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

Lessons on Integrating Scientific and Community Knowledge of Climate Change to Develop Adaptation Plans in Lower Mekong Basin

March 2015

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1. INTRODUCTION

Scientific projections of climate change hazards in the Lower Mekong Basin (LMB) indicate that the rural poor living within the region face vulnerabilities that affect their livelihoods and well-being. Projections indicate exposure to increased temperature and precipitation, floods, sea level rise, and drought (USAID 2013). In order to assist in addressing the impacts of climate change on rural communities in ecologically sensitive areas of the LMB, USAID Asia designed the Mekong Adaptation and Resilience to Climate Change (USAID Mekong ARCC) project. This five-year (2011-2016) technical assistance project is implemented by Development Alternatives Incorporated (DAI), in partnership with the International Centre for Environmental Management (ICEM), World Resources Institute (WRI), International Union for Conservation of Nature (IUCN), the Asia Management and Development Institute (AMDI), and the World Food Program (WFP). The primary aim of the project is to increase adaptive capacity and resilience of communities to the negative impacts of climate change. USAID Mekong ARCC aims to test approaches for building local level adaptive capacity and resilience with rural communities comprising 28,293 people across Thailand, Vietnam, Lao PDRs, and Cambodia.

As an important step to building adaptive capacity in USAID Mekong ARCC's target communities, the project focuses on the development of participatory adaptation plans that factor in both scientific information and local knowledge. A baseline awareness surveys conducted by the USAID Mekong ARCC project provides a snapshot of the critical need for adaptation planning by communities in the region. The surveys indicate that while 83% of respondents in project sites said that they noticed significant changes in weather over the last 5 to 10 years, only 4% feel prepared to adapt to climate change (DAI 2014a). Although these and other local communities can draw upon their history of dealing with shocks and crisis to develop strategies for coping with weather related hazards, the development of formal, long term adaptation plans helps to move them from coping to actively addressing both current and future threats, which markedly strengthens their resilience to climate change.

The objective of this report is, therefore, to capture lessons learned from the process USAID Mekong ARCC implementing partners (IP) in the LMB used to adaptation plans. The intent is for these lessons to help practitioners, government planners, donors, researchers and others to understand how scientific knowledge can integrate with local knowledge to enable communities to co-develop adaptation plans with implementing partners (primarily made up of non-governmental organizations), and scientists. Participatory processes employed in the co-development of these plans are important to foster two-way learning between NGOs and communities, allowing the resulting adaptation options to gain greater support from communities in their implementation, while also building local adaptive capacity and understanding of climate change. The processes utilized by USAID Mekong ARCC's implementing partners to achieve these outcomes will be the focus of this report.

This report is divided into 6 sections. Section 2 presents the research framework to co-develop adaptation plans and the four steps taken to merge scientific knowledge and community knowledge in order to develop adaptation plans. The research framework suggests that in order to co-develop adaptation plans, implementing partners, communities, and scientists need to establish credible information used to design the plan, relevance of the information, and legitimate participation of various actors to design the plan. Section 3 focuses on the methodology used to collect information for this report and section 4 describes the process of combining scientific climate information and community

climate stories to develop adaptation plans in Thailand, Vietnam, and Loa PDR. Section 5 highlights the lessons learned when integrating scientific and community understanding of climate change. Section 6 ends with reflections on how implementing partners and communities may implement adaptation plans going forward.

2. CO-DESIGNING ADAPTATION PLANS

Section 2.1 presents a framework to help understand how scientific knowledge can integrate with community understanding of climate change in order to co-develop adaptation plans between scientists, implementing partners ((IPs) and community members. Section 2.2 presents the four steps that scientists, knowledge brokers, and communities implemented to co-design adaptation plans.

2.1 FRAMEWORK TO CO-DESIGN ADAPTATION PLANS

For adaptation plans to be realistic, feasible, and effective, scientists, communities and implementing partners need to all contribute important inputs to the co-design of the plans. They need to ensure that plans include credible information and are salient to those who will benefit from and implement adaptation options generated by the plans. Figure 1 below demonstrates the process in which adaptation plans are co-designed.

Figure 1: Framework for Designing Adaptation Plans

(Adopted from Chaudhury et al. 2014)

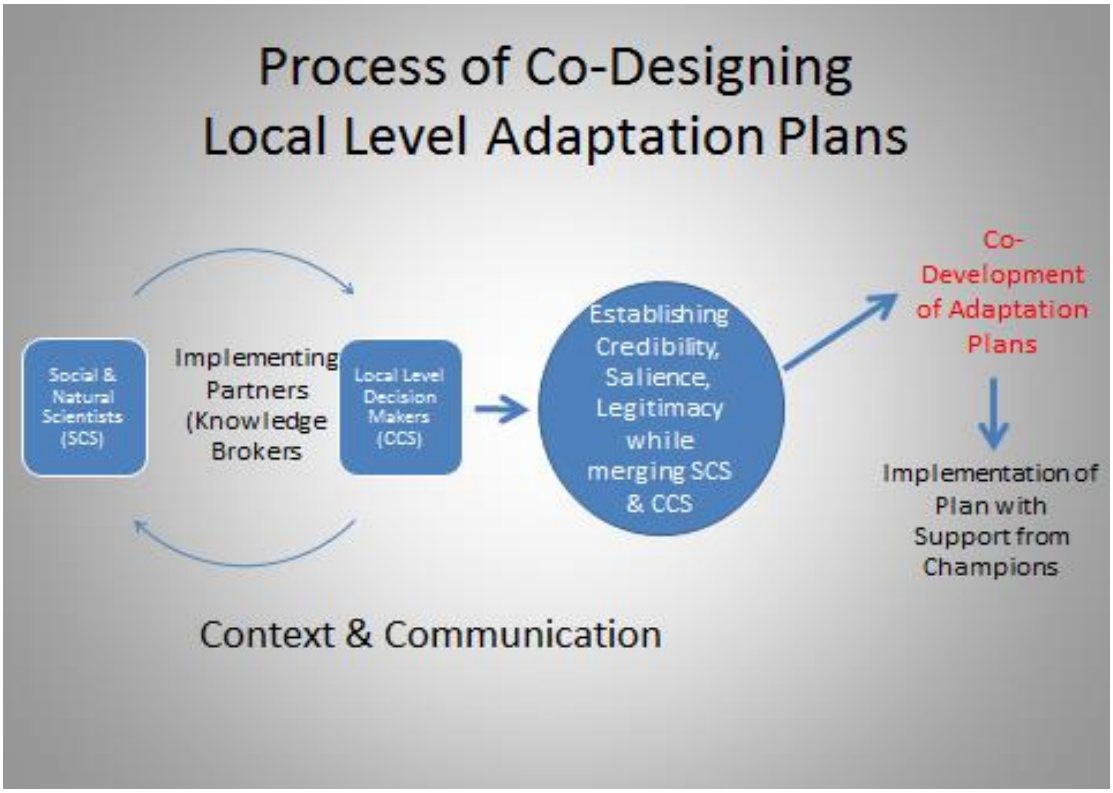


Figure 1 shows that there are three main actors in the process of co-designing adaptation plans. These actors include scientists, implementing partners (inclusive of local and international NGOs), and local level actors who both implement the plan's and benefit from the co-developed adaptation plan. **Scientists** in the USAID Mekong ARCC project were responsible for developing the scientific climate studies (SCS, see section 4). The **local level decision makers** are members of communities that have built the community climate stories (CCS, see section 4). **Implementing partners (IPs)/knowledge brokers** play a significant role in the process. Knowledge brokers make science more accessible and understandable to local level actors and facilitate the merging of scientific information with local level knowledge about climate change (Cash et al. 2003, 2011; Guston 2001; Hammill et al. 2013; Jasanoff 1996). Knowledge brokers are able to create a bridge between knowledge sets because they possess both the technical skills to understand climate science, and have rapport and relationships with those at the local level necessary to co-design adaptation plans.

The relationship among scientists, knowledge brokers, and local level actors determines what is ultimately included in the adaptation plan and the process by which the plan develops. Ideally, the three actors invest in establishing credibility, salience, and legitimacy, which are key components to successful co-designing of plans (Cash et al. 2003; Chaudhury et al. 2014) and explained below.

- **Credibility:** Refers to the perceived technical quality or adequacy of technical evidence and arguments by users of scientific information. Scientists first establish credibility by conducting climate analysis using reliable historical climate data and the latest climate modeling procedures to identify climate change trends. Knowledge brokers and local level actors then verify the scientific findings to help establish validity of the scientific study.

- **Salience:** Refers to the perceived relevance of the technical information provided by scientists to local level actors. Scientists and local level actors, through knowledge brokers, establish salience when they begin to collaborate in designing the adaptation plan through continual interaction and dialogue.

- **Legitimacy:** Refers to the process of collecting information needed to design the adaptation plan through participation of various actors in an unbiased and balanced manner. Legitimacy is established when all three actors include a wide range of perspectives to corroborate the design of adaptation plans.

