SEADPRI Series No. 1

LAYING THE FOUNDATION FOR ENHANCING CLIMATE CHANGE ADAPTATION IN SOUTHEAST ASIA

asean india
PROGRESS & PROSPERITY

seadpri
southeast asia disaster prevention research initiative

asean

APN
ASIA-PACIFIC NETWORK FOR
GLOBAL CHANGE RESEARCH

Universiti Kebangsaan Malaysia
The National University of Malaysia

Asian Network on
Climate Science and Technology
(ANCST)

ASEAN-India Project on
"Enhancing Climate Change
Adaptation in Southeast Asia" (Phase 1)

LAYING THE FOUNDATION FOR ENHANCING CLIMATE CHANGE ADAPTATION IN SOUTHEAST ASIA

Joy Jacqueline Pereira
Mohd Khairul Zain Ismail
Siti Khadijah Satari
Natalia Derodofa
Rocky Pairunan

Southeast Asia Disaster Prevention Research Initiative
Universiti Kebangsaan Malaysia (SEADPRI-UKM)

MAY 2015

asean india
PROGRESS & PROSPERITY

seadpri
southeast asia disaster prevention research initiative

asean

APN
ASIA-PACIFIC NETWORK FOR
GLOBAL CHANGE RESEARCH

Universiti Kebangsaan Malaysia
The National University of Malaysia

Asian Network on
Climate Science and Technology
(ANCST)

Suggested Citation: Pereira, J.J., Ismail, M.K.Z., Satari, S.K., Derodofa, N. and Pairunan, R. 2015. Laying the Foundation for Enhancing Climate Change Adaptation in Southeast Asia. SEADPRI Series No.1. LESTARI Publishers, Bangi, 69pp

Publisher:
Institute for Environment & Development (LESTARI)
Universiti Kebangsaan Malaysia
43600, UKM Bangi
Selangor

Printer:
UKM Cetak Sdn. Bhd.
Universiti Kebangsaan Malaysia
43600 Bangi
Selangor

Perpustakaan Negara Malaysia Cataloguing-in-Publication Data

Pereira, Joy Jacqueline, 1965-
LAYING THE FOUNDATION FOR ENHANCING CLIMATE CHANGE
ADAPTATION IN SOUTHEAST ASIA / Joy Jacqueline Pereira,
Mohd Khairul Zain Ismail, Siti Khadijah Satari, Natalia Derodofa,
Rocky Pairunan.
(SEADPRI Series No. 1)
ISBN 978-967-5227-74-5
1. Climate change--Southeast Asia.
2. Southeast Asia--Environmental conditions. I. Mohd Khairul Zain Ismail.
II. Siti Khadijah Satari. III. Natalia Derodofa. IV. Rocky Pairunan.
V. Title. VI. Series.
363.73874095

CONTENTS

FOREWORD

PROF. DR. MOHD. RAIHAN BIN TAHA
Director
Institute for Environment and Development (LESTARI)
Universiti Kebangsaan Malaysia

This document is a record of the Inception Workshop for the first phase of the ASEAN-India Project on "Enhancing Local Level Climate Change Adaptation in Southeast Asia". The project is being implemented by Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM) under the auspices of ASEAN and funded by the Government of India through the ASEAN-India Green Fund.

I am given to understand that this is the first project that has been approved under the ASEAN-India Green Fund and that the primary focus is on "Local Level Climate Change Adaptation". This is indeed timely as the recently released report of the Intergovernmental Panel on Climate Change (IPCC) states with a high level of confidence that adaptation is both place-specific and context-specific. There is no single approach for reducing risks which is appropriate across all settings or all countries or all local authorities for that matter. To be effective adaptation strategies should consider the linkages between vulnerability and exposure as well as socioeconomic processes and sustainable development. All these issue play out strongly at the local level.

I have been told that project partners involved in the workshop comprise both representatives of the ASEAN Working Group on Climate Change (AWGCC) National Focal Points and National Partner Organisations who are primarily from universities and research institutes – so you have both the government and a partner research organisation from each ASEAN country participating. This partnership is expected to continue throughout the project as the needs of ASEAN Member States for local level action oriented work is identified and a regional ASEAN-India climate change adaptation work programme is developed. The project is also expected to promote partnerships and incubate a network of climate change experts in all ASEAN Member States, who will interact with each other and their National Focal Points, to provide continuous inputs. Such partnerships are critical for managing the risks of climate change that has implications for future generations, economies and the environment. I take this opportunity to record our appreciation to the Government of India for their support in building this partnership within ASEAN.

PREFACE

PROF. NIJAVALLI H. RAVINDRANATH
India Project Coordinator
Indian Institute of Science (IISc)
Bengaluru, India

It is my great pleasure to thank the ASEAN Secretariat for their support and facilitation that has now resulted in the approval of the funding support from the ASEAN-India Green Fund for the ASEAN-India project on "Enhancing Local Level Climate Change Adaptation in Southeast Asia" (Phase 1), to be implemented by Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM) as the lead implementing agency with Professor Joy Jacqueline Pereira, Professor and Principal Research Fellow of SEADPRI-UKM, as the Project Coordinator from the ASEAN side.

Adaptation planning and implementation can be enhanced through complementary action across all levels, from individuals to governments. The role of national governments is to coordinate adaptation efforts of local and subnational governments. National governments can only facilitate adaptation, for example by providing information, policy and legal frameworks, and financial support to a very limited extent. Local governments, communities and the private sector have to play an increasingly important role in advancing climate change adaptation. I hope that through this project, the capacity of local governments and communities can be strengthened, and the potential for public-private participation can be critically examined and realised where feasible.

Adaptation is a means to build resilience and to adjust to climate change impacts. By enhancing capacity at the local level through this project, we are laying a sound foundation for ASEAN to be a resilient and sustainable community. We thank all Workshop participants for their inputs and thoughts. I hope that the project can capture some already existing good examples in the region, to be shared among the ASEAN Member states, and replicated where feasible.

PREAMBLE

Issues on adaptation and mitigation tend to be discussed separately in international platforms and this has great bearing on negotiations between governments. The reality is that at the local level, both the issues are interlinked and connected to sustainable development. We are all aware that there are many adaptation options that can help address climate change. By focusing on the local level there is an opportunity to implement integrated responses that link adaptation, mitigation, disaster risk reduction and other societal objectives related to sustainable development.

The Inception Workshop on Enhancing Climate Change Adaptation was held on 5-6 February 2015 in Bangi, Malaysia. The Inception Workshop comprised a capacity building session, a scene setting session and a focused discussion session to develop the terms of reference for the country scoping study. The capacity building session on Climate Impacts and Future Risks in Southeast Asia was organised in partnership with the Asia Pacific Network for Global Change (APN) and Asian Network on Climate Science and Technology (ANCST), drawing on experts from ASEAN and India. Local partners included the Ministry of Natural Resources and Environment (NRE) and the Ministry of International Trade and Industry (MITI).

This report documents the discussion at the workshop and includes presentation slides from speakers. The purpose is to further disseminate the body of work that was brought together to lay the foundation for enhancing climate change adaptation in Southeast Asia. The authors would like to record their utmost appreciation to Dr. Raman Letchumanan and India coordinator Prof. Nijavalli H. Ravindranath for their guidance in making the workshop a reality. The support of the ASEAN-India Green Fund and the facilitation of Dr. S. Satapathy and Mr. Nikhilesh Giri from the Government of India is also gratefully acknowledged. The capacity building session would not have been possible without strong support from national and international partners.

Joy Jacqueline Pereira
Mohd Khairul Zain Ismail
Siti Khadijah Satari
Natalia Derodofa
Rocky Pairunan

ACKNOWLEDGEMENT

- Mr. Chea Chan Thou, Ministry of Environment, Climate Change Department, Cambodia
- Mr. Cheb Hoeurn, Royal University of Phnom Penh, Cambodia
- Mr. Chea Leng, Paññāsāstra University of Cambodia, Cambodia
- Ms. Laksmi Rachmawati, Indonesian Institute of Sciences, Indonesia
- Mr. Vilakone Maniphousay, Ministry of Natural Resources and Environment, Lao PDR
- Mr. Amphayvanh Oudomdeth, Ministry of Natural Resources and Environment, Lao PDR
- Dato' Dr. Yap Kok Seng, Ministry of Natural Resources and Environment Malaysia
- Mr. Muhammad Ridzwan Ali, Ministry of Natural Resources and Environment Malaysia
- Ms. Koh Fui Pin, Ministry of Natural Resources and Environment Malaysia
- Dr. Saim Suratman, National Hydraulic Research Institute
- Prof. Dr. Joy Jacqueline Pereira, SEADPRI-Universiti Kebangsaan Malaysia
- Ms. Fara Azuin Amiruddin, Ministry of International Trade and Industry Malaysia
- Mr. Ibrahim Helmi Abdullah, Ministry of International Trade and Industry Malaysia
- Prof. Dr. Er Ah Choy, Universiti Kebangsaan Malaysia
- Prof. Khin Maung Cho, Myanmar Climate Change Watch, Myanmar
- Ms. Carmelita Passe, Environmental Management Bureau, Philippines
- Prof. Dr. Juan Pulhin Magboo, University of the Philippines Los Banõs, Philippines
- Dr. Raman Letchumanan, Nanyang Technological University, Singapore
- Mr. Andreas Schaffer, Nanyang Technological University, Singapore
- Mr. Srivatsan Vijayaraghavan, National University of Singapore, Singapore
- Ms. Sureeporn Kerdkankaew, Natural Resources and Environmental Policy and Planning, Thailand
- Ms. Bui Hoa Binh, Ministry of Natural Resources and Environment, Vietnam
- Ms. Le Thi Mai Thanh, Ministry of Natural Resources and Environment, Vietnam
- Mr. Tran Dinh Trong, Vietnam Institute of Meteorology, Hydrology and Climate Change, Vietnam
- Prof. Nijavalli H. Ravindranath, Indian Institute of Science, India
- Ms. Indu Krishnamurthy, Indian Institute of Science, India
- Mr. K.N. Ramachandran, High Commission of India, Kuala Lumpur
- Ms. Natalia Derodofa, ASEAN Secretariat
- Mr. Rocky Pairunan, ASEAN Secretariat
- Dr. Linda Stevenson, Asia-Pacific Network for Global Change Research (APN)
- Prof. Lord Julian Hunt, Asian Network on Climate Science and Technology (ANCST)

1. INTRODUCTION

The ASEAN-India Project on "Enhancing Local Level Climate Change Adaptation in Southeast Asia" (Phase 1) is implemented by Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM). Professor Joy Jacqueline Pereira of SEADPRI-UKM is the Project Coordinator from the ASEAN side and Prof. N.H. Ravindranath from the Indian Institute of Science (IISc) is the Project Coordinator from India. The objectives of the project are as follows:

- Conduct a needs assessment and scoping study in order to identify the needs of ASEAN Member States (AMS) in terms of climate change adaptation.
- Develop a regional ASEAN-India climate change adaptation work programme and network constituting Phase II and Phase III of the project.

Activities of the Project (Phase I) consists of an inception workshop and a final planning workshop, with the needs assessment and scoping study in between. Phase II and II of the project shall be developed in consultation with ASEAN Member States (AMS) during Phase I.

Arrangements

The Inception Workshop on Enhancing Climate Change Adaptation was held on 5-6 February 2015 in Bangi, Malaysia. The workshop was attended by about 30 participants (Appendix 1- participants list). Participants comprised representatives of the National Focal Points of the ASEAN Working Group on Climate Change (AWGCC) and Partner Institutions identified by the AWGCC National Focal Points as well as representatives of India's counterpart to the AWGCC and the ASEAN Secretariat.

The Inception Workshop comprised a capacity building session, a scene setting session and a focused discussion session to develop the terms of reference for the country scoping study (Appendix 2 – workshop programme). The capacity building session on Climate Impacts and Future Risks in Southeast Asia was organised in partnership with the Asia Pacific Network for Global Change (APN) and Asian Network on Climate Science and Technology (ANCST), drawing on experts from ASEAN and India. Local partners included the Ministry of Natural Resources and Environment (NRE) and the Ministry of International Trade and Industry (MITI). The presentation slides that are reproduced in this report is listed in Table 1.

Table 1: List of presentation slides reproduced in Appendices 3 and 4 of this report.

LIST OF PRESENTATIONS

1. Climate Impacts and Future Risks- Key Findings of the IPCC by Prof. Joy Jacqueline Pereira, page 17.
2. Climate Change and Human Security-Key Findings from IPCC AR5 by Prof. Juan M. Pulhin, page 20.
3. Forest and Climate Change-IPCC Findings by Prof. N. H. Ravindranath, page 23.
4. Inception Workshop-Climate Change Adaptation: Mobilizing the Private Sector by Mr. Andreas Schaffer, page 27.
5. ASEAN Experience on Climate Change Adaptation by Dr. Raman Letchumanan, page 32.
6. Impacts of Disasters on Agricultural Sector: A Case of Kampong Speu Province by Cheb Hoeurn, page 41.
7. Studies of Natural Disasters, Slow Onset Events and Loss & Damage in Quang Ngai, Vietnam by Mr. Tran Dinh Trong, page 43.
8. Loss and Damage Assessment on Land and Forest Degradation: Overview of the Philippines Study by Prof. Juan M. Pulhin, page 45.
9. Integrating DRR, CCA and L+D: Issue and Challenges in the Klang Valley by Prof. Joy Jacqueline Pereira, page 48.
10. Enhancing Local Level Climate Change Adaptation in Southeast Asia (Phase 1) by Prof. Joy Jacqueline Pereira, page 50.
11. Climate Change Adaptation Experience and Technology in India by Prof. N. H. Ravindranath, page 52.
12. Cambodia Major Activities Responding to Climate Change by Mr. Chea Chan Thou, page 59.
13. Climate Change Adaptation in Indonesia by Ms. Laksmi Rachmawati, page 62.
14. Priorities for Myanmar by Prof. Khin Maung Cho, page 63.
15. Regional Climate Modelling by Dr. Sri Raghavan, page 64.
16. Addressing Climate Change: The Philippines Experience by Ms. Carmelita M. Passe, page 66
17. Climate Change Adaptation in Vietnam by Le Thi Mai Thanh, page 68.

2. HIGHLIGHTS

In his opening remarks, Prof. Dr. Mohd Raihan Taha of the Institute for Environment and Development, representing Universiti Kebangsaan Malaysia thanked the Government of India for establishing the ASEAN-India Green Fund and focusing on enhancing local climate change adaptation in the region. By focusing at the local level there is an opportunity to implement integrated responses to link adaptation to mitigation and other societal objectives. He urged the project to capture already existing good examples in the region and replicate these where feasible. He also hoped that partnerships would be promoted and a network of climate change experts be established in all ASEAN Member States, interacting with each other and their National Focal Points to provide continuous inputs, beyond the life of the current project.

Climate Impacts and Future Risks in Southeast Asia

The capacity building session broadly covered three themes. These included key findings from the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC-AR5) relevant to the region,

climate change adaptation actions in ASEAN and selected local level studies in the region funded by the Asia-Pacific Network for Global Change Research (APN) (Appendix 3).

Key findings of the IPCC were presented by Coordinating Lead Authors Prof. Joy Jacqueline Pereira (SEADPRI-Universiti Kebangsaan Malaysia), Prof. Juan M. Pulhin (University of The Philippines Los Banõs) and Prof. N. H. Ravindranath (Indian Institute of Science, Bengaluru). Among the issues that were highlighted include the following:-

- Need to strengthen sharing of information and data on climate parameters to improve downscaled projections of extremes in the region;
- Need to improve monitoring of climate impacts (e.g. drought, degradation of forests and terrestrial ecosystems, etc.) and sharing of such information;
- Need for local level studies on the impact of climate change on livelihood, culture, identity, migration, etc. so that future human security issues can be addressed;
- Need to enhance scientific publications from the region in indexed peer reviewed literature, to make it accessible to the global community.

Climate change adaptation actions in the region focused on the private sector perspective presented by Mr. Andreas Schaffer (EOS, Nanyang Technological University) and ongoing actions by ASEAN shared by Dr. Raman Letchumanan (RSIS, Nanyang Technological University). Highlights include the following:-

- The involvement of the private sector in climate change adaptation projects has to be enhanced as many companies are at risk, in particular the food and beverage sectors;
- There are many barriers that need to be addressed to promote private sector participation and this includes mainstreaming of climate change adaptation and its integration in decision-making at the highest level of organizations;
- Climate change is a key issue in the Blueprint for the ASEAN Socio-Cultural Community (2009-2015) and priority actions have been identified including for adaptation and mitigation;
- The challenge is to identify key initiatives at the local level that focus on action oriented solutions and develop a work programme that meets the needs of ASEAN Member States, which would complement current programmes that address climate change in an implicit manner.

Four ongoing local level case studies funded by the APN Climate Adaptation Framework: Climate Change Adaptation, Disaster Risk Reduction & Loss + Damage were shared with the participants. The studies were presented by country team representatives Cheb Hoeurn (Royal University of Phnom Penh), Tran Dinh Trong, (Vietnam Institute of Meteorology, Hydrology and Climate Change), Prof. Juan Pulhin, (University of The Philippines Los Banõs) and Prof. Joy Jacqueline Pereira (SEADPRI-Universiti Kebangsaan Malaysia). Highlights include the following:-

- In Cambodia, Kampong Speu was the focus of study because it is a vulnerable province where there is a high incidence of poverty. Farmers are expected to face the impact of drought and local communities have limited understanding of related root causes and the potential disasters. The expected loss and damage is still under investigation but anticipated social problems include loss of livelihood, high rates of school drop-out and other aspects of social vulnerability.

- In Vietnam, the focus was on Quang Ngai province with very high incidences of typhoons, floods, riverbank and shoreline erosion, mountain landslide and flash floods. The coastal areas are also exposed to sea level rise, drought and saline intrusion. Loss and damage due to sea level rise is linked to fishery productivity, degradation of mangrove forests, saline intrusion in brackish and fresh water aquaculture zones, and inundation of transportation infrastructure.
- In The Philippines, the focus is on loss and damage associated with land and forest degradation in watershed areas in the Kanan Watershed, Quezon Province. The watershed is a key biodiversity area providing various provisioning, regulating, cultural and ecosystem support services, which is under pressure from increasing human activities. The plan is to examine cascading risks of land and forest degradation to selected ecosystem services using economic and non-economic methods.
- In Malaysia, assessment of loss and damage in the Greater Kuala Lumpur areas has identified several challenges. There is need to differentiate the natural and administrative boundaries and ensure that findings of physical science matches decision-making scales at the local level. A harmonised scale will facilitate recognition of cascading and slow onset hazards as well as identification of susceptible areas including the exposure of vulnerable communities at the local level. Availability of data is a challenge for assessment of loss and damage as well as detection and attribution related to extreme events.

3. SCENE SETTING FOR THE ASEAN-INDIA GREEN FUND PROJECT

The scene setting session commenced with a preamble from the Government of India. This was followed by an introduction to the project, experience of India and an overview of climate change adaptation in ASEAN Member States (Appendix 4).

The Focal Point of the ASEAN-India Green Fund, Dr. S. Satapathy conveyed his best wishes for the project through Prof. N.H. Ravindranath. Mr. K.N. Ramachandran, First Secretary of the High Commission of India in Kuala Lumpur attended on behalf of Mr. Nikhilesh Giri, who is the representative of Government of India to ASEAN. He took note of the very positive discussion and looked forward to a very successful collaboration between ASEAN and India. The Government of India looks forward to each ASEAN Member State having a centre of excellence on climate change adaptation, with a consortium of experts that can interact with each other and their counterparts in India. The participants were also informed that in addition to the current project, there are two workshops proposed, on climate modelling and monsoon modelling, to enhance capacity in the region.

The project on 'Enhancing Climate Change Adaptation in Southeast Asia' was introduced by the ASEAN Coordinator, Prof. Joy Jacqueline Pereira. The presentation by India Coordinator Prof. N.H. Ravindranath, highlighted "Climate Change Adaptation Experience and Technology in India" that is of relevance to the project. The series of country presentations focused on national priorities in the context of the project. Among aspects highlighted include the current status of the country's National Communication to the United Nations Framework Convention on Climate Change (UNFCCC) and National Adaptation Plans.

Mechanisms of interaction between National Focal Points, research institutes and universities were also mentioned. In some cases, key local-level issues in the country were introduced.

4. TERMS OF REFERENCE FOR COUNTRY SCOPING STUDY

The Terms of Reference for the country level scoping study was discussed in detail and finalized (Annex 1). The deadline for preliminary reports were agreed to and it was emphasized that local level short term (5-years) proposals for future work should be identified soonest possible to facilitate evaluation at the various levels within ASEAN and the Government of India. In conducting the country scoping study, the following aspects were highlighted:-

- Science Partners have the mandate to convene meetings within their countries, in conjunction with their Government Partners; and findings from the study, which could constitute proposals for common regional initiatives or unique national initiatives, will be part of the work programme for all ASEAN Member States and not be limited to support from any particular donor country.
- Recommendations for local level pilots should (i) be based on stakeholder consultation; (ii) focus on action oriented solutions that meets the needs of ASEAN Member States; (iii) leverage on national or sub-national budgets; (iv) feed into national or sub-national development plans; and (v) complement existing programmes within ASEAN.
- In identifying susceptible areas and exposed sectors, the emphasis should be on current climate variability and current vulnerability (inherent and external) so that coping strategies could be identified and capacity can be built to address adaptation deficit.
- There are many entry points for adaptation and the menu of approaches in ASEAN Member State needs to be documented to facilitate the development of a common framework using the best available science that meets local needs; this could be useful in developing a training module that is relevant to the region.

5. THE WAY FOWARD

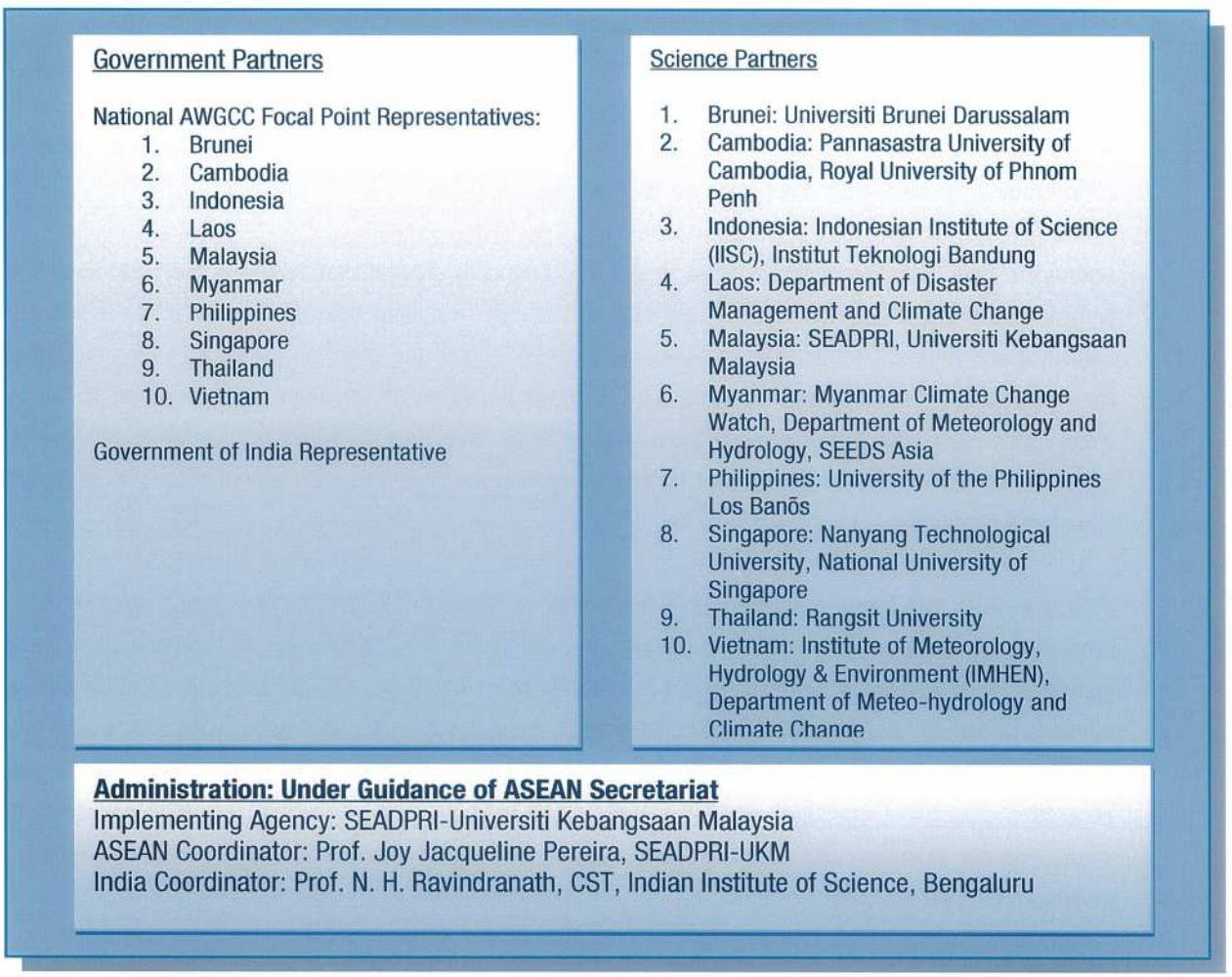
Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM) will serve as the implementing agency on behalf of ASEAN, reporting directly to the ASEAN Secretariat. Prof. Dr. Joy Jacqueline Pereira of SEADPRI-UKM, will lead the project team, in coordination with Prof. N. H. Ravindranath from the Centre for Sustainable Technologies (CST), Indian Institute of Science, Bengaluru, who has been appointed by the Government of India. SEADPRI-UKM will mobilize the teams comprising representatives from various institutions and representatives identified by ASEAN Member States (Figure 1). Key players are Government Partners comprising representatives of the National Focal Points of the ASEAN Working Group on Climate Change (AWGCC); Partner Institutions identified by the AWGCC National Focal Points and their collaborators, collectively referred to as Science Partners; as well as representatives of India's counterpart to the AWGCC and the ASEAN Secretariat. The next step is for SEADPRI-UKM to send an offer letter with the Terms of Reference for the Country Scoping Study (Annex 1) to Partner Institutions, whose response is to be endorsed by the AWGCC National Focal Points or their representatives.

Partner Institutions are expected to deliver the following three country reports as specified in the Terms of Reference:

- Preliminary Report on review of national documents: Deadline 1 May 2015
- Preliminary Report on vulnerable sectors and regions: Deadline 1 August 2015
- Preliminary Report on adaptation needs, priorities & pilots: Deadline 1 October 2015

Government and Science Partners will be involved in the Final Planning Workshop (October 2015) and preparation of the Synthesis Report (due on 1 December 2015).

