2nd Regional Workshop Report: Presenting & Discussing the Initial Findings

11-12 July 2011 | Hanoi, Vietnam

Basin-wide Climate Change Vulnerability & Adaptation Assessment for the Wetlands of the Lower Mekong Basin

prepared for the Mekong River Commission

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1 | INTRODUCTION

The Mekong River Commission has engaged ICEM to undertake a study entitled "*Basin-wide Climate Change Impact and Vulnerability Assessment for the Wetlands of the Lower Mekong Basin for Adaptation Planning".* This will be of 10 months duration and should be completed by the end of December 2011.

The purpose of this project is to undertake a climate change impact and vulnerability assessment of the wetlands of the Mekong basin and provide recommendations and options for effective adaptation. Central to achieving this is the need to develop a solid scientific evidence base and a rapid spatial assessment methodology for climate change vulnerability assessments of natural systems.

Three workshops are scheduled as part of project implementation and are designed to present project findings, discuss and share lessons learnt amongst stakeholders, draw together stakeholder feedback, gather relevant information from a wide audience, develop a network of climate change and wetland professionals & ensure successful implementation and uptake of project outputs.

In accordance with international best-practice, the assessment will take a functional approach to defining wetlands, focusing on how wetlands work rather than simply what the wetlands look like. This focus on ecosystem function is well suited for integrating the hydro-metrological impacts of climate change on the wetlands as well as linking them to the livelihoods of the millions of people in the basin who rely on them.

The project will act as a pilot and demonstration for the benefit of all MRC member countries. It will also build capacity for climate change vulnerability assessments, principally within the National Mekong Committees (NMCs), national agencies responsible for the natural resource management and those concerned with implementing climate change adaptation planning. Government staff will receive on-the job training and will participate in specific components of the assessment, targeted to building their capacity.

The second workshop was held in Hanoi, Vietnam on the 11-12th July 2011. This workshop report summarises the proceedings and discussion.

The **objectives** of the workshop were:

1. To present the study and some initial findings to a wider audience of government and non-government agencies from each of the four countries
2. To discuss climate change trends used at regional and national levels
3. To discuss the implications of climate change upon Mekong wetlands, their vulnerability and courses of action to maintain and protect them
4. To draw upon the knowledge and perceptions of participants to inform and guide the continuing study

The main focus for the workshop was to discuss the initial findings of the case studies in the Lower Mekong. Case studies from different wetland types in three of the LMB countries were presented based upon short field visits undertaken by the consultant teams. These case studies described the characteristics of each type of wetland and began to identify existing responses to climate change. The discussions ranged from clarifications on the findings to guidance for the study teams in developing the case studies further to the lessons for adaptation mechanisms.

The agenda and list of participants for the workshop is presented in Appendices 1 and 2.Presentations from the workshop can be downloaded from ICEM's website www.icem.com.au.

2 | OPENING SPEECH

DR LE DUCTRUNG | DIRECTOR GENERAL OF VIET NAM NATIONAL MEKONG COMMITTEE

"Excellencies, Distinguished guests, ladies and gentlemen - Over the last decade opinions and approaches to wetlands have changed dramatically. Ten years ago wetlands were considered as wastelands, not valuable natural resource assets to be conserved and protected as a development strategy. Then, the discussion would have been about how can we drain or modify the wetlands of the Lower Mekong Basin to use them for increased agricultural production, for aquaculture, for prawn farming, or for urban development to take advantage of high land prices in the cities. This would more likely have been a workshop on wetland removal from development landscapes and not on their rehabilitation and expansion in the face of climate change.

"The task before us is how to protect the remaining wetlands that we have and manage them better so that they can continue to provide the ecosystem services and products we depend on."

The extent to which the wetlands have been removed as wastelands in the past is shown by figures that will be presented in this workshop. Wetlands make up about 32% of the total land cover of the Lower Mekong Basin – about 250,000 km^2 out of 795,000 km^2.In the not so distant past most of this area was natural wetlands. Now most of this area is substantially modified and intensely managed -- only about 55,000 km^2 can be considered as natural wetlands – and those small pockets may be modified or altered by human use.80 percent has been converted to man-made wetland, for example for agriculture – paddy fields, aquaculture and fishponds, and for irrigation and hydropower. However, even man-made wetlands can contain rare biodiversity and provide useful ecosystem services and products, so they are not completely lost. But it is the remaining natural wetlands that are the focus of this study.

This workshop is about wetlands and climate change. Climate change is in everybody's minds at the moment, and examples of how the world's climate is changing occur almost every day, often through increased frequency of extreme events – storms, floods, drought as well as incremental sea level rise.

Land managers are beginning to appreciate that wetlands are an important natural resource that can act as a buffer against these extremes while continuing to provide for the livelihoods of rural and urban communities in the face of climate change threats.

The task before us is how to protect the remaining wetlands that we have and manage them better so that they can continue to provide the ecosystem services and products we depend on. Better still, how can we rehabilitate, enhance and expand wetlands, in the light of climate change. This study is about adaptation of wetlands and strengthening of their values. It is not about more intensive exploitation of wetlands in the light of climate change – it is about protection and enhancement of the wetland resources as an essential adaptation response to climate change. This is a very important distinction which we will be considering further in this workshop and throughout this study.

The Mekong River Commission has asked ICEM and its partners, IUCN, WorldFish Centre and SEA START to work with national and local governments in a study on the vulnerability and adaptation of wetlands to climate change. This one-year assessment is a first step in understanding the issues concerned with wetland management and climate change. The study will come up with recommendations for regional adaptation policies and measures that can be implemented for the different wetland types in all four countries of the Lower Mekong Basin.

This is an innovative and ground-breaking study that will be developing and testing methods for monitoring and assessing the effects of climate change on natural systems. It involves categorizing Mekong wetlands according to climate and agro-ecological zones, projecting climate and hydrological changes for those zones

and then using case studies covering all wetland categories to assess impacts and define adaptation responses. Then we will need to up-scale these wetland adaptation measures so that regional adaptation policies can be developed.

What you will hear over the next two days are the initial findings of the case study work from wetland locations in different parts of the Mekong basin. These are not the completed findings and recommendations. We want you to help shape those outcomes through discussion, your expertise and your experience.

We will hear what the local wetland managers and users are experiencing with climate change, and how they have adapted to extremes of climate in the past. We will hear from six case studies, two each from Cambodia, Lao PDR and Viet Nam. At least two more are being developed for Thailand, which will cover some very different wetland types – the most northern wetlands of the LMB and from the drier North East of Thailand. Many of the case study sites are the wetland "gems" of the Lower Mekong. A number are Ramsar sites. It is appropriate that we study these as examples, because if these are changed or lost irrevocably then the other lesser-known wetlands will be even more at risk.

The case studies are the most important part of the study. They are confronting the reality of changing temperature – not just the annual temperature, but the maximum and minimum temperatures at critical seasons of year. They are confronting the changing rainfall patterns – not just the annual rainfall, but the distribution of rainfall with shorter more intense wet seasons and longer and drier dry seasons. It is not just about rain falling on the wetland itself, but more importantly, on the catchment upstream, and the changing pattern of hydrology and sediments flowing into and through the wetland.

The case studies that we will discuss have been arranged so that we can compare sites with different hydrological features – two on the Mekong mainstream, two with flooding regimes affected directly by Mekong mainstream flows, one on tributaries not influenced by the mainstream, and one on a coastal area affected by the flows of freshwater and sediments once the Mekong reaches the sea.

