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

Lessons from Implementing Adaptation Plans in the Lower Mekong Basin

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Lessons from Implementing Community Adaptation Plans in the Lower Mekong Basin

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ACRONYMS

AMDI	Asian Management and Development Institute
DAI	Development Alternatives, Inc.
DAEC	Department of Agricultural Extension and Cooperatives, Lao PDR
ICEM	International Centre for Environmental Management
IPs	Implementing Partners
IUCN	International Union for Conservation of Nature
LMB	Lower Mekong Basin
NTFPs	Non-timber forest products
USAID	United States Agency for International Development
USAID Mekong ARCC	USAID Mekong Adaptation and Resilience to Climate Change
WFP	the United Nations World Food Programme
WRI	World Resources Institute

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EXECUTIVE SUMMARY

Climate change will significantly affect the Lower Mekong Basin (LMB). Climate scientists predict that rising temperatures, heavy rainfalls, floods, droughts, and sea level rise will increase in frequency. Such changes will have a negative impact on lives and livelihoods affecting more than 42 million people who especially live in rural areas and depend on agriculture. Estimates show 7-30 percent of rural GDP could be affected due to climate change. Therefore, increasing people's ability to cope and plan for climate change is an important task.

In an effort to increase adaptive capacity of people in rural areas, the USAID Mekong ARCC project brought together communities and implementing partners to co-design and implement adaptation plans in five sites around LMB. The USAID Mekong ARCC sites are located in Vietnam, Cambodia, Lao PDR, and Thailand. The overall aim of this report is to capture lessons learned from implementing the adaptation plans over the course of 2015. The report targets government agencies and donors who would like to know what adaptation activities reduce vulnerability in order to help scale such activities. The report also targets project implementers so that they are aware of the various barriers and enabling factors that can influence successful implementation of adaptation projects. The report analyzes community adaptation plans across all five sites, USAID Mekong ARCC quarterly reports, and findings from interviews with project implementing partners in all four countries.

The report starts by identifying the various threats that people face in the USAID Mekong ARCC sites. All sites except in Lao PDR face the threat of temperature rise and heat stress. Droughts are common in mostly Thailand, Lao PDR and Cambodia. However, countries such as Thailand and Lao PDR also face the threat of high levels of precipitation and flooding. Sea level rise and salinity is unique to Vietnam namely because the project site is located on the coast. The year 2015 was a particularly dry year, with above average temperatures due to El Nino. Therefore, El Nino may be a factor that has influenced the extent to which communities benefited from adaptation activities in USAID Mekong ARCC sites.

Communities and implementing partners applied a range of adaptation activities through the USAID Mekong ARCC sites to help farmer cope with and plan for climate threats. A common choice across the target communities was to adopt some form of agriculture diversification or modification strategy to reduce vulnerability. This includes introducing integrated farm management where farmers combine a variety of activities such as breeding heat tolerant livestock, planting saline tolerant crops, composting, and building fishponds. Water management is the second most important adaptation strategy among farmers in USAID Mekong ARCC target communities. Water management involves creating water storage and a distribution system that helps people efficiently use water and reduce water waste. Forest management that includes improved governance over forest resources and use of climate information for early warning was only significant in Thailand and Vietnam respectively.

Based on the various adaptation activities implemented, governments and donors should invest in the following adaptation activities:

- ***Livelihood diversification or modification to adapt to climate change is the most common strategy among farmers across the USAID Mekong ARCC sites.*** Diversification/modification enables farmers to protect their crops and livelihoods by planting flood resistant crops and breeding heat tolerant livestock.
- ***Water infrastructure to improve water distribution, storage and quality is a promising way to combat drought and heavy rainfall.*** Small-scale water infrastructure that distributes and stores water enables farmers to have access to water during times of droughts. Heavy rains and flooding can contaminate water sources but filtration systems have enabled communities to have access to safe drinking water.
- ***Forests control water flows, reduce landslides, improve soil condition, and provide non-timber forest products, which can help adapt to effects of climate change.*** Because forest contributes significantly to ecosystem services that help regulate water flow and soil quality, they are an effective way to adapt to climate change. Forest products also offer a source of income to many communities.
- ***Establishing early warning systems can reduce potential climatic disasters***. Advanced early warning systems through loudspeakers can reduce loss of lives and infrastructure. Dissemination of weather information helps farmers plan farming activities.

To successfully implement adaptation activities, project planners need to be aware of the following enabling factors and barriers that could either help or hinder implementation of adaptation activities:

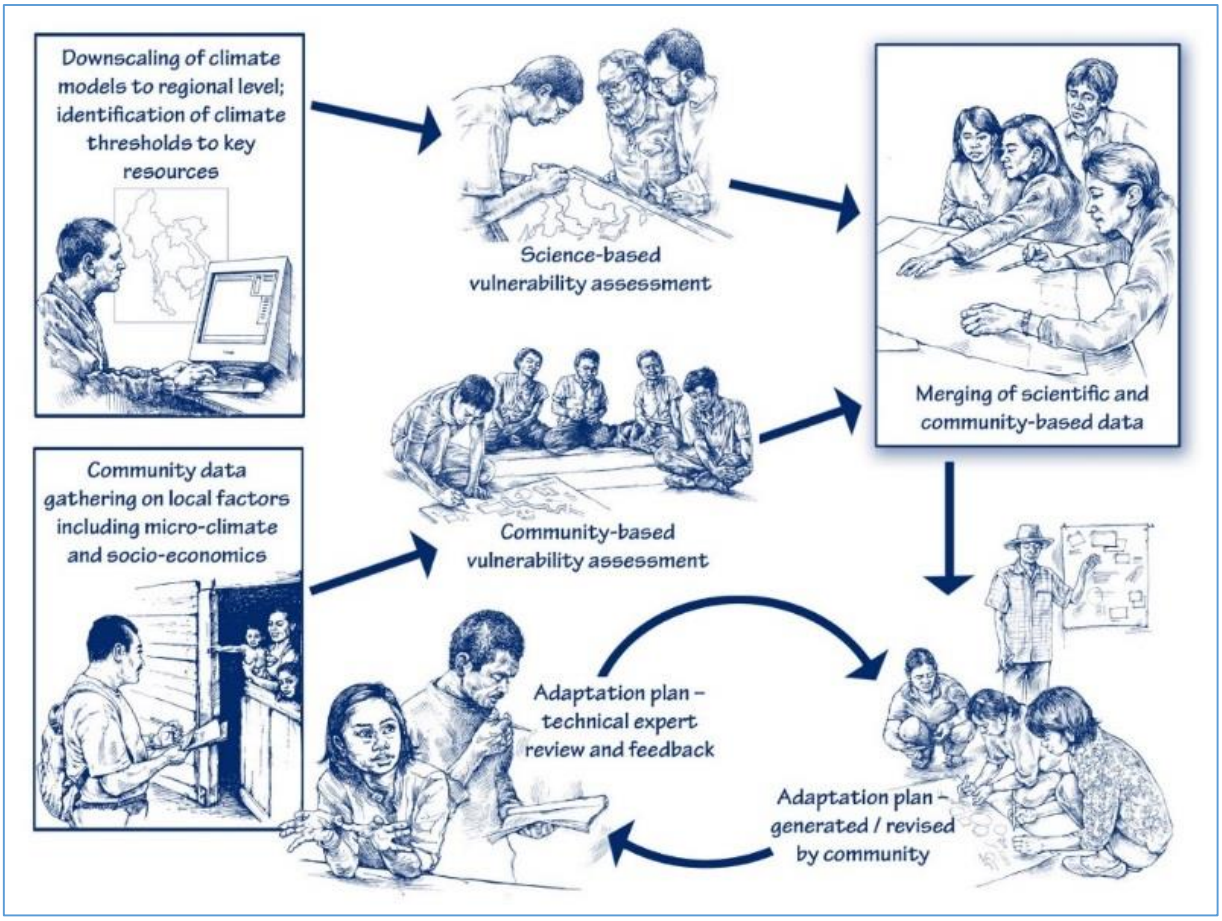
- ***Training and knowledge dissemination is a critical enabling factor in adopting adaptation strategies related to livelihood diversification/modification.*** Farmers across all five USAID Mekong ARCC sites received formal training by agriculture experts and weather forecasters. Without training and knowledge dissemination, farmers would not be aware of certain agriculture practices and benefits of early warning systems that help protect their livelihoods in the face of climate change.
- ***Partnerships between the government and communities are an essential enabling factor.*** Partnerships are critical across all sites in USAID Mekong ARCC. Partnerships are especially strong when there is clear alignment between government policies and needs of communities.
- ***Community engagement in the adaptation activity leads to community support.*** Perhaps the most important partner in an adaptation project is community members. Project implementers need to work very closely with communities to build support for an adaptation intervention.
- ***A key barrier has been financial costs and low return on investments***. Farmers incur financial costs when switching from one variety of crop or livestock to a new variety. Low return on investment when taking up a new agriculture practice due to low market prices for an agriculture product may be a barrier to adopting livelihood diversification. Therefore, activities must make financial sense to farmers.
- ***Remoteness of communities can be a barrier to managing water and engaging with communities.*** Communities located in remote areas make engagement with farmers difficult. Remoteness also makes implementation of adaptation options costly. Therefore, project implementers need to factor in transaction costs of helping people in remote areas adapt to climate change.
- ***Lack of participation is a barrier to governing water and forests.*** Farmers are busy due to a wide variety of reasons, and therefore, they may not have the time or the means to engage in water or forest governance. This may affect the sustainability of management committees. In such situation, project implementers will need to identify community champions who are dedicated to help govern common resources.

