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Case Study in Cambodia Community Based Adaptation: Two Examples from Rural Affected Communities

Cambodia Community Based Adaptation Programme (CCBAP)

UNDP Cambodia

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SWEDEN

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Executive Summary

Investments in Cambodia Community Based Adaptation Programme (CCBAP) during the 2010-2012 have achieved significant results in improving adaptive capacities at community level. CCBAP is designed to implement community based adaptation projects that seek to enhance the resiliency of communities to climate change impacts, through local level climate risk management projects. The objective of the case study report is to show two successful examples of community based adaptation project through capturing good practices and lessons learnt on community based adaptation measures that enhance community resilience to climate risks such floods and droughts in Cambodia. The first case showed clear evidences for community based adaptation to droughts through constructing water harvesting structure (spillway) to keep the water for irrigation, introducing new resilient seed variety, and changing in cropping calendar for improving farming activities. The second case revealed that the target communities has improved adaptation to floods through rehabilitating canals that have two strategic functions as drainage canal and irrigation canal. This has helped them change in agricultural practice through better water management by turning flood threats into farming opportunities. Each case identified good practices and lessons learnt from the two project examples to building resilience and adaptation at the community level. Consequently, this ensures that the communities could improve adaptive capacities to cope with climate change and ensure food security.

Abbreviations

AKAS	Action for Khmer Aid Service
CBA	Community Based Adaptation
CBO	Community Based Organization
CCBAP	Cambodia Community Based Adaptation Programme
CDP	Commune Development Plan
CIP	Commune Investment Plan
FWUC	Farmer Water User Committee
FWUG	Farmer Water User Group
GEF	Global Environmental Facility
IPM	Integrated Pest Management
MOE	Ministry of Environment
NGO	None Governmental Organization
PDOWRAM	Provincial Department Of Water Resources And Meteorology
SG	Saving Group
SGP	Small Grant Programme
SRI	System of Rice Intensification
TOT	Training of Trainer
USD	United States Dollar
UNDP	United Nations Development Program
VRA	Vulnerability Reduction Assessment

Introduction

Climate changes over time may be due to natural variability or as a result of human induced increases of greenhouse gases in the atmospheres and is reflected in the variation of the mean state of weather variables including temperature, precipitation and wind[1]. Current climate change estimates indicate that major environmental changes are likely to occur due to climate change in practically every part of the world, with majority of these changes being felt through modification of hydrological cycle as e.g. floods, droughts and storms[2].The impact is severely increasing on Cambodia because of high dependence on natural resources and lack of resources to cope with the changing climate. Climate change is expected to affect Cambodia significantly as it is one of the most vulnerable countries in the region.

Cambodia's vulnerability to climate change is linked to its characteristics as a post-civil war, least developed, agrarian country with 80% of the population living in rural areas, weak adaptive capacity, poor infrastructure and low elevation of the central plain[3]. Climatic events such as floods and droughts are already recognized as one of the main contributors to poverty in Cambodia. These changes will lead to greater variability and less predictability with much of the impact falling through water resources, with changes in availability, quantity and quality[4]. Natural hazards such as floods, droughts and storms are likely to become more prevalent and more intense. It is also expected that changes will occur in the timing, duration and intensity of the two main seasons – the wet season and the dry season. In short, this will mean that the dry season will be longer and drier than before, while the wet season will start a few weeks later and will be shorter and wetter than previously[5]. These types of shifts in

[1] Orindi, V.A. and Siri, E. 2005. Mainstreaming adaptation to climate change in the development process in Uganda. Ecopolicy 15. African Centre for Technology Studies (ACTS).

[2] TKK and SEA START RC. 2009. Water and Climate Change in the Lower Mekong Basin: Diagnosis and Recommendations 158 CAMBODIA HUMAN DEVELOPMENT REPORT 2011 for Adaptation. Water and Development Research Group, Helsinki University of Technology and the Southeast Asia START Regional Centre, Chulalongkorn University. Water & Development Publications, Helsinki University of Technology: Espoo, Finland.

[3] UNDP. 2010. “Cambodia Community Based Adaptation”. Project Document Report: Phnom Penh.

[4] UNDP. 2011. “Building Resilience: The Future for Rural Livelihoods in the Face of Climate Change”. Cambodia Human Development Report: Phnom Penh.

[5] Ministry of Environment (MoE). 2010. “GHG Inventory and Mitigation Study” (draft report prepared for SNC). MoE: Phnom Penh.

seasonal patterns will have enormous implications for the ways that people in Cambodia farm: changes to the growing time, changes to water availability, and reduced productivity of traditional crop varieties[6] [7]. But the impacts will also have broader implications for key areas of economic activity that are profoundly influenced by water and temperature – fisheries, forestry, food security, and health.

Under climate change, the frequency and intensity of floods and droughts are expected to increase. Marginal development gains attained during this decade in rural areas, after a turbulent past can be wiped out by climate change and variability. Farming communities in the rural areas whose capacity to deal with even the current climate variability is low will be mostly affected. Climate change and natural resource degradation have increased the vulnerability of poor rural Cambodians to food insecurity. Currently more than 13 million people are affected by drought and seasonal rains are becoming increasingly sparse and erratic[3]. This situation is expected to dramatically deteriorate as a result of climate change. Therefore there is an urgent need to build the low capacity of the communities to adapt to climate change and variability in order to ensure food security in rural communities of Cambodia.

The Cambodia Community Based Adaptation Programme (CCBAP) has been designed to implement the notion that adaptation will be more successful if it takes into account present and future risks. As a result, the CCBAP takes into account flooding and droughts, which have been identified as the most serious risk to communities, and integrates adaptation strategies in the short term with vulnerability reduction and risk management in the future. During the life of each individual Community Based Adaptation project, and consequently the programme as a whole, communities should observe a measurable reduction in their vulnerability to flooding and drought. It has been predicted that Cambodia will experience higher annual rainfall, with prolonging dry period in the rainy season and longer dry season and a more intensive wet season. At present, efforts to mitigate the effects of such weather patterns focus on disaster relief after extreme weather. The CCBAP aims to enhance community capacity to anticipate future climatic extremes and mitigate and adapt to them.

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[6] Johnston, R., C.T. Hoanh, G. Lacombe, A. Noble, V. Smakhtin, D. Suhardiman, K.S. Pheng and C.P. Sze. 2009."Scoping Study on Natural Resources and Climate Change in Southeast Asia with a Focus on Agriculture. Report prepared for SIDA. IWMI: Vientiane.

[7] Eastham, J., F. Mpelasoka, M. Mainuddin, C. Ticehurst, P. Dyce, G. Hodgson, R. Ali and M. Kirby. 2008. Mekong River Basin Water Resources Assessment: Impacts of Climate Change. CSIRO: Canberra.

