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Adaptation & Resilience to Climate Change

USAID Mekong Adaptation and Resilience to Climate Change

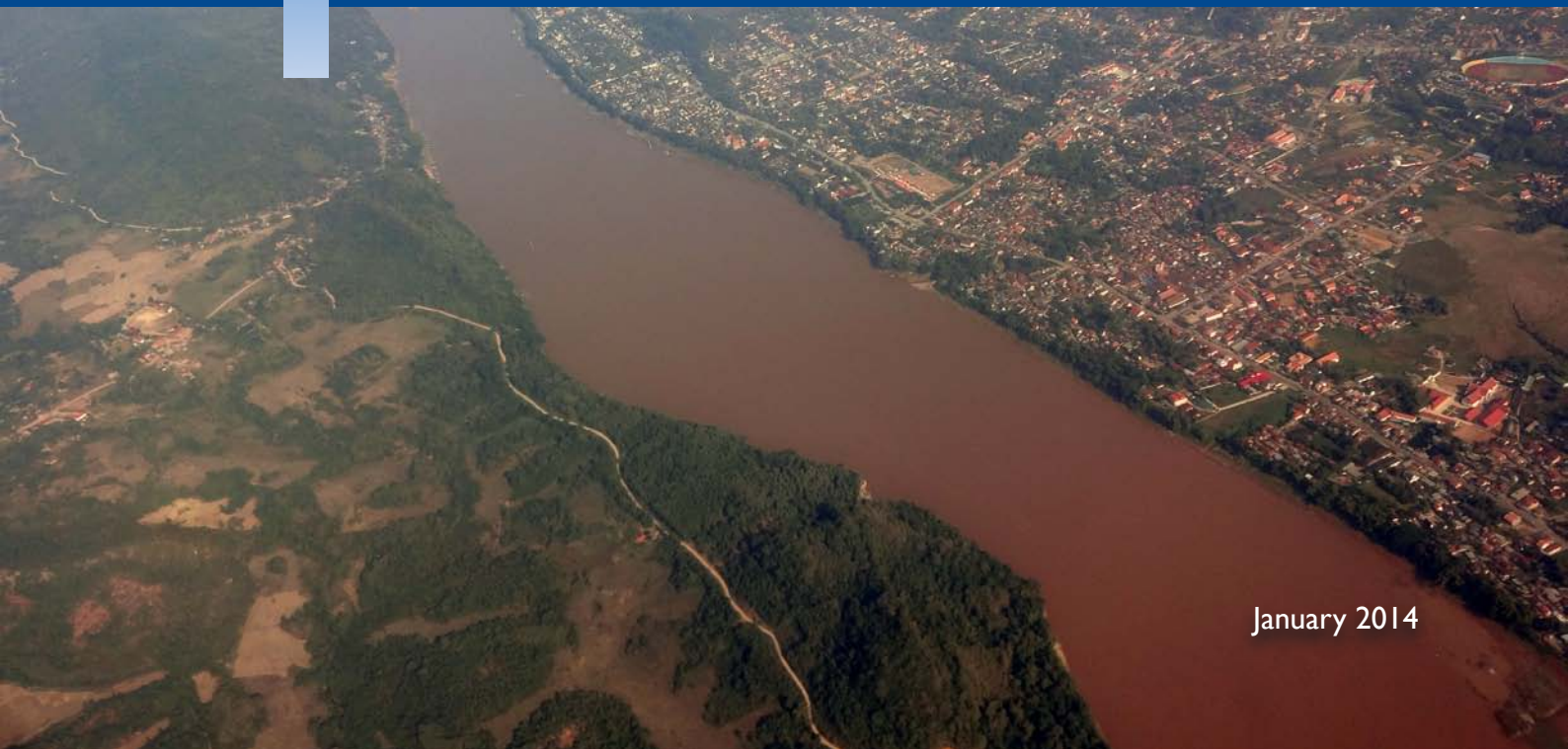




Climate Change Impact and Adaptation Study for the Lower Mekong Basin

KEY FINAL RESULTS

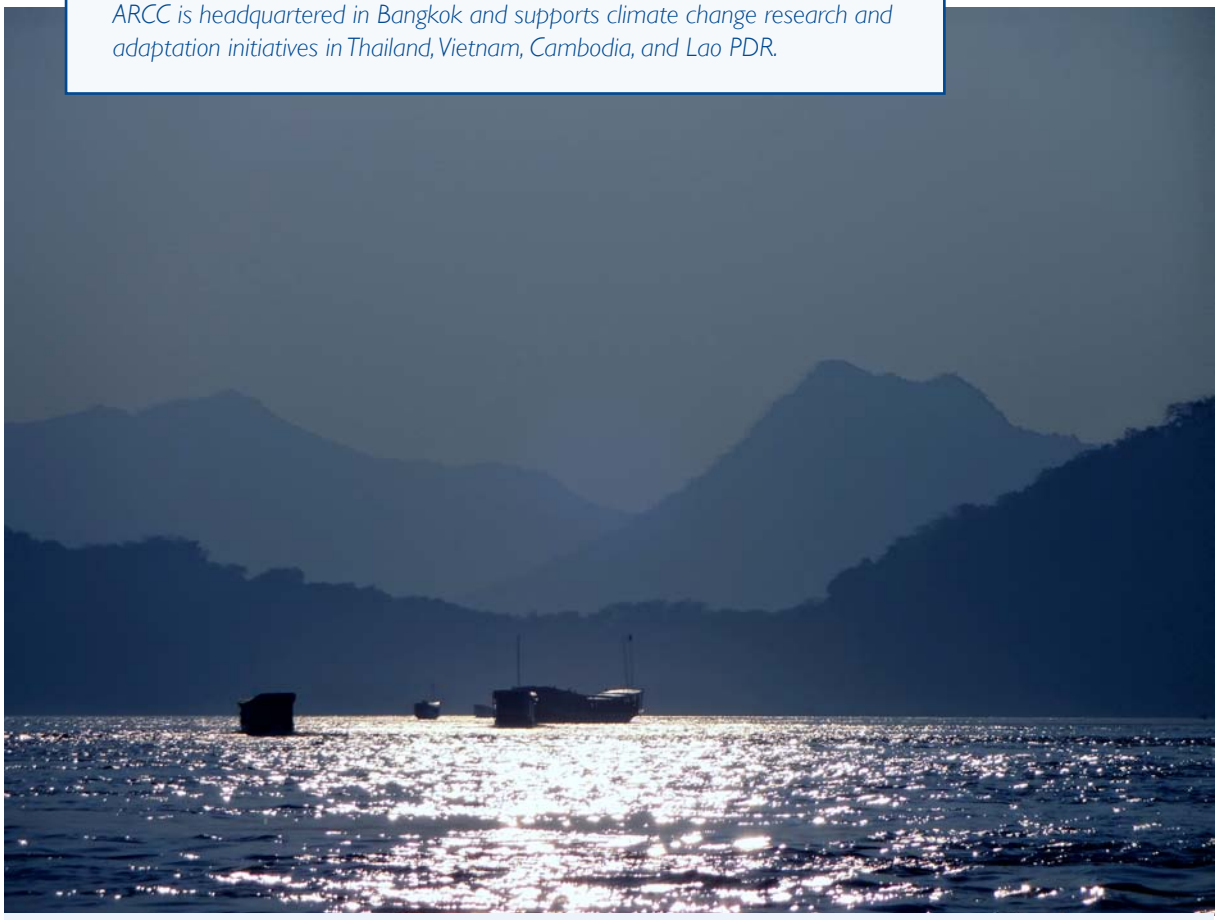
USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC)