Figure 1: Key players involved in the ASEAN-India Project



ENHANCING LOCAL LEVEL CLIMATE CHANGE ADAPTATION IN SOUTHEAST ASIA (PHASE I)
TERMS OF REFERENCE FOR COUNTRY SCOPING STUDY

INTRODUCTION

The Intergovernmental Panel on Climate Change Working Group II contribution to the Fifth Assessment Report (IPCC AR5) released on 31 March 2014 has identified ten key risks for Asia. Five are related to extreme climate events and its impacts on well-being and health linked to precipitation and high temperatures; two are related to food and water security; one is on exacerbated poverty and inequalities and creation of new vulnerabilities; while two key risks are related to biodiversity and ecosystem services. Vulnerability to climatic hazards is expected to increase, especially in island states and countries with long coastlines and low-lying areas, due to future climate risks that include increase in frequency and intensity of extreme events. The potential impacts on resources, ecosystems and human security in Southeast Asia have not been clearly identified and these are wide-ranging and may differ depending on country circumstances.

Southeast Asian countries must prepare to live in a changing climate particularly at the local or ecosystems level where impacts are felt directly and specific actions are most needed. Failure to do so can lead to exacerbated vulnerability, resulting in deprivation, displacement and even loss of lives in the medium to long term. Adaptation programmes will need to be planned based on inputs from pilot initiatives at the local or ecosystems level where key vulnerabilities are identified taking into account future conditions and existing capacity. Adaptation technology needs, priorities and the potential for green growth in this context will also have to be examined.

Good practices and policy-making that is facilitative, responsive and flexible to climatic changes has to be promoted. Coordinated action at the regional level can facilitate enhancement and exchange of knowledge gained at the local level. ASEAN can play a crucial role by initiating and coordinating a regional mechanism for implementation of adaptation responses in critical areas on a sustained basis. This can be done by (i) developing an action programme that identifies strategic actions and programmes for climate change adaptation based on local inputs and; (ii) establishing a regional mechanism that promotes sustained input of knowledge for actions on climate change adaptation into policy and planning processes to promote green growth and sustainable development.

OBJECTIVES

The main objective of the project on Enhancing Local Level Climate Change Adaptation in Southeast Asia (Phase 1) is as follows:

- Conduct a needs assessment and scoping study in order to identify the needs of ASEAN Member States (AMS) in terms of climate change adaptation.
- Develop a regional ASEAN-India climate change adaptation work programme and network constituting Phase II and Phase III of the project.

The activities of the Project (Phase I) shall consist of an inception workshop and a final planning workshop, with the needs assessment and scoping study in between. Phase II and II of the project shall be developed in consultation with ASEAN Member States (AMS) during Phase I.

SCOPE OF WORK

The scope of work for country teams encompasses the following:-

1. Review of national documents on adaptation actions including local situation and priorities (where available).
2. Assessment of scientific literature to identify impact of climate variability and change on various sectors (agriculture, water resources, forests and biodiversity, health, vulnerable ecosystems and regions, etc.) as available and relevant to the country.
3. Assessment of adaptation needs and priorities for sustainable development through stakeholder consultation at the relevant levels.
4. Identification/selection of pilot areas and stakeholders from relevant sectors at national and sub-national/local levels.
5. Recommendations for local level (action oriented) work programme describing, among others:-
    - Prospective impacts on resources and implications for regional security.
    - Potential network on climate change adaptation.
    - Good practices at the local level.
    - Climate change adaptation constraints and capacity.
    - Collaboration, knowledge sharing and communication between experts in ASEAN.
    - Inputs from national and sub-national/local stakeholders.

TIMELINE AND DELIVERABLES

The activities and timeline for project deliverables are shown in Table 1. Project Partners are expected to deliver the following reports:

1. Inception Workshop: Deadline 6 Feb 2015
2. Preliminary Report on review of national documents [Country Report]: Deadline 1 May 2015
3. Preliminary Report on vulnerable sectors and regions [Country Report]: Deadline 1 August 2015
4. Preliminary Report on adaptation needs, priorities & pilots [Country Report]: Deadline 1 October 2015
5. Final Planning Workshop: October 2015
6. Draft Final Report [Synthesis Report]: 1 December 2015

REPORT TEMPLATE

The Draft Final Report from project partners is proposed to contain the following, among others:-

1. **INTRODUCTION**: encompasses (but is not limited to) country context including current and projected geographic and socio-economic setting; governance systems etc.; [Guidance:
2. **NATIONAL STATUS ON ADAPTATION**: documents findings of review of national documents (including state/province/local levels, where available) on adaptation actions including local situation and priorities (where available);
3. **VULNERABLE SECTORS AND REGIONS**: synthesis of scientific literature on vulnerable sectors and regions

(agriculture, water resources, forests and biodiversity, health, vulnerable sectors and regions, etc.), including observations and projected changes, criteria for vulnerability, key risks and reasons for concern, etc.;

4. **ADAPTATION NEEDS AND PRIORITIES (in the context of identified vulnerable sectors and regions)**: commences with an overview of stakeholder consultation methods; criteria for setting priority; results of evaluation of adaptation needs and priorities for sustainable development through stakeholder profiling and consultation, etc.;
5. **PROPOSALS FOR LOCAL LEVEL PILOTS**: provides recommendations for 3-5 local level (action oriented) pilots. Each recommended pilot should ideally have a description of:-(i) selected geographic area and stakeholder profiles, (ii) prospective impacts on resources and implications for regional security, (iii) climate change adaptation constraints and capacity needs, (iv) potential for institutional arrangements and co-financing, (v) potential network of partners on climate change adaptation within the country, (vi) potential experts in ASEAN Member Countries for collaboration, knowledge sharing and communication. A section should also be devoted to (i) existing practices at the local level (where possible), and (ii) other pilots recommended by national and sub-national/local stakeholders during consultation, which are not highlighted for recommendation.
6. **BIBLIOGRAPHY**: The list of reference material used for preparing the final report.

The Draft Final Report from project partners will serve as the basis for developing the two final project deliverables as specified below:-

- **Needs Assessment and Scoping Study Report (State of Climate Change Adaptation in ASEAN):** A report containing initial information on identified needs of AMS in terms of climate change adaptation.
- **ASEAN-India Work Programme and Network for Climate Change Adaptation** (ASEAN-Adapt): Draft work programme containing (i) strategic actions and adaptation programs and (ii) a framework of the network and regional mechanism to facilitate its implementation to support green growth and sustainable development.

ADMINISTRATIVE ARRANGEMENTS

The Southeast Asia Disaster Prevention Research Institute, Universiti Kebangsaan Malaysia (SEADPRI-UKM) will serve as the implementing agency on behalf of ASEAN, reporting directly to the ASEAN Secretariat. Prof. Dr. Joy Jacqueline Pereira of SEADPRI-UKM, will lead the project team, in coordination with Prof. N. H. Ravindranath from the Centre for Sustainable Technologies (CST), Indian Institute of Science, Bangalore, who has been appointed by the Government of India. SEADPRI-UKM will mobilize the teams comprising representatives from various institutions and representatives identified by ASEAN Member States.

Partners

Phase I of the project shall consist of inception workshop and final planning workshop to be implemented within 1 year, with a needs assessment and scoping study conducted in between the workshops. All ASEAN Member States shall participate in the inception and final planning workshop (Phase I), and later in Phases II and III of the project. Project partners for the implementation of Phases II and III of the project shall be identified during

the final planning workshop of Phase I). Experts from India will be nominated by the Indian Government to facilitate transfer of technology under the auspices of the ASEAN-India Green Fund. Project Partners constituting research and capacity building organisations (mainly universities) will be endorsed by their respective Governments.

Budget

The project has received funding support of up to about USD 275,954 from the ASEAN-India Green Fund for the ASEAN-India for Phase I. Nearly half of the allocation is for convening meetings i.e. (i) Inception Workshop (USD 50,690), (ii) Project Meeting (USD20,000), and (iii) Final Planning Workshop (USD 65,264). Country teams are allocated a total of USD 70,000.00 covering 10 ASEAN Member States. The remaining funds are for experts from ASEAN and India to develop the ASEAN-India Work Programme and Network for Climate Change Adaptation (ASEAN-Adapt). The budget for project partners to conduct the country study is as follows:-

	Item	Allocation	No of Countries	Total
1	Part-time Assistants (USD5,000 per country)	5,000.00	10	50,000.00
2	Local communications/consultation (USD500 per country)	500.00	10	5,000.00
3	Copying/Printing (USD500 per country)	500.00	10	5,000.00
4	Consumables (500 per country)	500.00	10	5,000.00
5	Report Preparation/Translation/ etc.	500.00	10	5,000.00
	Country Team Total			**70,000.00**

Table 1: Project activities and timelines

ACTIVITIES	**2015**			
Phase I: Needs Assessment and Development of ASEAN Climate Change Adaptation Work Programme	M	J	S	D
1. Preparation and implementation of Inception Workshop [5-6 Feb 2015]	▲			
2. Review of national documents on adaptation actions including local conditions and priorities (where available)		●		
3. Review of scientific publications to identify vulnerable ecosystems and regions.			●	
4. Assessment of adaptation needs and priorities through stakeholder consultation.			●	
5. Preparation and implementation of planning workshop			▲	
Output 1: Needs Assessment and Scoping Study Report (State of Climate Change Adaptation in ASEAN (Deadline – Month 12)				●
Output 2: ASEAN-India Work Programme and Network on Climate Change Adaptation (Draft) (Deadline – Month 12)				●
Phase II & III: (to be developed during Phase I) ▲ Workshop ● Report				

APPENDIX 1

LIST OF PARTICIPANTS

Cambodia

1. Mr. Chea Chan Thou, Ministry of Environment, Cambodia
2. Mr. Cheb Hoeurn, Royal University of Phnom Penh
3. Mr. Chea Leng, Paññāsāstra University of Cambodia

Indonesia

1. Ms. Laksmi Rachmawati, Indonesian Institute of Sciences
2. Ms. Natalia Derodofa, ASEAN Secretariat
3. Mr. Rocky Pairunan, ASEAN Secretariat

Lao PDR

1. Mr. Vilakone Maniphousay, Ministry of Natural Resources and Environment
2. Mr. Amphayvanh Oudomdeth, Ministry of Natural Resources and Environment

Malaysia

1. Dato' Yap Kok Seng, Ministry of Natural Resources and Environment Malaysia
2. Mr. Muhammad Ridzwan Ali, Ministry of Natural Resources and Environment Malaysia
3. Ms. Koh Fui Pin, Ministry of Natural Resources and Environment Malaysia
4. Dr. Saim Suratman, National Hydraulic Research Institute
5. Prof. Dr. Joy Jacqueline Pereira, SEADPRI-Universiti Kebangsaan Malaysia
6. Prof. Dr. Er Ah Choy, FSSK-Universiti Kebangsaan Malaysia
7. Ms. Fara Azuin Amiruddin, Ministry of International Trade and Industry Malaysia
8. Mr. Ibrahim Helmi Abdullah, Ministry of International Trade and Industry Malaysia

Myanmar

1. Prof. Khin Maung Cho, Myanmar Climate Change Watch

Philippines

1. Ms. Carmelita Passe, Environmental Management Bureau, Philippines
2. Prof. Dr. Juan Pulhin Magboo, University of the Philippines Los Banos

Singapore

1. Dr. Raman Letchumanan, Nanyang Technological University
2. Mr. Andreas Schaffer, Nanyang Technological University
3. Mr. Srivatsan Vijayaraghavan, National University of Singapore

Thailand

1. Ms. Sureeporn Kerdkankaew, Natural Resources and Environmental Policy and Planning, Thailand

Vietnam

1. Ms. Bui Hoa Binh, Ministry of Natural Resources and Environment Vietnam
2. Ms. Le Thi Mai Thanh, Ministry of Natural Resources and Environment Vietnam
3. Mr. Tran Dinh Trong, Vietnam Institute of Meteorology, Hydrology and Climate Change

India

1. Prof. Nijavalli H. Ravindranath, Indian Institute of Science, Bengaluru
2. Ms. Indu Krishnamurthy, Indian Institute of Science, Bengaluru
3. K.N. Ramachandran, High Commission of India, Kuala Lumpur

APPENDIX 2

ASEAN-India Project on "Enhancing Climate Change Adaptation in Southeast Asia" (Phase 1)

INCEPTION WORKSHOP ON ENHANCING CLIMATE CHANGE ADAPTATION IN SOUTHEAST ASIA

5-6 February 2015

Bangi, MALAYSIA

Partners:

asean india PROGRESS & PROSPERITY

seadpri southeast asia disaster prevention research initiative

asean

APN ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH

NRE

MIT MALAYSIA

Asian Network on Climate Science and Technology (ANCST)

PROGRAMME

5 February 2015 (Thursday) **SESSION 1: CLIMATE IMPACTS AND FUTURE RISKS IN SOUTHEAST ASIA** ***(SESSION OPEN TO MALAYSIAN AND ASEAN DELEGATES)***	
08.30-9.00	**REGISTRATION – SESSION 1**
09.00-09.30	**OPENING REMARKS by Universiti Kebangsaan Malaysia** *Prof. Dr. Mohd Raihan Taha* *Director, Institute for Environment and Development* **GROUP PHOTO**
Moderators: *Natalia Derodofa, ASEAN Secretariat & Dr. Saim Suratman, National Hydraulic Research Institute (NAHRIM)*	
09.30-09.50	**Climate Impacts and Future Risks – Key Findings of the IPCC** *Prof. Joy J. Pereira, SEADPRI-Universiti Kebangsaan Malaysia*
09.50-10.10	**Climate Change and Human Security – Key Findings of the IPCC** *Prof. Juan Pulhin, University of The Philippines Los Banõs*
10.10 – 10.30	**Climate Change and Forests – Key Findings of the IPCC** *Prof. N. H. Ravindranath, Indian Institute of Science, Bengaluru*
10.30 – 10.50	**TEA-BREAK**
10.50 – 11.10	**Climate Change Adaptation – Mobilising the Private Sector** *Andreas Schaffer, EOS, Nanyang Technological University*
11.10 – 11.30	**Climate Change Adaptation Actions in ASEAN** *Dr. Raman Letchumanan, Senior Fellow, RSIS, Nanyang Technological University (formerly Head of Environment Division, ASEAN Secretariat)*
11.30 - 12.10	**Local Level Climate Extremes, Slow Onset Events and Loss & Damage:** • *Cheb Hoeurn, Royal University of Phnom Penh (RUPP)* • *Tran Dinh Trong, Vietnam Institute of Meteorology, Hydrology and Climate Change* • *Prof. Juan Pulhin, University of The Philippines Los Banõs* • *Prof. Joy J. Pereira, SEADPRI-Universiti Kebangsaan Malaysia*
12.10 – 13.00	**GENERAL DISCUSSION & CLOSING OF SESSION 1**
13.00	**LUNCH**

PROGRAMME

SESSION 2: ASEAN-INDIA GREEN FUND PROJECT – SCENE SETTING *(SESSION OPEN TO ASEAN DELEGATES ONLY)*	
13.50 – 14.00	**Registration – Session 2 (ASEAN Delegates Only)**
Moderator: *Dr. Raman Letchumanan, Former Environment Division Head, ASEAN Secretariat*	
14.00 – 14.15	**Preamble: Aspiration of the Indian Government for ASEAN** *by Dr. S. Satapathy, Focal Point of ASEAN-India Green Fund*
14.15 – 14.45	**Introduction of project on 'Enhancing Climate Change Adaptation in Southeast Asia'** *by Prof. Dr. Joy J. Pereira, SEADPRI-UKM*
14.45 – 15.15	**Climate Change Adaptation Experience and Technology in India** *by Prof. N. H. Ravindranath, Indian Institute of Science, Bengaluru*
15.15 - 15.30	**TEA BREAK**
Moderators: *Prof. Dr. Joy J. Pereira & Prof. N. H. Ravindranath, Project Coordinators*	
15.30 – 17.00	**Introduction of ASEAN project partners** *Presentation on countries' priorities in the context of the project by Project Partners (5-10 minutes each)*** *****Presentation is proposed to answer the following questions:*** *1) What is the current status of the country's National Communication to the UNFCCC?* *2) What is the current status of the National Adaptation Plan?* *3) How does the Focal Point interact with Research Institutes and Universities in the country?* *4) What are 2-3 (max) main local-level (city/river basin/coastal levels etc.) issues in the country?*
17.00 – 18.30	**Informal Discussion of Partner Organisations** *(Attendance is optional for Representatives of National Focal Points)*
19.00	**DINNER & END OF DAY 1**

6 February 2015 (Friday) **SESSION 3: ASEAN-INDIA GREEN FUND PROJECT – TERMS OF REFERENCE** ***(SESSION OPEN TO ASEAN DELEGATES ONLY)***	
09.00 – 10.00	Discussion on Terms of Reference for Scoping Study: Scope of Work
10.00 – 10.15	**TEA-BREAK**
10.15 – 12.15	Discussion on Terms of Reference for Scoping Study: Project Timeline; Deliverables; Report Template; Administrative Arrangement, etc.
12.15	**WRAP-UP, CLOSING & LUNCH** **CLOSING REMARKS** *by Prof. N. H. Ravindranath, Indian Institute of Science, Bengaluru* **CLOSING REMARKS** *by Ms. Natalia Derodofa, ASEAN Secretariat*

ACKNOWLEDGEMENT

BRUNEI DARUSSALAM
- *Department of Environment, Parks and Recreation, Ministry of Development*

CAMBODIA
- *General Department of Administration for Nature Conservation and Protection, Ministry of Environment*
- *Faculty of Mathematics,Science and Engineering, Pannasastra University of Cambodia*
- *Royal University of Phnom Penh (RUPP)*

INDONESIA
- *Information and Education Division, National Council on Climate Change*
- *Geotechnology Research Center, Indonesian Institute of Science (IISC)*

LAO PDR
- *Department of National Disaster Management and Climate Change, Ministry of Natural Resources and Environment*

MALAYSIA
- *Environment Management and Climate Change Division, Ministry of Natural Resources and Environment*
- *Ministry of International Trade and Industry (MITI)*
- *National Hydraulic Research Institute of Malaysia (NAHRIM)*
- *Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), Universiti Kebangsaan Malaysia*

MYANMAR
- *Department of Meteorology and Hydrology, Ministry of Transport*
- *Department of Meteorology and Hydrology*
- *Myanmar Climate Change Watch*

PHILIPPINES
- *Department of Environment and Natural Resources*
- *Climate Change Office, Environmental Management Bureau*
- *University of The Philippines Los Banõs*

SINGAPORE
- *Climate Change Programme Department, National Environment Agency*
- *The Tropical Marine Science Institute, National University of Singapore*
- *Earth Observatory of Singapore (EOS), Nanyang Technological University*
- *S. Rajaratnam School of International Studies (RSIS), Nanyang Technological University*

THAILAND
- *Management and Coordination Division, Office of Natural Resources and Environmental Policy and Planning*
- *Unit for Social and Environmental Research (USER), Chiang Mai University*

VIETNAM
- *Department of International Cooperation, Ministry of Natural Resources and Environment*
- *Department of Meteo-hydrology and Climate Change, Ministry of Natural Resources and Environment*
- *Vietnam Institute of Meteorology, Hydrology and Climate Change (IMHEN)*

ASEAN-INDIA GREEN FUND
- *Climate Change Division, Ministry of Environment and Forests*
- *Indian Institute of Science, Bengaluru*

ASEAN SECRETARIAT

ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH (APN)

ASIAN NETWORK ON CLIMATE SCIENCE AND TECHNOLOGY (ANCST)

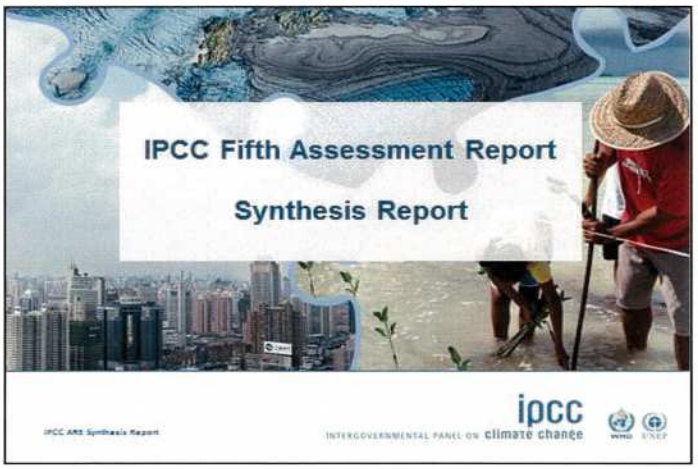
APPENDIX 3

Workshop on Enhancing Local Level Climate Change Adaptation in Southeast Asia
5-6 February 2015, Bangi, Malaysia

Climate Impacts and Future Risks – Key Findings of the IPCC

Joy Jacqueline Pereira, Ph.D, FASc.
Southeast Asia Disaster Prevention Research Initiative Universiti Kebangsaan Malaysia (SEADPRI-UKM)

seadpri



24 Asia

Coordinating Lead Authors:
Yasuaki Hijioka (Japan), Erda Lin (China), Joy Jacqueline Pereira (Malaysia)

Lead Authors:
Richard T. Corlett (China), Xuefeng Cui (China), Gregory Insarov (Russian Federation), Rodel Lasco (Philippines), Elisabet Lindgren (Sweden), Akhilesh Surjan (India)

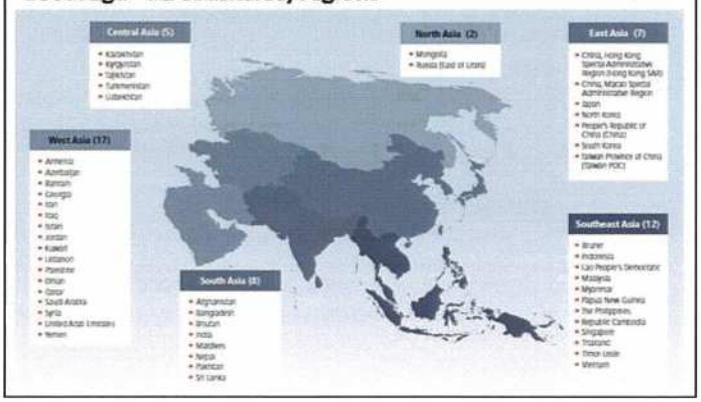
Contributing Authors:
Elena M. Aizen (USA), Vladimir B. Aizen (USA), Rawshan Ara Begum (Bangladesh), Kenshi Baba (Japan), Monalisa Chatterjee (USA/India), J. Graham Cogley (Canada), Noah Diffenbaugh (USA), Li Ding (Singapore), Qingxian Gao (China), Matthias Garschagen (Germany), Masahiro Hashizume (Japan), Manmohan Kapshe (India), Andrey G. Kostianoy (Russia), Kathleen McInnes (Australia), Sreeja Nair (India), S.V.R.K. Prabhakar (India), Yoshiki Saito (Japan), Andreas Schaffer (Singapore), Rajib Shaw (Japan), Daithi Stone (Canada/South Africa /USA), Reiner Wassman (Philippines), Thomas J. Wilbanks (USA), Shaohong Wu (China)

Review Editors:
Rosa Perez (Philippines), Kazuhiko Takeuchi (Japan)

Volunteer Chapter Scientists:
Yuko Onishi (Japan), Wen Wang (China)

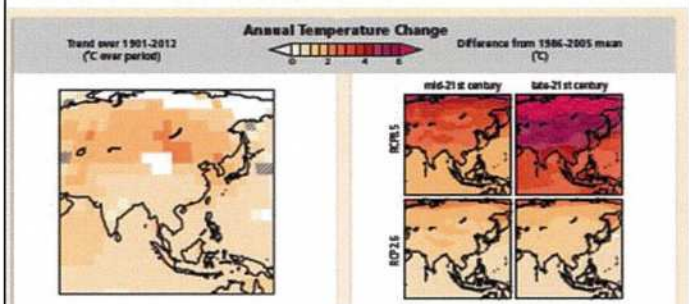
Chapter 24, Asia:
Coverage - 51 countries/regions

ipcc



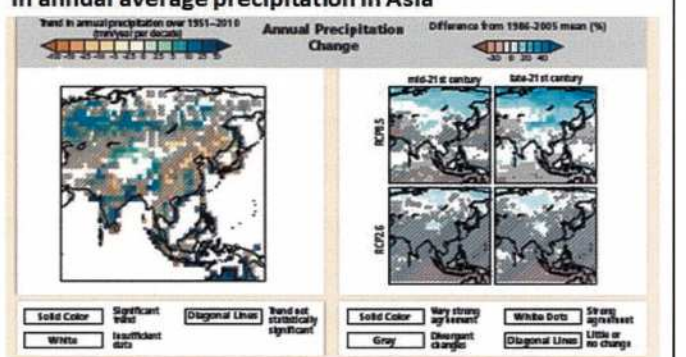
Chapter 24, Asia:
Observed and projected changes in annual average temperature in Asia

ipcc



Chapter 24, Asia:
Observed and projected changes in annual average precipitation in Asia

ipcc



Observations of Past Events

Climate Phenomenon	Asia	Southeast Asia
Heat Waves	It is likely that the frequency of heat waves has increased in large parts of Asia.	No Specific Observations
Drought	There is medium confidence that more megadroughts occurred in monsoon Asia and wetter conditions prevailed in arid Central Asia monsoon region during the Little Ice Age (1450–1850) compared to the Medieval Climate Anomaly (950–1250).	No Specific Observations
Floods	With high confidence, past floods larger than recorded since the 20th century occurred during the past five centuries in eastern Asia. There is medium confidence that in the Near East and India modern large floods are comparable or surpass historical floods in magnitude and/or frequency.	No Specific Observations

Future Projections

Climate Phenomenon	Asia	Southeast Asia
Precipitation	Future increase in precipitation extremes related to the monsoon is very likely in East Asia, South Asia and Southeast Asia.	Future increase in precipitation extremes related to the monsoon is very likely in Southeast Asia.
	Indian monsoon rainfall is projected to increase. For the East Asian summer monsoon, both monsoon circulation and rainfall are projected to increase.	There is low confidence in projections of future changes in the Madden-Julian Oscillation due to the poor skill in model simulations of this intraseasonal phenomenon and the sensitivity to ocean warming patterns. Future projections of regional climate extremes in Southeast Asia are therefore of low confidence.
		Reduced precipitation in Indonesia in Jul-Oct due to pattern of Indian Ocean warming (RCP 4.5 or higher end scenarios)
El Niño-Southern Oscillation	Natural modulations of the variance and spatial pattern of El Niño-Southern Oscillation are so large that confidence in any projected change for the 21st century remains low. Confidence is low in changes in climate impacts for most of Asia.	Low Confidence in any projected change for the 21st century

Sea Level Rise (IPCC 2013)

- Projected climate change (based on RCPs) in AR5 is similar to AR4 in both patterns and magnitude, after accounting for scenario differences.
- Projections of global mean sea level rise has increased in confidence since the AR4 because of the improved physical understanding of the components of sea level, the improved agreement of process-based models with observations, and the inclusion of ice-sheet dynamical changes.
- Global mean sea level will continue to rise during the 21st century. Under all RCP scenarios the rate of sea level rise will *very likely* exceed that observed during 1971–2010 due to increased ocean warming and increased loss of mass from glaciers and ice sheets.