The mission of CCBAP is designed to implement community based projects that seek to enhance the resiliency of communities to climate change impacts, through local level climate risk management projects. Lessons learned from community projects will then be leveraged to promote replication of successful community practices, and integration of lessons into national, sub-national policies and local planning process that reduce vulnerability to climate change impacts, from the community level to the national level. The CCBAP intends to produce 3 deliverables as the following:

i. Improved capacity within NGOs, CBOs and local communities to implement community adaptation measures
ii. Adaptation to climate change mainstreamed into commune level planning; and
iii. Lessons and good practices documented and shared to influence policy and programme development

Funded by Sweden and AusAID CCBAP granted to 46 projects with the amount of USD 2,837,612.15 in 380 villages, 107 communes, 56 districts in 21 provinces. Among the total budget, SIDAfunded USD 2,588,275.65 to 41 projects (34 projects to LNGOs and 7 projects to CBOs) implemented in 353 villages, 97 communes, 48 districts in 18 provinces and AusAID funded USD 249,336.50 to 5 projects implemented in 27 villages, 10 communes, 8 districts in 7 provinces.

Based on the traditional farming, only one crop cultivation cannot support community livelihood and sustain food security particularly within the current circumstance of climate change. Therefore, the four themes have been defined as the new approaches which the community can apply to adapt to climate change as follows:

- Water management: most of CBA project focused on rehabilitation of canals, community and family ponds, reservoir, water gate and new built spillway, water gate, pipe line installation from waterfall, rain water harvesting reservoirs and provided water filters.
- Resilience agriculture techniques: providing SRI techniques through using the resilience seeds, compost fertilizer, IPM, water management in the rice fields, vegetable growing, home gardening, animal raising, fish raising, cow banks...etc.
- Livelihood improvements: forming and supporting new saving groups, strengthening existing saving groups, promotion of community-based ecotourism, diversify incomes through small business in local context such as grocery, making cake buying seeds...etc.

- ❖ Capacity building on climate change: conducting the awareness raising on climate change, training on disaster preparedness, introducing adaptation practice through diversify crops and not depending only on rice.

This report presents the results of two case studies from Cambodia Community Based Adaptation Programme. The objective of the case study is to show two successful examples of community based adaptation project through capturing good practices and lessons learnt on community based adaptation measures that enhance community resilience to climate risks such floods and droughts in Cambodia.

Case Study 1

Community Initiative for Climate Change Adaptation through Water Conservation and Food Production

1. Background and objectives

Kampong Speu Province of Cambodia is considered one of the drought frequently affected areas in Cambodia. Specific characteristics of drought in the province are unpredictable delays in rainfall arrival in the early wet season, erratic variations in wet season rainfall arrival, amount or duration, early ending of rainfall during the wet season, and mini drought has occurred very frequently in the last 20 years and almost twice per year; between June and July and between October and November [8]. Drought and irregular rainfall are the most climate change vulnerabilities in the target commune and also have produced a significant negative impact on farmers' livelihood, particularly food security.

Figure 1: Rice fields affected by a short drought in Pheari Meanchey Commune observed in June 2012

Pheari Mean Chey commune is located in the north-eastern part of Baseth district in the Kampong Speu Province. There are 13 villages in the commune and 6 villages namely Trapeang Phlong, Prey Rong, Tasaom Aok, Samrong Pong Tuek, SachTrei and TuekThla, were selected as the project target area. There are 774 families with the population of 3,904 people (2,020 females) and their main livelihood activity is agricultural rice farming with 95% of the total families as rice farmers (Commune data book, 2010).

Based on the survey from the Vulnerability Reduction Assessment (VRA) conducted in April 2011, the community farmers in the target area emphasised that drought, rainwater shortage and hot temperature were the severely climate related risks which they had confronted within the community. Facing with frequent droughts, insufficient and irregular rainfall in the last 10 years, farmers in Pheari Mean Chey always delay rice transplanting until there is sufficient

[8] NGO Forum. 2012. "Impact of climate change on rice production in Cambodia". NGO Forum on Cambodia: Phnom Penh.

rainwater particularly in August or September but it is still scarce in some years (Figure 1). According to the VRA, the rice production in this commune was always reduced or even totally damaged due to this climate constraint. Moreover, the increase in temperature and droughts has resulted in more vulnerability on degradation of soil fertility within the community rice fields. During drought period, the community farmers whose rice fields were located along the existing canal (Figure 2) could get access to the water for irrigation through water pumping supported by Provincial Department of Water Resources and Meteorology (PDOWRAM) who spent diesel around 300 litters with transport cost of about 150,000 Riels (40 USD) for the intervention during the long drought period in the rainy season However, water in the canal was temporarily available and almost emptied at the end of the rainy season due to free water flow without water harvesting structure such as dam reservoir or spillway which was capable to store water in the canal from the upstream area. To keep water for sufficient use for rice production during the cultivating period, the local communities in the Pheari Meanchey commune have contributed some money about a few millions Riels (approximately 500 to 750 USD) nearly every year to build earth wall temporarily using sacks of sand to keep the water stored in the canal. However, this alternative option was costly and could not last long because when water flowed turbulently or flash flood occurred during heavy rain at the upstream area, this structure was always broken down. Because of these difficulties, the community farmers have lost both money and time.

Figure 2: Irrigation canal located in the target area having no water due to lack of water harvesting structure.

Consequently, Green Village Organisation has initiated an adaptation project with financial support from Sweden through Cambodia Community Based Adaptation Programme (CCBAP) managed by UNDP Small Grant Programme. The project has started from July 2011 to November 2012 with funding of USD 49,983.95 from UNDP/GEF SGP. The main goal of the project was to strengthen the climate change adaptation capacity of community through improving access to irrigation and improving technical knowledge and skills on agricultural productivity. The two main objectives are as follows:

- Increase accessibility to irrigation for 357 families with 331 ha of rice field for wet season rice and 105 families with 42 ha of rice field for dry season rice.

- ❖ Increase food productivity of 120 target families in target villages

2. Methodology and approach adopted in the project

2.1. Identifying priority needs of the community

Based on the VRA meeting, the common problems that the target communities faced from climate change occurring in the target area were: drought, soil fertility degradation, temperature increasing, insect problems on crop plantation, low yields of rice productions, animal diseases and human diseases. Through group discussion, it showed that the climate change impact severely affected the community livelihood including low yield of rice production, poor soil fertility which was hard and compact from year to year, many diseases happening with their animals and poultries, and increasing hot temperature. According the discussion, women, men and authorities group indicated their group were similarly affected by the climate change impact.

To adapt with this constraint, the community raised that the priority activities needed to be done included construction or rehabilitation of water irrigation infrastructure, soil improvement, training on new resilience techniques for livestock, rice transplantation, and introducing new rice variety which is resilient and can produce high yields.

2.2. Promoting stakeholder participation and collaboration

The project can be successful and sustainable when the project interventions are responsive to the real need of community members and also close cooperation with commune authority and technical line departments at subnational level. Even though the project was executed by Green Village Organization, this project applied a collaborative platform to promote relevant stakeholders in decision making and implementing the adaptation. The project engaged project's beneficiaries for implementing project's interventions in all stages including planning, implementing, monitoring and evaluation. The project beneficiaries have expressed their strong willingness to work closely. The agriculture office of Baseth district assisted on agricultural activities including training, field demonstration and monitoring support after the completion of project. The Provincial Department of Water Resources and Meteorology, Kampong Speu (PDOWRAM) has provided technical support on specifications and monitoring of spillway design and construction as well as formulating and strengthening of Farmer Water User Group (FWUG) for the community to manage effectively the spillway and water management. More importantly, there was an active support of project implementation and coordination from Pheari Meanchey Commune.

