

Other Activities

- Framing Workshop held from 21–25 July 2014 in Beijing, China.
- Participatory Rural Appraisal (PRA) in Infanta, Quezon, aimed to encourage locals from 36 villages to share knowledge on issues related to land use, livelihood and environmental conditions.

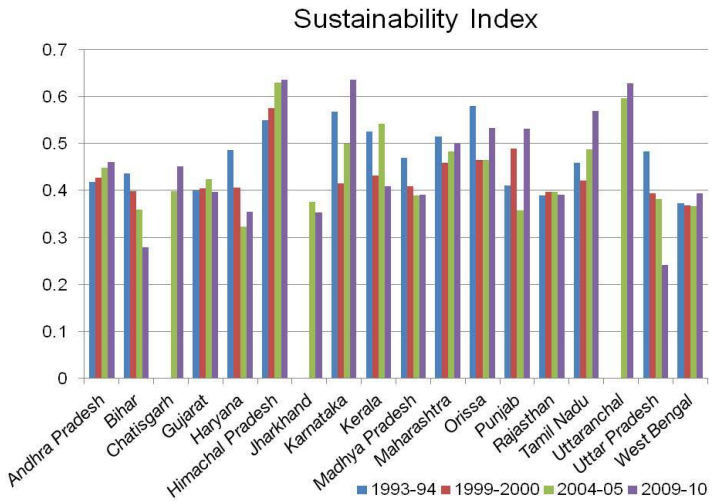


Figure 1. Bioenergy Sustainability Index in India.

Project Publications

Acosta, L. A., Eugenio, E. A., Enano, N. H., Magcale-Macandog, D. B., Vega, B. A., Macandog, P. B. M., … Lucht, W. (2014). Sustainability trade-offs in bioenergy development in the Philippines: An application of conjoint analysis. *Biomass & Bioenergy, 64*, 20–41.

Kumar, K. S. K., Rajan, R. S. S. Manivasagan, R. (2014). Biofuel Feedstock Cultivation in India: Implications for Food Security and Rural Livelihoods. Manuscript submitted for publication.

HIGHLIGHTS

- Since a large portion of biodiesel requirement is going to be met through jatropha oilseeds, the potential yield from existing jatropha cultivation could meet a mere 0.01% of total biodiesel required for 5% blending.
- Reaching targets require resolving uncertainty regarding transfer of ownership of community and government-owned wasteland.
- From a food security perspective, cultivation of jatropha and sweet sorghum may divert land from coarse cereal cultivation in few states such as Orissa and Assam leading to food security concerns.

PROJECT INFORMATION

Title:	Integrated Sustainability Assessment of Bioenergy Potentials in Asia: An Application of a Hybrid Approach on Trade-Offs and Pathways (PIC-STRAP)
Duration:	Year 2 of a two-year project
Total Funding:	US$ 90,000
Project Leader:	Prof. Damasa Magcale-Macandog
Full address:	Institute of Biological Sciences, University of the Philippines Los Baños, College, Laguna 4031, Philippines
Tel:	+63 49 5016503
Email:	demi_macandog@yahoo.com
Website:	http://strap.pik-potsdam.org/

LCI2013-05CMY(R)-JUPESTA

Low Carbon Urban Infrastructure Investment: Cases of China, Indonesia and Japan

Joni Jupesta[1], Takako Wakiyama, Manu Verghese Mathai, Ping Jiang, Wan Xin Li, Rizaldi Boer, Retno Dewi Gumilang, Toni Bakhtiar , Lukytawati Anggraeni
[1]Corresponding Author
United Nations University- Institute for Advanced Studies of Sustainability (UNU-IAS), Japan
Email: jupesta@unu.edu

Introduction

This two-year project outlines pathways to achieve low carbon cities. In China, we proposed a set of policy recommendations for an economic incentive to support green building development in accordance with the concept of the Clean Development Mechanism. In Japan, we analysed the risk and return of investment for renewable energy (e.g., wind power and solar power in Yokohama City). In Indonesia, we proposed that the energy efficiency in industries, among others, has the largest impact in cutting greenhouse gas (GHG) emissions in Jakarta Metropolitan. Based on this background, this project provides a new funding mechanism with engagement of many stakeholders such as public-private partnerships. The project outcomes will be used as guidance on how cities in selected countries (Shanghai, Yokohama and Jakarta) can play a key role in the green growth agenda, by stimulating growth through smart investment in urban infrastructure (i.e., by building physical infrastructure, by financial and tax incentives, energy supply, and heightening society's awareness of a sustainable lifestyle).

Work Undertaken and Results to Date

The three main results were presented under one session entitled "Footprinting and Low Carbon Urban Infrastructure Development" at the 2nd International Conference on Urbanization and Global Environmental Change (UGEC) held from 6–8 November 2014 in Taipei. Three speakers—Dr. Gelang Dewi from Indonesia, Dr. Ping Jiang from China and Ms. Wakiyama from Japan—led the discussion on low carbon urban infrastructure investment in China, Indonesia and Japan. Further, the conference papers together with other research outcomes related with the project will be published as an edited book. The shorter version will be published as a policy report.

The outcomes of the project are expected to be published by July 2015 and disseminated at both The International Forum for Sustainable Asia and the Pacific (ISAP) 2015 in Yokohama Japan and the 4th Annual Low Carbon Asia Research Network (LoCARNet) meeting in Johor Bahru, Malaysia.

Project Publications

Jupesta, J. & Wakiyama, T. (forthcoming, 2015). Low Carbon Urban Infrastructure Investment: Cases of China, Indonesia, and Japan, edited Book. MacMillan Palgrave Publisher.

Jupesta, J. & Wakiyama, T. (forthcoming, 2015). Low Carbon Urban Infrastructure Investment: Cases of China, Indonesia, and Japan, edited Book. UNU-IAS Policy Report.

Jupesta, J. (forthcoming, 2014). Green Investment in Asian Cities: Lessons from PR China, Indonesia and Japan, ADB Asia Pathway Blogs. http://www.asiapathways-adbi.org/

Jiang, P., Chen, Y., Dong, W. (2014). A Cost Effective Approach to Low Carbon Sustainability: An Insight into the Carbon Trading Mechanism in the Building Sector in China, Presented at session "Footprinting and low carbon urban infrastructure development" in: Urbanization and Global Environmental Change (UGEC) 2nd Conference: Urban Transitions and Transformations; Science, Synthesis and Policy. http://ugec2014.squarespace.com/

HIGHLIGHTS

- Cities is one of the seven critical issues discussed at Rio+20 (along with energy, jobs, food, water, oceans and disasters).
- Cities can support low carbon society as they account for more than half of the world's population, which contributes 80% of wealth creation and 60-80% of global energy consumption and global GHG emissions.
- Several options for low carbon infrastructure funding in Asian cities (Shanghai, Yokohama and Jakarta) in terms of building, household and transportation sectors have been identified.
- Upcoming publication of an edited book as well as policy report for scholars and policy makers dealing with urban cities and climate change-related issues.

Wakiyama, T., Abdullah, A., Jupesta, J. (2014). Investment Risk and Return Analysis for Low Carbon City Development in Yokohama. Presented at session "Footprinting and low carbon urban infrastructure development" in: Urbanization and Global Environmental Change (UGEC) 2nd Conference: Urban Transitions and Transformations; Science, Synthesis and Policy. http://ugec2014.squarespace.com/

Dewi, R.G., Siagian, U., Boer, R., Anggraeni, L., Hendrawan, I. (2014). Low Carbon City Development Paths of DKI Jakarta towards 2030. Presented at session "Footprinting and low carbon urban infrastructure development" in: Urbanization and Global Environmental Change (UGEC) 2nd Conference: Urban Transitions and Transformations; Science, Synthesis and Policy. http://ugec2014.squarespace.com/

Acknowledgements

Administrative support for this APN project is provided by United Nations University-Institute for Advanced Studies of Sustainability (UNU-IAS). We appreciate collaborative support from our partners in respective countries (Japan, China and Indonesia) and from the Institute for Global Environmental Strategies (IGES), Fudan University, City University of Hong Kong (CUHK), Bogor Agriculture University and Bandung Institute of Technology.

PROJECT INFORMATION

Title:	Low Carbon Urban Infrastructure Investment: Cases of China, Indonesia, and Japan
Duration:	Year 2 of a two-year project
Total Funding:	US$ 80,600
Project Leaders:	Dr. Joni Jupesta (UNU-IAS) and Ms. Takako Wakiyama (IGES)
Full address:	5–53–70 Jingumae, Shibuya-ku, Tokyo 150-8925 Japan (UNU); 2108-11 Kamiyamaguchi, Hayama, 240-0115, Japan (IGES)
Tel:	+81 3 5467 1212, Fax: +81 3 3499 2828 (UNU-IAS) +8146 826 9597, Fax: +81 46 855 3809 (IGES)
Email:	jupesta@unu.edu; wakiyama@iges.or.jp
Website:	www.ias.unu.edu; www.iges.or.jp

CAF2013-01NSY-L+D(F)-HUQ

The Asia Pacific Forum on Loss and Damage

Stephanie Andrei[1], Erin Roberts and Saleemul Huq
[1]Corresponding Author
Visiting Researcher, International Centre for Climate Change and Development, Bangladesh
Email: andrei.stephanie@gmail.com

Project Summary

The Asia Pacific Forum on Loss and Damage is coordinated by the International Centre for Climate Change and Development (ICCCAD) and the International Institute for Environment and Development (IIED). The Forum's main objective is to disseminate research on loss and damage, promote discussion and provide a platform for sharing research findings and best practices in addressing loss and damage in the region. With the aim of creating a community of practice for researchers conducting loss and damage-relevant research, the Forum has successfully attracted readership to the website, newsletter series and LinkedIn discussion board. In addition, one workshop and two meetings were organised at relevant global events including the 8th Conference on Community-based Adaptation, held in Kathmandu, April 2014; and the Fourth Asia Pacific Adaptation Forum, which took place in Kuala Lumpur in October, 2014.