Sea Level Rise (IPCC 2013)

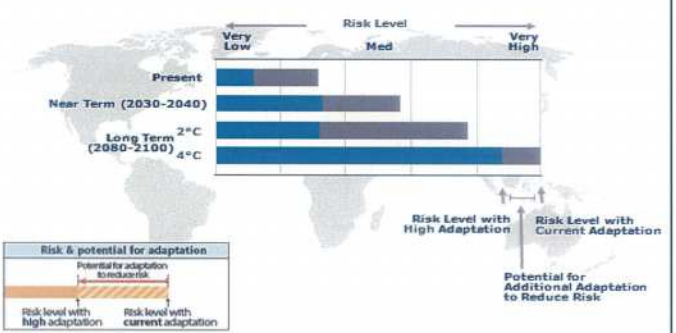
Global mean sea level rise for 2081–2100 relative to 1986–2005 will *likely* be in the following ranges:

- 0.26 to 0.55 m (RCP2.6)
- 0.32 to 0.63 m (RCP4.5)
- 0.33 to 0.63 m (RCP6.0)
- 0.45 to 0.82 m (RCP8.5) – medium confidence

Sea level rise will not be uniform. By the end of the 21st century, it is *very likely* that sea level will rise in more than about 95% of the ocean area.

About 70% of the coastlines worldwide are projected to experience sea level change within 20% of the global mean sea level change.

Assessing risk

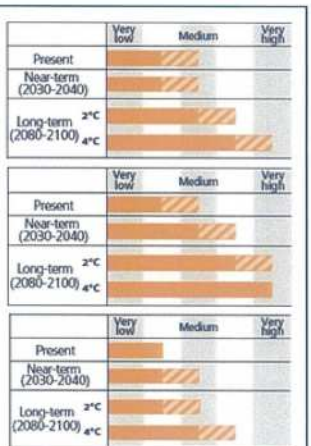


Key Risks in Asia

Increased [coastal, riverine and urban] flooding leading to widespread damage to infrastructure and settlements in Asia (medium confidence)

Increased risk of heat-related mortality (high confidence)

Increased risk of drought-related water and food shortage causing malnutrition (high confidence)

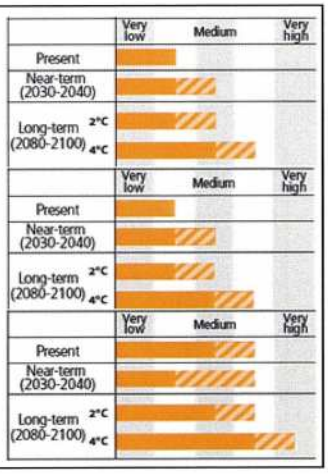


Key Risks in Asia

Increased risk of flood-related deaths, injuries, infectious diseases and mental disorders (medium confidence)

Increased risk of water and vector-borne diseases (medium confidence)

Exacerbated poverty, inequalities and new vulnerabilities (high confidence)

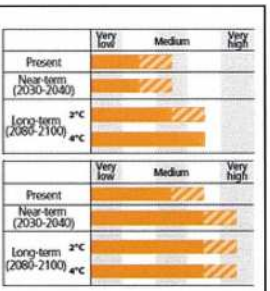


ipcc

Key Risks in Asia

Increased risk of crop failure and lower crop production could lead to food insecurity in Asia (medium confidence)

Water shortage in arid areas of Asia (medium confidence)



KEY CONCLUSIONS: IPCC-WG2 Chapter 24, Asia

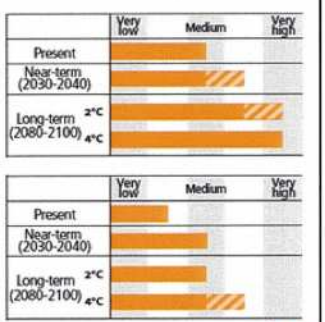
- Water scarcity is expected to be a major challenge for most of the region due to increased water demand and lack of good management (*medium confidence*)
- There is *low confidence* in future precipitation projections at a sub-regional scale and thus in future freshwater availability in most parts of Asia.
- Integrated water management strategies could help adapt to climate change, including developing water saving technologies, increasing water productivity, and water reuse.

ipcc

Key Risks in Asia

Coral reef decline in Asia (high confidence)

Mountain-top extinctions in Asia (high confidence)



ipcc

Chapter 24, Asia: Coverage of Information

Source: IPCC, 2014

ipcc

Sector	Topics/Issues	North Asia		East Asia		Southeast Asia		South Asia		Central Asia		West Asia	
	O = Observed impacts, P = Projected impacts	O	P	O	P	O	P	O	P	O	P	O	P
Freshwater resources	Major river runoff	/	x	/	/	/	/		x	x	x	x	x
	Water supply	x	x	x	x	x	x		x	x	x	x	x
Terrestrial and inland water systems	Phenology and growth rates	/	/	/	/	x	x		x	x	x	x	x
	Distributions of species and biomes	/	/	/	/	x	x		/	x	x	x	x
	Permafrost	/	/	/	/	/	x		/	/	/	/	x
	Inland waters	x	x	/	x	x	x		x	x	x	x	x
Coastal systems and low-lying areas	Coral reefs	NR	NR	/	/	/	/		/	NR	NR	/	/
	Other coastal ecosystems	x	x	/	/	x	x		x	NR	NR	x	x
	Arctic coast erosion	/	/	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Food production systems and food security	Rice yield	x	x	/	/	x	/		/	x	x	x	/
	Wheat yield	x	x	x	x	x	x		/	x	x	/	/
	Corn yield	x	x	x	/	x	x		x	x	x	x	x
	Other crops (e.g., barley, potato)	x	x	/	/	x	x		x	x	x	/	/
	Vegetables	x	x	/	x	x	x		x	x	x	x	x
	Fruits	x	x	/	x	x	x		x	x	x	x	x
	Livestock	x	x	/	x	x	x		x	x	x	x	x
	Fisheries and aquaculture production	x	/	x	/	x	/		x	x	x	x	x
	Farming area	x	/	x	/	x	x		/	x	/	x	x
	Water demand for irrigation	x	/	x	/	x	x		/	x	x	x	x
	Pest and disease occurrence	x	x	x	x	x	x		/	x	x	x	x
Human settlements, industry, and infrastructure	Floodplains	x	x	/	/	/	/		/	x	x	x	x
	Coastal areas	x	x	/	/	/	/		/	NR	NR	x	x
	Population and assets	x	x	/	/	/	/		/	x	x	x	x
	Industry and infrastructure	x	x	/	/	/	/		/	x	x	x	x
Human health, security, livelihoods, and poverty	Health effects of floods	x	x	x	x	x	x		x	x	x	x	x
	Health effects of heat	x	x	/	x	x	x		x	x	x	x	x
	Health effects of drought	x	x	x	x	x	x		x	x	x	x	x
	Water-borne diseases	x	x	x	x	/	x		x	x	x	x	x
	Vector-borne diseases	x	x	x	x	/	x		x	x	x	x	x
	Livelihoods and poverty	x	x	/	x	x	x		x	x	x	x	x
	Economic valuation	x	x	x	x	/	/		/	x	x	x	x

Adaptation is already occurring

ipcc

Effective risk management and adaptation are tailored to local and regional needs and circumstances

- Changes in climate extremes vary across regions
- Each region has unique vulnerabilities and exposure to hazards
- Effective risk management and adaptation address the factors contributing to exposure and vulnerability

Source: IPCC, 2012

ipcc

CLIMATE CHANGE AND HUMAN SECURITY

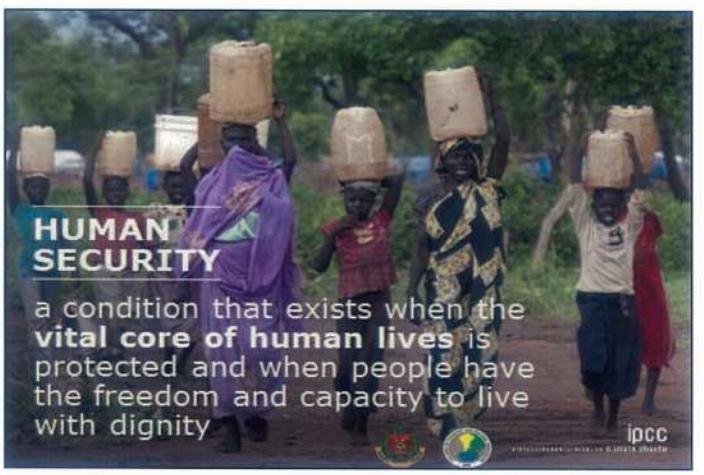
Key Findings from IPPC AR5

Juan M. Pulhin, PhD
Professor and Dean
University of the Philippines
Los Baños

Inception Workshop on Enhancing Local Level Climate Change Adaptation in Southeast Asia
5-6 February 2015, Bangi, Malaysia

Outline of Presentation

- Concept of human security
- Key findings from IPCC AR5 on human security
- Implications to Southeast Asia



HUMAN SECURITY

a condition that exists when the **vital core of human lives** is protected and when people have the freedom and capacity to live with dignity

Human Security

- **Vital core of human lives** includes the universal and culturally specific, material and non-material elements necessary for people to act on their interests.
- Human insecurity almost never has single causes but instead emerges from the interaction of multiple factors

Key Findings from IPCC- AR5

Human security will be progressively threatened as climate changes *(robust evidence, high agreement)*

Climate change is an important factor that threatens human security through:

- undermining **livelihoods**;
- compromising **culture and identity;**
- increasing **migration** that people would have rather avoided; and
- challenging the **ability of states** to provide the conditions necessary for human security

Climate change threatens the material element of human security

- Material aspects of life and livelihood such as food, water and shelter are closely coupled to weather and climate but also to mutiple factors in the economy and society

Climate change will compromise the cultural values that are important for community and individual well-being *(medium evidence, high agreement).*

Changing weather and climatic conditions threaten cultural practices embedded in livelihoods and expressed in narratives, world views, identity, community cohesion, and sense of place.

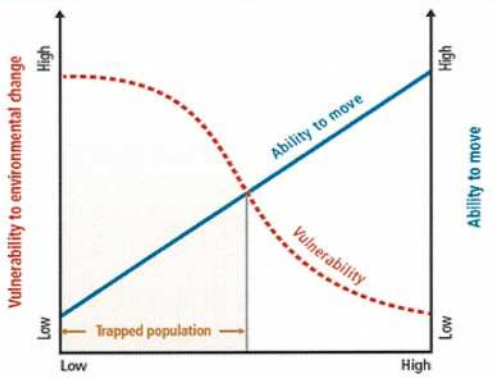
Loss of land and displacement, for example on small islands and coastal communities, has well documented negative cultural and well-being impacts.

Climate change over the 21st century is projected to increase displacement of people *(medium evidence, high agreement).*

Displacement risk increases when populations that lack the resources for planned migration experience higher exposure to extreme weather events, in both rural and urban areas, particularly in developing countries with low income.

Expanding opportunities for mobility can reduce vulnerability for such populations.

Changes in migration patterns can be responses to both extreme weather events and longer-term climate variability and change, and migration can also be an effective adaptation strategy.



Source: Adapted from Foresight, 2011; Black et al. 2013)

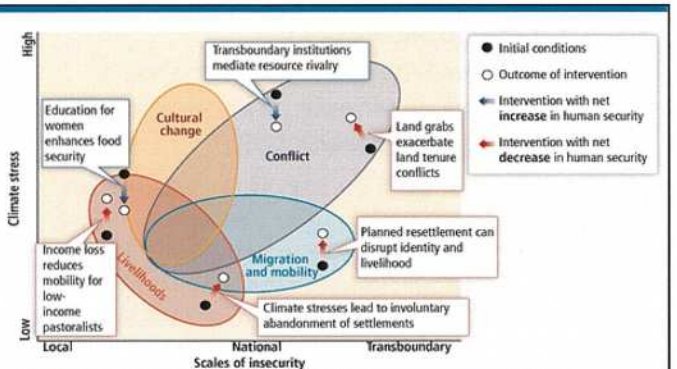
Climate change can indirectly increase risks of violent conflicts in the form of civil war and inter-group violence by amplifying well-documented drivers of these conflicts such as poverty and economic shocks *(medium confidence).*

Multiple lines of evidence relate climate variability to these forms of conflict.

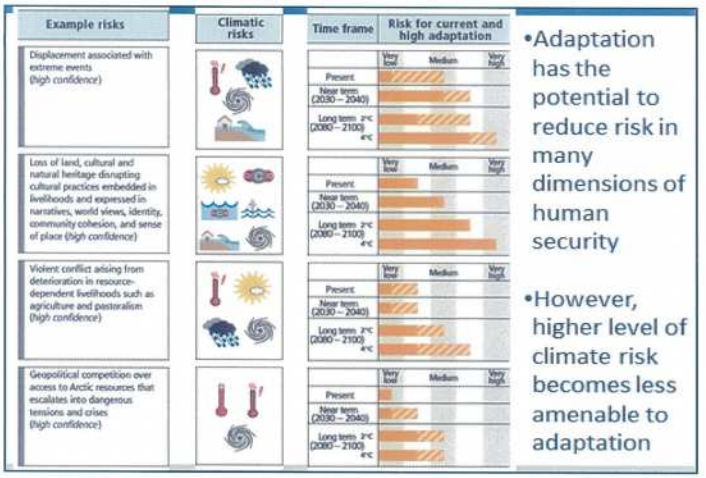
The impacts of climate change on the critical infrastructure and territorial integrity of many states are expected to influence national security policies *(medium evidence, medium agreement).*

For example, land inundation due to sea-level rise poses risks to the territorial integrity of small-island states and states with extensive coastlines.

Some transboundary impacts of climate change, such as changes in sea ice, shared water resources, and pelagic fish stocks, have the potential to increase rivalry among states, but robust national and intergovernmental institutions can enhance cooperation and manage many of these rivalries.



Synthesis of evidence on the impacts of climate change on elements of human security and their interaction and the outcomes of interventions and policies that either increase or decrease human security



- Adaptation has the potential to reduce risk in many dimensions of human security
- However, higher level of climate risk becomes less amenable to adaptation

Implications to Southeast Asia

Climate change is an important factor that threatens human security in the SEA especially among vulnerable nations through:

- undermining **capital assets that promote livelihoods**;
- compromising **culture and identity;**
- increasing **displacement and population movement**; and
- challenging the **ability of the governments** to provide the conditions necessary for human security including minimizing conflicts

Implications to Southeast Asia

- Adaptation has the potential to reduce risk in many dimensions of human security making local level adaptation a top priority
- Higher level of climate risk becomes less amenable to adaptation highlighting the need to combine adaptation and mitigation responses

ipcc

Implications to Southeast Asia

- Addressing the multi-dimensional aspect of human insecurity in the context of changing climate requires concerted efforts by government, private sector, civil society, and academic institutions at the local, national and regional level
- Site-specific and regional researches that promotes synergy, partnerships and capacity building will enhance understanding and help address problems of human insecurity

ipcc

Forests and Climate Change – IPCC Fimdings

Prof. N.H. Ravindranath
Author for IPCC Report
Indian Institute of Science
Bangalore

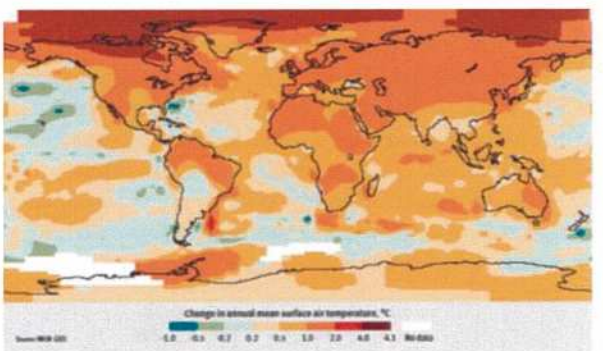
IPCC Working Groups and Forests

- **WG I: GHG / CO2 emissions – historical & projections for forest Sector**

- **WG II: Impact of climate change on forest ecosystems, vulnerability, impacts, adaptation**

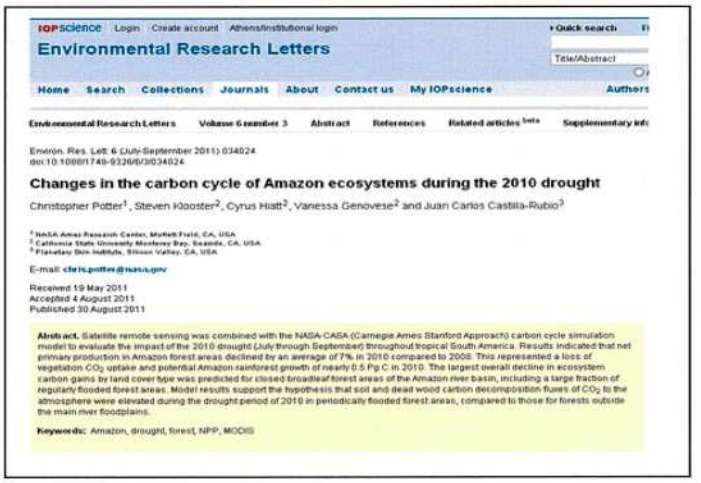
- **WG III: GHG / CO2 Mitigation potential of forest sector – AFOLU Sector**

Change in global annual mean surface air temperatures, 1960–2009 (NASA-GISS)



AR5 IPCC on Observed impacts of CC

1. In recent decades, changes in climate have caused impacts on natural and human systems on all continents.
   - Increased tree mortality, observed in many places worldwide, has been attributed to climate change in some regions
   - Increases in the frequency or intensity of ecosystem disturbances such as droughts, wind-storms, fires, and pest outbreaks have been detected in many parts of the world and in some cases are attributed to climate change.
2. In response to ongoing climate change many terrestrial species have
   - Shifted their geographic ranges, seasonal activities, migration patterns,
   - Experienced changes in abundances and species interactions
3. Impacts from recent climate-related extremes, such as heat waves, droughts, floods, cyclones, and wildfires, reveal significant vulnerability and exposure to current climate variability
   - Some ecosystems and
   - Many human systems.



IOPscience Login Create account Athens/Institutional login Quick search

Environmental Research Letters

Title/Abstract

Home Search Collections Journals About Contact us My IOPscience Authors

Environmental Research Letters Volume 6 number 3 Abstract References Related articles beta Supplementary info

Environ. Res. Lett. 6 (July-September 2011) 034024
doi:10.1088/1748-9326/6/3/034024

Changes in the carbon cycle of Amazon ecosystems during the 2010 drought

Christopher Potter[1], Steven Klooster[2], Cyrus Hiatt[2], Vanessa Genovese[2] and Juan Carlos Castilla-Rubio[3]

[1] NASA Ames Research Center, Moffett Field, CA, USA
[2] California State University Monterey Bay, Seaside, CA, USA
[3] Planetary Skin Institute, Silicon Valley, CA, USA

E-mail: chris.potter@nasa.gov

Received 19 May 2011
Accepted 4 August 2011
Published 30 August 2011

Abstract. Satellite remote sensing was combined with the NASA-CASA (Carnegie Ames Stanford Approach) carbon cycle simulation model to evaluate the impact of the 2010 drought (July through September) throughout tropical South America. Results indicated that net primary production in Amazon forest areas declined by an average of 7% in 2010 compared to 2008. This represented a loss of vegetation CO_2 uptake and potential Amazon rainforest growth of nearly 0.5 Pg C in 2010. The largest overall decline in ecosystem carbon gains by land cover type was predicted for closed-broadleaf forest areas of the Amazon river basin, including a large fraction of regularly flooded forest areas. Model results support the hypothesis that soil and dead wood carbon decomposition fluxes of CO_2 to the atmosphere were elevated during the drought period of 2010 in periodically flooded forest areas, compared to those for forests outside the main river floodplains.

Keywords: Amazon, drought, forest, NPP, MODIS

Global Change Biology

Primary Research Article

Failure to migrate: lack of tree range expansion in response to climate change

Kai Zhu[1,*], Christopher W. Woodall[2] and James S. Clark[1,3]

Article first published online: 1 NOV 2011
DOI: 10.1111/j.1365-2486.2011.02571.x

Global Change Biology
Volume 18, Issue 3, pages 1042–1052, March 2012

SEARCH

ARTICLE TOOLS

Additional Information (Show All)
How to Cite | Author Information | Publication History | Funding Information

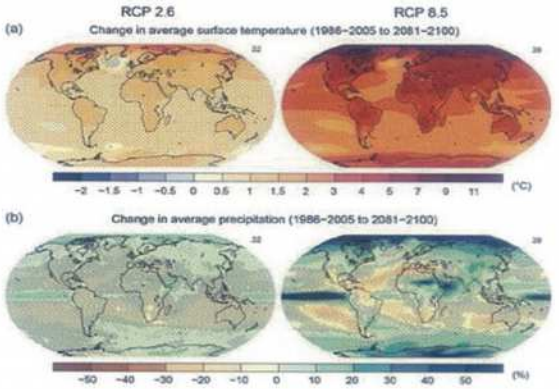
Abstract Article References Supporting Information Cited By

View Full Article with Supporting Information (HTML) | Enhanced Article (HTML) | Get PDF (892K)

Keywords:
biogeography; climate change; Forest Inventory and Analysis; latitude; presence/absence; range shift; seedling; tree migration

Abstract

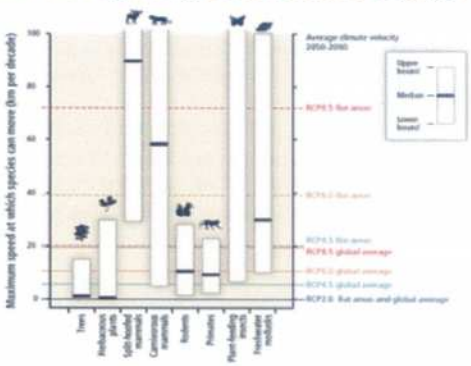
Tree species are expected to track warming climate by shifting their ranges to higher latitudes or elevations, but current evidence of latitudinal range shifts for suites of species is largely indirect. In response to global warming, offspring of trees are predicted to have ranges extend beyond adults at leading edges and the opposite relationship at trailing edges. Large-scale forest inventory data provide an opportunity to compare present latitudes of seedlings and adult trees at their range limits. Using the USDA Forest Service's Forest Inventory and Analysis data, we directly compared seedling and tree 5th and 95th percentile latitudes for 92 species in 30 longitudinal



IPCC Working Group 2 – Projections on Impacts

- Tree mortality and associated forest dieback will occur in many regions in the next one to three decades, with forest dieback posing risks for
  - Biodiversity of ecosystems
  - Ecosystem Services - carbon storage, wood production, water quality, and economic activities.
- Climate change is projected to be a powerful stressor on ecosystems
  - especially under high warming scenarios such as RCP6.0 and 8.5.
- A large fraction of species face increased extinction risk under projected climate change during the 21st century
  - especially as climate change interacts with other pressures
    - habitat modification, over-exploitation, pollution, and invasive species.
- Increased severe drought together with land-use change and forest fire would cause much of the Amazon forest to transform to less-dense, drought- and fire-adapted ecosystems
  - increasing risk for biodiversity while decreasing net carbon uptake from the atmosphere.

Many species will not be able to move fast enough during the 21st century to track suitable climates under mid- and high-range rates of climate change



ECOSYSTEMS, BIODIVERSITY, AND ECOSYSTEM SERVICES

- **Landscapes and seascapes are changing rapidly, and species, including many iconic species, may disappear from regions where they have been prevalent or become extinct,**
  - **altering some regions so much that their mix of plant and animal life will become almost unrecognizable.**
- Climate change impacts on ecosystems reduce their ability to improve water quality and regulate water flows.
- Climate change, combined with other stressors, is overwhelming the capacity of ecosystems to buffer the impacts from extreme events like fires, floods, and storms.
- Timing of critical biological events, such as spring bud burst, emergence from overwintering, and the start of migrations, has shifted, leading to important impacts on species and habitats.
- Whole system management is often more effective than focusing on one species at a time, and can help reduce the harm to wildlife, natural assets, and human well-being that climate disruption might cause.

US Global Change Program, 2014

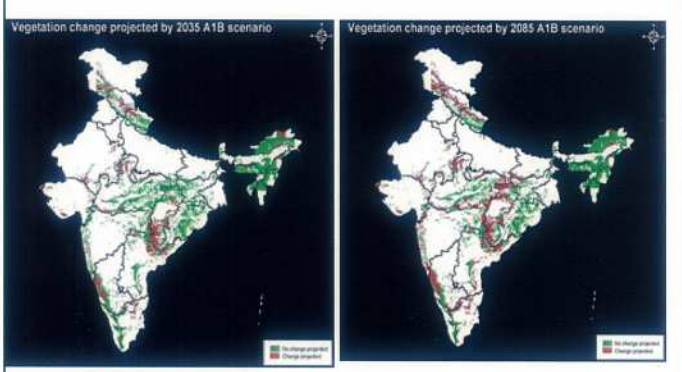
Climate Change impacts; Global Vegetation Model:

Climate Change Projections:

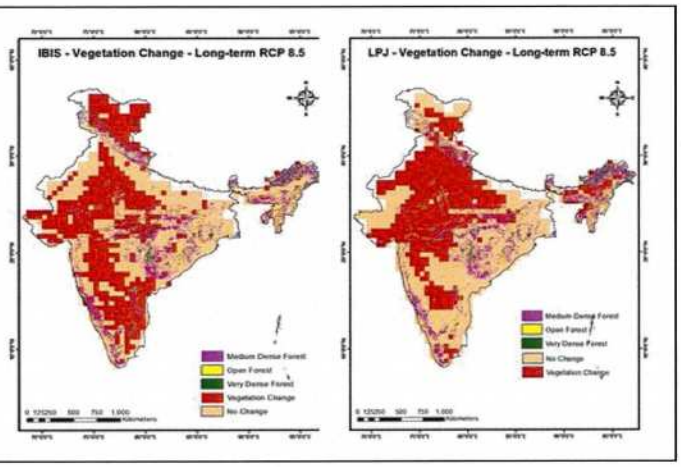
- Hadley HadRM3 data (50x50 km^2)
- Now new CMIP5-based ESMs and RCP Scenarios based climate projections
- CORDEX – Regional climate projections

Dynamic Vegetation Models

1. BIOME4: Equilibrium model
2. IBIS (Integrated Biosphere Simulator)
3. LPJ & CLM models



Red indicates that a change in vegetation is projected at that grid in the time-period of 2035 & 2085 - under A1B scenario
Green indicates that no change in vegetation is projected by that period.