1. INTRODUCTION

Climate change impacts in the Lower Mekong Basin (LMB) will result in significant changes in temperature and rainfall, as well as sea level rise by 2050. The USAID Mekong ARCC Climate Change Impact and Adaptation (USAID Mekong ARCC) study predicts that by 2050, annual precipitation will increase during the already wet, rainy season (ICEM 2013). More rain will cause flooding, which will be compounded by sea level rise in coastal areas. The study also states that LMB will face drier conditions during the dry season, increasing the annual period of drought, despite the overall increase in total annual rainfall. Average temperatures are expected to increase between 2 to 4 degrees Celsius. Based on climate vulnerability assessments in the study, climate change "will seriously affect the lives and livelihoods of more than 42 million people in the basin who depend entirely on agriculture" (ICEM: 27). Estimates show that the annual value of worker productivity, infrastructure services, agricultural output, hydroelectric power and ecosystem services are at risk from climate change and could lead to at least $16 billion loss per year. This translates into roughly 7–30 percent of rural gross domestic product in the LMB (Talberth 2015). Such assessments suggest that climate change is a significant and urgent concern in the LMB.

In an effort to increase adaptive capacity of people in rural areas of the LMB to the impacts of increased temperature, rainfall, and sea level rise, the USAID Mekong ARCC project brought together communities and implementing partners (IPs) to co-design adaptation plans (Chaudhury 2015). The process by which adaptation plans were created started by conducting science based vulnerability assessments that included downscaling and localizing climate projections. At the same time, IPs collected community level data on livelihoods and microclimates through community based assessments that utilized participatory tools to identify community assets, and map annual agricultural production cycles. Communities and IPs also constructed climate calendars, and historical climate timelines to describe trends in both climate and non-climate hazards. IPs worked with community members at the site level to develop these 'community climate stories' and then merged scientific and community based data. Community climate stories were developed through an iterative process where communities and implementing partners revised the assessment of climate impacts and livelihood threats, leading to the creation of adaptation plans to address identified vulnerabilities. Figure 1 below depicts the steps involved in developing the adaptation plans. Communities and IPs implemented the adaptation plans across five sites in Thailand, Vietnam, Cambodia, and Lao PDR covering approximately 30,000 people.

Figure 1: Process of Developing Adaptation Plans



Source: USAID 2014c

The overall aim of this report is to capture lessons learned from implementing the adaptation plans over the course of 2015. The audiences for this report are government agencies and donors who would like to know what adaptation activities reduce vulnerability in order to help scale such options, and project implementers who want to be aware of the various barriers and enabling factors that can influence adaptation projects. The report starts with identifying climate threats people in rural areas of the USAID Mekong ARCC project sites face in section 2. Section 3 describes the adaptation activities implemented in communities under USAID Mekong ARCC project to reduce climate vulnerability. This section also identifies enabling factors and barriers to implementing the adaptation activities. Section 4 ends by identifying adaptation activities that governments and donors should support. It also highlights the barriers and enabling factors for project planners so they are aware of what influences the success of adaptation projects.

The reader should be aware that the adaptation activities implemented during 2015 occurred during an El Nino year, which posed extra challenges. El Nino is a result of increase in temperature in the Pacific Ocean, which leads to changes in weather patterns. In the Mekong region, El Nino has led to increase in warm temperatures and droughts, which has negatively affected agriculture and fisheries. Droughts have continued in the Mekong region over 2015 and may intensify in early 2016 (Khem 2016). El Nino may be

a factor that has affected the extent to which project beneficiaries have benefited from the adaptation activity due to unusual drought like conditions and high temperatures in LMB.

This report analyzes information from community adaptation plans and USAID Mekong ARCC quarterly reports, and integrates findings from interviews with IPs in all four countries. International Union for the Conservation of Nature (IUCN) in Thailand and Lao PDR, Asian Management and Development Institute (AMDI) in Vietnam, and the United Nations World Food Programme (WFP) in Cambodia make up the IPs.

2. CLIMATE CHANGE THREATS

Numerous climate threats affect farmers' livelihoods in LMB. This section describes the climate threats identified in the community climate stories at the site level and scientific study at the province level. Overall, the community climate stories and scientific findings from the USAID Mekong ARCC Climate Change Impact and Adaptation Study (ICEM 2013) strongly match in their predictions of climate change in USAID Mekong ARCC sites.

2.1 TEMPERATURE RISE AND HEAT STRESS

Temperatures throughout the LMB are increasing (USAID 2014b). Temperatures in 2015 in particular have risen due to the El Nino effect. In the Chiang Rai and Sakon Nakhon Province in Thailand, climate projections suggest that by 2050, there will be a 2°C increase in annual mean temperature, which may lead to water shortages in the dry season (ICEM 2013). Although the scientific study highlights an increase in temperature as a key threat, communities in Chiang Rai and Sakon Nakhon project sites did not identify increase in temperature as threat (IUCN 2014 a, b). In Chey Commune in Cambodia, scientific study projects a 2°C to 4°C increase in daily maximum temperatures (ICEM 2013). Under climate change, daily maximum temperatures will typically exceed 35°C in March-April, which will have serious effects on crops, livestock, and other livelihood sectors. Heat stress, due to temperature rise during the dry season in Cambodia will also affect the productivity of non-timber forest products, which many people in rural areas rely on for their income and subsistence purposes (USAID 2014a). Community climate stories in Cambodia support this finding from the scientific study (WFP 2015a). In Thuan Hoa Commune in Vietnam, community climate stories state that people feel temperatures are increasing, which links to findings from the scientific climate study that predicts a 3-degree increase in annual temperatures by 2050. Heat stress in particular will be an issue in Vietnam affecting agriculture production (AMDI 2014a).