Context determines the extent to which the three groups of actors can establish credibility, salience, and legitimacy. Several contextual factors influence the establishment of credibility, salience, and legitimacy. For instance, the socioeconomic or political context, level of dependency of a population on a particular natural resource, governance systems and public participation are all factors that can influence the process of designing an adaptation plan (Kushner et al. 2012).

In addition to context, communication methods influence both the relationship between actors and the process of designing adaptation plans. Communicating climate variability and climate change information in particular is challenging for many reasons. For instance, local level actors may not understand climate science. Scientists may also not easily understand adaptation needs of local actors. Differentiating between climate variability and change is also problematic. Explaining uncertainty in projections is also difficult (Nisbet 2009). Therefore, the role of knowledge brokers is critical in translating and merging scientific knowledge and community understanding of climate change.

The interaction between knowledge brokers and local level actors, which depends on the context and communication methods used, determines the extent to which credibility, salience and legitimacy develops when merging CCS and SCS. However, champions can also play a role in promoting and implementing adaptation plans. Champions are usually a member of the local community but can also be from outside of the community who strongly support the process of co-developing adaptation plans and want to help implement the plans to build community climate resilience. Champions are different from knowledge brokers since champions usually do not have high levels of technical capacity to co-develop adaptation plans but can effectively play an advocacy role to help implement the plan because they have influence among other decision makers and stakeholders.

2.2 FOUR-STEP PROCESS TO MERGING SCIENTIFIC AND COMMUNITY KNOWLEDGE ON CLIMATE CHANGE

Section 2.1 presented how adaptation plans can be theoretically co-designed. This section presents the actual steps scientists, knowledge brokers, and local community members followed to co-design adaptation plans. The four-step process described below to merge scientific, community understanding of climate is based on participation of these three main actors who aim to establish credibility, and salience of the process of co-designing adaptation plans.

- **Step 1:** Scientists develop scientific climate stories (SCS). SCS contain information on climate hazards and projections from the USAID Mekong ARCC Climate Study (USAID 2013). Scientists from ICEM used six global circulation models, hydrological models, and crop models to understand past, present, and future impacts of climate change on agriculture and livelihoods. Climate projections are until 2050. Data is downscaled to the provincial level. In order to further downscale to the site level, IPs conducted local level vulnerability assessments in 2014. Local level vulnerability analysis helped fill gaps through additional research. Because scientists are not present in the field, IPs, who are the knowledge brokers between scientists and community members, ensure they understand the SCS to convey information from SCS to communities. Scientific information allows farmers to go beyond planning for the future based on weather trends and use scientific information to plan for the future to strengthen resilience and prevent maladaptation.

- **Step 2:** Knowledge broker/IPs facilitate the development of community climate stories (CCS). To develop CCS, IPs lead community members through a process that typically involves (DAI 2014a):
  1. identifying their financial, physical and natural assets, and prioritizing the resources upon which they most depend;
  2. mapping a typical annual agricultural production cycle and overlaying this with the climate calendar to highlight times of the year when extreme weather puts crops, livelihoods and community well-being at risk; and
  3. describing trends in both climate and non-climate hazards to understand how the communities perceive these to be changing over time

IPs use various communication and participatory rural appraisal (PRA) methods to develop CCS. Methods include participatory community maps, hazard maps, resource maps, historical time lines, future timelines, and transect walks. In addition to community vulnerability assessments, IPs also carried

out a climate awareness survey to understand what community members know and understand about climate change. Such information helps IPs to tailor programs based on local knowledge. Through this "bottom up" discussion, IPs help community members articulate how weather is changing in their area and how these changes are impacting their livelihoods (see Annex 3 for a diagram of the CCS process).

- **Step 3**: Merging of scientific and community knowledge starts in step three. IPs help community members to understand the basics of climate change and the climate projections from the SCS. Site based projections from the SCS are used to facilitate discussion on how the scientific climate projections would exacerbate current climate threats and how they would affect livelihoods (DAI 2014a). IPs also explain the difference between "weather" and "climate" using visual aids and PRA methods. Discussions between IPs and community members allow participants to compare community vulnerabilities identified when developing CCS with projected vulnerabilities from SCS, re-rank hazards identified in Step 2, capture changes in understanding and validate findings. The process of merging SCS and CCS enables community members to decide what credible and salient information they want to use from the SCS and CCS. The participatory bridging process between SCS and CCS ultimately leads to a shared understanding of scientific and community knowledge on climate change upon which adaptation plans are developed.

- **Step 4:** In order to develop the adaptation plans, IPs ask the community members to take part in an outcome mapping exercise to visualize and plan for the future based on merging of CCS and SCS in Step 3. Outcome mapping is a planning process that identifies what community members want to see and do not want to see for their village both today and in the future and how they can achieve this. Through outcome maps, a vision for the future is first developed and follow on discussions allow community members to assess what they can do to realize their vision through actions taken today, 5 years from now and when their children are grown (roughly 35 years from now, which is 2050). Several options are developed and at the end of planning stage, knowledge brokers ask community member to rank the options. If there is no consensus, community members vote on the best option or adaptation plan. At the end of the planning stage, community members designate roles to implement the most highly ranked plan.

In order to ensure consistency and quality control in applying the four-step process, knowledge brokers applied the four steps in a uniform manner across sites. However, IPs had some flexibility to implement this process based on local context. IPs also drew upon various strengths and experience they had with PRA techniques or other collaborative methods. Some IPs found it challenging to follow all the steps but those who did were able to better engage with the community and develop adaptation plans that the community would support. In order to maintain a balance between uniformity and flexibility, DAI managed the project "adaptively" when working in different field sites. Annex 4 provides details of activities conducted between steps 3 and 4.

3. METHODOLOGY

WRI designed semi-structured, qualitative questionnaires to understand the process by which scientific knowledge merged with local knowledge to co-design adaptation plans. The first questionnaire (see Annex 1) helped understand the perceived challenges and enabling factors that could influence the co-designing process prior to IPs merging scientific and local knowledge. Gathering information about perceived challenges helped USAID Mekong ARCC address potential difficulties in merging CCS and SCS before IPs actually merged the knowledge sets. WRI administered the first questionnaire over Skype in May 2014. Building on findings from the first questionnaire, WRI developed a second questionnaire (see Annex 2) to capture lessons from the actual process of merging scientific and local knowledge to develop adaptation plans based on the 4-step process. Questions focused on the relationship between IPs and local level community members; how they established credibility, salience and legitimacy that led to co-designing adaptation plans; and how context and communication influenced the process. The author administered the second questionnaire in person during the USAID Mekong ARCC annual IP meeting in Thailand in November 2014.

This report is primarily based on the perspective of IPs who work with communities in Thailand, Lao PDRs, and Vietnam. Due to the scope of the study, this report does not capture views of scientists involved in the SCS nor the community members involved in designing the CCS. Considering DAI played a critical part in designing the approach of merging scientific and community knowledge, training IPs, monitoring work in field sites, and reviewing all deliverables while implementing the USAID Mekong ARCC project, it was also important to capture DAI's perspective.

