



# Mekong River Commission

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## TERMS OF REFERENCE

Project Title:	Basin-wide Assessment of Climate Change Impacts on Food Security and Adaptation Options in the Lower Mekong River Basin
Title of Consultancy	International Consultant for Basin-wide Assessment of Climate Change Impacts on Food Security and Adaptation Options in the Lower Mekong River Basin
Programme:	Agriculture and Irrigation Programme (AIP)
Duration:	Maximum of 70 working days (March 2015 to October 2015)
Duty Station:	Home base, Office of MRC Secretariat in Phnom Penh (OSP), Cambodia with possible travel to the MRC's Member Countries
Report to:	Programme Coordinator, AIP

### 1. Background and Concepts

#### *Mekong River Commission*

The Mekong River Commission (MRC) is an international river basin organization built on a foundation of over 50 years of knowledge and experience in the Lower Mekong Basin. On the 5th of April 1995, Cambodia, the Lao PDR, Thailand, and Viet Nam, signed the "Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin". The Mekong Agreement 1995 provides the framework for cooperation in water-related fields and in the development of full potential of sustainable benefits for all Member Countries, while preventing harmful effects on the environment and the ecology.

#### *Background*

The population of the Lower Mekong River Basin [LMB] has been estimated at 60 million people. A large proportion of this population have livelihoods that are closely linked to the river system, with over 60% of the economically-active population having water-related occupancies that are vulnerable to water-related shocks and degradation.

With more than 20% of the population living below the poverty line – and 15% undernourished – the agriculture and fisheries sectors are vital for food security.

Agriculture is the single most important economic activity, providing livelihoods for approximately 60% of the basin population while Mekong fisheries are among the largest inland fisheries in the world, and provide most of the protein for the basin population.

Both agriculture and fisheries in turn depend on availability of water in sufficient quantity and quality to sustain productivity. Food production and security is therefore intimately linked to water security and management. However, over past decade population and urbanization are increasingly rapidly in the LMB, farming practices are dynamic and also changing rapidly.

Since flood and drought affected areas are considered more vulnerable in terms of food security, particularly focus will be placed on the relationship between flood, drought and food security.

At the same time there is a growing concern about the potential impacts of climate change on natural ecosystems, socio-economic characteristics and food security in the LMB. Such impacts also exacerbate the problems associated with supplying the region's increased demand for food. The impacts of climate change are likely to be particularly severe on LMB communities, given their strong reliance on natural resources for their livelihoods. It is thus important for the MRC to provide a more informed understanding about the impacts of climate change on food security in the LMB, which is a part of the overall basin-wide assessment of the climate change impacts in the LMB.

This assessment aims to provide comprehensive report to answer the questions: (i) How will climate change impact on food security within the basin? (ii) Which areas and communities are most vulnerable in this regard, (iii) How different food-producing sectors are impacted? And (vi) what adaptation options should be prioritized to ensure food security in the whole basin?. The results of this assessment will provide sound information for MRC to formulate the Mekong Climate Change Adaptation Strategy and Action Plan [MASAP] in the next step.

In late 2003, the CCAI together with Future Water had conducted a literature review and rapid assessment which lead to a draft report on "Past and Future Trends in Crop Production and Food Demand and Supply in the LMB" in which AquaCrop model and Food Balance Sheets were used as tools for analyzing and modeling the available data at MRCS and FAO. The results showed the varieties of basin-wide impacts and across different AR5 emission scenarios (updated), however the spatial resolution based on BDP sub-areas is too coarse for planning purpose. In addition, the result shows that AquaCrop model can be an effective tool to assess climate change impact to crops production under Mekong Basin context. On the other hand, current impact to crops assessments such as assessment on ecosystems, flood and drought and hydropower will be incorporated with the assessment of food security to draw whole picture of the impact of climate change to LMB.