January 2014

USAID Mekong ARCC Project Description

The USAID Mekong ARCC project is a five- year program (2011-2016) funded by the USAID Regional Development Mission for Asia (RDMA) in Bangkok and implemented by DAI in partnership with the International Centre for Environmental Management (ICEM), World Resources Institute (WRI), International Union for Conservation of Nature (IUCN), World Wildlife Fund (WWF), and Asian Management and Development Institute (AMDI). The project focuses on identifying the environmental, economic and social effects of climate change in the Lower Mekong Basin (LMB), and on assisting highly exposed and vulnerable rural populations in ecologically sensitive areas increase their ability to adapt to climate change impacts on water resources, agricultural and aquatic systems, livestock, and ecosystems. USAID Mekong ARCC is headquartered in Bangkok and supports climate change research and adaptation initiatives in Thailand, Vietnam, Cambodia, and Lao PDR.



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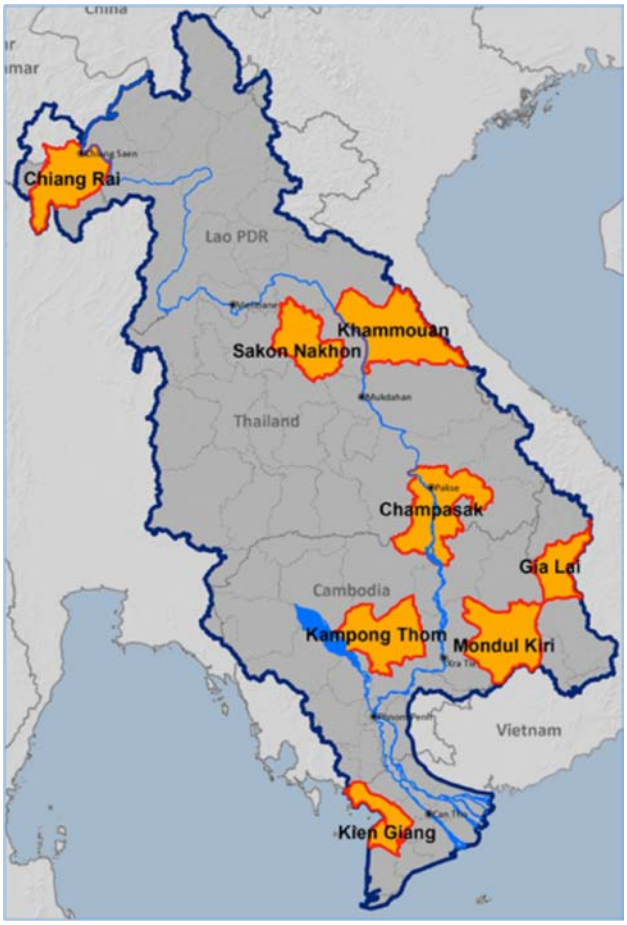
Climate Change Impact and Adaptation Study for the Lower Mekong Basin

Methodology

The USAID Mekong ARCC Climate Change Impact and Adaptation Study quantifies specific shifts in climate and hydrology factors for the Lower Mekong Basin (LMB) by 2050, and projects some of the likely impacts to agriculture and other important livelihood sectors resulting from future changes to the basin's hydroclimate.

Statistical downscaling of Global Climate Models (GCMs) was used to regionalize global climate projections and estimate changes to temperature and precipitation across the LMB. An Integrated Water Resources Management (IWRM) model[1] was also applied to the basin to determine related changes to hydrology such as the Mekong's mainstream flow rates, flood regime, and soil water availability.

The Land Use Suitability Evaluation Tool (LUSET) model[2], a technique previously developed and implemented by IRRI, was adapted to the study to determine crop suitability for a given area based on specific land unit characteristics and crop requirements. The model assessed the suitability of six crop species for the LMB under baseline climate conditions and compared that to future predicted conditions for 2050. The crops chosen for this evaluation were: rainfed rice, soybean, maize, cassava, robusta coffee, and rubber. Lastly, the AquaCrop yield model developed by the Food and Agricultural Organization (FAO)[3] was coupled to the IWRM model to estimate impacts of climate change on rice and maize yields in a number of more specific locations across the basin.



