USAID Mekong Adaptation and
Resilience to Climate Change




Planning and Implementing Rural Adaptation Initiatives in the Lower Mekong

Methods Applied to Integrate Climate Science and Local Knowledge

USAID Mekong ARCC Project Description

The U.S. Agency for International Development's Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC) is a five-year program (2011-2016) implemented by DAI in partnership with the International Centre for Environmental Management, World Resources Institute, (WRI), International Union for Conservation of Nature (IUCN), Asian Management and Development Institute (AMDI), and the United Nations World Food Programme (WFP). The project focuses on identifying the environmental, economic and social effects of climate change in the Lower Mekong Basin and assisting highly exposed and vulnerable rural populations in ecologically sensitive areas to increase their ability to adapt to climate change impacts on water resources, agricultural and aquatic systems, livestock and ecosystems.

Cover photo: In Nakai District of Khammouan, Lao PDR, the pilot villages locations are remote and fall entirely within the highly biodiverse Phou Hin Poun National Biodiversity Conservation Area of the Annamites Ecoregion.

Program:	USAID Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC)
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Acronyms

AMDI	Asian Management and Development Institute
CCS	Community Climate Story
DAI	Development Alternatives Inc.
FFS	Farmer Field School
GHG	Greenhouse gas
ha	Hectare
HH	Households
ICEM	International Centre for Environmental Management
IFS	Integrated Farming Systems
IP	Implementing Partner
IUCN	International Union for Conservation of Nature
LMB	Lower Mekong Basin
NGO	Non-Governmental Organization
NTFP	Non-Timber Forest Product
RDMA	Regional Development Mission for Asia
SCS	Scientific Climate Story
SOP	Standard Operating Procedure
SRI	System of rice intensification
THB	Thai Baht
VA	Vulnerability Assessment
WFP	World Food Programme
WRI	World Resources Institute
USAID	United States Agency for International Development
USD	United States dollar

CONTENTS

List of Figures

List of Tables

List of Tables (cont.)

Acknowledgements

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We would also like to thank project implementing partners: IUCN Thailand - Angela Joel Cadena, Bampen Chaiyarak, Ratkawee Boonmake; IUCN Lao PDR - Oudomxay Thongsavath, Thongsavath Somdachit; AMDI - Ngo Cong Chinh, Joseph Vile, Nguyen Thanh Ly, Dr. Vu Pham Hai Dang, Dr. Nguyen Tri Khiem; and WFP - Ammar Kawash, Chanthoeun Meng, SamOl Savun, Thea Iech. We are also thankful for the technical support from Anthony Steele, Henry Tucker, Jesper Claussen, Phoutassone Mosky, Donald Bason and Kevin Carlucci. Thank you to USAID for the continual support of the two Contracting Officer Representatives who oversaw implementation of the activities documented in this report: Pornpun Pinweha, and Saengroaj Srisawaskraisorn.

Executive Summary

The **USAID Mekong Adaptation and Resilience to Climate Change** (USAID Mekong ARCC) project is a five-year project (2011-2016) funded by the United States Agency for International Development (USAID) Regional Development Mission for Asia (RDMA) in Bangkok and implemented by Development Alternatives Inc. (DAI) in partnership with International Centre for Environmental Management (ICEM), World Resources Institute (WRI), International Union for Conservation of Nature (IUCN), Asian Management and Development Institute (AMDI), and World Food Programme (WFP). 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 to increase their ability to adapt to climate change impacts on water resources, ecosystems, agricultural and aquatic systems, livestock and other livelihood options.

This report has two primary aims: *first,* to demonstrate an integrative process for combining climate science and community knowledge to support the development of climate change adaptation plans; and *second,* to present the adaptation strategies applied in target communities of the LMB along with lessons learned through their implementation and monitoring. The report should be useful to those working with communities on climate change adaptation including, but not limited to, non-governmental organizations, international aid organizations, government agencies, and research institutions.

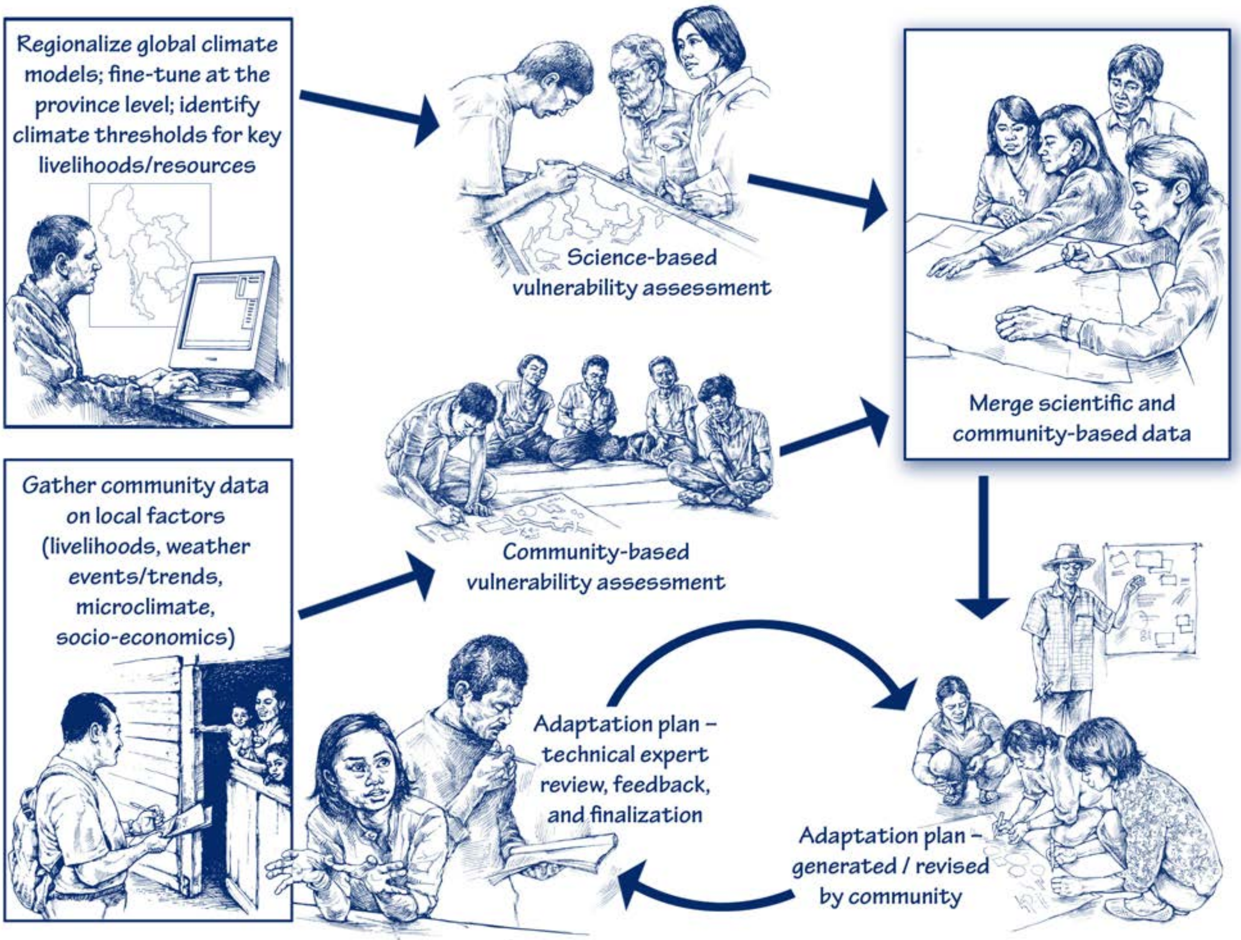
Based on climate modeling performed under the **USAID Mekong ARCC Climate Change Impact and Adaptation Study for the Lower Mekong Basin** (USAID 2013), the project selected five locations to implement ecosystem and community-based adaptation initiatives. These "hotspots" represent some of the most threatened areas in the basin due to projected changes in temperature, drought, rainfall, and sea level rise. Listed from upper basin to lower, the pilot sites included villages in i) Chiang Rai, Thailand, ii) Khammouan, Lao PDR, iii) Sakon Nakhon, Thailand, iv) Kampong Thom, Cambodia, and v) Kien Giang, Vietnam.

USAID Mekong ARCC Decision Making Framework

The USAID Mekong ARCC **Integrated Vulnerability Assessment and Adaptation Decision Making** framework was used with the target project sites to ultimately select and design context-specific technical solutions for strengthening livelihood resilience in the face of climate change. The framework merges the best available climate science research with communities' local expertise and knowledge. Under this framework, science-based and community-based assessments are initially conducted as two distinct processes. Knowledge sharing ensues where results from both the top-down and bottom-up assessments are evaluated and compared. A more holistic understanding emerges, which accounts for the longer term trajectory of climate provided by the scientific projections, along with the on-the-ground observations of how climate change is unfolding to date and specific effects on people, their livelihoods, and community resources. This merged understanding serves as the basis for developing adaptation solutions that fit the context and needs of individual communities. The generalized process is depicted on the next page.

Desk-Based Vulnerability Assessment

In the first step of the USAID Mekong ARCC implementation workflow, project implementers develop a desktop vulnerability assessment (VA) to gather data and conduct preliminary analyses around projected climate impacts and contextual factors influencing local adaptive capacity. ***Vulnerability*** is characterized by examining three primary components (climate threat ***exposure***, ***sensitivity*** to those threats, and the ***adaptive capacity*** to respond) as they relate to key livelihoods, community resources, and ecosystems. In addition, implementers give special consideration to understanding the differing vulnerabilities of men and women given their distinct gender roles in the community and household; as well as a given community's vulnerability to natural disasters, particularly within at-risk geographic areas.



Summary of integrative method for climate change adaptation planning

As described in more detail within the main body of the report, the project implementers at the pilot sites generally used the following tools and information to support their desktop VAs: Climate Projections, Livelihood Threat Assessment Tables, Scientific Vulnerability Matrices, Gender Vulnerability Assessments, and Disaster Risk Assessments. While the desktop VAs are conducted prior to fully engage the community in participatory assessments, many of the VA tools incorporate supporting data gathered at the community level through baseline surveys, focus group discussions, key informant interviews, etc.

Community Climate Story

Community Climate Story (CCS) activities are a next step to understanding vulnerability from the community perspective. Through a participatory process, this aspect of the USAID Mekong ARCC framework elucidates stakeholder concerns regarding their own experience and observations of climate change at the ground level. It also helps to characterize the community's biophysical and socio-economic context, livelihood options, and decision-making processes. As a result, CCS activities facilitate community-based analysis of climate vulnerabilities at the village level, and provide a platform to engage people in the process of understanding and preparing for climate risks.

Generally, the ***CCS process*** involves three steps. *First*, project implementers facilitate discussions among community participants around their key livelihoods, and help them to identify financial, physical, and natural assets contained within and around their villages. *Second*, the participants utilize vulnerability assessment tools to measure and consider the threats of changing climate to these key assets and livelihoods. *Third*, communities further refine and prioritize vulnerabilities by ranking livelihoods, resources, and threat severity, and by considering potential adaptive countermeasures.

Specific CCS activities implemented at the pilot sites are presented within the main report and include: the Community/Village Mapping Exercises, the Prioritization of Livelihood Activities, the Seasonal Livelihood and Seasonal Hazard Calendars, the Historical Timelines referencing major events in the villages' histories (with special reference to events related to the environment, climate, or natural disasters), the Community Vulnerability Matrices, and the Climate Hazards and Problems Ranking.

Scientific Climate Story, Shared Understanding, and Scenario Development

The third stage of the community adaptation planning process in the USAID Mekong ARCC framework involves three distinct sets of activities: 1) the Scientific Climate Story (SCS), 2) Shared Understanding and 3) Scenario Development. In conducting these workshops, implementing partners (IPs) draw on the same pool of villagers that participated in the CCS activities so as to build off prior sessions and to continue engaging with participants who had already committed time and energy to the process.

The ***SCS workshop activities*** involve a two-step process of review and education. Key aspects include:

- An overview of the findings from the Climate Study including projections (temperature, rainfall, drought, flooding, etc.) to 2050 and the results of more localized VAs using visual aids.
- A general climate education presentation, discussing and clarifying the difference between weather and climate, illustrating impacts of climate on livelihoods, and quizzing the participants in a game-like format to ensure understanding.

The ***Shared Understanding exercises*** provide a synthesis of the information gathered from the Climate Study, the VAs, and the CCS activities. The general workflow proceeds as follows:

- Facilitators present projected vulnerabilities based on the information gathered from the Climate Study and desktop VAs, and then review with the participants the community-identified climate threats and livelihood vulnerabilities discussed in the CCS workshops.
- Next, in collaboration with the facilitators, participants explore the similarities and differences between the scientific- and community-derived vulnerability lists and discuss reasons for discrepancies.
- Facilitators give participants the option to re-rank or confirm their initial prioritization of climate threats and key vulnerabilities from the CCS.

Villagers in Chey Commune of Kampong Thom, Cambodia evaluating livelihood threats as a part of the Shared Understanding exercises.

Finally, following the Shared Understanding exercises, facilitators work with participants to identify problems and needs of their communities, and through ***Scenario Development exercises*** produce the following results:

- A detailed step-by-step outcome mapping exercise considering the threats faced by the community against short-, intermediate-, and long-term solutions and adaptation options.
- A rough roadmap listing adaptation measures designed to set each village on a sustainable course to a community-defined ideal future.

Implementation of Adaptation Plan

The USAID Mekong ARCC participatory framework to integrate top-down climate science with bottom-up local knowledge results in an increased awareness of climate impacts, and locally developed strategies to avoid, minimize, mitigate or otherwise prepare for those impacts. Based on the community assessments, project facilitators develop adaptation plans that are filtered through external technical expert analyses to ensure adaptation initiatives are both good development and increase the climate change resilience of a community.

Adaptation projects implemented in the USAID Mekong ARCC pilot sites spanned a range of strategies that generally fit into six broad categories: ***Water Infrastructure and Management***, ***Climate Smart Agricultural Techniques***, ***Livestock Management***, ***Aquaculture***, ***Forest Restoration and Management***, and ***Community Organization and Capacity Building.*** Details of the activities implemented at each site are presented in detail in the main report.

Lessons Learned from Adaptation Implementation

USAID Mekong ARCC's field-testing of integrative adaptation decision-making followed by implementation of pilot activities across five at-risk sites in the LMB revealed a number of important lessons. First, In order to be successful, ***community adaptation options must show an economic gain.*** This could take the shape of lower input costs into production systems and/or higher market value of products.

Co-benefits related to increased food security and nutrition are also important. For example, pilot farmers participating in chicken and small-scale aquaculture projects gained an additional and steady protein source through eggs, meat, frogs, and fish. Home gardens were also quite successful in some communities, enhancing the nutrition of diets at the household level.

Small shifts to existing systems are more likely to be replicated as they generally involve less risk and are therefore more attractive to neighboring farmers and/or other communities. Larger scale infrastructure projects, while in some cases may have significant positive impact on community adaptive capacity, they involve more substantial technical and financial assistance from outside sources, for example, from government agencies or international aid organizations.

Training and capacity building are critical for enhancing community knowledge and adaptive behaviors. Farmer field schools and other educational platforms allow for continued adaptation following project closeout. Involving "model farmers" and influential community members to help facilitate on-going training and dissemination of knowledge post-project enhances longer-term sustainability.

US Ambassador to Thailand Glyn T. Davies confers a blessing on one of the project's target Hill Tribe communities in Chiang Rai Province, Thailand.

Project cycle is a key factor influencing success. In the case of USAID Mekong ARCC, the adaptation implementation component of the project occurred in large part during the 2015 El Niño event, which resulted in drought and extreme heat across the region. Because most of the activities lasted for roughly one year, some of the projects failed due to the extreme weather scenario. A more suitable timeframe for many of the projects would be three years. This would also allow for continued monitoring and supervision of many of the shorter-term projects that would be good to follow-up on in order to enhance their sustainability.

There are many other important ***co-benefits from the adaptation activities*** that were implemented in the target villages. For example, the sustainable land use practices applied in many of the pilot sites reduce reliance on monoculture systems and the associated impacts to soil fertility and agro-biodiversity. Examples of these sustainable practices include: the introduction of native rice species, the system of rice intensification, and the creation of organic pig pits that generate compost to fertilize fields. Monocultures require large inputs of chemical fertilizers and pesticides, leading to soil degradation, and thus reduce the value and resilience of land for agriculture. It is therefore critical to maintain healthy soils through sustainable land use. Integrated and organic agricultural practices, such as those promoted in many of the pilot sites:

- Build soil structure and soil fertility;
- Rehabilitate poor soils and bring degraded soils back into productivity;
- Reduce the financial risk of farm operations as farmers are less dependent on external inputs; *and*
- Increase agro-biodiversity, which builds resilience to storms, heat and increased pest and disease pressure.

