

MRC – GTZ - WSMP

**Local Knowledge Collection
in Watershed Management**

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2008

This report summarizes the survey on local knowledge collection in watershed management in the four pilot watersheds. The main report recapitulates the methodologies, processes and experiences gained from the surveys with summaries findings from the four countries, and the recommendation. The four individual and detailed reports on local knowledge collection in four pilot watersheds are presented in the annexes for further reading.

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1 Introduction

The Lower Mekong River Basin cradled over 60 millions of inhabitants. Agriculture and forestry are the most crucial sources of livelihoods, and the most direct and essential influences to the basin's environment across the national boundaries. The Mekong River Commission (MRC) is the inter-governmental organization of four countries (Laos, Thailand, Cambodia and Vietnam) that works collaboratively to govern water and water related resources in the Lower Mekong Basin. Under the sector program – Agriculture, Irrigation and Forestry Programme (AIFP) – a watershed management programme has set up with support from MRC-GTZ Cooperation since 2003 and at least one pilot site in each riparian country have been identified. This ongoing programme aims to explore the sustainable watershed management and development mechanisms in the context of each riparian country and to build up the humans' capacity in viewing the work at the basin level. The five years of trainings and capacity building in different pilot watersheds have penetrated the concepts of watershed management into most community leaders' mind and have formed the foundation for integrated watershed management to be planned and implemented in the next project phase.

This report will recapitulate the methodologies, processes and experiences gained from survey that conducted in four pilot watersheds on local knowledge collection in watershed management. The report divided into four sections that cover the concept of local knowledge, different methodologies used, the summary of the four case studies, and the recommendation. In the Annex, the detailed reports on local knowledge collection in four pilot watersheds are provided to for further reading. The local knowledge collection survey is part of the commission to facilitate the updating of watershed profiles of four pilot watersheds to ensure the scientific knowledge as well as experiences and perceptions of local people are incorporated and integrated. The updated watershed profile will provide the overall picture of watershed and highlight the challenges to assist the watershed committees to design the coping tactics and make the watershed master plans.

2 Local knowledge: Concepts and application

This section will illustrate the derived concept of local knowledge on watershed management that used in the survey. The terms – local knowledge and watershed management – in strict academic speaking are weak and abstract. Therefore, to clearly understand the meaning and scope of these two terms is the requisite to plan and design the survey.

The 'Local Knowledge', in Wikipedia (2008), is defined as the matured long-standing traditions and practices of certain regional, indigenous, or local communities, which assist to sustain the social network and livelihoods of the communities. This definition simplified knowledge as long-stand tradition and practices, and neglect the human and environment interaction. Miraglia's definition in her *Traditional Ecological Knowledge Handbook* (1998: 5), referred as the knowledge that collectively possessed by people which has been accumulated through time and passed down from generation to generation. The meaning of 'knowledge' still needs explicitly explanation. Knowledge, in Plato's classical simple definition, is a statement that contains three criteria: 'justified, true, and believed'. Over thousand years of studies this definition has been philosophically criticized and reformed in various ways (Wikipedia on Knowledge 2008). Nowadays, a general definition of 'Knowledge' from dictionary refers as the experience or study that gained from awareness, familiarity, and understanding of facts and information on a particular subject or field, the experience can be a form of expertise or skills, and the study can includes both theoretical and practical aspects (Oxford English Dictionary).

Based on the above discussion, this report would refer to the 'local knowledge' with four characteristics. Firstly, it is the experiences and practices that have been accumulated and developed in a particular geographical and social context. Secondly, the process of knowledge development takes long time and is passed from generation to generations. Thirdly, the local knowledge has a crucial influence in sustaining the social network and livelihoods within the community. And lastly, the knowledge formation is a dynamic activity with continuous exploring, communicating, error and trial testing and reasoning the relationship between human versus nature.

“Watershed Management” denotes by FAO as the human activities that aim to ensure a sustainable use of watershed resources (2007:3), or in GTZ's Watershed Resource Kit as 'the sustainable development by considering the human system and its relationships with the natural ecosystem of the watershed' (2008:26). Both explanations underline the human interaction with water and related natural resource of watershed to achieve sustainability. The term 'watershed', therefore, needs an explicit conceptual picture. A 'Watershed', in simple term, is a geographical area that sheds water into a river (Watershed Resource Kits, 2008:2). Nevertheless, watershed has a physical dynamic character with a vertical and complex ecosystem. By the force of gravity, the watershed gathers snow or rainfall from the highland and channels them down through the gradient slopes into the surface and underground aquifers (FAO 2007: 1). This process waters plants, transmits seeds, nurtures animals, and enriches soil through the minerals and organic sediment brought by run-off. And through the conveying of water, the watershed interlinks and integrates a variety of vegetation belts, ecotypes and ecological niches that from different altitude, climate and rainfalls.