Identification of "Hotspot" Provinces for Vulnerabilty Assessment and Adaptation Planning

An important output of the study is the identification of climate change hotspots. By determining the ranges where temperature, rainfall, and soil characteristics at specific geographic locations create conditions that transform ecosystems and alter productivity of crops, livestock, and aquatic systems, a better understanding is gained of how climate change will impact community livelihood and subsistence options.

The "hotspot" approach integrates and orients study findings and provides a scientific basis for the selection of focal areas for the community adaptation initiatives to be undertaken by USAID Mekong ARCC. The study team identified a subset of 8 priority hotspot provinces that are: 1) representative of the ecosystems found across the LMB, 2) contain a mix of staple and commercial crops, fisheries, and

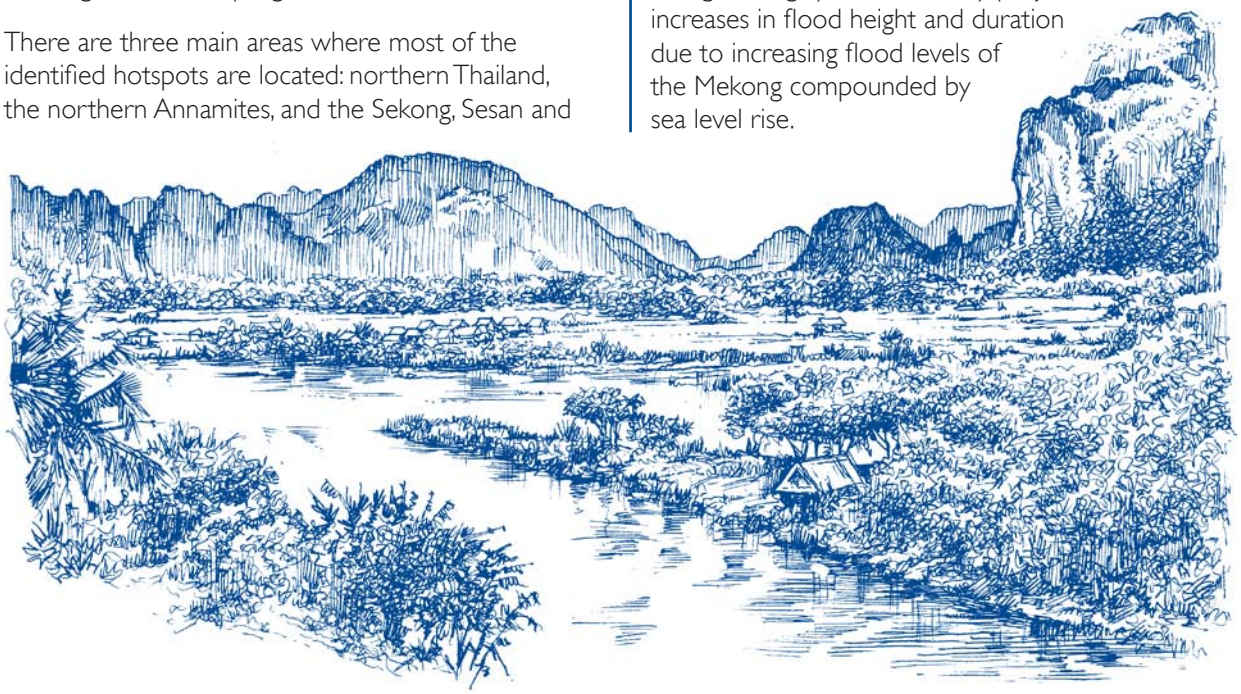
Priority Hotspot Provinces Selected by USAID Mekong ARCC Study

- Chiang Rai - Thailand
- Sakon Nakhon - Thailand
- Khammouan – Lao PDR
- Champasak - Lao PDR
- Mondulkiri - Cambodia
- Kampong Thom - Cambodia
- Kien Giang -Vietnam
- Gia Lai - Vietnam

[1] The Integrated Water Resources Management model was developed by the Environmental Impact Assessment Centre of Finland (EIA Ltd), the Mekong River Commission, World Bank, Aalto University, and ICEM.
[2] The Land Use Suitability Evaluation Tool was developed by the International Rice Research Institute in 2006.
[3] The AquaCrop model was published by the Food and Agricultural Organization of the United Nations in 2009.

livestock that are common throughout the basin, 3) are projected to experience the greatest relative increase in average temperature, rainfall, or sea level rise, and 4) where such shifts would significantly impact a number of important livelihood/subsistence options for communities. The selected hotspots, therefore, share common traits with other provinces in the LMB, which allows for replication and learning based on the new approaches to adapting generated from USAID Mekong ARCC field programs.

There are three main areas where most of the identified hotspots are located: northern Thailand, the northern Annamites, and the Sekong, Sesan and Srepok River (3S) basins. In the north of Thailand and in the northern Annamites area of central Lao PDR, major percentage increases in dry season precipitation will threaten these higher-elevation areas. Year-round increases of maximum temperature, particularly during the wet season, will mean that areas to the east and northeast of Cambodia and the Vietnamese Central Highlands are highly threatened. In addition, areas of the Mekong Delta, represented by Kien Giang, are highly threatened by projected increases in flood height and duration due to increasing flood levels of the Mekong compounded by sea level rise.