Ladies and Gentlemen, this is an important and interesting workshop. You obviously think so as well, judging by the rank and quality of the participants. It is a workshop that will influence the way in which we think about wetlands in the Mekong, and how we act to protect them for the future. Your contribution of ideas and comments on how to improve these case studies and to recommendations for adaptation that come out of them are a very important part of the process.

In formally opening the proceedings, may I thank our colleagues in the MRC Secretariat Environment Programme and Climate Change Adaptation Initiative for developing, commissioning and overseeing this study. And may I thank ICEM and its partners for developing the ideas further and implementing the regional aspects and local case studies. Finally I would like to thank all those responsible for organizing this workshop, both in MRCS, the Viet Nam National Mekong Committee and ICEM.

Ladies and Gentlemen, I now declare this workshop open and hope that you will find it both interesting and informative."

3 | KEY MESSAGES

The key messages arising from the 2nd Regional Workshop are summarised below.

CLIMATE CHANGE VULNERABILITY AND ADAPTATION ASSESSMENTS

- **Climate change requires response despite existing uncertainty:** There are high levels of uncertainty and variability in scenarios, models and interpretation of future threats. In the face of this, CC assessments need to:
    - take a precautionary approach in managing the risks associated with development
    - understand past extreme events and trends
    - understand past vulnerabilities and past adaptation
    - talk in terms of future trends and ranges rather than precise futures
- **Address the adaptation deficit:** No system is perfectly managed and responding to existing climate variability and challenges will address the adaptation deficit improving system capacity to then address future change.
- **Put climate change into its development context:** The Mekong Basin is an extremely dynamic system with riparian countries undergoing very rapid social and economic develop. Non-climate drivers of change are often dominate the disturbance and degradation of Mekong wetlands and it is therefore important to put climate change into context with other significant human changes to wetland hydrology which are likely to have greater short-term impact on wetlands than climatic changes – especially, hydropower, irrigation and pollution loading

CLIMATE CHANGE TRENDS IN THE LOWER MEKONG BASIN

- **Increased variability in wet and dry season rainfall** – Trends in future rainfall are difficult to estimate because of uncertainties in modelling the Mekong monsoon, however, it is expected that the wet season will get wetter and the dry season drier with an overall increase in annual rainfall. Relative changes in dry season rainfall will influence the frequency and severity of meteorological drought and affect the timing and duration of transition from aquatic to terrestrial states – an essential component of wetlands.
- **Onset and duration of the seasons will change.** The Lower Mekong basin is characterised by a flood pulse hydrograph with four distinct hydro-ecological seasons (dry season, transition to flood, flood, and transition to dry). These seasons play a distinct role in the functioning of wetland systems, the creation of habitats and supporting life-cycles of flora and fauna species. With climate change there will be a likely delay and shortening of the wet season and a reduced prevalence of important transition seasons.
- **Water stress, drought and dry spells will increase as dry season rainfall becomes more erratic.** The increased seasonal and inter-annual variability in rainfall and hydrology will affect the predictability of seasonal water availability, inducing additional pressures on natural resource-dependent communities living alongside Mekong wetlands.

- **Run-off will increase in response to wet season rainfall changes** – Changes in wet season rainfall will lead to increases in catchment run-off. This is likely to be most significant for the left-bank tributaries of Lao PDR.
- **Rates of evaporation are likely to increase.** Evaporation is an important factor for shallow wetlands during the dry season, especially those on floodplains and flat area. Rates of evaporation are predominantly affected by insolation, solar radiation but are correlated to air temperature as well. Increases in air temperature will likely lead to greater rates of evaporation affecting the persitence of standing at the end of the dry season.

CASE STUDY SITES

- Each **case study site has its own unique social, environmental and economic values and impacts and vulnerability from climate change**. All communities have experienced and observed changes in climate patterns that have affected their wetland. Each wetland has other significant threats from development and human activities in addition to climate change

All natural wetlands have aspects of human interventions and therefore the investigation of natural wetlands will allow discussion of adaptation options for man-made wetlands also.

4 | PRESENTATION SUMMARIES

The following section provides a summary of each presentation from the second regional workshop. The full set of presentations can be downloaded from the ICEM website http://www.icem.com.au.

4.1 INTRODUCTION AND OVERVIEW OF PROJECT

PETER-JOHN MEYNELL | MEKONG WETLAND ECOLOGIST& NATURAL SYSTEMS SPECIALIST

The objective of the project is to undertake a **climate change impact and vulnerability assessment** for the Mekong wetlands that considers their functions and biodiversity, and to provide **recommendations for adaptation options** aiming at **securing wetland values.** The project objectives will be achieved by:

- Developing a **methodological framework for assessing climate change vulnerability of wetlands**, which can be easily translated between wetlands of the same type and between the local, sub-basin and basin spatial scales
- Developing an **evidence base** from case study sites to systematize the characteristics of vulnerability for different wetland types
- Providing an detailed understanding of the **implications of climate change to the health and function of wetlands** in the Mekong basin to the extent necessary to permit the formulation of specific **adaptation and management recommendations**
- Including an element of **capacity building** to strengthen the respective analytical and management capabilities in the concern line agencies of the MRC member states

There are three phases to the Project:

*Phase 1:*Establishing the baseline and defining the threat of climatic changes to wetlands
*Phase 2:*Undertaking eight case studies looking at wetland ecology, livelihoods and economics vulnerability to climate change
Phase 3: Up scaling case study finding to the different wetland types found in the sub-basin and LMB.

4.2 APPROACH AND METHOD

PETER-JOHN MEYNELL | MEKONG WETLAND ECOLOGIES & NATURAL SYSTEMS SPECIALIST

The focus of the study is the impacts of climate change, distinguished from other development trends and threats to wetlands. This project will first consider the adaptation of the wetland ecosystems themselves, then the adaptation of human uses and livelihoods of the wetlands. This project focuses on natural wetlands, not man-made or converted wetlands.

The assessment will be completed at two scales. At the **basin-wide scale**, analysis will focus on categorising wetlands based on their characteristics, as well as using IPCC SRES scenarios and internationally accepted downscaling and modelling techniques to quantify the threats posed by climate change in terms of changes to basin hydrology and meteorology. At the scale of the **case study sites**, vulnerability to climate change will be assessed in greater detail through interpretation of downscaled climate and hydrological data to assess the threats to wetland sites

4.3 CLIMATE CHANGE TRENDS IN MEKONG REGION

TAREK KETELSEN | HYDROLOGIST

This project is focuses on two types of climate change – changes in average climate and changes in extreme climate. The geographic or spatial and temporal scale is (almost) as important as the change itself. There are two types of climate change assessments being undertaken by this project, an impact assessment that is focused on threats and impacts of climate change and a vulnerability assessment that is focused on understanding the biophysical and socio-economic systems and their sensitivity to change. Several major climate change assessments have been completed to date that this project will build upon.

Climate change modelling comes with a high and varied level of uncertainty, including statistical uncertainty, scenario uncertainty, and recognised ignorance. Climate change requires that decision makers take a precautionary approach in managing risk associated with development. This means that we should talk in terms of trends and ranges rather than precise prediction, identify trends and vulnerabilities based on past events and patterns, and understand the effects of existing adaptation to past extreme events and regular climate. Trends and effects have been identified for the Lower Mekong Basin.