2.2 DROUGHTS

In Chiang Rai and Sakon Nakhon, Thailand project sites, communities identified droughts during the dry season as a key climate vulnerability, which the scientific study in Chiang Rai but not in Sakon Nakhon supports (IUCN 2014 a, b). Although communities did not identify drought in Sakon Nakhon, they identified lack of water in the dry season that may be linked to droughts. Scientific study reveals that in Chey Province in Cambodia, droughts will occur at the end of the dry season, which will affect the availability of critical fisheries habitat because water availability will decrease between 3 percent and 10 percent during the dry season (WFP 2015b). Community climate stories also reveal that people are concerned with more intense and longer droughts in Cambodia (WFP 2015a). In Khammouan Province in Lao PDR, daily maximum temperatures will increase by 2°C to 3°C by 2050 that could lead to drought (ICEM 2013). Drought is the most prevalent concern among communities in the Lao PDR site since it affects rice production and creates water shortages (IUCN 2015a).

2.3 HIGH PRECIPITATION, VARIABLE RAINFALL, AND FLOODS

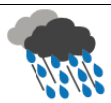
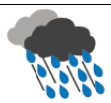
Thailand will face an increase in annual average precipitation by 9-18 percent in Chiang Rai and 21 percent in monthly precipitation in Sakon Nakhon (ICEM 2013). This could lead to an increase in flash floods, landslides, and waterlogging. In Chiang Rai, communities in the project site have already begun to identify "unusual rain", which is defined as unpredictable and erratic (IUCN 2014a). In Sakon Nakhon, however, communities in the project site did not identify increase in precipitation a threat (IUCN 2014b). Similarly, Khammouan Province in Lao PDR also faces the risk of floods and flash floods as the mean annual precipitation increases, especially in the wet season. Community stories in Khammouan reveal the same concern with flash floods, which could affect fisheries, non-timber forest product collection, and casual labor (IUCN 2015a).

2.4 SEA LEVEL RISE & SALANITY

Typhoons, storms and flooding occur frequently in Vietnam. In addition to these threats, most people in Thuan Hoa Commune, located on the coastal plain of the Mekong Delta, are susceptible to sea level rise due to very low elevation. Salinity will especially affect coastal areas of Vietnam where salinity intrusion will become an issue during the dry season from January to April. Increase in salinity could lead to a reduction in rice production from three to two rice crops per year. Without saline-tolerant varieties, rice yields could decrease by almost 50 percent in the case of mild saline water intrusion (USAID 2014d). Community identification of increase in water salinity as a threat corresponds to the scientific study analysis that suggests there will be increase in salinity in coastal areas of the province, especially in ponds and fields (AMDI 2014a). Sea level could rise by 30cm by 2050 leading to salinization of irrigation canals and paddy soils, affecting rice production and inland fisheries (AMDI 2014b).

Table 1 below summarizes the various threats that USAID Mekong ARCC project sites will face. According to table 1, all sites except in Lao PDR face the threat of temperature rise and heat stress. Droughts are common in sites in Thailand, Lao PDR and Cambodia. However, people in sites in Thailand and Lao PDR also face the threat of high levels of precipitation and flooding. Sea level rise and salinity is unique to Vietnam namely because the project site is located on the coast.

Table 1: Climate Threats in USAID Mekong ARCC Project Sites[1]

	Temperature & Heat Stress	Droughts	Precipitation & Flooding	Sea Level Rise & Salinity
Sakon Nakhon Province, Thailand				
Chiang Rai Province, Thailand				
Nakai District, Lao PDR				
Thuan Hoa Commune, Vietnam				
Chey Commune, Cambodia				

Icon source: IPCC 2014

[1] Because of the large number of adaptation options implemented in Thailand, the two sites are disaggregated.

3. PRIORITIZED ADAPTATION ACTIVITIES

Most of the target communities in USAID Mekong ARCC project sites choose to use a suite of adaptation activities to reduce vulnerability to climate change. Interviews with IPs suggest that adaptation activities primarily fall into four categories: livelihood diversification/modification, water management, forest management, and use of climate information. The author asked IPs to rank the adaptation activities that communities in the project sites viewed as most important. Table 2 below shows the adaptation activities implemented and ranked across project sites in Cambodia, Laos PDR, Thailand, and Vietnam that addresses temperature rise and heat stress, precipitation and floods, droughts, and sea level rise. For a full list of adaptation options implemented under USAID Mekong ARCC, see Annex B.

Table 2: Adaptation Categories and Options in USAID Mekong ARCC Project Sites

Adaptation Categories	Adaptation Options	1	2	3
Livelihood Diversification/ Modification to Address Temperature Increase and Heat Stress, Droughts, Heavy Rains, and Floods, and Sea Level Rise	Integrated farm management	- Cambodia - Thailand – Chiang Rai	- Vietnam	- Thailand – Sakon Nakhon
	Fish Ponds		- Laos PDR	Cambodia
	Integrated shrimp-rice farm with salt tolerant rice	-Vietnam		
Water Management to Address Droughts & Water Contamination	Water Storage & Distribution System	- Laos PDR - Thailand – Sakon Nakhon		
	Dikes & Canals		- Cambodia	
	Water Quality Monitoring			- Thailand– Chiang Rai
Forest Management to Address Droughts & Heavy Rains	Forest Governance		- Thailand – Sakon Nakhon - Thailand – Chiang Rai	
Use of Weather Information for Adaptation Planning	Early warning systems			- Vietnam
	Weather Monitoring			- Thailand- Chiang Rai and Sakon Nakhon

A common choice by the target communities across all five USAID Mekong ARCC project sites is to adopt some form of livelihood diversification or modification strategy to reduce vulnerability. This includes introducing integrated farm management where farmers combine a variety of activities such as breeding heat tolerant livestock, planting saline tolerant crops, composting, and building fishponds. After livelihood strategies, water management is the second most important adaptation strategy among farmers in USAID Mekong ARCC target communities. Water management involves creating water storage and a distribution system that helps people efficiently use water and reduces water waste. Forest management that involves improved governance over forest resources and use of climate information for early warning was only significant in project sites in Thailand and Vietnam respectively. The sub-sections below describe the adaptation activities in detail, how the activities address climate threats, and the enabling factors and barriers to implementing adaptation activities.