2.3. Construction of water harvesting structure

There was an existing irrigation canal which was made during the Khmer Rouge Regime from 1976 to 1978. It is located in Sach Trei village and received water from about 9 km

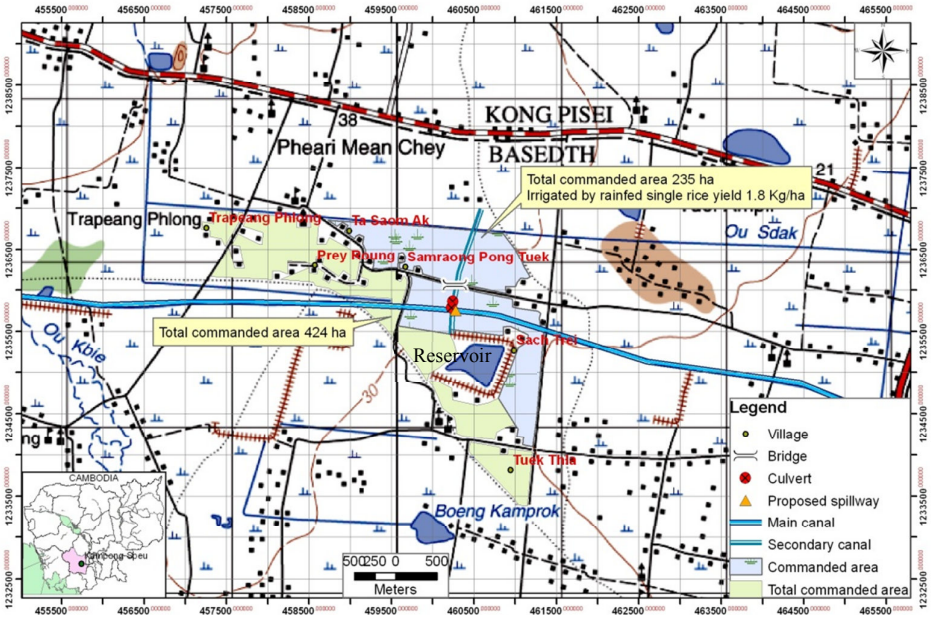

Figure 3: Location of spillway construction to be put into the canal in the target area (map source: PDOWRAM, Kampong Speu)

upstream dam reservoir (Figure 3). So far, the canal has never been rehabilitated. No hydraulic structures such as spillway along the canal were constructed to keep the water in the target area; therefore, it could not be sufficiently stored for rice cultivation during drought period which was longer than normal in rainy season. In this community based adaptation project, a spillway with 25.20 meters in length and 4.50 meters in height has been constructed to store the water from the upstream area for improving rice cultivation in the target area (Figure 4).

Figure 4: Spillway constructed to keep water in the canal and to bring more water to the lake reservoir in the target area

Moreover, the spillway would also divert more water from the canal to the vicinity lake reservoir where water can be stored for agricultural use in rainy season, domestic water supply during the dry season and also improved aquatic vegetable and fish in the Sach Trey Lake. Both canal and reservoir have capacity to store about 2,317,000 m^3 of water which can irrigate around 331 hectares of wet season rice field and about 472,200 m^3 of water for around 42 hectares of dry season rice field in the target villages.

2.4. Formulating Farmer Water User Group (FWUG)

Farmer Water User Group has been established in collaboration with PDOWRAM and the commune in the target area. The FWUG was formed with the participation from each target village community including women. The committee would play an important role to ensure the sound management and maintenance of spillway during and after the project end. They have taken responsibilities to open and close the water gate of the spillway, monitor the spillway and collect irrigation water fee from the project beneficiaries. The committee would use that money to manage and maintain the spillway. The project would strengthen the capacity of FWUG through providing training on difference topics including roles and responsibilities, water management and book-keeping as well as provide ongoing support on their daily functioning.

2.5. Establishing Village Seed Credit

The project has established the Village Seed Credit in each target village in collaboration with Baseth District Office of Agriculture. With the support from this system, the farmers would be able to get access to loan for buying agricultural inputs such as rice seed and fish fingerling for their farming activities. Village seed credit will ensure the sustainability of resource availability for farming activities even though the area is affected by climate risks. Thus, the farmers will be able to secure seed in the village during climate change which results in natural disasters especially droughts. Moreover, resilient seed from Village Seed Credit would be also introduced to other villagers.

2.6. Building capacity of community through training program

Raising Climate Change Awareness

The benefits from climate change awareness training would mainstream concepts of climate change adaptation to the commune authority. Therefore, the commune authority and project beneficiaries could understand what the main impacts by climate change are and which intervention options are available in the commune and they would be ready for farming activities. More importantly, the commune authority would gain more experiences in

developing commune development plan for adapting to climate change within their commune.

Raising climate change awareness would be conducted in each village during the promotion of the project meeting in order to increase the knowledge on climate change at village and commune level. The message on climate change risks and adaptation activities would be focused during the meeting. By so doing, the community would have more understandings on its impacts on their livelihoods and seek more prevention and adaptive options to help them reduce the vulnerabilities by drought, especially in the rainy season. The project would also assist the community and commune council to integrate the climate change adaption/prevention activities proposed by target community into the Commune Council Development Plan (CDP) as well as the Commune Investment Plan (CIP).

System of rice intensification (SRI)

Introducing SRI is beneficial for the farmers with resilient seed and techniques through taking a short period of growing rice varieties which can save both time and water in order to undertake double or triple cropping per year. This project has provided TOT training on SRI protocols and tools to the selected key farmers from the target villages, staff from Baseth District Office of Agriculture and staff from Green Village Organization. Key farmers were supported to set up rice demonstration plots and provided training on SRI techniques. 6 demonstration plots would be offered in the project. SRI could help reduce the seed and cost particularly for the farmers who have small rice field. Thus, they would be able to save some money from seed expense.

Raising fish in the paddy field

The training on raising fish in the paddy rice field is introduced to the farmers within the target area. This would promote knowledge of fish raising for increasing homestead food production, generating more alternative income and improving soil fertility. The training would be focused on different topics including fish raising circle, pond preparation in the rice field, fish fingerling selection and releasing, fish feeding and pond management. The fish fingerling support would be provided to farmers as a credit through Village Seed Credit mechanism; which the target farmers had to pay back after harvesting season.

3. Interim achievement and results

3.1. Training and capacity building achievement

The main purpose of SRI training was to introduce new method of rice cultivation for resilience to climate change by increasing rice production and exceeding for selling based on rice field size. It was also intended to introduce new seed variety which was suitable for soil condition, water management and availability in place. Through the demonstration farms on SRI, the target beneficiaries including household headed women could see and observe on how the improved techniques worked at the demonstration site which helped them to change their behaviour and practices (Figure 5). 120 farmers have received SRI training and most of them have started to change their behaviour to reduce from 5 to 10 seeding of one clump to few seeding of one clump after the training. SRI was cost effective especially for the small holder farmers who own small paddy field. They have been able to save seed for rice cultivation and reduce some expense on rice seed. Moreover, this would help them to build resilience to water shortage and they did not need to wait until there was full water in the field for planting seeding. The target communities were also introduced to cultivate resilient rice variety (Chulsar) which took a shorter time (approximately 3 months) to harvest. They were interested in using this type for rice cultivation when irrigation water could be accessed and started to increase cropping times particularly for the farmers whose rice fields were close to the main canal.