In 2003, AIP conducted a study on "Assessment of the conditions necessary to achieve the long-term food security and poverty reduction in the LMB under climate change conditions". The study aims to facilitate the long-term planning and policy-making in the crop production sector towards a food secured and poverty-alleviated future for the LMB under climate change. In this study, baseline of crop production and poverty situation of MCs were analyzed. Besides, crop modeling in climate change context and gross margin analysis were conducted in pilot areas. Taking into account climate change scenarios, the future yields of rice, maize, cassava and soybean in Thailand are projected as a case study. The results indicate that yields of rice, maize and cassava in Thailand will decrease by 2025 and 2050 under climate change scenarios while yield of soybean will slightly increase by 2025 and 2050. The impact of climate change on rice yield in Northeast Thailand was assessed via SWAT model and PRECIS dynamic downscaling. The SWAT model simulates the water availability in the study area and the crop production using the Erosion-Productivity Impact calculator (EPIC) plant growth model. It predicted that rice yield would decrease up to 30 per cent in the future.

Another activity of AIP 2.1.1 – Prepare and analyze the inventory of irrigation projects under development has been done with a paper titled Irrigation for Food Security, Poverty Alleviation and Rural Development in the LMB. This paper provides data and information to assess the pros and cons of future irrigation development potential, their social, economic and environmental implications, and the implications for water balance, increased food production, food security, poverty alleviation, environmental considerations and climate change. Furthermore, the irrigation database improvement is on-going activity of AIP in which line agencies collect data and improve irrigation database under regional coordination and supervision. This database can provide significant input to basin-wide assessment of food security.

CCAI and AIP has conducted number of working sessions and discussion and revealed a clear need for more substantial study with finer resolution and at least provisional level data and information, at the same time considering the limited availability of data, especially in fisheries and livestock components.

## ***Concept Definitions***

### **Food security**

Food security is a multi-dimensional issue that includes the following four dimensions: food availability, food accessibility, food utilization, and food systems stability. “Food security exists when all people at all times have physical or economic access to sufficient safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life”.

*Food availability* refers to the amount of food that is available relative to food utilization within a given area. It includes food production, imports, and food stock within that area.

Even if food is available within an area, not all people may have access to it. *Food accessibility* is therefore also an important element of food security and encompasses food prices, purchasing power, and access to markets for the people of the area.

*Food utilization* refers to nutritional value and food safety issues, i.e. even if food is available and people have access to it, the nutritional value and food safety may not be optimal.

*Food systems* encompass all activities related to the production, processing, distribution, preparation and consumption of food. The outcomes of all these activities within the food system contribute to food security.

With respect to the water management interest of the MRC, the Assessment will be focused mainly on *food availability* with consideration of its relation to the components of other three dimensions.

### **Climate change**

*Climate change*, in IPCC usage refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity.

This usage differs from that in the United Nations Framework Convention on Climate Change (UNFCCC), where climate change refers to a change of climate that is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and that is in addition to natural climate variability observed over comparable time periods.

*Vulnerability* is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

*Adaptation* is- Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. Various types of adaptation can be distinguished, including anticipatory, autonomous and planned adaptation:

Anticipatory adaptation – Adaptation that takes place before impacts of climate change are observed. Also referred to as proactive adaptation.

Autonomous adaptation – Adaptation that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Also referred to as spontaneous adaptation.

Planned adaptation – Adaptation that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state.

Climate change impacts.

Climate change will have impacts on all four dimensions of food security. With respect to the *food system* dimension, climate change will affect all elements of the food systems, i.e. production, processing, distribution, preparation and consumption of foods.

The impacts of climate change on food security, especially in flood and drought affected areas include:

- Impacts of increased frequency and severity of storms
- Impacts of sea level rise and salinity intrusion
- Impacts of increased severity of droughts and floods on food systems and thus food security.
- Impacts of increased temperature on crops, fish and other aquatic animals [OAA], including increased/decreased prevalence of certain pests/diseases
- Impacts of changed precipitation patterns on crop production and fisheries productivity
- Impacts of decreased seasonal predictability as a result of climate change, on farming and fisheries communities, and in turn their food systems
- Indirect impacts, e.g. policy decisions to respond to climate change may have indirect impacts on food security (example: production of bio-energy at the expense of food production).

### ***Objectives of study***

The overall objective of the Assessment is to provide a comprehensive assessment of the impacts of climate change on food security in the LMB.

The specific objectives of the study are to:

- To assess vulnerability of area and sectors related to food security that are vulnerable to the impacts of changing climate on food security throughout the LMB.
- To identify and prioritize vulnerable areas and communities and propose adaptation options with relation to food security under climate change projections
- To provide the key findings and lesson learned of the assessment for further mainstreaming climate change adaptations to the Mekong Adaptation Strategy and Action Plan [MASAP]; and
- To enhance understanding and capacity of the member countries to adapt to the impacts of climate change on key components of food security throughout facilitating and mentoring the whole process of assessment.