Implications of CC impact on forests

1. Future climate will not be optimal for the current forest type and biodiversity.
   - Failure to migrate – leads to mortality
2. Leading to forest dieback, shift in forest type in the long term, invasion of invasives
3. Irreversible Loss of biodiversity and Ecosystem Services
   - Adverse implications for water resources
   - Loss of tourism potential
4. Loss of livelihoods to forest dependent communities

Uncertainity about future status of Forests

1. Multiple drivers and stressors are/will impact or determine Forest ecosystems, BD and ESS in future
   - Natural drivers; cyclone, drought, etc
   - Human drivers; land use change, climate change
2. CC will be an additional driver & impact of CC will be exacerbated by other stressors
3. There are uncertainties with respect to
   - Drivers; human induced
   - Uncertainty or limitations about projections of CC, Land use change; DGV models & data
4. Thus the future of Forest ecosystems, BD and ESS could be worse than know so far from from models.
5. Thus there is need to include these uncertainties in decesions on policies and Management practices

Adaptation; why and options

1. Climate change is already impacting forests
2. Climate change is projected to have adverse impacts even leading to changes in forest types, extinction of biodiversity, etc.
3. The impacts are irreversible; biodiversity loss
4. Further there is lag in response of forests to climate change – no need to wait for impacts to be exhibited
5. There is adequate knowledge to plan for adaptation

Broader Adaptation Strategies

1. Mitigation actions can reduce but not eliminate the risk of impact of climate change on terrestrial ecosystems
2. Reduction of non-climate stresses and restoration of degraded forest ecosystems
3. Expansion and linking Protected Areas
4. Creation of corridors to facilitate assisted migration, especially in fragmented forests
5. *Ex situ* conservation
6. Anticipatory planning of species along latitude / Altitude
7. Forest Silvicultural practices to enhance resilience

Current Status of Science

1. There are multiple ESMs or GCMs –
   - providing different projections of changes in Temperature, rainfall, ET, cloud cover, etc
2. There are different Emission scenarios or RCPs
   - providing different projections of changes in Temperature, rainfall, ET, cloud cover,
3. There are multiple impact models for a given sector
   - showing different impacts – on crop yields, stream flow, forest type shift
4. Impact for a given level of CC is further
   - determined by Vulnerability (Sensitivity/adaptive capacity) & Exposure
5. There are uncertainties, BUT Adaptation Planning / Actions need not wait for perfect science

Knowledge modeling and data gaps

- **Relibale climate projections at regional levels**
- **Need for reliable multi- DVM based projection of impacts of climate change – DVMs suitable for tropical forest types.**
- **Development of DVMs for species level assessment of impacts of climate change**
- **Modeling for assessmentof climate change and landuse drivers on forests and biodiversity**
- **Long term ecological studies to assess the impact of changing climate on biodiversity and ecosystems**

Research and monitoring of forest response to changing climate- including setting up long term monitoring plots

1. **Initiate long term monitoring of forests in different regions**
   - Early detection and prediction of ecosystem thresholds, particularly tipping points
2. **Identify and monitor indicators of impact of CC**
   - Species migration along the altitude and temperature gradient
3. **Monitor phenological indicators**
   - Bud appearance and bud busting, appearance of leaves, leaf fall, quantum of flowering and seeding, etc.
4. **Recording of forest die-back (e.g. tip drying)**
5. **Incidence of fire and pests**
6. **Species composition and occurrence of invasive species**
7. **Monitoring of arrival and residence period of migratory species**

- **Climate Resilient Afforestation Programme**
  - I. Promote natural regeneration and mixed species planting in the afforestation programmes to enable risk spreading, and also increase genetic diversity.
  - II. Anticipatory planting of tree species across latitudinal and longitudinal gradients, in particular identification of species from warmer districts and their promotion in districts projected to become warmer.
  - III. Assisted migration to maintain or improve migration corridors, including active management to improve survival along the shifting vegetation especially in the transitional zones and by translocation of species.
- **Linking of Protected Areas, Corridors and Fragmented Forests**
  - I. Link Protected Areas and fragmented forests for securing corridors to facilitate species migration under a changing climate.
  - II. Identify critical forest corridors and fragmented forests and promote ecosystem restoration through climate-resilient afforestation and by managing non-climate disturbances.
- **Research for Climate-Resilient Silviculture**
  - I. Develop/identify appropriate temperature, pest and fire tolerant species and silviculture practices to cope with changing climate and its impacts.
  - II. Low impact forest-harvesting and suppression of invasive species are critical for conservation of native biodiversity.
- **Climate Resilience in REDD+ Projects. Build climate resilience in REDD+ projects through**
  - I. linking of protected areas, corridors and fragmented forests
  - II. Climate resilient efforestation programme
  - III. Building resilience in communities through agro-forestry and plantation forestry incorporating climate resilient practices such as promotion of mixed species and native species.

ASEAN-India Project on Enhancing Local Level Climate Change Adaptation in Southeast Asia

Inception Workshop – Climate Change Adaptation: Mobilizing the Private Sector
(Bangi, Malaysia, February 5th / 6th 2015)

Agenda

- Public vs. private sector adaptation
- Case study and examples of private sector adaptation efforts in SEA
- Reflect on approaches to engage with private sector

Differences in Framing Climate Change Adaptation

Public Sector & Civil Society	Private Sector
• Safeguarding communities • Climate proofing of infrastructure • "Mainstreaming" of CCA • 5 – 30 year time horizon	• Quantifiable risks to firm value system • Cost / revenue / capital impact • Earning's growth • Typically 0 – 10 year time horizon
Public Interest	Private Owners
	SME's / Large Caps

Overall Private Sector is behind on CCA ...

"To date, government and civil society have taken the lead."

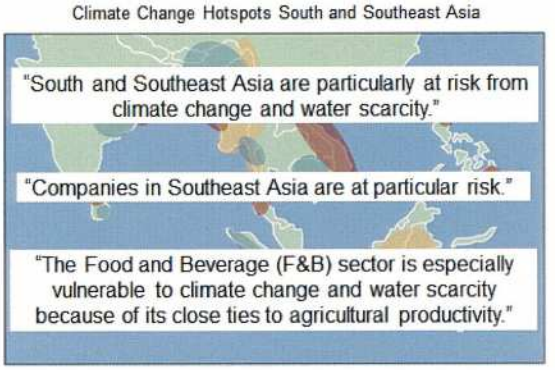
"The private sector has been slow to react."

"Business is behind."

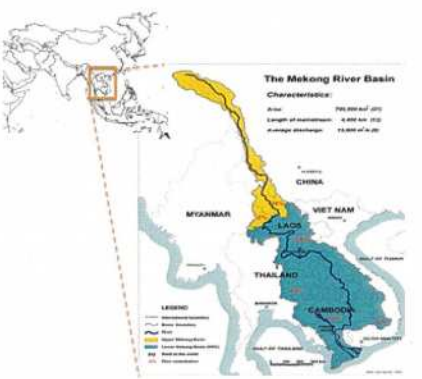
Private sector is largely absent from climate change adaptation projects

... Despite General Recognition of Vulnerabilities in Region

Climate Change Hotspots South and Southeast Asia



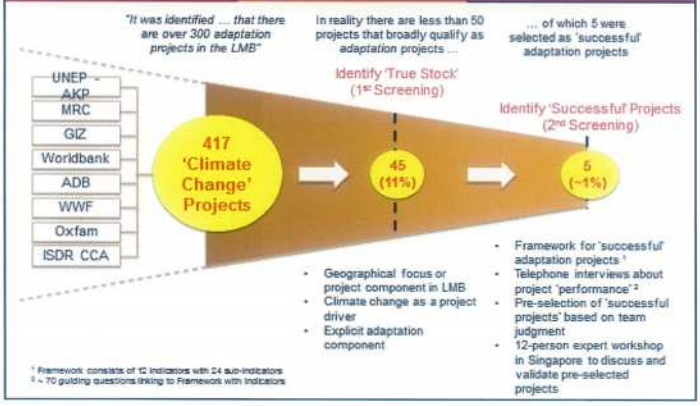
Case Study SME's: Lower Mekong River Basin State of Adaptation Practice



Lower Mekong River Basin:

- Area of > 600,000 km²
- ~ 60 million population
- 70% of population heavily reliant of agriculture and fishery
- Across 4 riparian countries fish exports ~ US$ 5.6 bn
- Thailand & Vietnam with ~ 50% of global rice exports

Process to Identify 'Successful' Adaptation Projects



[1] Framework consists of 12 indicators with 24 sub-indicators
[2] ~ 70 guiding questions linking to Framework with indicators

Shortlist of 'Successful Projects'

1	Earth Net Foundation (ENF)	- Vulnerability assessment and capacity building for mong smallholder rice farmers in Northeast Thailand (Yasothorn Province), to deal with rainfall variability and droughts
2	GIZ	- Natural resource management and ecosystem-based adaptation to deal with saltwater intrusion in the Kien Giang Biosphere Reserve, Mekong Delta, Vietnam
3	CSIRO	- Bridging top-down and bottoms-up adaptation planning and practice by targeting household segments in rice-based communities in Cambodia and Laos
4	Oxfam Vietnam	- Reducing vulnerability to coastal climate hazards and creation of a long-term adaptation strategy in the Mekong Delta, Vietnam (Ben Tre Province)
5	UNDP	- Mainstreaming regional climate change adaptation via demonstration of resilient practices in agriculture and water resource management in Cambodia

Earth Net Foundation (ENF) Project: Situation

- Since early 2000s Thai farmers are experiencing climate variations
- Observations Yasothorn Province:
  - ✧ Rising temperatures and greater volatility in rainfall patterns
  - ✧ Damages to rice seedling and/or high weed competition; shorter growth periods especially
- Overall decline in rice yields

- ENF is non-profit body specializing in organic agriculture collaborating with small-scale farmers
- Commercial arm of ENF is specialized in the marketing of organic and fair-trade products

Key Project Objectives

1) To identify **climate vulnerabilities** faced by small-scale farmers in target groups

2) To build **adaptive capacity** for smallholder farmers

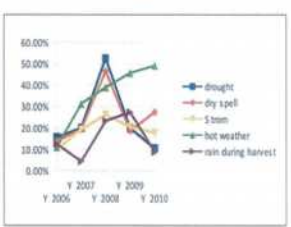
3) To promote and facilitate **implementation measures** for adaptation

Vulnerability & Risk Assessment Approach

Qualitative + Quantitative Approach

- Series of workshops with farmers to assess observed climate / weather changes by farmers
- Risks validation with scientific data, from SEA-START and the Department of Meteorology (Thai Ministry of Sciences and Technologies)
- Future climate trends from downscaled PRECIS climate model

Survey: % farmers identified risk in particular year



Adaptation Planning

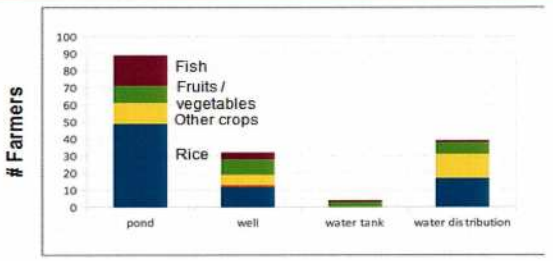
Adaptation Plan Focus

- On-farm water management
- Reduce dependency on rain fall and improved efficiency of water utilization
- Addressing both immediate needs as well as long term climate risks

Finance & Implementation

- Farmers submit self-designed loan proposal to on-farm water improvement project to a project executive committee
- OXFAM GB provided the seed money for a revolving fund:
  - ✧ Max. amount THB 30,000 (around USD 1,000)
  - ✧ Maximum 6-year installed loan repayment and progressive interest rates
  - ✧ Returns of loan principles are used to finance new applicant farmers in following years

Water Infrastructure Investment Scheme & Impact



- Diversification of 'income'
- Project supplied 50% more water to second rice crops
- Greater food self-sufficiency
- Sales of surplus to market

Examples from Large Caps in Region

- Currently no concept of assessing material financial risk of equities and adaptation needs
- Strong interest to sell green bonds as financial instrument to finance climate mitigation and adaptation

- Systematic and science-based assessment of possible impacts of climate change on future crop yield rates, logistics operations, etc.

- Strong internal climate downscaling and prediction capabilities in home market
- Exploring collaboration opportunities with regional research institute / university to support climate downscaling and impact assessment

Engagement Framework for Discussion (1)

Large Caps / Firm Value Chains

Awareness	Climate Risk Assessment	Adaptation Planning	Finance	Implementation & Monitoring
• Sr. Decision Maker Firms	• Company-specific / confidential • Fact-based: historical data, projections and impact scenarios • Linked to measurable financial value drivers: costs, revenue, capital	• Materiality-focused • Typical topics: ✧Supply chain / raw materials ✧Business risk / operations ✧Asset protection • 0 - 10 (- 30) years	• Balance sheet • Project finance • Green bonds	• Projects • Technical / implementation partners • Metrics

Engagement Framework for Discussion (2)

Public Goods & Services

Awareness	Climate Risk Assessment	Adaptation Planning	Finance	Implementation & Monitoring
• Sr. Decision Maker Policy	• National / regional / local risk assessments • Fact-based: historical data, projections and impact scenarios • Linked to measurable economic and social impact and adaptation benefits: employment, social costs, economic costs, etc.	• Public-Private Partnerships (PPP) • Typical topics: water resources, coastal defenses, flood management, disease, etc. • 5 – 30 years	• National budgets • Development finance • Project finance • Municipal / Green bonds	• Projects • Technical / implementation partners • Metrics

EARTH OBSERVATORY OF SINGAPORE

An Institute of Nanyang Technological University

Thank You

Possible leverage points for APAN (1)

Industry-sector specific working groups

- Private-sector led
- Linked to existing sector efforts, e.g. RSPO, BEI, etc.
- Linked via governance and co-ordination mechanisms to broader APAN efforts

Cross-stakeholder initiatives around specific themes

- Cross-stakeholder efforts are increasingly used as a vehicle to bridge the interest divide between stakeholder groups
  - ✧ Aligned around common goals
  - ✧ Requires independent & neutral secretariat to drive day-to-day work around analytical workstream, communication, etc.
- Examples: Fishing for a Future, GAIN, GAVI, Portfolio De-carbonization Coalition
- Possible topic for APAN:

Possible leverage points for APAN (2)

Bridge knowledge barriers for private sector CCA

- Provide access to climate models via a 'clearinghouse' function and modeling experts
- Sponsor studies to build climate change impact assessment tools; study design with strong private sector input
- Design and offer executive education sessions on physical and value related climate change impacts, tools and best practices for adaptation

Provide 'easy to access' and 'affordable' capital pools for early CCA movers

- Commercial CCA capital with investment criteria linked to projects that merge private firm benefits with social or environmental impacts
- Integrate philanthropic capital pools to integrate impact investment-type of CCA projects

2) Climate projections are not easily useable

GCM's & downscaled models not easily accessible for private sector firms and restricted in use

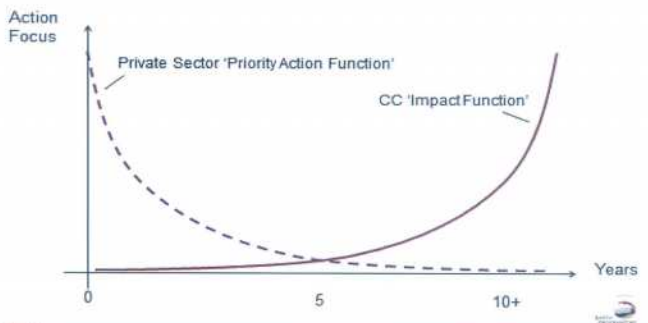
Models have poorest 'skill' in the 5-30 year projection time period

Projections are still relatively coarse

Models 'disagree' with each other on key variables and have significant projection spreads

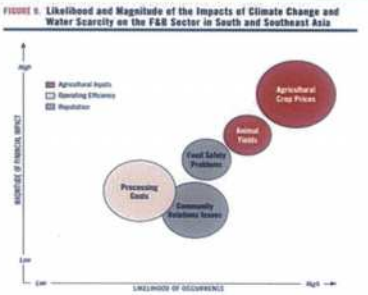
Source: EOS

3) Mismatch of Timescales and Competition for Capital



Source: EOS

4) Difficulty in calculating firm value impacts (3)



Source: HSBC / WRI 2010 "Investing Risks' Financial Impacts of Climate Change and Water Scarcity on Asia's Food and Beverage Sector

5) Organizational barriers (1)

1

- CC / CCA is **difficult** to capture organizationally
  - Procurement
  - Supply chain
  - Marketing
  - Finance
  - Risk / Compliance

→ Cross-functional 'Sustainability' officers or teams are **not always impactful**

2

- Integration of CCA into decision making requires relatively **high level of skill and sophistication**

→ Prevalent **CCA skills** are typically **correlated** with firm size due to investments

	Low	Medium	High
MNC		Strong	Very Strong
Large National / Regional			Medium - Strong
SME's			Weak

Source: EOS

5) Organizational barriers (2)

3

- CCA capacity investments will only be made if **endorsement from top management**
  - CEO
  - Board

→ Endorsement and investments require a demonstrated **'business case'** and KPI's to track progress

4

- Internal awareness building and external stakeholder communication is critical
  - Employee and management education
  - External communications campaign

→ Requires **marketing team** involvement when internal capacity is being developed

Source: EOS

Agenda

- Discuss challenges of integrating private sector into CCA efforts
- **Share perspectives on possible way forward**

Concluding thoughts

Window of opportunity for next 15 months

Must reframe the dialogue – explore new approaches

Provision of resources and capital to get tangible results

Rough estimate of CCA capacity by sector

Reactive → Proactive

- Institutional Asset Owners
- Commercial Banks
- Health
- Materials
- Industrial
- Transport
- IT
- Telco
- Real Estate
- Utilities
- Consumer Goods
- Agriculture
- Tourism
- Insurance

Source: EDS estimate based on WRI / CSR Asia / Sida Study 'Making Climate Your Business', 2009; WRI Case Study; CDP 'Water public companies describe climate-related risks and costs'; discussions with private sector companies

Private sector views on climate risks and impacts

Reactive → Proactive

Institutional Asset Owners

*"**Relatively little research** has focused on the investment implications of climate change at total portfolio level and how institutional investors might respond."*

Materials

*"Severe weather events **can lead** to operational delays and increased operational costs. Storm **may create** delays in the deliveries of necessary supplies and equipment."*

Utilities

*"The physical risks associated with climate change **will compel** Con Edison to build greater resilience .... The **costs identified here** are in orders of magnitude approximations."*

Consumer Goods

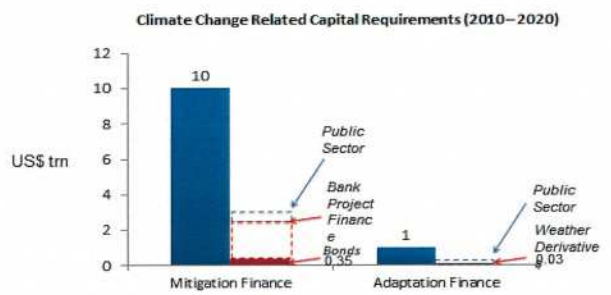
*"A reduction in cotton production last year due to changes in precipitation and drought ... was a contributing factor to global price increases. **We experienced** higher material costs."*

Insurance

*"In 2012, **we recorded net pre-tax catastrophe losses** of US$ 633 million, primarily from Superstorm Sandy."*

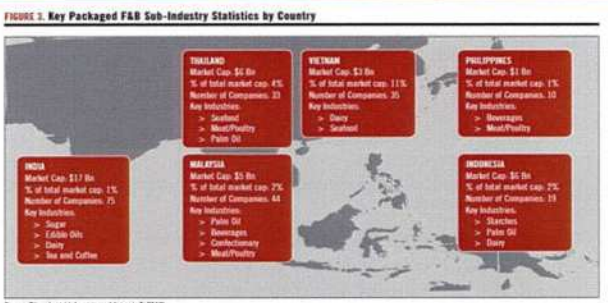
Source: EDS estimate based on WRI / CSR Asia / Sida Study 'Making Climate Your Business', 2009; WRI Case Study; CDP 'Water public companies describe climate-related risks and costs'; discussions with private sector companies

Consequence – Gap in climate finance



Bonds: 76% Transport / rail ; 12% Energy; 70% of bonds government backed
Source: Climate Bonds Initiative

View of Financial Sector on Large Caps (1)



Source: Bloomberg (data accessed January 7, 2010)
*Note: Select companies, most notably San Miguel Pure Foods (Philippines), are not included due to unavailability of data. Please see Appendix 2 for list of companies included.

Source: HSBC / WRI 2010 'Investing Risks' Financial Impacts of Climate Change and Water Scarcity on Asian Food and Beverage Sector

ASEAN Experiences on Climate Change Adaptation

Dr. Raman Letchumanan

ASEAN at a Glance

Characteristics	Facts
Population	About **580 million people** (2008)
Population density	**130 people per square kilometer** (world average: 49 people per sq km)
Population in urban areas	**44% of region's total population**; projected to increase to 55% by 2020
Coastlines	**173,000 km** (14% of the world total)
Forest cover	**1,904,593 sq km** (2007)
Mangrove	**Over 52,000 sq km**
Peatland	**25 million hectares** (60% of global tropical peatlands)
Coral reefs	**34% of the world total**
Poverty incidence (% of population living below respective national poverty line)	*Cambodia (34.7%), Indonesia (16.6%), Lao PDR (32.7%), Malaysia (3.6%), Myanmar (26.6%), the Philippines (30.0%), Thailand (8.48%), Viet Nam (14.75%)*

Source: The Fourth ASEAN State of Environment Report, 2009

ASEAN is one of the world's most vulnerable regions to climate change impacts such as droughts, fires, heat waves, floods, typhoons, sea level rise

- A large proportion of the population and economic activity is concentrated along coastlines
- The region is heavily reliant on agriculture for livelihoods;
- There is a high dependence on natural resources and forestry;
- The level of extreme poverty remains high.

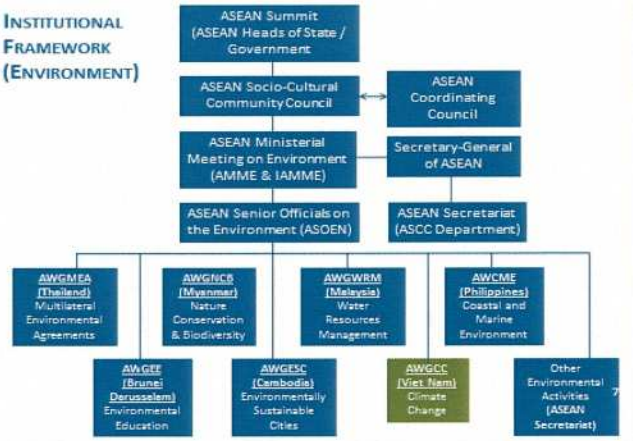
ASEAN Member States' National Initiatives

- Several ASEAN Member States have announced voluntary mitigation targets:
  - **Indonesia**: GHG emission reduction of 26% of GHG emission by 2020 through business as usual approach, and extra 15% cut with international support.
  - **Malaysia**: reduction of 40% in terms of energy intensity of GDP by 2020 compared to 2005 levels
  - **Philippines**: reduction of 20% from BAU of their emission growth path),
  - **Singapore**: emission reduction of 16% below BAU by 2020.
- Many AMS have also started strengthening their adaptive capacity through mainstreaming climate change adaptation in development planning.

Relevant Declarations / Statements

- ASEAN Declaration on Environmental Sustainability (13th ASEAN Summit, 2007)
- ASEAN Declaration on COP-13 to the UNFCCC and CMP-3 to the Kyoto Protocol (13th ASEAN Summit, 2007)
- Singapore Declaration on Climate Change, Energy and the Environment (3rd EAS Summit, 2007)
- Joint Ministerial Statement of the First EAS Energy Ministers Meeting (2007)
- Ministerial Statement of the Inaugural EAS Environment Ministers Meeting (2008)
- ASEAN Joint Statement on Climate Change to COP-15 to the UNFCCC and CMP-5 to the Kyoto Protocol (15th ASEAN Summit, 2009)
- Singapore Resolution on Environmental Sustainability and Climate Change (11th AMME, 2009)
- ASEAN Leaders' Statement on Joint Response to Climate Change (16th ASEAN Summit, 2010)
- **ASEAN Leaders' Statement on Climate Change to UNFCCC COP17/CMP7 (19th ASEAN Summit, 2011)**

Institutional Framework (Environment)



Cross-Sectoral Nature of Climate Change

- **Environment**
  all areas particularly conservation of biodiversity, water resources management, coastal and marine environment, public awareness and environmental education, forest fires and transboundary haze pollution etc
- **Agriculture and Forestry**
  food security, forest degradation
- **Disaster Management**
  more and severe weather related disasters such as floods, droughts, typhoons, etc
- **Science and Technology**
  Weather monitoring and forecasting, research and development on climate related impacts and responses, vulnerability studies, etc
- **Health**
  more and severe weather related diseases

Cross-Sectoral Nature of Climate Change

- **Human Development**
  impact on poverty, sustainable livelihoods, social development, and generally on the achievement of the MDG goals
- **Economic Growth**
  affects production and transaction costs through internalizing environmental costs, change in products, services and markets, drag on GDP growth, carbon taxes, allocation and trade of environmental rights, new market opportunities for environmental goods and services.
- **Energy, Transportation**
  renewable energy, energy conservation, mass and efficient transportation, etc
- **Political and Human Security**
  environmental security issues, political debate influenced more and more by environmental issues, in particular climate change

The Blueprint for the ASEAN Socio-Cultural Community (2009-2015)

ASEAN Climate Change Initiative

D10. Responding to Climate Change and addressing its impacts

Strategic Objective: Enhance regional and international cooperation to address the issue of climate change and its impacts on socio-economic development, health and the environment, in ASEAN Member States through implementation of mitigation and adaptation measures, based on the principles of equity, flexibility, effectiveness, common but differentiated responsibilities, respective capabilities, as well as reflecting on different social and economic conditions.

Section D10 of The Blueprint for the ASEAN Socio-Cultural Community (2009-2015)

Actions:

i. Encourage ASEAN common understanding on climate change issues and where possible, engage in joint efforts and common positions in addressing these issues;
ii. Encourage the efforts to develop an ASEAN Climate Change Initiative (ACCI);
iii. Promote and facilitate exchange of information/knowledge on scientific research and development (R&D), deployment and transfer of technology and best practices on adaptation and mitigation measures, and enhance human resource development;
iv. Encourage the international community to participate in and contribute to ASEAN's efforts in afforestation and reforestation, as well as to reduce deforestation and forest degradation;

Section D10 of The Blueprint for the ASEAN Socio-Cultural Community (2009-2015)

Actions:

v. Develop regional strategies to enhance capacity for adaptation, low carbon economy, and promote public awareness to address effects of climate change;
vi. Enhance collaboration among ASEAN Member States and relevant partners to address climate related hazards, and scenarios for climate change;
vii. Develop regional systematic observation system to monitor impact of climate change on vulnerable ecosystems in ASEAN;
viii. Conduct regional policy, scientific and related studies, to facilitate the implementation of climate change convention and related conventions;

SECTION D10 OF
THE BLUEPRINT FOR THE ASEAN SOCIO-CULTURAL COMMUNITY (2009-2015)

Actions:

ix. Promote public awareness and advocacy to raise community participation on protecting human health from the potential impact of climate change;

x. Encourage the participation of local government, private sector, non-governmental organisations, and community to address the impacts of climate change; and

xi. Promote strategies to ensure that climate change initiatives lead to economically vibrant and environment friendly ASEAN Community taking into account win-win synergy between climate change and the economic development.