It is important that climate change is put in context with other significant human changes to wetland hydrology, such as changes to the rainfall runoff due to land clearing and deforestation, changes to surface water volumes due to water abstraction for human use through irrigation and water supply, and the changes

to basin storage capacity from hydropower. These will have greater impact on wetland in the short term than climatic changes.

4.4 MEKONG WETLAND ASSETS

PETER-JOHN MEYNELL| MEKONG WETLAND ECOLOGIES & NATURAL SYSTEMS SPECIALIST

Approximately 69% of wetlands in the Lower Mekong Basin are man-made freshwater wetlands, 18% are natural freshwater wetland; and the remainder are made up of: estuarine, lakes and ponds riverine, coastal and marine natural and manmade wetlands. Man-made wetlands make up about 33% of the total surface area of the LMB. Natural wetlands make up about 9%.The majority (80%) of the freshwater wetland are rice agriculture - irrigated, rain fed, recession, 14% are swamps and the remainder (6%) are made up of grassland, peatlands, flooded forests and other agriculture crops. Over 50%of riverine, estuarine and marine and coastal wetlands are man-made - channels or agriculture areas.

Wetlands can be considered and identified by elevation, latitude, eco-region, WWF ecological zones, occurrence in different mean annual temperatures, current mean annual rainfall, and predicted climate change effects. Through categorisation we can identify commonalities and assets of the wetlands, for instance, almost all the wetlands in the LMB are below 500m in elevation and all of the wetlands in the LMB fall almost entirely in the Lower Mekong floodplains and the Central Indochina dry forest eco-regions, while in other categories there are greater distinction between wetland type and their characteristics.

5 | SUMMARY OF CASE STUDIES

The presentations of each of the six case studies from Lao PDR, Cambodia and Vietnam were arranged into three groups. The Thailand case studies were not presented at this workshop, pending a final decision on the sites selected.

The case studies were grouped as follows:

- Sites on the Mekong mainstream
  - Siphandone, Lao PDR
  - Stung Treng, Cambodia
- Sites away from the mainstream but influenced by flows of the Mekong
  - Lower Stung Sen, Cambodia
  - Tram Chim, Viet Nam
- Sites on tributaries not affected by Mekong mainstream flows
  - XeChamphone, Lao PDR
- Coastal sites affected by Mekong mainstream flows after discharge into the sea
  - MuiCa Mau

5.1 SITES ON THE MEKONG MAINSTREAM

5.1.1 *Siphandone, Lao PDR | **Charlotte Hicks***

Siphandone is a complex of wetlands with unique ecosystems - the braided river channels makeup some 2,000 islands and in channel features which end at the renowned Khone Falls. The Siphandone wetland (500 Km^2) is a highly productive wetland, providing many resources and is rich in biodiversity (400 fish species, 187 bird species, and 713 plant species). Fisheries are especially productive and are a key part of local livelihoods and the provincial economy. The economic value of the Siphandone Wetlands is very high, provisioning food sources, income and materials, regulating the Mekong ecosystems through adding oxygen, nutrients cycling etc.at the Water Falls, as well as cultural and supporting services. Also, the Irrawaddy Dolphin, the critically endangered species is a flagship species that attracts thousands of tourists annually to the area, which brings huge income to the local residents.

Flooding is not a significant problem in Siphandone but a natural expression of the seasonal flood pulse, in contrast to other wetland sites, however drought is an issue. Changes in water depths leading to shallower pools are also an issue in the Mekong mainstream, and may lead to changes in the Mekong wetland ecosystems. Climate change may also accelerate soil erosion, which is already exacerbated by the clearing of land cover. Furthermore, longer drought periods will wither native grasses and consequently reduce soil stability.

Siphandone has international significance as a transboundary wetland as it is home to species of international conservation significance such as the Irrawaddy Dolphin, and because of its role in international, trade, tourism and investment. About 72 deep pools have been identified as fish conservation zones. An agreement has been reached at the district level for local communities to self-management these zones. Yet, the wetland has insufficient management status, already making it difficult to balance conservation and development priorities. Fisheries dominate the management approach and livelihood strategies in Siphandone; other species, habitats, and livelihood options require equal attention.

*5.1.2 Stung Treng: Cambodia | **Mam Kosal, Sideth Muong, Prom Nga***

Stung Treng is an important wetland area in Cambodia and is one of 3 national Ramsar sites. It has unique characteristics in its' forest types, swift flow, deep pools, and sandbars the support over 100 species of "white fish" that are reported to migrate to Stung Treng to spawn. Furthermore, Stung Treng is the largest riverine type of habitat in the region and consequently, large colonies of waterbirds depend on it.

The Stung Treng system is now under threat from climate change. The typical flooded forest in Stung Treng has seen 10% die off; unstable sandbars and deep pools are vulnerable to changing sediment supply and transport, and pond waters have seen the development of obnoxious algae in the last few years. These will have significant impacts on habitats and species. The Stung Treng wetland has economic value for residents and migrants in terms of fishing and farming activities. People's livelihoods depend upon the balance of wetland ecosystem s that is under pressure from climate change and human activity, such as damming and pollution.

5.2 SITES INFLUENCED BY MEKONG MAINSTREAM FLOWS

*5.2.1 Stung Sen: Cambodia |**Mam Kosal, Sideth Muong, Prom Nga***

Stung Sen is an important wetland in Cambodia due to the high level of productivity. Stung Sen is one of the three core areas in the Tonle Sap Biosphere reserve and it is part of a larger system that supports the rich wetland biodiversity as well as local livelihoods and the economy of Cambodia. The highly productive system of Stung Sen has seen a reduction in inflow from the Mekong, its source of water and sediment. The erratic supply of Mekong water and run-off from within the catchment has changed the profile of nutrient development and supply within the flooded forest system of the Tonle Sap Lake. Changed flood pulse and duration has also had negative effects on the migration of juvenile fish back from the Mekong. The increasingly low water level in the dry season and warmer temperatures have caused fish to die out.

Stung Sen wetlands have high economic value for residents and migrants in term of fishing and farming activities. People's livelihoods depend upon the balance of wetland ecosystems that are now influenced by climate change and other human action, such as dams and pollution. The decreasing population living in the Stung Sen wetland (-1.42% over the last 10 years) could be due to the reduction of services that the wetland is supplying to these communities.

*5.2.2 Tram Chim: Vietnam | **Nguyen Huu Thien***

Tram Chim National Park is one of the last remaining areas of the Plain of Reeds (PoR), and was established to preserve part of the PoR habitat and biodiversity for future generations. Wetland ecosystems of the PoR and biodiversity were shaped and supported by the annual flood pulse of the Mekong River. The ecosystem requires an alternate flood and dry season cycle. Its biodiversity comprises of 130 species of fish, 232 bird species, and 130 species of plants. The flagship species is the Eastern Sarus Crane. Locally important goods from the wetland are fish, fuel wood, grass, lotus and water lily for foods, microclimate regulation. Wetland services are also important to delta region and country, including tourism, history and culture, ground water recharge, saline intrusion regulation, carbon sequestration, scientific, biodiversity conservation.

Recently, changes in weather have been observed, including increased temperature and evaporation, lower flood peaks, longer dry season resulting in drought, and unpredictable off-season high intensity rain events resulting in short and localized inundation of field surfaces that causes eleocharis failure in producing tubers that leads food supply shortages for the Sarus Crane. Mismanagement practices such as stocking unnaturally high water all year round, tall ring dykes that limit intake of fish eggs and fries from Mekong flood water, protectionist approaches resulting in conflict with local communities are a threat. However, the biggest threat to the survival of the ecosystem is the proposed mainstream Mekong dams.