3.1 LIVELIHOOD DIVERSIFICATION/MODIFICATION

Project-supported farmers across the five ARCC Mekong sites chose livelihood diversification/ modification as a common means to adapt to climate change. This took the form of planting heat tolerant crops, intercropping of fruit trees and tea plants, and introducing new species that are more heat tolerant or saline resistant. Crop diversification reduces the risk of major or total crop loss and maintains food security during floods and droughts. Crop and livestock diversification is part of an ecosystem-based adaptation approach to increase the resilience of the agro-ecological farming system in villages while diversifying village incomes (IUCN 2015b).

a) Adaptation Activity: Integrated Farm Management

THAILAND

USAID Mekong ARCC targeted farmers in Sakon Nakhon and Chiang Rai Provinces depend heavily on agriculture for their livelihoods. However, due to climate change, traditional crops no longer support livelihoods. Farmers in these villages have learned techniques that support crop and livestock diversification by participating in trainings given by government agricultural institutions. The trainings showed farmers sustainable agricultural practices, such as growing native rice varieties that can withstand floods and breeding heat tolerant black pigs and chickens. Farmers learned to use organic material as a 'bio-mattress' in the livestock pens. The manure mixed with the organic compound produces fertilizer. Farmers then learned how to remove the organic fertilizer to use on their crops or increased their income through selling. Many farmers are also planting Assam tea integrated with fruit trees on their farms, which are both more heat tolerant. Diversifying into new agricultural crops such as planting lemon, rattan, and coffee

Climate smart pig raising in Kok Klang Village, Sakon Nakhon.

enables farmers to diversify risk of crop loss and be more resilient in the face of increasing rainfall and temperatures, which were among the key threats in the provinces.

Training on growing new crops and raising livestock have been the strongest enabling factor in adopting a variety of heat and drought tolerant crops and livestock (IUCN interview, November 18, 2015). In order to make other farmers aware climate smart agriculture practices, farmers who attend the training sessions disseminated their knowledge from the training to other farmers in the village. Although these crops are helping many farmers adapt to climate change, many are still involved in large-scale monoculture activities that provide higher incomes compared to small scale integrated farming techniques that help adapt to climate change. Therefore, it remains to be seen whether farmers continue to diversify their crops, which does not contribute significantly to their income.

VIETNAM

In Vietnam, USAID Mekong ARCC targeted farmers who raised pigs to diversify and protect their livelihoods from increase in temperatures and heat stress, and adopted bio-mattresses to prevent water contamination related to raising pigs (AMDI 2014a)[2]. The bio-mattress pig pits are part of an integrated system that provides several indirect benefits to strengthening climate change adaptation. For example, farmers use material from the organic litter bed as natural compost for vegetable gardens and fruit trees, leading to decrease in chemical fertilizer use, and improvement in soil health. Soil stability is critical, particularly during the rainy season where extreme rainfall can create soil instability. Through AMDI partners in USAID Mekong ARCC targeted sites, households in Thuan Hoa Commune received training on the bio-mattress pilot activity and 10 farmers received piglets (2 piglets per farmer) to raise on bio-mattress. Both men and women are involved in pig raising activities, and therefore, benefited from this activity equally.

Farmers also received training on monitoring health of pigs and quality of bio-mattress. The commune vet and Vietnam Red Cross officer are the local staff responsible for providing support to farmers. AMDI is in regular communication with commune-level support staff to ensure farmers follow good practices and address issues that may come up (AMDI 2015a). Therefore, training and support given to farmers has been a significant enabling factor in adopting this practice. The value of pigs, however, is low due to competition from other countries exporting pigs to Vietnam. Low profits may be a barrier to scaling up breeding of pigs and use of bio-mattresses. Both governments and donors, however, are interested in helping to reduce water contamination from farms, and therefore, bio-mattresses as a way to reduce water contamination could still be supported in the future (AMDI interview, November 2015).

CAMBODIA

In Chey Commune of Cambodia, USAID Mekong ARCC targeted farmers have been facing droughts that have affected their food security. In order to support the sustainable growth of crops, WFP-supported farmer field schools (FFS) trained farmers with access to land on integrated farming techniques to conserve water and create compost that can help maximize productivity on the land.

[2] The bio-mattress consists of a layer of organic materials on the floor of the pigpen, comprising rice bran, rice husks, sawdust and microorganisms. The microorganisms in the bio-mattress break down pig's feces, incorporating it into the organic material. This reduces waste run-off into water sources when farmers clean pigpens.

Participants in the FFS for System of Rice Intensification in Chey Commune, Kampong Thom transplant rice.

Water conservation in particular is important for farming purposes, especially in times of droughts. At the commune level, WFP has good working relationship with commune council and leaders have been active and engaged in trainings. The integrated farming management techniques are also part of local development plans, which will potentially help to scale activities in the future. Because of high levels of migration to cities by men, women are mostly benefiting from this activity. It is, however, too early to discuss whether more farmers will benefit from learning about new agricultural methods (WFP interview, November 17, 2015).

b) Adaptation Activity: Fish Ponds

LAO PDR

In Nakai District, Lao PDR, USAID Mekong ARCC targeted farmers constructed frog and fishponds as a way to diversify their income, improve their food security and adapt to climate change (IUCN 2015a). Engaging in this is activity is especially important in the dry season where the lack of water makes it difficult to find fish or frogs for daily nutrition requirements. Aquaculture helps to diversify away from raising livestock that fall ill due to heat stress. Aquaculture is also more affordable for many farmers compared to raising livestock, and therefore, an easier adaptation option to adopt. In order to construct ponds, staff from the Department of Agricultural Extension and Cooperatives (DAEC) travelled to Nakai to provide training on pond construction to male villagers who are responsible for pond construction. The village head selected 10 households to receive training. The DAEC chose households that have enough land to accommodate the fishponds, are available for continued training, can undertake project monitoring, and are able to give feedback on their pond. Women will most likely maintain the fishponds since they will be closer to home. Rather than adding to women's daily workload, the provision of fish or frogs should decrease their time spent searching and collecting aquatic species in rivers. Once pond construction is completed, households will be able to sell to other villagers. Given the easy-to-establish, low-cost nature of fish and frog ponds, other villagers may also start constructing their own household ponds in the future.

THAILAND

In Huai Kang Pla village in Chiang Rai Province of Thailand, increases in water temperatures has led to a decline in fish stock, which is a key source of income and nutrition. Decrease in water availability, droughts, flooding, and flash flooding are affecting fish population (IUCN 2014a). In order to sustain fishing as the climate changes, farmers in USAID Mekong ARCC targeted communities created fishponds with tilapia, which are more heat tolerant. Sixteen percent of the community could directly benefit from this activity through increased food security and income generation from the sale of fish to other

villagers. A significant barrier, however, is the tension over land tenure and the extent to which farmers have access to land to build fishponds.

CAMBODIA

Farmer from Chey Commune, Kampong Thom feeds fish in his newly constructed pond.