Figure 5: Farmers applying SRI techniques for their rice transplanting activities

The target farmers were also trained on techniques of raising fish in paddy rice field. 6 key farmers were selected to join a 2 day-TOT training. Following TOT training, the project has provided support to 3 key farmers for small canal/pond preparation and fish fingerling to start raising in their paddy rice field. These raising sites of the key farmers were used as the demonstration sites (Figure 6). 5 target farmers from each target village

Figure 6: Farmer showing his fish raising pond in the paddy field

have received training on techniques of raising fish in the paddy rice field at the demonstration site. As a result, 30 target farmers received training and 6 families have applied it to their paddy rice fields. It was seen that the rice yield from the demonstration field where fish raising was applied was higher than the other demonstration sites where not raising fish. The impacts from fish raising have also contributed to provide more adaptive capacities to some farmers as an alternative livelihood option for ensuring food security.

3.2. Increase in irrigated rice fields and rice productivity

The spillway constructed within this project was very useful not only to keep the water in the canal but also to divert more water to the vicinity existing lake reservoir (500 meters in width and 700 meters in length). Having sufficient water has allowed the community farmers to increase their rice production through irrigation with the support from this newly constructed spillway (Figure 7). During the first year after the construction, there were 102 families from 6 target villages who were able to access to water from the canal to irrigate their early wet season. Water storing in the canal and lake reservoir could be potentially used to irrigate the paddy fields up to 331 hectares of wet season rice, 143 hectares of early wet season rice and 42 hectares of dry season rice.

Figure 7: Spillway finally constructed to keep the water for irrigation in the target area

After spillway construction, some farmers whose rice fields were located along the canal could cultivate early wet season rice in 36.4 ha which they have never done before due to water shortage resulting from delay in rainfall or droughts. Moreover, during a drought recently occurred from late May to early August 2012, 176.7 hectares of early wet and wet season rice owed by 268 families in the target communities were secured from sufficient water available in the canal (Figure 8). More importantly, the water stored in the canal and reservoir could be used for rice cultivation during the dry season. The community farmers within the target areas particularly those who had rice fields along the canal and reservoir have started to increase cropping time from one time up to three times per year. As a result, the spillway has enabled them to increase rice productivity and to build adaptation knowledge on rice/crop cultivation without depending on rainfall in rainy season as before. More importantly, they could develop adaptation concepts on harvesting water from rainfall and manage it from the canal and reservoir for irrigation during insufficient rainfall.

Figure 8: Rice fields irrigated using the canal water with support from the new spillway in June 2012

Having this new spillway to keep more water available in the canal and reservoir, the farmers were able to use water for cultivating rice along the canal for dry season, early wet season and wet season rice. The production trend has been increased in the target villages due to having enough water available both in the rainy and dry season without depending solely on the irregular rainfall.

3.3. Improving water availability and ecosystem in the vicinity lake reservoir

More water from the canal diverted to the lake has reached up to a certain level comparatively higher than the previous conditions since water was much more available until the dry season. For instance, water level in the reservoir in the year 2012 was relatively high up to 2.5 meters if compared to the same periods over the past years accounted for only 1.3 meters. Consequently, it could remain sufficiently available for dry season use. The community farmers living around the reservoir could use the water for both domestic and agricultural purposes for the whole year. During the period without rainfall, the communities were able to use the reservoir water for irrigating their proximate rice fields through a concrete canal constructed within this project support (Figure 10). This concrete canal could reduce water losses through infiltration and increase flow speed with comfortable water distribution to the rice fields. Its lifespan would be also longer and maintenance cost could be

Figure 9: Lake Reservoir receiving more water from the spillway

also reduced if comparing with earth canal. This alternative would help them to be capable to adapt with irregular rainfall in particular droughts which frequently affected community livelihoods over the past years.

Figure 10: Concrete canal receiving water from the reservoir to irrigate nearby rice fields during the dry season December 2012

In addition to this, it was also noticeable to observe the improvement of ecosystem service within the lake reservoir when more water has increased than the previous year. It was likely that more nutrients in the lake have been also improved due to rising in water level flowing from the canal. The communities have seen more fish and other aquatic resources growing than the previous years. The improvement on ecosystem and biodiversity production in the lake reservoir would be served as a source of alternative food options for the communities; hence, this would help to partly support food security in the target area. During the dry season or drought period, the animals such as cattle could also access to available water for drinking.

3.4. Improving integrated participatory approach in community based adaptation

In facilitating community based adaptation processes, a consistent and participatory process is the key element to build a sustainable adaptation. Women participation has been also promoted within this project from the early stage of VRA meeting to the formulation of FWUG and Village Seed Credit. The project has clearly identified the climate change impacts in the target area and importantly addressed the actual needs of the target communities through VRA. It has encouraged them to make their own decision on their needs and to carry out interventions which have responded to the climate change impacts happening in the area. As such, they have provided the money as a part of in-kind contribution to the project (1000 USD). This has built ownership capacity to the commune authority and project's beneficiaries. In participatory monitoring and evaluation, they have developed their own targets, indicators and priority needs for their communities. The commune and its communities have been involved actively

Figure 11: Roundtable discussion with commune councils and target communities in Pheari Meanchey Commune

in decision making and implementing the project supported by Green Village Organization (Figure 11). They have committed to maintain the achievements from the project in particular the spillway which was their high priority need to help them adapt to droughts occurring in their areas. This project has successfully integrated other relevant stakeholders such as PDOWRAM to assist the communities in providing technical guidelines for constructing the spillway and District Office of Agriculture to support agricultural techniques including SRI, raising fish, and selecting rice variety which was adaptive to droughts.

Farmer Water User Group (FWUG) has been also established in this project to ensure the sound management and maintenance of spillway, water management and distribution within the community with support from the commune and PDOWRAM. It is a sustainable strategy after the project end therefore, the communities still continue to maintain the spillway and manage the reservoir. Farmer representative including women from each target village who have benefited from the spillway have been elected to be a member of the committee (Figure 12). The commune has committed to coordinate and support this committee not only during the project but also after the project end. The participatory approach including women roles was very useful to enhance the collaboration among the communities and the commune in order to sustain the established framework including FWUG and Village Seed Credit.