There are also ***substantial long-term benefits provided by maintaining healthy forests*** related to their role in providing critical ecosystem services such as provision of food, fresh water and fuel, watershed protection, air quality maintenance, storm protection, and cultural aspects of recreation, spirituality, and aesthetics.

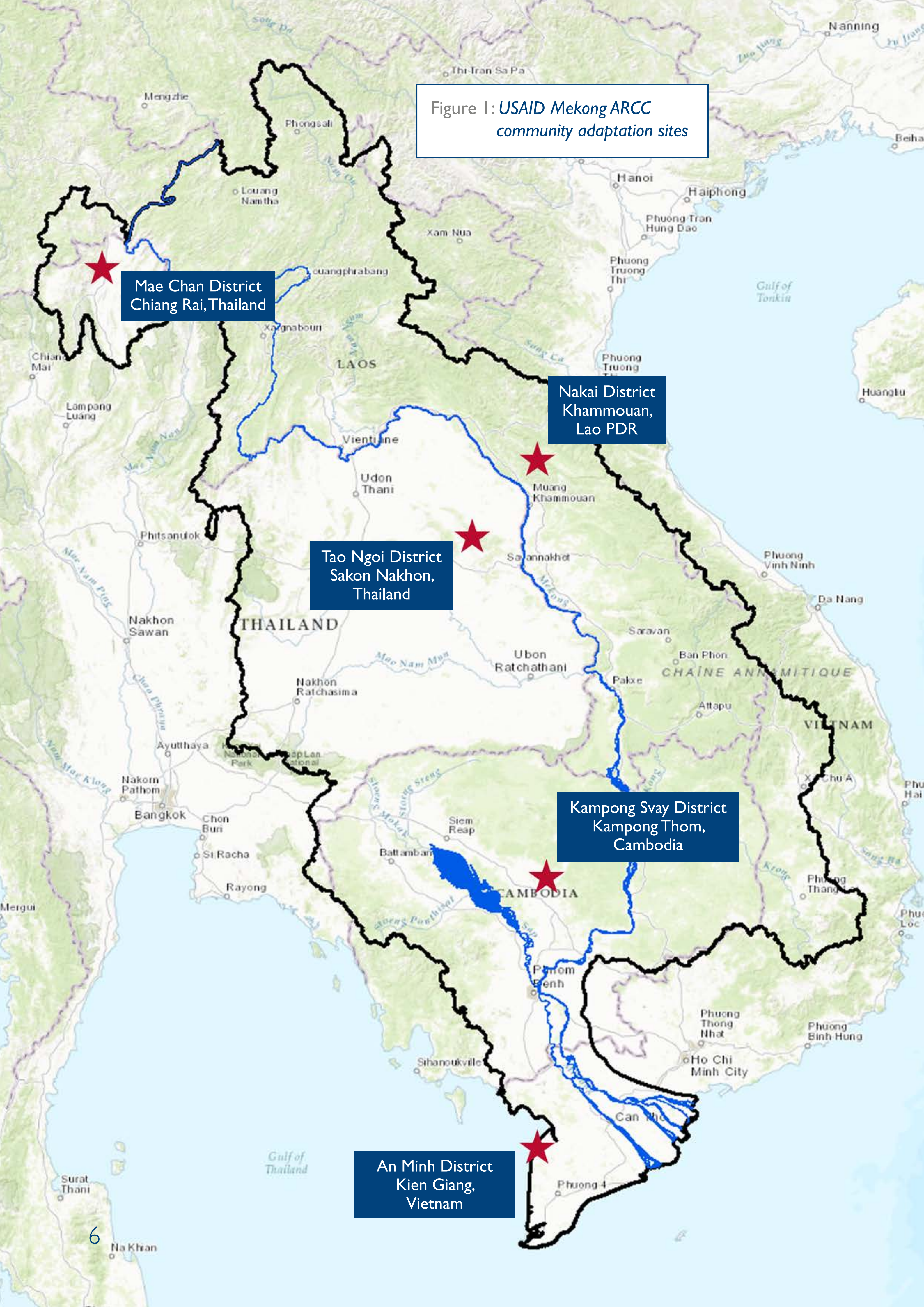


Figure 1: *USAID Mekong ARCC community adaptation sites*

Introduction

The **USAID Mekong Adaptation and Resilience to Climate Change** (USAID Mekong ARCC) project is a five-year project (2011-2016) funded by the United States Agency for International Development (USAID) Regional Development Mission for Asia (RDMA) in Bangkok and implemented by Development Alternatives Inc. (DAI) in partnership with International Centre for Environmental Management (ICEM), World Resources Institute (WRI), International Union for Conservation of Nature (IUCN), Asian Management and Development Institute (AMDI), and World Food Programme (WFP). 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 to increase their ability to adapt to climate change impacts on water resources, ecosystems, agricultural and aquatic systems, livestock and other livelihood options.

In the first two years of the project, USAID Mekong ARCC completed downscaled modeling of climate projections and associated impacts on the LMB. The main report–***USAID Mekong ARCC Climate Change Impact and Adaptation Study for the Lower Mekong Basin (Climate Study, USAID 2013)***– identified regional climate "hotspots" representing the most threatened ecozones, catchments, provinces, and protected areas examined in the overall study. Of eight hotspot provinces identified by the study, USAID Mekong ARCC selected five target locations to implement ecosystem and community-based adaptation initiatives. Listed from upper basin to lower, the pilot sites included villages in i) Chiang Rai, Thailand, ii) Khammouan, Lao PDR, iii) Sakon Nakhon, Thailand, iv) Kampong Thom, Cambodia, and v) Kien Giang, Vietnam.

To enhance the efficiency of working with communities on the ground level, USAID Mekong ARCC chose to work with project partners who already had a presence in the target provinces to provide programming, research and analysis, and overall project facilitation at the pilot sites. For Chiang Rai and Sakon Nakhon in Thailand, and Khammouan, Lao PDR, the project team engaged the respective Thai and Lao offices of IUCN. In Cambodia, the team partnered with WFP. In Vietnam, the team partnered with AMDI, with additional assistance provided by the Vietnam Red Cross. Throughout this report, these partners will be referred to specifically by name and in general as "Implementing Partners" (IPs).

This USAID Mekong ARCC report presents an analysis of the community adaptation initiatives in two parts. The first section provides an overview of the methods used for site-specific research, community engagement, and planning prior to the commencement of the pilot adaptation activities. It includes explanations of individual methods, and provides illustrative results from employing these methods with communities at the site level. The second section focuses on the specific adaptation strategies chosen for implementation within the pilot sites, provides an overview of results, and presents lessons learned from piloting the adaptation activities.

This report has two primary aims: *first,* to demonstrate an integrative process for combining climate science and community knowledge to support the development of climate change adaptation plans; and, *second*, to present the adaptation strategies applied in rural communities of the LMB along with lessons learned through their implementation and monitoring. The report should be useful to those working with communities on climate change adaptation including, but not limited to, NGOs, international aid organizations, government agencies, and research institutions.

Mae Chan District -
Chiang Rai Province,
Thailand

Nakai District -
Khammouan Province,
Lao PDR

Tao Ngoi District -
Sakon Nakhon Province,
Thailand

Overview of Pilot Sites 2

The selected pilot sites provide a representative cross-section of the range in societal and ecological conditions present within the LMB (Figure 1).

In **Mae Chan District of Chiang Rai Province, Thailand**, the pilot villages of Loh Yo, Hae Ko and Huai Kang Pla are situated within a mixed agricultural and forested landscape of northern Thailand and are unique in supporting a culturally diverse population consisting of numerous tribal groups along with ethnic Thais. The communities are located within the "Golden Triangle" known for its historic role in the opium industry, near the tri-point border of Myanmar, Thailand, and Lao PDR.

In **Nakai District of Khammouan Province, Lao PDR**, the pilot villages - Ban Kouane and Ban Xong - are remotely located within the Phou Hin Poun National Biodiversity Conservation Area of the Annamites Ecoregion. The communities are underdeveloped with high rates of poverty, illiteracy, and malnutrition while located within an area of rich ecology and globally unique species and habitats.

In **Tao Ngoi District of Sakon Nakhon, Thailand**, the pilot village of Kok Klang is highly connected to and dependent on surrounding community forestland that is a part of the Phu Pa Yon National Park. Overuse of the forest and land tenure issues are ongoing challenges.

This northeastern Thai community is unique in its strong presence of both Catholics and Buddhists, and there is also notable representation by women in governing structures.

In **Kampong Svay District of Kampong Thom Province, Cambodia**, Chey Commune is situated within Cambodia's central lowlands and the Tonle Sap/Great Lake drainage basin. The six pilot villages within Chey Commune are quite impoverished in an area of poor sandy soils, and rely on remittances from migratory labor to supplement their inadequate income from rice farming.

In **An Minh District of Kien Giang Province, Vietnam**, the pilot site of Thuan Hoa Commune is located within the Vietnam Mekong Delta and is uniquely characterized by a vast system of canals influencing all aspects of local residents' lives and livelihoods. Commune members are engaged primarily in a dual rice/shrimp farming practice that is the dominant livelihood option.

3 USAID Mekong ARCC Decision Making Framework

The USAID Mekong ARCC **Integrated Vulnerability Assessment and Adaptation Decision Making framework** takes a unique approach to designing context-specific technical solutions for strengthening livelihood resilience in the face of climate change. The framework works at the community level, merging the best available climate science research with communities' local expertise and knowledge. The generalized process is depicted in Figure 2 and outlined in more detail below.

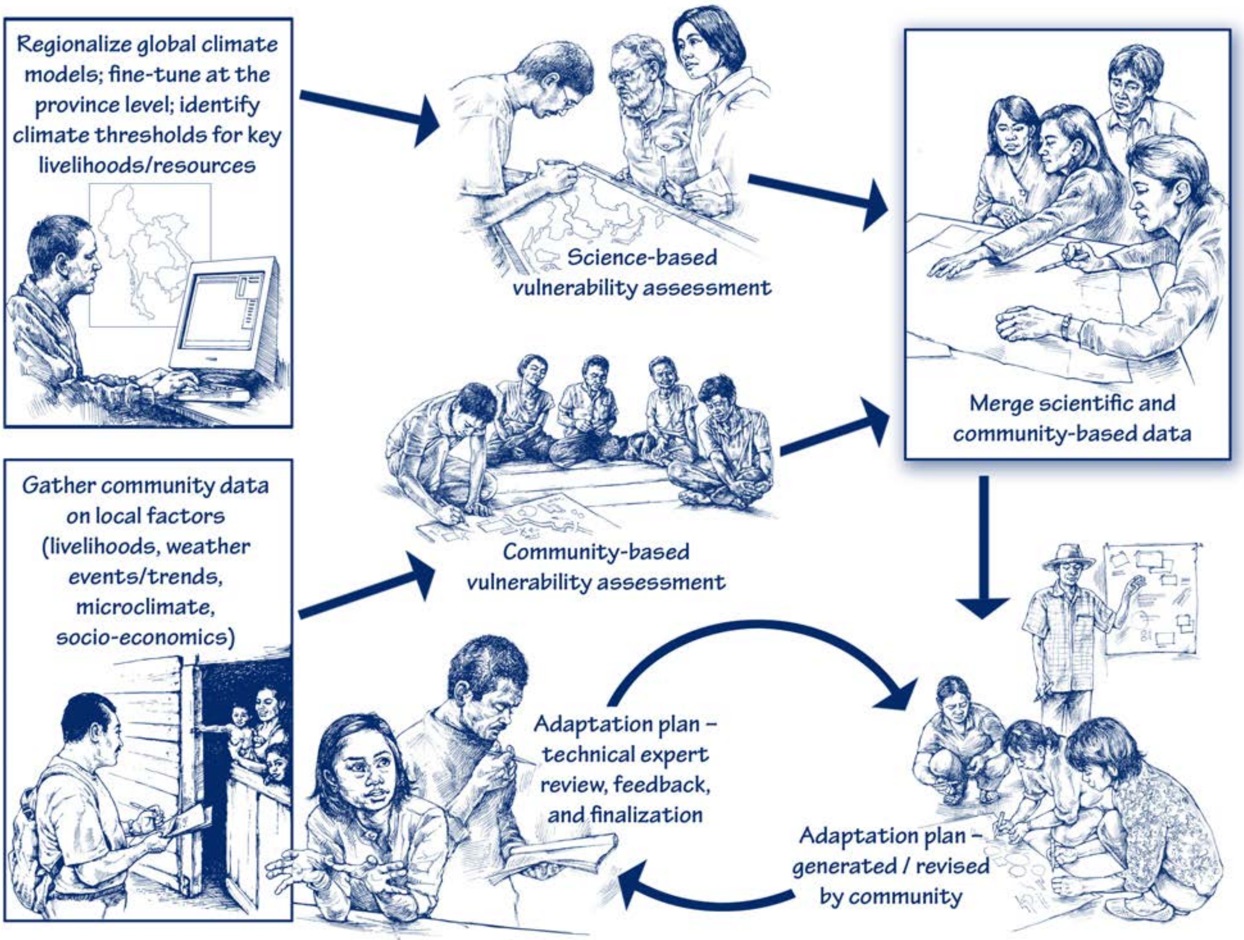


Figure 2: *Summary of integrative method for climate change adaptation planning*

Under this framework, science-based and community-based assessments are initially conducted as two distinct processes. Purposeful comparison of results and sharing of knowledge occurs during the merging process (upper right, Figure 2) and during the adaptation plan development and revision process (bottom right and middle, Figure 2). Figure 3 presents a more specific workflow for accomplishing this process, as developed and implemented by USAID Mekong ARCC partners. The following sections further describe the process in more detail.

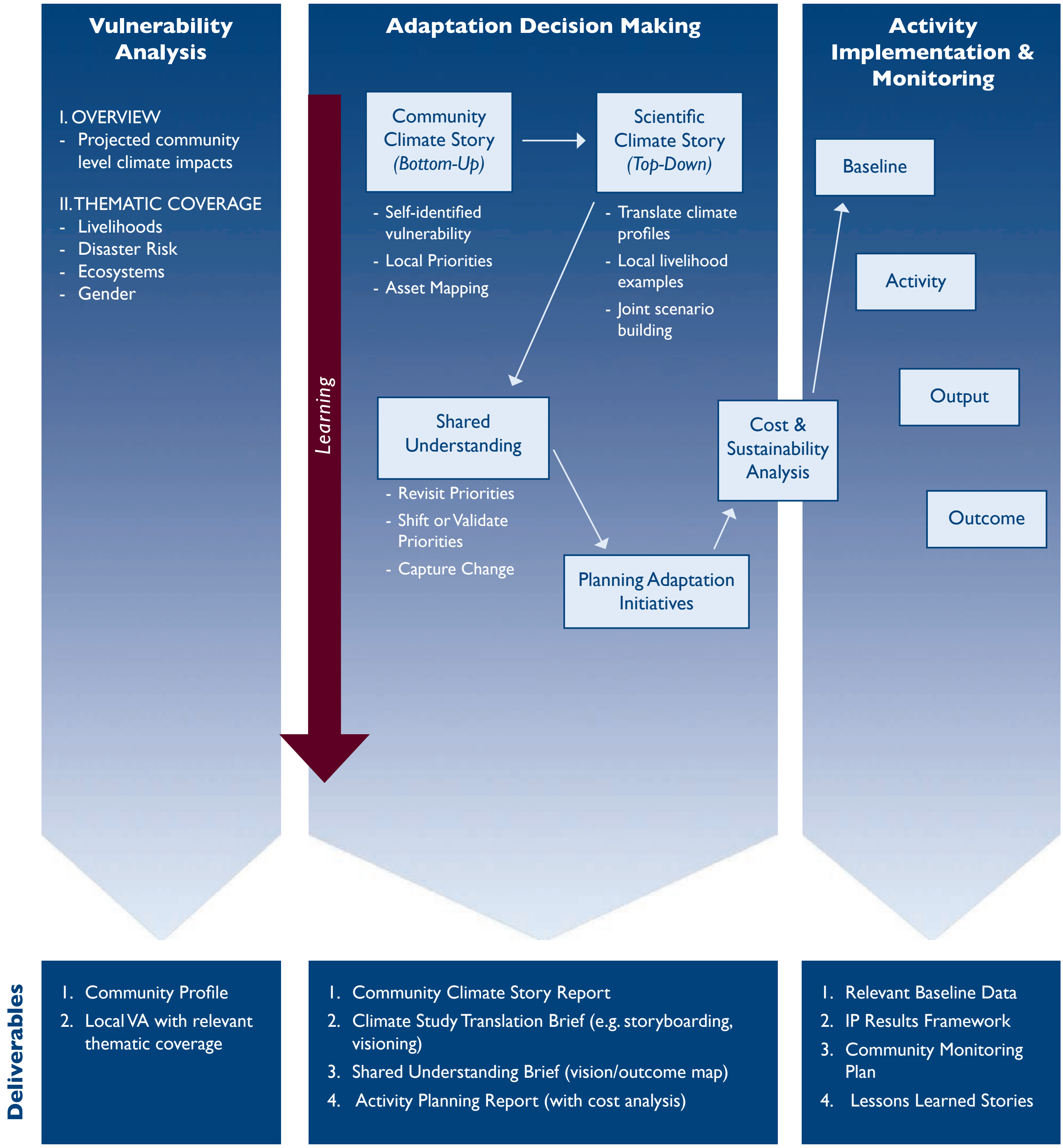


Figure 3: *USAID Mekong ARCC Implementation Workflow*

4 Desk-Based Vulnerability Assessment

In the first step of the USAID Mekong ARCC implementation workflow, IPs develop a **desktop vulnerability assessment** (VA) to gather data and conduct preliminary analyses around projected climate impacts and contextual factors influencing local adaptive capacity.