Fishponds are very popular in Cambodia, especially because constructing a fishpond is cheaper than raising larger livestock, such as cattle (WFP interview, November 18, 2015). It is also a low-cost solution to providing a source of nutrition and income. The World Food Programme's 'Food for Assets Program' has enabled poor people in USAID Mekong ARCC targeted communities in Chey Commune of Kampong Thom Province to construct fish ponds in exchange of cash or food. Those who are well off in the commune hire landless people to construct ponds, and therefore, those without land benefit from this activity as a source of income diversification. Once farmers build the fishponds, they buy their own fingerlings to populate the fishpond. The cost of buying fingerlings has made some farmers reluctant to invest in fishponds (WFP 2015b). However, those who can buy fingerlings have markets within the commune where they are able to sell excess fish that they will not use for their own consumption. Although income from selling fish is not as high compared to non-agricultural work, it provides supplementary income. Fishponds have particularly helped vulnerable women by providing them with a source of income. Fishponds have the potential to be economically viable but profitability of small scale fishery activities are highly dependent on sound management of resources, including feed and the optimal size of fish for both household consumption and excess selling (WFP 2015b). Therefore, the extent to which fishponds will expand depends on how farmers manage them.

c) Rice-Shrimp Systems and Salt Tolerant Rice

VIETNAM

Rice-shrimp farming in Thuan Hoa Commune, Kien Giang

Rice-shrimp rotational farming occupies the largest farmed area of Thuan Hoa commune in Vietnam. Farmers have implemented the rice-shrimp system since early 2000s. The rice-shrimp farming system is the principal source of livelihoods for people in the commune and produces 600-800 tons of shrimp per year for commercial purposes (AMDI 2014a), with rice grown for subsistence purposes. Because of sea level rise, however, salinity has increased, reducing rice yields and threatening shrimp. Additionally, high temperatures and heat stress during the wet season also led to failure in shrimp culture.

In order to address flooding and salinity, which is a primary threat in rice-shrimp systems, farmers in USAID Mekong ARCC targeted communities plant salt tolerant rice as an adaptation strategy, which would also allow shrimp to thrive even with variable rainfall patterns and saline levels[3]. This is a modification of traditional rice-shrimp system since it uses shrimp that are genetically more heat tolerant and rice that is genetically more saline tolerant. In cases where there is excessive salinity, however, AMDI introduced farmers to sedge-grass to help reduce temperature and salinity (AMDI interview, November 19, 2015). Sedge-grass is a feed source for the shrimp and offers them a habitat.

In order to set up the rice-shrimp system, AMDI selected 33 households to adopt the modified rice-shrimp system. Both men and women who depend on rice-shrimp farms for their livelihoods were involved. However, since men are commonly heads of household and in charge of aquaculture farming and business, men received formal training. Farmers without land do not directly benefit from the rice-shrimp systems. This particular rice-shrimp model is low cost, potentially profitable, easy to maintain, and does not require farmers to convert land. Farmers are also able to purchase post larvae shrimp at subsidized costs. Breeders raise this type of modified shrimp in a controlled environment and check the shrimp for diseases.

Early shrimp yields have been low and in some cases zero in USAID Mekong ARCC targeted communities. This is largely due to prolonged heat stress during the shrimp production season because of El Nino. Additionally a dam was constructed nearby that has reduced water levels, making the rice-shrimp system drier and lowering yields. Even though yields were low in 2015, farmers are optimistic that the shrimp-rice system will increase their income, especially since there is a market for shrimp in the area. The financial sustainability of this model will in the future depend on the relationship between farmers and post larvae shrimp suppliers who are able to give farmers loans or credit to purchase larva (AMDI interview, November 19, 2015). The Government of Vietnam is interested in scaling climate resilient rice-shrimp systems from the 56 ha USAID Mekong ARCC pilot site to 250,000 ha since this activity aligns with the national policy under the Directorate of Fisheries, and Ministry of Agriculture and Rural Development (USAID 2015b).

3.2 WATER MANAGEMENT TO ADDRESS DROUGHTS AND FLOODS

Poor water management and water quality have been major impediments to income generation and community health in LMB. Access to clean water is very limited during droughts and floods, which negatively affects health and sanitation. In order to improve water availability and quality, communities in project sites in Thailand and Lao PDR are installing water storage units and, improved piping and filtration systems to sustainably use water and maintain its quality. This has helped to ensure water security for communities.

a) Water Storage and Distribution Systems to Combat Droughts

[3] Planting rice and raising shrimp are done in rotation.

LAO PDR

Nakai District in Lao PDR faces prolonged and pronounced dry periods, unseasonable rain events, and more extreme storms and flash flooding. Such impacts of climate change reduce water on one hand, and lower the quality of water on the other hand. Therefore, communities strongly support an adaptation activity to build water storage and distribution systems. Large water storage tanks provide communities as way to store water during droughts. Improved piping, outlets and platforms allows communities to better manage water supply. A critical enabling factor when implementing this adaptation activity in USAID Mekong ARCC sites was collaborating with the local government in setting up the infrastructure to install the pipes. Partnership between the local government and communities has been essential in establishing this system; especially since installing infrastructure to better manage water is also part of the district development plan (USAID Mekong ARCC interview, November 17, 2015). Enabling communities to contribute their time and labor helped create buy-in from the community and a sense of ownership and responsibility over the water storage and distribution system. Water management committees are comprised of government officials and communities that help govern the use of the water storage and distribution system (USAID 2015a).

In all six-project target villages in Nakai, women and children are the main carriers and collectors of drinking water. It is anticipated that installing water storage systems will have a positive impact on the daily life of women and children since they will no longer have to travel far to collect water, reducing their burden and allowing women more time for alternative livelihood activities (IUCN 2015c). Poor groups in the community will also be able to benefit from the system since water will be free but controlled by a valve to conserve water.

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

Although a water storage and distribution system helps people in the target villages, there were numerous challenges to installing this system (USAID Mekong ARCC interview, November 17, 2015). Villages in this province are located in remote area, which made it very difficult to deliver equipment and build the infrastructure. The remoteness also increased the costs of setting up the system. Additionally, even though water management committees exist, the remoteness of the site makes it challenging for those in the committee to continuously monitor the impact of the water storage and distribution system on the community.

THAILAND

Farmers in Kok Klang village in Sakon Nakhon Province in Thailand are vulnerable to water scarcity especially in the dry season because the water supply network relies heavily on springs that are dependent on rainfall (IUCN 2014b). In addition to low rainfall in the dry season, people in Kok Klang have not been managing water adequately. One of the solutions for sustaining water use in the dry

season is to install water storage and distribution systems that provide water for subsistence purposes. This will be especially useful for vulnerable groups that may not have access to water in the dry season.

The sub-district administration helped install water storage and distribution systems ("water tower") in the USAID Mekong ARCC site in Kok Klang village by providing inputs for the storage system. The water management committee consists of 40 people representing 25 "water sections" in the village. They helped install pipes for storage and distribution (IUCN interview November 18, 2015). The committee is organized and responsible for oversight, building awareness about water conservation and data collection and analysis of water use. The committee is also responsible dispute resolution. In addition to the water committee, communities established a charging mechanism to conserve water whereby households pay a certain amount per liter of water use. Each month, with the help of a water meter, a volunteer collects water use data from the water meter, reports to the committee, and collects fees. Fees go to a community fund to improve water management in Kok Klang, and to recover expenses of the committee members. Through the water storage and distribution system, as well as meters, the community in the project site and IPs expect that there will be greater water efficiency and regulation that will help minimize water waste because people now have to pay for the service.

Although this water management system is an efficient way to manage water, especially in the dry season, one barrier is that the management could be time consuming for the water committee and for people to attend committee meetings. Finding volunteers to be part of the committee may be difficult. Therefore, it is unclear how long a committee may be able to sustain itself in terms of retaining committee members.

b) Dikes & Canals

CAMBODIA

In Cambodia, scientific findings show that water availability will decrease between 3 percent and 10 percent during the dry season (WFP 2015a). This situation will be exacerbated due to the lack of irrigation systems in place to bring water to where it is needed the most. The lack of water has also affected livestock and agricultural yields while increasing diseases. In order to address water shortage, communities in the project site in Cambodia have constructed dikes and a 700m canal to help store water for agricultural production and protect paddy fields during floods. Community led construction of the small-scale water infrastructure, with the support of WFP, has increased the adaptive capacity of farmers because they are now able to manage water more effectively and efficiently (WFP 2015b). Whether farmers build new dikes and canals in the future is questionable because it is expensive and not economically sustainable. It will be difficult for communities to finance additional water storage assets on their own without external support, which could be a barrier to scaling this activity.