### ***Scope of the assessment***

- Regarding food security, the assessment will cover following two dimensions:
  1. Food security: mainly on food production and where possible, food import and export at basin, national and provincial levels
  2. Food utilization: food nutrients balance
- Food production includes: main crops cultivation [rainfed and irrigated rice and maize] and fisheries and livestock [poultry and others] production. The baseline study covers all available data of these components, but climate impacts will be quantitatively assessed only for crop production.

### ***Assessment Framework***

The assessment includes five key components/steps: (1) basin-wide assessment of food availability, (2) basin-wide assessment of food utilization, (3) Basin-wide identification of vulnerable areas, (4) Identification and evaluation of adaptation in vulnerable areas [national case studies], and (5) Mainstreaming adaptations into strategies and plans. The process and linkages of different components are illustrated in Figure 1.

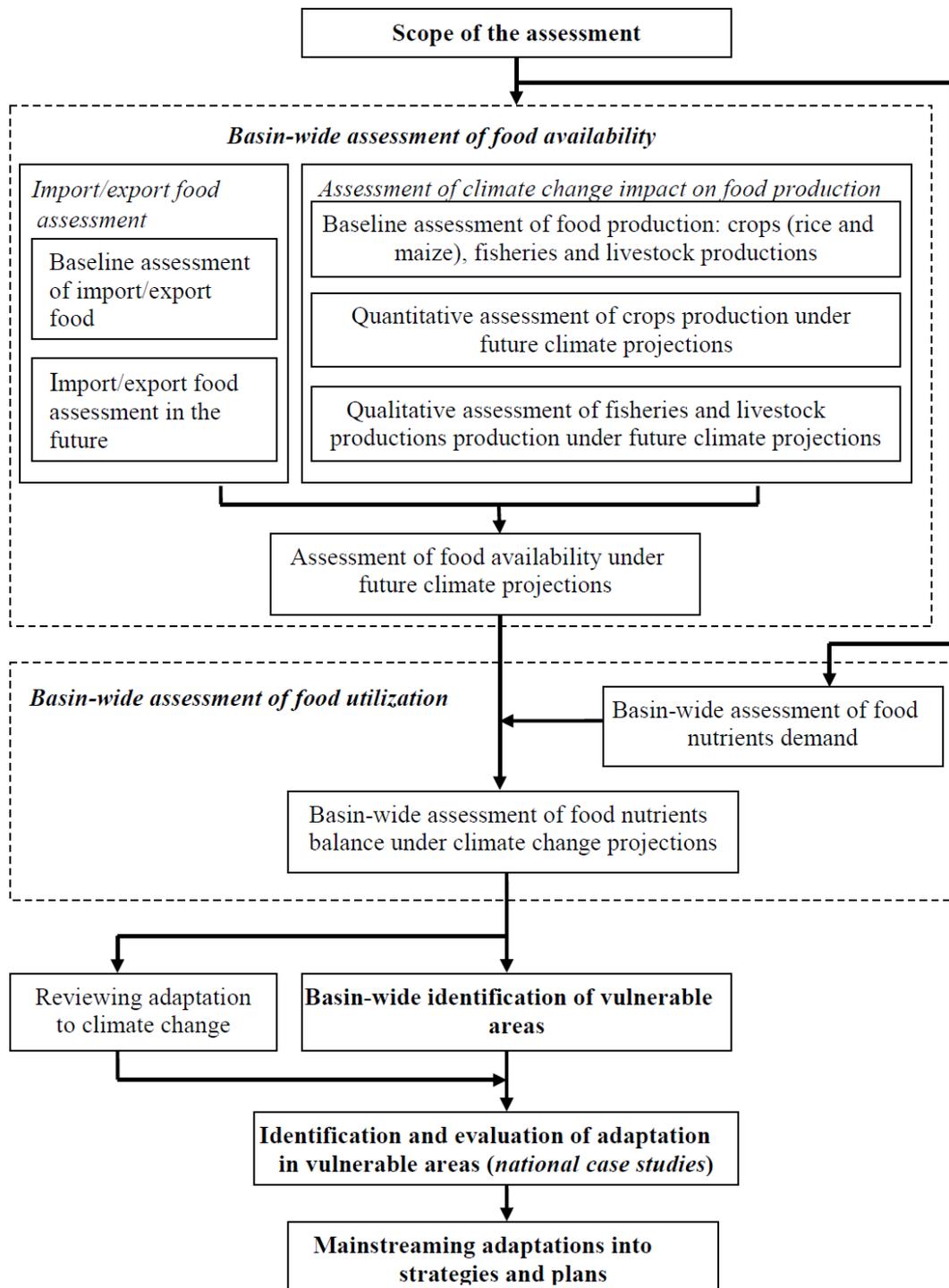


Figure 1: Assessment Framework of the Basin-Wide Assessment of Climate Change Impacts on Food Security for the LMB

## 2. Objectives of the Consultancy

The objective of this consultancy is to guide team discussions of national consultants, facilitate meetings and workshops for Basin-wide Assessment of Climate Change Impacts on Food Security and Adaptation Options in the Lower Mekong River Basin, and conducts the assessment, including five key components/steps: (1) basin-wide assessment of food security, (2) basin-wide assessment of food utilization, (3) basin-wide identification of vulnerable areas, (4) identification and evaluation of adaptation in vulnerable areas, and (5) mainstreaming adaptations into strategies and plans.

### **3. Outputs/Deliverables**

Output of this TOR is a report that contains the following items

- 1) Scoping report of the study, which describes the scope, approach, methodology, expected results, schedule and other pertinent information of the assessment. The scoping report must contain detailed workplan (includes methods of assessment, design for workshops, and timelines.)
- 2) Draft final report (highlights baseline assessment of food production, basin-wide baseline assessment of food nutrients balance, assessment vulnerability to climate change impact on food availability, vulnerability area in terms of food availability and food nutrients balance and magnitude of climate change impact, mainstreaming adaptations into strategies and plans, and key findings and lesson learned). Final report incorporating all the comments given by MRCS and MCs.