'Watershed management' has become increasingly significant in the social, political and economical field due to the various functions that offered to the human society. For instance, the freshwater from the streams supports all kind of lives, nurtures the agriculture, and provides energy to industries and urban development. The forest within a watershed provides not only habitats to wildlife, but also firewood, timber, herbs, and Non-Timber Forest Products (NTFPs) to humans' livelihoods. Therefore, to manage the water and water related resource, such as, fishery, forest, land, soils and minerals, in an appropriate and sustainable manner ensures the human survivals and development.

Local knowledge on watershed management, hence, includes the experiences, beliefs, traditions, skills, and practices that people have developed from the interaction with different kinds of natural resources within a particular watershed. This interaction process is also a long-term learning process for human to understand and adapt to its surrounding environment and use the resources to support their livelihoods and development.

3Methodology

This section will discuss about the research methodologies that can be used in local knowledge collection. It will explore different places that local knowledge exists, the influential factors to local knowledge collection and analysis, and different applicable methods in doing the survey.

The places and channels to search and identify for local knowledge is a vital stage. Most of the times, this knowledge could be found in books or in libraries or even do not have the written version, but it is embedded in the way local people believe and behave and in their livelihoods practices. Most of the information is orally passed through generations. There are mainly five channels to learn the local knowledge: first is through events, such as, traditional worships and rituals, these events demonstrate the ways people understand nature and relationship of human and nature, and the present social structure and social network of the community. The second is through storytelling and songs singing and these are mostly demonstrated in local events but also in daily

life. Many local folklores, legends, and songs explain some local unusual natural phenomena, or express the general feeling about their live with the nature. The third is through traditional written format, such as religious doctrine, local customary law and regulations that used to govern people's behaviours in the community. The forth is through different kinds of symbols. These symbols can be the paintings in religious structures, and special spiritual huts in the important places of individual houses and community's holy places. The last is the tools people uses for daily livelihoods, especially in agriculture, fishery and forestry. These five channels provide researchers a general and comprehensive guide to search and collect local knowledge; however these channels may change in different local context.

In local knowledge collection, two influential factors that need researcher to pay attention that are the emphasis of the spiritual beliefs, and identification of the external influences. The spiritual beliefs are vital element in local knowledge collection and analysis, which assist researchers to understand the perceptions and behaviours of local people. Most of these beliefs, customs and rules are developed over a long period of time in order to adapt to a specific local environment. For instance, the special rituals and worships for their community spiritual forest to ask for good harvest and happiness, and the rituals to send banana tree made human bodies to the Tonle Sap Lake to request for less human casualties during flooding, in Siem reap watershed, Cambodia. These beliefs and rules are functioned as rules and orders to guide and constrain people's behaviours within the community and with different natural resources surrounded them. For example, the research have found forest with spiritual belief are well maintained than those normal community forest in Siem Reap watershed, Cambodia, and holy forests and deep pools in the river are considered as holy places in Nam Ton Watershed, Laos that villagers must not disturb otherwise they will receive punishment. This knowledge has also illustrated the inseparableness with the local people's skills in utilizing different natural resources for daily livelihoods.

The external influences play significant roles in shaping the watershed environment constantly, which influence the way local people interact with the natural resources in watershed and subsequently impact the way people generate and adjust the local knowledge for their livelihoods. The external influences can be caused by human such as political policies, market incentive, and wars, and by nature, includes extreme weather and cataclysm. In the Mekong region, the external influences need special attention, because these countries have experienced a series of social and political changes in the past few decades, including long periods of wars, state building, the after-war reconstruction, the transformation of planned economy to free market economy, and globalization influence on foreign investment and international trade. These social, economical and political alterations have consumed a lot of natural resources, changed the landscape of watershed, mobilized vast population around the countries, and remodeled the understanding and management mechanism of local people on watershed.