700m canal constructed by the community in Chey Commune, KampongThom.

c) Water Quality Monitoring through Filtration System

THAILAND

In the Chiang Rai project site, farmers have to cope with contaminated water after a heavy rainfall, which is becoming more frequent with climate change. Contaminated water is a cause of water borne diseases. In order to address this climate threat, the community installed a water filtration system (IUCN 2014a). Eighty-one percent of households across the two villages will benefit from the water filtration systems that will help reduce sediments. A community member is responsible for coordinating with the villagers on access and maintenance of the filtration tank. Village leaders will raise funds from households for maintenance of the filtration system in the future.

3.3 FOREST MANAGEMENT

Forest management offers a way for people to improve ecosystems services. This includes controlling water flows, especially during heavy rains and droughts. Protecting forests also reduces landslides, protects biodiversity, and improves soil condition. Furthermore, forests provide non-timber forest products that people in Thailand particularly rely on for both subsistence purposes and as a source of income.

a) Adaptation Activity: Forest Governance

THAILAND

Kok Klang villagers and school children participate at the reforestation ceremony.

In Chiang Rai and Sakon Nakhon Provinces, harvesting of non-timber forest products (NTFPs) is an important source of supplementary income. Women are the main collectors and particularly benefit from selling NTFPs. Overharvesting of NTFPs and heat stress has reduced NTFP availability (IUCN a, b). Additionally, heavy rains have weakened forest ecosystems, and particularly soil structures, which can wash away NTFPs. NTFPs are found in community forests, which are threatened by forest encroachment and expansion of monocultures. Thus, forest protection plays a critical role in maintaining an abundant level of NTFPs, while at the same time protecting forest ecosystem services that help preserve soil stability and biodiversity, and are important for combatting heavy rains.

In order to protect community forests in Sakon Nakhon and Chiang Rai, forest management committees in the project sites, in collaboration with the District Forestry Office, are strengthening forest

governance[4]. The forest committees in both provinces consist of 12-15 representatives elected in a village meeting who are responsible for overseeing forest management activities, data collection and analysis, and communicating forest rules to villagers (IUCN 2014a, b). The committee is also responsible for planning restoration for forest enrichment. In Chiang Rai in particular, forest management also includes preventing forest fires to help protect NTFPs (IUCN 2014a). In order to establish better governance systems, IUCN, the Forest Department, and forest committees conducted a forest inventory of *Non Sao Ae* and *Phu Nang Lao* community forests in July 2015 in Sakon Nakhon to set boundaries and register the area as a community forest (IUCN 2014b). IUCN has built awareness about forest protection and the importance of healthy ecosystems in Sakon Nakhon by engaging with monks who are able to educate people about the value of forests, organizing tree planting events, and engage school children in biodiversity surveys (IUCN 2014b). In Chiang Rai, IUCN helped organize tree-planting ceremonies to make people aware about forest protection and created signage on forest regulations to inform residents and tourists (IUCN 2014a). Although management rules are in place, a major barrier to implementing forest rules in and Sakon Nakhon is unclear land tenure and forest encroachment, which deters villagers from officially registering the forest management committee with the local government (IUCN interview, December 10, 2015). In Chiang Rai, the challenges are deforestation, illegal logging and monocultures (IUCN 2014a). Forest governance may be difficult to scale in the future due to these barriers.

3.4 USE OF WEATHER INFORMATION

The use of climate information in the form of weather forecasts plays an important role in preparing for sudden weather events, such as cyclones, storm surges and flooding. Anticipatory community planning and early warning systems are now in place to help cope with natural disasters, especially in Vietnam. Weather monitoring in Thailand is helping farmers plan agricultural activities and protect their crops.

a) Early warning systems

VIETNAM

The Government of Vietnam uses loudspeakers to make announcements on politics, agriculture, and the weather. The loudspeaker communication system also serves as an early warning system in times of extreme weather events so people can evacuate in time (USAID 2015c). People in Thuan Hoa Commune project site specifically requested a loudspeaker system in the commune since there was none (AMDI interview, November 19, 2015). The Government, however, has yet to approve the frequency of messages relayed in the area (AMDI 2015b). In the meantime, AMDI provided training to commune communication officers so they are able to disseminate early warnings effectively.

[4] Hill tribes in Chiang Rai practice indigenous forest management, and therefore, have a forest governance system in place. However, a parallel customary forest management system is also in place where the District Forest Office is involved. This section focuses only on the customary forest management system.

b) Weather Monitoring

THAILAND

Training Villagers in Chiang Rai on weather station and monitoring.

Although IPs did not rank the use of weather information to plan for adaptation among the top three activities in Thailand, an external expert assessment of sites in Thailand identified, it as an important and highly replicable technique and therefore has been included in this report. IUCN helped to install a small-scale weather monitoring station in both Chiang Rai and Sakon Nakhon and provided training on how to use the weather monitoring system. One system was set up in a school in Kok Klang village in Sakon Nakhon under USAID Mekong ARCC's "climate witness" activity. IUCN chose a school to place the weather monitoring system to teach children about weather information so that they are able to pass on the information to their parents. In Chiang Rai, specific village volunteers became 'climate witnesses'. They are in charge of facilitating discussions in the village on using weather information to plan their daily activities. The villagers have confirmed that the weather station is useful for determining the when to spray herbicides, and plant and collect forest products. The weather monitoring station is useful to villagers since the forecast is localized than the one they receive through radio or smart phone. However, according to IUCN (interview, January 2015), the project also encountered some challenges and limitations. In particular, the forecast is limited to 24 hours, and therefore, difficult for farmers to use for planning long term. Challenges also exist with disseminating weather information to other villages. Despite these challenge, representatives from government agencies, neighboring villages and partner organizations in Chiang Rai expressed interest in scaling up weather forecast dissemination through installing more weather stations. This is especially because the forecasts are localized and the climate witness activity helps raise awareness about the weather.

4. RECOMMENDATIONS ON ADAPTATION OPTIONS & FACTORS THAT INFLUENCE IMPLEMENTATION OF ADAPTATION PLANS

Based on the experience of implementing adaptation plans discussed in section 3, section 4.1 provides recommendations on the types of adaptation activities governments and donors should support. . Section 4.2 identifies the barriers and enabling factors that project implementers need to consider before implementing and possibly scaling adaptation activities Section 4.3 ends with concluding remarks on implementing community adaptation plans in the LMB.

4.1 RECOMMENDATIONS ON ADAPTATION OPTIONS

Government officials and donors are keen to understand what type of activities they should invest in to build and scale up the adaptive capacity of farmers in LMB. ***Livelihood diversification or modification is the most common strategy to adapt to climate change among farmers in target communities across all five USAID Mekong ARCC sites.*** Because most people in rural parts of LMB are farmers, they rely heavily on agriculture as a source of income and food security. Ways to minimize risk of total crop failure due to climate change include breeding heat tolerant livestock, such as black pigs in Thailand or shrimp in Vietnam. It also involves planting crops that are saline tolerant, such as rice in Vietnam. Diversification also entails planting new crops such as lemon, rattan or coffee as in the case of Thailand or building fish ponds as in Lao PDR and Cambodia. Diversification offers an additional source of income when other crops fail due to climate change.