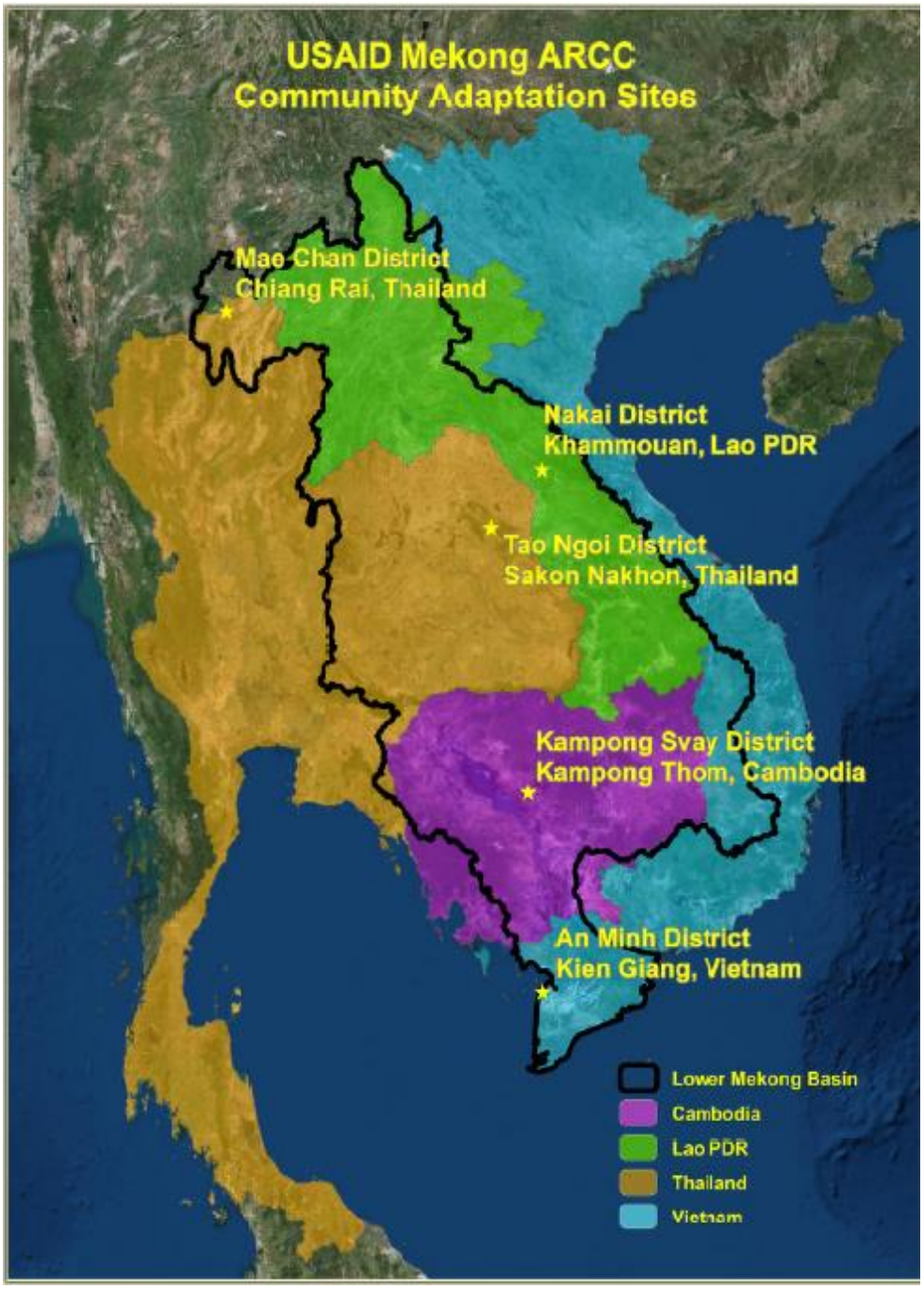
4. APPLICATION OF THE FOUR-STEP PROCESS IN LOWER MEKONG BASIN

The LMB is a diverse sub-region in terms of its economic development, political systems, ecosystems and culture. There are, however, several similarities between countries concerning climate hazards. In Vietnam, famers face rising sea level, salinity intrusion, and intense rainfall. In Lao PDR, drought and flooding are bigger concerns. Thailand, like Lao PDR, faces droughts and intense rainfall similar to Vietnam. Cambodia also faces droughts similar to Lao PDR and Thailand. Annex 5 provides a summary table of country-specific characteristics and climate challenges.

Map 1 below shows the various field sites under the USAID Mekong ARCC project. The USAID Mekong ARCC project personnel identified sites in two ways. First, USAID Mekong ARCC identified priority provinces based on 'hot spots'. Hot spots are areas of the Basin projected by the parameters used in SCS that would experience the greatest change in any one climate or hydrological parameter (temperature, rainfall, sea level rise) or where such changes represent a threat to existing livelihoods and natural systems. Second, USAID Mekong ARCC chose sites using a list of provinces that are eligible for its support. IPs for each site were chosen based on their level of skills in PRA and the extent to which they had relationships with local communities where the project would be implemented. The sites represent a diverse portfolio of landscapes, economies, people, and climate impacts.

Map 1: Project Field Sites

(Source: DAI)



The rest of section 4 presents that how scientific knowledge merged with community understanding of climate change in Thailand, Vietnam, and Lao. The focus of section 4 is on how steps 3 and 4 were applied in the field sites, and the lessons learned from these steps. This report does not cover Cambodia since they joined the project at a late stage and knowledge brokers in Cambodia have not completed the 4-step merging process.

4.1 THAILAND

Thailand is the world's largest exporter of rice and is wealthier in terms of GDP compared to the other LMB countries (DAI 2012). Agriculture employs 49% of the population and contributes 10% to the GDP. However, impacts from climate change are changing rice productivity, which affects almost half of the population.

International Union for Conservation of Nature (IUCN) in Thailand is the IP/knowledge broker in two provinces where climate change impacts rice production. IUCN worked extensively in Chiang Rai Province, and therefore, knows the local context well and has working relationships with communities in the province. Although IUCN does not have a long history of working in Sakon Nakhon Province, they are familiar with the local context, know the village heads and how the local administration operates. In these provinces, local planning takes place at the sub-district level. Administrative units at the sub-district level produce a three-year plan and allocate budget to implement various development programs. The subdistrict level implements the plans through consulting people at the village level. This allows villages to participate and propose action plans that they feel is important for their local context.

The local planning and decision making context allows for a consultative and participatory environment where those at the sub-district can work together with those at the village level. The consultative environment enabled IUCN to engage legitimately with those at the village level to implements steps 2-4 in a participatory manner with different social groups to capture local experiences with climate change. Various ethnic, religious, and gender groups provided their perspectives on climate change in small focus group settings. Fostering interaction between different social groups can, however, be challenging especially when there is tension between groups. For instance, historical tensions between the local government and some community groups in Sakon Nakhon initially made exchange of information difficult. To address such challenges, in many cases, the knowledge brokers spoke individually to community members to obtain their perspective on CCS privately and not in a public setting. This helped community members feel that they have a role and stake in developing the CCS for their own benefit despite social tensions.

The biggest challenge when merging SCS and CCS (step 3) was communicating the complex concepts necessary to understand "climate change" and its impacts. Although there were high levels of participation, it was difficult for knowledge brokers to establish salience of the SCS because the concept of climate change is foreign to most community members, even though they have experienced extreme weather events. In order to explain climate change and findings from SCS, knowledge brokers had to simplify messages to make them relevant and credible to community members. For instance, IP's simplified messages about temperature and precipitation from the SCS by using very little technical language. Knowledge brokers made messages from SCS relevant to farmers' livelihoods by talking about the impact of climate change on important crops that the community cultivated, such as rubber, maize, and rice using visual aids. When communicating findings from SCS to the community members, IPs realized that the weather is much easier to discuss compared to the climate since community members can relate to daily weather but not to long-term climate predictions. To establish relevance, which makes SCS more credible to community members, knowledge brokers discussed how cropping seasons had changed due to erratic rainfall. Learning and discussing climate change enabled community members to compare it to their own experience and either accept or question elements of the SCS that were or were not valid and relevant in their lives or for people in the neighboring village. The process of learning

about climate change allowed community members to begin to merge the parts of scientific findings that they deemed valid and relevant with the CCS they had developed.

Although there were high levels of participation when merging SCS and CCS, communicating findings from SCS in Chiang Rai was a bigger challenge than in Sakon Nakon, particularly because of high diversity of languages spoken from village to village. In Chiang Rai, communities comprised of ethnic hill tribe groups, such as Akha and Lisu, who generally communicate in local languages and do not regularly speak Thai. In order to address this communication barrier, knowledge brokers worked with village leaders to understand how best to communicate climate change. Village interpreters helped translate from Thai to local languages. Use of interpreters helped but sustained learning about climate change was a key concern of the IP. For example, when the IP returned to the sites to present the SCS, they realized that community members had forgotten the discussion they had before on the concept of climate change. When the IP returned to merge the SCS and CCS, only some people remembered the concept of climate change. Because learning and understanding about climate change takes time, IPs acknowledged that teaching climate change through a scientific lens cannot be accomplished immediately but needs to be part of a continuous dialogue over time.

Once the knowledge brokers communicated the findings from SCS, community members confirmed the scientific findings from the SCS. Knowledge brokers and community members felt that information in CCS and SCS overlapped in a more general manner (see Annex 6 for community adaptation priorities before and after using SCS). For instance, community members thought that information on rising temperature and increasing precipitation in the SCS is credible because community members are already experiencing higher temperatures and increasing rainfall. Matching SCS and CCS helped to build credibility and salience of the SCS.

The outcome mapping process (step 4) was carried out by defining the community's vision of the future; identifying present, intermediate (5 years from now) and long-term actions (35 years from now); and outcomes that will help achieve the vision. Knowledge brokers played an important role in ensuring that the outcome mapping included discussions about climate change since in many cases, the topic of climate change was lost since community visions did not concretely address climate change. Community visions primarily reflected general aspects of resilience. Figure 2 provides an example of outcome mapping from Hae Ko, Thailand.