The main purpose of the website (www.lossanddamageforum.org) is to share research on loss and damage in the region and respond to Frequently Asked Questions (FAQs). Developed using feedback and suggestions from an international expert panel, the FAQs not only help shed light on the difficult concept of loss and damage, but also provide links to additional literature for further reading. Since loss and damage remains an emerging issue at national and local levels, finding relevant research has been challenging and differentiating "loss and damage" from "adaptation" research has been a point of discussion throughout the construction of the website.

Outcomes to Date

By the end of 2014, the Forum has published five newsletters (Figure 1) with articles written by international researchers and experts. Fifteen articles will have been published and disseminated across the network. The network has grown significantly over the past year starting with 50 individuals and now totalling just over 150 from within and outside the Asia-Pacific region. These individuals have also helped contribute to discussions on LinkedIn. While this process has been slow due to unfamiliarity with the forum, currently, the LinkedIn group has 51 members of which 27% are from the research community.

The Forum has provided a platform for discussion through the events it has organised and convened throughout the year. The events took place alongside larger conferences to reduce costs and to take advantage of a wider audience. The first event took place during the 8th Annual Community Based Adaptation Conference with almost 15 participants who discussed upcoming research, events and issues. The second event was held alongside the 4th Asia-Pacific Climate Change Adaptation Forum in Kuala Lumpur, Malaysia. The workshop attracted over 30 participants and included a presentation session for the first half of the day and a discussion session in the second. The report of the workshop can be found on the website. One of the outcomes of the workshop will be a framing paper on loss and damage to be presented as a commentary piece in Nature and Climate Change next year. The third event will take place during the twentieth Conference of the Parties in Lima, Peru, where participants will be asked to provide feedback on the two-year work plan of the Warsaw International Mechanism on loss and damage.

HIGHLIGHTS

- Engaged with researchers, practitioners, and stakeholders from pan Asia-Pacific.
- Generated a successful newsletter series that has received articles across the region with country-specific submissions from Bangladesh, Republic of Korea, India, Philippines and Nepal.
- Organised a workshop in September 2014, which attracted over 35 participants from various countries within Asia and abroad.

Figure 1. *Latest issue of the newsletter of the Asia-Pacific Forum on Loss and Damage (Newsletter 5, December 2014).*

PROJECT INFORMATION

Title:	Asia Pacific Forum on Loss and Damage
Duration:	Single-year project
Total Funding:	US$ 47,500 USD
Project Leader:	Dr. Saleemul Huq
Full address:	Plot 16, Block B, Aftabuddin Ahmed Road; Bashundhara, Dhaka 1229
Tel:	+88(0)2840164553
Email:	saleemul.huq@iied.org
Website:	www.lossanddamageforum.org

CAF2014-CD01NMY-WIJENAYAKE

Enhancing Capacity of Policy Makers and Practitioners in India, Sri Lanka and Nepal on Loss and Damage Related to Slow Onset Events in the Region

Vositha Wijenayake[1]
[1]Corresponding Author
Climate Action Network South Asia, Dhaka, Bangladesh
Email: vositha@cansouthasia.net

Objectives

- Mobilise scientists, policy makers and practitioners to comprehensively assess the impact of slow onset events and prepare a comprehensive response.
- Spread awareness about L&D caused by slow onset events to people and ecosystems.
- Sensitise, engage and build capacity of stakeholders, particularly policy makers and practitioners, to develop appropriate solutions.

Rice farmers in Bangladesh struggle to adapt to increased salination (Photo: UNFCCC).

Methodology

- Background note on slow onset events for various stakeholders specific to three chosen countries with slow-onset event experiences, institutional capacity and gaps in the policy framework vis-à-vis DRR, CCA and L&D.
- Development of modules for capacity building on integrating L&D perspective, focusing on slow onset events, DRR, CCA and development strategies.
- Mapping of stakeholders involved in research and community-based practices with regard to DRR, CCA and L&D.
- Capacity building workshops in three countries and regional consultation on slow onset impacts and addressing L&D.

Project Activity Status

- Climate Action Network South Asia in partnership with Action Aid and APAN has initiated implementation of the project in the identified countries India, Nepal and Sri Lanka to address the need for understanding slow onset events and its impacts on people, livelihoods and ecosystems.
- The project started with an inception workshop of partners in Delhi in October 2014 to discuss the methodology, identify existing research information sources for capacity building modules and align the methodology as per the latest information. The workshop/meeting also discussed roles and responsibilities of partners and an activity calendar that can be used to prepare a project timeline.
- The consortium is in the hiring process of a Researcher assisted by Interns in project countries, to prepare background notes and capacity building modules. The researcher will use CANSA L&D paper as basis.
- The researcher will work with Action Aid to bring convergence in two APN-funded projects.
- Since project activities aim to mobilise governments, scientists and civil society to assess the current and future impact of slow onset events and collectively develop solutions to address it, APAN activities in South Asia will be organised in project countries to support capacity building workshops as back to back events.

Upcoming Project Activities

- Collating information for a background note from CANSA members and other partner organisations in the countries.
- In Parallel - initiating activities to map stakeholders, working on slow onset disasters and needs for capacity building on the L&D phenomenon.

Upcoming Publication

- Capacity building modules on addressing L&D created by slow onset events. (To be completed by April 2015).

A hot meal for the people displaced by floods in India's Uttarakhand state (Photo: Uttarakhand government portal).

PROJECT INFORMATION

Title:	Enhancing Capacity of Policy Makers and Practitioners in India, Sri Lanka and Nepal on Loss and Damage Related to Slow Onset Events in the Region
Duration:	Year 1 of a two-year project
Total Funding:	US$ 85,000
Project Leader:	Ms. Vositha Wijenayake
Full address:	Climate Action Network South Asia, c/o Bangladesh Centre for Advance Studies, 10, Road # 16/A, Gulshan Avenue, Dhaka, 1212, Bangladesh
Tel:	+94 777 597 387
Email:	vositha@cansouthasia.net
Website:	www.cansouthasia.net

CAF2014-CD02NMY-NHAT

Capacity Building for National and Provincial Stakeholders and Remote Communities on Loss and Damage Related to Disaster Risk Reduction and Climate Change Adaptation

Truong Duc Tri[1], Luong Quang Huy, Le Minh Nhat, Mai Kim Lien, Pham Thi Tra My and Nguyen Khanh Toan

[1]Corresponding Author

Department of Meteorology, Hydrology and Climate Change, Hue Economic University

Email: nhatkyoto@gmail.com

Brief Introduction of the Project

In 2014 the Viet Nam National Climate Change Committee collaborated with Hue Economic University to propose a capacity building project including a national workshop and a series of training courses at local levels for loss and damage (L&D). The activities aim to create a common understanding of L&D, and establish comprehensive links among national agencies and local communities to address L&D through disaster risk reduction (DRR) and CCA initiatives.

The first six-month period of the project will review legal documents in both CCA and DRR to identify gaps in addressing L&D caused by climate change. The content of the workshops and training courses will be developed via in-depth analysis and assessments by a group of selected experts, covering various topics including colloquial understanding of L&D and potential integration of DRR and CCA to address L&D for sustainable development.

The second phase of the project will host national workshops and training courses. The main purpose is to build capacity of climate change focal points at designated ministries, provinces and in remote communities to effectively address L&D and respond to climate change.

Work Undertaken and Results to Date

The team has been established with experts from the Department of Meteorology, Hydrology and Climate Change where NCCC office is hosted, and representatives from Hue Economic University. Recently, the team has reviewed more than two hundred CCA documents and more than one hundred legal documents in DRR. The team found that the DRR legislation system is well established compared with with CCA initiated in 2008. DRR tends to focus on emergency responses and is habitually absent of long term visions and sustainable recovery strategies while CCA documents are fully integrated with long term visions but commonly lack feasible plans to translate its ambitious agenda. (Shamsuddoha, 2013)

It was discovered that mechanisms to address natural disaster related to L&D exist and are implemented by Provincial People Committees. L&D data are accounted and reported annually. However, data accuracy is problematic due to lack of synthesised methodologies and proper tools to estimate L&D. Three field trips in selected provinces that may expose different types of L&D will be conducted in the ensuing months to obtain more evidence on the effectiveness of existing CCA and DRR policy implementation to reduce L&D.

The greatest difficulty the team has faced to date is the lack of systematic methodology to document L&D data at both national and provincial levels. Current data is insufficient, and scattered in many documents from different sources. To address this challenge, the team needs to search for data and information related to L&D, and compile the data systematically for analysis.

Project publications

The team has submitted an article entitled The Relationship between Climate Change Adaptation and Disaster Risk Reduction from the context of Loss and Damage to the domestic journal "Natural Resources and Environment Magazine".

Acknowledgements

Our appreciation goes to APN for financially supporting this research and capacity building project.

References

Shamsuddoha, M., Roberts, E., Hasemann, A., & Roddick, S. (2013). Establishing Links between Disaster Risk Reduction and Climate Change Adaptation in the Context of Loss and Damage. Policies and Approaches in Bangladesh. Retrieved from http://www.lossanddamage.net/download/7096.pdf

PROJECT INFORMATION

Title:	Capacity Building for National, Provincial Stakeholders and Remote Communities on Loss and Damage Related to Disaster Risk Reduction and Climate Change Adaptation
Duration:	Year 1 of a two-year project
Total Funding:	US$ 80,000
Project Leader:	Dr. Le Minh Nhat
Full address:	Room A404, Floor 4th, No.10 Ton That Thuyet st., Hanoi, Viet Nam
Tel:	+84 9 886 20373
Email:	nhatkyoto@gmail.com
Website:	dmhcc.gov.vn

HIGHLIGHTS

- Establish a common understanding of Loss and Damage (L&D) concept among climate change adaptation practitioners and disaster risk reduction communities at central levels.
- Collect and review L&D data for Viet Nam from 1995-2013.
- Identify limitation of implementing climate change adaptation (CCA) measures in Viet Nam since 2009.
- Identify inadequate humanitarian post-disaster support and necessity for a longterm vision for disaster risk reduction strategies.