VAs appraise the population and environment at a specific location in terms of vulnerability to climate change and other non-climate-related environmental and socio-economic factors. Vulnerability is commonly understood as a function of a population or system's ***Exposure***, ***Sensitivity***, and ***Adaptive Capacity*** as detailed in Figure 4.

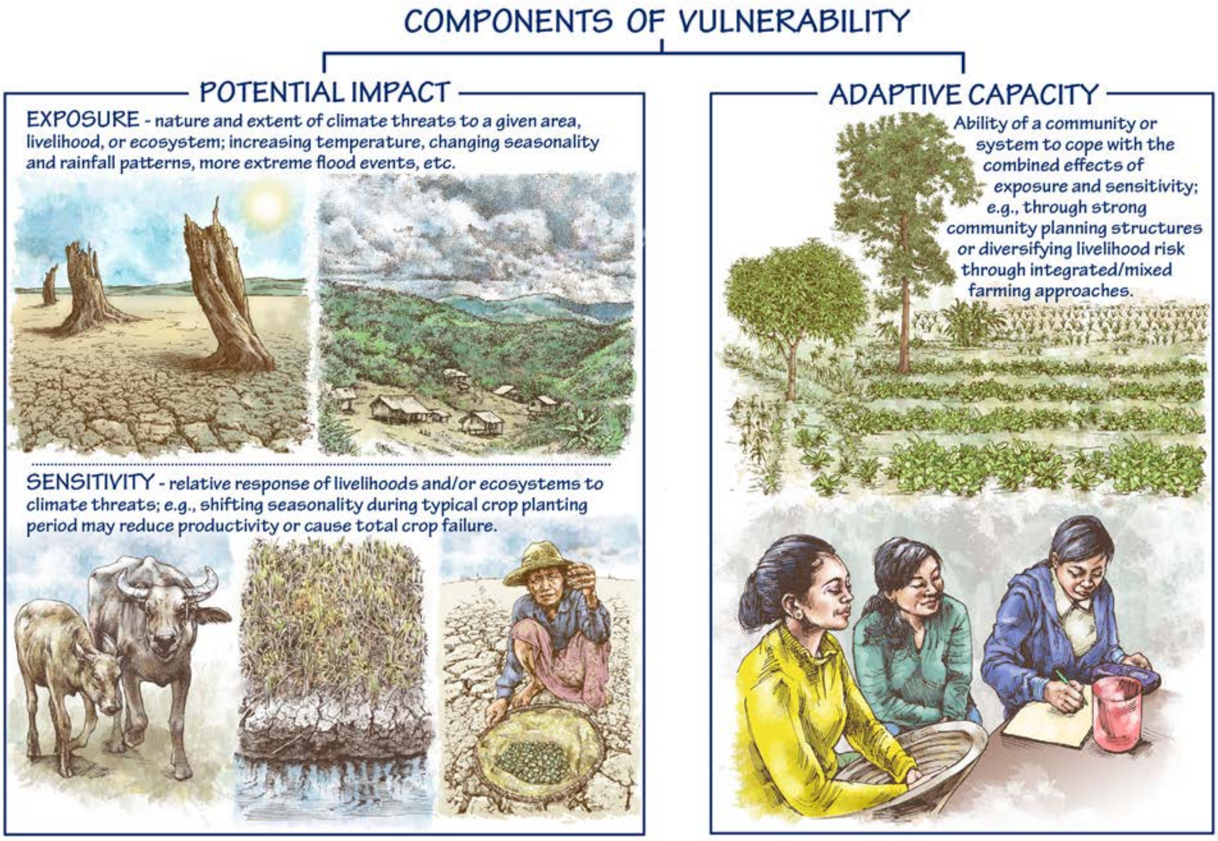


Figure 4: *Vulnerability is magnified by the combined effects of exposure to climate threats and sensitivity of livelihoods and ecosystems to these threats; vulnerability is reduced by a community's or system's adaptive capacity.*

While there were small differences between the desktop VAs conducted for the various USAID Mekong ARCC pilot sites, generally each assessment sought to characterize community vulnerability by examining the three primary components (exposure, sensitivity, adaptive capacity) as they relate to key livelihoods, community resources, and ecosystems. In addition, IPs gave special consideration to understanding the differing vulnerabilities of men and women given their distinct gender roles in the community and household. Women are disproportionately affected by climate change–as a group, they are more poor, more dependent on natural resources, and have less say in decision-making contexts compared to their male counterparts. For this reason, a special section of this report has been devoted to women and other special vulnerable groups (Section 4.4). Likewise, several of the IPs at the pilot sites also evaluated vulnerability to natural disasters as a separate assessment. Extreme events occurring in particularly at-risk geographic areas, such as coastal areas of the Mekong Delta or steeply sloped mountainous areas, have the potential to cause devastating loss of lives and acute infrastructure damage that warrant special consideration (Section 4.5).

As described in more detail below, the IPs at the pilot sites generally used the following tools and information to support their desktop VAs: Climate Projections, Livelihood Threat Assessment Tables, Scientific Vulnerability Matrices, Gender Vulnerability Assessments, and Disaster Risk Assessments. While the desktop VAs are conducted prior to fully engaging the community in participatory assessments, many of the VA tools incorporate supporting data gathered at the community level through baseline surveys, focus group discussions, key informant interviews, etc.

Climate Projections 4.1

Climate projections are scientifically derived analyses of likely future changes in climatic variables based on assumed greenhouse gas (GHG) emissions scenarios. The desktop VAs completed for USAID Mekong ARCC utilized scientific data developed by the Climate Study, and other more localized data when available, to assess province-level climate projections, comparing baselines with estimated adjustments to conditions by 2050. The climate projections cover expected changes in average, maximum, and minimum temperatures throughout the year, precipitation levels on a monthly, seasonal, and annual basis, and the frequency and severity of extreme events (storms, floods, droughts). Figure 5, for example, displays projected changes in temperature and precipitation across the entire basin by 2050. Figure 6 is a province-level display of dry season temperature change by 2050, which includes Sakon Nakhon, Thailand and Khammouan, Lao PDR, two of the focus areas for the community-based work.

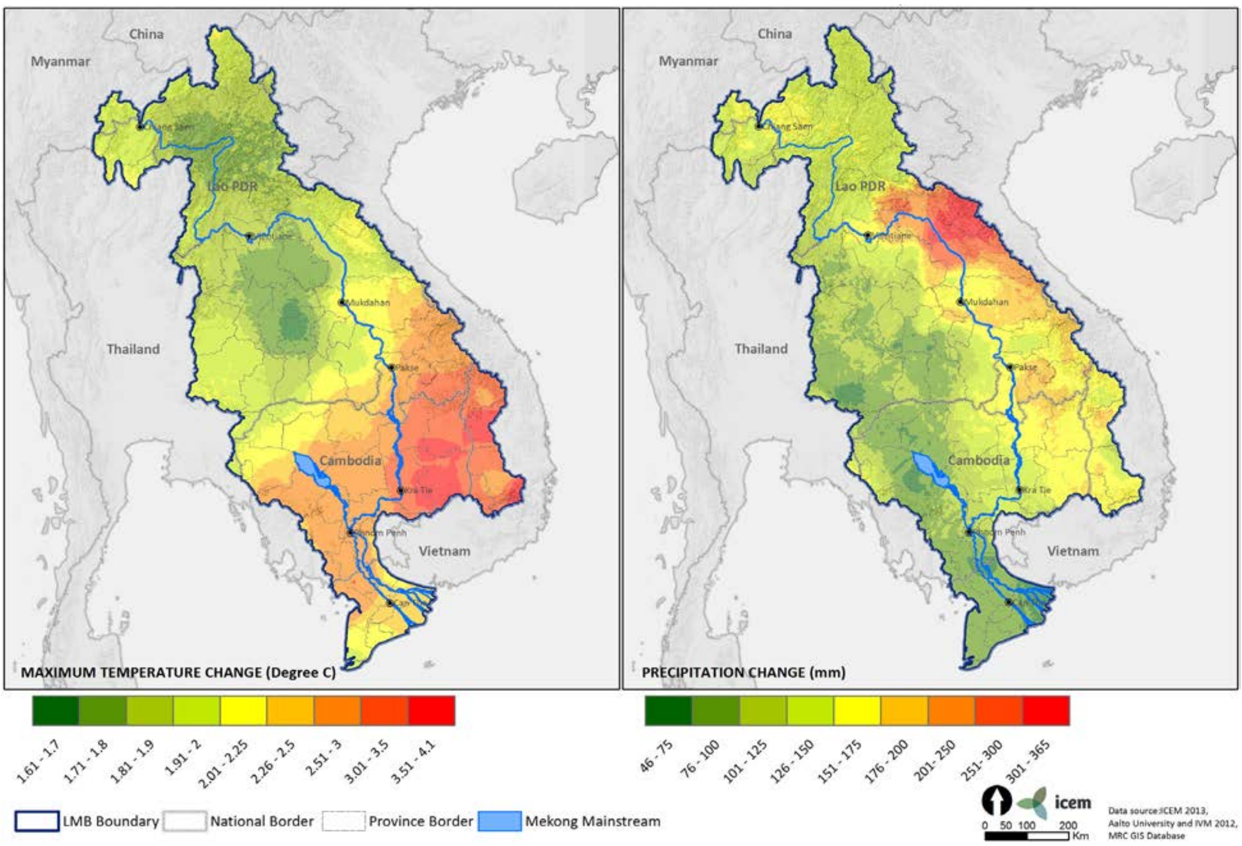


Figure 5: *Projected maximum temperature and precipitation changes across the Lower Mekong Basin by 2050 (USAID Mekong ARCC Climate Change Impact and Adaptation Study, November 2013)*

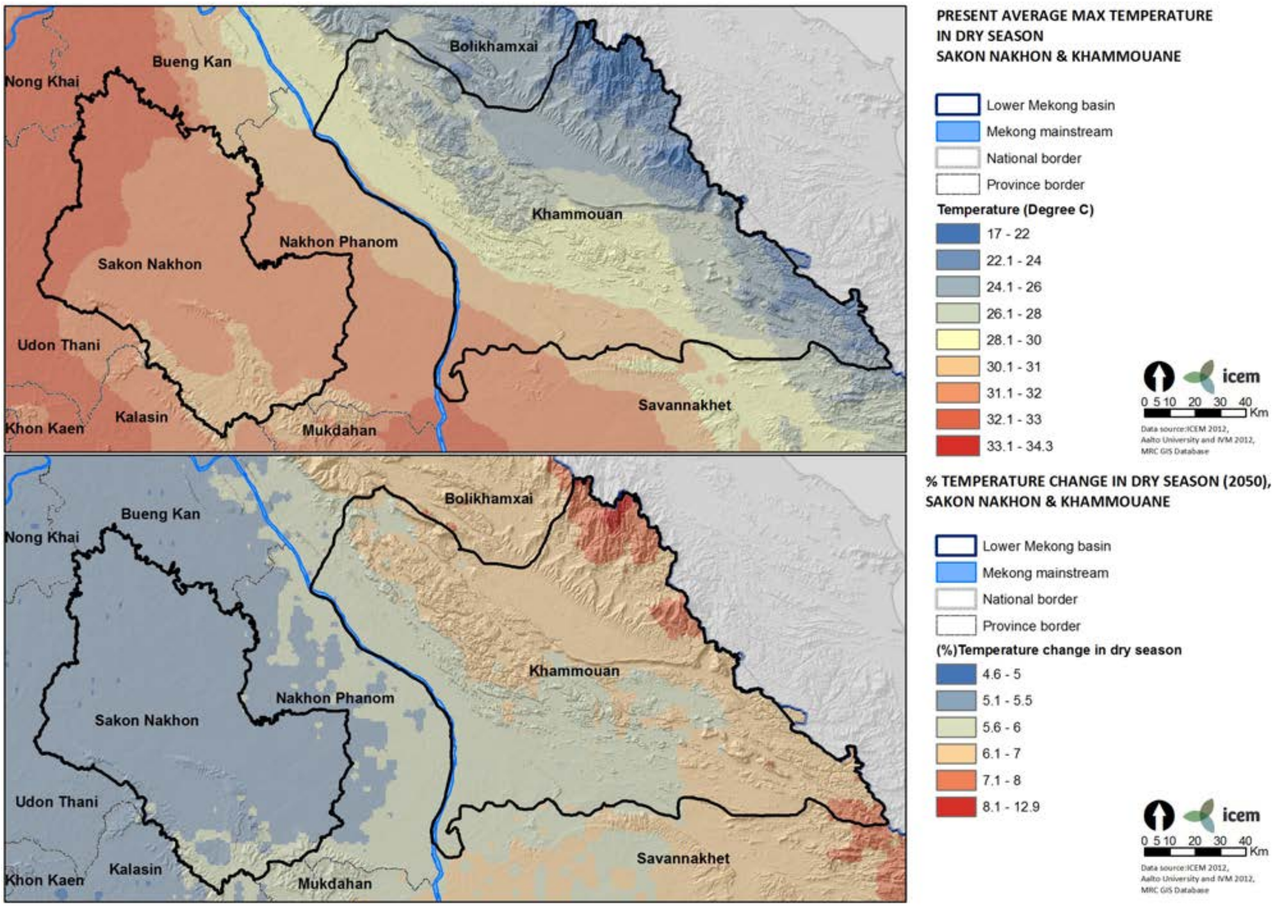


Figure 6: *Projected changes in dry season temperature by 2050 for Sakon Nakhon Province, Thailand and Khammouan Province, Lao PDR*

Khammouan Province, Lao PDR

Livelihood Threat Assessment Tables 4.2

Upland rice, maize & chicken.

Livelihood threat assessment tables provide a structure for analyzing potential vulnerabilities of livelihoods deemed important to communities. Livelihood threat assessments may also extend beyond direct income sources (e.g., agriculture, livestock, fisheries) to natural systems, health and/or infrastructure. For the pilot sites, the results from the Climate Study provided the primary basis for assessing vulnerability using this tool.

The example below from Huai Kang Pla Village in Chiang Rai, Thailand shows relevant livelihoods along with descriptions of potential climate threats and determination of vulnerabilities based on consideration of exposure, sensitivity, and adaptive capacity. The table also includes a short list of potential adaptation options for each livelihood.

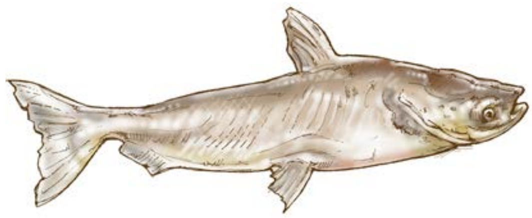
Table 1. *Threat assessment for a selection of livelihoods important to Huai Kang Pla Village, Chiang Rai Province, Thailand (IUCN Thailand, Vulnerability and Capacity Assessment Report, June 2014)*

Livelihood Area	Threat	Impact & Vulnerability Summary	Exposure	Sensitivity	Adaptive Capacity	Vulnera-bility	Potential Adaptation Options (selection)
Upland rice (food and cash crop)	Increased temperature	Although upland rice will generally be less affected by changes in climate than lowland rice, an increase in temperatures might decrease yields. Vulnerability to mentioned threats is assessed as medium in the USAID Mekong ARCC Climate Study.	Medium	Medium	High	Medium	Monitor changes in yield and, if relevant, try new varieties and diversify
	Increased precipitation		Low	Low	High	Medium	
	Water stress		Low	High	Low	Medium	
Maize (cash crop)	Increased temperature	Slight decrease in maize suitability due to temperature increase.	Medium	Low	Low	Medium	Shift in cropping calendar to avoid high temperatures and precipitation Diversification, alternative crops Intercropping with legume species
	Increased precipitation		Medium	Medium	Low	Medium	
Local chicken (consumption)	Increased temperature	The system for small-scale chicken is already outside the ideal temperature range; added heat stress will reduce reproduction and immunity. Feed and animal health issues. Local variety might be more heat-tolerant. As exposure to high temperature will be lower in the upland area, exposure has been adjusted to 'medium' compared to 'high' in the initial assessment.	Medium	High	Very Low	High	Ensure adequate vaccination Alternative feeding Housing ventilation, shade trees
	Flash floods, storms		Medium	High	Low	High	Introduce local varieties Locate housing and feed storage away from high-risk areas

4.3 Scientific Vulnerability Matrices

Scientific vulnerability matrices provide a means for ranking the vulnerability of key resources and livelihoods at the community level. The vulnerability determination for each hazard draws largely from data collected pursuant to scientific studies prior to evaluating community perceptions of the issues at hand. However, the analysis does factor in an importance weighting for each livelihood or resource based on the IPs prior working knowledge of the communities and/or baseline survey results.