Figure 2: Outcome Mapping in Hae Ko, Thailand

(Source: IUCN 2014)

Hae Ko Outcome Mapping Activities	Goals/Expected Outcomes			
	Short term	Intermediate term	Long term	
Clean Water				Vision: *A strong community that is safe from forest fire with clean water for consumption, abundant forest, enriched soil, good plantation, sustaining agricultural system (plantation, fruits, livestock) for increased income, as well as convenient transportation.*
-Improvement of water system (both quality and quantity)	-Establish water filtration system	-Clean drinking water	-Good quality water leading to good health	
Prevention and control of erosion				
-Grow vetiver sp. grass	-Reduced soil erosion	-Reduced risk to lose cultivation area		
-Preventing soil erosion by planting method (grow fruits or timber plants)	-Decreased slash and burn cultivation	-Decreased deforestation		
Sustainable Agriculture including multi-cropping				
-Grow commercial plants e.g. coffee, plums, *para* rubber	-Yield can be sold in the market	-Soil is enriched		
-Practice integrated agriculture e.g. paddy with beans, maize, fruits and coconuts	-Reduced herbicides -Increased food for family consumption -Decreased family expense			
-Grow Assam tea				
-Raise black pigs (natural method)				
-Raise fish				
Improved occupations for women				
-Develop women's group (handicrafts) to diversify income				
Sustainable landscapes including forests				
-Control forest fire		-Forest is restored	-Abundant forest -Regular rainfall -Good air -Safe and healthy life	
Improved road access				
-Road development	-Easy access			

The outcome mapping exercise empowered communities to take ownership of their actions. Because communities were able to decide on their own future, there were generally no tensions between knowledge brokers and community members.

Four villages (Loh Yo, Huai Kang Pla, and Hae Ko in Chiang Rai, and Kok Klang in Sakon Nakhon) developed their adaptation plans (see Annex 7 for details). The most common adaptation activities include water management to address droughts and floods, forest restoration for managing deteriorating water and soil conditions, and agricultural practices to diversify income. IUCN felt that the biggest challenge when implementing the plan would be to organize committees around water management and rearing livestock to help implement the plan. Considering IUCN has good relationships with community members in Chiang Rai and Sakon Nakhon, they may be able to identify community level champions to help implement the plan. Since there were high levels of participation in Thailand, and, therefore, higher levels of ownership over the adaptation plan, there is a good chance that IUCN and community members will implement the co-developed adaptation plan without too many difficulties except for Huai Kang Pla. IUCN considers Huai Kang Pla to be challenging because it is composed of six sub-villages and each sub-village has different challenges and climate vulnerabilities. IUCN will not be able to address all challenges and vulnerabilities due to limited staff and budget. IUCN hopes to implement pilot activities that are replicable to benefit other community and additional challenges.

4.2 VIETNAM

The Mekong delta contributes 46% of Vietnam's national food production. Increases in flooding and salinity, and sea level rise threaten food security in Vietnam. Vietnam could face a 40% drop in rice cultivation and loss of GDP between 7-10% due to sea level rise (DAI 2012).

The Asian Management Development Institute (AMDI) in consortium with the Vietnam Red Cross (VNRC) is the IP/knowledge broker in the Thuan Hoa Commune of An Minh District in Kieng Giang, Vietnam. According to AMDI, Vietnam's annual social and economic development planning process takes place at the commune level. The commune leader and sector heads lead the planning, prioritization of activities, and budgeting process of commune level plans. Commune leaders and sector head do not always share the commune plans with the community but through a village leaders who acts as "quasi-government" member and is part of the national government's "outreach" to the village level. Village leaders rarely incorporate feedback from villagers before making final decisions. Therefore, participatory planning is highly limited due to a "top-down" decision-making system.

The local level planning process is changing, however, with the presence of local NGOs, such as VNRC. The VNRC is helping to plan for disasters at the commune level through a participatory approach. Through VNRC initiatives, people at the village and commune levels are now able to contribute to the disaster preparedness and response plan. Commune leaders now help assess vulnerability and adaptive capacity to respond to disasters. Through VNRC initiatives, commune leaders realize that village level participation is "crucial" to developing response systems and to sharing the responsibility of adapting to climate change. VNRC's approach led the national government to approve the Participatory Community Based Disaster management approach in 2009, opening the door to more participation at the village level.

AMDI adopted VNRC's participatory approach to planning and applied it in the Thuan Hoa Commune. AMDI included different genders, age groups, and people with varying education levels to allow commune members to participate legitimately in developing CCS, and merging CCS and SCS. According to AMDI, the knowledge brokers, gender and age differences did not affect participation. The level of education, however, influenced participation where those with higher levels of education were more interested in attending workshops and participating in activities. Those living inland were not as interested in participating compared to those in the coastal areas where salinity and sea level rise are issues that have to be addressed regularly. Those who own land and are involved in agriculture livelihood activities were also more interested in discussing climate change. The level of income also influenced the level of participation. For instance, in some sites, poor people were more interested in working and earning an income than participating in a meeting to discuss future climate change. Wealthier groups in the village are more interested because climate change will affect their material assets.

AMDI used multiple communication tools to promote discussions to merge CCS and SCS and to explain the relevance of the SCS (step 3). Simple, visual aids on temperature rise and droughts were most effective across all sites. For example, figure 3 below shows the negative effect of rising temperature on shrimp, which is an important source of income. The image shows shrimp struggling for life as the sun gets brighter and water temperatures rise.

Figure 3: Climate Change Graphic

Source: DAI for AMDI 2014

Visuals, accompanied by contextually relevant, short, and sharp information provided by AMDI helped to explain the images. Community members also watched a video entitled "It's Getting Hot in Here" (developed by Live and Learn Vietnam) to help them understand the climate impacts in Vietnam. Knowledge brokers used songs and games to keep the participants engaged, even though these songs and games are not related to climate change. The use of "edu-tainment" that mixes 'serious' and 'fun' approaches led to good feedback from the participants. In the future, the IP suggests conducting more in-depth group discussions on particular topics instead of general discussions about climate change. For instance, there could be a focus group discussion just on salinity and not multiple topics to avoid confusion. Communication, however, needs to be an ongoing process. Once the IP held workshops to discuss and merge CCS and SCS, commune members participated. However, once the IP left, there was no follow up on the discussions. Gaps between visits by AMDI led to commune members forgetting the discussions. Following up and continuing discussions are important ways to help people understand a new and somewhat abstract concept of climate change.

For the most part, the general information in the SCS matched the CCS (step 3) in terms of temperature and rainfall, which led community members to feel that the SCS was a credible and salient document for adaptation planning. As was the case with all the scientific information, the climate projections that the SCS provided, was at the provincial level and not the communal level, which meant that AMDI had to downscale this further to the community level to make it useful for commune members to apply in their planning. For example, the SCS focused on freshwater systems, which was not very relevant to those in coastal areas since salinity and sea level rise is more of an issue. In order to discuss salinity, knowledge brokers used additional, published scientific information on salinity to complement the climate projections in the SCS to make information more relevant.

The outcome mapping (step 4) process was challenging because many community members were not used to planning for the future using outcomes. Developing the adaptation plan through outcome mapping required several iterations between the knowledge brokers and community members. There were differences in viewpoints on adaptation plan objectives and activities. For example, some participants (usually men) requested transport infrastructure improvement in their plans. Because this is not an adaptation activity and was outside of the scale their resources, AMDI explained that while infrastructure is an important aspect of community development, it lay outside the project's scope. Once explained, both parties were able to engage in productive discussions on the adaptation plan, making the process easier.

Thuan Hoa is a predominantly aquaculture community and the adaptation plan in Vietnam focuses on the sector including shrimp-rice farming and planting salt tolerant rice due to high salinity levels. Disaster risk reduction warning systems for intense rainfall and rearing livestock for supplementary income are also part of the adaptation plan (see Annex 7). AMDI is located far from the field site so it will be a challenge for AMDI to provide immediate support and facilitate communication between commune members and local leaders to implement the adaptation plan. AMDI will rely on VNRC based in the site for implementation and communication support. Continuous communication with communities is important for successful implementation. Another challenge will be to decide which type of farmer to support. Currently, adaptation plans benefit farmers in the rice-shrimp system who own land. One suggestion is to pick adaptation plans government policies support. Since the Vietnamese government has policies promoting rice-shrimp farming systems, it may be better to choose activities based on this type of farming system.

4.3 LAO PDR

The Mekong River runs through most of Lao PDR but the hydrology of the river is changing because of climate, landscape and land use change in Lao PDR. It is the poorest country compared to the others in the LMB where 72% of the population lives on less than two dollars per day. Lao PDR is also highly vulnerable to climate change due to low adaptive capacity of people (DAI 2012). Although there is limited information on climate change in Lao PDR, current projections suggest that Lao PDR will face floods and rising temperatures. Such impacts will affect agriculture, which most of the population depends upon.

In Lao PDR, IUCN-Lao PDR is the IP/knowledge broker. IUCN has been working in Nakai Districts for several years and understands the decision making process well, and how to work with the villagers in the remote area where public participation in decision-making may not be common practice. For the most part, people at the local level have very little autonomy in making decisions about their future. In most cases, the village head must consult the district or provincial level authorities before making decisions, which leaves little autonomy for the village to make and implement their own plans. Furthermore, communities do not feel that they have a role and responsibility in the decisions making process. District level officials take charge of planning and decision-making without much community input due both to a top-down style of governing structure, and community members not believing they have a role to play in public discussions.