### **4. Approach and Methodology**

#### **4.1 Approach**

To achieve deliverable outputs set out in this consultancy assignment the approach will comprise of a mixture of methods and tools related to literature review, analysis, collecting data and information, drafting of assessment methods and tools, development of assessment indicators, interview, field survey, conduct consultations meeting and workshop at national and regional levels and coordination with AIP.

The assessment is based on a multi-disciplinary approach and cross-programme cooperation. Secondly, transboundary and integrated approach are used with clear role of actors at both regional and national levels and how regional level and how regional level supports national level and vice versa.

Within the secretariat, AIP and CCAI will cooperate with other MRC programme on various aspects.

- Information and Knowledge Management Programme, IKMP, on modeling, land cover and forestry changes
- Flood Management and Mitigation Programme, FMMP, on flood monitoring and flood risk assessment
- Drought Management Programme, DMP, drought impacts and drought risk assessment
- Fisheries Programme, FP, baseline data and assessment of fisheries production
- Environmental Programme, social impact monitoring, expected change & vulnerability assessment.
- Basin Development Programme, BDP, linking BDP Scenarios to climate change and socioeconomic development and food security

Amongst above programs, FMMP and DMP are conducting on-going joint activities with CCAI. Their assessment of flood and drought susceptibility will provide inputs to this activity.

The implementation process of this activity requires close cooperation between partners in regional level and partners in national level. National consultant will be hired to collect data from line agencies and consult with them to accomplish national work that providing results to region level. The activity will be conducted by regional coordination, including international consultant, that will provide guidance, result and share database to national level.

Result of this study benefits both regional and national levels. Vulnerability assessment and potential adaptations can be effectively used by policy maker, decision maker and development partners at different scales.

The AIP will also seek cooperation from relevant external partners with significant regional experience on food security issues such as FAO, WFP, IWMI, World Fish Center, etc.

## 4.2 Methodology

### 4.2.1 Data collection

- Collect secondary data from MRCS and line agencies of MCs
- Collect statistical data in MCs and literature review for base line assessment
- Questionnaire and discussion with national, local government authorities, farmers and other relevant stakeholders.

Both questionnaire survey and focus group participatory discussion with farmers and other stakeholders will be used to analyze vulnerability of the community in term of food security under climate change context and evaluate adaptations to address the challenges.