As the example matrix from Loh Yo Village, Chiang Rai, Thailand (Table 2) illustrates, hazards are ranked on a scale from 1–4 (low to very high) with respect to their influence on each livelihood's vulnerability. The matrix also takes into account non-climate hazards and the community's adaptive capacity to such hazards.



Wild fish are very vulnerable to increased temperature, flash floods, landslides and storms.

Table 2. *Scientific Vulnerability Matrix for Loh Yo Village, Chiang Rai, Thailand (IUCN Thailand, Vulnerability and Capacity Assessment Report, June 2014)*

		Climate and non-climate hazards							
Livelihood resources	Importance weighting (4-critical to 1-slightly important)	Increase in temperature	Increase in rainfall	Drought	Flash floods, landslides	Storms	Non-climate threats	Minus community adaptive capacity (3-high to 1-low)	Total
Upland rice	4	2	2	2	2	1	1	-1	13
Maize	4	2	2	2	2	2	2[1]	-1	15
Bamboo shoots and other NTFPs	4	2	2	2	2	2	3[2]	-1	16
Sesame	3	2	2	2	2	2	1	-1	13
Paddy rice	2	3	2	2	2	2	1	-1	13
Chicken	2	3	2	1	3	3	1	-1	14
Wild fish	2	3	2	2	3	3	2[3]	-1	16
Plums, Japanese apricot	2	2	3	2	2	2	1	-1	13
Health	3	2	2	1	3	3	1	-2	13
Infrastruture	3	1	2	1	3	3	1	-2	12
Total	29	22	21	17	24	23	14	-12	

From this vulnerability ranking, NTFPs, maize, chicken and wild fish are the most vulnerable livelihoods for Loh Yo Village. Upland rice as their main food crop also represents an important vulnerability. Wild fish and chicken are very vulnerable to increased temperature, flash floods, landslides and storms while NTFPs appear to be more vulnerable to non-climate threats. Increasing temperatures, flash floods, landslides and storms are the most important hazards.

[1] Vulnerable to market price fluctuations.
[2] Vulnerable to habitat loss and overharvesting.
[3] Vulnerable to habitat loss and overharvesting.

4.4 Gender Vulnerability and Specific Vulnerable Groups Assessment

The vulnerability of women, and other "Specific Vulnerable Groups", was assessed in the desktop VAs in various manners at the different pilot sites. In Thailand, the pilot communities include populations of hill tribe people who have traditionally been marginalized so these vulnerable groups received special consideration along with women. The Lao VA addressed gender at the provincial level, where data was available, making note of the local norms with regard to gender roles and how certain gender-specific livelihoods may be directly affected by climate change.

To illustrate specific implications of climate change on women in Thuan Hoa commune in Kien Giang Province, the Vietnam VA included a "Gender implications of climate change" table (see Table 3 below), referencing gender-specific threats (e.g., disparity in educational background and under-representation in governance), the implications in the context of climate change, and the adaptive capacity of the province in regard to these threats.

Table 3. *Gender implications of climate change and other impacts in Thuan Hoa Commune, Kien Giang Province, Vietnam (AMDI Awareness Survey Report, 2014)*

Threat	Potential gender implications	Adaptive capacity
Low female education levels	Women lack knowledge on CC and its impacts, and therefore are limited in their ability to respond (AMDI's Awareness Survey found 84.5% of women in Thuan Hoa Commune were totally unaware of climate change at the start of the project).	Proposed women-targeted projects to increase awareness and understanding of CC and its impacts. This has flow-on benefits for children's education on this topic.
Low female involvement in governance	Development of policies that are 'gender blind', and do not recognize the unique often vulnerable position of women in society. AMDI's Awareness Survey revealed women account for 25% of the total staff of the commune government, and that there are no female heads of the People's Committee, technical units or mass organizations, except the Women's Union.	Women do have a platform for voicing concerns through the Women's Union. Proposed projects to improve women's involvement in local government and civil society organizations.

4.5 Disaster Risk Assessment

Disaster risk assessment addresses the vulnerability of communities to natural disasters. For the pilot communities, different sites were assessed for disaster risk from climate change at different levels depending on the information that was available. While the VA assessment for the Lao site was done at the provincial level, the VA assessment for the Vietnam site considered disaster risk at the site-specific level. The VAs for the Thailand sites did not consider this in a separate assessment, but included reference to disaster risk in their community vulnerability matrices (see below Section 5.6).

To conduct a disaster risk vulnerability assessment, the IPs considered a province's or site's inherent propensity for natural disasters, along with various socioeconomic factors affecting vulnerability in light of government disaster management plans, disaster risk reduction projects, and the historical local responses to disasters. The Lao VA addressed these elements in narrative form, while the Vietnam VA conducted their analysis in an expanded section with an accompanying disaster risk vulnerability table (Table 4 below).

Table 4. *Disaster risk assessment of Thuan Hoa Commune, Kien Giang Province, Vietnam (AMDI VA Report Thuan Hoa Commune, July 2014)*

Threat	Description	Exposure, sensitivity, impact	Vulner-ability	Adaptation Options
Flooding/ sea level rise	Increased precipitation, wet season flows in the Mekong, and sea level rise are likely to increase the severity and frequency of floods.	Very High exposure due to climate and development and lack of drainage in the intensive system of fields and waterways. Medium sensitivity based on poverty and other welfare indicators; past experiences with flood events reduces sensitivity somewhat. Major implications are water-borne and vector-borne disease, food insecurity from loss of crops or income-generating assets.	High	Development of forecasting and early warning systems for flooding and vector-borne disease Construction of raised community flood shelters Strengthening existing dyke and waterway network Review and upgrade drainage capacity of fields and waterways Install raised rainwater tanks to provide emergency water during flooding
Salinity	Increased temperature and sea level rise likely to increase severity and frequency of salinity.	Very High exposure due to climate and sea level rise as well as lack of drainage in the intensive system of fields and waterways. High sensitivity because main income generation and food security are dependent on level of salinity. Major threats are water-borne and vector-borne disease due to lack of clean and fresh water especially during dry season, food insecurity from loss of crops or income-generating assets.	High	Review and upgrade drainage capacity of fields and waterways Build sluice gate and dyke to control sea water Install raised rainwater tanks to provide emergency water during dry season Shift seasonal calendars Introduce new varieties more resistant to salinity Shift to saline water farming and aquaculture Plant trees that can de-salinize the water
Storms	Increased intensity of storms are projected to hit the commune, associated with high waves and high tide.	Very high exposure due to climate and topography, temporary housing structure (accounting for 53% of houses) and poor road conditions (in many parts of villages, no concrete road, and small road can serve only motorbikes, no cars). High sensitivity because lack of coping experiences and capacity to respond to storms. Major threats are deaths and injuries caused by collapsed structures and sea water, water-borne and vector-borne disease, food insecurity from loss of crops or income-generating assets, damaged housing and infrastructure.	High	Development of forecasting and early warning systems for storms and vector-borne diseases Improve housing conditions of house construction Strengthen existing dyke and waterway network Review and upgrade drainage capacity of fields and waterways

Community Climate Story 5

Community Climate Story (CCS) activities are a next step to understanding vulnerability from the community perspective. Through a participatory process, this aspect of the USAID Mekong ARCC framework elucidates stakeholder concerns regarding their own experience and observations of climate change at the ground level. It also helps to characterize the community's biophysical and socio-economic context, livelihood options, and decision-making processes. As a result, CCS activities facilitate community-based analysis of climate vulnerabilities at the village level, and provide a platform to engage people in the process of understanding and preparing for climate risks. It is important to involve comparable numbers of male and female participants to gain a holistic understanding of vulnerability and the differing impacts of climate change on men and women. In cultural contexts where women are soft-spoken or passive, or where diverse populations exist (tribal, educational, religious), implementers may incorporate strategies to actively seek input through smaller focus groups.

In the practical implementation of CCS activities at the different pilot sites, the IPs utilized slightly different approaches responding to unique community aspects such as education level, culture, and political context. Generally, however, each approach followed a three-step process. *First,* IPs facilitated discussions among project participants around their key livelihoods, and helped them to identify financial, physical, and natural assets contained within and around their villages. *Second*, the participants utilized vulnerability assessment tools to measure and consider the threats of changing climate to these key assets and livelihoods. *Third,* communities further refined and prioritized vulnerabilities by ranking livelihoods, resources, and threat severity, and by considering potential adaptive countermeasures.

Specific CCS activities implemented at the pilot sites are presented below including: the Community/Village Mapping Exercises, the Prioritization of Livelihood Activities, the Seasonal Livelihood and Seasonal Hazard Calendars, the Historical Timelines referencing major events in the villages' histories (with special reference to events related to the environment, climate, or natural disasters), the Community Vulnerability Matrices, and the Climate Hazards and Problems Ranking.

Thuan Hoa Commune villagers participating in CCS activities.

Community/Village Mapping Exercises 5.1

The CCS process includes participatory mapping exercises to help communities visualize their geographic context and location-related vulnerabilities. These visual aids include village maps, resource and hazard maps, and transect maps. The village maps are the simplest, depicting general features of importance including village boundaries, housing areas, water sources, roads, and agricultural areas of importance. The village resource maps identify in more detail the important resource areas and assets that are significant to maintaining secure livelihoods and protection of important cultural aspects. The village hazard maps depict areas that are at higher risk from climate threats such as flooding or drought.

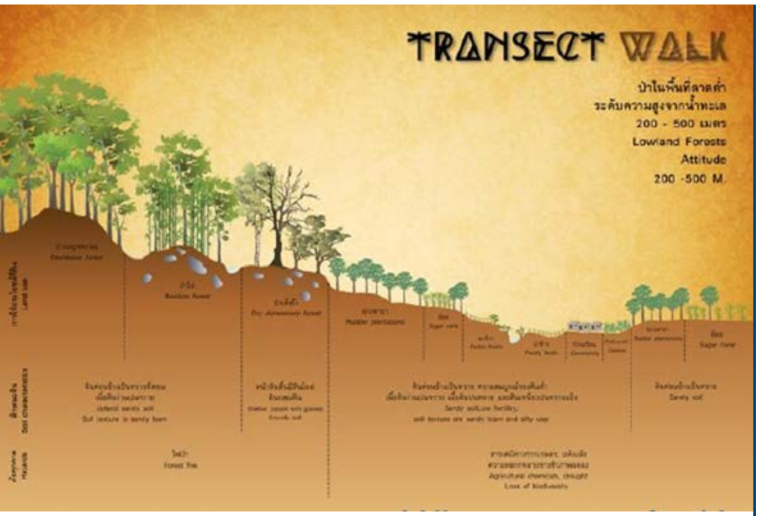


Figure 7. *Village transect map for Kok Klang Village in Sakon Nakhon Province, Thailand (IUCN Thailand Kok Klang Village Community Climate Story Report, May 2014)*

Transect maps provide an alternative snapshot of the community landscape, showing a rough approximation of topography, the location of natural resources, housing, crops, and other areas of importance. IP facilitators, village leaders, and other representative community members walk along a pre-defined, straight-line transect to collect information and form a map. As geographic and human-built conditions change, these shifts in landscape are noted along with their approximate distance along the transect line. The walk is also a good time to hold conversations and gather information from other community members who are engaging in their normal daily routines. The transect mapping activity ideally takes place over a three to four hour period. Figure 7 provides an example of a transect map created for Kok Klang Village in Sakon Nakhon Province, Thailand.

Taken together, these maps provide a visual overview of the landscape, terrain, key resources, and social structures within a community. They also serve to enhance understanding of a community's connection to and dependence on the surrounding environment and how geographic location can influence vulnerability to climatic factors.

5.2 Prioritization of Livelihood Activities

The desktop VA provides an initial analysis of livelihood importance within a target community, based on such means as baseline surveys and prior working knowledge of socio-economic conditions. Communities revisit the relative importance of key livelihoods as part of the CCS process. For example, in the six pilot communities of Khammouan Province in Lao PDR, CCS participants prioritized their most important livelihoods through a group activity as summarized in Table 5.

For comparison, the Vietnam IPs demonstrate an alternative way to consider prioritizing livelihoods using categories of **slightly important**, **important**, **very important**, or **critical** (Table 6).

Villagers from Khammouan Province in Lao PDR prioritize the most important livelihoods.

Table 5. *Prioritization of livelihood activities in six villages in Khammouan Province, Lao PDR (IUCN Lao PDR Community Climate Story Report, June 2014)*

Khoum/ sub-village	Ranking of the most important livelihoods in target villages of Khammouan, Lao PDR								
	1	2	3	4	5	6	7	8	9
Kouanesam	Grow rice	Livestock	Fishing	Grow Vegetables	Collect wild mushroom	Collect bamboo shoot	Hunting (bird and mouse)		
Vanghin	Grow rice	Livestock	Fishing	Grow Vegetables, corn and peanut	Collect wild mushroom	Collect bamboo shoot	Hunting (bird and mouse)		
Kouane	Grow rice	Livestock	Fishing	Grow Vegetables, tobacco	Collect wild mushroom	Collect bamboo shoot	Rattan, etc.		
Yang	Grow rice	Livestock	Garden[4]	Fishing	Collect wild mushroom	Collect bamboo shoot	Rattan, etc.	Hunting	Labor service
Donkeo	Grow rice	Livestock	Garden[5]	Fishing	Collect wild mushroom	Collect bamboo shoot	Rattan, etc.	Hunting	Labor service
Xong	Grow rice	Livestock	Fishing	Grow Vegetables	Collect wild mushroom	Collect bamboo shoot	Rattan, etc.	Labor service	

Table 6. *Major income sources for households in Thuan Hoa Commune, Kien Giang Province, Vietnam (AMDI Community Profile 2014)*

Income source	Level of importance for community income generation			
	Slightly important	Important	Very important	Critical
Shrimp				■
Crab		■		
Blood cockle		■		
Fish	■			
Rice	■			
Livestock	■			
NTFPs	■			
Casual labor		■		
Regular employment	■			
Business (shop, trader)	■			

[4] Vegetables, tobacco and corn.
[5] Vegetables, tobacco, corn and cucumber.

5.3 Seasonal Livelihood Calendar

Seasonal livelihood calendar shows the annual distribution of livelihood activities within a community, for example, rice farming, livestock raising, gardening, fishing, and NTFP collection. The calendars include notes regarding planting cycles, resource prevalence, and gender roles.

The following seasonal calendar (Table 7) shows the main livelihood activities of Khoum Kouanesam in Khammouan Province, Lao PDR throughout the year. Through village participation in constructing the calendar, the villagers noted livelihood activities applicable to men and women.

Table 7. *Seasonal livelihood calendar for Khoum Kouanesam, Lao PDR (IUCN Lao PDR, Community Climate Story Report, June 2014)*

Livelihood Description	Dry Season				Rainy Season							Dry
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rice production						PL[6] M	P+T MF	L MF	L MF	H[7] F	H F	H F
Livestock												
Fishing							XXX	XXX				
Grow Vegetables												
Collect wild mushroom				XXX	XXX	XXX						
Collect bamboo shoot					XXX	XXX	XXX	XXX	XXX	XXX		
Rattan			XXX									

Note: Under rice production: **PL** - Prepare land; **P** - Planting; **T** - Transplanting; **L** - Look after crop; **H** - Harvest; **M** - predominant task by males; **F** - predominant task by females;
Last 4 rows: Women collect wild mushrooms, vegetables, bamboo shoots and rattan.
XXX: heightened resource presence

5.4 Seasonal Hazard Calendars

Seasonal hazard calendars list each of the hazards facing a community and note the prevalence and severity of such hazards on a month-to-month basis throughout the year. Hazard calendars also capture rough demarcation points between seasons at a given location (e.g., dry, rainy, and hot seasons, etc.).