ASEAN Agreement on Transboundary Haze Pollution

prevent, monitor, and mitigate land and forest fires to control transboundary haze pollution through concerted national efforts, regional and international cooperation

through :

- monitoring and assessment
- prevention
- preparedness
- national and joint regional emergency response
- technical and scientific cooperation
- capacity building and public awareness

ASEAN PEATLANDS ARE IMPORTANT FOR CARBON STORAGE AND REDUCING GHG EMISSIONS

Peatland carbon stores:
Global: 550 billion tonnes; ASEAN: 70 billion tonnes (13%)
Twice the carbon stored in all global forest biomass combined

But Peatland Emissions:
Global: 3-4 billion tonnes CO2 / yr ASEAN: 1.5-2 billion tonnes/yr (50%)
Equivalent to 6-7% of global fossil fuel emissions

ASEAN PEATLANDS : KEY FOR WATER STORAGE AND FLOOD PREVENTION

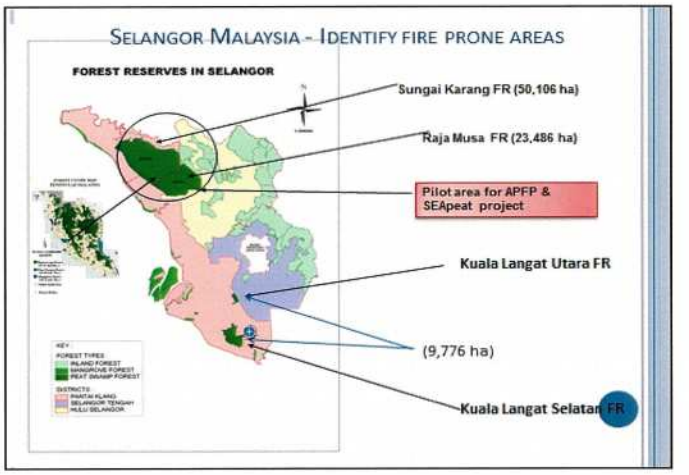
- **Peatlands: Key for water storage and regulation**
- **Provides Water - Prevents Floods**

90% OF TRANSBOUNDARY HAZE IN SOUTHERN ASEAN IS FROM PEATLAND FIRES

GUIDELINES ON INTEGRATED MANAGEMENT

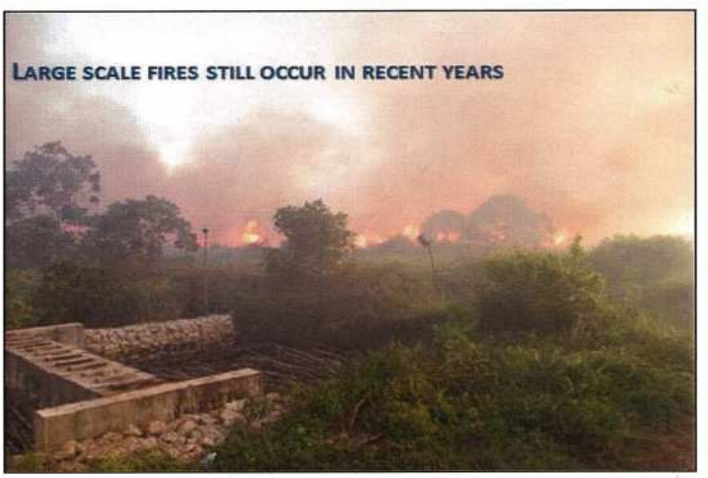
NEED TO ENSURE ADJACENT DEVELOPMENTS ARE COMPATIBLE WITH MAINTAINING THE PEATLANDS


IFAD-GEF Project on Rehabilitation and Sustainable Use of Peatland Forests in Southeast Asia
Riau, Sumatera
Lake Sentarum, West Kalimantan
North Selangor Peat Swamp Forest, Malaysia

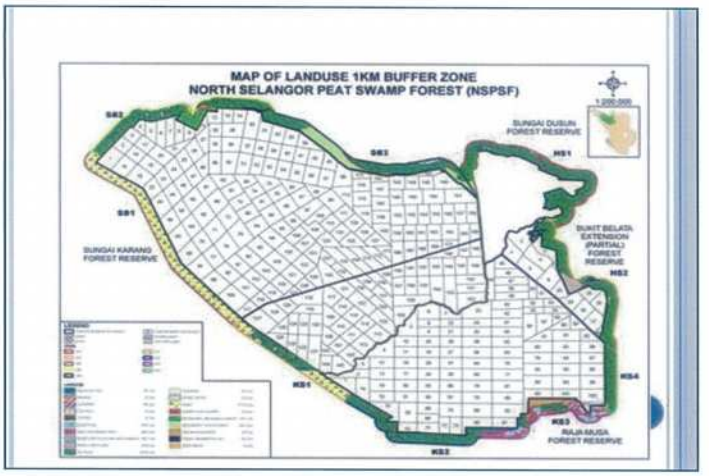

SELANGOR MALAYSIA – IDENTIFY FIRE PRONE AREAS
FOREST RESERVES IN SELANGOR
Sungai Karang FR (50,106 ha)
Raja Musa FR (23,486 ha)
Pilot area for APFP & SEApeat project
Kuala Langat Utara FR
(9,776 ha)
Kuala Langat Selatan FR

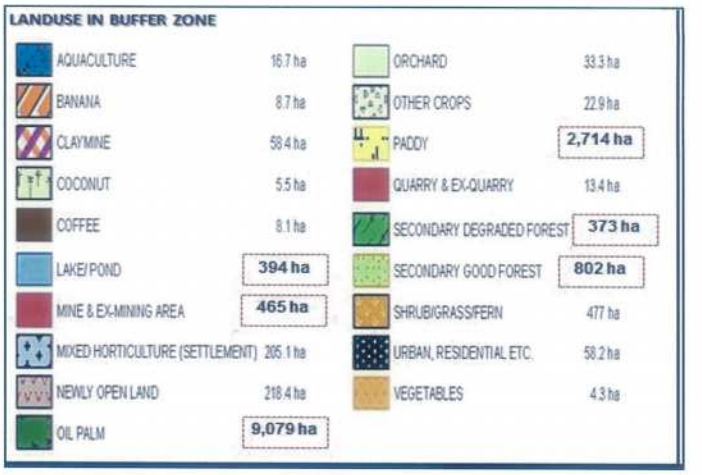

NORTH SELANGOR PEAT SWAMP FOREST
Sungai Besar
Sekinchan
Google earth


PEATLAND FOREST CONTRIBUTES TO PROVISION OF WATER SUPPLY TO RICE FIELDS IN MALAYSIA

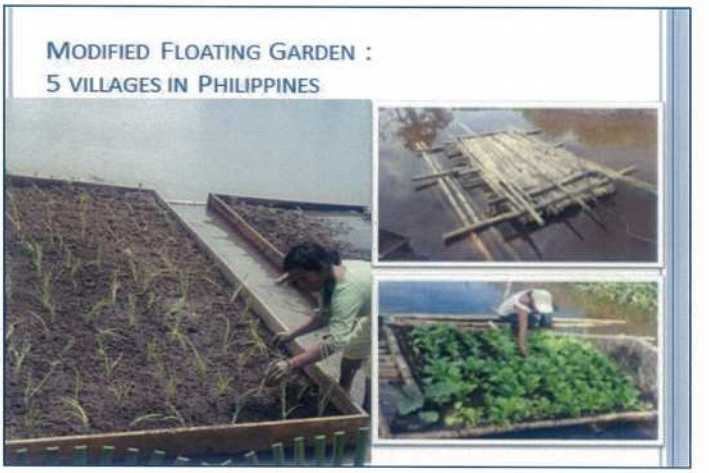

LARGE SCALE FIRES STILL OCCUR IN RECENT YEARS


Clay bund constructed by private company to raise the water level at the fire prone areas
2012
2013

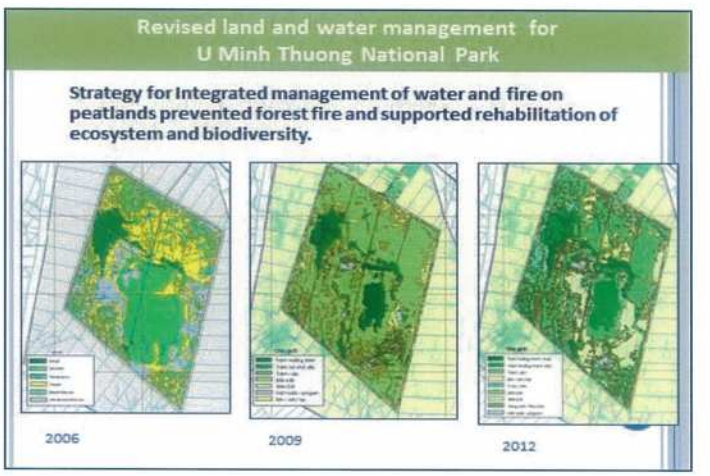

MAP OF LANDUSE 1KM BUFFER ZONE
NORTH SELANGOR PEAT SWAMP FOREST (NSPSF)
SUNGAI KARANG FOREST RESERVE
SUNGAI DUSUN FOREST RESERVE
BUKIT BELATA EXTENSION (PARTIAL) FOREST RESERVE
RAJA MUSA FOREST RESERVE


LANDUSE IN BUFFER ZONE
AQUACULTURE 16.7 ha
BANANA 8.7 ha
CLAYMINE 58.4 ha
COCONUT 5.5 ha
COFFEE 8.1 ha
LAKE/ POND 394 ha
MINE & EX-MINING AREA 465 ha
MIXED HORTICULTURE (SETTLEMENT) 265.1 ha
NEWLY OPEN LAND 218.4 ha
OIL PALM 9,079 ha
ORCHARD 33.3 ha
OTHER CROPS 22.9 ha
PADDY 2,714 ha
QUARRY & EX-QUARRY 13.4 ha
SECONDARY DEGRADED FOREST 373 ha
SECONDARY GOOD FOREST 802 ha
SHRUB/GRASS/FERN 477 ha
URBAN, RESIDENTIAL ETC. 58.2 ha
VEGETABLES 4.3 ha


Natural Floating Peat Island: Inle lake, Myanmar


MODIFIED FLOATING GARDEN :
5 VILLAGES IN PHILIPPINES


SORJAN FARMING SYSTEM TRANSFERRED TO AGUSAN MARSH, PHILIPPINES
US10,000 FOR PILOT SITES IN 10 VILLAGES 14 HA
Barren land
3-week old planted field
2.5 months old
Pechay
Okra
String beans
Corn
Eggplant
Watermelon
Cucumber


Revised land and water management for
U Minh Thuong National Park
Strategy for Integrated management of water and fire on peatlands prevented forest fire and supported rehabilitation of ecosystem and biodiversity.
2006
2009
2012

ASEAN Programme on Sustainable Management of Peatland Ecosystems (SMPE) 2014-2020

Six SMPE Targets

1. All peatland areas identified and inventorized;
2. Zero-burning uniformly practiced and controlled-burning only in exceptional cases to prevent any uncontrolled wildfires on peatlands, and eliminate any widespread smoke haze;
3. Fire prone sites rehabilitated by focusing on root causes of fire,
4. Peatlands sustainably managed, sustainable livelihoods enhanced, and sustainable economic use mainstreamed;
5. Peatlands conserved to contribute to significantly reduced emissions of greenhouse gases and increased peatland biodiversity in the region;
6. APMS and NAPs implemented; national and regional capacity enhanced

Annual ASEAN+3 Leadership Programme on Sustainable Production and Consumption

ASEAN Plus Three Youth Environment Forum (AYEF) 2010: Creating a Climate for Change

ASEAN ESD Film Festival 2011: Change the Climate Change (Phnom Penh, Cambodia)

Using the power of photos in explaining the complex topic of biodiversity and its relation to climate change

Over 1,000 photos have been received

ASEAN – German Programme on Response to Climate Change: Agriculture, Forestry and Related Sectors (GAP-CC)

Component 1: Forest Issues of the AFCC

Forest Certification / Sustainable Forest Management
Forest Governance and Finance
REDD+

Component 2: Climate Response Strategies and Climate Proofing

Adaptation and Mitigation in Key Agricultural / Forestry Value Chains
Climate Proofing
National Adaptation Plans
Climate Finance
Knowledge Management

ASEAN Multi-Sectoral Framework on Climate Change: Agriculture, Fisheries and Forestry towards Food Security (AFCC)

- The overall goal of the AFCC is **to contribute to food security through sustainable, efficient and effective use of land, forest, water and aquatic** resources by minimizing the risks and impacts of and the contributions to climate change.
- To achieve its goal, sectoral activities will be carried out under the two major objectives of: **(i) coordination on the development of adaptation and mitigation strategies and (ii) cooperation on the implementation of integrated adaptation and mitigation measures.**

Biodiversity and Climate Change Project (BCCP)

ASEAN Centre for Biodiversity | giz

The overall objective of BCCP is to support ASEAN Member States (AMS) develop and enhance their strategies to appropriately address the interface between biodiversity and climate change.

Other Activities

Environmentally Sustainable Cities

- ASEAN ESC Model Cities Programme
  Year 1: April 2011 - March 2012, 14 cities
  Year 2: Inception Meeting in June 2014
- Citylinks Pilot Partnership
- ASEAN ESC Award (2008 and 2014)

Environmental Education

- ASEAN Eco-schools Award
- ASEAN Guidelines on Eco-schools
- ASEAN Environment Year

Coastal and Marine Environment

- Climate Change and ASEAN Coastal Areas: Vulnerability, Impacts and Adaptation (Phase I) (Proposed)

Biodiversity

- Biodiversity & Climate Change Project
- ASEAN Heritage Parks Programme

Water Resources Management

- Development of Integrated Water Resources Management Guidelines

Climate Change Adaption (CCA) in the Work Programme for the ASEAN Agreement on Disaster Management and Emergency Response (AADMER), 2010-2015

- **Work Programme for AADMER developed**
- **Climate Change Adaptation is to be taken into account** in the relevant strategic components of the Work Programme:
  - Prevention and Mitigation
  - Risk Assessment, Early Warning and Monitoring
  - Preparedness and Response
  - Recovery and Rehabilitation

Energy Security & Climate Change

- **ASEAN Plan of Action for Energy Cooperation (APAEC) 2010-2015** was adopted by the ASEAN Ministers on Energy in 2009 with the theme of *"Bringing Policy to Actions Towards a Cleaner, more Efficient and Sustainable ASEAN Energy Community"*.
- The **three key initiatives** of the ASEAN energy security policy/plan within which environment and climate change appears as important elements in the next five years include:

  (i) Energy Efficiency and Conservation;

  (ii) Renewable Energy; and

  (iii) Coal and Clean Coal Technology.

Energy Security & Climate Change

- **Energy Efficiency and Conservation (EE&C)**

The strategic goals of EE&C in APAEC include:

(i) pursuing the aspirational goal of reducing regional energy intensity of at least 8% by 2015 based on 2005 level;

(ii) achieving higher end-use energy efficiency for all sectors through regulatory & market approaches, where appropriate;

(iii) enhancing institutional & human capacity emphasizing the development of energy efficiency technology & service providers in the ASEAN region;

(iv) encouraging private sector participation, especially financial institutions to support EE&C investment and implementation.

Energy Security & Climate Change

o Coal and Clean Coal Technology (CCT)

The strategic goals of CCT in APAEC 2010-2015 include:

(i) promoting and increase cleaner coal use and trade for regional energy security;

(ii) strongly encouraging the use of clean coal technologies through regional cooperation; and enhancing institutional & human capacity emphasizing the development of energy efficiency technology & service providers in the ASEAN region;

(iii) building the perception of coal as a cleaner fuel as a result of clean coal technologies.

Energy Security & Climate Change

o Renewable Energy (RE)

The strategic goals of RE in APAEC 2010-2015 include:

(i) achieving a collective target of 15% for regional renewable energy in the total power installed capacity by 2015

(ii) strengthening regional cooperation on the development of renewable energy and alternative energy including hydropower and bio-fuels;

(iii) promote the development of centers of research and development on renewable energy in the region;

(iv) promoting open trade, facilitation and cooperation in the renewable energy sector and related industries as well as investment in the requisite infrastructure for renewable energy development.

ASEAN Transport Integration & Climate Change

ASEAN-Japan Action Plan on Environment Improvement in Transport Sector (AJ-APEIT)

- The plan will serve as a basic framework for ASEAN and Japan to implement measures for environmental improvement with the objective of achieving sustainable development by realizing low-carbon and low-pollution transport systems in the ASEAN region.
- The AJ-APEIT will cover the 5 year period from 2010-2014, and emphasize the following: **(i) human and institutional capacity development, (ii) compilation of best practices, (iii) infrastructure improvement, (iv) experiments and (v) information sharing.**

ASEAN Transport Integration & Climate Change

Energy Efficiency and Climate Change Mitigation for the Land Transport Sector (ASEAN-Germany)

- The objective of the project is to limit the increase and ultimately reduce fuel consumption and greenhouse gas emissions through higher energy efficiency of land transport systems in ASEAN.

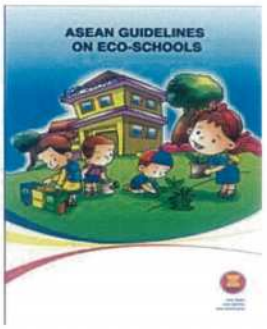
ASEAN Air Transport Integration Project (AATIP) (ASEAN-EC)

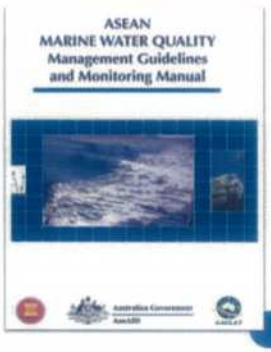
- One of the main objectives of the project is to address the issue of limiting the environmental impact of aviation through exchanges on international rules and regulations, including collaborative research and development and through the evaluation of other possible measures to reduce noise and CO_2 and other emissions from aviation.

ASEAN Heritage Parks (AHP) Programme

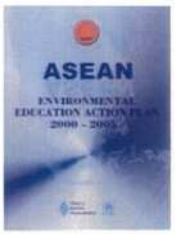
ASEAN State of the Environment Reports

GUIDELINES





ASEAN ENVIRONMENTAL EDUCATION ACTION PLAN (AEEAP)



2000 - 2005

2008 - 2012

2014-2018

INSTITUTIONS / CENTRES

ASEAN CENTRE FOR BIODIVERSITY
Conserve Biodiversity, Save Humanity!

http://www.aseanbiodiversity.org/

中国-东盟环境保护合作中心
China - ASEAN Environmental Cooperation Center

http://chinaaseanenv.org/english/

ASEAN Environmentally Sustainable City (ESC) Award Programme

Recipients of the ASEAN ESC Award 2008

Brunei Darussalam:	Temburong District
Cambodia:	Municipality of Phnom Penh
Indonesia:	Palembang City
Lao PDR:	Luang Prabang District
Malaysia:	North Kuching City Hall
Myanmar:	Taungyi City
Philippines:	Puerto Princesa City
Singapore:	South West Community Development Council
Thailand:	Bangkok City
Viet Nam:	Ha Long City

ASEAN Initiative on Environmentally Sustainable Cities (AIESC)

25 ASEAN participating cities in ASEAN ESC Network
(as of 17 November 2008)

Country	City
Brunei Darussalam	Bandar Seri Begawan
Cambodia	Phnom Penh, Siem Reap
Indonesia	Padang, Palembang, Pekanbaru
Lao PDR	Luang Prabang, Vientiane, Xayabourie
Malaysia	Kuantan, Putrajaya, North Kuching City Hall
Myanmar	Mandalay, Yangon
Philippines	Cagayon de Oro, Iloilo, Quezon City
Singapore	Singapore
Thailand	Bangkok, Chiang Mai, Krabi, Phuket
Viet Nam	Da Nang, Ha Long, Ha Noi

THANK YOU

Impacts of disasters on agricultural sector: A case of Kampong Speu Province

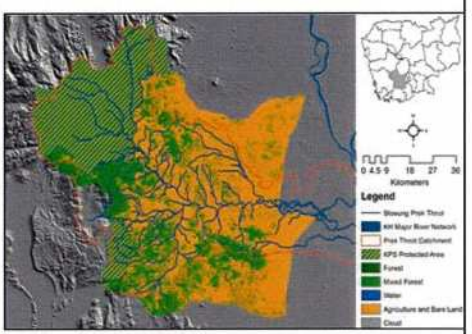
Presented by
Cheb Hoeurn

Content

- Background of Kampong Speu
- Rationale of the study
- Emerging issues and challenges
- On-going adaptation activities
- Existing loss and damage assessment

Background of Kampong Speu

- Area: 653,396 ha, 167,771 ha is for cultivation area
- Population: 812,290 people (51% female); 67.61% are farmers.
- Prek Thnot catchment influences all hydrological conditions.
- Lower part covered by rice fields with less forest and low elevation.



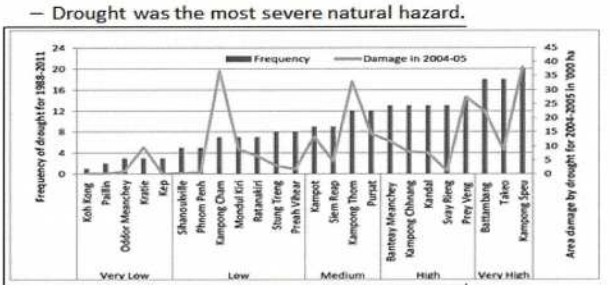
Land Use and Hydrology of Kampong Speu province

Rationale of the study

- Why Kampong Speu?
  - Third venerable province to Climate Change
  - Farmers in the KPS province will face more productivities losses in the future due to Drought
  - KPS has very a high incidence of poverty compared to other provinces.

Emerging issues and challenges

- **Disasters and vulnerability assessment**
  - 3rd Vulnerable province in Cambodia.
  - Drought was the most severe natural hazard.



Drought frequency by province, 1988-2011 and area damaged by drought in 2004-05 in Cambodia.

Emerging issues ...Cont

- **Disasters impacts and social change**
  - Increase migration to urban and foreign countries
  - Increase more responsibilities of vulnerable groups (women, children, elderly without adult protection and poorest households)
  - Changes in social status and identity of the communities
    - From property owners to debtors
    - From framers to migrant workers...

On-going adaptation ...Cont

- **Perceptions of local community on climate change**
  - Not many Cambodians understand the basic science of climate change
  - Most farmers in KPS have limited knowledge and understanding about the cause and consequences of climate change or the disaster risks.
- **The responses of local farmers**

1) To Drought

- Supplying water to rice filed during the prolong drought
- Shifting crop calendar and crop variety
- Increasing the use of chemical fertilizer

2) To Flood

- Spreading information about potential hazards among villagers,
- Sending young kids and aged people to safe places
- Sharing food commodities among affected families/groups

On-going adaptation ...Cont

- **Community commitment and participation in responding to disaster impacts**
  - local communities have high commitment and willing to participate in the DRR programs
  - They formed as CBO, whose roles to mobilize collectives in protecting naturals resources, creating saving groups.
  - However, poor and vulnerable groups seem to stand behind the stages because they often spend most of their time for daily livelihood activities.

Existing loss and damage assessment (current and future)

- **Lose Income sources**

Year	Affect				Losses/damages			
	Droughts (Ha)	Pests (Ha)	Floods (Ha)	Livestock diseases (Head)	Droughts (Ha)	Pests (Ha)	Floods (Ha)	Livestock diseases (Head)
2009	1,475	1,270	-	2,524	332	-	-	189
2010	1,929	-	1,766	2,845	223	-	277	125
2011	-	-	-	3,698	-	-	-	191
2012	10,715	-	-	1,584	320	-	-	144
2013	2,239	-	-	2,398	-	-	-	139
Total	16,358	1,270	1,766	13,049	865	-	277	788

Source: PDA annual report 2013 cited in MAFF (2013)

Conclusion

- KPS was the third most vulnerable province to natural disasters due to low adaptive capacity.
- Agriculture is the most affected factor.
- Drought is most severe hazard.
- Communities have limited understanding on related root causes and the consequences of disaster impacts
- Disasters bring about severe incomes and infrastructure losses and social problems such as gender issues, school drop-out, social vulnerability.

Areas for improvement

- Exclusive livelihood programs should be established to assist the most vulnerable peoples and help stabilize their livelihoods in the short time period.
- Also, government agencies and development partners should work in close partnership to continue:
  - building community capacity;
  - providing them with necessary infrastructure such as irrigation systems, road and other techniques, which are beneficial for communities in long-term.

Thanks for your attention!

INCEPTION WORKSHOP ON
ENHANCING CLIMATE CHANGE ADAPTATION IN SOUTHEAST ASIA

5-6 February 2015, Bangi, Malaysia

STUDIES OF NATURAL DISASTERS, SLOW ONSET EVENTS AND LOSS & DAMAGE IN QUANG NGAI, VIETNAM

Tran Dinh Trong
Vietnam Institute of Meteorology, Hydrology and Climate change

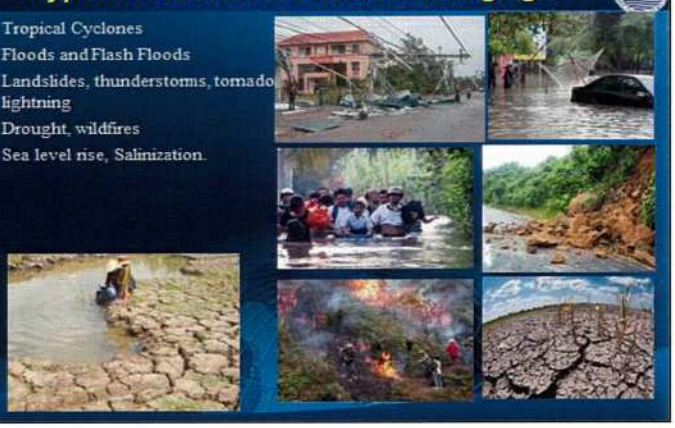
Why Quang Ngai Province is Chosen?

Quang Ngai province:

- Situated in the middle of Vietnam.
- The coastal line is more than 130km with many river mouths such as Sa Ky, Cua Dai, My A, Sa Huynh
-Effected by many kinds of Natural disasters
- Action Plans to cope with climate change for the Province has been approved.

Types of Natural Disasters in Quang Ngai

- Tropical Cyclones
- Floods and Flash Floods
- Landslides, thunderstorms, tornado lightning
- Drought, wildfires
- Sea level rise, Salinization.