Key Results from the Study

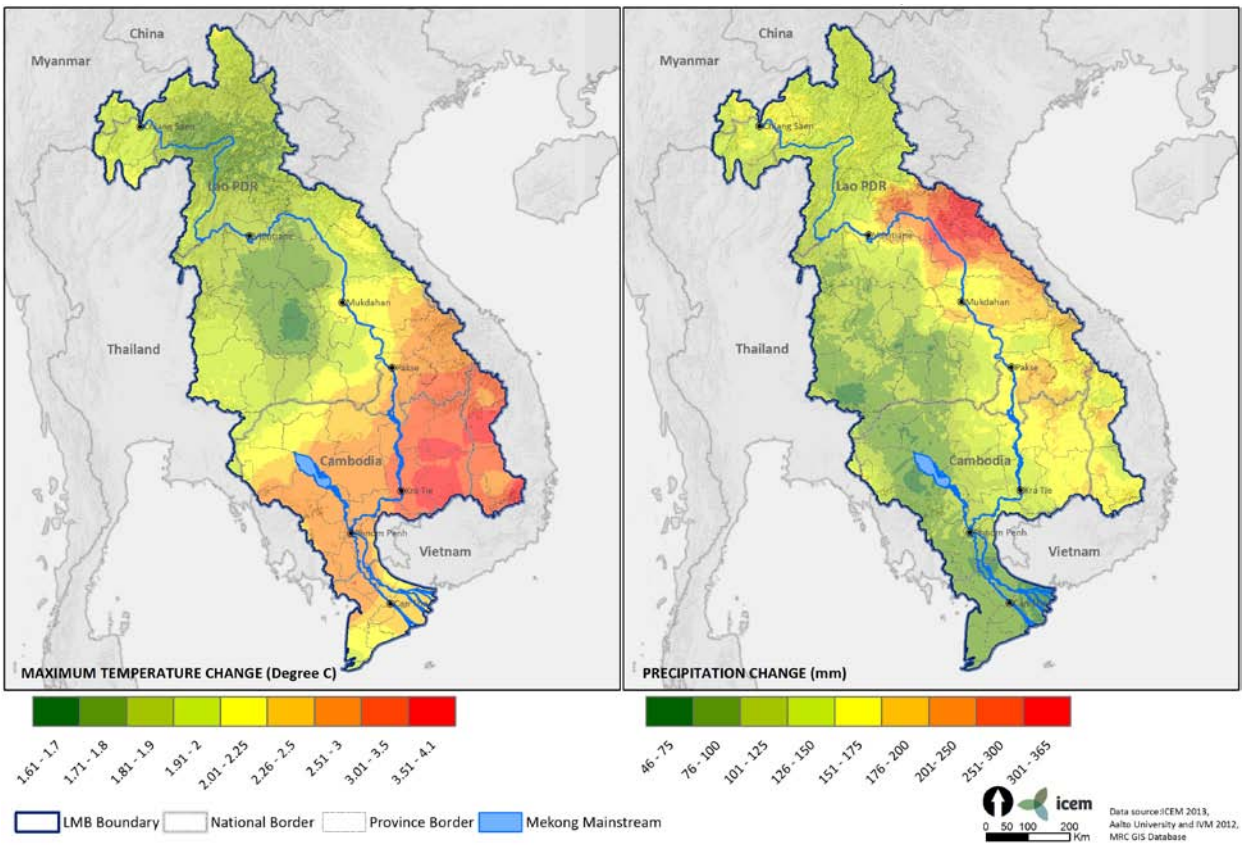
Projected Changes to Temperature, Rainfall and Sea Level Rise

By 2050 the extent and distribution of rainfall and daily maximum temperatures will differ significantly from the LMB's historical trends. In terms of temperature, Intergovernmental Panel on Climate Change (IPCC) global climate change models – utilizing mid-range carbon emissions scenarios – forecast the worldwide average annual temperature to rise 2 degrees Celsius by 2050. The USAID Mekong ARCC climate study, however, forecasts far more extreme temperature shifts for the LMB. As shown in the map below, some parts of the basin may experience significant shifts in average annual temperature, particularly the eastern plains of Cambodia and parts of the Central Highlands of Vietnam. The annual temperature in this area could increase as much as 3°C to 5°C and cause dramatic changes in the ability of certain crops, fish, and livestock species to be productive and thrive. Such a temperature rise would seriously impact the livelihood, health, and food security prospects of the local communities in these areas.

Annual precipitation is forecast to rise throughout the LMB by anywhere from 35 mm to 365 mm, with the largest increases occurring in the northern Annamites mountain range in central Lao PDR. Significant increases in dry season precipitation will also occur in northern Thailand.

Additional hydrological effects associated with climate change in the LMB include increased flooding along the Mekong mainstream due to the overall higher rainfall; more frequent and severe extreme storm events; as well as a significant increase in flood depth and duration in the Mekong Delta due to the compounded effects of increased flooding in the Mekong mainstream and an estimated 0.3 m sea level rise (SLR). Increases in salinity will occur within parts of the Mekong Delta as a component of SLR, most significantly during the dry season.

Projected Annual Precipitation and Annual Average Maximum Daily Temperature Changes in the Lower Mekong Basin between 2005 and 2050.