Table 8 illustrates the main climate hazards for Khoum Kouanesam, Lao PDR. By comparing hazard calendars with seasonal livelihood calendars, communities and IPs can make observations regarding the seasonal timing of livelihood vulnerabilities. For example, while droughts typically occur between March and May in Kouanesam, if one extends into June or July (as occurred during the 2014 and 2015 El Niño event) it can disrupt the normal planting and seeding schedule for rice cultivation, or cause an early crop to fail with potentially significant impacts on overall crop productivity.

[6] Land preparation includes plowing the soil and fencing which is the major task of men, however women also assist.
[7] Harvesting is the major task of women; however men are responsible for collecting rice and bringing to the home.

Table 8. *Hazard Calendar of Kouanesam (IUCN Lao PDR, Community Climate Story Report, June 2014)*

Events	Dry Season				Rainy Season							Dry
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flood							* *	* *	* *	* *		
Drought			* *	* *	* *							
Rainfall				* *	* *	* *	* *	* *	* *	* *		
High Temperature				* *	* * *							

Note: * - low; * * - medium; and * * * - high

Historical Timelines 5.5

The historical timelines list important and climate-related events that have occurred in the past as recalled by CCS participants. Among the events listed are village establishments, major infrastructure improvements, natural disasters, outbreaks of disease, and periods of unusual weather.

In the Chey Commune village of Koun Tnaot (Kampong Thom Province, Cambodia), for example, community members have observed an increase in the frequency of floods and drought since the 1980s, during which time non-climatic hazards also had a significant impact on livelihoods (the village was heavily mined during the civil war) (Table 9 below). Interestingly, participants in most villages linked observed soil degradation to the proliferation in chemical fertilizer application in the mid-1990s, mainly due to improper and excessive usage. In 2014, an intense drought from June to August caused damage to poultry, and an estimated loss from 40-50 percent of the vegetable and paddy areas.

Table 9. *Historical timeline for Koun Tnaot Village in Chey Commune, Kampong Thom Province, Cambodia (WFP Community Climate Story Report, July 2015)*

Period	Events
1984 to 1994	- Civil war continuing, heavily land-mined; - High yields from farming activities, most farmers did not use chemical fertilizers; - Plenty of wild fish available; - Predictable rains, droughts not intense.
1995 to 2004	- Soil quality noticeably deteriorated; - Small increase in frequency/intensity of droughts and floods; - Significant decrease in the availability of wild birds and fish.
2005 to 2014	- Droughts and floods increased in intensity; - Slow increase in availability of fish; - Increase in incidence of animal and human diseases; - Increase in outward migration; - Increase in indebtedness.

5.6 Community Vulnerability Matrix

The community vulnerability matrices illustrate community members' evaluations of the relative impact of climate hazards and disasters on specific livelihoods and resources. At the pilot sites, IPs asked participants to collectively evaluate the severity of such impacts, and in instances where agreement could not be easily reached, to take a vote to come to a final determination. The resulting data sets provide a window into the participants' general views as to which livelihoods and resources are most at risk in their communities, as well as to which of the climate hazards and disasters pose the greatest overall threat.

In Huai Kang Pla Village, Chiang Rai Province, Thailand, for example, villagers identified unusual rain, drought, increased rainfall, and diseases as the main climate-related threats impacting their community. Of these threats, unusual rain and drought were identified as the most significant to livelihoods and resources in the village. The most vulnerable livelihoods identified by the community were fruit orchards and livestock (Table 10 below).

Ranking community vulnerabilities in Loh Yo Village, Chiang Rai Province, Thailand.

Table 10. *Community vulnerability matrix for Huai Kang Pla Village, Chiang Rai Province, Thailand (IUCN Thailand, Chiang Rai Community Climate Story Report, June 2014)*

Livelihoods/Resources	Disasters and Climate hazards							Total score
	Unusual rain	Drought	Hail storm	Storm	Disease Epidemic	Hotter	More rain	
Upland rice yield	3	3	0	3	2	0	3	14
Livestock (chicken, pig, duck)	2	3	1	2	3	3	2	16
Maize yield	3	3	0	2	1	2	2	13
Water for consumption and use	3	3	1	0	2	0	3	12
NTFPs (bamboo shoot, mushroom, vegetables)	3	3	0	0	0	2	0	8
Fruit orchards (rambutan, pineapples)	3	3	3	2	2	2	3	18
Gingers	3	3	0	0	3	3	3	15
Total score	20	21	5	9	13	12	16	

Note: Vulnerability ranking: **0** - no impact; **1** - low impact; **2** - medium impact; and **3** - high impact

Scientific Climate Story, Shared Understanding, and Scenario Development

6

The third stage of the community adaptation planning process in the USAID Mekong ARCC framework involves three distinct sets of activities, 1) the Scientific Climate Story (SCS), 2) Shared Understanding, and 3) Scenario Development. In conducting these workshops, IPs draw on the same pool of villagers that participated in the CCS activities so as to build off prior sessions and to continue engaging with participants who had already committed time and energy to the process.

The ***SCS workshop activities*** involve a two-step process of review and education. Key aspects include:

- An overview of the findings from the Climate Study including projections (temperature, rainfall, drought, flooding, etc.) to 2050 and the results of the more localized VAs using visual aids.
- A general climate education presentation, discussing and clarifying the difference between weather and climate, illustrating impacts of climate on livelihoods, and quizzing the participants in a game-like format to ensure understanding.

The ***Shared Understanding exercises*** provide a synthesis of the information gathered from the Climate Study, the VAs, and the CCS activities. The general workflow proceeds as follows:

- Facilitators present projected vulnerabilities based on the information gathered from the Climate Study and desktop VAs, and then review with the participants the community-identified climate threats and livelihood vulnerabilities discussed in the CCS workshops.
- Next, in collaboration with the facilitators, participants explore the similarities and differences between the scientific- and community-derived vulnerability lists and discuss reasons for discrepancies.
- Facilitators give participants the option to re-rank or confirm their initial prioritization of climate threats and key vulnerabilities from the CCS.

Community members in Chiang Rai Province, Thailand review the findings from the Climate Study.

Finally, following the Shared Understanding exercises, facilitators work with participants to identify problems and needs of their communities, and through ***Scenario Development exercises*** produce the following results:

- A detailed step-by-step outcome mapping exercise considering the threats faced by the community against short-, intermediate-, and long-term solutions and adaptation options.
- A rough roadmap listing adaptation measures designed to set each village on a sustainable course to a community-defined ideal future.

Outcome mapping In Khammouan Province, Lao PDR

6. | Climate Education and Awareness-Raising

Because many rural villagers in the LMB have had relatively little formal education and are not accustomed to thinking beyond near-future timeframes, it can be challenging to improve their awareness and understanding of potential climate change impacts in their communities. SCS participants work through these obstacles by discussing key terms and foundational concepts such as exploring the notion of short-term weather conditions versus longer-term climatic patterns. Facilitators use a number of participatory tools to enable these discussions including videos, flip charts, drawings, and games. This approach helps community members evaluate how weather affects their work and lives on a daily, weekly, and even seasonal basis versus the bigger picture relevance of climate affecting larger livelihood options such as crop choices and other community investment decisions. Showing how climate is relevant to key crops (e.g., what can be grown given the usual temperature and rainfall patterns for a certain area) enhances community understanding of future implications when discussing climate change. Facilitators may quiz participants in a fun, game-like style to gauge the level of understanding and make adjustments to their workshop process as necessary. Drawings and cards also help to illustrate how specific climate factors influence community livelihoods or ecosystem vulnerability (Figure 8). In some communities in USAID Mekong ARCC sites for example, facilitators asked villagers to select a climate card and present to the group on how that climatic factor affected their livelihood.

Figure 8. ***Example drawings depicting climate threats in target communities.***

Villagers in Chey Commune (Kampong Thom Province, Cambodia) use drawings of climate impacts to discuss community vulnerabilities to climate change.

Comparative Analysis 6.2

Preparation for the **Shared Understanding** activities requires project facilitators to use information gathered from the Climate Study, desktop VA, and CCS. Flipcharts and tables are used for comparing climate threats identified by community members in previous sessions to the outlook from scientific projections. Furthermore, facilitators lead discussions to compare community-identified impacts on key livelihoods and ecosystems based on their ground-level experiences versus the scientific assessment of likely impacts based on the projection data. For example, scientific findings could show increases in precipitation leading to future waterlogging of critical NTFP areas thus reducing species availability and/or quality. The community, however, may not have highlighted this as a key vulnerability based on what they have experienced or observed to date. Such a discrepancy should be discussed and assessed as a group. Community participants re-prioritize self-perceived vulnerabilities based on the consideration of both community and scientific data that has been collected and presented. Table 11 shows an example of a re-ranking of climate hazards and their impacts on livelihoods in Thuan Hoa Commune, Vietnam as part of the SCS and Shared Understanding workshop.

Participants changed three hazard rankings over the course of the workshop. They explained that the education on the science-based livelihoods assessment and the scientific projections allowed them to see that temperature rise, flooding, and sea level rise will impact certain livelihoods more significantly.

Re-ranking of vulnerabilities in Thuan Hoa Commune, Kien Giang Province, Vietnam.

Table 11. *Hazard impact analysis on livelihoods, 8 I village in Thuan Hoa Commune, Kien Giang Province, Vietnam (AMDI Scientific Climate Story Report, November 2014)*

Hazards / Livelihoods	Prolonged heat	Abnormal rainfall	Increasing temperature	Flooding	Sea level rise	Salinity intrusion	Disease
Aquaculture: shrimp, crab, cockle	2	3	3	0 (3)	3	1	3
Mangrove forest and aquatic resource	2	0	0 (3)	0	3	1	3
Livestock (pig, duck, etc.)	2	3	2	0	1	0	3
Rice farming	3	2	3	3	0 (3)	3	3

Note: Red text indicates a re-ranked category at the end of the Shared Understanding exercises

6.3 Developing a Community Vision

Visioning exercises help people identify key aspects of their community that they want to protect and enhance, and at the same time identify key challenges and problems faced by their community. This component is an important precursor to developing specific adaptation strategies that aim to increase the community's resilience to climate change while also striving to reach the community vision. An example workflow follows:

1. Facilitators divide villagers into groups and ask them to write down on cards their understanding of the key challenges and problems facing their community. Depending on specific community characteristics, groups may be divided by gender or ethnicity to ensure equal participation.
2. Facilitators collect cards and group them together to identify common themes.
3. Facilitators ask villagers to identify needs in addressing these problems, followed by a subsequent grouping of common themes similar to the challenge identification.
4. Facilitators review the results of the problems and needs activities with villagers as a reconvened group and mark possible themes that could be supported through community adaptation activities.
5. Facilitators divide villagers into sub groups to create a community vision based on the common themes illuminated in the prior activities.

Guiding questions that may be helpful for participants in developing a community vision:

- What do you want your community to look like today?
- What are you doing today to address community needs? And what could you do better to address these needs?
- What do you dream to see in your community in 5 years?
- What do you dream for your children in their lifetime in your community and what can they do to achieve this in the near and long term?

Villagers work on their community vision in Thuan Hoa Commune, Kien Giang Province, Vietnam.

To develop a shared vision, facilitators ask each sub-group to write down their draft vision and read it out loud to the larger group. Facilitators underline key words of each group's statement that helps to combine themes for developing a single community vision. Facilitators then ask village leaders, respected elders, or anyone who would like to write, to combine the themes into one community vision.

"Ban Kouanesam has fertile soils, industrious farmers, strong community solidarity, reliable access road, beautiful forests, protection of ancient artifacts and places, advanced occupations, advanced educations, clean water available, stable electricity, good health, and the forest gibbon sings loudly across the Nadao rice fields." – Community vision from Ban Kouanesam, Khammouan Province, Lao PDR

"A harmonious community with healthy people, safe with no drugs on fertile and beautiful land and abundant forests, reduced use of agricultural chemicals, clean and adequate water, safe and sufficient food." – Community vision from Huai Kang Pla Village, Chiang Rai Province, Thailand

Outcome Mapping 6.4

Outcome mapping follows the visioning process and lays the groundwork for developing adaptation initiatives. Community members strategize specific steps to take to achieve long-term community goals. Community members consider three timeframes: now, over the next five years, and over their children's lifetime. In the case of the Lao pilot villages, the IP facilitators posted the community vision where workshop participants could easily reference while they brainstormed on activities and corresponding outputs over the three time scales. Figure 9 presents the results of the outcome mapping exercise in Ban Kouanesam.

Outcome mapping in Chiang Rai Province, Thailand.

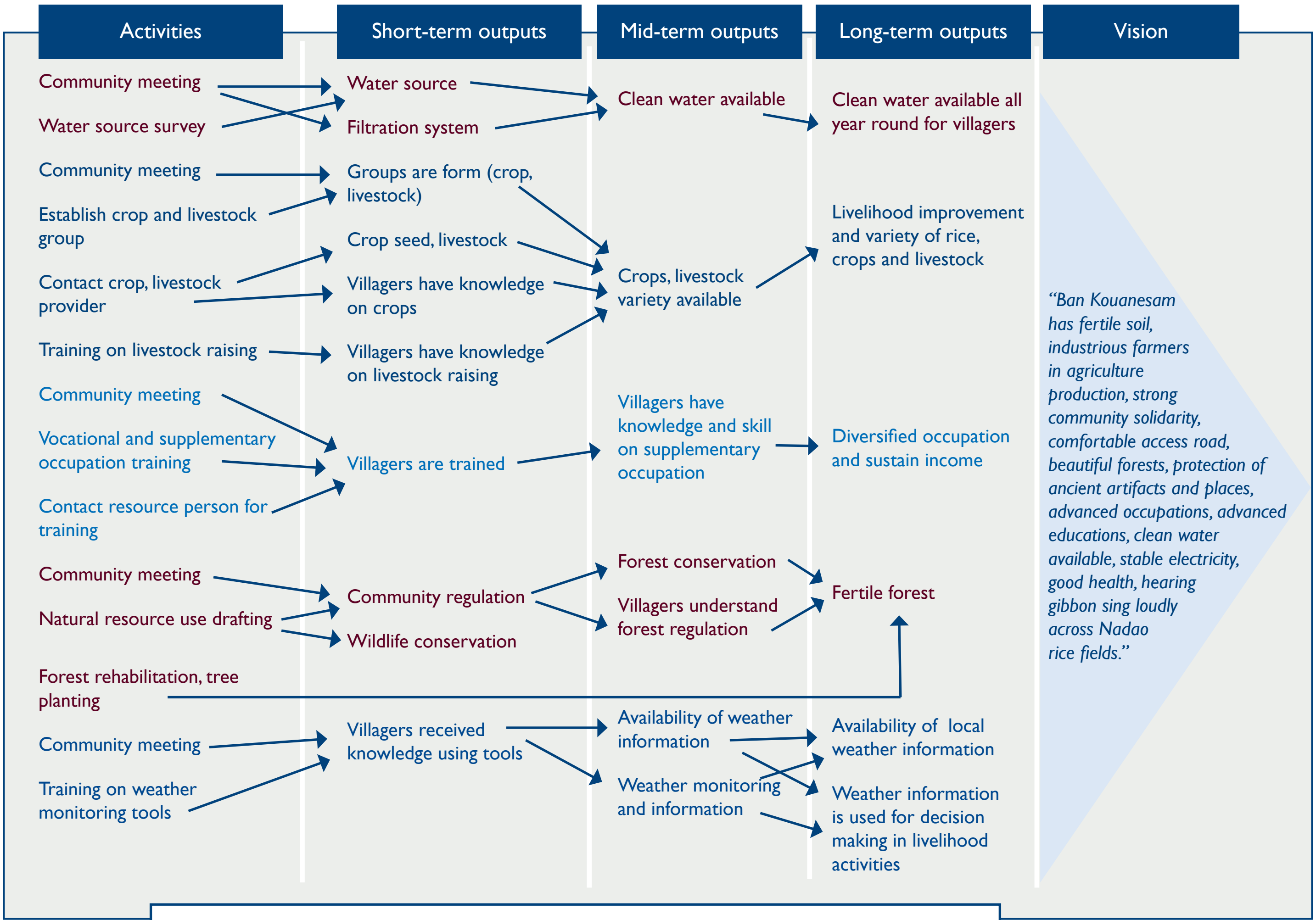


Figure 9: *Outcome Mapping in Ban Kouanesam, Khammouan Province, Lao PDR*

7 Implementation of Adaptation Plan

The USAID Mekong ARCC participatory framework to integrate top-down climate science with bottom-up local knowledge results in an increased awareness of climate impacts, and locally developed strategies to avoid, minimize, mitigate or otherwise prepare for those impacts. Based on the community assessments, project facilitators develop adaptation plans that are filtered through external technical expert analyses to ensure adaptation initiatives are good development and increase the climate change resilience of a community.