CAF2014-CD03NMY-IBRAHIM

Building Capacity for Reducing Loss and Damage Resulting from Slow and Rapid Onset Climatic Extremes through Risk Reduction and Proactive Adaptation within the Broader Context of Sustainable Development

Kamaulazizi Ibrahim[1], Normaliza Abdul Manaf and Kanayathu C Koshy
[1]Corresponding Author
Centre for Global Sustainability Studies, Universiti Sains Malaysia, Penang, Malaysia
Email: kamarul@usm.my

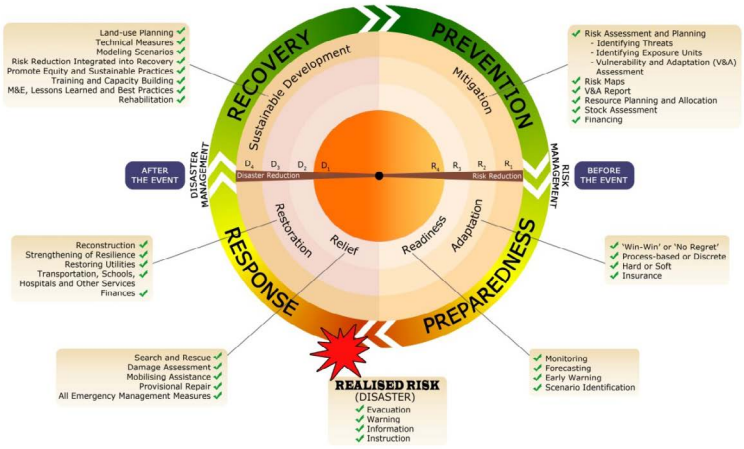
Project Summary

This is a two-year project on 'learning labs' (training workshops) in Malaysia, Viet Nam, Lao PDR and Cambodia that will bring together multiple stakeholders to explore ways to reduce the risk posed by climatic hazards before they are realised as disasters resulting in loss & damage (L&D). The central focus of this unique training is personalised instruction and hands-on learning. In most situations involving climatic extremes (and other disasters in general) the starting point appears to be an unexpected event followed by a hastily put-together reactionary relief and rehabilitation plan followed by a cooling-off period until the next disaster strikes. In more prepared communities and countries, anticipatory preparation and more robust recovery measures are carried out as proactive measures. If we could define risk more inclusively to cover both 'rapid onset-high impact' events such as floods and typhoons, and 'slow onset-high impact' events, such as climate change and poverty, we could move from an event-based to a process-based intervention strategy for disaster risk reduction/management (DRR/M), in which case vulnerable communities will become active participants rather than passive victims. This training will consider such an approach by factoring sustainable development (SD) considerations in all the four major phases of the DRM loop – prevention, preparedness, response and recovery. This is the uniqueness of the training. Thus, this training is tailored to address closely the capacity needs of APN's Climate Adaptation Framework and the outcome of the special APN workshop on CCA, DRR and L&D held in Kobe, 21–23 August 2013.

This first year of the project will be mostly in Malaysia. CGSS, together with APN, will conduct a three-day 'learning labs' (training workshops) at the Hotel Concorde Inn Kuala Lumpur International Airport Kuala Lumpur, Malaysia from 3-5 December, 2014. The workshop will address the technical terms in the DRM cycle, explain the connection between DRM and SD, train participants on easy-to-use risk assessment methodology (R.A.M developed by CGSS), provide access to loss &damage assessment approaches, help prioritise adaptation options, and provide trainingon risk reduction project planning using logical framework analysis & Atkissons methodology to develop and implement interdisciplinary risk reduction projects. The backdrops of discussions will be the Hyogo Framework and the Future We Want.

About 60 participants will be involved: Thirty-five trainees, eight resource persons, two secretariat staff and three collaborators from Cambodia, Viet Nam and Lao PDR and funded by APN; and 12 participants from the South East Asia Sustainability Network (SEASN) and funded by SEASN.

Disaster Risk Management for Sustainable Development



Project Publications

Compilation of Handouts for Disaster Risk Management for Sustainable Development (DRM-SD)

Acknowledgements

This project is fully funded by the Asia-Pacific Network for Global Change Research (APN).

HIGHLIGHTS

- The workshop will address all technical terms involved in the DRM cycle and clearly explain connection between DRM and Sustainable Development.
- Training on the use of an easy-to-use risk assessment methodology (R.A.M developed by CGSS).
- Providiving access to loss and damage assessment approaches and help prioritise adaptation options.
- Training on risk reduction project planning using logical framework analysis and Atkissons methodology to develop and implement interdisciplinary risk reduction projects.

PROJECT INFORMATION

Title:	Building Capacity for Reducing Loss and Damage Resulting from Slow and Rapid Onset Climatic Extremes through Risk Reduction and Proactive Adaptation within the Broader Context of Sustainable Development
Duration:	Year 1 of a two-year project
Total Funding:	US$ 70,000
Project Leader:	Prof. Kamarulazizi Ibrahim, Director CGSS, USM, Malaysia
Full address:	Centre for Global Sustainability Studies, Level 5, Hazah Sendut Library Extension, Universiti Sains Malaysia, Penang, Malaysia
Tel:	+604 653 5422/5429
Email:	kamarul@usm.my
Website:	http://cgss.usm.my/index.php/apn

CAF2014-CD04NSY-SHARMA

Can Traditional Livelihoods and Mining Co-exist in a Changing Climate: Strengthening Public-Private Partnerships in Mongolia to Reduce Risk and Address Loss and Damage

Vigya Sharma[1], Byambajav Dalaibuyan, Myagmartsooj Natsag, Gerelt-Od Erdenebileg, Saruulzaya Adiya
[1]Corresponding Author
Centre for Social Responsibility in Mining, The University of Queensland, Australia
Email: v.sharma@uq.edu.au

Introduction

While herding maintains a deep-rooted socio-cultural significance for Mongolia, increasing aridity and rampant desertification pose serious threats to the continuity of traditional livelihoods. At the same time, a booming mining industry is causing an atmosphere of scepticism amongst Mongolia's large herder population with regard to growing competition over access to land and water. Impacts from both large scale and artisanal mining on the country's socio-ecological landscape are evident in varying forms.

Climate change adds a further layer of complexity to this already dynamic relationship between herding and mining, resulting in several implications for the country's future development. Both industries remain critically dependent on suitable natural climatic conditions for long-term viability. In-house institutional capacity to tackle loss and damage (L&D) resulting from climatic changes is currently limited despite recurring climate-influenced natural disaster events (locally known as 'dzud') that leave millions of livestock dead and several thousand households consequently impacted.

The fact that communities possess neither the capacity nor the resilience needed to address these complex climatic challenges further reinforces the need for a project that transcends sectoral boundaries to address disaster risks and resulting L&D. This project proposed a novel approach to bring together two of Mongolia's key economic sectors – mining and herding – otherwise at conflict over access to land and water resources, to work in collaboration with government and civil society actors to a) identify risks from climatic changes; and b) build capacity to adapt to these changing conditions with a view to reducing the resulting L&D through both incremental and transformative changes. The project was founded on the premise that dialogue, coordination, coherence and synergy among relevant stakeholders are key instruments to strengthen climate risk management approaches that can adequately address L&D.

Work Undertaken and Results to Date

The project undertook a series of capacity building workshops in September 2014 managed by CSRM at the University of Queensland, Australia jointly with Civic Solutions, a local NGO based in Ulaanbaatar, Mongolia. Mongolia's Ministry of Environment and Green Development provided in-kind support to the project along with encouragement towards the idea of bringing together stakeholders from across herding groups, mining companies, civil society organisations, media and local (soum), provincial (aimag) and central government departments to a single platform to understand climatic influence on each sector, enhance capacity to deal with resulting impacts and improve preparedness towards climate-influenced natural disasters in the future.

Two multi-stakeholder workshops were conducted in Umnugobi and Bayankhongor provinces with a concluding symposium organised in Ulaanbaatar. A particularly important outcome from these workshops has been to propose the establishment of a Knowledge Hub. The Hub will bring together various stakeholder groups to enable a robust ongoing dialogue on better understanding the interface between Mongolia's mining and herding sectors in light of current and future climatic changes. Several ideas in relation to the proposed Knowledge Hub were discussed at the workshops and these will play a critical role in informing policy guidance on multi-stakeholder public-private partnership development that will be available in the final report due to be published by February 2015.

HIGHLIGHTS

- Applying a cross-sectoral lens to analyse complex challenges to Mongolia's current and future sustainability.
- Focus on public-private partnerships to bring together Mongolia's mining and traditional herding sectors to view climate change as a 'common' concern and address L&D.
- Develop the idea of a 'Knowledge Hub' to host multi-stakeholder cross-sectoral dialogue on Mongolia's complex mining-traditional livelihoods-climate disaster nexus over the coming decades to build local capacity on disaster preparedness and management.
- Three workshops conducted to bring together a range of local perspectives, priorities and context to provide a broader understanding of, and build capacity to better deal with, current and future climate-influenced challenges to Mongolia's mining and herding landscapes.

Upcoming Project Publications

- Final project report – due by first quarter 2015
- Project Factsheets on key findings and policy recommendations for distribution among workshop participants and relevant actors in Mongolia
- Journal article on workshop findings

Acknowledgements

We thank APN for providing funds to undertake workshops, the Mongolia's Ministry of Environment and Green Development (MoEGD) lead by Minister Dr. S. Oyun, and the Aimag Governors and their office in Umnogovi and Bayankhongor.

PROJECT INFORMATION

Title:	Can Traditional Livelihoods and Mining Co-Exist in a Changing Climate: Strengthening Public-Private Partnerships in Mongolia to Reduce Risk and Address Loss and Damage
Duration:	Single-year project
Total Funding:	US$ 30,000
Project Leader:	Dr. Vigya Sharma
Full address:	Level 4, Sir James Foots Building, Centre for Social Responsibility in Mining, University of Queensland, St Lucia, Queensland, 4072, Australia
Tel:	+61 431 436 296
Email:	v.sharma@uq.edu.au

CAF2013-CD05NSY-HOLLAND

Capacity Building for Resilience Planning in Fiji: Bridging the Science-Policy-Practice Interface in Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR) and Loss and Damage (L+D)

Elisabeth Holland[1]
[1]Corresponding Author
University of South Pacific, Fiji
Email: elisabeth.holland@usp.ac.fj

Introduction

In the aftermath of sudden shock events and in the face of escalating climatic disaster risk, individuals, institutions, communities and societies are encouraged to be more 'resilient'. Prevention of loss and damage may be impossible in the face of threats that are both difficult to manage and hard to predict. Instead, a more realistic aim is to adopt proactive pre-event and post-disaster DRR and use capacity building actions to be resilient and adapt to the 'new normal'.