Decision-making is, however, different from participation: Although targeted farmers in Nakai District do not have high levels of decision-making autonomy, they freely participated in developing CCS and

eventually merging CCS with SCS. Initially, men participated more than women did because culturally men play a larger role in public engagement. Women eventually participated with the help of knowledge brokers who spoke to women individually and encouraged them to contribute to the discussions. Knowledge brokers played an important role in giving women the voice to speak publically.

The biggest challenge in Lao PDR was communicating climate change, which made it difficult to establish credibility and relevance of the SCS. Considering climate change is a new concept to most community members, communicating technical terms was a challenge. Visual aids helped to explain climate impacts. For instance, facilitators showed a skinny cow on a cracked field to explain the impact of drought. The level of education may or may not have played a role in enabling community members to participate and understand the concept of climate change.

Although community members began to understand climate change, many forgot what they learned after a few months. This is partly explained by the fact that the IP was not able to travel to the site due to its inaccessibility during the rainy season. The lack of interaction between community members and knowledge brokers resulted in community members forgetting what they had initially learned about climate change. This suggests that communicating climate change is a process that needs to be sustained over time, especially when people do not possess a high level of education nor regularly think about planning for climate change. Once the rainy season ended, the IP was able to return to the site more frequently, which helped participants remember the activities they engaged in such as participatory mapping to develop CCS (this took place in IP's first visit), and the pictures that were shown to translate the SCS (during the IP's second visit). By the third time IPs visited to co-develop adaptation plans, the community was familiar with possible impacts of climate change. Without IPs visiting multiple times, the community may not have understood climate change adaptation as much.

Merging the CCS and SCS (step 3) in Nakai was not a difficult process because villagers expressed the same climate concerns about temperature and rainfall as indicated by the science. Table 1 below provides an example of rankings between CCS and SCS. Table 1 shows hazards similarly ranked in CCS and SCS, which helps to make the SCS more relevant while validating CCS findings.

Table 1: Comparison of CCS and SCS Hazards in Lao PDR

(Source: IUCN 2014)

Weather hazard	Drought		Flood		Storm/wind		Diesease		Heavy rainfall	
and livelihood	CSC	SCS	CSC	SCS	CSC	SCS	CSC	SCS	CSC	SCS
Rainfed-rice	3		2	3	0	2	2	1	2	
Livestock	2		1		0		3		2	1
Fisheries	2		3	2	0		3		0	
Mushroom collecting	3		3		0		1		3	
Rattan shoot collecting	0	1	0		0		0		0	
Bamboo shoot collecting	0	2	0	1	0	2	0		0	
Casual labours	0		3		1		0		3	

Outcome mapping was very challenging (step 3) as community members thought that 2050 is too far in the future to plan. The knowledge brokers facilitated planning for the future through outcome mapping in three timeframes: 2015, 2020, and 2050. In order to make planning for 2050 possible, IPs framed planning by discussing how to plan for children's future, which made the planning exercise for community members more salient. In this process, community members made links between current climate threats they identified in the CCS with future projections from the SCS. This helped to make the future scientific projections more relevant to community members. This process, however, was very time consuming since it presented a new way of planning for community members.

Although it was difficult to plan for the future, adaptation plans were developed with a focus on minimizing drought by conserving water through improved watershed management (see Annex 7). The IP and communities are planning activities around basic water infrastructure improvements to increase supply during the dry season. Another adaptation option is to improve livestock rearing techniques in an effort to increase food and asset security in times of drought. In order to implement these plans, government support would be required considering the heavy involvement of the government at the local level.

5. OVERALL LESSONS LEARNED ACROSS SITES

This section provides a summary of overall lessons learned when integrating scientific and community understanding of climate change in order to develop adaptation plan. The lessons are from implementing of steps 3 and 4 of the 4-step process to merge CCS and SCS. They reflect on the components of the framework to co-design adaptation plans, such as credibility, salience, legitimacy, communication, and context. The section categorizes the lessons under community engagement; learning and communication; and methodology.

Community Engagement:

- ***Community level engagement empowers community members to design their own adaptation plans.*** One of the reasons why each site was able to co-develop adaptation plans was because knowledge brokers deeply engaged with community members. Knowledge brokers enabled community members to legitimately participate, and therefore, empower them to develop their own CCS by facilitating discussions on climate change. Beyond PRA, knowledge brokers in Vietnam, for instance, used various visual techniques to help community members learn and discuss how shrimp farming will decrease due to temperature increase. Knowledge brokers also supported learning when presenting the SCS to community members. For example, in Lao PDR, community member learned that the SCS ranked diseases affecting rain-fed rice higher than in the CCS. SCS allowed community members to be aware of new potential future climate hazards that they may not have be aware of before. Discussions around SCS empowered community members to strengthen their adaptation plans since it allowed them to use SCS for outcome mapping. Knowledge brokers facilitated learning about climate change at the community level and this empowered community members to design their own adaptation plans through a climate lens.

- ***Awareness about local context is key to establishing effective participation and community level engagement.*** In order to establish effective participation among community members when developing CCS and merging CCS and SCS, knowledge brokers in all sites first acknowledged the local context that could affect participation, such as culture and social tensions. Then, knowledge brokers worked within the context to promote participation. How knowledge brokers encouraged participation when merging CCS and SCS differed among the various sites. For instance, in Lao PDR, because women do not usually engage in public discussions, knowledge brokers encouraged them to voice their concerns privately or among women groups. In such cases, IPs felt that having female knowledge brokers could be a way to enable more women to participate in public discussions. Although men and women are able to participate in public discussions freely in Thailand, social tensions between groups did not make participation easy for some. In the case of Thailand, knowledge brokers spoke to individual community members to avoid public confrontation. These examples demonstrate the importance of understanding local context that determines who can engage in developing adaptation plans as well as the importance of experienced knowledge brokers who know the

local context, can develop trust and rapport with community members, and can encourage participation accordingly.

Learning & Communication:

- ***Learning about climate change is a process.*** Knowledge brokers across all sites expressed that learning about climate change and livelihood vulnerabilities does not happen in one session but over time. Repeated visits to field sites and using powerful communication methods remind community members what is climate change and why community members should engage in the process of merging SCS and CCS. This is especially important in areas that have limited access throughout the year. Engaging community members in the learning process needs to be an ongoing activity so that community members do not forget what they have learned. Local champions from local organizations who would potentially be engaged in implementing the adaptation plan can also help refresh understanding of climate change and keep the project vision active. Local champions, however, need to engage from the start of the project to generate interest and support learning.

- ***Making SCS credible and salient depends on communication methods.*** An important part of Step 3 is to use the scientific findings from SCS to strengthen CCS and update hazard rankings. In all sites, knowledge brokers found it challenging to make SCS credible and relevant to the community members because the concept of climate change was new to most community members. Although community members deal with weather hazards on a regular basis, they are not used to technical terminology and planning far into the future. In order to overcome this challenge, knowledge brokers worked to localize the scientific information to make the SCS more credible and relevant. For instance, IPs connected messages from the SCS to how effects on farming, which would impact most participants. The use of communication methods such as the diagram on how shrimp production is affected by higher temperatures, videos and "edu-tainment" in Vietnam, helped create credibility and relevance of scientific findings from SCS while maintaining community engagement in the learning process.

Methodology:

- ***Local level climate studies are critical for designing adaptation plans.*** Although the USAID Mekong ARCC Climate Change and Impact Study downscaled climate science to the provincial level, this SCS was not adequate for communities to develop localized adaptation plans. The SCS provided important information as to how the climate has and will change in the future across the province, and how this will affect key provincial livelihood alternatives and natural systems, but this information wasn't localized to a site context. Because communities have varying microclimates and each pursue differing food and income generating options, the SCS was supplemented with a local community vulnerability and impact assessment, which the IPs conducted for each site. For instance, in Vietnam, the SCS focused on freshwater being an issue at the provincial level, which was not a concern for those living in coastal areas of Vietnam where sea level rise and salinity were larger threats. To supplement the SCS, knowledge brokers included both local level vulnerability assessments and local scientific studies on present and future salinity, which local participants were able to use to develop their adaptation plans.

- ***It is possible to plan for long-term adaptation if timeframes are broken down.*** Long term adaptation planning is a challenge. People face difficulties planning 5 years in advance let alone 35

years in advance. One way in which to address adaptation planning is to break down the planning into the present, intermediate future (5 years from now), and long term (35 years from now) when developing outcome maps. Most people are able to plan for the present and possibly the intermediate future but planning beyond 5 years requires people to connect the future with something tangible in the present: their children and immediate climate threats. Knowledge brokers facilitated discussion with community members on how community members envisioned their children's future while thinking about the climate hazards they face today and in the future, and how their children's livelihoods could change in the future with climate threats. SCS projections provided community members further insight into significant climate hazards that community members may not have perceived to be a threat in the present and future. Therefore, connecting the future change to something tangible at the present is an effective way to plan long term.