Figure 12: Meeting of community members to select village representative for the committee of FWUG

3.5. Improving socio-economic benefits to the target communities

This project has provided a number of socio economic benefits to the 6 target villages within Pheari Meanchey Commune. For instance, the construction of the spillway has reduced the expense of the communities on earth wall temporarily built to keep the water in the canal and on diesel cost for pumping machine. Before implementing this project, they have invested money almost every year to keep water in the canal. The new spillway has provided more water to improve rice production through irrigation within the target villages. The spillway has also increased water security within the commune during the delay of rainfall and droughts. As such, the beneficiary farmers including women headed families could have more adaptive capacities to cope with climate constraints occurring in their area. The farmers especially

those who had rice fields along the canal and lake reservoir were able to cultivate from 2 to 3 times per year; as a result, more income from farming activities has been generated. It can be clearly seen that the investment of spillway construction (about 25,000 USD) was very cost effective since this spillway was able to support 331 hectares of wet season rice, 143 hectares of early wet season rice and 47 hectares of dry season rice (total 521 hectares/year). For example, during the drought in 2012, 176.7 hectares have been rescued. According to the interview with the beneficiary farmer, if one hectare provides 3 tons of rice which can gain a profit of about 200 USD/hectare, the total profits for 176.7 hectares could provide the money about 35,340 USD. Moreover, some additional cost could be saved from diesel for pumping water to Sach Trey Reservoir of 390 USD (300 litters), transportation of 40 USD, community earth dam of 750 USD. Therefore, the total profits can be obtained approximately 36,520 USD for 2012. This clearly showed the results from the project implementation through spillway construction.

Moreover, the established village seed credit system allowed the target village farmers to get access to loan for buying agriculture inputs such as rice seed, fingerling etc. for their farming activities and then pay back after harvesting. Thus, this would help them to reduce more expense without borrowing money from micro credit agencies or lending from private business people which generally imposed high interest rate. The system would ensure the sustainability of resource availability for farming activities and decrease financial difficulty from climate change impacts. Through improving agricultural productivity, some community farmers have earned more income from the early wet season rice and from other sources, as a result, approximately 26 families have owned pumping machines and 1 family could have one tiller machine. Additionally, the project has helped some farmers reduce seeking the wood from the forest and turned them to do rice farming. The project has also introduced raising fish in the rice paddy field to promote homestead food production so that the target farmers have more alternative livelihood options to ensure food security during climate change. The socio economic benefits from this project has changed the commune to a new development stage from drought affected place to the area where water is secured for rice cultivation during both rainy season and dry season. More importantly, they would be able to improve food security and had more opportunities to generate additional income through increasing rice production. The achievement from this project would expectedly contribute to increase job opportunities and partly reduce labour migration from this commune to the city and neighbouring countries.

4. Major challenges

Construction of spillway to keep the water available in the canal is very essential to improve rice production in the target area; however, water can be pumped to irrigate only the rice fields close to the upstream canal and around the lake reservoir. Moreover, gathering many people to work closely in the longer run is a big challenge since it requires a constant support and motivation from commune authorities and equitable benefit sharing among the communities. It is likely unforeseeable to see relevant stakeholders have independent capacities to sustain the established mechanisms from this project since the project duration was so short that they could not build more experiences in performing their roles and responsibilities during the project implementation. Lack of financial resources is the main barrier to sustain adaptation process for upscaling to wider communities.

5. Good practices and lessons learned

Although the project has only been operated for a little over one and haft years, several major achievements allowed us to reflect on the project and to extract some good practices and early learnings. It is obvious that the selection of project site in the target area is considered to be essential for successful project implementation. This project showed that Green Village Organization working with commune authority have properly selected a good location where there was an existing canal and lake reservoir to facilitate more adaption options in harvesting water for irrigation in order to cope with drought impacts. Moreover, when the community priority needs were clearly identified and included in the project objectives, they were willing to be engaged with the project implementation. Building project ownership to the commune in this project has attained involvement and support from technical line departments. Right selection of project interventions could build integrated participatory mechanism from the project beneficiaries. This approach was so useful to activate their participation not only in the short-term but also in long-term adaptation to climate change. The project also built the capacity of the commune and the communities including project planning, implementing and monitoring and evaluation. In addition, the commune played an important role in coordinating with technical line-departments to cooperate with Green Village Organization to implement the project.

The project has introduced the target community to improve water harvesting which could ensure farming activities during delay in rainfall or drought periods. The small holder farmers have learnt to change some agricultural practices such as SRI and use some rice varieties which are resilient to droughts. The quick change in behaviour of project's beneficiaries to

use short-term rice was so important to adapt with climate change, especially when there was drought during the rice growing. It was observed that the traditional practices using long-term rice has been remarkably changed when some of them have seen the advantages of short-term rice introduced within the project. The trend in cultivating early rainy season and dry season rice has been also increased when using the short-term rice variety with support from irrigation water from the spillway and has provided similar yields the same as those of long-term rice. It was also noted that some of the farmers started to change cropping calendar because whenever water is available, they could do cultivation. This has encouraged the other farmers to replicate this agricultural practice within the target area. One key learning was that successful implementation of the project required mainly the integrated participatory approach from relevant stakeholders to work together. Good collaboration from technical line-departments/authorities is a key factor to make the project successful in term of providing technical support on spillway construction, providing SRI training to farmers, mobilizing farmers to participate with the project. Furthermore, the beneficiary communities in the target villages in Pheari Meanchey Commune have been empowered to have a decision making on their community development to adapt to droughts resulting from the impacts of climate change. The social interconnection among different stakeholders has been remarkably seen after the implementation of the project. Therefore, the adaptation process will be expected to provide more socio economic benefits from 4 to 5 year impacts after the project.

6. Mainstreaming climate change into commune level

The project has worked to embed a longer-term perspective in planning and interventions at the commune planning level. It is at the local level that much of the action for building resilient rural livelihoods will occur in order to reduce vulnerabilities of the rural communities. Using VRA, the commune authority has understood priority needs of the community which should be considered to integrate into commune development plan. For instance, for reducing drought impacts and water scarcity which always hindered the community livelihoods in the target area, a spillway has been constructed to adapt with this local circumstance. Therefore, the achievements and socio economic benefits from the project implemented by Green Village Organization in cooperation with target communities and relevant stakeholders have made the commune authority understand and ready to mainstream climate change adaptation the next five-year Commune Development Plan.

7. Conclusions and recommendations

Through Vulnerability Reduction Assessment (VRA), priority needs in the target area have been clearly addressed; therefore, effective approach has been designed to respond to climate change adaptation. The project has built the capacity of the community farmers through the training program including raising climate change awareness, SRI techniques and raising fish in the paddy field. Constructing a spillway to keep water more available in the canal and divert to the reservoir will help secure water shortage in the target area during the delay or absence of rainfall and drought period. The farmers do not need to depend on traditional cropping calendar. Whenever there is water available in the canal and reservoir, they can start cultivation. This adaptive approach has supported them who have rice field close to canal and reservoir to improve rice farming from one up to three times per year. Therefore they would be able to adapt to droughts in rainy season and stop totally depending on rainfall in the target area. As a result, they could sustain their livelihoods and generate more income through farming activities.

The project should be longer enough to strenghten village seed credit and FWUG to work properly before the project end. Regarding the village seed credit and FWUG, it is compulsory to set clear guidelines, rules, regulations and financial arrangement for the committees to comply with. Allocated budget from water fee should be properly reserved for the maintenance of spillway and canal protection from bank erosion in order to make its lifespan in a longer period. Additionally water management planning and water use efficiency should be considered because water availability is very limited and cannot supply to a large number of paddy fields during the drought periods. In order to create an enabling environment for adaptation, it is important to firstly create the determination from the communities themselves to adapt, and secondly create integrated participatory approach to foster adaptation processes. Therefore, enhancing the participatory integrated approach in project design and implementation is very essential to achieve sustainable community based adaptation in the long run.