The flexibility of Resilience Planning means it can encompass a wide array of technical and social strategies, engage with both formal and informal mechanisms of intervention, and be informed by expert, local and indigenous knowledge. This may include, for example, a focus on land-use or building regulation or measures to strengthen community resilience from a civil society perspective. The useful flexibility of the term and its potential to mitigate loss and damage through planning means that 'resilience' has been rapidly promoted, emerging as a common term in the vocabulary of politicians and policy-makers concerned with CCA and DDR.

Project Activities

This project will build capacity in Fiji to better understand and integrate CCA, DRR and L+D within Resilience Planning. A partnership between specialists from Fiji and New Zealand will raise awareness and strengthen capabilities in Resilience Planning taking into account distinctive Fijian cultural, environmental and governance features. The processes and activities developed in Fiji during this project will be disseminated through our regional network and be translated and adapted to local circumstances by our partners in the different countries to institutionalise best practices and create a regional Resilience Planning and help bridge the science-policy-practice interface. This project will identify gaps in prevailing practices; build on current strengths; raise awareness and build capacity amongst key Fijian role players involved in CCA, DRR and L&D; and explore how to institutionalise Resilience Planning best practice and thus bridge the science-policy-practice interface.

Methodology

The research approach will be grounded in a 'participatory learning and action' methodology that is tailored to meet the distinctive needs of Fijian communities and both formal and informal institutions. This project has three objectives enumerated as follows:

- To identify gaps and strengths in prevailing practices through needs assessment, programme design and institutional buy-in from both formal and informal role players;
- To raise awareness and build capacity amongst key Fijian actors involved in CCA, DRR and L+D through interactive workshops drawing on local knowledge and experience; and
- To disseminate resilience planning best practice to Fiji and explore the potential to translate knowledge to other countries in the Pacific region.

HIGHLIGHTS

- » Resilience is a term that is becomingly commonly used in science and policy with regard to CCA, DDR and L&D.
- » Capacity building in Fiji to better understand and integrate CCA, DRR and L&D within Resilience Planning.
- » A partnership between specialists from Fiji and New Zealand will raise awareness and strengthen capabilities in Resilience Planning taking into account distinctive Fijian cultural, environmental and governance features.

In Fiji, the foundation of resilience for communities is their culture and way of life (Photo: Jacek Sniecikowski/CC BY-NC 2.0).

References

O'Hare, P., & White, I. (2013). Deconstructing Resilience: Lessons from Planning Practice: Special Edition of Planning Practice and Research. *Planning Practice and Research, 28*(3), 275–279. doi:10.1080/02697459.2013.787721

White, I., & O'Hare, P. (2014). From rhetoric to reality: which resilience, why resilience, and whose resilience in spatial planning? *Environment and Planning C: Government and Policy, 32*(5), 934–950. doi:10.1068/c12117

PROJECT INFORMATION

Title:	Capacity Building for Resilience Planning in Fiji: Bridging the Science-Policy-Practice Interface in Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR) and Loss and Damage (L&D)
Duration:	Single-year project
Total Funding:	US$ 45,000
Project Leader:	Prof. Elisabeth Holland
Full address:	University of the South Pacific, Laucala Campus, Suva, Fiji
Tel:	(+679) 323 22831
Email:	elisabeth.holland@usp.ac.fj

CAF2014-RR01NMY-BASNAYAKE

Initiating Data Collection and Pilot Site Selection for Conducting Research on Improving Methodology to Minimise Flood Hazard Risk

Senaka Basnayake[1], Md. Habibur Rahman, Madan Lal Shrestha, Lalith Chandrapala, Rishiraj Dutta, and Susantha Jayasinghe
[1]Corresponding Author
Asian Disaster Preparedness Center, Bangkok, Thailand
Email: senaka_basnayake@adpc.net

Overview

The project is designed to address regional research in developing an econometric methodology for estimating economic loss and damage (L&D) in the agricultural sector using climate change-induced flood risk assessment maps, which will be extracted from downscaled high-resolution future climate scenarios for the pilot sites of three countries including Nepal, Sri Lanka and Thailand. The project also intends to explore science-based disaster risk reduction (DRR) and climate change adaptation (CCA) interventions such as strengthening early warning systems for floods, behavioural changes of farming communities (livelihoods) to adopt changes in cropping calendars, changes in crop varieties and other climate-smart technological packages. It will further address the capacity building component by conducting two regional training workshops on the methodology of "Climate Inclusive Risk Assessment for Floods" and "L&D for Crops due to Impending Flood Hazards."

Main Objectives

- Improve the methodology for risk assessment for flood hazards due to climate change impacts;
- Improve the methodology for estimating L&D in agricultural sector due to floods; and
- Improve science-based CCA and DRR interventions for minimising damage to agricultural crops.

Progress to Date

Project implementation began with coordination between ADPC and respective country partners in October 2014. The initial stage of the project involved discussions with regards to data collection procedures, and selection of pilot sites in the respective countries.

For Thailand, discussions were held between ADPC and Royal Irrigation Department (RID). RID, the mandated government organisation for issuing and disseminating flood early warnings for the public, will work closely with ADPC in data collection (L&D data due to floods) and selection of rice growing pilot sites which are vulnerable to flood hazard. ADPC will also work closely with the Thai Meteorological Department (TMD) in collecting hydro-meteorological data in the selected pilot sites.

Nepal Academy of Science and Technology (NAST) is the focal agency to implement the project in Nepal. NAST will coordinate data collection (yield and L&D data due to floods) and select pilot sites. NAST will also work with the Department of Hydrology and Meteorology (DHM), Nepal to collect hydro-meteorological data for conducting risk assessment.

The Department of Meteorology (DOM) is the focal agency for implementing project activities in Sri Lanka. The Crop Science Department of the University of Peradeniya will work with DOM to select rice grown pilot sits and collect yield and L&D data due to floods. DOM will collect hydro-meteorological data for conducting climate-inclusive risk assessments in the pilot sites.

HIGHLIGHTS

» Discussions initiated with partners in Nepal, Sri Lanka and Thailand to implement the project.
» Data collection procedures and pilot sites selection started with support of partner agencies.

On 7 December 2010, vast tracts of land in Pakistan's Sindh province are still inundated, six months after the extreme rainfall that forced more than 20 million people away from their homes (Photo: UK-DFID/Flickr CC BY 2.0).

Presently, discussions with the focal agencies have been completed and they have been asked to select a few pilot sites, which are mostly frequented by floods. ADPC is also in the process of revising the work plan so as to adjust some activities to be conducted in different countries. At the same time, ADPC has requested Government departments to nominate focal points from the agencies.

Acknowledgements

ADPC is thankful to APN for funding this research activity under its Climate Adaptation Framework.

PROJECT INFORMATION

Title:	Developing Climate Inclusive Potential Loss and Damage Assessment Methodology for Flood Hazards
Duration:	Year 1 of a three-year project
Total Funding:	US$ 130,000
Project Leader:	Dr. Senaka Basnayake
Full address:	Asian Disaster Preparedness Center, SM Tower, 24th Floor, 979/69 Paholyothin Road, Samsen Nai, Phayathai, Bangkok-10400, Thailand
Tel:	+66 (0) 2298 0681 – 92
Email:	senaka_basnayake@adpc.net
Website:	www.adpc.net

CAF2014-RR02NMY-SINGH

Developing and Promoting a People-Centred Approach to Assess and Address Impacts of Climate Change-Induced Loss and Damage

Harjeet Singh[1]
[1]Corresponding Author
ActionAid International, New Delhi, India
Email: harjeet.singh@actionaid.org

Project Objectives

ActionAid International has started with the implementation of this project in Bangladesh, Cambodia, Myanmar, Nepal and Viet Nam to make communities and policy makers aware of the challenges posed by climate change-induced loss and damage (L&D) and failing adaptation strategies. By pointing out the urgency, the project will also propose an approach that addresses avoidable L&D through effective Disaster Risk Reduction (DRR) and Climate Change Adaptation (CCA) strategies of tackling underlying causes and developing appropriate approaches to address residual and unavoidable L&D. As this is an emerging field of work, it requires that relevant methodologies and approaches are developed and tested to assist policy makers and build the capacity of vulnerable communities, governments, development practitioners and other stakeholders. This project will develop and test a methodology to assess L&D vis-à-vis different hazards and impact scenarios and document examples of a range of approaches to address it.

Upcoming Project Activities

The project officially started with the project inception meeting in Dhaka on 19th and 20th August 2014. ActionAid Bangladesh hosted the meeting and one collaborator from other project countries of Nepal, Viet Nam, Myanmar and Cambodia, participated along with other collaborators - Manu Gupta of Asia Disaster Response and Risk Reduction Network (ADRRN) and Sanjay Vashist of Climate Action Network - South Asia (CANSA).

In December and January, the five country offices will each do a mapping of relevant institutions and agencies in their respective countries and invite them to support in the development of a L&D assessment methodology. Meetings will be convened between scientists, practitioners and community members on DRR, CCA and L&D to jointly develop impact scenarios based on scientific temperature rise predictions.

The national research fellows and local partner organisations will then move on to a next phase whereby desktop research will be undertaken to collect country-specific scientific data. With the help of guidelines and a questionnaire, assessments will be done in a total of seven villages in the five countries. These villages have been selected taking into account various geo-climatic zones as well as the established relationship of ActionAid country offices with the community. The field work will result in detailed case studies of the seven villages capturing various impact scenarios and possible approaches. It is expected that the case studies will help to develop generic methodology to assess L&D under different impact scenarios and develop approaches to address it.

Upcoming Publication

Generic methodology to assess L&D under different impact scenarios and develop approaches to address it is to be published in the second year of the project.

HIGHLIGHTS

- Forums will take place to bring together scientists, practitioners and community members on DRR, CCA and L&D to jointly develop impact scenarios.
- An assessment methodology to establish the level of L&D will be developed and tested.
- Approaches to address L&D will be proposed at the end of the project.

Community-based disaster risk reduction project collects data from women in Central Asia (Photo: Luke Bostian, Flickr CC BY-NC 2.0).