6. NEXT STEPS: IMPLEMENTING ADAPTATION PLANS

IPs and community members have successfully developed adaptation plans by merging CCS and SCS. Adaptation plans will be reviewed by external experts to assess whether they can be funded and implemented (Annex 7 contains expert views). The assessment is based on whether the plan addresses sustainable development and adaptation to climate change. The plans must show an improvement in climate resilience of rural livelihoods in the project sites. Once this decision is made, IPs will go back to communities to present the plan that has been approved. There will be some iteration between IPs and community members before implementing the plan.

Adaptation plans will potentially benefit many but implementing adaptation plans will require strong government support of the plan and community mobilization. According to DAI, implementation may be most successful in communities where government strongly supports adaptation work and DAI's implementing partners. Successful implementation will depend on when community members are available to participate depending on their seasonal migration and farming patterns. Considering that the USAID Mekong ARCC project is highly participatory, there is a high chance that communities already support adaptation plans since they helped co-develop them, and therefore, implementing adaptation plans may be a smooth process.

REFERENCES

AMDI (2014) Update on USAID Mekong ARCC Project in Vietnam Presentation. USAID Mekong ARCC Meeting for Implementing Partners. November 20 & 21, 2014. Bangkok, Thailand.

Cash DW, Clark WC, Alcock F, Dickson NM, Eckley N, Guston D, Jager J, Mitchell R (2003) Knowledge systems for sustainable development. Proceeding of the National Academy of Science USA 100(14):8086–8091.

Chaudhury M, Dinshaw A, McGray H (2014) Designing Climate Vulnerability Assessments for Decision Making Uptake: A Conceptual Framework and Case Examples. USAID: African and Latin American Resilience to Climate Change (ARCC).

DAI (2014a) Annual Report Year Three – October 1 2013 to September 30, 2014. USAID: USAID Mekong ARCC.

DAI (2014b) Mekong ARCC Presentation. USAID Mekong ARCC Meeting for Implementing Partners. November 20 & 21, 2014. Bangkok, Thailand.

DAI (2012) Mekong Adaptation and Resilience to Climate Change Work Plan. USAID: USAID Mekong ARCC.

Guston DH. 2001. Boundary organizations in environmental policy and science: an introduction. *Science, Technology and Human Values* 26(4):399-408.

Hammill A, Harvey B, Echeverria D (2013) Understanding Needs, Meeting Demands: User-oriented analysis of online knowledge broker platforms for climate change and development. Winnipeg: IISD.

IUCN (2014) Project Progress in Lao PDR Presentation. USAID Mekong ARCC Meeting for Implementing Partners. November 20 & 21, 2014. Bangkok, Thailand.

Jasanoff S, Wynne B. 1998. Science and decision-making. In: Rayner S, Malone E, eds. *Human choice and climate change: the societal framework*. Columbus, Ohio: Battelle Press. 1:1-87.

Kushner B, Waite R, Jungwiwattanaporn M, Burke L (2012) Influence of Coastal Economic Valuations in the Caribbean: Influencing Conditions and Lessons Learned. WRI Working Paper November 2012.

Nisbet, M. C. (2009). Communicating climate change: Why frames matter for public engagement. Environment: Science and Policy for Sustainable Development, 51(2), 12-23.

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. Available online at: www.mekongarcc.net/resource.

ANNEX 1: QUESTIONNAIRE 1

A. Local Context

1. Do you feel as if you have a good understanding of the local planning and decision-making processes? If yes, please describe this context.
2. Do you think this context fosters co-learning and participatory planning and decision-making? Why or why not?
3. Do you think it will be challenging to work with socially differentiated groups to merge community climate stories (CCS) and scientific climate stories (SCS)?

B. Questions on Developing Scientific Climate Studies

1. How do you plan to communicate and present how projected changes in climate will impact the community to the community?
2. Do you perceive that scientific climate projections will be difficult for the community to understand? Why or why not?
3. How do you plan to carry out the outcome mapping?
4. Do you think this process will support learning between IPs and community members? Why or why not?

C. Questions on Integrating Community Climate Stories with Scientific Climate Studies

1. What kinds of strategies (i.e. participatory approaches, tools, networks) do you anticipate using to bridge community climate stories with scientific climate studies?
2. How will you communicate the need to merge CCS and SCS?
3. What do you think will be some of the challenges and enabling factors that may hinder or help the knowledge integration process?
4. How will you evaluate that CCS and SCS has been integrated enough to reach a shared understanding of climate change issues that could lead to the development of adaptation options?

ANNEX 2: QUESTIONNAIRE 2

A. Context of Learning and Planning

1. When you were developing your plan to integrate CCS and SCS, was there anything about the community that you kept in mind during your planning?
2. Was there anything challenging about the context that affected how CCS and SCS and were integrated?
3. Was there anything about the context that made it easy to integrate CCS and SCS?
4. Question for Chiang Rai, Thailand: Since decision making takes place at the sub-district level, did this make it easier for people to participate in sharing and learning from CCS and SCS, and developing adaptation plans? (This is from part 1. This may or may not be asked depending on the conversation)
5. Question for Sakon Nakhon, Thailand: Was it easy for Catholic groups and former communists to participate when sharing and learning from CCS and SCS and, developing adaptation plans? (This is from part 1. This may or may not be asked depending on the conversation)
6. Question for Thuan Hoa, Vietnam: Was it easy to engage people at the village level to share, learn and co-produce adaptation plans when historically commune leaders rarely involved people at the village level in decision making? (This is from part 1. This may or may not be asked depending on the conversation)
7. Question for Nakai District, Lao PDRs: Was it easy to engage people at the village level to share, learn and co-produce adaptation plans when historically people at the village level do not participate in decision making? (This is from part 1. This may or may not be asked depending on the conversation)

B. Communicating and Learning from Integrating CCS and SCS

1. What kinds of methods did you use to collect develop the CCS?
2. What kinds of methods did you use to develop the SCS?
3. What kinds of communication methods did you use to communicate the SCS to community member?
4. Did you face any challenges when using these communication methods to explain the SCS to the community? If so, how did you overcome these challenges?
5. What helped in communicating the SCS to the community?
6. Were there any differences in understanding between men and women? If so, what were the differences and how did you accommodate different types of understanding related to climate change? (gender is a part of the ARCC Mekong project)
7. Did you try to simplify messages from the SCS and make SCS content relevant to community members? If so, how? (simplifying messages was a common issue in part 1)
8. Where there any uncertainties that you had to communicate from the SCS to the community members? If so, what were they and how did you try to communicate uncertain information about the future? (communicating uncertainties was a common issue in part 1)

9. Was there anyone in the community that helped other community members to understand information from the SCS or helped you understand the situation in the community? If so, please describe how he/she helped to integrate CCS and SCS.
10. What was the biggest lesson that you learned when trying to communicate and integrate CCS and SCS?
11. Did anything surprise you in the process?
12. Overall, do you feel that community members have developed a better understanding of climate change based on SCS and CCS so that they are able to make informed decision and plan adaptation activities? Why or why not?
13. If you were to integrate SCS and CCS again in the future, what would you do differently?

C. Co-Designing and Implementing Adaptation Plans

1. Now that you have integrated CCS and SCS, how will you co-design an adaptation plan with the community? How would you go about prioritizing options?
2. What do you think will be the barriers when co-designing the plan?
3. What do you think will enable you to easily co-design the plan?
4. What do you see as enabling factors and barriers to implementing the plan?