5.3 SITES NOT INFLUENCED BY MEKONG MAINSTREAM FLOWS

*5.3.1 Xe Champhone: Lao PDR | **Phaivanh Phiapalath***

Xe Champhone is a unique wetland. It is part of floodplain river systems with over 50 oxbows lakes and it is one of two Ramsar sites in Lao PDR, however, only half of the wetland(124 km^2) is declared a Ramsar site. The wetland is the main producer of rice and fish for Savannakhet Province, Lao PDR. The wetland landscape covers four districts whose communities rely on the wetland for their livelihood. Today, not only are the natural wetlands productive fisheries but also modified or semi man-made wetlands, such as "Ang Soui lake", also provide large amount of services.

The economic values of Xe Champhone wetland are considered high, through the provisioning of and regulating of fisheries and wetland vegetables for local food supply and income. The Xe Champhone wetlands reduce in size and become isolated in the dry season. The dry season can also cause further problems with domination by invasive species. This causes declines in fish species biodiversity and numbers. Consequently, fisheries are more productive in the man-made and altered wetlands of Xe Champhone where their water level and vegetation is regulated.

Flood and drought are the most serious issues in Xe Champhone. The increase run off due to climate change will change river morphology through the higher rate of soil erosion. Almost all the deep pools, a key habitat in the ecosystem, of Xe Champhone River, have become shallower. Moreover, invasive species – *Mimosa pigra* is expands throughout the system during floods. Conversely, local villagers have suffered through longer droughts. Drought conditions make living conditions difficult with limited rice yield and livestock success. Some villages, such as Ban Khamtao, have experience salinity in the ground water meaning they had to purchase drinking water. Xe Champhone River is not a deep system (average depth of 1 m) and is often segmented during periods of low flows in the dry season.

Key species, such as the Siamese crocodile, *Anaspoecilorhycha* "Spot billed duck", *Indotestudo elongate* "Elongate Tortoise" suffer during drought astheir habitat and population becomes fragmented. Some fish

species also experience problems when migratory pathways are blocked. In addition to climate change, dykes and irrigated dams cause additional obstacles to the migration and success of breeding for some fish spices.

5.4 COASTAL SITES INFLUENCED BY MEKONG FLOWS AFTER REACHING THE SEA

*5.4.1 Ca Mau: Vietnam | **Hoang Van Trang***

The Ca Mau National Park is part of the Ca Mau peninsular and mudflat. It was established in 2003 and is an important coastal wetland for Vietnam and ASEAN. It is a biosphere reserve area as well as an important bird area of Vietnam. The park separates the sea into the East and West Sea and comprises of a large diversity of species and habitats representing terrestrial, estuarine, river mouth and mudflat ecosystems.

The park provides series of services including the provision of fish, shrimp, clams, construction materials, firewood, and aquaculture. It also regulates the climate, flow and water purification and pollution treatment. The park, especially its mangroves, protects the coastline and sea dyke from erosion and mitigates sea wave and natural disasters. The park is a common area for cultural, scientific and recreational activities, and it is a very important breeding and spawning area for many species.

Recently, abnormally prolonged dry, hot seasons, unpredictable and high intensity rain events in the dry season, sea level rise leading to coastline erosion, and decreased bird populations have been observed that have a negative impact on aquaculture causing increase in poverty rates. Rapid population growth, harvesting of mangrove trees for charcoal, fuel wood, net poll, hunting of wildlife, destructive fishing and exploiting of natural resources as well as violation against law enforcement are all threats to the wetland.

5.5 RELATED PARTNER PROJECT

*5.5.1 Building resilience to CLIMATE CHANGE Impacts, Coastal Southeast Asia | **Robert Mather, IUCN***

Robert Mather from IUCN presented a recently commenced IUCN project to illustrate the complementary approaches. The IUCN project aims to increase the adaptive capacity of people and ecosystems on which they depend to cope with the anticipated impacts of climate change and plan for Disaster Risk Reduction (DRR), through sound governance and planning.

Impacts of climate change on coastal zones include sea level rise, higher sea temperatures, changes in precipitation patterns and run off, changed oceanic conditions, and changes in storm tracks, frequency and intensity. These impacts will likely lead to displacement of coastal lowlands and wetlands, impacts on habitats and species, increased coastal erosion, increased flooding and drought conditions, salinisation, and increased vulnerability. This vulnerability to climate change can be assessed using knowledge of the three components – exposure, sensitivity and adaptive capacity.

In the context of the IUCN project, a vulnerability assessment of critical coastal habitats and climate change is undertaken of the mangroves, coral reefs systems, and seagrass habitats. Results from the habitats assessment show that the highest impacts of climate change are to intertidal mudflats in Ben Tre, Can Gio, Soc Trang and the melaleuca forest in Kien Gang. While the highest impacts of climate change and existing threats are to seagrass beds in Kampot, Koh Kong, Chanthaburi, Trad, and Kien gang; mangroves in Ben Tre, Can Gio, Kien Gang, and SocTrang; mudflats in Ben Tre, Can Gio, and Soc Trang; and melaleuca forest/seasonally flood grassland in Kien Gang.

6 | DISCUSSION POINTS

During the course of the workshop, the presentations raised many questions and comments from workshop participants and a number of important contributions and suggestions were made. These have been consolidated and summarised below. The discussion sessions were particularly important in getting feedback on the initial findings of the case studies for incorporation.

6.1 DEFINITIONS AND BOUNDARIES

If the project only looks at natural wetlands, then we may miss the overall objectives of basin-wide assessment of wetlands. Whilst 42% of the land cover in the LMB is considered as wetlands, 33% is considered as man-made wetlands. The large majority of all the wetlands in the LMB are classified as "freshwater wetlands" of which 80% are agricultural wetlands – irrigated and rainfed rice fields. The project will not be considering rice fields, though it is probable that a large proportion of these agricultural lands were natural wetlands at one stage in history. The project will therefore focus on the 9% remaining of natural or semi-natural wetlands where less is known about them and where adaptation is less easily managed than in man-made wetlands.

These definitions of man-made and natural wetlands come directly from the MRC wetland classification. However, the distinction between the two is not clear-cut, and almost all natural wetlands have been changed through the activities of man. Wetland management including for adaptation to climate change may require increasing man-made interventions and infrastructure in order to protect the wetland values against outside pressures.

What are the boundaries of wetland systems? In many cases the boundaries of where the wetland starts and finishes is not clear and considering the mosaic of different habitats that is typical of most of the case study sites, it is very difficult to be precise about the boundaries. It may not be possible to define and measure the areas of habitats exactly, but trends and estimates of percentage change may be possible.

A suggestion was made that the ecologically interesting areas in Munlapamok District and the Dong Khanthung/XeLamphao area should be included in the Siphandone case study site.

6.2 METHOD AND APPROACH

Does the project plan to do quantitative assessments as well as qualitative assessments of climate change? The study will incorporate both qualitative and quantitative assessments. Detailed climate modelling using 6 GCMs, statistical downscaling and a basin-wide hydrological model will be utilised to quantify changes in temperature, precipitation and hydrology at the case study sites. However, in a study in which there is a great deal of uncertainty about the levels of climate change predictions, will be phrased in terms of trends and ranges with full acknowledgement of the variability between GCMs. This information is only useful when it can be *directly* linked to some key parameters which define the functioning of the wetland. Alongside the modelling of CC threats, the study team will also characterise the sensitivity and exposure of the wetland to these threats.