Finally, this project showed clear evidences on adaptation to drought through constructing water harvesting structure (spillway) to keep the water for year round, introducing new resilient seed variety, leading to change in cropping calendar; therefore, it is considered as a successful example in community based adaptation to climate change on drought.

Case Study 2

Management of Water and Fish Resource for Improving Community Livelihood

1. Background and objectives

Kampong Preang is a commune located in Sangke District of Battambang province. The commune stands along the national road 5, approximately 20 kilometers eastward from the provincial town of Battambang. Two communities in Os Touk and Kach Rotes village were selected as project target area. There were 797 households with the total population of 3,573 people (1,891 women). Rice farming and fisheries are the main source of livelihood within communities.

Climate change is a noticeable phenomenon which has been recently observed by the local communities in the commune since the year 2000. The area has been sometimes affected by flood water from the Tonle Sap Lake during September to October because it is close to the Tonle Sap floodplain. Additionally, when there was excessive rainwater flowing from the southern upland area of the commune, this has driven more flooding to the commune in some years. However, from June to October, drought periods usually happened mainly in July or August and strongly impacted on rice or other crop cultivation. This climate constraint has brought about major challenges on rice production since the cultivation was delayed until there was sufficient rainfall. But when the cultivated rice got just about 1 month old, flood water from Tonle Sap arrived in October and lasted about 3 to 4 weeks, which has potentially damaged rice in the area. Instead, during the dry season, there was no water available for cultivating dry season rice.

Figure 1: Rice fields in the target villages were affected by flood water from Tonle Sap Lake in October 2011

Based on the Vulnerability Reduction Assessment (VRA) conducted by Action for Khmer Aid Service Organisation, it indicated that the communities were particularly vulnerable as raining has become erratic and much less predictable. The area has suffered from chronic loss of forest cover, water shortage and flooding were common problem, crops were infested by pest, and livestock died, inappropriate use of chemical fertilizer and pesticides and lack of fund and seed. For instance, in 2010, the communities reported that the rainfall was so abundant that flood from rainwater affected the community rice fields. Moreover, flood water from the Tonle Sap Lake in 2011 inundated the area during October about several weeks, which has resulted in big loss of rice production (Figure 1).

In the target area, there were also some existing canal networks which were constructed during 1976-1978. however, most of the schemes were mainly shallow and very dry during dry season due to long-term sediment deposition; therefore, water could not be sufficiently kept in the canal for irrigation (Figure 2). In addition, the canal could not function as a drainage network to drain flood water out of the villages when there was excessive rainfall, possibly inundating the area.

Figure 2: Canal excavated during 1976 – 1978 before project implementation in 2011

Consequently, Action for Khmer Aid Service Organization (AKAS) in collaboration with the commune has implemented an adaptation project with financial support from Sweden through Cambodia Community Based Adaptation Programme (CCBAP) managed by UNDP Small Grant Programme. The project has started from September 2011 to November 2012 with funding of USD 49,966.75 from UNDP/GEF SGP. It aims at improving local livelihood of 797 households in the two communities of Kampong Prieng Commune through better access to irrigation water and fishery resources. Three Specific objectives are as follows:

- Improve irrigation water management through rehabilitation of existing canal and dike
- Ameliorate local livelihood of 310 households through rehabilitation of a natural lake, where fishery resources could be increased and conservation management plan of two more lakes
- Raise climate change awareness to the target communities and improve adaptation in response to the impacts of climate change

2. Methodology and approach adopted in the project

2.1. Identifying priority needs of the community

Through VRA meeting conducted by Action for Khmer Aid Service Organization (AKAS) in collaboration with the commune, the priorities needs of the local people in the commune have been identified. To adapt with the constraints which they faced in the commune, the community raised that the priority activities needed to be done included rehabilitation of existing irrigation canal which could store water for improving agricultural production and drain floodwater out of the villages. Renovating the natural lake for fish refuge conservation was also proposed to improve their alternative livelihood option through fishing activities during the flooding period.

2.2. Rehabilitation of existing canal and natural lake

There were existing canal networks in the target area; however, most of them were so shallow that water could not be kept to irrigate the rice fields. During excessive rainfall in the target area, it could not function as drainage canal to evacuate water from the villages; therefore, rehabilitating the canal was crucial not only to improve water for irrigation but also to drain excessive rainwater from the target villages.

Figure 3: Canal rehabilitated for irrigation and flood drainage in the target area

This project supported to renovate two canals of 9,400 meters in length running across three villages namely Os Touk, Kach Rotesh and a little part of Sala Trav Village (Figure 3). The canal design was technically supported by Provincial Rural Development of Battambang with approval from the Provincial Department of Water Resources and Meteorology.

The natural lake of 5 hectares (Boeung Thlan) located in Os Touk Village was very shallow and dried during the dry season; thus, it could not be used as conservation lake for fish refuge in the dry season. The lake would be restored with an area of 10,000 m^2 to serve as a conservation lake for the target communities (Figure 4). During flooding period, they could improve their alternative livelihood through fishing activities within the area close the conservation lake.

Figure 4: Conservation lake rehabilitated for fish refuge in Os Touk Village

2.3. Establishing Farmer Water User Committee and Saving Group

Farmer Water User Committee (WFUC) was set up in collaboration with the commune and the two target communities. FWUC were formed with the participation from each target village community. The committee would play an important role to ensure the sound management and maintenance of renovated irrigation canal after the project end. For Fishery Community, there was an existing committee established and recognized by the Fisheries Administration in the target area since 2009, only conservation plans and regulations would be created by the committee to manage and maintain fish species and fish refuge in the lake. They would also play a role in combating with illegal fishing activities within the conservation lake.

Establishing Saving Group (SG) would give the opportunity to the community to have their own fund in creating other business through using saving group fund. They would not need to borrow from private business group with high interest rate. The community thus had their own fund especially for agricultural activities including fertilizers, pesticides, and petroleum cost. In case there were droughts or floods, they could use the saving fund to help the community. Since there have been some SGs in the target commune established in 2009; only 4 more groups were created (2 in Kach Rotesh and 2 in Os Touk).

3. Interim achievement and results

3.1. Raising awareness on climate change to the target communities

Figure 5: Students participating in climate change awareness raising at the pagoda

The two communities in Os Touk and Kach Rotesh Village including students from elementary school to high school were disseminated about the climate change impacts through film documentary provided by CCBAP (Figure 5). Awareness raising has been conducted 10 times with the 1,936 participants (952 women). Video screening on adaptation and mitigation of climate change impacts in the villages was followed with queries in order to get them better understand how climate change are affecting their livelihoods. The events were organized to promote community participation in building adaptation/prevention knowledge within their communities for getting ready when the disaster has been officially informed.