PROJECT INFORMATION

Title:	Developing and Promoting a People-Centred Approach to Assess and Address Impacts of Climate Change-Induced Loss and Damage
Duration:	Year 1 of a three-year project
Total Funding:	US$ 105,000
Project Leader:	Mr. Harjeet Singh
Full address:	ActionAid International, PostNet Suite 248, Private Bag X31, Saxonwold 2132, Johannesburg, South Africa
Tel:	+91 98100 36864 and +44 78720 33547
Email:	harjeet.singh@actionaid.org
Website:	http://www.actionaid.org/

CAF2014-RR03NMY-PEREIRA

Integrating Climate Change Adaptation, Disaster Risk Reduction and Loss and Damage to Address Emerging Challenges due to Slow Onset Processes

Joy Jacqueline Pereira[1], Juan Pulhin, Nguyen Van Thang, Chhinh Nyda, Tun Lwin and SVRK Prabhakar

[1]Corresponding Author

Southeast Asia Disaster Prevention Research Initiative–Universiti Kebangsaan Malaysia (SEADPRI–UKM), Malaysia

Email: pereirajoy@yahoo.com, joy@ukm.edu.my

Introduction

The Asia-Pacific Network for Global Change Research (APN) awarded a research grant for the project entitled "Integrating Climate Change Adaptation, Disaster Risk Reduction and Loss and Damage to Address Emerging Challenges due to Slow Onset Processes" in 2014. The project brings together distinct groups of biophysical and socio-economic scientists to leave a legacy of enhanced capability and collaboration in multidisciplinary research that links disaster risk reduction (DRR), climate change adaptation (CCA) and loss and damage (L&D) whilst fulfilling the goals of APN.

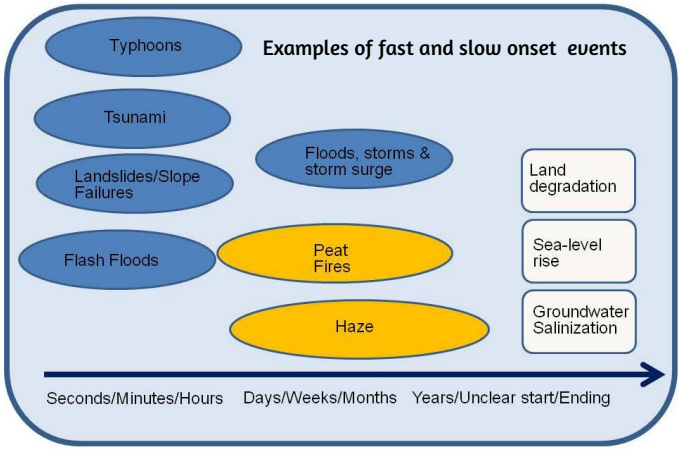
Project Objectives

The project involves researchers, policy makers and practitioners from various disciplines and brings their expertise to bear on specific areas via local level pilots. The objectives are as follows:-

- Identify characteristics, priorities and emerging issues related to slow onset processes in low-lying coastal areas, floodplains and highlands of Southeast Asia that impacts the livelihood and well-being of the communities therein;
- Assess limits to adaptation based on the "best available science" and propose risk based approaches that integrate climate change adaptation and disaster risk reduction;
- Develop methodologies to evaluate prospective loss and damage (both economic and non-economic) associated with adverse and cascading impacts of climate change drawing on lessons from disaster risk management, and discerning natural and anthropogenic causes of climate change; and
- Recommend policy and planning strategies to integrate climate change adaptation, disaster risk reduction and loss and damage in development plans in line with existing governance systems.

Arrangements and Future Expectations

There are six countries involved in this project: Malaysia, Cambodia, Myanmar, Philippines, Viet Nam and Japan. A local level pilot will be selected in each of the five countries in Southeast Asia. Information will be drawn from previously completed and ongoing studies funded by multiple sources and primary surveys. Knowledge on economic and non-economic valuation will come from Japan and ongoing projects funded by APN.



The project is expected to yield research reports, policy briefs, synthesis reports, peer-reviewed journal articles, book chapters and proceedings as well as brochures in local languages. Side events at national meetings will facilitate information dissemination and interaction of team members with National Focal Points for DRR and CCA. Outreach will be expedited through participation at international events and web-linkages.

Project members have had their inception meeting on the sidelines of the Asia Pacific Adaptation Forum 2014 held in Kuala Lumpur from 1-3 October 2014. The Forum served as an opportunity for capacity building and also enabled the presentation of preliminary findings by respective partners.

Acknowledgements

Project members would like to thank APN for the grant. They also acknowledge the support of their respective institutions: Universiti Kebangsaan Malaysia, University of The Philippines Los Banos, Vietnam Institute of Meteorology, Hydrology and Environment (IMHEN), Royal University of Phnom Penh, Myanmar Climate Change Watch and Institute for Global Environmental Strategies (IGES), Japan.

HIGHLIGHTS

- » Researchers, policy makers and practitioners from various disciplines will bring their expertise to bear in specific areas.
- » Local level pilots will be conducted in Malaysia, Cambodia, Myanmar, Philippines and Viet Nam.
- » Team members will interact with National Focal Points for DRR and CCA.

PROJECT INFORMATION

Title:	Integrating Climate Change Adaptation, Disaster Risk Reduction and Loss and Damage to Address Emerging Challenges due to Slow Onset Processes
Duration:	Year 1 of a three-year project
Total Funding:	US$ 140,000
Project Leader:	Prof. Joy Jacqueline Pereira
Full address:	SEADPRI-Universiti Kebangsaan Malaysia, Institute for Environment and Development, 43600 Bangi Selangor, Malaysia
Tel:	+6-012-9331722
Email:	pereirajoy@yahoo.com / joy@ukm.edu.my
Website:	www.ancst.org/apn

CAF2014-RR04NMY-THOMALLA

An Analysis of Longer-Term (5-10 Years) Recovery following Major Disasters in the Asia-Pacific Region: Lessons for Resilient Development

Dr. Frank Thomalla[1]
[1]Corresponding Author
Stockholm Environment Institute-Asia Centre, Bangkok, Thailand
Email: frank.thomalla@sei-international.org

Brief Introduction of the Project

The aim of this project is to undertake a critical analysis of the longer-term recovery process in five selected case studies of disasters that occurred in the Asia-Pacific Region during the last ten years: the 2008 Cyclone Nargis (Myanmar), the 2011 Bangkok floods (Thailand), the 2001 Mekong Delta Floods (Viet Nam and Cambodia), and the 2004 Indian Ocean Tsunami (Indonesia). The project will generate insights that will improve our understanding of the types of transformations required in societies at risk from natural hazards and climate change impacts in order to become more resilient to such risks. Specific research objectives include: the identification of disaster loss and damage 'systems', an evaluation of the performance of recovery efforts against stated formal objectives, and an identification of the greatest achievements and challenges in building disaster resilience over a 5-10 year time period.

Work Undertaken and Results to Date

The project was kicked off with a presentation given by project collaborator, Louis Lebel, at the Asia Pacific Forum on Loss and Damage workshop hosted by APN, ICCCAD and IIED in Kuala Lumpur, Malaysia on 30 September 2014. This workshop coincided with the Asia-Pacific Climate Change Adaptation Forum, co-organised by APAN, in which several SEI researchers also attended. An additional meeting was held between SEI and ICCCAD's Saleemul Huq and Stephanie Andrei in Bangkok, Thailand to discuss the current state of knowledge on loss and damage (L&D).

Following these events, a two-day inception workshop was at held at SEI-Asia Centre's office in Bangkok on 18-19 November with the project leader and all project collaborators. The workshop allowed the case study leaders to exchange research ideas and develop individual case study plans. A detailed set of protocols for conducting literature reviews, case study research and key informant interviews, and a key terminology list, were further developed and finalised at the workshop. In order to facilitate the exchange of information and resources, a shared Zotero library (based on a comprehensive literature review) and Dropbox folder containing project documents is now accessible for all project members.

In order to showcase the research being carried out for this project, an article has been submitted to Outreach Magazine under the theme 'Disasters, security and loss and damage,' which will be circulated at the UNFCCC COP20 in Lima, Peru on 3 December 2014. To provide more information to interested stakeholders, a project webpage has now also been established on SEI's website.

The Tonle Sap in Cambodia is the largest freshwater lake in Southeast Asia and is an ecological hotspot designated as a UNESCO biosphere reserve in 1997 (Photo: CGIAR Climate/Flickr CC BY-NC-SA 2.0).

Project Publications

Louis, L. (2014). Analysis of longer-term recovery following disasters: opportunities for collaboration and methodological issues [PowerPoint presentation]. Presented at Loss and Damage Workshop, Asia Pacific Forum on Loss and Damage, Kuala Lumpur, Malaysia. 30 September 2014.

Thomalla, F. (Under review). Taking a longer view of recovery in the world's most disaster-prone region. Outreach Magazine. Stakeholder Forum for a Sustainable Future.

HIGHLIGHTS

- Presented at the Asia Pacific Forum on Loss and Damage workshop in Kuala Lumpur, Malaysia, 30 September 2014.
- Hosted a two-day inception workshop with the project leader and all project collaborators in Bangkok, Thailand, 18-19 November 2014.
- Developed key project documents, including: Protocols for literature reviews, case study research and informant interviews, and a key terminology list.
- Finalised sub-contracts for all case study leaders.
- Submitted article to Outreach magazine under the theme 'Disasters, security and loss and damage' to be published at COP20 (UNFCCC) on 3 December 2014.