Adaptation projects implemented in the USAID Mekong ARCC pilot sites spanned a range of strategies that generally fit into six broad categories: ***Water Infrastructure and Management***, ***Climate Smart Agricultural Techniques***, ***Livestock Management***, ***Aquaculture***, ***Forest Restoration and Management***, and ***Community Organization and Capacity Building***. Descriptions of each of these categories follow.

Water Infrastructure and Management involves activities geared toward the construction or rehabilitation of water supply systems including the installation of water filtration systems, and the use of water meters to monitor and respond to community water use. This category also includes irrigation and flood control projects, e.g., canal construction to supply water to agricultural fields during dry periods and dyke construction to mitigate flood events.

Women and girls of Ban Xong Village, Khammouan, Lao PDR collect water and bathe in the evening from the newly constructed water tank and piping.

Climate Smart Agricultural Techniques incorporate practices that build resilience into farming systems such as crop diversification to reduce reliance on monocultures and the use of native rice and other crop varieties that can handle more extreme climatic conditions. Integrated farming approaches are used to conserve valuable soil and water resources, enhance positive feedback loops, and foster sustainability.

Participants in the Farmer Field School for System of Rice Intensification in Chey Commune, Kampong Thom, Cambodia transplant rice.

Livestock Management activities include the construction of housing that improves ventilation and drainage, and the incorporation of organic bed materials with enzymes to break down waste (bio-mattress). Projects also include the use of native chicken and pig species that can handle higher temperatures. Vulnerable groups (women, ethnic minorities, and landless poors) in particular benefit from the supplemental income generated by livestock projects, thereby increasing their resilience to climate change.

Piglets bred under an improved livestock management project in Chiang Rai, Thailand. The bed is made out of organic materials that can later be used as compost in home gardens.

Aquaculture activities include projects that improve the rice-shrimp rotational farming system in the Mekong Delta, such as installing shrimp nurseries to improve the productivity of the aquaculture ponds; monitoring water quality parameters including temperature, dissolved oxygen, and salinity levels to inform management decisions; and improving the selection, testing, and cooperative purchase of post larval shrimp. Other aquaculture projects include small-scale frog and catfish ponds to provide an additional protein and income source for households.

Small-scale aquaculture pond in Chey Commune, Kampong Thom, Cambodia.

Forest Restoration and Management builds community organization and social capital by the formation of management committees that protect and regulate use of community forests. Activities also include forest restoration plantings, and educational workshops on the use of mangroves to minimize erosion in coastal areas.

Local people in Sakon Nakhon Province conduct a community forest blessing ceremony in conjunction with tree planting activities to preserve ecosystem function.

Community Organization and Capacity Building activities include awareness-raising focused on climate change and adaptation, and monitoring the weather and interpreting weather forecast information. This category also includes the monitoring, evaluation, and adjustment of ongoing adaptation activities as well as the incorporation and mainstreaming of climate change adaptation into planning structures and processes. Additional training on alternative livelihoods reduces risk by diversifying income generation potential.

Mangroves planting demonstration in Thuan Hoa Commune, Kien Giang Province, Vietnam. Community members learn how to mitigate some of the impacts of sea level rise through bank stabilization with mangroves.

7.1 Adaptation Implementation by Site

Details of the activities implemented at each site are presented below.

7.1.1 Chiang Rai, Thailand

Climate change adaptation activities took place in the three pilot villages of the Mae Chan Watershed in Chiang Rai, Thailand (Figure 10, Chiang Rai Site Location Map): ***Loh Yo***, ***Hae Ko***, and ***Huai Kang Pla*** (the latter includes five satellite villages). Activities included the installation of water filtration systems in Hae Ko Village and two sub-villages of Huai Kang Pla; training and follow-on projects focused on integrated farming and crop diversification techniques; and the introduction of community forest regulations, and weather monitoring to inform farming and NTFP harvesting activities. Activity details for Chiang Rai are provided in Table 12.

Water filtration system installed in Hae Ko and Huai Kang Pla villages, Chiang Rai Province, Thailand.

Chiang Rai Adaptation Results Summary: As a component of the adaptation activities in Chiang Rai, IUCN Thailand invited an external panel of agricultural and livestock experts to visit the pilot sites and to evaluate the activities on five

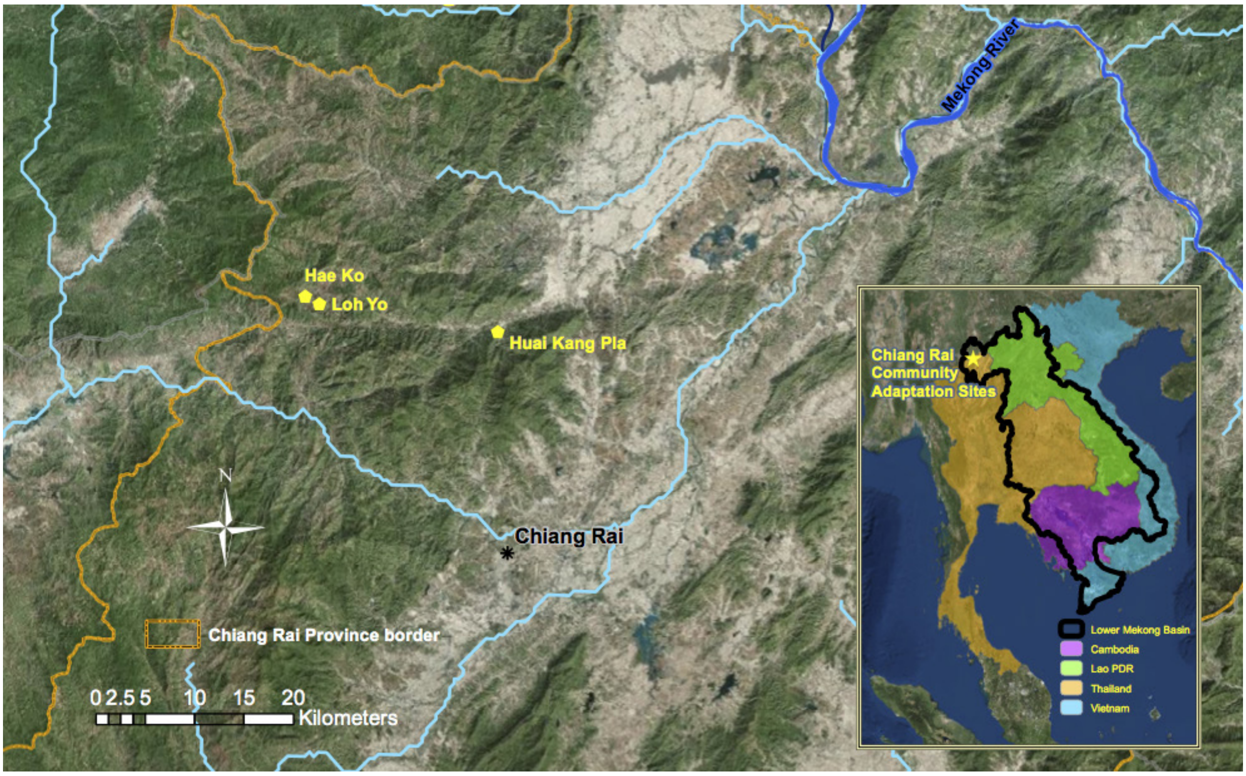


Figure 10: *Community adaptation sites in Chiang Rai Province, Thailand*

success factors: adaptive capacity, adaptive planning, inclusivity, sustainability, and replicability. The activities that scored the highest most consistently across these categories included the weather-monitoring project in Huai Kang Pla Village, the Assam tea integrated agriculture project in Loh Yo Village, the forest management activities in Hae Ko Village, and the chicken-raising activities in Huai Kang Pla Village.

In terms of the villagers' own viewpoints (expressed through an endline survey, n=147), the project participants in Chiang Rai indicated that the primary benefit of engaging in the adaptation activities was the supplemental income source that was provided. Traditionally, the villagers have focused their livelihood efforts on farming monoculture crops, putting them at higher risk of crop failure or reduced yields from climatic stresses. By diversifying their livelihoods, they mitigate the substantial risks that come with reliance on one crop.

Table 12. *Summary of adaptation activities in villages of Loh Yo, Hae Ko, and Huai Kang Pla, Chiang Rai, Thailand*

Infrastructure Improvements	Livelihood Diversification	Governance and Capacity Building
Water filtration system installed in Hae Ko Village.	66 households (HH) participated in raising black pigs: each HH received two pigs and constructed a pig pen with bio-mattress to generate compost and reduce pollution.	Villagers in all Chiang Rai pilot villages are monitoring adaptation activities to facilitate coordinated adjustment of activities over time according to performance.
Water filtration system installed in two sub-villages of Huai Kang Pla.	27 HH participated in producing eggs with layer chickens: each HH received 5 chickens with an average production of 4 eggs per day.	Weather monitoring station installed in Huai Kang Pla with three villagers trained to help inform decisions based on short-term weather conditions as well as longer term climatic patterns.
900 villagers have access to clean drinking water due to these new systems.	36 HH participated in raising black chickens for meat production.	Forest management committees were organized in Hae Ko and Huai Kang Pla to establish regulatory structures, and to plan and monitor restoration activities.
	93 HH participated in intercropping projects (e.g., Assam tea grown in the shade of fruit trees in Loh Yo).	
	14 HH participated in improved aquaculture activities.	

As one pilot farmer in Chiang Rai describes, "*We earn more income from raising pigs and can produce compost from their manure.*" And another stresses, *"Having more income sources helps to reduce burning (from monoculture)."*

Cost-benefit analyses have been conducted for the black pigs, chickens, and integrated agriculture activities based on data spanning the Chiang Rai and Sakon Nakhon project sites. These are presented under Section 7.1.2 (Sakon Nakhon, Thailand).

7.1.2 Sakon Nakhon, Thailand

Climate change activities took place in Kok Klang Village in Tao Ngoi District in Sakon Nakhon Province, Thailand (Figure 11, Sakon Nakhon Site Location Map). The community has historically depended on the nearby forest, cattle husbandry, and rubber plantations as primary subsistence and income-generating livelihoods. Water scarcity during the dry season in particular has been an on-going problem, requiring the community to truck in water for household use and severely limiting irrigated agriculture, and it is becoming worse with climate change. Adaptation activities included the establishment of a water committee, the installation of household water meters, and the introduction of water consumption charges to improve water conservation measures; the establishment of a forest management committee to develop and enforce regulations for harvesting forest products; and integrated farming activities including raising native livestock and crop varieties more suited to the shifting climate; and improved organic waste management and recycling systems. Activities are summarized for Kok Klang Village in Table 13.

Kok Klang Adaptation Results Summary: The expert panel that toured the Chiang Rai pilot communities also evaluated project activities in Sakon Nakhon, examining the same factors related to adaptive capacity, adaptive planning, inclusivity, sustainability, and replicability. The activities that scored the highest most consistently across these categories included native rice production, chicken-raising, and growing the forest vegetable *pak wan*. From the villagers' perspective, the improved water system and increased water supply was the number one benefit of the project.

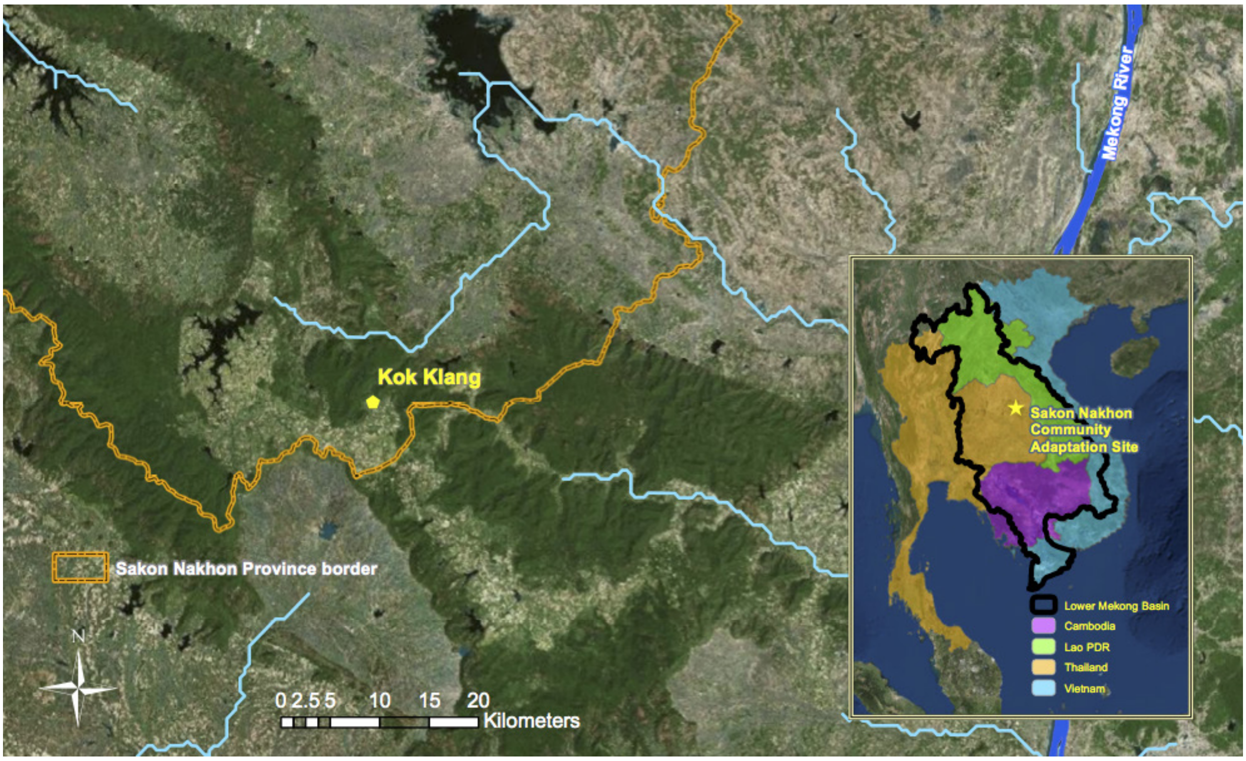


Figure 11: *Community adaptation site in Sakon Nakhon Province, Thailand*

Table 13. *Summary of adaptation activities in Kok Klang Village, Sakon Nakhon, Thailand*

Infrastructure Improvements	Livelihood Diversification	Governance and Capacity Building
Water tower constructed and pipelines repaired.	13 households (HH) each received two pigs and constructed a pig pen with bio-mattress to generate organic compost and reduce pollution. In the last quarter of the project (Jan-Mar 2016), 40 piglets were successfully bred. Livestock group formed to sustain activities through village livestock fund.	Weather monitoring system installed in Kok Klang School; two teachers trained and monitoring weather conditions to better inform decision-making; information disseminated to community through students.
Water meters installed in Kok Klang households to monitor water use and provide basis for fee structure.	12 HH each received 10 chickens with an average production of 8 eggs per day. Eggs used for HH consumption (protein source) and sold for cash income.	Villagers monitoring adaptation activities to facilitate coordinated adjustment of activities over time according to performance; 8 villagers initially participating.
	27 HH raised black chickens, a variety that is more resilient to high temperatures. 4-6 chickens were given to each HH, which had an 85% survival rate.	Forest management committee established and functioning. Community restoration planting day organized and conducted. Signboards with forest regulations installed. Fire prevention activities conducted.
	15 HH participated in testing native rice varieties as an alternative to traditional rice strains. 5.5 tons of native rice was produced, and seeds of 25 native rice varieties were collected for future use.	Community waste bank committee (five representatives) established and functioning; villagers can sell and earn money from recyclable waste.
	Kok Klang villagers cultivating *pak wan*, an NTFP vegetable that yields a high market price.	Water committee established and monitoring water use. Management regulations, including fee structure in place.

Growing native rice in Kok Klang Village, Sakon Nakhon Provin ce, Thailand.

One Kok Klang participating villager expressed, "*We have developed water sources, improved the management system and set up the water management fund. For the first time, we have water to use in the dry season!"* Another villager described, *"Water is crucial for us. (The project) has finally solved the problem we have had for a long time."*

Cost benefit analyses have been developed for activities including pig raising, chicken raising, and integrated farming (Boxes 1-3). Data collected from both Chiang Rai and Sakon Nakhon, Thailand have been used in the analyses.

Cost-Benefit Considerations for Raising Black Pigs in Chiang Rai and Sakon Nakhon

The table below compares the profitability of the black pigs raised on the bio-mattress and modified pig pen systems with traditional pig raising techniques. The average numbers used for the traditional pig raising system are based on interviews and focus group discussions with villagers who are familiar with both the traditional and modified pig raising techniques.