3.2. Improving irrigation water through canal rehabilitation

Previously, the canal could not supply water for irrigation even during early wet and late rainy season since it was very shallow due to long-term sediment deposition. The two canals have been rehabilitated with total length of 9,400 meters with two main strategic functions as an irrigation canal to bring in and store water to supply for early and late rice cultivation in the rainy season and as a drainage canal to reduce flash flood when there has heavy rainwater from upland (Thoeupdey mountainous area)

Figure 6: The canal would help the farmers to improve their rice cultivation particularly in case of delay in rainfall or droughts

It could be seen that the farming activities during the early dry season in this area after the project implementation have been remarkably increased. This increase could be attributed to new trend in changing agricultural practice and having reliable irrigation canals without totally depending on rainwater.

Figure 7: Restored canal embankment to work as a road and dike

Additionally, the project has also restored canal embankment to work as a road along the rehabilitated canal using excavated soil from the canal through active participation from the target communities. The road was important to facilitate not only for transport of agricultural products in the target area but also function as a dike for keeping flood water from Tonle Sap Lake between the two villages and the dam. It also worked as a dike to protect the two villages from flash flood water rising from Tonle Sap Lake in the rainy season and also store flood water at the upstream rice fields during flooding period (Figure 7). When the early dry season in November arrived, the stored water was released to irrigate the rice fields at the downstream area. Consequently, the agricultural production within the target villages has been less vulnerable from floods.

3.3. Change in agricultural practice and cropping calendar

In the target area, the farmers traditionally started long-term rice farming at the early wet season in May or June and harvest in November or December sometimes facing with water scarcity in the dry period of rainy season or long flood in September to October. When flood water from the Tonle Sap arrived, the rice fields were dominantly inundated during a couple of weeks; as a result, rice production was almost or totally damaged. Moreover, the communities said that since the year 2000, rainfall pattern was irregular and sometimes delayed; the farming activities were started late. More importantly, having flood experience from 2011, which affected their rice and also receiving the message from Ministry of Water Resources and Meteorology forecasting the occurrence of major flood from Tonle Sap Lake in 2012, the communities have been reluctant and hopeless to do rainy season rice cultivation and caused villagers to migrate to find a job in neighbor country.

Therefore, the project has been formulated to build the community resilience to adapt with this constraint through promoting dry season rice cultivation using resilient rice variety which

took about three months to harvest. With support from this adaptation project through canal rehabilitation and training awareness raising in climate change impact, the project beneficiaries have started to change their agricultural practice using short-term rice variety with irrigation water available in the newly rehabilitated canal during the early dry season. This changing was also influenced by the long flood in 2011, which almost destroyed their rice crop and some experiences of few families have stated to pilot by themselves for short-term rice crop cultivation in 2011. Consequently, the farmers in the target area have decided to change their traditional cropping calendar. Through the field evidence, it has been observed that some rice fields were just planted while the others were ready for harvesting (Figure 8), which meant that whenever water was available; the farmers could do the cultivation.

Figure 8: Cultivating dry season rice (short-term rice) through different timing using irrigation water from the rehabilitated canals, December 2012

Before implementing the project, the commune chief said that the farmers in both villages were worried about flood when the government announced a flood from Tonle Sap Lake in Battambang province, especially in Kampong Preang Commune. However, after the project came in, the farmers have changed their mind from worries since they could have opportunity to use flood water for rice cultivation at least two crops per rainy season (early and late rice) through changing rice seed and crop calendar from May or June to August or early September and from late October or early November to January or February, by avoiding the cultivation during the Tonle Sap flood period from late September to October (Table 1). Seeing this new changing trend in agricultural practice taking place in the target villages, the commune chief said that he was

Figure 9: Kampong Preang Commune chief showing dry season rice cultivation in the target village in December 2012

proud of his people for the traditional habit change to apply dry season rice cultivation in order to adapt with floods for improving their livelihoods. He told that the farmers in this area traditionally used long term rice variety for rainy season and never did dry season cultivation. He pointed to the rice field where the farmers cultivated dry season rice and could obtain good yield (Figure 9).

Table 1: Cropping calendar through change in agricultural practice before and after the project

Agricultural practice	May	June	July	August	September	October	November	December	January	February
Before the project		Long term rice								
After the project		Early wet season (short-term rice)			flood period		Late wet /early dry season (short-term rice)			

The cultivation in the early dry season has been recently increased significantly and also replicated to the other nearby villages who saw the benefits of this new practice. The farmers whose rice fields were close to the canal could cultivate at least two times. For example, in 2012, 762 hectares were harvested (613 families) and 377 hectares were cultivated for second cropping (250 families). He also added that the farmers cultivated not only for food but also for selling. As such, it was good experience of the communities on changing disaster flood to opportunity flood for increasing rice cultivation from one to double or triple rice cultivation per year.

3.4. Rehabilitation of natural lake for fish refuge conservation

A natural lake in Os Touk village has been rehabilitated with the area of 10000 m^2 in the total lake area of 50000 m^2. The lake has been conserved and monitored by the community fishery committee. 120 kg of fingerlings has been released in the lake in order to improve fish resources in the community. This approach would provide more alternative livelihood options through fishing besides farming activities.

Figure 10: Lake rehabilitated for fish refuge conservation (left) and plant growing around the lake after 1 year restoration (right)

Even though the community was affected by flood, some families would have some opportunities to seek more food through fishing activities. During the flood season, the fish would come out of the lake to the vicinity paddy fields; hence, the community farmers were able to do some fishing to feed their family as an alternative food production so that they could reduce their food expense. When fish is much caught during flood season, the price would drive down so the villagers could spend less on their food. Consequently, the target communities could have another option to adapt with floods and make sure that they still have enough food during flood period.

3.5. Biodiversity and ecosystem improved

During the dry season in the target area, the rice fields used to be dried up with no water; hence, very few biodiversity particularly aquatic species such crab and snail could survive. However, when water was available, biodiversity and ecosystem has been naturally increased. Through the evidence from the rice fields during the dry season after adopting this project, it could be seen that a number of birds have been remarkably growing in this area because more food has been increased in the rice fields (Figure 11). It was observed that dry season rice cultivation has promoted more biodiversity production including aquatic resources (crab, fish, frog etc.), and birds in the paddy fields.

Figure 11: Increasing in birds in the rice fields during the dry season in December 2012

Furthermore, the renovated lake in Os Touk village has been served as not only for fish refuge conservation but also for bird accommodating place. The communities reported a number of birds staying during the night time nearby the lake where there have been fast growing plants after the renovation. As such, this project has been seen to contribute to sustaining and improving more biodiversity during the dry season.

3.6. Water User Committee established and Community Fisheries Committee strengthened

Water User Committee has been created by the two communities for the purpose of canal maintenance and irrigation water management. It is a sustainable approach after project end. There were five members (two women) who have been elected to form the committee through the support and coordination from AKAS and the commune. Management regulations and rules were also set up and disseminated to the community members to ensure the sustainability of irrigation water for the target communities. Thus, it would provide more opportunities to access and manage those available water resources for improving agricultural production during the climate constraint. Additionally, the committee was also responsible for repairing and maintaining the new rehabilitated road along the canal to secure its durability. During the project implementation, the committee gathered the target villagers to monitor the progress of canal, road and dike rehabilitation; hence, this has built community ownership to the project.