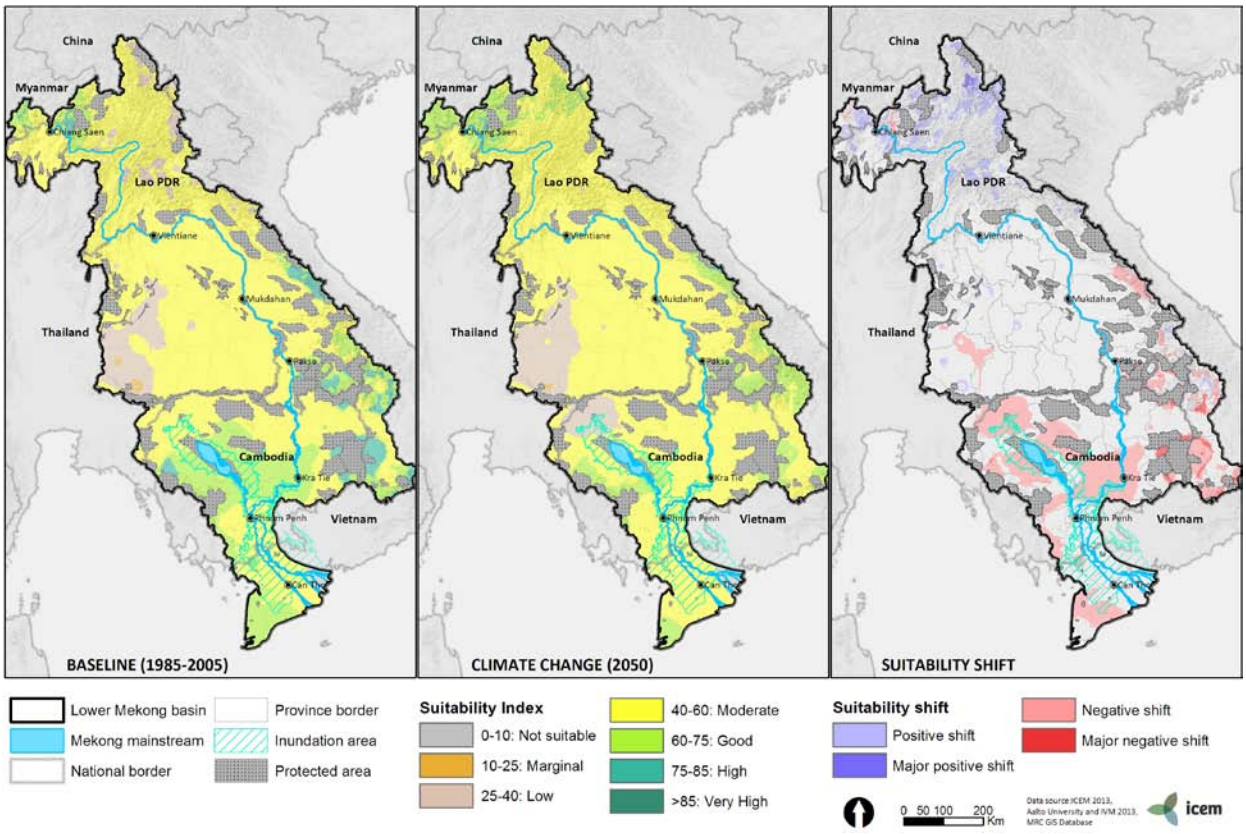
Projected Changes to Livelihood Sectors

Non Rice Crops

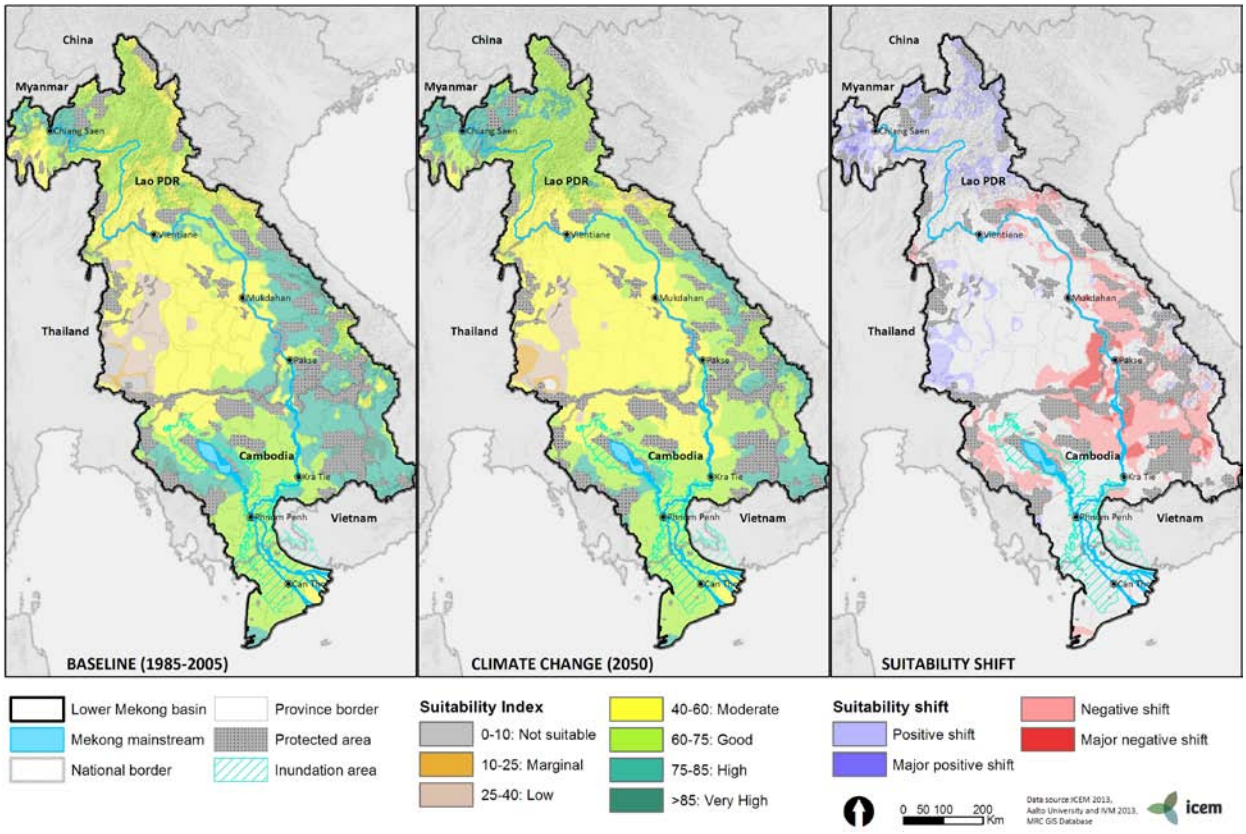
Climate change may induce geographical shifts in the suitability of the LMB for several crop species assessed, including:

- Suitability of industrial crops like rubber, robusta coffee, and cassava shifting to areas of higher altitude with optimal suitability in 2050 centered on northern Thailand and northern Lao PDR;
- Plains and lower altitude areas becoming less suitable for rubber, robusta coffee, and cassava, especially in eastern Cambodia;
- Dramatic increases in precipitation in central Lao PDR affecting cassava, soybean, and maize culture. For these crops, the rainfall suitability also decreases in the Vietnamese Central Highlands and eastern Cambodia;
- A general increase of crop suitability is projected for Northeast Thailand due to an increase of rainfall; and
- Maize yield projections show general decreases across the LMB, with Gia Lia (-12%), Mondulkiri (-6%), and Kampong Thom (-6%) Provinces being the most severely affected of the hotspot areas.