Dangerous Level of natural hazards occur in Quang Ngai province

TT	Types of Natural Disaters	Level of danger			
		Very High	High	Medium	Slight
1	Typhoons	X			
2	Floods	X			
3	Riverbank and shoreline erosions		X		
4	Mountain Landslide		X		
5	Northeast monsoon		X		
6	Thunderstorms, tornados, lightning		X		
7	Flash floods		X		
8	Sea level rise			X	
9	Droughts			X	
10	Saline intrusion			X	
11	Hot dry winds				X
12	cold weather damage				X
13	Hail				X
14	Fog, frost				X

Sea Level Rise in Quang Ngai

CC scenarios	Decades								
	2020	2030	2040	2050	2060	2070	2080	2090	2100
Low	7-8	12-13	17-18	22-25	29-33	35-41	41-49	47-57	52-65
Medium	8-9	12-13	18-19	24-26	31-35	38-44	45-55	53-63	61-74
High	8-9	13-14	19-21	27-29	36-40	47-53	58-67	70-82	83-97

Sea Level Rise Scenario for Region 4 including Quang Ngai Province (cm)

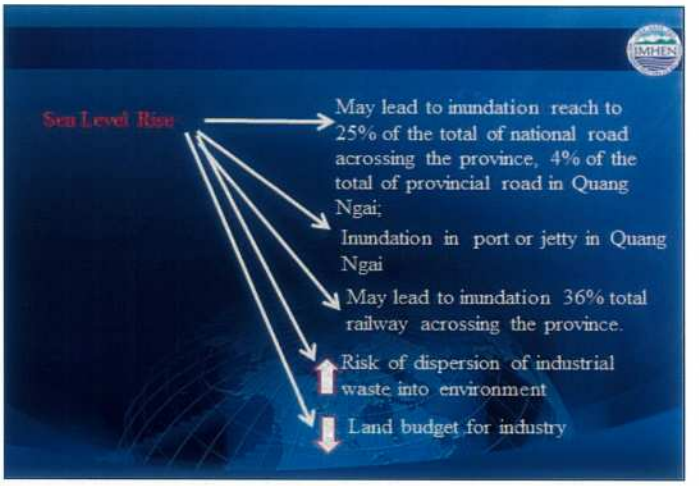
High Emission Scenario

Salinization in Quang Ngai

- **Main reason**: the salinity of seawater intrusion in estuaries across the tide.
- **Many factors contribute the degree of salinity** :
  - The salinity of coastal water (sea Quang Ngai has the largest average salinity of about 32 ‰);
  - The tide regime in estuary (both diurnal and semi-diurnal tides , tidal estuaries range during the dry season average from 1.2 to 1.3 m, large most do not exceed 1.5 m);
  - The topography of the coastal plains and river slope;
  - The flow of upstream.
- **Areas affected** are coastal plains of the river mouth as the region: East of Binh Son District (Sa Can river mouth), East of Son Tinh, Tu Nghia and Mo Duc districts (Dai and Lo river mouths), Southeast of Duc Pho (My A and Sa Huynh river Mouths).

Loss and damage

- Still in qualitative than quantitative



Projected Inundation area under climate change scenarios

(Total area of Quang Ngai is 515,295 ha)

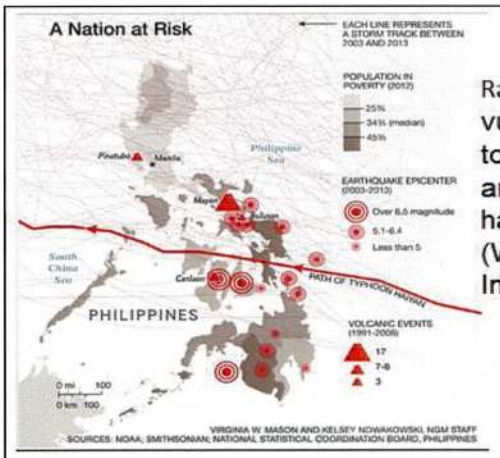
Scenarios	Period	Area of entire inundation(ha)	Differences with a historical flood in 1999 (ha)	Scale of changes in comparison with the flood in 1999 (%)
1999	1999	59366		
B1	2020-2039	60645	1279	2,15
	2040-2059	60820	1454	2,45
	2060-2079	60838	1472	2,48
	2080-2099	60838	1472	2,48
B2	2020-2039	60825	1459	2,46
	2040-2059	60825	1459	2,46
	2060-2079	60932	1566	2,64
	2080-2099	60639	1273	2,14
A2	2020-2039	60638	1272	2,14
	2040-2059	60825	1459	2,46
	2060-2079	60949	1583	2,67
	2080-2099	60984	1618	2,73

Thank you

Loss and Damage Assessment on Land and Forest Degradation: Overview of the Philippine Study

Juan M. Pulhin, PhD
Professor and Dean
College of Forestry and Natural Resources,
University of the Philippines Los Baños

Inception Workshop on Enhancing Local Level Climate Change Adaptation in Southeast Asia
5-6 February 2015, Bangi, Malaysia



Ranked 3rd in vulnerability to disaster and natural hazards (World Risk Index 2011)

Why Loss and Damage an important concern in the Philippines' forest lands?

- More then 50% of the country's total land area of 30 M ha classified as forest land under various forms of degradation
- As disasters hit degraded ecosystems including deforested areas, they put pressure on jobs and the economy, increasing the social vulnerability of poor communities (WB, 2013)
- Disasters result to loss and damage to property, territory, lives and livelihoods.
- Increasing population in forest lands increases vulnerability to climate-related risks

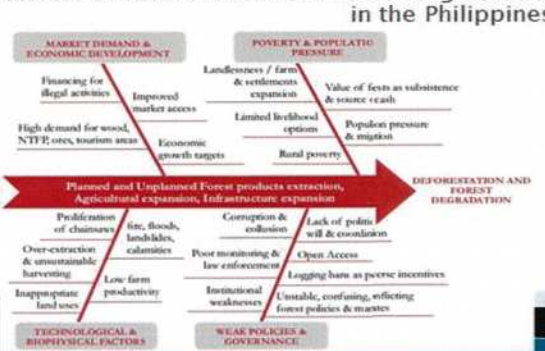
Philippine historical forest cover, all forest types (1575-2005)

Year	Forest Cover (million ha)	% of Total Area
1575	27.5	91.67
1863	20.9	69.67
1920	18.9	63.00
1934	17.8	59.33
1970	10.9	36.33
1980	7.4	24.67
1990	6.7	22.33
2005	7.2	24.00

Source: RMPFD, 2003 (Note: 2005 data based on PFS, 2011) Cited from Carandang, et.al.2013.

Loss and damage associated with land and forest degradation one of the least explored areas of research

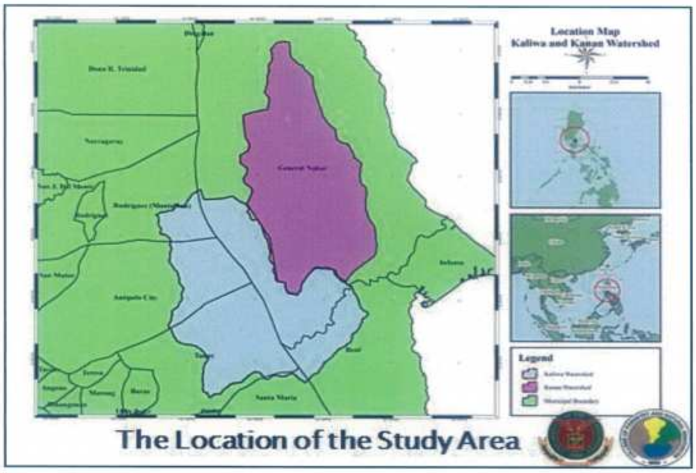
Fishbone diagram of the underlying causes of drivers of deforestation and forest degradation in the Philippines

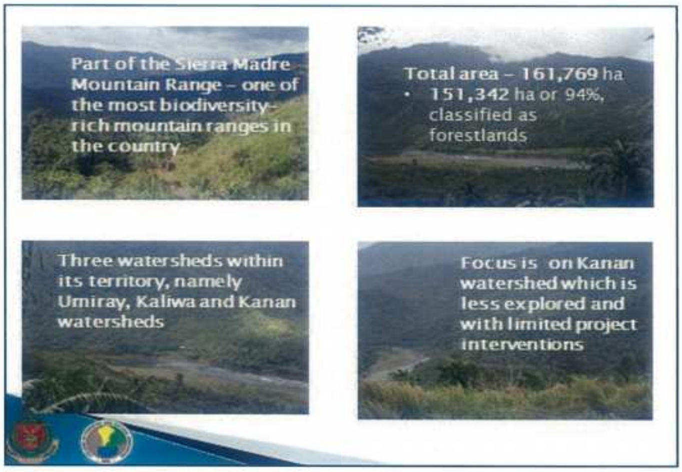


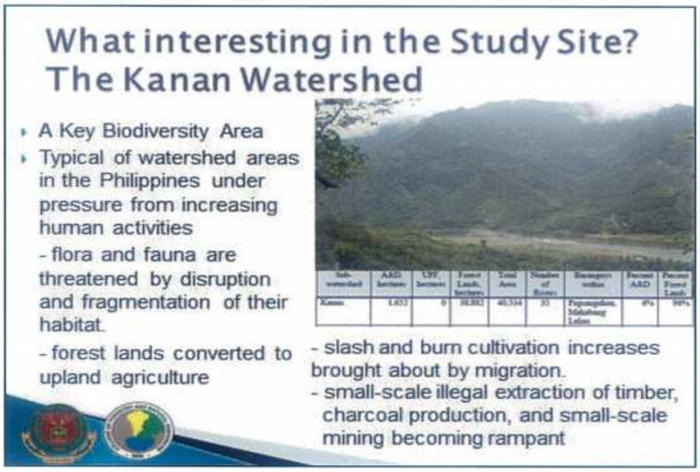
Source: Carandang, et.al.,2013

Objectives of the study

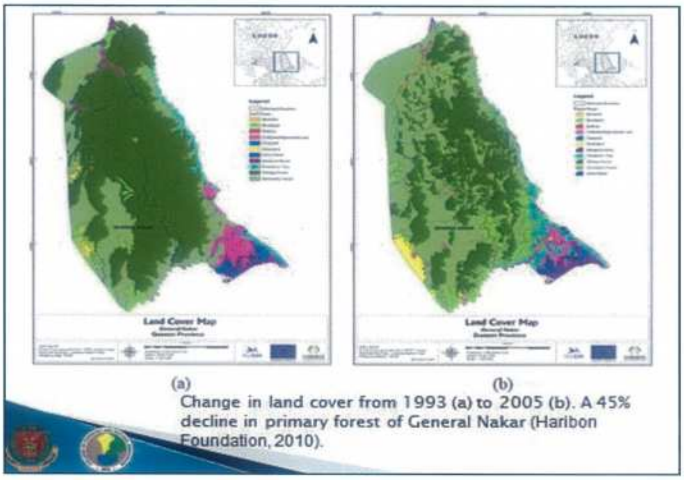
- Determine the loss and damage associated with land and forest degradation in watershed areas in Kanan Watershed, General Nakar, Quezon Province, Philippines
- Identify characteristics, priorities and emerging issues related to loss and damage associated with land and forest degradation in the watershed area that impacts the livelihood and well-being of the communities
- Assess limits to adaptation based on the "best available science" and propose risk-based approaches that integrate CCA and DRR
- Develop methodologies to evaluate prospective L+D (both economic and non-economic) associated with adverse and cascading impacts of climate change



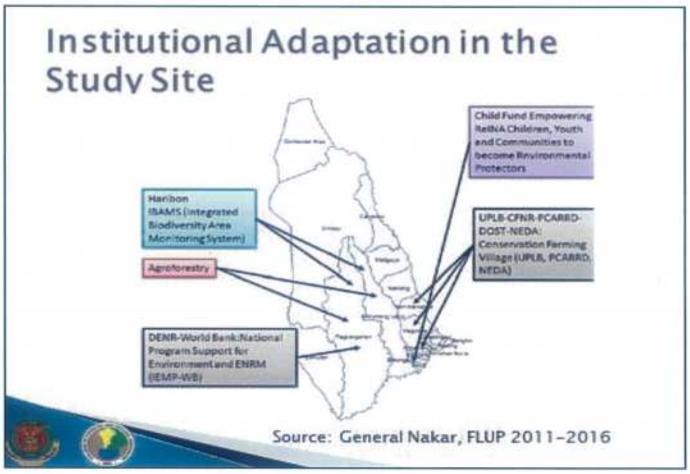




Sub-watershed	A&D, hectares	UFL, hectares	Forest Lands, hectares	Total Area	Number of Rivers	Barangays within	Percent A&D	Percent Forest Lands
Kanan	1,432	0	38,882	40,314	35	Pagsangahan, Mahabang Lalim	4%	96%



(a) (b)
Change in land cover from 1993 (a) to 2005 (b). A 45% decline in primary forest of General Nakar (Haribon Foundation, 2010).



Planned Methodology: Will examine cascading risks of land and forest degradation to selected ecosystem services using economic and non-economic methods

Provisioning Services
(Products obtained from ecosystem)
- ❑ Food
- ❑ Fresh water
- ❑ Fiber
- ❑ Fuel wood
- ❑ Biochemical
- ❑ Genetic resources
- ❑ Livelihood sources

Regulating Services
(Benefits obtained from regulation ecosystem services)
- ❑ Climate regulation
- ❑ Disease regulation
- ❑ Water regulation
- ❑ Water purification
- ❑ Pollination

Cultural Services
(Non material benefits from ecosystem)
- ❑ Spiritual
- ❑ Recreation and ecotourism
- ❑ Aesthetic
- ❑ Educational
- ❑ Inspirational
- ❑ Cultural heritage
- ❑ Sense of place

Supporting Services
(Services necessary for the production of all ecosystem services)
a. Soil formation b. Nutrient cycling c. Primary production

Source: Millennium Ecosystem Assessment, 2006)

Workshop on Enhancing Local Level Climate Change Adaptation in Southeast Asia
5-6 February 2015, Bangi, Malaysia

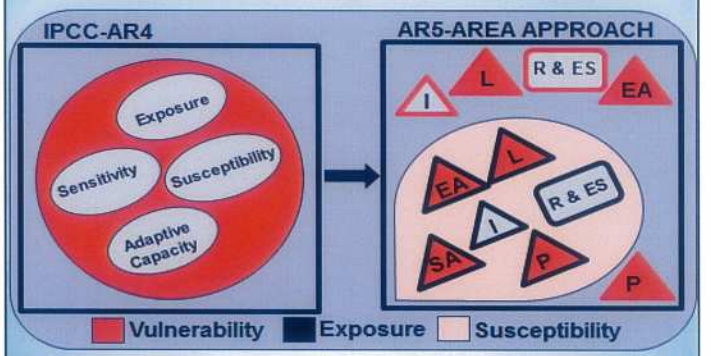
APN
ASIA-PACIFIC NETWORK FOR GLOBAL CHANGE RESEARCH

Integrating DRR, CCA and L+D: Issues and Challenges in the Klang Valley

Joy Jacqueline Pereira, Lim Choun Sian,
Nurfashareena binti Muhamad &
Nurul Syazwani Yahaya

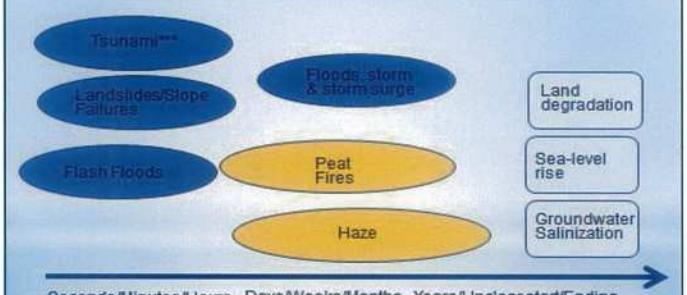
seadpri

Notional Linkages of Concepts

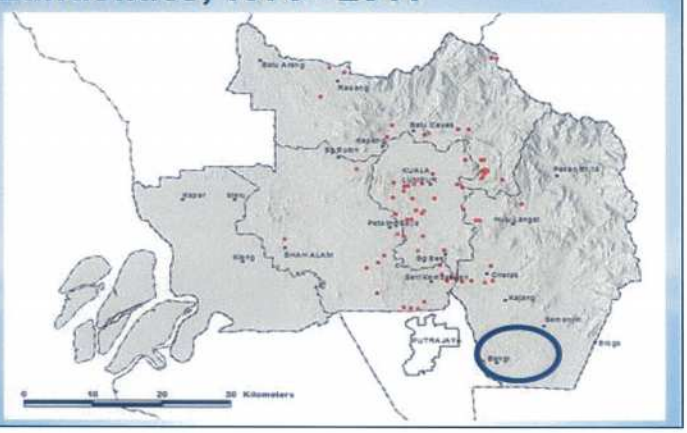


I= Infrastructure; SA= Social Assets; EA= Economic Assets; L= Livelihood; P= People; R= Resources ; ES= Ecosystem Services (Source: Pereira, 2012)

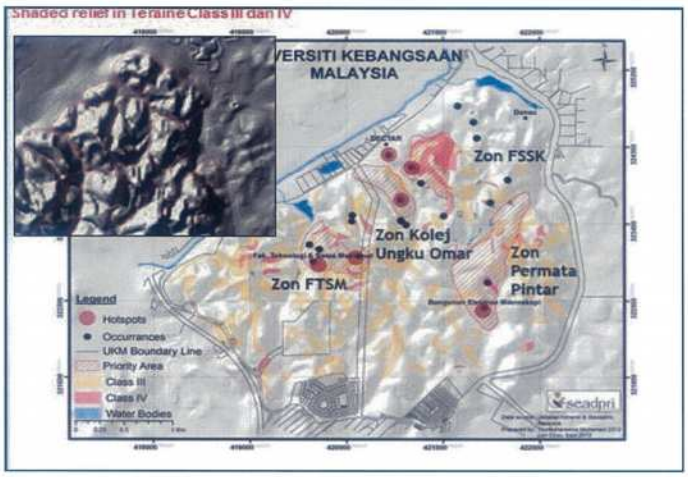
Fast & Slow Onset Events



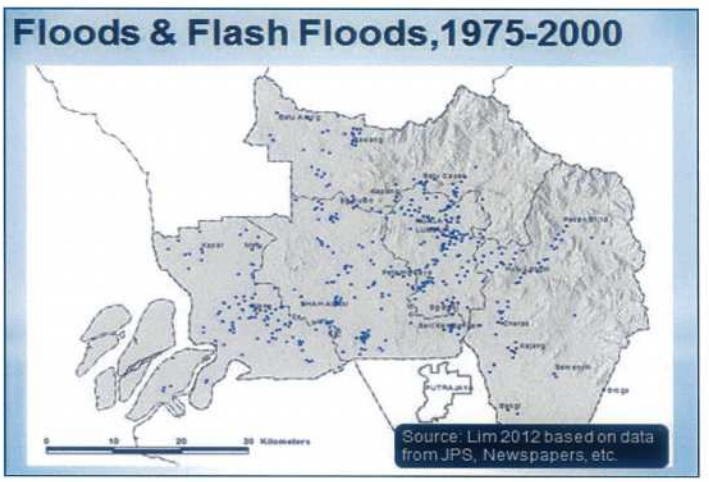
Landslides, 1970 - 2011



Shaded relief in Terraine Class III dan IV

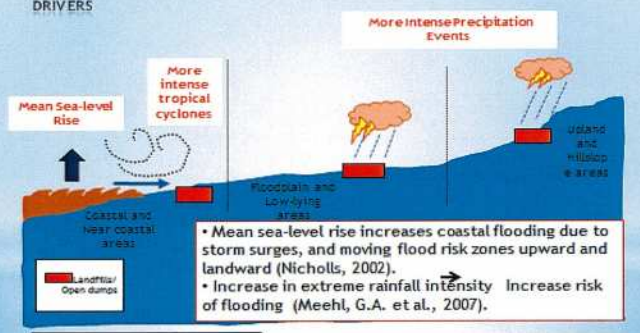


Floods & Flash Floods,1975-2000



Emerging and Cascading Hazards

* CLIMATE DRIVERS

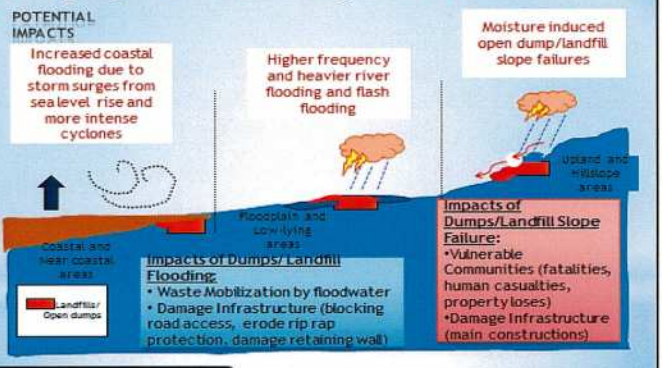


- Mean sea-level rise increases coastal flooding due to storm surges, and moving flood risk zones upward and landward (Nicholls, 2002).
- Increase in extreme rainfall intensity → Increase risk of flooding (Meehl, G.A. et al., 2007).

Source: Nurul, Lim and Pereira 2013

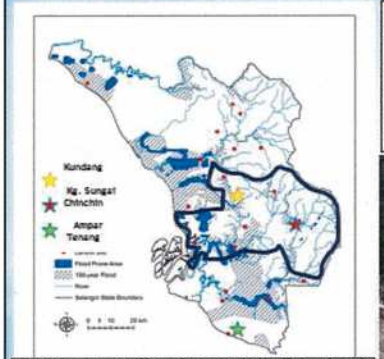
Emerging and Cascading Hazards

* POTENTIAL IMPACTS



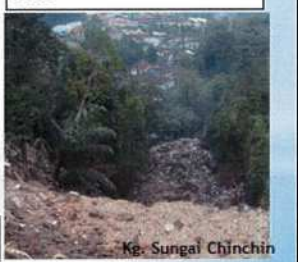
Source: Nurul, Lim and Pereira 2013

Emerging and Cascading Hazards



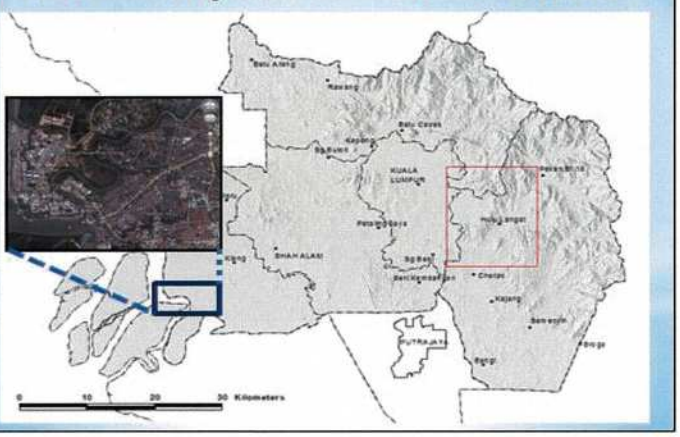
Flood prone area and 100-year flood map with identified active and closed landfill sites in Selangor. (Sources: Flood map adapted from RPN2 Report 2009, landfill sites from NAHRIM and NRE2010) Source: Nurul Lim and Pereira 2013

Landfill Sites Exposed to Flooding:
- Number of sites located within flood prone area: 4
- Number of sites located within 100-year flood: 9
- Number of sites potentially exposed to impacts from sea level rise: 3

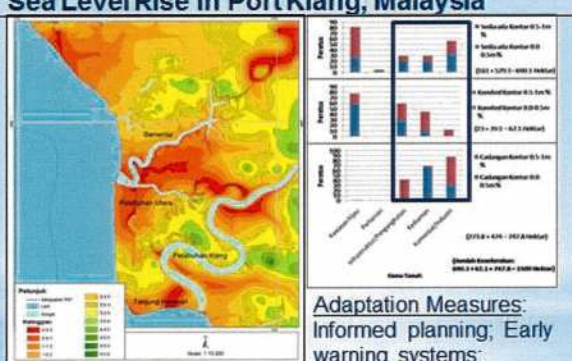


Kg. Sungai Chinchin

Potential Impacts of Sea-level Rise



Areas Potentially Affected by Sea Level Rise in Port Klang, Malaysia



Source: Rasyidah et al., 2013 based on data from JPBD Selangor. Projection by NAHRIM for 2100

Adaptation Measures: Informed planning; Early warning systems; Maintenance of drainage; Risk pooling; Relocation, etc.

Concluding Remarks

- Differentiation of natural and administrative boundaries; science to match decision-making scale at the local level;
- Recognition of cascading hazards and slow onset hazards - persistent, insidious and long-term;
- Identification of susceptible areas and spatial distribution of exposed and vulnerable communities therein;
- Challenges in detection and attribution related to extreme events;
- Availability of data for assessment of loss and damage;
- Need for early warning and response systems including new models for risk sharing and social protection schemes;
- Legal implications and future security challenges at national and regional levels

APPENDIX 4

Workshop on Enhancing Local Level Climate Change Adaptation in Southeast Asia
5-6 February 2015, Bangi, Malaysia

seadpri

Enhancing Local Level Climate Change Adaptation in Southeast Asia (Phase 1)

Introduction

* AMS must prepare to live in a changing climate particularly at the local or ecosystems level where impacts are felt directly and specific actions are most needed.
* Adaptation needs to be planned based on inputs from pilot initiatives at the local or ecosystems level where key vulnerabilities are identified taking into account future conditions and existing capacity. This is also where:-
  * Adaptation technology needs, priorities and the potential for green growth will also have to be examined
  * Good practices and policy-making that is facilitative, responsive and flexible to climatic changes has to be identified and promoted.
* ASEAN can play a crucial role by initiating and coordinating a regional mechanism on a sustained basis for implementation of adaptation responses in critical areas. This can be done by
  * Developing an action programme that identifies strategic actions and programmes for climate change adaptation based on local inputs and;
  * Establishing a regional mechanism that promotes sustained input of knowledge for actions on climate change adaptation into policy and planning processes to promote green growth and sustainable development.

Objectives

* Conduct a needs assessment and scoping study in order to identify the needs of ASEAN Member States (AMS) in terms of climate change adaptation.
* Develop a Regional ASEAN-India Climate Change Adaptation Work Programme and Network constituting Phase II and Phase III of the project.
* The activities of the Project (Phase I) shall consist of an inception workshop and a final planning workshop, with the needs assessment and scoping study in between.
* Phase II and II of the project shall be developed in consultation with ASEAN Member States (AMS) during Phase I, to cover among others:-
  * Prospective impacts on resources and implications for regional security.
  * Potential network on climate change adaptation.
  * Good practices at the local level.
  * Climate change adaptation constraints and capacity through local scenarios.
  * Collaboration, knowledge sharing and communication between experts in ASEAN member countries.
  * Inputs from national and sub-national stakeholders.

Scope of Work

* Review of national documents on adaptation actions including local scenario and priorities (where available).
* Assessment of scientific literature to identify vulnerable ecosystems and regions.
* Preliminary identification of stakeholders from relevant sectors at national and sub-national levels.
* Assessment of adaptation needs and priorities for sustainable development through stakeholder consultation.
* Selection of pilot areas and stakeholder profiles.
* Recommendation of local level (action oriented) work programme:-
  * Prospective impacts on resources and implications for regional security.
  * Potential network on climate change adaptation.
  * Good practices at the local level.
  * Climate change adaptation constraints and capacity through local scenarios.
  * Collaboration, knowledge sharing and communication between experts in ASEAN member countries.
  * Inputs from national and sub-national stakeholders.