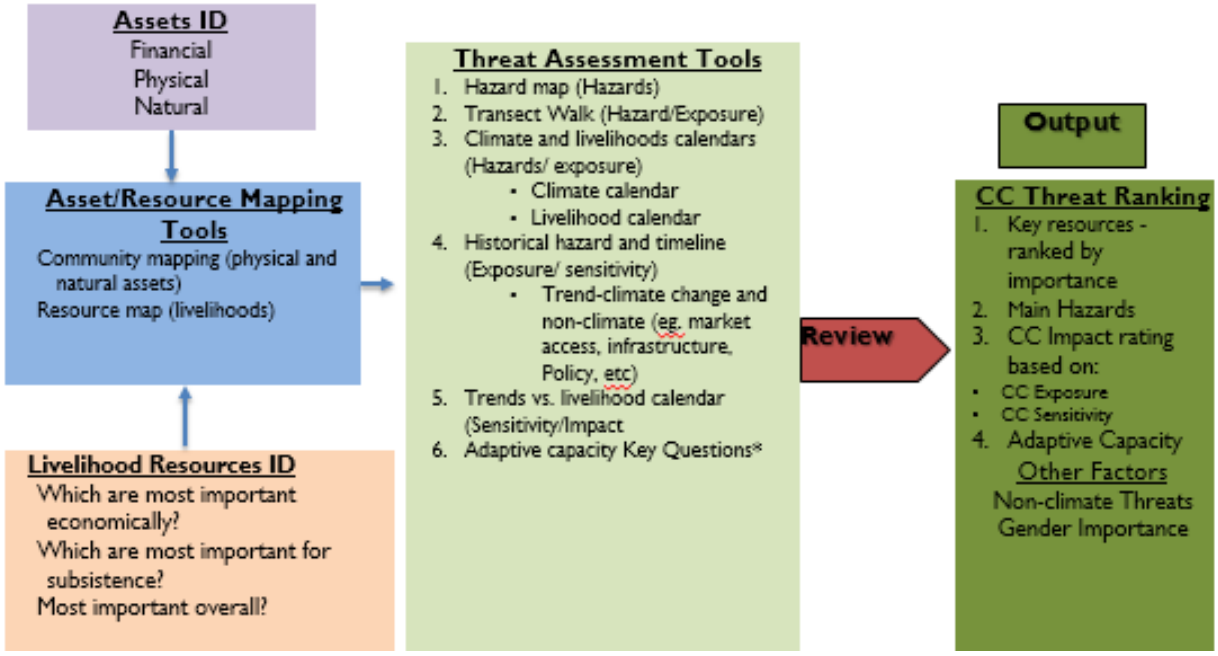
D. Questions for DAI

1. What do you hope the IPs will be able to accomplish when merging SCS and CCS?
2. What kinds of challenges have the IPs faced so far in developing the SCS and CCS and then trying to merge the two types of understanding of climate change in the various sites?
3. What has helped the IPs so far in the process so far to accomplish the task of merging SCS and CCS in the various sites?
4. Overall, do you think the merging of SCS and CCS has gone well in the various sites? Why or why not?
5. Now that you have learned from the process of merging SCS and CCS, what would you do differently the next time you attempt this?
6. What do you anticipate will be the challenges when IPs and community members co-develop adaptation plans?
7. What do you anticipate will the challenges and opportunities to implementing the adaptation plans?

ANNEX 3: COMMUNITY CLIMATE STORY PROCESS

Figure 4: Community Climate Story Process

(Source: DAI 2014a)



Below is an example from Lao PDR on the CCS process (IUCN 2014)

Figure 5: Resource Mapping

Figure 7: Climate Hazard Assessments

Hazard & Climate Calendar	Dry season				Rainy season							Dry
	1	2	3	4	5	6	7	8	9	10	11	12
Flood								**	**			
Drought												
Rainfall									***	***	***	
Animal disease			Db	Dp								
Fish disease			De	Df								

TC = Too cold D = Diarrhea TH = too hot * = Low ** = Medium *** = High

Db = Buffalo die Dp = Pig die De = Eel die Df = Fish die

Figure 6: Livelihoods Assessments

Livelihood activities	Dry season				Rainy season							Dry
	1	2	3	4	5	6	7	8	9	10	11	12
Rice						P+S ♀+♂	P+T ♀+♂	L ♀+♂	L ♀+♂	H ♀+♂	H ♀+♂	H ♀+♂
Grow vegetable, corn and peanut					P	H	H					
Fishing					*** Frog	*** Frog	*** Fish	*** Fish	*** Fish	*** Fish		
Collect mushroom					***	***	***					
Livestock												
Collect bamboo shoot					**	***	***	***	***	***	***	
Hunting (birds and mouse)											***	***

* Low ** Medium *** High

P = Plough S = Seedling T = Transplanting L = Look after H = Harvest

Figure 8: Threat Ranking

Impact	Drought	Flood	Storm	Disease	Rain
Rice	3	1	0	3	2
Capture fishes, frogs and snails	3	0	0	2	2
Collect NTFPs	1	0	0	0	1
Hunting	1	1	0	2	0
Worker service	2	2	0	1	1

0 = No impact 1 = Low 2 = Medium 3 = High

ANNEX 4: MERGING SCS AND CCS

(Source: DAI 2014b)

STEPS	REVIEW	EDUCATION	VALIDATION & SHARED UNDERSTANDING	SCENARIO DEVELOPMENT
Objectives:	1) Explain Scientific Climate Story process 2) Explain importance of community view and scientific view (uncertainty) 3) Report back key findings from awareness survey (using charts and graphs) 4) Review weather hazards identified by villagers (from community climate story workshop)	1) Explain "weather" vs. "climate" • Videos (in local language if exist, if not explore ways to dub) • Q&A 1) Provide specific site based projections • Matching card games (threats, vulnerabilities, adaptation options) • Drawings/Comic/Booklet • Posters • Quiz Game 1) Wrap Up by asking • What do you need to know about the weather today? • In 5 years? • What do your children need to know about the weather in the future?	1) Compare community weather hazards vs. projection direction 2) Compare community vulnerabilities with projected vulnerabilities 3) Re-rank community vulnerabilities 4) Capture changes or validation 5) List out potential opportunities	1) Develop timelines with historical events from CCS (Past, Today, 2050) 2) Outcomes: What do they want to see and don't want to see—today and for their children. 3) Develop Vision 4) Discuss what they can do to achieve what they want to see in each period (today, 5years, children's life) Q: What are they doing today? Q: What could they do better? Q: What else could they do? (Today, 5 years, Future)
No. of day(s):	One day		1-1.5 days	
Expected results:	• Increase understanding of process • Increase awareness of projected impacts locally	• Introduction of key climate change concepts • Reviewed scientific vulnerabilities	• Prioritization of hazards and vulnerabilities based on community perception and scientific projection	• Desired outcomes identified • Vision developed • Range of options identified

ANNEX 5: COUNTRY-SPECIFIC CHARACTERISTICS

(Source: DAI 2012)

Setting MRB	Country Context	Projected CC Impacts	Projected Resulting Effect	Existing Initiatives
Lao PDR ▪ Lies almost entirely within the LMB. ▪ Climate, landscape and land use are the major factors shaping hydrology of the river.	▪ 74% of population live on less than $2 per day (source World Bank) ▪ High vulnerable to CC due to low adaptive capacity ▪ Limited information available to identify future climate change trends	▪ Significant precipitation increase in east and south ▪ Increase in mean annual temperature ▪ Increase in severity, duration, frequency of floods, particularly in floodplain areas ▪ Mekong River tributary sub-basins with higher discharges	▪ Agricultural and infrastructure losses due to increased storm intensity/frequency; ▪ Land degradation, soil erosion, higher prevalence of infectious diseases from increased rainfall ▪ Hydropower projects alter hydrological regime, exacerbate vulnerability downstream	▪ Policy frameworks are the 2009 NAPA and the 2010 Strategy on Climate Change; ▪ ADB assisting GoL to prepare Climate Impact and Adaptation Sectoral Strategy for Rural Infrastructure; ▪ GoL activities in water resource, ag and forestry adaptation
Thailand ▪ River forms border with Laos, intersects Northeast, Northern regions. ▪ Northeast contributes small % of river's flow due to evaporation	▪ World's largest exporter of rice ▪ GDP per capita greater than that of Laos, Cambodia and Vietnam combined ▪ Agriculture employs 49% of the population and contributes 10% of GDP. ▪ Coastal areas vital for tourism	▪ Increase in mean annual temperature/length of hot season ▪ Higher rainfall intensity in the wet season. ▪ Increase in flood and drought frequency ▪ River basins face H2O shortage	▪ Changes in rice productivity ▪ Damage to wetland from reduction in water availability ▪ Damage to the coastal zone from changes to coastal erosion and accretion patterns ▪ Sea level rise covers Bangkok, stresses coastal tourism.	▪ Policy frameworks include Action Plan on National Climate Change and Five Year Strategy on Climate Change (2008-12), which provides guidance for developing action plans for adaptation activities; ▪ Significant int'l support for over 75 CC projects in 5 sectors.
Cambodia ▪ River enters Cambodia with 95%+ of flows having already joined ▪ Large-scale reversal of flow into and out of Tonle Sap ▪ Phnom Penh marks beginning of delta	▪ Fisheries supply 80% of animal protein in Cambodian diet ▪ Fishing primary income source for 1/3 of Tonle Sap pop^{n}, ▪ Agriculture sector accounts for half the GDP ▪ High vulnerable to CC due to low adaptive capacity	▪ Increase in mean annual temp. of 1.4 to 4.3C by 2100. ▪ Annual rainfall to increase, particularly in wet season. ▪ Flooding and droughts increase in frequency, severity, duration ▪ Inundation of the coastal zone ▪ Changes in water levels affect flow reversal of Tonle Sap	▪ Changes in rainfall, temperature, hydrology alter fish abundance, availability, composition ▪ Coastal zone inundation leads to prevalence of infectious disease ▪ Upstream dams exacerbate CC impacts by retaining sediments and blocking fish migration ▪ Sea level rise in Vietnam results in mass migrations to Cambodia.	▪ Primary policy framework (NAPA) does not prioritize adaptation planning ▪ Policies focus more on disaster relief than climate change ▪ Hosted two significant int'l adaptation financing initiatives: Pilot Programme for Climate Resilience. EC's Global Climate Change Alliance.
Vietnam ▪ Delta that is sensitive to both upstream hydrological change and sea level rise.	▪ Mekong river delta contributes 46% of total national food production;	▪ Increased precipitation leads to flooding and saline intrusion ▪ Increased annual average temperature of 2.5°C by 2070 ▪ Changes in rainfall pattern, increased incidence/severity of typhoons and drought ▪ Possible sea level rise of 1.0 m by 2100, extreme tides/storm surges	▪ Flooding: 40% drop in rice yields; ▪ Sea level rise results in losses equivalent to 7-10% of GDP ▪ Salinity intrusion changes cropping patterns, productivity, negatively effects ecosystems. ▪ Prevalence of infectious disease ▪ Dams limit sediment deposit, contribute to land erosion.	▪ National Target Programme (NTP) principal policy framework addressing CC in Vietnam; ▪ Ministry of Agriculture and Rural Development completed Action Plan Framework for addressing climate change in agricultural and rural development sector.