Social adaptation to climate change will affect wetland management and therefore should be incorporated into the study. The study will first try to assess the impacts of climate change upon the wetlands ecosystems, independent of other pressures from human activity or development. Once this is done, the impacts from other pressures will be superimposed over climate change impacts. Social and livelihood responses to climate change are part of these other pressures, such as requiring more water for agricultural crops during drought which may be taken from the wetland. Some of these may be predictable and taken into account, while others are less predictable. In this way, the focus of the vulnerability assessment is on the wetland ecosystem, the

team will not undertake a comprehensive vulnerability assessment of communities living adjacent to the wetlands, it will explore the dependency of these communities on tangible ecosystem services and products and explore how sensitive these communities are to changes in the availability of these services.

Will the project look at the cost-benefit analysis of maintaining a wetland function against the cost of manmade solutions to the complete loss of wetland? The project will be assessing several ecosystem value streams in each case study site and trying to identify the change in these values due to climate change. For at least one site we will do a preliminary assessment of the cost effectiveness of the adaptation mechanisms proposed. The project will not be able to do a total valuation of wetlands nor a full cost-benefit analysis of the adaptation mechanisms as these are very data intensive and time consuming analyses, and the project does not have the resources for this.

What is the project schedule for capacity building and the key capacity building activities? The project has several capacity building aspects. The first is a series of regional meetings with government staff involved with wetland management and climate change participate. Secondly; the project aims to develop the knowledge and understanding of climate change and wetlands and will increase the capacity within the region to adapt to climatic changes. Thirdly, the MRC has provided additional resources to appoint national teams from government agencies who will take part in fieldwork, analysis and reporting alongside the consultant teams in each country, thus building their personal, departments and government capacity in climate change vulnerability and impact assessment.

6.3 DATA RELIABILITY AND CONSISTENCY

What is the confidence of the models and data used in the climate change modelling and in the GIS analysis?

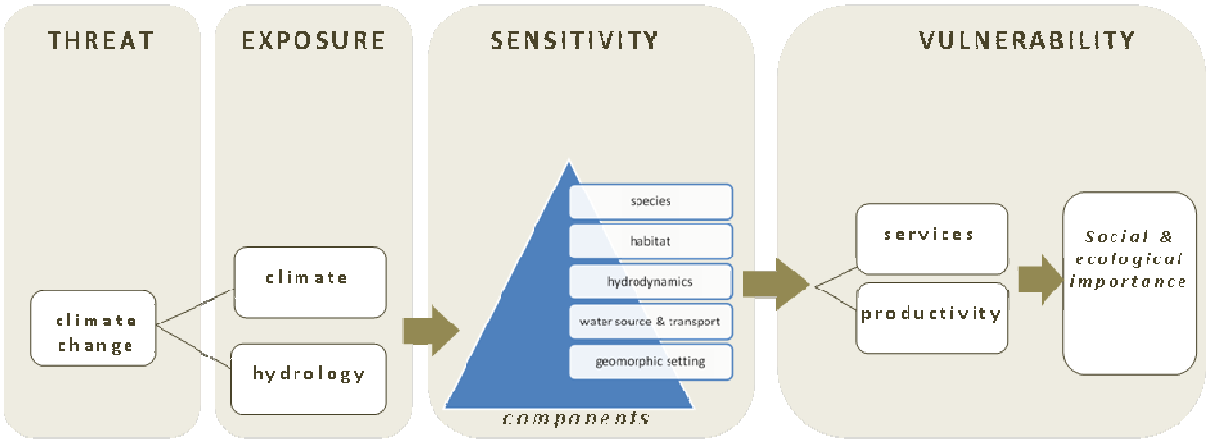
Climate change modelling involves a number of assessment phases starting at the global atmospheric system and moving with increasing resolution to the basin, region and case study wetland. At each stage there are assumptions and uncertainties which compound upon one another. This accumulation of error is one of the major limitations of current climate modelling and one of the points of focus for research leading up to the IPCC Fifth Assessment Report. The approach has sought to minimise the introduced error by:

- reviewing the 17 GCMs which have been applied previously to the Mekong Region and selecting the 6 which were best able to replicate historic temperature and precipitation;
- introducing a comparison at the basin-level of CC results obtained from the statistical downscaling technique with previous efforts using dynamic downscaling;
- calibrating the basin model with all available monitoring data from the MRCS IKMP

- developing climate change trends based: (i) on 25 year time slices rather than individual years, and (ii) fitting statistical distributions to the daily climate data so that trends can be reported across the full range of what is possible with an indication of what is probable

6.4 VULNERABILITY ASSESSMENT AND IMPACTS

The project needs to be sure to show the links between wetland and climate change. In the approach and method there is a clear emphasis upon developing the causal linkages between changes in climate through hydrological changes to changes in the extent and character of the wetland and its biodiversity, and therefore to the ecosystem value streams (see figure below). A causal and systematic approach limits the range of possible climate change impact pathways to those for which data or a qualitative understanding is currently available.



To what extent will the project address transboundary wetland issues rising from climate change? There are two wetland case studies that relate to transboundary situations – namely Siphandone in Lao PDR and Stung Treng in Cambodia. The study will seek to enhance linkages between Siphandone and Stung Treng case studies highlighting transboundary aspects.

Transboundary adaptation mechanisms may be required that relate to the changes in these sites. The changes in flows in the Mekong resulting from climate change are also likely to have transboundary impacts in almost all the sites, except those high up in the tributaries, including the coastal site at Mui Ca Mau.

This is just a rapid assessment with only one field trip to the case study sites. Ideally fieldwork should be repeated again in the dry season, with longer-term monitoring. The case studies would also benefit from having additional experts look at different aspects of the wetland and its biodiversity in order to provide a more precise assessment of climate change impacts on the wetlands. Such follow-up work might be suggested as part of the recommendations of the study.

Invasive aquatic species, especially water hyacinth and Mimosa pigra, are evident in many of the case study sites, and their spread may be one of the most important impacts of climate change. The case studies should include an analysis of this. In Xe Champhone where the Mimosa pigra is problematic, the study needs to consider how to address and rehabilitate affected areas.

6.5 RECOMMENDATIONS

Will the project produce national adaption options instead of or as well as regional options? The case studies will be developing specific suggestions for adaptation based upon local conditions. These will be tailored for general use according to the type of wetland, and can be used at national as well as regional levels. Where the

adaptation mechanisms relate to improving overall wetland management, or wetland conservation policy, these can be upscaled to the appropriate level both national and regional.

'No regrets' or reducing the climate change adaptation deficit. The concept of "no regrets" adaptation was explained as prioritising adaptation options that would be justified under all possible climate change scenarios, the measures that should be undertaken to protect and use the wetlands sustainably. This allows managers and planners to start immediately with adaptation parallel to the consolidation of the scientific evidence base, taking the measures that we need to do anyway and ensuring that sustainable wetland management is put in place.

The climate change adaptation deficit is defined as the failure to adequately address *existing* climate risks. Controlling and eliminating this deficit in the course of development is the first step in the longer-term project of adapting to climate change. Development decisions that do not properly consider current climate risks add to the costs and therefore increase the deficit. As climate change accelerates, the adaptation deficit has the potential to grow much larger compounding existing problems and giving rise to new ones.