PROJECT INFORMATION

Title:	An Analysis of Longer-term (5-10 years) Recovery following Major Disasters in the Asia-Pacific Region: Lessons for Resilient Development.
Duration:	Year 1 of a two-year project
Total Funding:	US$ 90,000
Project Leader:	Dr. Frank Thomalla
Full address:	15th Floor, Witthyakit Building, 254 Chulalongkorn University, Soi Chula 64, Phyathai Road, Pathumwan Sub-district, Pathumwan District, Bangkok 10330, Thailand
Tel:	Tel: +66 (0)2 251 4415 (ext. 108)
Email:	frank.thomalla@sei-international.org
Website:	http://www.sei-international.org/

CAF2014-RR05NMY-LASCO

Assessing the Linkages between Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and Loss and Damage (L&D)

Rodel Lasco[1]

[1]Corresponding Author

The Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Reduction Foundation, Inc., Philippines

Email: rlasco@omlopezcenter.org

Background

Climate-related disasters are common phenomena in Southeast Asia, more particularly in Cambodia, Indonesia, Philippines, Thailand, and Viet Nam. Most of the major cities in these countries are concentrated in low-lying areas making them vulnerable to these events, more particularly flooding. In recent years, these areas including Manila, Bangkok, Hanoi, Jakarta, and Siem Reap have experienced severe flooding as influenced by monsoon and tropical cyclones causing billions worth of damages to infrastructure (urban and rural), agriculture (including loss of livelihoods) and private properties (Maiti, 2007). Maiti further argued that most countries in Southeast Asia do not have established systems to assess economic loss and damage (L&D), especially in the agriculture sector.

From 2007 to 2011, the estimated damages from floods in six countries of Southeast Asia amounted to almost 4.7 billion US dollars. During these years, 31% and 28.7% of flood events occurred in the Philippines and Indonesia, respectively (Kouadio et al., 2012). The Philippines, Mekong River delta region of Vietnam, Cambodia and Thailand were among the most vulnerable areas in Southeast Asia (Yusuf & Francisco, 2009). The projected changes in climate are expected to worsen the impacts of climate-related disaster events.

Objectives

The main objective of this collaborative project is to assess the linkages between CLimate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and L&D in the low-lying coastal cities of Cambodia, Indonesia, Philippines, Thailand and Viet Nam. Through this project, we will:

- Review existing frameworks for assessing loss and damage due to climate-related disasters;
- Identify emerging issues, gaps and opportunities in linking CCA, DRR and L&D assessment;
- Develop a robust framework in linking CCA, DRR and L&D assessment; and
- Recommend research and development (R&D) and policy-releavnt agendas for implementation.

Participating Countries

- Philippines – Dr. Rodel D. Lasco, Oscar M. Lopez Center for Climate Change Adaptation and Disaster Risk Management Foundation, Inc. (OML Center)
- Cambodia – Dr. Preap Visarto, Department of Agricultural Directorate, Ministry of Agriculture, Forestry and Fisheries (MAFF)
- Indonesia – Dr. Rizaldi Boer, Center for Climate Risk and Opportunity Management in Southeast Asia and the Pacific (CCROM-SEAP)
- Thailand – Mr. Suppakorn Chinvanno, Global Change System for Analysis, Research and Training (START)

HIGHLIGHTS

- » Communities continue to experience excessive losses of human lives and damages to valuable properties as well as serious injuries and major displacements due to various climate-related disasters worldwide.
- » CCA and DRR play a vital role in addressing loss and damage.
- » Lacking are studies on L&D, especially in relation to CCA and DRR.

- Viet Nam – Dr. Nguyen Huu Ninh, Center for Environment Research Education and Development (CERED)

Project Publications

Activity briefs will be produced after the national expert group meetings. Workshop proceedings from each country will also be prepared to aid the writing of the synthesis report. The synthesis report will include the results of related literature reviews, each country's workshop findings, and the proposed framework that links L&D with CCA and DRR.

References

Kouadio, I. K., Ghazi, H. F., & Aljunid, S. M. (2012). Human impact and financial loss of floods in Southeast Asia, from 2007 to 2011. *BMC Public Health, 12*(Suppl 2), A9. Retrieved from http://dx.doi.org/10.1186/1471-2458-12-S2-A9

Maiti, S. (2007). Defining a flood risk assessment procedure using community based approach with integration of remote sensing and GIS. International Institute for Geo-information Science and Earth Observation, The Netherlands. Retrieved from http://www.itc.nl/library/papers_2007/msc/iirs/maiti.pdf

Yusuf, A. A., & Francisco, H. (2009). Climate Change Vulnerability Mapping for Southeast Asia Vulnerability Mapping for Southeast Asia (pp. 1–26). Singapore.

PROJECT INFORMATION

Title:	Assessing the Linkages Between Climate Change Adaptation (CCA), Disaster Risk Reduction (DRR), and Loss and Damage (L&D): Case Studies in the Low-Lying Coastal Cities of Cambodia, Indonesia, Philippines, Thailand and Vietnam
Duration:	Year 1 of a two-year project
Total Funding:	US$ 80,000
Project Leader	Dr. Rodel D. Lasco
Full address:	36th Flr. One Corporate Center Bldg. Julia Vargas corner Meralco Avenue, Ortigas, Pasig City 1605 Philippines
Tel:	+63 2 982 2276
Email:	info@omlopezcenter.org
Website:	www.omlopezcenter.org

CAF2014-RR06-NMY(ARCP)-WANG

Integrated Flood Modelling and Pre-Disaster Loss Estimation in Asian Countries

Yi Wang[1], Srikantha Herath and Bin He
[1]Corresponding Author
United Nations University, Tokyo, Japan
Email: ywang@unu.edu

Introduction

Flood events are one of the most common and destructive disasters in the Asia-Pacific region and flood damage has shown increasing trends over the past few decades. Changes in climate and land use and expansion of cities have exacerbated economic loss and damage (L&D) to life and property with the escalation of extreme flood events, especially in the developing and less developing countries due to poor flood risk management practices, which includes effective flood early warning systems.

Japan, China, Thailand and Myanmar are four Asian countries with different geological conditions and varied economic development, yet all suffer from natural disasters frequently with flood disasters being the most common and major disasters. In Myanmar, flood associated with heavy precipitation events is a recurring phenomenon across the country. However, there is still a lack of knowledge in Myanmar regarding flood processes, flood characteristics analysis, and flood L&D estimation. It is also necessary to assess the implications on social and economic sectors in the country. Methodology and techniques for a comprehensive flood process analysis and flood L&D assessment in Myanmar are needed.

With currently observed changes to climate, it is important to have prior knowledge of expected loss in order to mobilise commitment to reduce future potential loss especially in developing and least developed countries. Decisions on disaster mitigation usually depend on cost estimation and benefits from actions taken, especially when budgets are limited and competitive. An estimate of loss from future floods is essential to prepare effectively for a disaster and facilitating good decision-making at local, regional, state and national levels of government. Flood loss estimates can also be used to evaluate the cost effectiveness of alternative approaches to strengthening flood control measures.

This research proposes to test methodology (Figure 1) developed in Japan on flood analysis combined with flood loss estimation in China and Thailand. The tested pre-disaster loss estimation model for floods will be suitably modified and supplemented for Myanmar to develop the country's flood disaster risk management and prevention strategy under future climate change scenarios. Myanmar can benefit from such knowledge and experiences to develop an appropriate flood analysis system and flood loss estimation methodologies that can help develop comprehensive flood management strategies.

Work Undertaken to Date

- August 2014: Pre meeting in United Nations University and University of Tokyo, Japan.
- Project planning and preparation, including development of action plans, activities and task assignments of collaborators.
- November 2014: Project Inception Workshop in Yongon, Myanmar – The first inception workshop with the Department of Meteorology and Hydrology, Myanmar, to discuss project activities in Myanmar.

HIGHLIGHTS

- Conduct a comprehensive flood process analysis and flood L&D assessment.
- Test the methodology developed (in Japan) on flood analysis combined with flood loss estimation.
- Develop comprehensive flood management strategy in a rapidly developing landscape under changing climate.

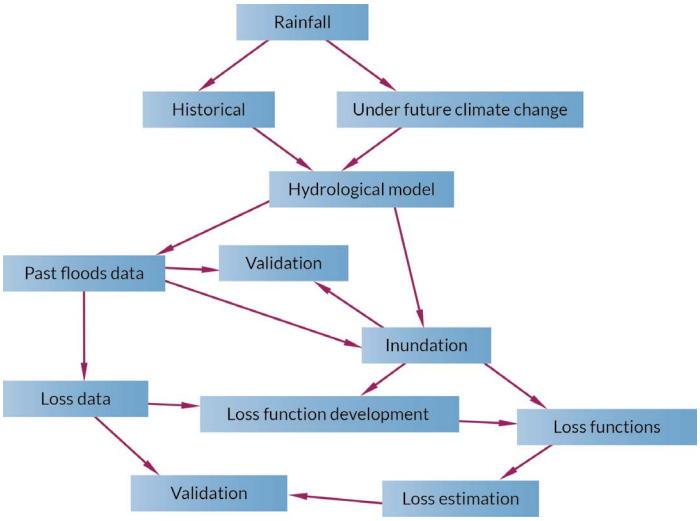


Figure 1. *Flow chart of the flood analysis and damage estimation process used in the project.*

Acknowledgements

- The United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS)
- Asian Disaster Preparedness Center (ADPC)
- Chinese Academy of Sciences (CAS)
- Department of Meteorology and Hydrology, Myanmar (DMH)

PROJECT INFORMATION

Title:	Integrated Flood Modeling and Pre-Disaster Loss Estimation in Asian countries
Duration:	Year 1 of a three-year project
Total Funding:	US$ 120,000
Project Leader:	Dr. Yi Wang
Full address:	UNU, 5-53-70 Jingumae, Shibuya-ku, Tokyo 150-8925, Japan
Tel:	+81 (0)3 3499 2828 /+81 (0)3 3406 7347
Email:	276825916O@qq.com; ywang@unu.edu

CAF2014-RR07NMY-LOTIA

Methods Toolbox for Assessing Loss and Damage at Local Level

Hina Lotia[1]

[1]Corresponding Author

General Manager, Programme Development Department, Leadership for Environment and Development (LEAD), Pakistan

Email: hlotia@lead.org.pk

Introduction

Loss and damage (L&D) refers to impacts of climatic stressors that cannot be or have not been avoided through mitigation, adaptation and disaster risk management (Warner & van der Geest, 2013). Between 1970 and 2012, 8832 disasters, including droughts, floods, windstorms, tropical cyclones, storm surges, extreme temperatures, landslides and wildfires, resulted in 1.94 million deaths and USD 2.4 trillion in economic losses globally (WMO, 2014). Besides the havoc caused by sudden-onset events, there is enormous L&D from slow-onset processes, such as sea level rise and desertification. Despite the emergence of the topic in recent years, comprehensive methods for assessing L&D are lacking.