Table 14. *Cost-benefit comparison of traditional vs. modified pig raising system (USAID Mekong ARCC and IUCN Thailand, Raising Black Pigs (Mu Lum), 2016)*

	Traditional pig raising system	Modified system (with improved breed selection and feed, vaccination, and water on demand system)
EXPENDITURES	Piglet (10 kg) THB 1,200 Material THB 1,500 Feed (5 months) THB 2,000 *Total cost THB 4,700*	Piglet (12 kg) THB 2,000 Material THB 770 Water system THB 200 Feed (5 months) THB 1,230 Vaccination THB 100 *Total cost THB 4,300*
INCOME	Sale of pig (80 kg) THB 5,000 (or used for consumption) *Total income THB 5,000*	Sale of pig (80 kg) THB 5,000 (or used for consumption) Sale of compost THB 1,200 (or used in own fields) *Total income THB 6,200*
PROFIT OR LOSS	Profit per pig THB 300 (US$ 8)	Profit per pig THB 1,900 (US$ 53)

Explanations:

Input costs

- The cost of piglets is higher in the improved system, as the project, in collaboration with its partners, carefully selected a native breed that is more tolerant to heat and more resistant to disease. If the farmers breed the pigs to produce offspring, the input cost will be reduced and therefore the profit increased (and the farmers can get additional income from the sale of piglets).
- The cost of feed can be reduced through the use of local feed sources such as banana stems, elephant ear *(Colocasia esculenta)*, papaya, corn, pumpkin, taro, sweet potato leaves, rice bran, and young shoots of grass with high protein content (not old grass stalks with high cellulose content). Traditionally, the farmers mainly used concentrate feed and some local feed sources, but did not select them based on their protein content and did not improve the nutritional value through fermentation (a technique they learned from the project).
- Materials costs can be reduced through the use of locally available materials to construct the pig pens, including bamboo, rice husks for the mulch pit, etc. In the traditional pig raising system, the villagers mainly use pig pens with concrete floor that are more expensive to build.

The main economic benefits of the system seem to come from the reduced costs of feed and from the sale or use of compost. In addition, there are important non-quantified benefits such as reduced risk of losses, increased resilience and improved quality of soil through field and garden application of pig pen compost.

Cost-Benefit Considerations for Raising Black and Layer Chickens in Chiang Rai and Sakon Nakhon

The tables below highlight the costs and benefits of the chicken projects in Chiang Rai and Sakon Nakhon. There also are additional non-quantified benefits from livelihood diversification such as reduced risk of losses, increased resilience and self-reliance, and improved food security.

Costs of vaccinations have not been included in this analysis as they were provided for free by the Livestock Offices in the pilot sites. It is important that villagers consult with local livestock extension officers before starting to introduce new chickens.

Table 15. *Cost-benefit analysis of raising black chickens (USAID Mekong ARCC and IUCN Thailand, Raising Black Chickens and Layer Chickens, 2016)*

	Black chickens		
EXPENDITURES	6 chickens (3 months) @250B	THB	1,500
	Material	THB	430
	Feed (5 months)	THB	1,050
	Total cost	*THB*	*2,980*
INCOME	Sale of 24 chicken offspring @ 200B	THB	4,800
	after successful breeding of an average of 4 chicks per chicken and raising for 4-5 months (or used for consumption)		
	Total income	*THB*	*4,800*
PROFIT OR LOSS	Profit for 6 chickens	THB	1,820
	(after 5 months)		(US$ 51)

Table 16. *Cost-benefit analysis of raising layer chickens (USAID Mekong ARCC and IUCN Thailand, Raising Black Chickens and Layer Chickens, 2016)*

	Layer chickens		
EXPENDITURES	6 chickens (16-18 weeks)	THB	1,200
	Material	THB	320
	Feed (20 months)	THB	3,730
	Total cost	*THB*	*5,250*
INCOME	Sale of eggs (144 eggs per month for 19 months, @ 3 baht per egg) (or used for consumption)	THB	8,208
	Total income	*THB*	*8,208*
PROFIT OR LOSS	Profit for 6 chickens	THB	2,958
	(after 20 months)		(US$ 83)

Note: A period of 19 months, which corresponds to the average lifespan of chickens laying eggs, has been used. An average egg laying rate of 80 percent has been used in this calculation. It is also assumed that the chickens do not lay eggs in the first month.

This analysis shows that a longer return of investment is required for layer chickens (or a larger number of chickens to reduce costs through economies of scale). Thus, raising black chickens at small scale may be more profitable than raising layer chickens due to the high sale price of black chickens vs. the smaller income potential from selling eggs. However, the two activities can be combined in order to increase the self-sufficiency and the diversity of protein sources in the community.

Cost-Benefit Analysis for Diversified Agriculture in Chiang Rai and Sakon Nakhon

The table below compares the market price and income from traditional crops with those for sample alternative crops and rice varieties grown through the pilot activities (shaded grey in table). The numbers are based on interviews conducted with villagers and officials in Chiang Rai and Sakon Nakhon. This analysis is intended to be a starting point for discussion. To further analyze the cost details (particularly of inputs of fertilizer, insecticide, and labor) a separate study would need to be conducted.

Although the market price of the individual crops cannot be compared easily without knowing the expenditures and yields per hectare, the table is intended to provide comparable data on the market value of the crops introduced by the project. For instance, native rice, Assam tea, and pak wan are high-value crops for which demand is expected to remain high in the future. As such, they represent a way not only to diversify income and adapt to climate change but also to increase household income.

Table 17. *Market price analysis of traditional and alternative crop varieties (USAID Mekong ARCC and IUCN Thailand, Agricultural Diversification, 2016)*

Product	Market price (in baht/kg)	Additional information
Commercial rice varieties	14	Income per rai: THB 6,125 (one crop per year as non-irrigated) Cost per rai: THB 4,075
Maize	5-6	Can grow two crops per year Income per rai: THB 5,000-6,000 Maize yields were much reduced in 2015 due to a lack of rainfall; however higher prices have partly offset the lower production.
Rubber	40-60	Price is variable (depends on market price and government subsidies)
Cassava	2-3	Income per rai: THB 25,000
Sugarcane	0.7-0.8	Average production: 10 tons per rai
Assam tea	40-80 (for fresh leaves)	Demand (especially from China) is expected to remain high in the future. Assam tea is more marketable than Chinese tea because it is sought after by large commercial bottled tea companies e.g. Oishi and Ishitan. Also, it is becoming more popular among Chinese drinkers as it is believed that Chinese tea contains more chemicals used in planting and processing. Cost of seedling: THB 7-10 Survival rate in Loh Yo in 2015: 70% The harvest of leaves may begin when the Assam tea plant is 2-5 years old, and reaches maximum production at age 7-10 years. The economic life of the plant is about 40 years.
Pak Wan *(Melientha suavis)*	300	Harvest during Feb–May (dry season), when many other crops cannot be grown without irrigation, and labour usually is abundant.
Native rice varieties	40-80	Can be marketed as high-value rice variety

The value and importance of healthy forests and soils in the agro-ecological landscape should also be considered when evaluating the costs and benefits of employing integrated agricultural techniques (e.g., Assam tea grown under fruit trees and pak wan vegetable grown sustainably in forest shade).

7.1.3 Khammouan, Lao PDR

Implementing partner IUCN – Lao worked with six sub-villages in Nakai District of Khammouan Province, Lao PDR (Figure 12, Khammouan Site Location Map). The communities are very remote with limited resources and are largely cut-off from main transportation routes during the rainy season. Most of the villagers engage in subsistence farming and livestock-raising. Climate change adaptation activities included the construction of site-specific water supply system upgrades in three of the sub-villages comprising both new and rehabilitated gravity-fed systems in addition to storage tanks, water distribution taps, and improved wash platforms. Additional activities included the construction of small-scale catfish and frog ponds for 10 households of Ban Kouane Sam Village, and associated training on management techniques (for 25 villagers); and the establishment of a forest protection and regulation team. Water improvement activities are summarized in Table 18 for the three villages that partook in improved infrastructure projects.

Construction of small-scale fish pond in Kouane Sam Village, Khammouan, Lao PDR.

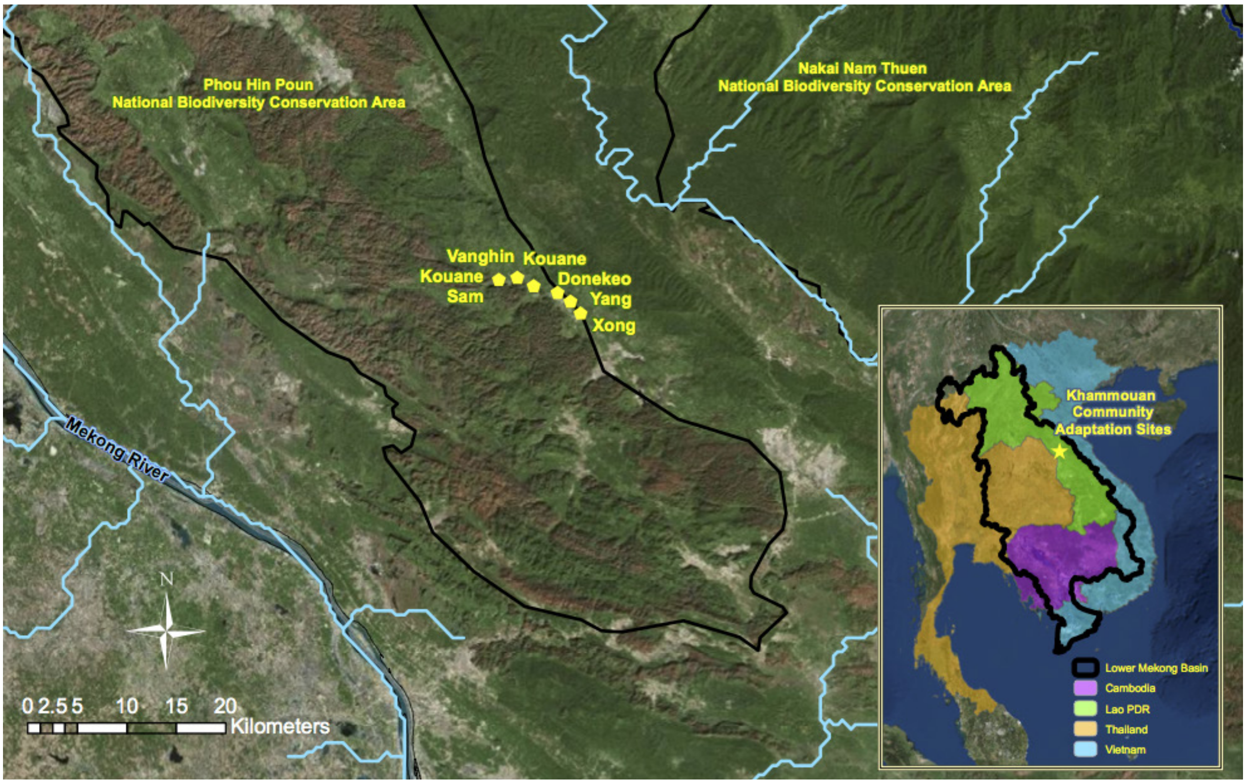


Figure 12: *Community adaptation sites in Khammouan Province, Lao PDR*

Table 18. *Summary of Water Improvement Activities in Nakai District, Khammouan Province, Lao PDR*

Ban Xong Village	Ban Yang Village	Ban Donkeo Village
Rehabilitation of existing pipeline in Ban Xong Village (approx. 593 residents) – new intake structure with stone weir, reinforced concrete structure, and basic filtration; 15 reinforced concrete columns along unsupported sections of pre-existing pipeline; 10,000 L concrete storage tank with 3 taps; 5 m x 4 m concrete wash platform with improved drainage,	Rehabilitation of existing pipeline in Ban Yang Village (approx. 407 residents) – relocation of intake structure with basic filtration; 20 reinforced concrete columns along unsupported sections of pre-existing pipeline; replacement of damaged and leaking pipe sections; retrofitting of pre-existing (but not yet used) 11,000 L concrete storage tank with 3 taps; 5 m x 4 m concrete wash platform with adequate drainage.	Construction of a new gravity fed water system in Ban Donkeo Village (approx. 396 residents) including construction of a stone masonry weir at the intake location, a reinforced concrete intake structure with basic filtration, a 3.4 km pipeline, a break-pressure tank, a 10,000 L concrete storage tank, and five distribution tap stands.

Nakai District Adaptation Results Summary: The difficulty in transporting construction materials into the valley was a primary challenge in implementing the water supply improvement projects in the three sub-villages in Lao PDR. The unpaved road into the valley where the communities are located becomes dangerous and impassable during the rainy season. At other times of the year, transportation of construction materials is still difficult and costly. The villagers provided a significant amount of labor carting materials along routes in the valley that were inaccessible by trucks and cars. For similar future initiatives, the project evaluators recommend careful planning to adequately anticipate the timeframe and costs that are associated with such remote, and difficult-to-access project locations.

The catfish and frog pond activities also met difficulties due to the remote location of the pilot communities. The juvenile frogs and catfish fingerlings that were purchased to stock the small-scale ponds had a high mortality rate due to the distance they had to be transported, the vehicle used, and the packing density. Suggested modifications include transporting during early morning or night to avoid heat, and easing the transition into the ponds by placing the juveniles in their plastic bags in the ponds for 30 minutes prior to their release. In addition, more intensive supervision and monitoring would have been useful as many of the participating villagers lacked the skills to trouble-shoot on their own. Despite the challenges in implementing these activities, participants reported a general interest in continuing with the small-scale frog and catfish production as it provides a good source of protein and a potential income-generation opportunity. Non-participating neighbors have started replicating the project in their own homes, and so have others from nearby communities.

Villager in Ban Donkeo, Khammouan, Lao PDR draws water from one of five tap stands connected to nearly 4000 meters of pipeline and distribution lines installed by USAID Mekong ARCC .

7.1.4 Kampong Thom, Cambodia

Implementing partner World Food Programme (WFP) worked with six communities of Chey Commune in Kampong Thom Province, Cambodia. The site is situated in the lowland plains between the Tonle Sap Lake to the southwest and the Mekong River mainstream to the east (Figure 13, Kampong Thom Site Location Map). The commune is highly migratory, and many leave for seasonal labor opportunities to supplement household income. As a result, WFP facilitators found it difficult to maintain consistency with project participants. Climate change adaptation activities in Chey Commune included the construction of a canal to store water for household/domestic use and some irrigation during periods of drought, as well as the construction of two dykes to manage extreme flood events during the rainy season and to provide additional water storage capacity.

Additionally, villagers were trained in climate-resilient techniques including the system of rice intensification (SRI) to explore water-saving technologies for their main subsistence crops. The project also supported the construction of 72 household fish ponds and 136 compost pits. Activities are summarized for the Chey Commune pilot villages in Table 19.

Home garden project in Chey Commune, Kampong Thom Province, Cambodia.