7 | WORKING GROUP SESSION RESULTS

After the case study presentations and discussion, participants worked in country groups to consider each case study within that country. The groupswere asked to develop a matrix for each project site to respond to five key questions:

1. What are the three main existing trends in wetland natural components?
2. What are the main drivers/reasons for those trends?
3. How will climate change impacts affect those trends?
4. What have been the responses by government and communities to those trends?
5. Suggest adaption options to address trend with climate change

The tables below show the results of the country working groups:

7.1 STUNG TRENG& STUNG SEN, CAMBODIA

Main trends shaping wetland natural components and climate change effects.

What are the three main existing trends in wetland natural components	What are the main drivers/reasons for those trends	How will climate change impacts affect those trends	What have been the responses by government and communities to those trends	Suggest adaption options to address trend with climate change
Declined in fish resource	Habitat destruction Water regime change Population growth Over and illegal fishing Water pollution Sediment lost Wetland conversion, encroachment	Worsen: Indirectly relevant Worsen	Law enforcement Fishery management review, NR based community established, keenly to cooperate with gov't effort	Alternative income generation activity options Habitat restoration, Aquaculture promotion and selection of fish species Gov't policy on job creation Capacity building to community on CC
(ii) Wetland pollution	Urbanisation Migration Improper agricultural practice Water regime	Worsen	Law on environmental protection and natural resource management, Sub-decree on water pollution control	Nation wetland action plan Enforce the endowment fund collection
(iii) Water bird	Fish stock declined Habitat destruction Water regime change Pollution	Worsen	Royal decree on creation of the protected areas Joint Prakas MAFF-MOE on wildlife trade	Law enforcement Public awareness Habitat protection and conservation

7.2 SIPHANDONE

Key climate change impacts on wetland natural components.

Wetland natural system components	If…(Climate condition)	Then…(Impact of climate change)
Species: • Mekong Irrawaddy Dolphin • *Henicorhychus* (Pasoi)	Longer dry period experienced in SPD already If longer drought If higher dry season flow. Changing in seasonal patterns or changes in water levels and flow Longer Drought	Irrawaddy Dolphin will become shallower and possible more sandbar appear due to high sedimentation during wet season, Consequently, its breeding is ineffective. Habitat changes (become closed water wetlands and food source decrease) Impacts on time migration during pre wet season (May to July) and back upstream in Jan to Feb. Food source will be problem, scarcer e.g. *Microsporaflucosa* (Khaihin)
Habitats • Sandbar and beaches • Deep pool	Increased wet and dry season flow Longer dry period, Increased rainfall in wet season Increased wet and dry season flow	More bank erosion and sedimentation, more *Mimosa pigra*, More exposure, more sandbars appear stream, More erosion, Higher sedimentation and resulted shallower.
Hydrology	Increased wet and dry season flow Drought, Longer dry period	Increase sediments in stream and make shallower pool, Increase erosion Water level changes Water level decreased Lower ground water level, Higher evaporation, Higher water temperature in isolated water bodies,
Geomorphology (landscape and sediment)	Higher rainfall, over flooding Longer dry period	River channels and riverbanks change Changes of sandbars and shifting around the stream

Main trends shaping wetland natural components and climate change effects

1. What are the three main existing trends in wetland natural components	2. What are the main drivers/reasons for those trends	3. How will climate change impacts affect those trends	4. What have been the responses by government and communities to those trends	5. Suggest adaption options to address trend with climate change
Increased soil erosion and sedimentation	Land cover change, e.g. due to drought, deforestation Thin top layer of soil and soil cannot contain water longer	Decreased in capacity of land cover e.g. grasses and other plants	Change to and creased in dry crop season	Rehabilitate Ton kai, ficus sp. etc. that function to maintain the banks from erosion.
Fish population decreased especially Henicorhynchussps.(Pasoi) Some key fish species e.g. Pangasium sp.	Changes in floods for Mekong – Tonle Sap Over fishing, and partly barriers	Changed in water levels of the Mekong River	Establish fish conservation zone including village regulations for fish conservation	
Mekong Dolphin	Decreasing in water quality, shrinking the habitat (deep pool), Decreasing food sources Increasing boats and nets in the habitat areas	Decreased in food sources e.g. Pasoi More sedimentation and runoff and including chemical fertilizers and pesticides in the stream Perhaps, water level change might benefit to the species	Strengthen the cooperation between the Lao and Cambodia Fishery Law Dolphin guidelines WWF and ADB projects, funding for promoting Dolphin tourism and conservation	Enhance regulations e.g. boat traffic and fishing nets used

7.3 XECHAMPHONE

Key climate change impacts on wetland natural components.

Wetland natural system components	If...(Climate condition)	Then…(Impact of climate change)
Species: Siamese crocodile	Longer dry period in XCP are being experienced already… If higher temperature and drought…	…which makes the crocodile's habitat be disconnected and smaller, and the population fragmented. Consequently, its breeding is ineffective, chance of successful hatching is low. Habitat changes (become closed water wetlands and food source decrease since only a few species can live in such habitat). …Higher temperature may affect sex determination (all females or all males born will change in age class composition)
Habitats: Open water wetlands	Higher rainfall, over flooding Longer dry period, high tolerant	Make the exotic species and other floating weeds expanded e.g*Mimosa pigra*, water hyacinth, *Salviniacucullata*. Finally, those species become thicker floating mats and some of the mats ceased down to stick in soil during dry season resulted to shallower. More drying down/shrinking
Hydrology	Higher rainfall, over flooding Drought, longer dry period,	Increase in water quality from upstream, Increase sediments in stream and make shallower, Spread out of invasive species, Changes in river channels because of higher erosion. Pile up of some oxbows, Change in soil quality. Water level in lakes and ponds decreased, Lower ground water level, Higher evaporation, soil drier, Higher salinity, Higher water temperature, Higher concentration of substance, Potential increase in pesticide concentration in the area because of investment in sugarcane plantation.
Geomorphology (landscape and sediment)	Higher rainfall, over flooding Longer dry period	River channels changes. Appearance of sands in rivers.

Main trends shaping wetland natural components and climate change effects

1. What are the three main existing trends in wetland natural components	2. What are the main drivers/reasons for those trends	3. How will climate change impacts affect those trends	4. What have been the responses by government and communities to those trends	5. Suggest adaption options to address trend with climate change
Fish population decreased	Overfishing (change in fishing gears e.g. electrical fishing gears used, fishing for commercial purpose) Habitat changes (floating mats) Quality and quantity of water in the wetlands changes e.g. water temperature, salinity? Barriers to migration of fish e.g. weirs/dykes	People respond to climate change impacts in other areas with more fishing in the wetlands. Results of over flooding make invasive species expanded, More dry out and dry down Average rainfall in dry season drops, temperature and evaporation is increased Change in raining patterns, esp. lower water level during the fish migration will make more difficult for fish migration. Bring more invasive species Longer drought	Fishery Law, regulations of the district exist but ineffective Local communities responsible by fishing more and using more equipment, importing fish from other countries for consumptions Increase aquaculture Government has a national wildlife day which they do fish release as to mark the day	Revise the existing regulations related to wetlands and fish management. Take more effective law enforcement, Zoning for use and breeding Control and manage fishing gears e.g size of fishing net or other destroyed fishing gears.
Increasing salinity in paddy field	Too many irrigation schemes Water quantity is decreased Increase water use in the wetlands,	Higher evaporation Average rainfall is decreased	n/a	Conduct scientific based research to find best practice