The Toolbox

With funding from APN, UNU-EHS, LEAD-Pakistan, AIDMI (India), IDS-Nepal and KEI (Republic of Korea) will develop and test a toolbox for assessing L&D at the local level. The 2-year project will be implemented in three stages: 1) development of the toolbox; 2) testing of the toolbox in Pakistan, India and Nepal; and 3) fine-tuning, publication and dissemination of the final handbook, with lessons learnt from the test case studies. Besides providing a firm theoretical basis, the handbook will include guidance on site selection, training of field staff, budget considerations, analysis of results, etc. Moreover, it will provide hands-on research tools, such as questionnaires and topic lists for focus group discussions and key informant interviews.

The Training

From 27-31 October 2014, a five-day training course took place at LEAD Pakistan, and was attended by the principal investigators under this project. The objectives of the workshop were to:

- Familiarise the investigators with the conceptual framework and the methods;
- Introduce and justify the study sites where the toolbox will be tested, and the climatic stressors and impacts the studies will focus on;
- Refine the methodology, based on feedback and discussions.

On day one, a discussion took place on the objectives of assessing L&D and whether the focus should be on informing compensation for climate change impacts or on supporting policy and action to minimise future L&D. Considering that compensation is quite controversial and the science of attribution is still in its infancy (James et al., 2014), it was decided that the main policy objective of the toolbox should be to support action to minimise future L&D in vulnerable communities.

Next Steps

The workshop focused mainly on capacitating the principal investigators on the methods for assessing L&D in vulnerable communities. This will benefit them in the next few months to conduct high-quality research in the selected sites. Valuable feedback and hands on experience from the three target countries helped refine the toolkit. Based on the site selection guidelines in the handbook, LEAD Pakistan decided to study impacts from floods in Rajanpur (Punjab); AIDMI will study impacts from cyclones in Puri District (Odisha); and IDS-Nepal will focus on L&D from a landslide in Sindhupalchowk District. The lessons learnt from these case studies will contribute to the final toolkit for assessing loss and damage which will be published by late 2015.

References

IPCC (2014). Climate change 2014: Impacts, Adaptation, and Vulnerability. Summary for policy makers. Retrieved from http://www.ipcc.ch/report/ar5/wg2/

James, et al. (2014). Characterizing loss and damage from climate change. *Nature Climate Change, 4*: 938-939.

Warner, K. & van der Geest, K. (2013). Loss and damage from climate change: Local-level evidence from nine vulnerable countries. *International Journal of Global Warming, 5* (4): 367-386.

World Meteorological Organization (2014). Atlas of Mortality and Economic Losses from Weather, Climate and Water Extremes (1970-2012).

PROJECT INFORMATION

Title:	Methods Toolbox for Assessing Loss and Damage at Local Level
Duration:	Year 1 of a two-year project
Total Funding:	US$ 82,000
Project Leader:	Ms. Hina Lotia
Full address:	LEAD Pakistan, LEAD House, F-7 Markaz, Islamabad, 44000, Pakistan
Tel:	+92 51 2651511
Email:	hlotia@lead.org.pk
Website:	http://www.lead.org.pk/

HIGHLIGHTS

- » L&D refers to impacts of climatic stressors that cannot be or have not been avoided through mitigation, adaptation and disaster risk management.
- » UNU-EHS has developed a draft toolbox for assessing L&D at the local level.
- » Early 2015, the toolbox will be tested in vulnerable communities in Pakistan, India and Nepal.
- » Late 2015, after integrating lessons learnt from the test case studies, the toolbox will be published and disseminated for wider use.

CAF2014-RR08NMY-CHIBA

Addressing Non-Economic Loss and Damage Associated with Climate Change: Learning from Recent Past Extreme Climatic Events for Future Planning

Yohei Chiba[1], Sivapuram V.R.K. Prabhakar, Ainun Nishat, Sangam Shrestha and Ajinder Walia
[1]Corresponding Author
Institute for Global Environmental Strategies, Japan
Email: y-chiba@iges.or.jp

Why addressing Non-Economic L&D is important?

Loss and damage (L&D) associated with climate change, including extreme and slow-onset events, are likely to increase, especially with "non-economic factors and the inter-linkages of phenomena leading to cascading, transnational effects" (UNFCCC, 2012). Non-economic losses in the context of climate change "can be understood as losses of, inter alia, life, health, displacement and human mobility, territory, cultural heritage, indigenous/local knowledge, biodiversity and ecosystem services," and "occur in three distinct areas: private individuals, society and the environment" (UNFCCC, 2013).

Experience of the study team suggests that unreported non-economic L&D could constitute as much as 50% or more of the reported economic L&D. "In many developing countries, non-economic losses may well be more significant than economic losses," and "recognizing and managing the risk of non-economic loss should therefore be a central aspect of climate change policy" (UNFCCC, 2013). In general, non-economic damages have often not been taken into consideration in most risk assessments both climatic and non-climatic in nature, and in designing insurance and compensation mechanisms (UNISDR, 2010; Hoffmaister and Stabinsky, 2012) and the non-economic losses have often not been reported in most post-disaster reports and databases (Swiss Re, 2012).

How Non-Economic L&D is factored in?

The international disaster database on EM-DAT, as an example, records the economic impact of a disaster, economic damages such as direct consequence (e.g., damage to infrastructure, crops, housing, etc.) and indirect consequence (e.g., loss of revenue, unemployment, market destabilisation), on a monetary basis (EM-DAT, 2014). In addition, some types of non-economic losses such as the numbers of persons killed, the numbers of persons injured, and the number of persons homeless or affected, are reported. However, other considerable non-economic losses such as L&D to cultural heritage, indigenous/local knowledge, biodiversity and ecosystem services have not been reported. On the contrary, the number of indicators reported at the national level varies considerably between a developed country and developing countries (Table 1). Part of the problem has been the difficulty in estimating non-economic damages (Tol and Fankhauser, 1998) and lack of proper recognition of traditional value systems among stakeholders engaged in disaster risk reduction (DRR).

Database	No. of indicators reported	
	Economic	Non-economic
EM-DAT	1	5
Japan (Database covering natural disasters during 2003-2011)	10	5
Bangladesh (database covering floods, cyclones and landslides)	8	3

Table 1. Number of economic and non-economic L&D indicators reported at various international and national disaster reporting databases.

Overview of the Research

The research intends to study non-economic L&D associated with climate change through case studies of recent climatic extreme events in Bangladesh, India, Japan, Philippines and Thailand. The research will have three components:

- Develop an assessment framework, where structured questionnaire surveys with key indicators can be implemented in a participatory manner to identify, prioritise and measure non-economic L&D from climatic disasters, as well as expert consultations, focused group discussions and associated quantitative analytical techniques;
- Identify best practices for measuring non-economic L&D, and existing DRR and CCA measures, with a focus on financial instruments to assess the extent to which non-economic L&D can be considered in designing these responses; and
- Develop policy-relevant guidelines for strengthening DRR and CCA plans and policies at national and sub-national levels to address non-economic L&D.

HIGHLIGHTS

- » Non-economic L&D associated with climate events are not often considered in most risk assessments and post-disaster reports and databases.
- » Issues such as lack of proper recognition among stakeholders engaged in DRR for value that society attaches to non-economic L&D is compounded by a lack of simple methods to quantify and report non-economic L&D.
- » Project aims to develop an assessment framework and identify methodologies to prioritise, measure and report non-economic L&D in key vulnerable sectors.

Acknowledgements

We thank the Asia-Pacific Network for Global Change Research (APN) for funding this project.

PROJECT INFORMATION

Title:	Addressing Non-Economic Losses and Damages Associated with Climate Change: Learning from the Recent Past Extreme Climatic Events for Future Planning
Duration:	Year 1 of a two-year project
Total Funding:	US$ 80,000
Project Leader:	Mr.Yohei Chiba
Full address:	Institute for Global Environmental Strategies, 2108-11, Kamiyamaguchi, Hayama, Kanagawa, 240-0115, Japan
Tel:	+81 46 855 3772
Email:	y-chiba@iges.or.jp
Website:	http://www.iges.or.jp/en/natural-resource/ad/landd.html

CAF2014-RR09NMY-HUONG

Climate Change Risk Assessment and Adaptation for Loss and Damage of Urban Transportation Infrastructure (UTI) in Southeast Asia (SEA)

Lam Vu Thanh Noi[1], Cao Thi Thu Huong, Richard T. Cooper and Tran Quang Minh, Spoann Vin

[1]Corresponding Author

Director of Environment and Climate Change Centre, Sub-Institute of Transport Sustainable and Environment Research Institute of South Viet Nam, Ho Chi Minh City, Viet Nam

Email: lamuem1980@gmail.com

Introduction

Climate change (CC) is likely to negatively impact urban transportation infrastructure (UTI) in Southeast Asia, and it is important to improve our knowledge concerning CC loss and damage (L&D), and also appreciate the interconnections between hazards, vulnerabilities and adaptive capacity. Presently, there are few practical approaches for determining L&D with regard to UTI in the context of CC and increasing urbanisation. Effective management of UTI is a challenging task, with limited knowledge on how to integrate suitable adaptation measures and strategies into urban transport planning at the local (i.e., city and community) level. New knowledge gained from CC risk assessments will help decision makers to better incorporate CC adaptation into more resilient UTI management. This project aims to enhance CC adaptive capacity through cooperative research on assessing L&D for UTI, including development of practical guidelines for implementing adaptation measures and strategies in Southeast Asia coastal cities of Viet Nam, Thailand and Cambodia.

Methodology

The project considers CC-related disaster risk as a function of the interaction between hazards, vulnerability, and adaptive capacity.

Work Undertaken and Results to Date

The project duration is two years with project objectives: (i) characterising CC-related hazards in Cambodia, Viet Nam and Thailand; and (ii) selecting study areas (cities) for conducting UTI CC risk assessments. Current research progress and immediate future activities are outlined below.