Since the natural lake in Os Touk has been renovated, the existing fishery committee recognized by the local authority and Fisheries Administration would take responsibilities to monitor it. The project has strengthened the capacity of the committee with support from local authority. To manage the lake and fish resources effectively, conservation management plan and regulations were also established by the committee themselves. For instance, the committee took some actions to combat with illegal fishing which could severely destroy the fish resources within the commune. It would be able to promote fish productivity in the conservation lake for the target communities in order to sustain food security through fishing activities especially when flood affects rice farming which is their main livelihood activity. As a result, this would help them to increase adaptive capacity to seek more alternative food source during flooding periods.

3.7. Improving adaptation and increase in socio economic benefits to the target communities

The project has improved adaptation and increase in socio economic benefits for the two villages in the Kampong Preang commune by changing flood threats to farming opportunities. In this area, the community farmers traditionally cultivated long-term rice which started from early rainy season in May and end by November. When there was a delay in rainfall at the early season or flood from the Tonle Sap Lake during September or October, the rice production were mainly affected by these impacts; as a result, their livelihoods got more vulnerable.

Through the canal rehabilitation, it has provided more water available in the canal to improve rice production through irrigation before flood and after flood recession in late October. The farmers especially those who had rice fields along the renovated canal (around 400 hectares) were able to cultivate early dry season rice started when floods receded. Using the resilient rice variety to drought, it has contributed more advantages on irrigation water use and harvest duration (about only three months). The community farmers reported that they were happy with farming activities since they could do the cultivation in the early dry season because they just began this agricultural practice. Previously, when flood water arrived and lasted about 3 to 4 weeks mainly in October, they were afraid that their rice would be damaged. But, they started to think that when flood water arrived, the rehabilitated dike would help keep the water at the upstream rice fields and in the canal and then it could be later used for irrigating their paddy fields during the early dry season. Consequently, they could increase their adaptive capacity to do the farming activities after flood recession in early November. More importantly, the canal rehabilitated within this project was also used as a drainage canal which could evacuate excessive rainwater from the upstream of the commune. Therefore, the project has contributed to reducing their vulnerabilities from floods through adopting dry season rice cultivation after rehabilitation of two canals of 9,400 meters.

The rehabilitation of natural lake for conservation of fish refuge has provided complementary benefits to the target communities who could have more alternative livelihood options especially during the flooding period. Some of them would be able to generate more income through fishing activities. This would partly help to secure food production when flood water arrived. Furthermore, in case the target farmers faced financial difficulties, they could access to loan from the Saving Group with low interest. Thus, this would help them to reduce more expense without borrowing money from micro credit agencies which generally imposed high interest rate. As such, the socio economic benefits from this project have turned the threats to the opportunities which the community farmers could build their adaptive capacity to cope with climate change impacts such as floods and droughts in their area. The impacts from this project would be also expectedly to partly reduce labour migration from this commune to the city and neighbouring countries through improving farming activities.

4. Major challenges

Even though this adaption project has provided fruitful output, some challenges still occurred since the project duration was relatively short. In order to build a sufficient capacity of the established systems including FWUC and Saving Group, more support and timeframe should be allocated to allow them to learn and take more practices in performing their role in order to

get them work professionally. For instance, FWUC had a management structure including roles, regulations but they lacked of experience to undertake the tasks. Additionally, the earth canals renovated within this project would be shallow immediately and easily damaged; thus, the maintenance and reparation would be costly.

5. Good practices and Lessons learned

Several major achievements allowed us to reflect on the project and to extract some good practices and some lessons learnt even if the project has only been operated for only one year. This project has brought more opportunities to the commune to build their own capacity to engage relevant supporting departments to assist the project. It is obvious that the selection of project site with project staff capacity is considered one of main crucial factors for successful project implementation. Moreover, when the community priority needs were clearly understood in the project objectives, the communities would be willing to participate in the project activities. It is so important that the communities and local authorities have to be aware of the project; thus, the cooperation among them will be strong. Additionally, the communities in the target villages have been promoted to have more ownership and decision making in the project implementation.

The most significant learning from this project was that the target farmers have improved water management by turning disaster threats into farming opportunities. Commune authority used administrative procedures to communicate with line department for technical assistance in the project. They have started to change their traditional practice using short-term rice and modify cropping calendar before and after flood through early wet and late wet season rice cultivation which they have never done before. The rice productivity was seen increased; as a result, more replication of such a changing practice in the two target villages has been increasingly expanded to the nearby villages. Another good lesson learnt is that the commune authority used administrative procedures to communicate with line department for technical assistance in the project.

6. Mainstreaming climate change into commune level

The project has worked to embed a longer-term perspective in planning and interventions at the commune planning level. Using VRA, the commune authority has understood priority needs which should be considered to integrate into commune development plan. Based on the project output, the commune authority was very happy to see the target communities reduce vulnerabilities from climate change impacts. Even though, floods occurred in this area, the farmers could do the rice cultivation more than one time and extra fishing to ensure

food security. Therefore, the achievements and socio economic benefits from the project implemented by Action for Khmer Aid Service Organization in cooperation with the target communities and relevant stakeholders have inspired the commune authority in Kampong Preang to integrate climate change adaptation into communal development programme.

7. Conclusions and recommendations

The climate change threats are real and the impacts are local. Solutions, therefore, are to be generated from the local communities and local authority. The project has been designed to address community based adaptation through canal rehabilitation, conservation lake and community capacity building to adapt with climate change. Better water management by turning flood risks into farming opportunities has been successfully achieved to support the target communities to adapt with this constraint. The farmers in the target villages have changed their agricultural practice and did not need to depend on traditional cropping calendar and regular rainfall as they could manage to harvest water even flood water from Tonle Sap Lake. When floods recede, they can start late wet/early dry season rice cultivation through irrigation water from the rehabilitated canal. This adaptive approach has supported those who have rice fields close to the canal to improve farming activities from one cropping to two or three croppings per year. The change in agricultural practice has been also replicated to the other villages particularly in the area close to water source. As a result, the target communities were able to generate more income through farming activities and secure their livelihoods. Additionally, during the flooding period, some of them could have more alternative livelihood options through fishing activities provided by the conservation lake. In case they face financial constraint for agricultural works, they can either access to get loan from Saving Group with low interest. Regarding biodiversity and ecosystem, it has been also improved through increasing more water available during dry season and lake rehabilitation.

Regarding water distribution, division canals to supply water to the paddy fields further from the main canal were not yet accommodated due to financial resources; therefore, benefit sharing among the target beneficiaries was not fully achieved from this project. As such, the commune authority should find the possibility to continue the project to improve resilient concrete canals which has longer lifespan than earth canal for the next phase. Furthermore, it is also necessary to provide resilient agricultural techniques to support the farmers in building resilience on climate change. Moreover, more capacity building, technical assistance and constant support from the commune and provincial line department should be provided to strengthen the communities especially FWUC, Community Fisheries Committee and Saving Group.

Finally, this project has assisted the target communities to build community resilience and improve adaptation through better water management by changing flood threats to farming opportunities. Therefore, it is considered as a successful example in community based adaptation to climate change on floods.

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