7.4 MUI CA MAU, VIETNAM

Summary table of key climate change impacts on wetland natural components

Wetland natural system components	If…(Climate condition)	Then…(Impact of climate change)
1. Species	High Mekong flood Sea level rise Increased temperature	Nutrient supply increased => Increased in fishery productivity but too deep to catch for water birds Mangrove migration or die out Negative impact on sea grass or seaweed Hotter water surface + more stratified water column impacts on primary productivity Change in behaviour, species composition
2. Habitats	High water level Low flood Increased temperature	Reduce feeding area for water bird Push the mangrove backward inland Reduce sedimentation/siltation Increase salinity intrusion and salinity Increased evaporation
3. Geomorphology (landscape and sediment)	Off-season rains Sea level rise Low flood Extreme event	Reduce salinity Coastal erosion; large flooded area Reduce sedimentation/delta building Storm surcharge

Main trends shaping wetland natural components and climate change effects

1. What are the three main existing trends in wetland natural components	2. What are the main drivers/reasons for those trends	3. How will climate change impacts affect those trends	4. What have been the responses by government and communities to those trends	5. Suggest adaption options to address trend with climate change
(i) Aqua-culture production decreased	- Over-fishing and destructive / overcrowded exploitation - Prolonged flooding - Increased temperature, water level and sea level rise - Cyclone, change in the flow velocity - Land-based pollution - Inefficiency aquaculture	↑	- Regulation - Patrolling/ guard station - Environmental education - Strengthening management, conservation and sustainable utilization - Rehabilitation - Establishment of aquatic resources protection zones	- Capacity building - Law enforcement - Community participatory approach - More research - Conservation of habitat, species and genus - Develop adequate aquaculture model - Benefit sharing - Pollution management and treatment - Financing

	practices		- Vocational training and new job creation	
(ii) Erosion in the east coast increased	- High sea level - Strong wave, wind - Change in the flow regime - Waterway transportation/ high speed boat	↑	- Replanned settlement - Heighten up foundation and building - Reforestation/ rehabilitation - Mangrove -front dike built-break water wall - Build the internal road	- Maintain existing mangrove forest - Reforestation - Benefit sharing - Control speed boats - Watershed and river basin management - ICM- Integrated coastal management - Financing
(iii) Decrease delta building rate	- Decreased rainfall - Low flood - Upstream dam construction - Erosion (strong wave, wind...) - Reduce sedimentation	↑	- Reforestation - Rehabilitation - Sea dyke - MRC - Research/ monitoring - Watershed management policies	- Watershed and river basin management - Protection and reforestation - Regional cooperation - Capacity building - Financing

7.5 TRAM CHIM

Summary table of key climate change impacts on wetland natural components

Wetland natural system components	If… (Climate condition)	Then…(Impact of climate change)
Species	High Mekong flood	More fish ➔ more food for water bird
	Low and late start of floods	Less fish ➔ less water bird
	Increased temperature	Hotter water surface + more stratified water column ➔ impacts on primary productivity(+ or - ?)
Habitats	High flood	Washing out dead biomass ➔ good annual regrowth of vegetation + less accumulated fuel ➔ less fire risk
	Low flood	Accumulated dead biomass ➔ poor annual regrowth of vegetation + more accumulated (dead) fuel ➔more fire risk
	Increased temperature	Increased evaporation➔increased fire risk

Geomorphology (landscape and sediment)	Off-season rains	Accumulated of acidity in low areas and canals➔fish die-off

Main trends shaping wetland natural components and climate change effects

1. What are the three main existing trends in wetland natural components		2. What are the main drivers/reasons for those trends	3. How will climate change impacts affect those trends	4. What have been the responses by government and communities to those trends	5. Suggest adaption options to address trend with climate change
Fish	↓	Tall dykes limiting intake of fish eggs and fingerlings Low flood peaks Overfishing	Worsen • Increased T^0 • Low flood peak	Sustainable Users Groups Demonstrated cuts of internal dykes to improve flows	More cuts of internal dykes Lower the ring dykes
Crane	↑	Habitat recovery Appropriate hydrology	Negative • Affect productivity of Eleocharis	Pilot Integrated Fire and Water Management Strategy	Approve and adopt the Integrated Fire and Water Strategy
Water fowl	↓	Low flood Less fish	Worsen: • Low flood • less fish	Sustainable Users Groups Demonstrated cuts of internal dykes	Facilitate freer flows in the larger landscape (buffer zone)
Eleocharis: Area Productivity	↑ ↓	Appropriate water levels Off-season rains	Increase Decrease	IFWS (Integrated Fire and Water Strategy)	Permanent recognition of the IFWS Flexibility in application of IFWS (release excessive water caused by off season rains)
Mimosa	↓	Less soil and plant community disturbance Active manual control	Increase mimosa. Outcompete native species	Active weeding	Continue weeding Find uses for mimosa (double-edged sword) Flexibility in national policy to empower wetlands managers to make site-based decisions.

8 | CLOSING SESSION

8.1 STATEMENT BY DELEGATION FROM THAILAND

The Thai delegation made a statement that conveyed their appreciation for the presentations of the project case studies and their intention to recommend two sites in Thailand to be considered for similar case study assessment. The two sites are both Ramsar sites:

1. Nong Bong Kai non-hunting area in the Chiang Saen area or Northern Thailand and
2. Bung Kong Long non-hunting area in Nong Khai province in North East Thailand. The latter has a strong local community network.

They expected this case study work to start soon to be completed by the end of September

The Thai delegation stressed the need to include human activities and functions in the wetland such as the role of the River Basin Organisation. They would have liked to have seen a greater participatory process of decision making included in the project, including for the site selections.

They expressed concern about the reliability of the climate change and wetland data that they would be able to collect and how this could be extended in the development of recommendations for management of the wetland.

8.2 NEXT STEPS

Peter-John Meynell outlined the next steps in the study, which included:

- Case studies finalisation by the end of September (drafts by end of August)
- Vulnerability assessment draft report by end of October
- 3rd and final workshop at the end of November (probably 23/24) in Phnom Penh
- Completed synthesis report by end of December

8.3 THANKS AND CLOSURE

MRC Director Sourasay thanked all participants for their excellent contributions to the discussions and enhancing the case studies and closed the meeting.