Activities and Timelines

ACTIVITIES	Year 1					
Phase I: Needs Assessment and Development of ASEAN Climate Change Adaptation Work Programme	2	4	6	8	10	12
1. Review of national documents on adaptation actions including local scenario and priorities (where available).						
2. Preparation and implementation of inception Workshop [3 October 2014, KL]		W1				
3. Review of scientific publications to identify vulnerable ecosystems and regions.						
4. Assessment of adaptation needs and priorities through stakeholder consultation.						
5. Preparation and implementation of planning workshop on review of the needs assessment report and development of the work programme.					W2	
Output 1: Needs Assessment and Scoping Study Report (State of Climate Change Adaptation in ASEAN (Deadline- Month 12)					01	
Output 2: ASEAN-India Work Programme and Network on Climate Change Adaptation (Draft) (Deadline - Month 12)						02
Phase II: (to be developed during Phase I)						
Phase III: (to be developed during Phase I)						

W = Workshop Report = O

Deliverables of Project Partners

* Month 3
  Preliminary Report on review of national documents
* Month 6:
  Preliminary Report on vulnerable ecosystems and regions
* Month 8:
  Draft Final Report on adaptation needs and priorities
* Month 10:
  Draft Final Report local level (action oriented) work programme

REPORT TEMPLATE

* INTRODUCTION: encompasses (but is not limited to) country context including current and projected geographic and socio-economic setting; governance systems etc.;
* NATIONAL SCENARIO ON ADAPTATION: documents findings of review of national documents on adaptation actions including local scenario and priorities (where available);
* VULNERABLE ECOSYSTEMS AND REGIONS: synthesis of scientific literature vulnerable ecosystems and regions, including observations and projected changes, criteria for vulnerability, key risks and reasons for concern, etc.;
* STAKEHOLDER PROFILE: provides an overview of stakeholders from multiple sectors (with respect to vulnerable ecosystems and regions) at national and sub-national levels.
* ADAPTATION NEEDS AND PRIORITIES: commences with an overview of stakeholder consultation methods; criteria for setting priority; results of evaluation of adaptation needs and priorities for sustainable development through stakeholder consultation, etc.;
* PROPOSALS FOR LOCAL LEVEL WORK PROGRAMME: provides recommendations for 3-5 local level (action oriented) programmes. Each recommended program should have a description of:-(i) selected geographic area and stakeholder profiles, (ii) prospective impacts on resources and implications for regional security, (iii) good practices at the local level, (iv) climate change adaptation constraints and capacity needs, (v) potential network of partners on climate change adaptation within the country, (vii) potential experts in ASEAN Member Countries for collaboration, knowledge sharing and communication. A section should also be devoted to other programmes recommended by national and sub-national stakeholders during consultation, which are not highlighted for recommendation.
* BIBLIOGRAPHY: The list of reference material used for preparing the final report.

Project Deliverables

The Draft Final Report from project partners will serve as the basis for developing the two final project deliverables as specified below:-

* **Needs Assessment and Scoping Study Report (State of Climate Change Adaptation in ASEAN):** A report containing initial information on identified needs of AMS in terms of climate change adaptation.

* **ASEAN-India Work Programme and Network for Climate Change Adaptation** (ASEAN-Adapt): Draft work programme containing (i) strategic actions and adaptation programs and (ii) a framework of the network and regional mechanism to facilitate its implementation to support green growth and sustainable development.

Arrangements

Government Partners

* National AWGCC Focal Point Representatives
  * Brunei
  * Cambodia
  * Indonesia
  * Laos
  * Malaysia
  * Myanmar
  * Philippines
  * Singapore
  * Thailand
  * Vietnam
* Government of India Representative

Science Partners

* Project Partners for the implementation of Phase II and III of the project shall be identified during the final planning workshop of Phase I. Potential Project Partners:
  * Brunei: To be identified
  * Cambodia: Pannasastra University of Cambodia, Royal University of Phnom Penh
  * Indonesia: Indonesian Institute of Science (IISC), Institut Teknologi Bandung
  * Laos: To be identified
  * Malaysia: SEADPRI, Universiti Kebangsaan Malaysia
  * Myanmar: Myanmar Climate Change Watch/Department of Meteorology and Hydrology
  * Philippines: University of the Philippines Las Banos
  * Singapore: Nanyang Technological University / National University of Singapore
  * Thailand: Chiang Mai University
  * Vietnam: Hue University, Institute of Meteorology, Hydrology & Environment (IMHEN), Department of Meteo-hydrology and Climate Change

Administration: Under Guidance of ASEAN Secretariat
Implementing Agency: SEADPRI, Universiti Kebangsaan Malaysia
ASEAN Coordinator: Prof. Dr. Joy Jacqueline Pereira, SEADPRI-UKM
India Coordinator: Prof. N. H. Ravindranath, CST, Indian Institute of Science

Budget for Country Studies

	Item	Allocation	No of Countries	Total
1	Part-time Assistants (USD5,000 per country)	5,000.00	10	50,000.00
2	Local communications/consultation (USD500 per country)	500.00	10	5,000.00
3	Copying/Printing (USD500 per country)	500.00	10	5,000.00
4	Consumables (500 per country)	500.00	10	5,000.00
5	Report Preparation/Translation/ etc.	500.00	10	5,000.00
	Country Team Total			70,000.00

seadpri

*THANK YOU!

Climate Change Adaptation Experience and Technology in India

Prof N H Ravindranath
Indian Institute of Science
Bangalore

Adaptation to Climate Variability and Climate Change

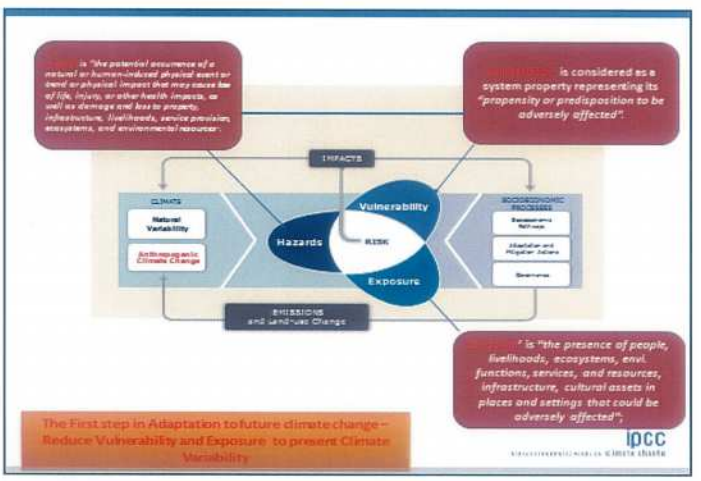
- Natural ecosystems, food production systems and socio-economic systems are exposed to:
  - Current climate risks due to climate variability and extreme climates
  - Future climate change
- There is a need for adaptation to both current climate variability/extreme events and long-term climate change.
- This requires climate variability assessment – climate change projections – impacts assessment – vulnerability profiling – adaptation deficit assessment – adaptation to climate variability and climate change

Six Steps Approach to Development of Risk Profile & Adaptation Strategy to Climate Change

Steps	Major tasks	Details
Step-1	Current Climate Variability assessment Climate change projections	- Historical climate data - Using ESMs – Developing multiple models – NOT single model – Range of projections
Step-2	Assessment of impacts of climate change	Impact assessment for the selected climate scenarios using Impact Assessment Models into the future
Step-3	Assessment of Risk / Vulnerability Profiles - Current climate risks - Future climate change	Develop of Risk profiles - Crop/ water / forest systems vulnerability to - Current risks - projected CC and socio-economic factors
Step-4	Assess current coping strategies to current climate risks	Conduct socio-economic and technical assessments at field level
Step-5	Assess Adaptation Deficit	Conduct policy analysis and field studies
Step-6	Development of Adaptation strategies to CC	Technology assessment for current and future climate risks Cost-benefit analysis

Current Status of Science

1. There are multiple ESMs or GCMs –
   - providing different projections of changes in Temperature, rainfall, ET, cloud cover, etc
2. There are different Emission scenarios or RCPs
   - providing different projections of changes in Temperature, rainfall, ET, cloud cover,
3. There are multiple impact models for a given sector
   - showing different impacts – on crop yields, stream flow, forest type shift
4. Impact for a given level of CC is further
   - determined by Vulnerability (Sensitivity/adaptive capacity) & Exposure
5. There are uncertainties, BUT Adaptation Planning / Actions need not wait for perfect science



Issues in Adaptation

1. How Adaptation to climate change is different from;
   - what farmers/fishermen, etc are doing now
   - Watershed Development, irrigation prog., afforestation programs etc targeting now
2. How to assess the impact of CC and risk / vulnerability assessment can be combined for developing adaptation strategies
   - How important is Inherent vulnerability
3. Adaptation to what;
   - Current climate variability or risk? Or Current Extreme events
   - Future climate change? Or Extreme events
   - CC impacts or vulnerabilities
4. Adaptation Strategy in what timeframe?
   - Immediate future next 1 to 5 years,
   - Short term of 10-20 years OR long term 30-50 years
5. Are current Traditional / modern Coping strategies for current climate risks adequate for future CC??
6. How to develop Adaptation strategies for future climate risks – which also addresses current climate risks
7. Priority for Incremental or Transformational adaptation strategies?
8. How to avoid "maladaptation"
9. How uncertainties involved in CC projection, impact projections, vulnerabilities assessments? Determine Adaptation strategies

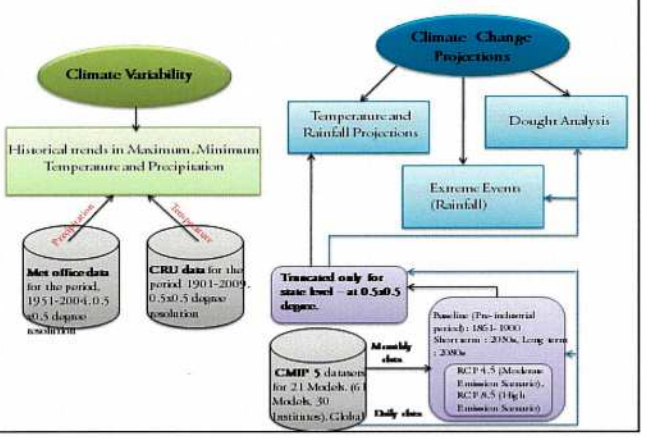
Adaptation Framework and Assessment

1. Adopt a common Adaptation assessment framework
   - I. Current climate risks scenario
   - II. Climate change risks scenario
2. Assess current climate risks and implications
3. Assess the climate change and im[acts
4. Assess Current coping / adaptation strategies
   - Adequacy of strategies of rural / farming / forest communities, fishing communities
5. Assess adaptation element of current developmental programs and policies
6. Develop adaptation / resilient strategies for
   - Current climate risks
   - climate change impacted scenarios
7. Suggest adaptation mainstreaming approaches – institutions, financing, capacity needs, etc.

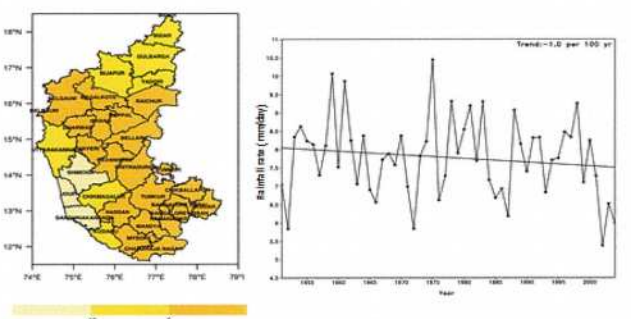
Adaptation

- **Developing a comprehensive risk-framework-based vulnerability profile at National / state level;**
  - **Biophysical and Socio-economic vulnerability**
  - **For Current climate and future climate change risks**
- **Assess Adaptation Deficit to current climate risks**
  - **Assess current Climate risks, vulnerabilities & coping strategies & Adequacy of current strategies –For the identified Vulnerability hot spots**
- **Develop criteria and Guidelines for identifying / preparing**
  - **Incremental and Transformational adaptation strategies for** selected hot spot Zones / Ecosystems

CLIMATE VARIABILITY & CLIMATE CHANGE ASSESSMENT

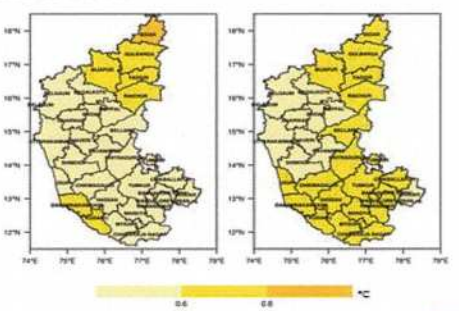


Rainfall Trends



The IMD (Indian Meteorological Department) gridded (0.5deg x 0.5deg) rainfall analysis shows that there is a long term negative trend in rainfall over Karnataka (approximately 10 % per century) for the period 1951-2004.

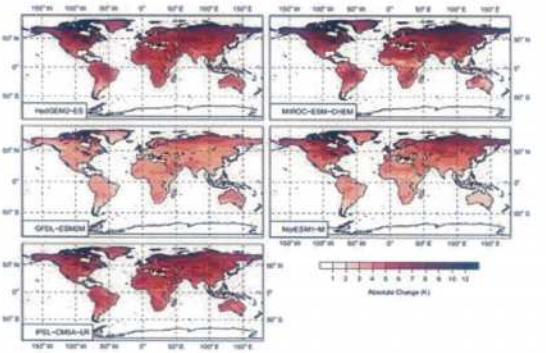
Observed Temperature Trends in Karnataka at District level



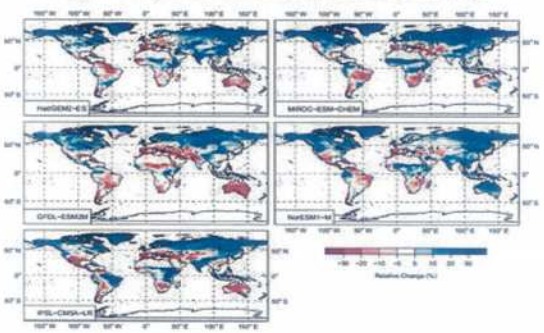
The Climatic Research Unit (CRU) gridded (0.5deg x 0.5deg temperature for Karnataka shows a steady warming trend in both the minimum and maximum temperatures.

Climate change projections

Difference in bias-corrected, average surface air temperature over land between end of the century (2070–2099) and present-day (1980–2010) under RCP8.5 in the five climate models used in the ISI-MIP



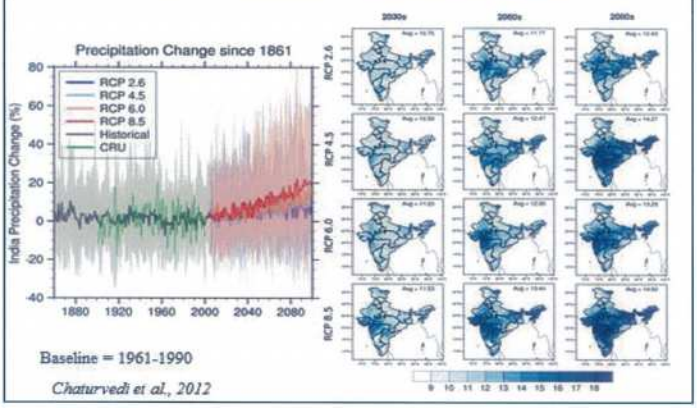
Relative difference in average annual rainfall (in percent). Desert regions with present-day annual rainfall below 100 mm are masked



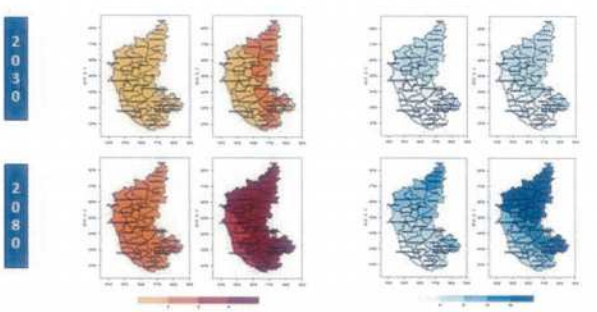
Climate change projections: Options

Options	Feasibility / Issue
CORDEX Ensemble	-Now limited models outputs available -More model outputs may become available -All climatology parameters NOT available
CORDEX – Individuals ESMs	-Use Projections from each CORDEX RCM
CMIP5- Ensemble of all ESMs	-Feasible -Scale varies for models
CMIP5-Ensemble of 5 ESMs with scale 1x1	Feasible
Ensemble of sub-set of CMIP5 models	Feasible for different sectors based on availability of climate parameters
RCP Scenarios	RCP 4.5 / RCP 8.5
Time periods	-2020 – 2050 /2030s - 2050 – 2099/ 2080s -1980-2010 for current;2005-2035, 2035-2065; 2065-2099
Baseline	Preindustrial / 1960 – 90 / 1980 – 2005
Scale	100 km x 100 km, 50km x 50 km

Precipitation projections for India and their reliability

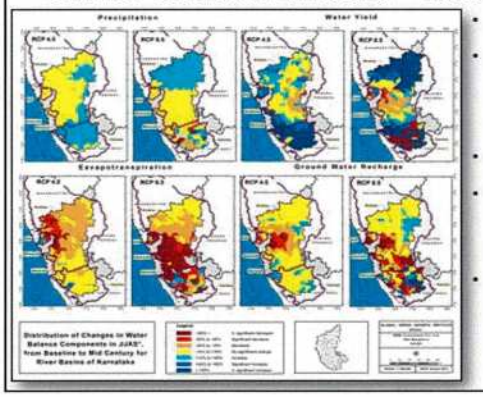


District-wise projected change in temperature and rainfall in 2030s and 2080s relative to the industrial period under RCP 4.5 and RCP 8.5



IMPACTS ASSESSMENT

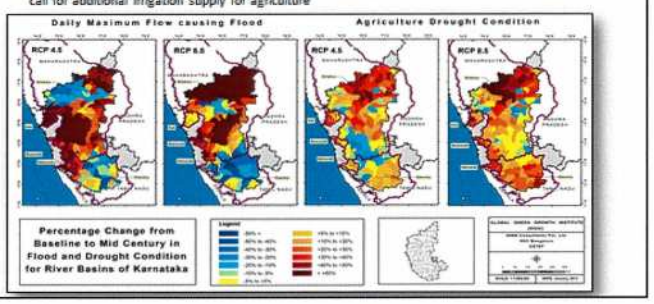
Impacts of Climate Change on Water Resources on River Basins of Karnataka – Water Availability



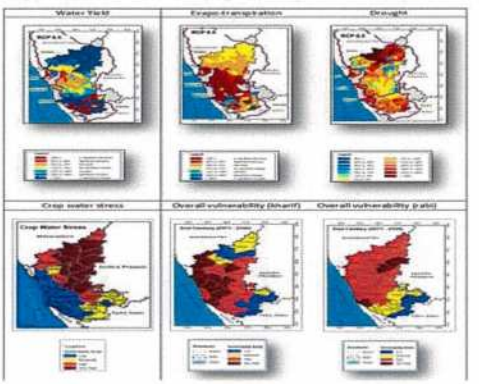
- Projected 10-15% increase in rainfall
- Projected increase in Stream flow
  - RCP 4.5: in Cauvery, WFR
  - RCP 4.5: in Cauvery, Krishna, WFR
- No significant change in evaporative losses
- Projected decrease in Ground water recharge (more significantly in RCP 8.5)
- Large spatial variation in water balance components

Impacts of Climate Change on Water Resources on River Basins of Karnataka – Flood and Drought

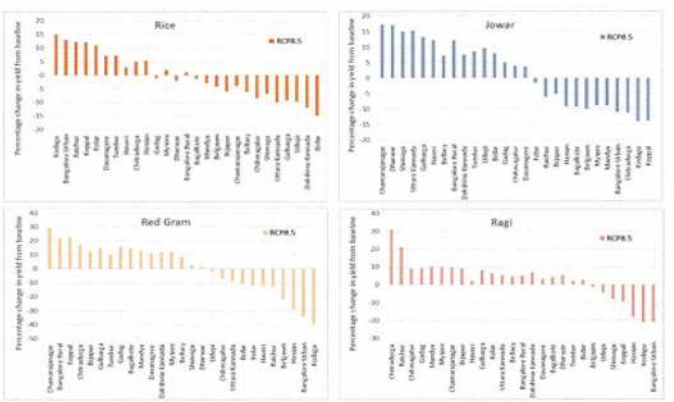
- Flood – Projected increase peak discharge magnitude in many parts of Krishna, Cauvery. Negligible change in WFR in RCP 8.5 scenario
- Flow Dependability – supply to various reservoirs may not have much reduction at the 75% dependable flow level in RCP 4.5 whereas in RCP 8.5: reduction in flow dependability at 75% and 90% is projected in many reservoirs
- Drought – many parts of Krishna, Cauvery and WFR show high water stress. These conditions may call for additional irrigation supply for agriculture



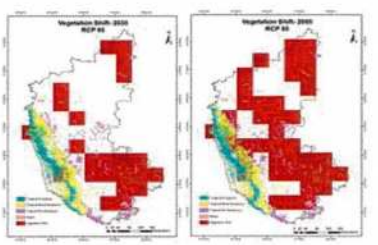
Impact and vulnerability of water sector to projected climate change by mid-century (2030s) according to RCP 8.5



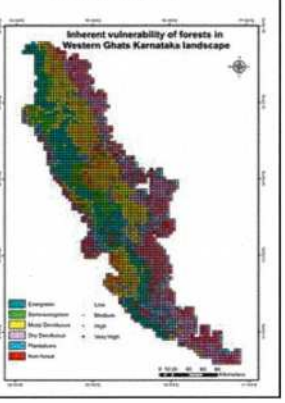
Impact of Climate Change on Agriculture



Vegetation grids undergoing change under RCP 8.5 by 2035 and 2085



Inherent vulnerability – Western Ghats



RISK / VULNERABILITY PROFILING

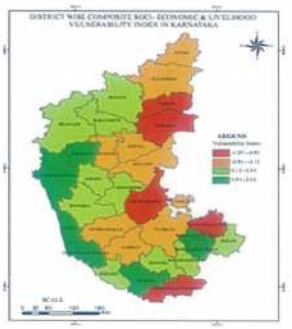
Types of Vulnerability

Bio-physical vulnerability	• Agriculture sector • Coast zones • Water resources • Forest sectoral
Socio-economic vulnerability	• Forest dependent communities • Fishing communities • Village communities • Farmers / farming community • Livelihood Vulnerability

Scenarios for Risk /vulnerability analysis

1. **Current risk / vulnerability for current climate risks**
   - Inherent vulnerability
2. **Risk / Vulnerability under future Climate scenarios**
   - With only climate change indicator varied
   - All indicators (Climate Change +non-Climate Change) varied

Socio-economic vulnerability profile



- **Most vulnerable**
  - Chamarajanagar, Chikballapur, Chitradurga, Raichur, and Yadgir
- **Least vulnerable**
  - Bangalore (Urban), Dakshina Kannada, Dharwad, Udupi, and Uttara Kannada

ADAPTATION ASSESSMENT

Mainstreaming Adaptation – Assessment Framework

Case Studies

ADAPTATION PROJECTS

Climate Smart Village models in Bihar & Haryana, India

- **Climate Smart Village model is a unique initiative by Climate Change Agriculture, Food and Security (CCAFS) in India**
  - **to promote agriculture practices that will mitigate the effects of climate change on agriculture and**
  - **To help communities adapt to climate change to ultimately become resilient to extreme weather events such as droughts, floods, and delayed monsoons.**
- **Climate Smart Agriculture involves a portfolio of interventions that are chosen to suit the local environment and the community's needs.**
  - **index-based insurance, weather forecasting services, efficient irrigation and water management, conservation agriculture, inter-cropping and crop diversification, minimum tillage, Land levelling and agro forestry**

CGIAR Research Program on Climate Change, Agriculture and Food Security CCAFS

Climate change adaptation in rural areas of India

- **Objective:** In four of India's federal states, vulnerable population groups are better able to adapt to climate change and climatic variations.
- **Approach / Activities**
  - State-level vulnerability and risk assessments
  - Developing and testing adaptation measures
  - Climate proofing of public investments and rural development programmes
  - Development of financial instruments for adaptation
  - Information and knowledge management
  - State-level action plans on climate change

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Enhancing Institutional and Community Resilience to Disasters and Climate Change

- **Goal: support efforts to strengthen capacities of government, communities and institutions to accelerate implementation of disaster risk reduction and climate change adaptation plans.**
  - **Assam, Andhra Pradesh, Himachal Pradesh, Jharkhand, Kerala, Maharashtra, Odisha, Sikkim, Tripura, Uttarkhand**
- **Highlights**
  - **Communities in Puri district of Odisha are better able to adapt to extreme weather conditions**
  - **Knowledge Resource Centre set up in Puri district provides grassroots information on adaptive water and agricultural practices**
  - **Better understanding of hazard risk in Khargone district, Madhya Pradesh through completion of Hazard Risk Vulnerability Analysis**
  - **State and community level expert group learning exercises conducted in Odisha**
  - **Community institutions strengthened to employ participatory groundwater monitoring systems**
  - **A manual on crop water budgeting developed to deal with climate change in drought prone regions**

UNDP

Adaptation to Climate Change in Drought Stricken Areas of South India

- **Goal; Strengthen the knowledge and capacities communities in pilot Hydrological Units to respond to climate change impacts**
- **Components**
  - **INFORMATION TOOLS**
    - **Baseline Study**
    - **Participatory Climate Monitoring**
  - **PILOTS**
    - **Famer Climate Schools**
    - **Sustainable Land and Water Management Pilots**
  - **DISSEMINATION AND UPTAKE**
    - **Community level**
    - **District level government departments**

Participatory Climate Monitoring

Farmer Climate Schools

SLWM Pilots

Cambodia Major Activities Responding to Climate Change

Mr. CHEA ChanThou,
Deputy Director of Climate Change Department,
Ministry of Environment
5 Feb. 2015

1

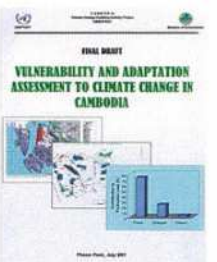
Introduction

- December 1995 Cambodia ratified the UNFCCC,
- July 2002: Accession to the Kyoto Protocol,
- October 2002: Submitted INC to UNFCCC,
- April 2006: Establishment of the National Climate Change Committee (NCCC)
- October 2006: Lunched the Cambodian NAPA
- January 2007: Preparation of the SNC, not finalized
- Oct. 2013: Lunched CCCSP
- 2014 up to date: preparing CCAP by Govt. Institution
- 2014: Finalized NAP stock taking assessment and road map for Cambodia

2

Assessment of Cambodia Climate in the Initial National Communication (INC)

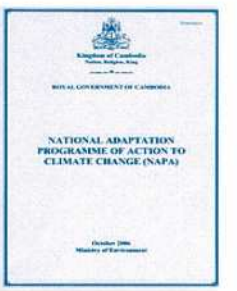
- This assessment was conducted in the INC by using two GCM models: CCSR & CSIRO, and two emission scenarios: SRESA2 & SRESB1, showed that:
  - Cambodia's temperature would increase up to 1.35 - 2.5^{0}C in 2100.
  - Annual rainfall would increase between 3 and 35% from current condition and lowland areas seem to be more affected than high land areas.