Coffee Robusta Suitability in the Lower Mekong Basin.



Rubber Suitability in the Lower Mekong Basin.



Rainfed Rice Crops

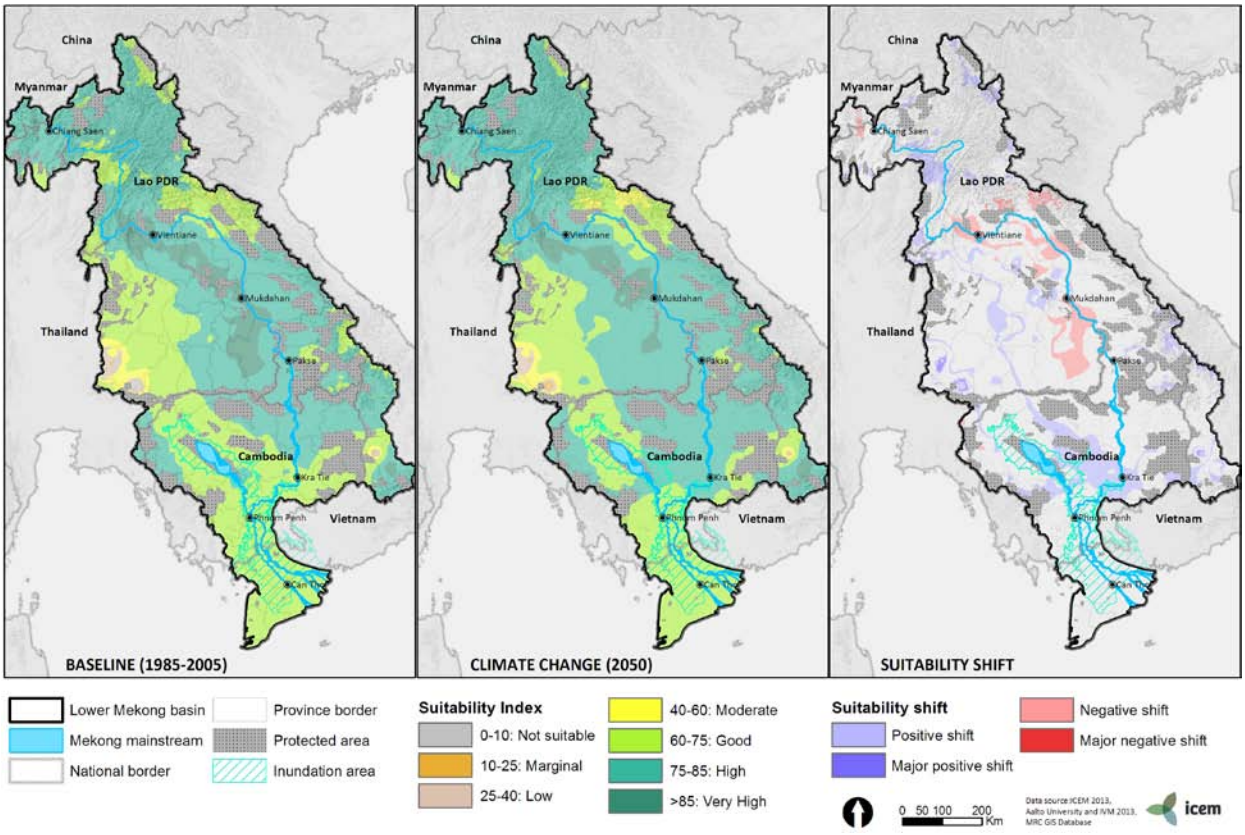
Climate change will have fewer effects on lowland rainfed rice than other crops; however rice is vulnerable to increased temperature in the wet season, decreased water availability in the dry season, and salinity intrusion in the delta. Other potential climate impacts, both positive and negative, include:

- Positive changes for crop yield in Sakon Nakhon Province in Northeast Thailand and negative changes in Gia Lai Province, Vietnam, Champasak Province, Lao PDR, Chiang Rai Province in northern Thailand, and Modulkiri Province, Cambodia; and
- The changes in projected yield are in part due to increased rainfall in the wet season resulting in a negative impact in already "wet" areas like Champasak and Gia Lai, and positive impacts in a "dry" area like Sakon Nakhon.

Crop Yield Modeling for Rainfed Rice: Baseline and Percent Change by 2050.

Crop Yields	Baseline (ton/ha)	Change by 2050 (%)
Chiang Rai	3.4	-4.8
Sakon Nakhon	2.1	4.6
Khammouane	3.4	-0.1
Champasak	2.9	-5.6
Gia Lai	3.3	-12.6
Mondulkiri	2.1	-3.0

Lowland Rainfed Rice Suitability in the Lower Mekong Basin.