In addition to diversifying agriculture crops and livestock, ***water infrastructure to improve water distribution, storage and quality is a promising way to combat drought and increase in heavy rainfall.*** Small-scale water infrastructure construction in Lao PDR project site and storage and filtration systems in Thailand are activities worth investing in by governments and donors as a means to improve resilience in rural livelihoods. Although infrastructure costs can be a challenge in remote places, such as in Lao PDR, establishing water management committees and collecting fees for maintenance as in the case of Thailand could help to efficiently use and maintain water supplies.

Forests control water flows, reduce landslides, improve soil condition, and provide NTFPs, which can help adapt to effects of climate change. Because forest contribute significantly to ecosystem

services, the Government of Thailand and donors should recognize the value of forests and invest in better forest governance to protect them. Forests provide NTFPs, which are an important source of income for forest communities in the project sites in Thailand. The biggest threat to forest protection however is the expansion of monocultures and unclear land tenure in some areas that may undermine forest governance plans and limit scaling of community forests.

Finally, governments and donors should invest in ***establishing early warning systems and weather monitoring stations to reduce the impact of potential climate disasters***. Advanced early warning systems through loudspeakers that notify people of storms in the Vietnam project site have helped to reduce loss of lives and infrastructure. In project sites in Thailand, using weather information has helped farmers plan farming activities. Although use of weather information is helpful, challenges remain with information dissemination.

4.2 ENABLING FACTORS AND BARRIERS TO IMPLEMENTATION

In order to implement the adaptation activities highlighted in section 4.1, project implementers need to be aware of various enabling factors and barriers that could either help or hinder implementation of adaptation activities. The enabling factors and barriers could also influence the extent to which adaptation activities are scaled.

Training and knowledge dissemination is a critical enabling factor in adopting adaptation strategies related to livelihood diversification/modification. Farmers across USAID Mekong ARCC project sites in Cambodia, Thailand, Lao PDR and Vietnam received formal training by agriculture experts on crops and livestock that are tolerant to heat stress, temperature rise, rise in sea level, and salinity. Farmers also received training on how to use weather information and what to do after receiving warnings through a loudspeaker system. Farmers who received training have played a critical role in disseminating knowledge to other farmers to take up certain adaptation practices through farm visits and formal/informal village meetings. Without training and knowledge dissemination, farmers would not be aware of certain agriculture practices that help protect their livelihoods in the face of climate change. Therefore, project planners and implementers need to design adaptation projects that have a significant learning and capacity development component built into their adaptation projects related to livelihood diversification/modification.

Partnerships between the government and communities are an essential enabling factor. Installment of water storage and distributions systems would not have been possible in project sites in Lao PDR nor Thailand without cooperation between the local government and communities. In the case of forest governance in project sites in Thailand, partnership between the District Forest Office and villagers was important in establishing the forest committee that set rules to manage the use of community forests. In project sites in Vietnam, strong partnership between the government, AMDI, and farmers led to successful implementation of modified rice-shrimp systems. Therefore, project implementers should facilitate the development of strong partnerships between communities and local and national governments. Ties between communities and the government will be easier to establish when adaptation activities that farmers want align with government policies, such as installing water storage and distribution systems, establishing community forests, and promoting rice-shrimp systems.

Community engagement in the adaptation activity leads to their support. Perhaps the most important partner in an adaptation project is community members. Project implementers need to work very closely with communities to build support for an adaptation intervention. This has happened in

several ways among communities in USAID Mekong ARCC sites. For instance, communities in Lao PDR and Thailand help set up water storage and distribution systems, which created their buy-in. Farmers have been willing to invest their time and finances to establish water storage and distribution systems in both countries. Involving religious leaders to educate people about the importance of forests and allowing schoolchildren to participate in a biodiversity surveys in project sites in Thailand enabled communities to take an initiative to govern their forests to protect ecosystem services as an important adaptation strategy.

In addition to enabling factors, project implementers also need to be aware of barrier that may hinder the implementation of adaptation projects. **A key *barrier has been financial costs and low return on investments***. Farmers incur financial costs when switching from one variety to a new variety that are heat or saline tolerant. In Cambodia, some farmers in project sites found it difficult to take up fishponds to diversify their livelihoods because of the costs of establishing the pond and buying fingerlings. When it came to establishing dikes and canals to manage water, farmers received external support for this activity but it is questionable if such infrastructure can be expanded due to the costs of installation. Financial costs may be more burdensome once the USAID Mekong ARCC project concludes its activities and farmers are no longer able to access subsidized inputs. Furthermore, low return on investment on pigs and shrimp due to low market prices in project sites in Vietnam may be a barrier to adopting livelihood diversification. In order to implement successful projects and to scale them, project implementers will need to consider input and market prices because even though agricultural diversification and infrastructure to manage water are adaptation strategies, it must make financial sense for farmers to implement.

Remoteness of communities can be a barrier to managing water and engaging with communities. Communities in project sites in Lao PDR are located in very remote areas, which make it difficult to engage with communities to implement adaptation option, such as transporting and installing infrastructure that can help regulate water in times of drought. Remoteness also makes installing water infrastructure costly. Therefore, project implementers need to factor in transaction costs of helping people in remote areas adapt to climate change when designing adaptation projects.

Lack of participation is a barrier to governing water and forests. Farmers are busy due to a wide variety of reasons, and therefore, may not have the time or the means to engage in water or forest governance as project sites in Thailand have shown. This may affect the sustainability of water management in Chiang Rai. This may also limit the spread of community forests to protect forests for adaptation purposes. In such a situation, project implementers will need to identify community champions who are dedicated to help govern common resources, such as water and forests. Project implementers will have to work closely with community champions to maintain the governance structure and illicit support of other community members to manage common resources in a participatory manner.

4.3 CONCLUDING REMARKS

Governments and donors have several options to boost and scale adaptive capacity based on the evidence gathered from the USAID Mekong ARCC pilot project experience. Because most people in rural areas in the LMB are farmers, investing in farmers' ability to diversify or modify their crops and livestock is a way to secure their livelihoods and food security when droughts or floods strike. Water is

a critical resource that governments and donors should support. Investing in infrastructure to effectively and efficiently distribute, store, and improve the quality of water is important in maintaining agriculture production even in times of drought, and providing clean drinking water, which tends to become contaminated with heavy rains or floods. Forests are also a critical resource that helps maintain water flow and soil stability, especially when there are heavy rains. Therefore, investing in strong forest governance enables people to use ecosystems to adapt to climate change. Although most investment areas relate to natural resources, such as crops and livestock, water, and forests, investing in early warning systems could also help farmers minimize their exposure to climate threats. In order to increase adaptive capacity, governments and donors may have to invest in multiple options at the same time. Taking a landscape approach to investing in a portfolio of adaptation options where agriculture, water, and forests in particular interrelate, could lead to a stronger adaptive capacity.