- Literature reviews and data collection were the focus of the first couple of months of project implementation in all three countries.
- In Hoi An, Viet Nam, field work and meetings were held in November 2014. The Hoi An meeting invited the Hoi An Peoples Committee Chairman, and experts from Urban Transport Management Department, Planning and Finance Department, Economic Department, and Environment and Nature Resource Department (see photos). Each department presented information related to CC impacts on UTI.
- The research team will collect data in Vinh Long, Viet Nam, in December 2014, and classify UTI types in each of the two studied cities, identifying assets and inventories for each type of UTI, as well as conducting rapid vulnerability assessment for L&D in Hoi An and Vinh Long (planned completion date of April 2015).
- Field trips for data collection in Thailand and Cambodia will take place after site visits in Viet Nam to refine data collection needs and methodological details. However, secondary data collection is ongoing, including for Samut Sakhon and Hua Hin in Thailand (planned completion date of May 2015). Secondary geospatial data is being sourced from various government agencies in Thailand, including the Departments of Irrigation, Mineral Services, Land Development, and the Geo-Informatics and Space Technology Development Agency (GISTDA).
- Selected study sites in Cambodia are Sihanoukville and Kampot. The research team will collect data in these cities in late 2014/early 2015. Rapid vulnerability assessment for loss and damage of will be conducted from February to May 2015.

HIGHLIGHTS

- Facilitate sharing of climate change risk-related knowledge among stakeholders by bringing effective L&D assessment tools and techniques for UTI planning and management to local governments, transportation organisations and other agencies.
- Enhance the understanding of decision makers on CC adaptation that will subsequently allow for integration of climate change adaptive measures and strategies into the urban transportation sector.
- Increase awareness of climate change impacts concerning L&D of UTI, and adaptation measures for increasing the effectiveness of local governments in urban transportation sector development and investment planning.

Acknowledgements

The study team would like to send our sincere thanks to APN for supporting research activities in Viet Nam, Cambodia and Thailand. We also appreciate the support of the People's Committee of Hoi An for data collection and facilitating project activities in Hoi An.

References

Urban Transport Management Department of Hoi An (2014). Report on current status of roads in Hoi An City. Hoi An, Viet Nam.

PROJECT INFORMATION FORM

Title:	Climate Change Risk Assessment and Adaptation for Loss and Damage of Urban Transportation Infrastructure (UTI) in Southeast Asia (SEA)
Duration:	Year 1 of a three-year project
Total Funding	US$ 80,000
Project Leader	Ms. Cao Thi Thu Huong
Full address:	Vice Director, Transport Sustainable Development and Climate Change Centre (TSDCC), TDSI Vice General Director, Transport Sustainable Development and Environment Research Institute (TERI), 162 Tran Quang Khai, Hoan Kiem, Ha Noi, Viet Nam
Tel:	+84 4 3935 1478
Email:	huongcaotdsi@gmail.com
Website:	https://www.linkedin.com/company/climate-change-risk-assessmen-of-urban-transportation-infrastructure-in-southeast-asia?trk=biz-companies-cym

OTHER APN ACTIVITIES 4

Climate Change Innovation and Resilience for Sustainable Livelihood

Madan Lall Shrestha[1], Jeeban Panthi, Dilli Bhattarai, Nir Krakauer
[1]Corresponding Author
The Small Earth Nepal (SEN), Nepal
Email: madanls@hotmail.com

Introduction and Objectives

Climate change is one of the most crucial environmental, social, and economic issues the world is facing today. Some impacts such as increasing heat stress, more intense floods, prolonged droughts, and rising sea levels have now become inevitable. Climatic extremes are becoming more frequent; wet periods are becoming wetter and dry periods are becoming dryer. However, people are able to describe the impacts faced by climate change but not the meaning of 'climate change'. The impacts are most severe for poorer countries and the time has come to plan and implement adaptive measures to minimise adverse impacts.

It is important to explore innovative ideas and practices in building resilience for sustainable development and livelihood, particularly in rural areas of developing countries, which are highly vulnerable to climate change. Climate innovation and technologies involve basic science and engineering as well as information dissemination, capacity building, and community organising. In this context, an International Conference on Climate Change Innovation and Resilience for Sustainable Livelihood was held in Kathmandu, Nepal from 12–14 January 2015 (Figure 1).

Conference Objectives

The objective of the conference was to provide a forum for researchers, students, scientists and policy planners to exchange ideas, communicate and discuss research findings and new advances in climate change innovations. The three-day conference focused on innovative approaches from the physical and social sciences to support economic development in mountain and lowland South Asia, which faces serious climate hazards along with food security, water, and soil management and environmental challenges of justice.

Conference Messages

- The Himalayas is one of the data-poor regions in the world, and there are two major factors contributing to data gaps: lack of measurements/observations; and not having a common platform to share the scattered data held by various agencies. There is a missing link between data producers and users. Planners and policy makers need past data as well as future scenarios and expert interpretation of what the numbers imply, therefore, it is very essential to establish a common data sharing platform for planning climate-resilient development strategies.
- Even if the currently still increasing greenhouse gas emissions end today, the atmosphere will continue warming for decades to come.
- Conference presenters stressed that we need to go for pluralistic approaches of climate resilience for mitigating impacts on people and ecosystems. Planetary and ecosystem services need to be explored and used properly.
- Not only science generates innovation, but local innovations exits that need to be explored, scaled up and replicated.
- It is essential to adopt a climate-smart approach of site-specific co-production of knowledge and co-creation of innovations merging scientists' facts and local indigenous knowledge for sustainable livelihood.

HIGHLIGHTS

- 250 participants from 27 countries.
- 75 oral, 55 posters, 11 stall exhibition, 2 plenary sessions and 2 panels.
- Identified gaps in data and information sharing among different sectors and highlighted the need for a common data sharing platform.
- Urged an all-stakeholder approach for co-creating sustainable livelihoods.

- There is a huge lack of institutional ability to disseminate information at local and central levels. It is essential to translate scientific facts to users' language, which is a major challenge.
- Scalability, diffusion, adoption and capacity building should all be considered in research and development efforts.

Acknowledgements

The conference was a joint effort of The Small Earth Nepal (SEN), City University of New York (CUNY), Colorado State University (CSU), Department of Hydrology and Meteorology (DHM), Nepal Academy of Science and Technology (NAST), Nepal Agriculture Research Council (NARC) and Agriculture and Forestry University (AFU), Nepal. Several organisations have supported the conference technically and financially, including USAID/Livestock Innovation Lab, USAID/Hariyo Ban programme, ICIMOD, APN, and The World Academy of Science (TWAS).

Figure 1. Group photograph during the conference.

PROJECT INFORMATION

Title:	International Conference on Climate Change Innovation and Resilience for Sustainable Livelihood
Duration:	Six months
Total Funding:	US$ 5,000
Project Leader:	Dr. Madan Lall Shrestha
Full address:	626-Bhakti Thapa Sadak, Naya Baneshwor, Kathmandu, Nepal
Tel:	+977 1 4782738
Email:	madanls@hotmail.com
Website:	www.climdev15.org

APN Scientific Planning Group (SPG) Representatives

The SPG Members recommend the scientific programme, including proposals for funding and allocation of current available funding for consideration by the Inter-Governmental Meeting (IGM); works with the Steering Committee and the Secretariat in arranging scientific programme activities; and interacts on the APN's behalf with other international research programmes on global change. SPG Members also interact with the national Focal Point of their respective countries, the Secretariat, and the national and global change communities.

BANGLADESH
Md. Giashuddin MIAH
giash1960@gmail.com

BHUTAN
Peldon TSHERING
Peldon@nec.gov.bt

CAMBODIA
Veasna KUM
veasna_kum@yahoo.com

CHINA
Wenjie DONG
dongwj@bnu.edu.cn

INDIA
B.N. GOSWAMI
goswami@tropmet.res.in

INDONESIA
Erna Sri ADININGSIH
ernasri@lapan.go.id;
ernasri@yahoo.com

JAPAN
Kensuke FUKUSHI
fukushi@ir3s.u-tokyo.ac.jp

LAO PEOPLE'S DEMOCRATIC REPUBLIC
Chundara VIRASACK
sack_4369@yahoo.com

MALAYSIA
Fariza YUNUS
fariza@met.gov.my

MONGOLIA
Tsogtbaatar JAMSRAN
tsogtbaatarj@magicnet.mn;
geoeco@magicnet.mn

NEPAL
Madan Lall SHRESTHA
madanls1949@gmail.com

NEW ZEALAND
Andy REISINGER
andy.reisinger@nzagrc.org.nz

PAKISTAN
Amir MUHAMMED
amir.muhammed@nu.edu.pk;
amir.muhammed@gmail.com

PHILIPPINES
Henry ADORNADO
erdbco@yahoo.com;
hadornado@yahoo.com

REPUBLIC OF KOREA
Soojeong MYEONG
sjmyeong@gmail.com

RUSSIAN FEDERATION
Alexander STERIN
sterin@meteo.ru

SRI LANKA
Lalith CHANDRAPALA
meteo1@sltnet.lk

THAILAND
Jariya BOONJAWAT
jariya@start.or.th

UNITED STATES OF AMERICA
Luis M. TUPAS
ltupas@nifa.usda.gov

VIET NAM
Kim Chi NGO
chikimngo2@yahoo.com;
chikimngo2008@gmail.com

Invited Experts to Scientific Planning Group

AILIKUN
Director, International Program Office of Monsoon Asia Integrated Regional Study (MAIRS)
aili@mairs-essp.org

Lance Clive HEATH
Project and Business Development Manager, Climate Change Institute (CCI), Australian National University
lance.heath@anu.edu.au

Kanayathu Chacko KOSHY
Professor, Centre for Global Sustainability Studies, Universiti Sains Malaysia
kanayathu.koshy@gmail.com

Chao Han LIU
Chairman, Southeast Asia Regional Committee for START
chliu@cc.ncu.edu.tw

Subramaniam MOTEN
Former Director of Malaysian Meteorological Department
subra@met.gov.my

APN Secretariat
East Building, 4F
1-5-2 Wakinohama Kaigan Dori
Chuo-ku, Kobe 651-0073
JAPAN

Tel: +81 78 230 8017
Fax: +81 78 230 8018
Email: info@apn-gcr.org
Website: www.apn-gcr.org

Ministry for the Environment
Manatū Mō Te Taiao

United States Global Change Research Program