APPENDIX 1 | AGENDA

DAY 1: Monday 11th July		
Time	**Activity**	**By**
08.00 – 08.30	Registration	
08.30 – 08.45	Welcome and opening statement Welcome Speech	Le Duc Trung, Director General, VNMC Sourasay Phoumavong, Director of Environment Division, MRCS
08.45 – 09.00	Introductions	
09.00 – 09.15	Introduction to the MRC Mekong Wetlands and Climate change study	Peter-John Meynell, Team Leader
09.15 – 10.00	Overview of the approach and method 1. Regional review of the Mekong's wetland assets 2. Using climate change models to develop regional trends 3. Case studies of wetland vulnerability and adaptation 4. Upscaling of case study findings to regional level 5. Development of regional adaptation options for Mekong wetlands	Presented by ICEM team members
10.00 – 10.15	Plenary discussion and clarifications	
10.15 – 10.30	Refreshments	
10.30 – 11.00	Findings to date – Mekong's wetland assets and case study sites selected	Peter-John Meynell
11.00 – 11.30	Findings to date – Climate change trends in the Mekong region	Tarek Ketelsen
11.30 – 12.00	Plenary discussion	
12.00 – 13.30	Lunch	
	Case study session 1: Wetlands on the Mekong mainstream	
13.30 – 14.00	Initial findings from Siphandone	Charlotte Hicks
14.00 – 14.30	Initial findings from Stung Treng	Mam Kosal, Sideth Muong, Prom Nga,
14.30 – 15.00	Discussion	
15.00 – 15.15	Refreshments	
	Case study Session 2: Seasonally flooded wetlands affected by Mekong flows	
15.15 – 15.45	Initial findings of case studies – Lower Stung Sen, Cambodia	Mam Kosal, Sideth Muong, Prom Nga,
15.45 – 16.15	Initial findings of case studies – Tram Chim, Vietnam	Nguyen Huu Thien
16.15 – 16.45	Discussion	
16.45-17.00	Close	
Day 2: Tuesday 12th July		
	Case study session 3: Seasonally flooded wetlands associated with tributaries away from the Mekong	
08.30 – 09.00	Initial findings from case studies – Xe Champhone, Lao PDR	Phaivanh Phiapalath
09.00 – 09.30	Discussion	
	Case study session4: Coastal and marine wetlands	
09.30 – 10.00	Initial findings of case studies – Mui Ca Mau, Vietnam	Hoang Van Thang
10.00 – 10.30	Discussion	
10.30 – 10.45	Refreshments	
10.45 – 11.45	Building Resilience to Climate Change Impacts – Coastal Southeast Asia	Robert Mather, IUCN
11.45 – 12.00	Plenary discussion	
12.00 – 13.30	Lunch	
13.30 – 15.00	Working group discussions on the implications of climate change, vulnerability assessments and possible courses of action based upon the case studies	
15.00 – 15.15	Refreshments	
15.15 – 16.30	Working group feedback and Plenary discussion	
16.30 – 16.45	Next steps	Peter-John Meynell
16.45 – 17.00	Closing remarks	MRCS

APPENDIX 2 |LIST OF PARTICIPANTS

Country		Agency/Organisation	Representative
Cambodia Government	1	Wetlands and Coastal zone Department - Ministry of Environment	Mr. Long Kheng, Chief of Office
	2	Climate Change Department - Ministry of Environment	Dr. Khlok Vichet Rathat, Technical Staff
	3	Government National Expert - Ministry of Water Resources and Meteorology	Yin Savuth, Deputy Director
	4	Cambodia National Mekong Committee - Government of Cambodia/MRC	H.E. Mr. Te Navuth, Secretary General
	5	Cambodia National Mekong Committee - Government of Cambodia/MRC	H.E. Mr. Kol Vathana, National CCAI Coordinator and as Deputy Secretary General
	6	Cambodia National Mekong Committee - Government of Cambodia/MRC	Mr. Peou Vuthyrak, National EP Coordinator
	7	Department of Environment in Kampong Thom Province - Ministry of Environment	H.E. Mr. Heng Hourt, Director
	8	Department of Environment in Stung Treng Province- Ministry of Environment	Mr. Eng Phirong, Director
Lao PDR Government	9	Faculty of Biology - National University of Lao	Dr. Niane Sivongsay, National Expert of Wetland
	10	Faculty of Biology - National University of Lao	Mrs. Manichanh Namanivong, National Expert of Climate Change
	11	Climate Change office - Water Resources and Environment Administration (WREA)	Mr. Amphayvanh Oudomdeth, Technical
	12	Water and Environment Research Institute - Water Resources and Environment Administration (WREA)	Dr. Bounthanh Bounvilay, Assistant Director General
	13	Department of Environment - Water Resources and Environment Administration (WREA)	Mr. Khonesavanh Louanraj, National Coordinator of Ramsar
	14	Laos National Mekong Committee	Mrs. Nouansy Thiphasay, EP National Coordinator
	15	Water Resources and Environment Office - Savannaket Province	Mr. Noukan Inthapanya, Deputy Director
	16	Section of Water Resource -Champasack Province	Mr. Phonesay Thammavongkham, Deputy head
Thailand Government	17	Office of Natural Resources and Environment Policy and Planning - Ministry of Natural Resources and Environment	Ms. Aree Wattana Tummakird, Senior Environment Specialist
	18	Thai National Mekong Committee - Department of Water Resources	Mr. Somsak Boromthanarat , Advisor to Environment Programme
	19	Thai National Mekong Committee - Department of Water Resources	Mrs. Ruamporn Ngamboriruk, Senior Policy and Plan Analyst, National EP Coordinator
	20	Thai National Mekong Committee - Department of Water Resources	Mr. Thanit Satiennam, Foreign Relation Officer
Viet nam	21	Vietnam National Mekong Committee - Ministry of Natural Resources and Environment (MONRE)	Dr Le Duc Trung

	22	Vietnam National Mekong Committee - Ministry of Natural Resources and Environment (MONRE)	Mrs Nguyen Thi Ky Nam
	23	Department of Biodiversity - Ministry of Natural Resources and Environment	Mr. Tran Ngoc Cuong
	24	Department of Biodiversity - Ministry of Natural Resources and Environment	Ms. Mai Ngoc Bich Nga
	25	Department of Meteorology, hydrology and climate change - Ministry of Natural Resources and Environment	Ms. Nguyen Van Anh
	26	Sub-Institute of forest planning, Ho Chi Minh City - Ministry of Agriculture and Rural Development	Dr. Pham Trong Thinh
	27	Sub-Institute of Hydrometeorology and Environment of South Vietnam - Ministry of Natural Resources and Environment	Mr. Pham Thanh Long
	28	Mui Ca Mau National Park - Ca Mau province	Mr. Tran Quoc Tuan
	29	Tram Chim National Park - Dong Thap province	Mr. Nguyen Van Hung
International organizations/NGOs	30	WWF	Barbara Pollini
	31	WWF	Diep Tham Ngoc
	32	WWF	Kevin Marks
	33	IUCN	Robert Mather
	34	IUCN	Jake Brunner
	35	CI	Bunnara Min
	36	GIZ	Rosmarie Metz
	37	Institute of Tropical Biology, Vietnamese Academy of Science and Technology	Suriya Vij
	38	Training and Scientific Council, Vietnam National University	Professor Truong Quang Hoc
	39	Institute of Water Resource Planning, Ministry of Agriculture and Rural Development	Simon Tilleard
MRCS	40	MRCs	Mr Sourasay Phoumavong
	41	MRCs	Srinetr Vitheth
	42	MRCs	Bach Hanne
	43	MRCs	Nguyen Thi Hai Yen
	44	MRCs	Chanon Thaicharoen
ICEM team	45	Team Leader	Peter-John Meynell
	46	Mekong Climate Change Adaptation and Institutional Specialist	Jeremy Carew-Reid
	47	Wetland Livelihoods Specialist	Marie-Caroline Badjeck
	48	Social Economist	John Sawdon
	49	Project Coordinator, Hydrological Modeler	Tarek Ketelsen
	50	Cambodia Country Coordinator, Sociologist and Institutional Specialist	Nga Prom
	51	Wetland Ecologist	Mam Kosal
	52	Environmental Economist	Sideth Muong

53	Lao PDR Country Coordinator, Wetland Ecologist	Phaivanh Phiapalath
54	Wetland Institutional Specialist	Charlotte Hicks
55	Socio-Economist	Saykham Voladet
56	Vietnam Country Coordinator, Livelihoods& Institutional Specialist	Nguyen Huu Thien
57	Wetland Ecologist	Hoang Van Thang
58	Socio-Economist	Vu Xuan Nguyet Hong
59	Mekong GIS Specialist	Tran Thanh Cong