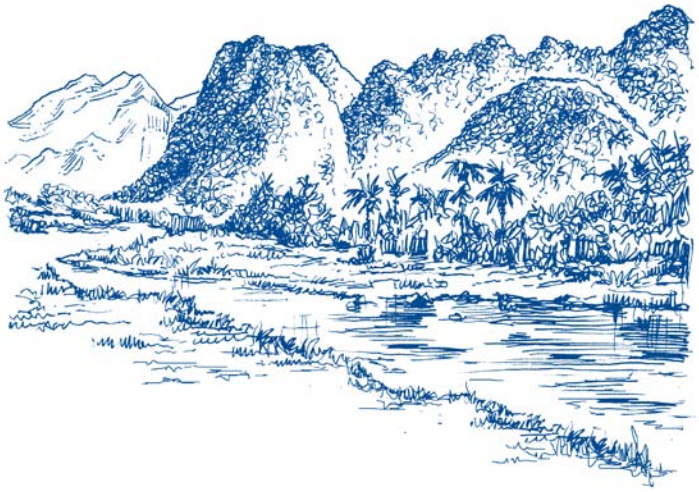


Non-Timber Forest Products (NTFPs)

- Productivity and fertility of NTFPs may be affected by increased temperatures, with dry season spikes impacting flowering, fruiting, and seed dispersal; and
- Increases in temperature predicted for Mondulkiri could push important livelihood products such as Cardamom and Paper Mulberry beyond their absolute temperature range.

Livestock

- Higher temperatures will have little measureable impact on individual animals in low-intensity systems but multiplied across villages to regions the impacts may be significant;
- Changes in rainfall will affect livestock units through feed and animal health issues. (Changes in the availability, quality, and price of feeds are fundamental to all livestock production systems, as feed costs typically account for between 65 and 80 percent of production costs);
- Pathogens will likely be affected in terms of viability outside hosts and rates of proliferation by humidity levels and the quality and quantity of vector breeding sites. Wetter periods increase the likelihood of disease transmission through fomites (i.e., non-living platforms such as mud that are capable of carrying and transmitting infectious organisms), increasing the importance of employing effective biosecurity measures; and
- Wild species in the LMB – which are important genetic resources – will be threatened by climate change directly and indirectly through loss of habitat, hunting, and the threat of infectious diseases.

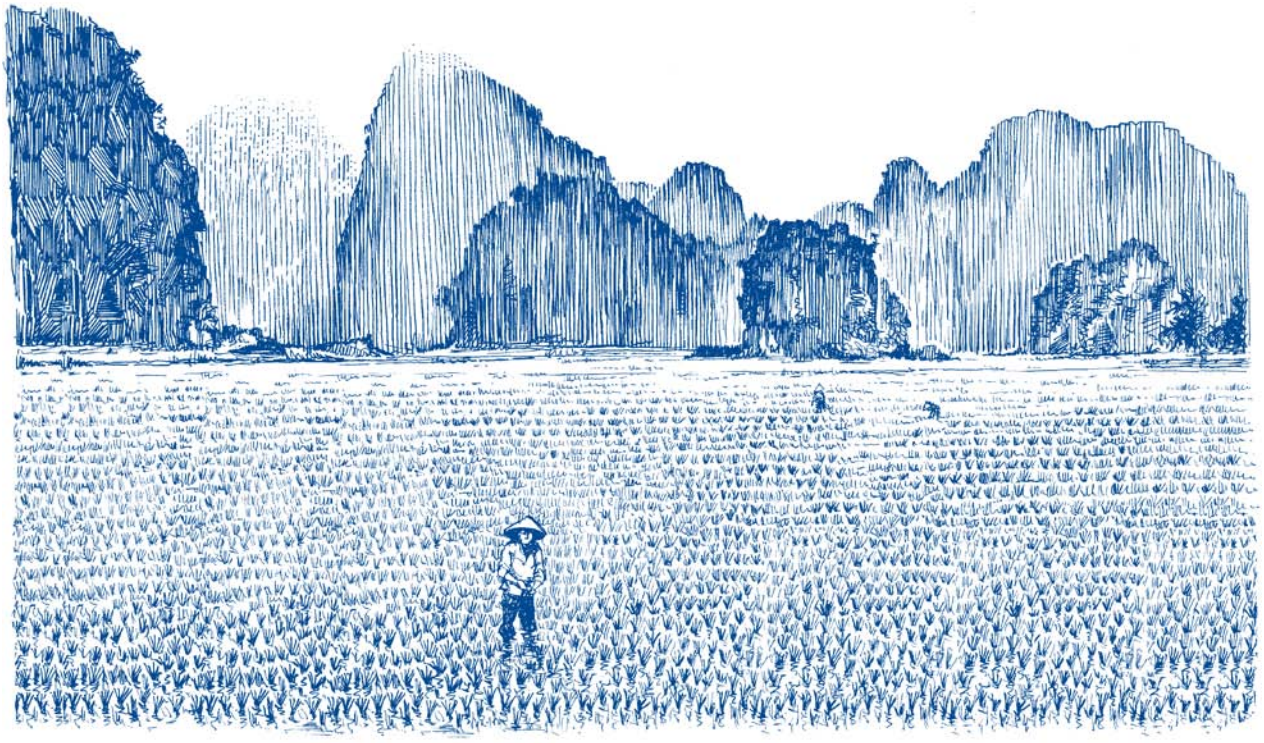


Ecosystems

- Climate change in the LMB will accelerate the loss of populations and species due to extreme temperatures, particularly during dry periods, and will be a significant driver of biodiversity loss;
- Reorganization of plant and animal communities will likely occur as a result of climate change, and new "problem" species will enter communities affecting overall structure and function; and
- Geographic ranges for both species and ecosystems will shift, and there will be an overall loss in habitat extent.

Fisheries

- Black fish, which have limited migrations, appear more "climate-proof" than migratory white fish and upland fish and may be expected to increase in the proportion of fish catches as temperatures increase;
- Aquaculture could be more vulnerable to climate change than capture fisheries, with flash floods causing a sudden drop in salinity in the delta provinces and inviting disease in coastal shrimp ponds in Vietnam;
- Aquaculture infrastructure will be increasingly vulnerable to damage resulting from extreme events such as flash floods;
- Increasing temperatures throughout the LMB will result in greater eutrophication of aquaculture ponds and associated negative water quality effects on adjacent streams and river systems.