3

National Adaptation Programme of Action (NAPA)

The Cambodian NAPA consists of 39 'no-regret' adaptation projects in 4 sectors (agriculture and water resources, human health, coastal zone, and cross cutting) which focus on measures that have direct impacts on the livelihoods of local people, in particular the poorest.



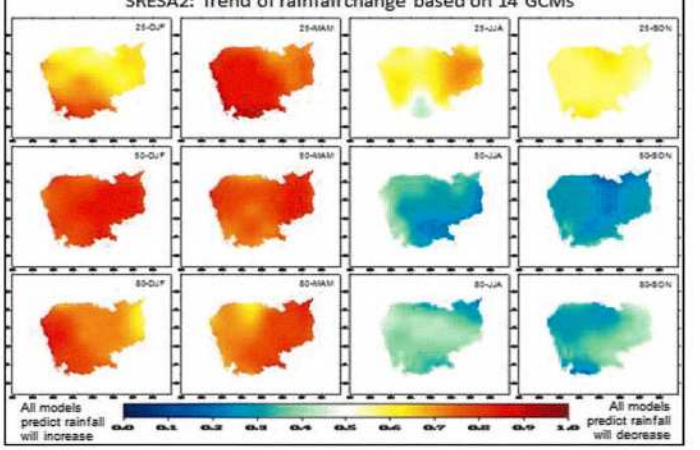
4

Key finding of assessment in the draft 2nd National Communication (SNC)

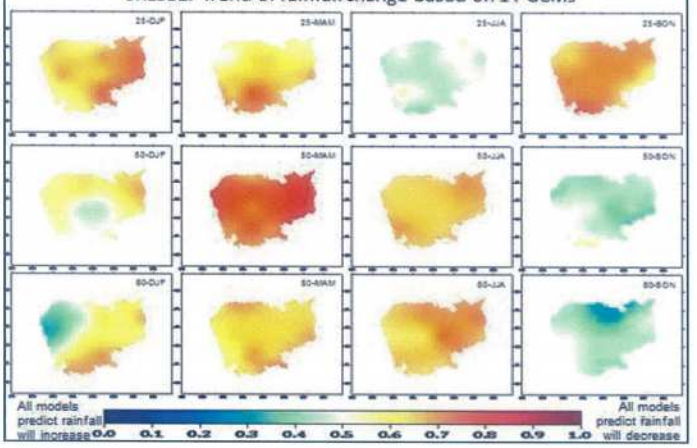
- Based on data 1960-2000, Cambodian climate (rainfall and temperature) has already change, and the future rainfall pattern will continue to change depending on emission scenarios
- CC projection based on 14 GCMs GCM Model was run by Yuji Masutomi from Climate Risk Assessment Division, Center for Global Environmental Research, National Institute for Environmental Studies, 16-2 Onogawa, Tsukuba, Ibaraki 305-8506, Japan
- Under high emission scenarios (SRESA2)
  - DS rainfalls DJF and MAM will decrease with high probability and WS JJA and SON rainfall may increase but with lower probability than the DS rainfall. This suggests that the onset of rainy season may delay in the future under this emission scenario.
  - WS rainfall JJA and SON will decrease until 2025 and then increase again in 2050 and 2080
- Under low emission scenarios (SRESB1)
  - Similar with SRESA2 DS rainfall will decrease but with lower probability.
  - Different with SRESA2, WS rainfall JJA will increase in 2025 and then decrease again in 2050 and 2080
- Change in rainfall pattern will affect many sectors. Adaptation studies and pilots projects at local levels must be developed and implemented
- Global community achievement in reducing GHG emission will have different implication on Cambodia

5

SRESA2: Trend of rainfall change based on 14 GCMs



SRESB1: Trend of rainfall change based on 14 GCMs



Cambodia Climate Change Strategic Plan 2014-2023

Vision

Cambodia develops towards green, climate resilient, equitable sustainable and knowledge-based society.

MISSION

Creating a national framework for engaging public and private sectors, and civil society in a participatory process for responding to climate change to support sustainable development.

Goals:

- Reducing vulnerability to climate change impacts of critical (natural and societal) systems and most vulnerable groups
- Shifting towards a green development path by promoting low-carbon development and technologies
- Promoting public awareness and participation in climate change response actions.

Strategic objectives of CCCSP

1. Promote climate resilience through improving food, water and energy security
2. Reduce sectoral, regional and gender vulnerability to climate change impacts
3. Ensure climate resilience of critical ecosystems (Great Lake, Mekong River, coastal ecosystems, highlands etc.), biodiversity, protected areas and cultural heritage
4. Promote low-carbon planning and technologies to support sustainable development of the country
5. Improve capacities, knowledge and awareness for climate change response.
6. Promote adaptive social protection and participatory approaches in reducing loss and damage
7. Strengthen institutions and coordination frameworks for national climate change responses
8. Strengthen collaboration and active participation in regional and global climate change processes.

9

NAP process in Cambodia (1)

- Based on the stock taking assessment, the goal of the NAP process in Cambodia could be defined as *"Ongoing Climate Change Adaptation processes are strengthened through cross-sectoral programming and implementation at national and sub-national level".*
- The goal of the NAP process does not modify other objectives set by the NSDP and the CCCSP. It builds on their objectives with a focus on strengthening and better integrating on-going processes. It further identifies cross-sectoral programming and implementation at national and sub-national level as key principles for process strengthening.

10

Strategic Intervention Areas of NAP (2)

To operate this goal, the following **strategic intervention areas are suggested:**

1) **Inter-sectoral coordinated implementation:** Fields of activity based on Sector Climate Change Action Plans which offer synergies through joint collaboration between sectors
2) **Data systems and analyses:** Harmonize/standardize data processing, modelling, projections, vulnerability assessments, and use of Geographical Information Systems (GIS)
3) **Support financing systematically:** MOE might adopt a 'finance brokering' function to match financing needs with sources.
4) **Capacity development and vertical mainstreaming linking national and sub-national levels:** Support measures such as capacity development, advisory services, up-scaling mechanisms, and enhanced ownership at the local level.
5) **Overall steering of implementation and evaluating effectiveness (M&E):** Prioritise the establishment and running of an overall M&E system at MOE to ensure learning process for Climate Change Adaptation.
6) **Qualitative mainstreaming:** Including integrating climate risks into Environmental Impact Assessment and climate proofing larger projects.

11

Cambodia's NAP Roadmap (3)

The road-map is divided into three work-streams which occur in parallel over the time frame 2014-2019:

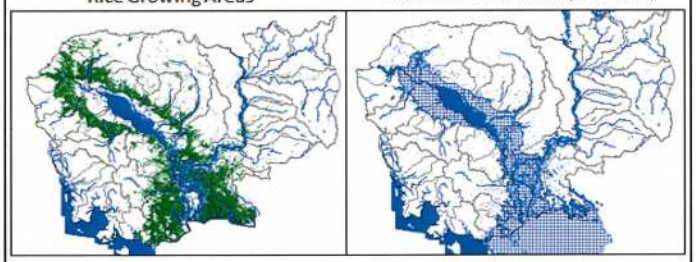
- **Workstream I: Planning, establishing and steering the NAP process.** This requires an overall steering of the NAP process. Many activities from the six strategic intervention areas will be launched.
- **Workstream II: Implementing the NAP process / the CCCSP and Sector CCAPs.** Deal with the implementation of the strategic intervention areas 1 to 5. The different activities, such as the detailed vulnerability assessment, will also inform and thus assist the implementation of the existing strategies and actions plans.
- **Workstream III: Reviewing and learning.** Deal with the implementation of an effective M&E system. It thus implements the strategic intervention area 6. From here, lessons learned will also be fed back into the steering of the NAP process and provide lessons to the international community.

12

Vulnerable rice growing areas to flood

Rice Growing Areas

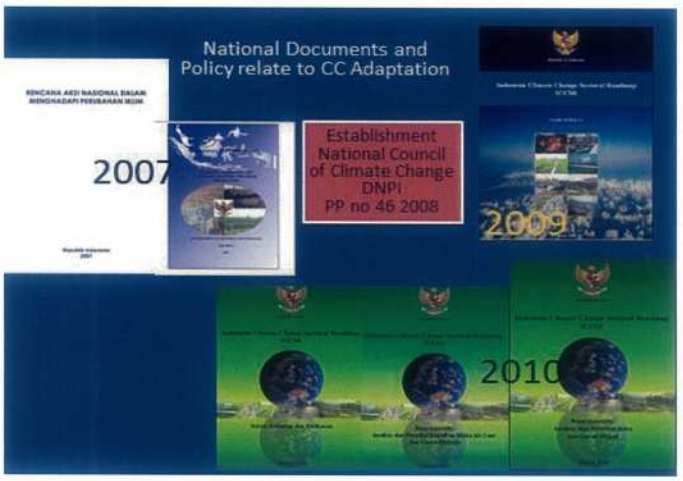
Maximum Flood Extent (Year 2000)



Climate Change Adaptation in Indonesia

Inception Workshop on Enhancing Climate Change Adaptation in Southeast Asia
Bangi-Putrajaya, 5-6 February 2015

Laksmi Rachmawati
rachmawati.laksmi@gmail.com
Indonesian Institute of Sciences
Research Centre for Population
www.kependudukan.lipi.go.id



Challenges

- Changing of institution
- In the process of mainstreaming
- Gap of information and knowledge (among national stakeholders; national – local (provincial/ District level)
- Donor driven (Mercy corps, GIZ, UNDP, Care)

Local Level Adaptation

- PN 9 (National Priority Research) on Climate Change 2012-2014
- Communities level- responsive
- Local government level (districts) – (?)
  - Business as usual- development
  - VA (?)
- Adaptation initiative -> international donor
  - Cities network (Semarang- Mercycorps ACCRN) , APEKSI
  - Agriculture
  - But less for small islands and fisheries

Priorities for Myanmar

Professor Khin Maung Cho
Resource Person
Myanmar Climate Change Watch
(On behalf of Dr. Tun Lwin)
The Republic of The Union of Myanmar

Priorities for Myanmar

- (1)Myanmar have already submitted First National Communication to the UNFCCC.
- Myanmar is currently working Second National Communication to the UNFCCC.
- (2)The National Adaptation Plan for Myanmar have completed the First Project (two years) under the support of Least Developed Countries Fund by Department of Meteorology and Hydrology,Myanmar.

- (3)The Focal Point for Myanmar is Department of Meteorology and Hydrology, which department is working closely with the Research Institutes and Universities,such as, University of Agriculture ,Yezin,Naypyidaw ,Yangon Technological University ,Yangon , University of Forestry ,Yezin ,Naypyidaw, and Yangon University,Yangon, and others Universities ,and Agricultural Research Centre,Yezin,Napyidaw, Forestry Research Centre,Yezin,Naypyidaw.

- (4)Ther are many issues in Myanmar, but I want to mention three issues,which are floods ,deficit rain and post monsoon rain.
- Our Deltaic Area is suffering floods almost every year.
- Our Dry Zone Area is suffering deficit rain in every year until middle of August.
- Post monsoon rain is suffering all areas of our countries,which rain damages the agricultural products ,all over the country.

Regional Climate Modelling

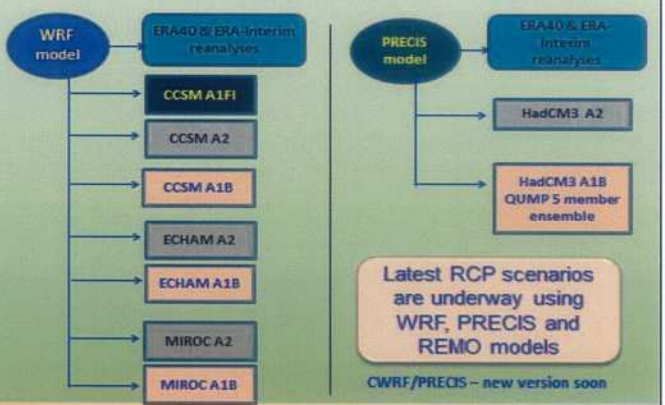
Dr. Sri Raghavan
Senior Research Fellow
Climate and Water Research Group
Tropical Marine Science Institute
(TMSI)
Dr.Liong Shie-Yui (Head)
Dr.Vu Minh Tue, Dr.Nguyen Ngoc Son

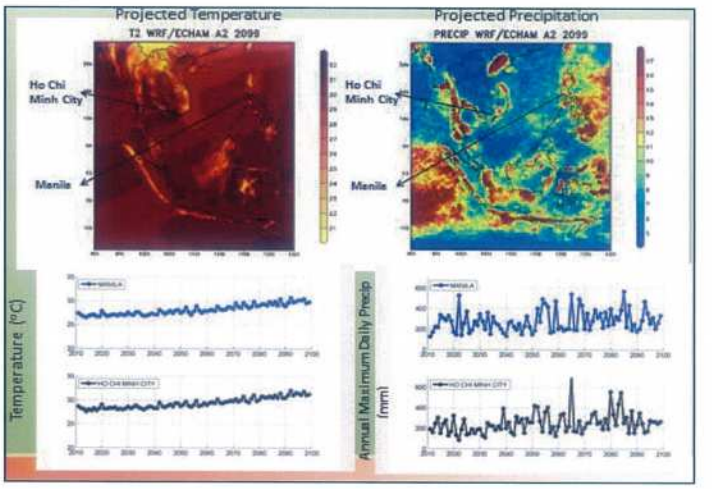
Recent Climate Research at TMSI

Commissioned by the Govt. of Singapore to undertake:

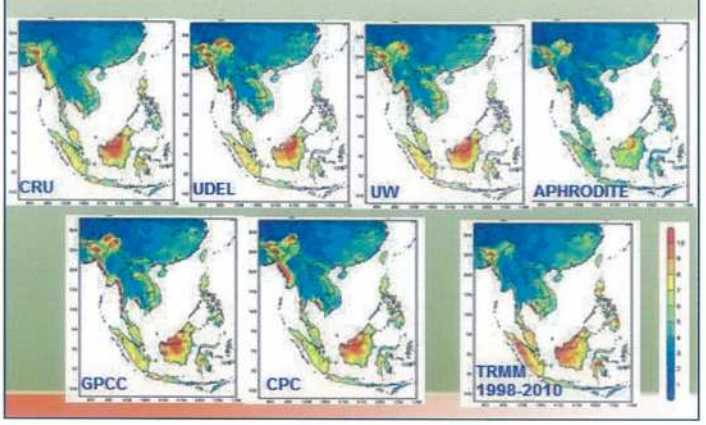
- National Level first study for climate change and impacts (2007-2009) by the National Environment Agency (NEA)
- Building and Construction Authority (BCA) (2010-2014)

TMSI's Climate Downscaling work — as of today

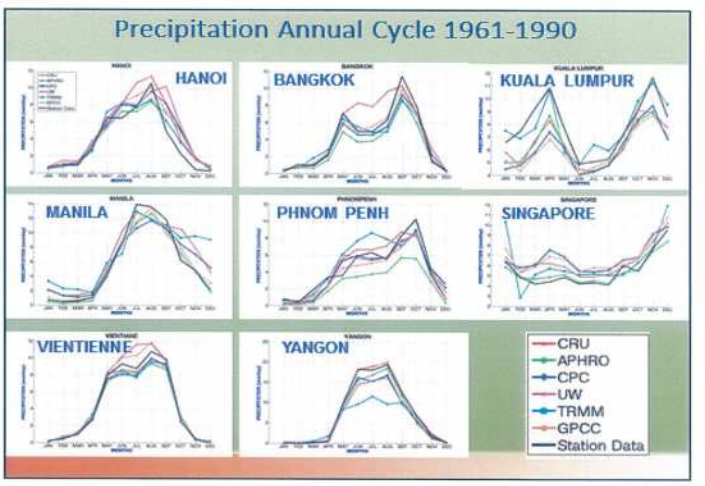




Mean Annual Rainfall 1961-1990 (mm/day)



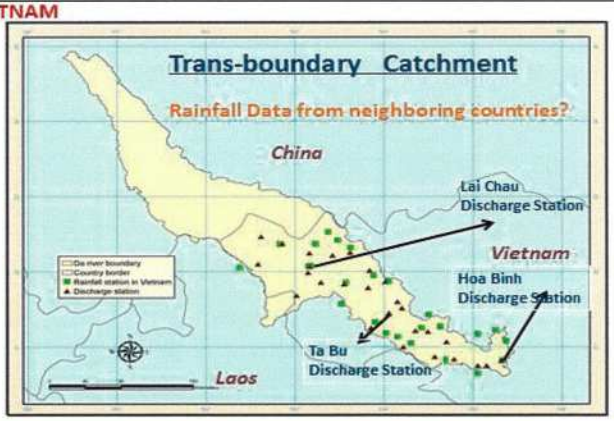
Precipitation Annual Cycle 1961-1990



Use of Regional Climate Model data to study Major Impacts:

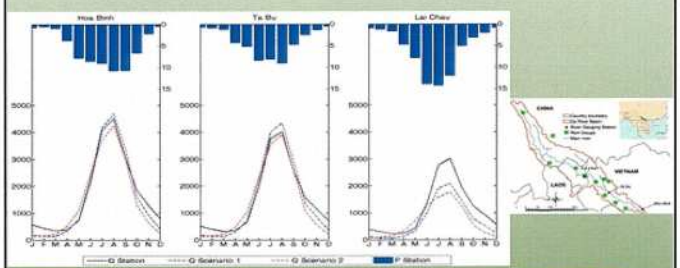
1. Flood
2. Drought

VIETNAM



Proxy data from RCM??

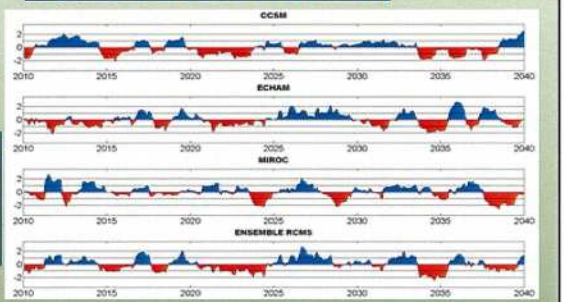
Annual Cycle of stream flow: Trans-boundary study



- RCM data serves as a proxy for data sparse region or trans-boundary area where data sharing is limited

Also worked on Poko/Dakbla river basins, Red River delta, Central Highland – floods/droughts

Projected Future climate: A2 scenario



Temperature: 0.6 to 3 C

Rainfall: -20% to 50%

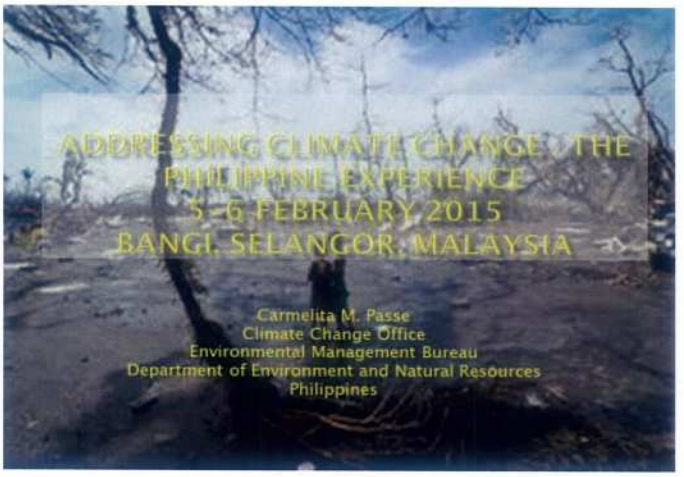
RCMs	WRF/CCSM	WRF/ECHAM	WRF/MIROC	ENSEMBLE RCMs
Number of events	5	9	7	6
Duration	8, 23, 50, 13, 59	21, 31, 14, 38, 6, 18, 22, 9, 15	12,12, 20, 23, 8, 12, 30	8, 25, 13, 50, 22, 24
Deficit	-146.92	-140.03	-124.48	-136.98
Frequency	0.43	0.48	0.32	0.39

Key Messages to take home – from a climate perspective:

- Amongst gridded observation data, uncertainties are quite significant
- Climate Downscaling is very much necessary. In particular, RAINFALL projections MUST come from RCM(s)/Downscaling. CWRF – a sophisticated RCM
- **Ensemble of RCMs: highly recommended**. Use of more RCMs and SCENARIOS (from GCMs) will give more '***added value***'.
- Future climate drought/wetness drawn from ensemble study implies that drought tendency is likely over 2011-2040 and flooding may be severe by the end of the century

Enhanced Regional Cooperation

- Better Data Sharing
- Need for dense observational data network
- Effective training programs for Univ/Institutes
- More Workshops to facilitate regional cooperation
- Capacity Building – Staff Attachments
- Integrated ASEAN/Regional climate modelling
- Publications – IPCC



National Communication Submitted to the UNFCCC

- Initial National Communication , May 19,2000
- Second National Communication, December 29, 2014

Status of National Adaptation Plan

National Framework Strategy on Climate Change (2010)

Serves as a roadmap in creating a climate-resilient Philippines

National Climate Change Action Plan (2011)

Developed to address a realistically achievable program of action for integrated climate change adaptation and mitigation

National Climate Change Action Plan

7 strategic priorities

- Food security
- Water sufficiency
- Environmental and ecological stability
- Human security
- Sustainable energy
- Climate-smart industries and services
- Knowledge and capacity development

Collaboration with Universities and Research Institutes

- Representative seats in the Advisory Board of the Climate Change Commission
- Representative seats in the People's Survival Fund Board
  - Functions :
    1. Promulgate policies
    2. Provide over-all strategic guidance in the management and use of the fund

- Under the MDGF 1656 Project: Joint Programme on Strengthening the Philippines' Institutional Capacity to Adapt to Climate Change, the University of the Philippines-Inter-Department Program on Climate Change conducted a study on the preparation of the vulnerability assessment tools for agriculture, forestry and biodiversity and the application of these tools at the pilot site.

- The same project also engaged the services of the University of the Philippines Manila (Institute of Health Policy)

1. Development of the vulnerability assessment framework
2. Development of climate change M&E framework system
3. Documentation of good and innovative practices

Local Level Issues

1. **Agriculture and Food**

- The agriculture sector in the Philippines is highly dependent on a constant water supply and predictable growing seasons.
- Increased tropical cyclone activity and associated storm surges, intense rain events, prolonged droughts, and resulting physical factors, such as nutrient-poor soils, disrupt farming activities and hamper agricultural production.
- 75 million tons of soil in watershed areas are lost annually to erosion, affecting about 70% of the country's total area, especially surface water resources.

Thank you!

MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT OF VIETNAM
DEPARTMENT OF METEOROLOGY, HYDROLOGY AND CLIMATE CHANGE

Climate change adaptation in Vietnam

Le Thi Mai Thanh
DEPARTMENT OF METEOROLOGY, HYDROLOGY AND CLIMATE CHANGE
MINISTRY OF NATURAL RESOURCES AND ENVIRONMENT OF VIETNAM

Country context

- Sq of 330,000 km^2 with coastal line of > 3000 km and 3000 islands
- Monsoon tropical climate with Temp. of 13 - 28°C, high humidity > 80% and avg. rainfall of 1400 – 2400 mm/yr
- Dense river system with 9 large river systems, > 2360 rivers, streams and avg. drainage density of 0.6 km/km^2
- Population of 90 mil. by 2013

Climate change impacts in Viet Nam

Agriculture:

- Change growing season, seed and crop type
- Increase crop growth rate (shorten their growth cycle)
- Increase water demand → higher risk of severe droughts and water shortage for irrigation

Coastal zones:

- Increase flood area, risk of saltinization for fresh water, storm intensity and duration, coastal erosion.
- Destroy coastal ecosystems
- Damage property, agricultural and aquaculture production, forestry and infrastructure.

Water resources: River stream flow volume

National Climate Change Strategy

Adaptation

- Actively respond to natural disasters and monitor climate change
- Ensuring food security and water security
- Respond to SLR for vulnerable areas
- Protection and sustainable development of forests and biodiversity conservation for effective response to climate change

→ ***Agriculture, Coastal zones and Water resource are priority adaptation areas.***

Notable activities in adapting to CC

- Improve the adaptive capacity for vulnerable regions, the Red river delta and Mekong river delta, coastal and urban areas;
- Capacity building in community-based and ecosystem based adaptation .
- Enhance and improve the protection of forest and the mangrove system;
- Upgrade the protection system for coastal areas;
- Develop high-tech, low emissions and sustainable agriculture;
- Expand REDD / REDD + and LULUCF programs.

Adaptation measures

Agriculture:

- ✓ Adopt scientific, efficient water management methods.
- ✓ Improve land management capacity to enhance land conservation.

Coastal zones:

- ✓ Strengthen embankments, intensify security services, prevent saltwater intrusion, transportation and residential infrastructure.
- ✓ Invest in construction of adaptive infrastructure, develop agricultural techniques and elevating houses above flood levels.

Water resources:

- ✓ Reinforce and upgrade existing infrastructure systems of rivers, sea dykes, flood diversion areas, flash flood relief channels…

Major constraints

- ✓ Lack uniformity and insufficient hydro-met observational infrastructure and telecommunication systems.
- ✓ Lack of adaptation impact assessment and response measure development models and tools
- → *Incomplete database*
- → Shortage of technical expertise
- ✓ Limited CC awareness of community
- ✓ Limited fund for CCA-related activities.

Thank you!

SEADPRI-UKM

Universiti Kebangsaan Malaysia's Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM) was established in June 2008. The Initiative addresses crucial challenges on disaster risk reduction in Malaysia and the region. The importance of having a research focal point in this region was felt when Malaysia and neighbouring countries grappled with various issues related to science and governance in facing the 26.12.04 tsunami disaster. SEADPRI-UKM was created to provide basic solutions for disaster prevention through multi– and inter–disciplinary research on risk management to bridge the science-governance interface. The focus of research is on climatic hazards, geological hazards and technological hazards. The emphasis is on capacity building, mainly through post-graduate programmes and specialised training.

The SEADPRI Series is a periodic publication on science, technology and capacity building for disaster and climate resilience. The inaugural SEADPRI Series highlights the project on "Enhancing Local Level Climate Change Adaptation in Southeast Asia" (Phase 1) supported by the ASEAN-India Green Fund. The Inception Workshop for the project was held on 5-6 February 2015 in Bangi, Malaysia. The workshop was attended by about 30 participants, comprising representatives of the ASEAN Working Group on Climate Change (AWGCC) National Focal Points and National Partner Organisations who are primarily from universities and research institutes as well as partners from India.

asean india
PROGRESS & PROSPERITY

seadpri
southeast asia disaster prevention research initiative

asean

APN
ASIA-PACIFIC NETWORK FOR
GLOBAL CHANGE RESEARCH

UNIVERSITI
KEBANGSAAN
MALAYSIA
The National University of Malaysia

Asian Network on
Climate Science and Technology
(ANCST)

ISBN 978-967-5227-74-5