Whether governments and donors invest in agriculture diversification or modification, water infrastructure, forest governance or early warning systems, adaptation project implementers need to be aware of the various enabling factors and barriers to successfully implement adaptation strategies among communities. Training and knowledge dissemination, partnerships between different stakeholders, and community engagement are key enabling factors that can lead to successful implementation of an adaptation option. Without knowledge exchange between technical experts and farmers, and without collaboration between local governments and communities, changing practices to adapt to climate threats will be a challenge. Project implementers also need to keep barriers in mind when implementing adaptation options. Barriers include financial costs to farmers when changing practices, low financial return when farmer change practices, remoteness of communities that increase implementation costs, and lack of engagement among stakeholders to implement options. Therefore, project implementers may need to implement adaptation options that governments and donors choose to invest in that are low cost yet profitable, and encourage participation among different stakeholders at the community level so that farmers support adaption options.

REFERENCES

AMDI (2014a) Community Adaptation Plan: Thuan Hoa Commune, *An Minh District, Kien Giang Province* Vietnam. USAID.

AMDI (2014b) Vulnerability Assessment Report Thuan Hoa commune, An Minh District, Kien Giang Province, Vietnam. USAID.

Chaudhury M (2015) Lessons on Integrating Scientific and Community Knowledge of Climate Change to Develop Adaptation Plans in Lower Mekong Basin. USAID Mekong ARCC.

ICEM (2013) USAID Mekong ARCC Climate Change Impact and Adaptation: Summary. Prepared for the United States Agency for International Development by ICEM - International Centre for Environmental Management.

IUCN (2014a) Community Adaptation Plan: Huai Kang Pla Village, Hae Ko Village, and Loh Yo Village, Chiang Rai Province, Thailand. USAID.

IUCN (2014b) Community Adaptation Plan: Kok Klang Village, Sakan Nakhon Province, Thailand. USAID.

IUCN (2015a) Community Adaptation Plan: Ban Khounsam, Ban Vanghin and Ban Khuan Nakai Villages, Khammouan Province, Laos PDR. USAID.

IUCN (2015b) Community Adaptation Plan: Loh Yo Village, Chiang Rai, Thailand. USAID.

IUCN (2015c) Quarterly Report Laos PDR July 1- September 30, 2015. USAID Mekong ARCC.

IPCC (2014) Climate Change: Impacts, Adaptation, and Vulnerability. Summary for Policy Makers. Available from www.ipcc.net

Khem S (2016) Report on Hydrological Conditions in the Lower Mekong Basin: Dry and Wet Seasons in 2015 and the Impact of El Nino. Conference presented at the 23rd Council Meeting of the Mekong River Commission. January 2016. Phnom Penh, Cambodia.

Talberth, J (2015) Valuing Ecosystem Services in the Lower Mekong Basin. USAID Mekong ARCC.

USAID (2014a) Cambodia Climate Change Vulnerability Profile. Bangkok: USAID Mekong Project.

USAID (2014b) USAID Mekong ARCC Climate Change Impact and Adaptation Study for the Lower Mekong Basin on Non-Timber Forest Products and Crop Wild Relatives. Prepared for the United States Agency for International Development by ICEM – International Centre for Environmental Management. Bangkok: USAID Mekong Project.

USAID (2014c) USAID Mekong ARCC's Implementing Partners Meeting Follow-Up Report. November 20-21, 2014. Bangkok, Thailand.

USAID (2014d) Vietnam Climate Change Vulnerability Profile. USAID Mekong ARCC.

USAID (2015a) Quarterly Report for Laos PDR April 1- June 30, 2015. USAID Mekong ARCC.

WFP (2015a) Community Adaptation Plan: Chey Commune Adaptation Plan, Cambodia. USAID.

WFP (2015b) USAID Mekong ARCC Project Assessment - Kampong Thom, Cambodia.

ANNEX A: QUESTIONNAIRE FOR IMPLEMENTING PARTNERS ON IMPLEMENTATION OF ADAPTATION PLANS

The objective of this questionnaire is to understand whether certain adaptation options that have been implemented in the Lower Mekong Basin has (1) strengthened management of assets needed for adaptation, (2) reduced vulnerability through good development, and (3) have the potential to scale. The author conducted interviews with implementing partners in November and/or December 2015 over Skype.

A. Identifying and Prioritizing Adaptation Options

1. Which of these adaptation options are most important for the community you are working? Please rank the top three options.

Adaptation Typology	Adaptation Options	Rank Top 3
Water Management to Address Droughts & Floods	Water Meter	
	Water Storage	
	Water quality monitoring	
Livelihood Diversification/Modification to Address Temperature Increase, Droughts, Floods, and Sea Level Rise	Integrated farm management that includes heat/drought tolerant crops & livestock	
	Fish ponds	
	Flood/salt resistant rice against sea level rise	
	Integrated farm management that includes rice-shrimp system	
	Agroforestry	
Use of Climate Information for Adaptation Planning	Weather monitoring	
	Loud speaker system for early warning	
Forest Management to Address Droughts & Floods	Forest management	
	Mangrove restoration	

2. Why are these the top three adaptation options?

B. Improved Management of Assets

Resources that provide a foundation for taking adaptation actions – whether social, financial, physical, natural or technical can be thought of as assets for adaptation. The Project considers 'Improved Management of Assets' to consist of assets inventoried, enabling conditions and systems that are in place.

1. Interviewee describes the assets in the adaptation option identified above.
2. What were some of the enabling conditions that have helped to implement this option (e.g. access to assets, trainings and information, management plan, systems that support adaptation)?
3. What were some barriers that made it difficult to implement this option?
4. To what extent does this option include women, poor, and vulnerable groups? Did they manage assets differently? If so, how?

C. Reduced Vulnerability/Good Development

Good development that improves people's access to assets and leads to increased wellbeing is crucial for enabling communities and households to adapt. Based on community vulnerabilities and activities identified under this project, good development and wellbeing needed to reduce vulnerability involves increase in economic development, improved health, strong social networks that transfer knowledge, and strengthened ecosystems.

1. Have people been able to sustain or increase their level of income through this option? Why or why not?
2. To what extent has learning and knowledge sharing taken place to reduce vulnerability?
3. Has the level of vulnerability been reduced among women, poor, and vulnerable groups? If so, how?

D. Scaling Adaptation Options

1. Among the three options you have ranked, what options have the potential to scale via replication and why? What needs to be in place for it to replicate?

ANNEX B: FULL LIST OF ADAPTATION OPTIONS UNDER USAID MEKONG ARCC

Adaptation Typology	Adaptation Activities	Cambodia*	Lao PDR	Thailand	Vietnam
Water Management to Address Droughts & Water Contamination	Dikes & Canals	✓			
	Water Storage & Distribution		✓	✓	
	Water Quality			✓	
Livelihood Diversification/Modification to Address Temperature Increase, Droughts, Heavy Rains, Floods, and Sea Level Rise	Integrated farm management that includes heat/drought tolerant crops & livestock	✓		✓	✓
	Fish Ponds	✓	✓		
	Flood/Salt Resistant Rice against sea level rise		✓		✓
	Integrated farm management that includes rice-shrimp system against sea level rise and increase in temperatures				✓
Use of Weather Information for Adaptation Planning	Weather Monitoring		✓	✓	✓
	Loud speaker system for early warning				✓
Forest Management to Address Heavy Rains and Storms	Forest Management			✓	
	Mangrove restoration				✓

*Cambodia has fewer adaptation options in place compared to other countries because it has only begun to develop community adaptation plans and implement activities.