Adaptation Measures

Adaptation measures are necessary throughout the LMB to mitigate the impacts of climate change; and there is a growing sense of urgency for the implementation of such measures as temperatures continue to rise, precipitation patterns shift more significantly from baseline conditions, and the combined effects of increased flooding and sea level rise affect greater land surface areas.

Agriculture

- Traditional agro-systems throughout the LMB are diverse and as such offer greater flexibility in responding to the varying effects of climate change. Current basin-wide trends in agriculture, however, have resulted in greater intensification and the use of monocultures; these types of systems will require significant inputs and associated resources to respond to the pressures stemming from climate change.
- Agricultural sector adaptation measures include the development and use of new crop varieties; adjustment of the traditional cropping calendar; improved water conservation techniques; and improved soil management.

Fisheries

- Capture fisheries adaptation approaches include the protection and rehabilitation of upland catchments, as well as measures to enhance stream habitat such as the creation/maintenance of deep pool refuges and the removal of obstacles for migration.
- Aquaculture systems should be protected from impacts associated with flashfloods, e.g., by improving the integrity of embankments and through construction of diversion canals to facilitate drainage of floodwaters during extreme events.

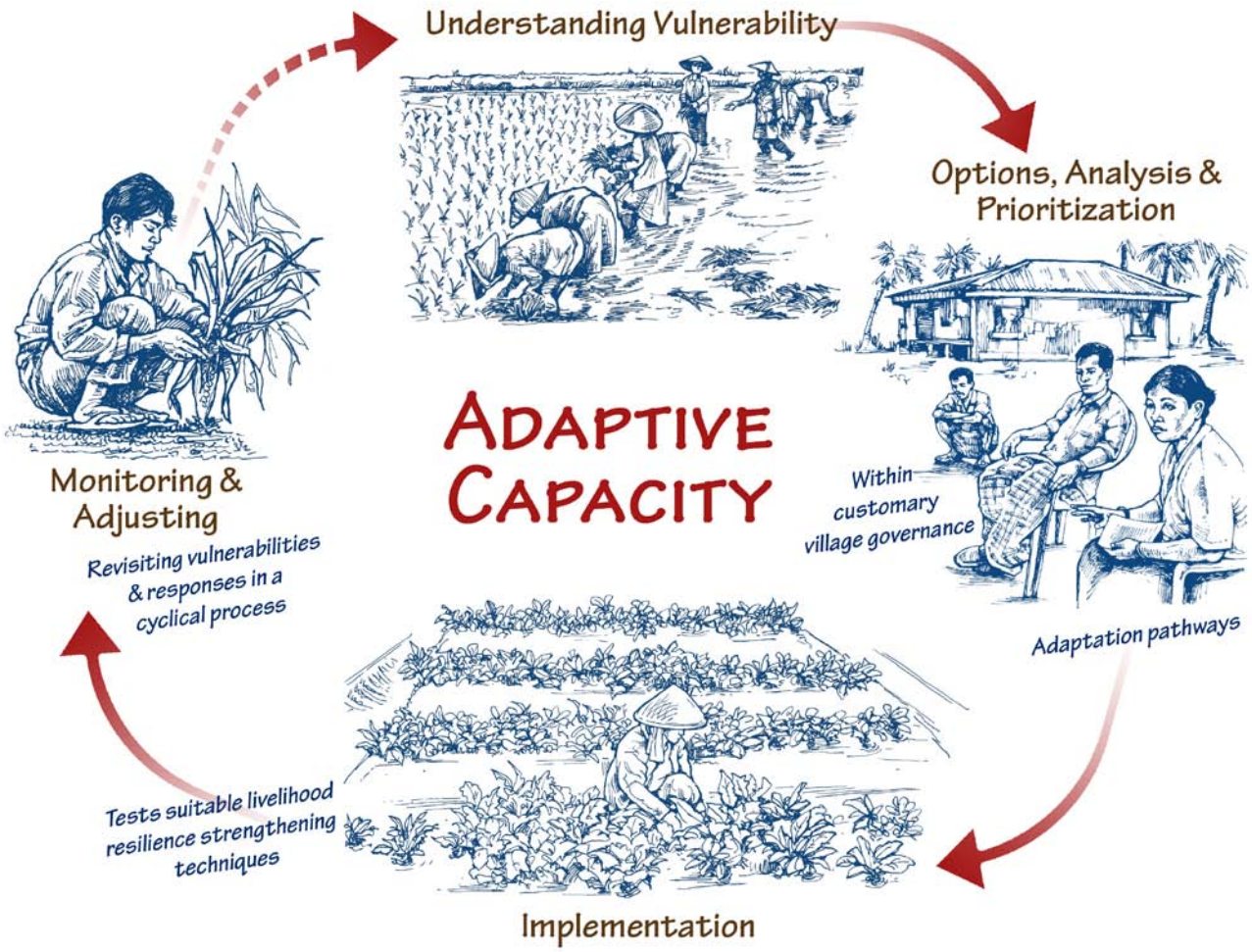
Livestock

- Increased resilience in livestock systems through better access to vaccination programs, improved feed and forage options, and improvement to housing structures will be critical to successful adaptation in this sector.

Ecosystems and Community-based Adaptation

The completion of the USAID Mekong ARCC Climate Adaptation and Impact Study for the LMB is not an end point but instead serves as a tool in linking research and on-the-ground adaptation action that increases the adaptive capacity of local communities. Through partners, USAID Mekong ARCC is assisting communities at 5 sites in Thailand, Lao PDR and Vietnam to better understand and prioritize climate risks and take action that strengthens their resilience to food and livelihood insecurity resulting from climate change (see figure below for process of incorporating Study results into community planning). Successful adaptation will require flexibility and a diversity of approaches to adapt to shifting conditions.

Incorporating Climate Change Study Analysis into Community Decision-Making.



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