### 4.2.2 Modeling and Spatial analysis

- Using AquaCrop / SWAT Crop model for crop production

The main advantages of AquaCrop over other tools are: limited data requirements, a user-friendly interface, strong focus on climate change, water focused, developed and supported by FAO, expanding growing group of users world-wide, and flexibility in the level of details. The crop model will be run under future climate change projections. Several climate change scenarios will be selected to input dataset of future climate characteristics into AquaCrop model.

Besides, SWAT Crop will be tested and would be a model alternative for crop modeling.

- ArcGIS solution for spatial analysis (linked with AquaCrop model)

### 4.2.3 Food nutrient balance analysis

For food nutrient balance analysis, the activity will use an FAO tool named food balance sheet. In a FAO definition, “A food balance sheet presents a comprehensive picture of the pattern of a country’s food supply during a specified reference period.” In general, a Food Balance Sheet includes: (i) quantities, (ii) calories, (iii) proteins, and (iv) fats. This tool will be applied at provincial scale.

### 4.2.4 Vulnerability assessment and community based adaptation

This tool will be used for case study in vulnerable areas to identify community threats, resilience and potential adaptation measures to climate change.

## 5. Responsibilities, Tasks and Milestones

The following specific tasks, deliverables and time allocation are foreseen:

Tasks/deliverables		Indicative time allocation (days)
1	Guide team discussion to arrive at a final list of all national consultants’ activities, and focus sites/areas for the assessment.	2
2	Provide scoping report including questionnaire for case study.	5
3	Facilitate and mentor all meetings during the assessment to ensure that all national consultants are aware of the study goals, workplan, and timelines.	2
4	Basin-wide assessment of food availability under future climate projections -Baseline assessment of crops (rice and maize), fisheries and livestock productions and import/export food -Qualitative or quantitative (depending on data availability) assessment of fisheries and livestock productions under future climate change -Import/export food assessment in the future (if possible). If not, assuming to keep current situations. -Quantitative assessment of crops production under future climate	17

	projections	
5	Basin-wide assessment of food utilization -Basin-wide assessment of food nutrient demand -Basin-wide assessment of food nutrient balance under climate change projections	17
6	Basin-wide identification of vulnerable areas and adaptation review -Basin-wide identification of vulnerable areas and communities -Based on the results of vulnerability, identifying/proposing adaptation options to the impacts climate change for the whole basin	15
7	Enhancing knowledge and capacity of stakeholders -Draw out and analyse lessons learned and experiences to enhance knowledge, understanding and capacity	5
9	Attend the workshops and provide specific impact on the assessments, and adjust them as necessary to complete.	2
10	Provide final report, compiling all national consultants' individual reports. Adhere to standard formatting, font, and layout specifications provided incorporate comments.	5
	Total working days	70

## 6. Implementation arrangement

The AIP Programme Coordinator and Technical Advisor attached to AIP will oversee the project, and will facilitate all in-house and national contacts and convene meetings as required. The Consultant reports to the AIP Programme Coordinator through the Technical Advisor attached to AIP. The report will further be submitted to CCAI for final review.

Besides, the consultant works closely with CCAI team of Council Study “Study on the sustainable management and development of the Mekong River, including impacts of mainstream hydropower projects” for technical discussion and information sharing.

The work will involve work at home base, the MRCS office in Phnom Penh, field surveys in all the four MCs, and consultation workshop(s) at the venue to be decided.

## 7. Qualifications / Requirement

- Master or PhD degree in agricultural science, climate change, or related fields;
- At least 15 years of experience in agriculture project and research;
- At least 5 years of experience working in Lower Mekong Basin in related field;
- Ability to communicate effectively, verbally and in writing with a wide range of people and to work in a multicultural environment;
- Demonstrated experience of working as short term consultant with analytical skill;
- Demonstrated sound knowledge of climate change impacts on food security, preferable in the Mekong basin; and
- Excellent written and oral communication skills in English.

## 8. Condition of payment

20 % of total contract value will be paid after signing the contract. The remainder will be paid upon acceptance of all the submitted outputs. Daily Subsistence Allowance and travel cost for official work-related travels will be paid separately in accordance with MRCS's regulations.

**9. Signature Block**

**Programme Coordinator**

Name: \_\_\_\_\_

Date : \_\_\_\_\_

**Consultant**

Name: \_\_\_\_\_

Date : \_\_\_\_\_