ANNEX 6: ADAPTATION PRIORITIES FROM CCS AND MERGING OF SCS AND CCS IN SAKON NAKHON, THAILAND (IUCN 2014)

Priorities from CCS

1. Develop water supply system for the community by establishing a fund for developing the community water supply system.
2. Increase a potential in practicing delicate rice cultivation in small scale.
3. Developing knowledge and system for additional food cropping in sugarcane and cassava cultivation areas e.g. growing upland rice in sugarcane or cassava cultivation areas
4. Enhancing livelihood options e.g. growing a variety of native vegetables (e.g. *Melientha suavis*) and promoting them to be the community cash products. Undertaking integrated farming in the rubber plantation such as feeding ants for the eggs in rubber cultivation, growing Arabica coffee in between the rows of rubber plantation and growing eaglewood (*Aqularia spp.*) etc.
5. Developing system for native livestock feeding e.g. chicken and pig.

Revised priorities from merging SCS and CCS

1. Water management remains priority 1.
2. Forest management is added as priority 2 due to the importance of NTFPs.
3. Agriculture, which includes the following sub-themes, is priority 3.
    - Increase a potential in practicing delicate rice cultivation in small scale.
    - Developing knowledge and system for additional food cropping in sugarcane and cassava cultivation areas e.g. growing upland rice in sugarcane or cassava cultivation areas.
4. Enhancing livelihood options remains priority 4.

ANNEX 7: ADAPTATION PLANS

(Source: DAI 2014b)

Organization	Threats/Issue	Solution	How Solution Addresses Threat/Issue	Sector Expert Feedback on Proposed IP Plans
AMDI *Kien Giang, Vietnam*	Rising sea levels/salt water intrusion	- Salt tolerant rice - Sedge and shrimp system - Water monitoring system	- Solution maintains shrimp production while making system resilient to increased levels of salinity. - Water monitoring program to improve information for farmers to help with timing for planting rice and harvesting shrimp. - A potential barrier is the dynamism of the issue/threat.	**Jesper (Aquaculture):** Over time, the salinity gradient moves inward, we can move the pilot in the intermediate zone as well. There's a risk that the farmers don't like the nursery option and there's a risk that the shrimp won't grow as fast. Making good use of the slurry from the pigs. **Claire (Water):** Salt intrusion is the main water issue, also the general lack of fresh water and limited rain water collection which requires imported water from offshore limestone islands. **Tom (Livestock):** Need good clean water for pig production. Would recommend all organizations to do a quick and dirty market survey on pigs. You need to work out what your limitations are in your local market and whether you can look beyond that in terms of your production capacity. **Alex (Scaling/Partnerships):** Would like to hear more about the consideration of various modeling and forecasts which will have consequences for Kien Giang (salinity will move very high upstream). There's a risk of developing solutions based on certain information that will change. Should consider potential
	Increased intensity of natural disasters, changes in rainfall	- Provide education to raise community awareness (incl. use of loudspeaker system) - Develop system to collect information from local teams in charge of collecting indicators from farmers (water salinity levels, etc.)	- Increases local community's understanding of climate change impacts on livelihoods so they can better prepare for climate change scenarios. - Improves local farmers' capacity to use weather information for their farming activities.	
	Decreasing income for vulnerable groups (decreasing land plot size is particularly an issue)	- Pig production on bio-mattress – fresh water is an issue in this commune – focus more on intermediate and further inland zones.	- Addresses income diversification, land generation, and gender equity - Projected climate change impacts mean that income from aquaculture and other enterprises are decreasing so diversification of income sources are important. - Pig production is beneficial in terms of	

Organization	Threats/Issue	Solution	How Solution Addresses Threat/Issue	Sector Expert Feedback on Proposed IP Plans
			less run off in streams and canals. - Integrating pig production with a small home garden, since you will be having good compost output, will help improve food security and income diversification.	interaction with other initiatives in the area to achieve a broader impact. **Henry (Comm. Development):** What I like is that AMDI isn't focusing on the things you can't do. When visiting, I saw waste management was an issue with sewage going into the canals, I'm not sure if it's possible to do under this project, but keep in mind this is still a pretty big issue. Perhaps there is something you can do. Also consider water management during natural disasters, when the fresh water supply boats won't be able to access the islands regularly, if at all.
IUCN – Lao *Khammouan, Lao PDR*	Drought	- Water storage system	Water management system with tank system and a deep well	**Jesper**: What is the viability of aquaculture here? **Claire**: Will be able to improve water storage management given current level, must determine community wants and what makes sense for the long term. **Tom**: Must be careful about the transition from free-range livestock to a confined system. **Alex**: Forest conservation seems to be a threat (landslides, flash floods), which requires collective action and public investment that may be outside the focus of the Mekong ARCC project. **Henry**: Talk about ecotourism doesn't make sense right now, the village doesn't have the resources to manage. Would need to set up the system, and you're still a couple years from that. Training mechanics and
	Flooding	- Forest conservation system - Weather monitoring system	Long-term water conservation and increasing preparedness	
	CC Impacts on Income Sources	- Training for supplementary occupations (mechanics, livestock, tailoring) - Ecotourism?	Diversify the community's sources of income to increase resilience to climate change impacts on natural resources.	

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				establishing a mechanic shop would be good, with all the motorcycles and hand tractors. If they break down, they lose basic sources of income. But Mekong ARCC would have to determine if this in within the scope of the USAID project. Pigs and composting system –your problem would be market access. With a basic situation, need to start with the basics.
IUCN-Thailand *Chiang Rai & Sakon Nakhon, Thailand*	Increased temperature/heat stress	- Black pigs - Native rice cultivation - Pak wan	- Healthier cleaner environment - Genetics - Local knowledge	**Jesper**: Talked a bit about tilapia and catfish, I think you can integrate agriculture and aquaculture systems. **Claire**: Many water-related threats here. Will have to see what other organizations are doing in this sector already. **Tom**: I would recommend checking supply, demand and access in the local areas. **Alex**: How would national-level flood mitigation plans impact the adaptation option plan? You might develop solutions for a problem now, but need to account for these national-level changes to inform which investments to support. **Henry**: The composting feeds into agriculture, water supply and water management to reduce waste for the people, new pig system. It is an integrated program.
	Drought	- Improved water management	- Clean water supply - Water charges - Water conservation for farming use	
	Loss of biodiversity	- Improved forest management	- Integrated agroforestry (assam tea, fruit trees) - Biodiversity surveys	
	Heavy rainfall, affecting water quality	- Improved water management	- Water quality testing - Water filters	
	Lack of agricultural diversification	- Exchange visits - New crops	- Integrated agriculture	
	Excess agricultural chemicals	- Improved waste management	- Composting	
WFP *Kampong Thom, Cambodia*	Drought – no water management, no pond, no canal.	- Water management system and infrastructure - Community committees to maintain - Training	- Improved access to water - Building capacity for community-based management	**Jesper**: Should look more into an integrated approach. The World Fish Center has successful small catfish systems existing to show people in

Organization	Threats/Issue	Solution	How Solution Addresses Threat/Issue	Sector Expert Feedback on Proposed IP Plans
	Animal disease – strong biosecurity, vaccines are limited	- Technical expertise and training - Awareness raising - Building partnerships	- Improved food security - Links to improved livelihood security - Has knock-on effect on agriculture production.	the pilot area so the households can discuss pros/cons of these systems. **Claire**: Water committees are very common in Cambodia. WatSan group in Phnom Penh may be good resource. **Tom**: You have opportunity to work closely with community and utilize best practices from FAO and SAF who have experience in the region. Opportunity to try out some new things at a localized level and feed that back into other organizations more broadly. **Alex**: What are the solutions targeting the most vulnerable and some side-effects of those solutions on the most vulnerable? **Henry**: If you're dealing with water shortages, is it possible to think about pond construction?