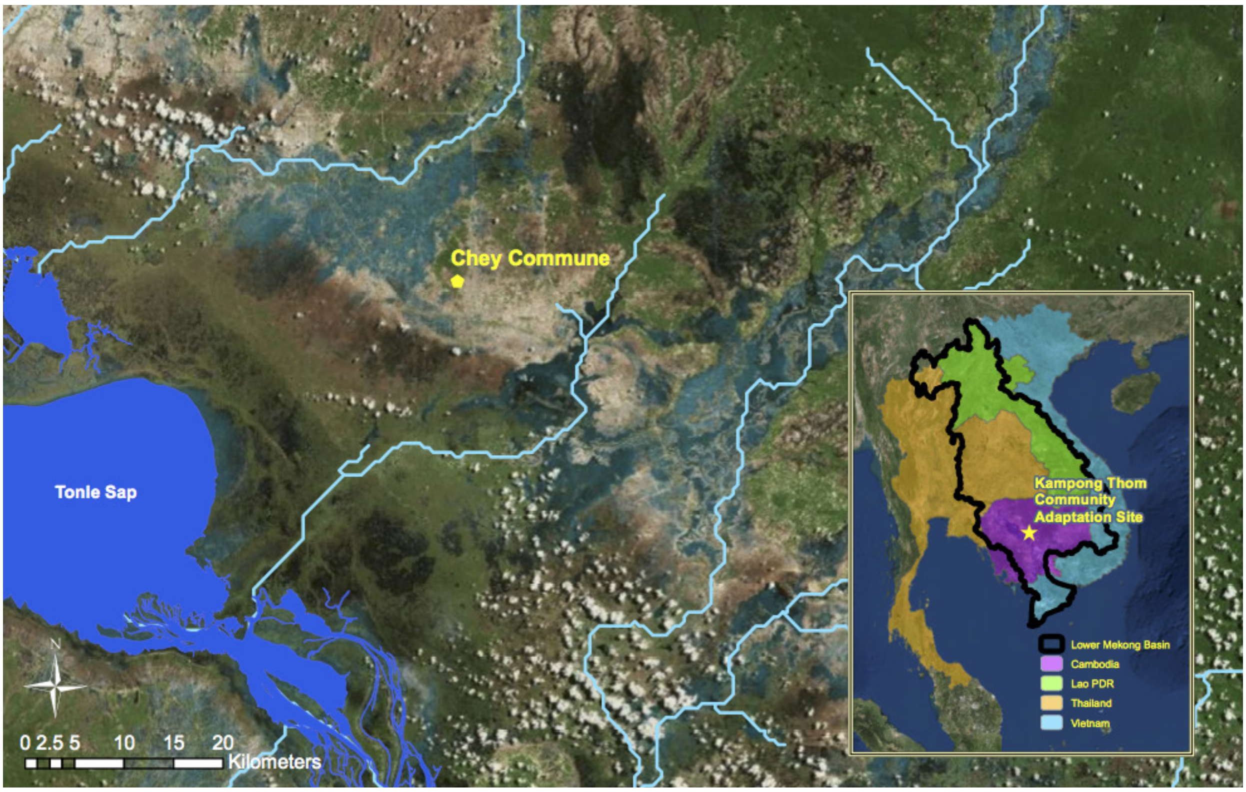


Figure 13: *Community adaptation site in Kampong Thom Province, Cambodia*

Table 19. *Summary of adaptation activities in Chey Commune, Kampong Thom Province, Cambodia*

Infrastructure Improvements	Livelihood Diversification	Governance and Capacity Building
Two dykes constructed in Trapeang Areak Village to serve the dual purposes of (1) water storage for agricultural production and (2) protection of fields from flooding.	72 fish ponds constructed as a component of Farmer Field School (FFS) trainings.	420 households participated in climate change awareness and drought educational workshops.
One irrigation canal constructed in Ta Theav Village to support agricultural production during dry periods. The canal serves 450 ha of agricultural land.	129 compost pits constructed as a component of FFS trainings.	FFS training in System of Rice Intensification (SRI) practice and Integrated Farming Systems (IFS). 129 farmers from six villages participated.
Six solar stations installed to support household level water infrastructure projects.		12 model farmers to provide tours and education relating to household IFS projects.

System of rice intensification (SRI) practice in Chey Commune, Kampong Thom, Cambodia.

Chey Commune Adaptation Results Summary: This section provides an evaluation of the following project components completed in Chey Commune: large-scale water infrastructure (specifically, the two dykes and one canal); household-level IFS training and activities (e.g., aquaculture ponds, home gardens, and compost pits); and the SRI activity.

The two dykes and one irrigation canal directly address water management needs that had been identified by the community as high priority. However, because of their relatively high construction costs, their replication (and potentially larger maintenance issues in the future) may require external support mechanisms.

The household-level IFS projects (small-scale aquaculture ponds, compost pits, and vegetable gardens) were highly beneficial in terms of their direct contribution to poor and vulnerable groups. They were also quite successful in that other community members, who were not direct beneficiaries of the project, replicated the activities on their own based on observed benefits; this occurred most notably with the aquaculture ponds and home gardens. The gardens offered a supplemental nutrition source for project participants and also provided alternative income generation. For challenges, the compost pits did not generally provide sufficient material for home gardens. Also, the ponds were being stocked with wild feed that may ultimately deplete natural resources in an unsustainable manner. As a result, additional training and monitoring for the household-level projects, particularly the compost making and ponds, would benefit their long-term usefulness and sustainability.

IFS training participants enhanced their adaptive capacity by producing master plans for the household-level projects that aimed to increase their resilience over time. In addition, 12 "model farmers" were selected to provide additional guidance on IFS techniques to the larger community, thereby scaling out the benefits of receiving the training. Migration was identified as a challenge, however, as some beneficiaries ultimately dropped out of the training program due to their need for outsourcing themselves for labor. Project evaluators suggested a better selection process for determining who would be the most effective beneficiaries of this training program.

The SRI activity encountered a few obstacles, related to (1) a late start to the project, which caused the initial planting of seedlings to be out of sync with the rainy season cycle, (2) the sandy soil conditions of the commune, and (3) the extreme drought and heat wave of El Niño, which produced difficult growing conditions during the life of the project. Despite these challenges, there is potential for success in the future if villagers are able to continue the project due to the lower inputs required such as fertilizer and seed. Ideally the SRI activity would be implemented over a three-year cycle so that participants could fully realize its benefits.

Villager in Chey Commune, Kampong Thom, Cambodia displays her master plan for establishing an integrated farming system to diversify livelihood options at the household level.

7.1.2 Kien Giang, Vietnam

Climate change adaptation activities took place in four out of eight villages in Thuan Hoa Commune in the Mekong Delta province of Kien Giang, Vietnam (Figure 14, Kien Giang Site Location Map). The coastal farming community is highly vulnerable to sea level rise and salinity intrusion. Adaptation strategies focused on improvements to the rice-shrimp farming system, diversification of livestock management, awareness-raising and training for mangrove restoration, installation of loudspeakers for communications and disaster preparedness, and mainstreaming of climate change adaptation into commune planning. Specific improvements to the rice-shrimp rotational system included the introduction of temporary nurseries to increase robustness of shrimp prior to their release into the ponds; training and capacity building around water quality monitoring in the aquaculture ponds; and

Nursery installation in rice-shrimp pond in Thuan Hoa Commune, Kien Giang, Vietnam.

the incorporation of salt-tolerant rice and sedge species into the farming system. Activities are summarized for Thuan Hoa Commune in Table 20.

Kien Giang Adaptation Results Summary: Aspects of the modified rice-shrimp system were received well by farmers. Despite the concurrent El Niño heat wave that caused massive shrimp fatalities

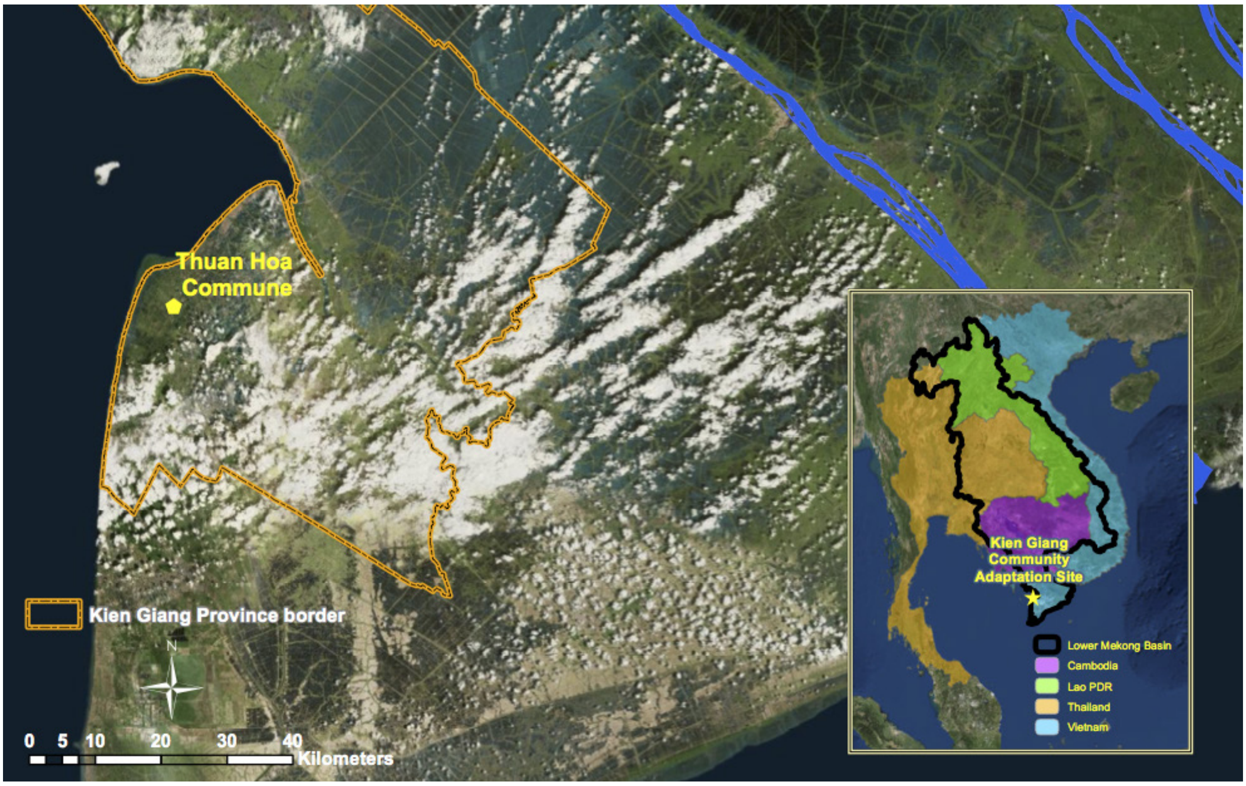


Figure 14: *Community adaptation site in Kien Giang Province, Vietnam*

Table 20. *Summary of adaptation activities in Thuan Hoa Commune, Kien Giang Province, Vietnam*

Infrastructure Improvements	Livelihood Diversification	Governance and Capacity Building
Loudspeaker installed in commune as an early warning system for extreme weather events and to facilitate information about weather and water quality conditions.	33 HH covering 56.5 ha participated in the modified rice-shrimp model including temporary nursery installation and improved post larval shrimp purchase. Farmers also tested salt-tolerant rice and sedge species.	Commune officers trained in water quality monitoring of salinity, oxygen, and temperature in aquaculture ponds to inform management decisions.
	10 HH participated in pig production on bio-mattress project. 2 piglets were given to each HH along with Standard Operating Procedures (SOPs) and logbook. Farmer training day with livestock experts.	2 workshops provided on mangroves and their importance for bank erosion control. Educational planting demonstrations.
		Climate change adaptation being incorporated into the Social Economic Development Plan at the commune level.

throughout the Mekong Delta in April-May of 2015, 74 percent of the pilot farmers in Thuan Hoa Commune reported increased survival rates of post larval shrimp in December of 2015. 58 percent of participants reported increased income, and 71 percent reported an expected increase in future income if they continued using the modified rice-shrimp model. Popular components included the low cost of incorporating the nursery into the aquaculture pond using local materials, and that no land conversion was required to modify the system. Over 80 percent of the participants plan to continue using the modified model, with nursery installation the priority modification. (While planting salt-tolerant rice was part of the piloted activities, there was minimal success due to the extreme conditions of the El Niño heat wave and drought.)

Farmers participating in the pig project had more mixed reviews. While they generally profited by raising pigs on the bio-mattress, their profits were lower than what they experienced previously using a traditional concrete-floor pen. Seven out of 10 participants reported that they would not continue using the bio-mattress in the future. Benefits reported included less labor inputs and water use, as they did not have to routinely flush out the pigpens as they do with the traditional, concrete-floor system. However, they had problems with the bio-mattress becoming too wet and not composting properly. The wetness was likely due to the roofs of the pens not being constructed properly and allowing rain to come through. Also, the elevation of the floor was too low for some of the pens resulting in flood damage and rising moisture. Finally, some of the drinking systems leaked, which exacerbated the wetness problem. In conclusion, project evaluators determined a need for more training and monitoring during the course of the pig project in Thuan Hoa to have been able to avoid and respond to problems more adequately.

Improved post larval shrimp purchase was an important component of the modifications of the rice-shrimp system in Kien Giang, Vietnam

8 Lessons Learned from Adaptation Implementation

USAID Mekong ARCC's field-testing of integrative adaptation decision-making followed by implementation of pilot activities across five at-risk sites in the LMB revealed a number of important lessons. First, In order to be successful, ***community adaptation options must show an economic gain.*** This could take the shape of lower input costs as was found with the pig raising activities in Chiang Rai, which used locally available feed options instead of purchasing higher-priced feed from external sources. The bio-mattress set-up in the pig pens also provided additional income through sale of manure. In Sakon Nakhon, farmers increased the revenue from their rice crops by growing native strains that had higher market value.

Non-quantifiable benefits related to increased food security and nutrition are also important. For example, farmers participating in the chicken and small-scale aquaculture projects gained an additional and steady protein source through eggs, meat, frogs, and fish. Home gardens were also quite successful in some communities such as in Chey Commune in Cambodia, enhancing the nutrition of diets at the household level.

Small shifts to existing systems are more likely to be replicated as they generally involve less risk and are therefore more attractive to neighboring farmers and/or other communities. For example, in Kien Giang, Vietnam, the farmers talked positively about the modifications to their rice-shrimp practice because they did not require land conversion or major changes to their existing aquaculture ponds. The popular nursery component involved a simple netted structure that was easily added to the pre-existing pond footprint at low cost. Post-project surveys within the Vietnam pilot community indicated that these modifications to the rice-shrimp system would be followed after the project ended in large part due to their easy incorporation into the existing system. Furthermore, neighbors who were not directly participating in the USAID-funded activities began replicating aspects of the modified rice-shrimp system before the project ended.

On the flip side, the larger scale water infrastructure projects in both Chey Commune, Cambodia and Nakai District, Lao PDR would not easily be replicated by other communities in similar situations without significant external support, for example, from government agencies or other international aid organizations. These projects were costly and required a high level of logistical coordination. While they will have significant positive impact on the adaptive capacity of the benefitting communities, they involved more substantial technical and financial assistance from outside sources.

Training and capacity building are critical for enhancing community knowledge and adaptive behaviors. Farmer field schools and other educational platforms allow for continued adaptation following project closeout. However, it is important to screen beneficiaries to avoid involving community members who cannot complete training programs due to seasonal migration and other constraining factors. Also, involving "model farmers" and influential community members to help facilitate on-going training and dissemination of knowledge post-project enhances longer-term sustainability.

Project cycle is a key factor influencing success. In the case of USAID Mekong ARCC, the adaptation implementation component of the project occurred in large part during the 2015 El Niño event, which resulted in drought and extreme heat across the region. Because most of the activities lasted for roughly one year, some of the projects failed due to the extreme weather scenario. A more suitable timeframe for many of the projects would be three years. This would also allow for continued monitoring and supervision of many of the shorter-term projects that would be good to follow-up on in order to enhance their sustainability.

There are many other important ***co-benefits from the adaptation activities*** that were implemented in the target villages. For example, the sustainable land use practices applied in many of the pilot sites reduce reliance on monoculture systems and the associated impacts to soil fertility and agro-biodiversity. Examples of these sustainable practices include: the introduction of native rice species, the system of rice intensification, and the creation of organic pig pits that generate compost to fertilize fields. Monocultures require large inputs of chemical fertilizers and pesticides, leading to soil degradation, and thus reduce the value and resilience of land for agriculture. It is therefore critical to maintain healthy soils through sustainable land use. Integrated and organic agricultural practices, such as those promoted in many of the pilot sites:

- Build soil structure and soil fertility;
- Rehabilitate poor soils and bring degraded soils back into productivity;
- Reduce the financial risk of farm operations as farmers are less dependent on external inputs; *and*
- Increase agro-biodiversity, which builds resilience to storms, heat and increased pest and disease pressure.

There are also ***substantial long-term benefits provided by maintaining healthy forests*** related to their role in providing critical ecosystem services such as provision of food, fresh water and fuel, watershed protection, air quality maintenance, storm protection, and cultural aspects of recreation, spirituality, and aesthetics.

References

AMDI (2014) Awareness Survey Report.

AMDI (2014) Community Profile.

AMDI (2014) Scientific Climate Story Report, Thuan Hoa Commune, Kien Giang Province, Vietnam.

AMDI (2014) Vulnerability and Capacity Assessment Report, Thuan Hoa Commune, Kien Giang Province, Vietnam.

IUCN Thailand (2014) Vulnerability and Capacity Assessment Report, Chiang Rai, Thailand.

IUCN Thailand (2014) Kok Klang Village Community Climate Story Report, Sakon Nakhon Province, Thailand.

IUCN Lao PDR (2014) Community Climate Story Report, Khammouan Province, Lao PDR.

IUCN Thailand (2014) Chiang Rai Province - Community Climate Story Report, Thailand.

IUCN Thailand (2015) Cost-Benefit Analysis for Raising Black Pigs.

IUCN Thailand (2015) Cost-Benefit Analysis for Agricultural Diversification.

IUCN Thailand (2015) Cost-Benefit Analysis for Raising Black Chickens and Layer Chickens.

WFP (2015) Community Climate Story Report, Chey Commune.

USAID (2013) USAID Mekong ARCC Climate Change Impact and Adaptation Study for the Lower Mekong Basin: Main Report. Prepared for the United States Agency for International Development by ICEM - International Centre for Environmental Management. Bangkok: USAID Mekong ARCC Project.

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