This research on local knowledge collection and analysis has integrated both the knowledge on spiritual/religious beliefs and rules, and knowledge and skills on daily interaction with the watershed for livelihoods. The spiritual/religious knowledge contains customs, rituals and local legends, folklores on water and water related issues in watershed. The knowledge on daily interaction with watershed is divided into the different natural resources within the watershed, which includes, fishery, riverbank management, irrigation, forestry, household water usage, sanitation, and leisure; and infrastructural development with significant impacts to the environment of watershed and to the inhabitants' livelihoods (see illustration 1).

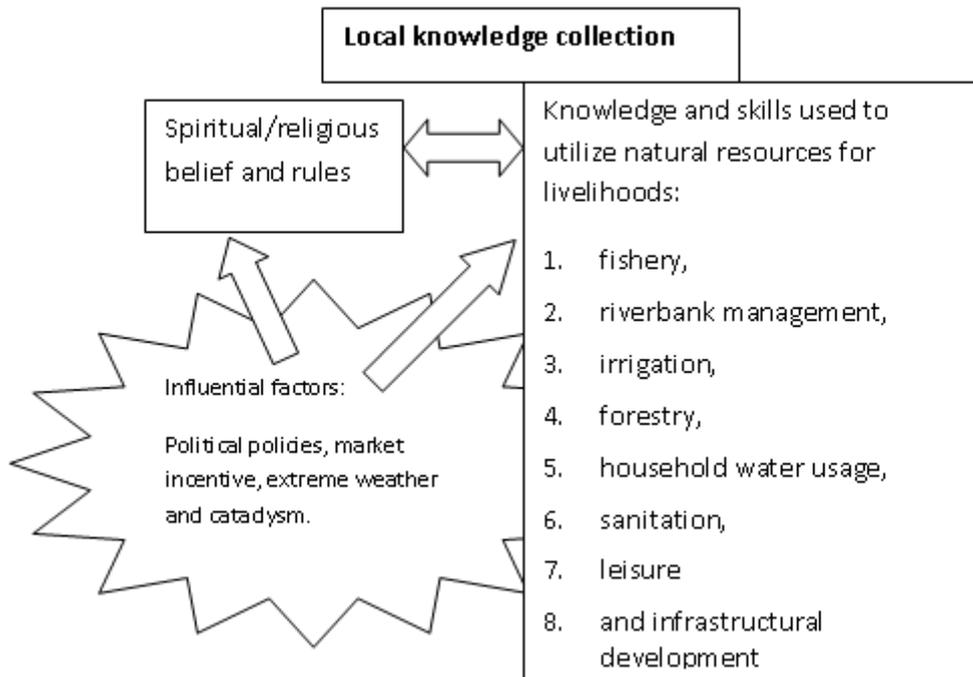


Illustration 1: Topics on local knowledge collection for watershed management

The research survey for local knowledge collection is type of social research survey, and therefore it can use several social research methodologies, such as secondary data collection and literature reviews, interviews of key informants, focus group discussion, and participatory observation. The researchers can select and combine different methods based on their capacity and the local condition.

Secondary data collection and literature reviews are pre-requisite to all other methods. The secondary data collection assists the researcher in understanding the preliminary background on the watershed environment, local community's general traditions and customs, their natural resource management mechanism and means of livelihoods. The secondary data collection also helps to avoid the duplication of works. During the watershed update, the watershed baseline study and other related reports have assisted the researcher to gain detailed background information on different pilot watersheds.

Interview of key informants is a very important survey technique in getting in-depth information on particular topic. The key informants can be either traditional community chiefs or influential and respectful people whom are believed to have the knowledge and skills in particular areas and are eligible to pass his/her knowledge to the young, such as, religious leaders, women leaders, herbalists, chief hunters, professional fisherman, and village traders. This kind of interview normally should conduct in an open and informal setting, like a conversation. The researcher can prepare some questions to guide the interview from moving to different topics, but since interviewee is very knowledgeable, researcher should let the person to talk as much as they want to. The strength of this method is the researcher can gain the detailed information from the conversation on particular topic. Sometime a bonus from interview is a participatory observation that invited by the interviewee to participate in a particular activity on the topic they have discussed. However, the weakness is time consuming that the researcher may spend one half day or one day on only one particular topic. Another weakness is some information obtained may base on personal

opinions not on the real facts, so further re-confirmation is needed.

Focus Group is another kind of interview that instead of interview individual, several knowledgeable people are interviewed together. Similar like key informant interview, researcher should make an open and informal atmosphere for the group and prepare the question guidelines to guide the discussion. But unlike the key informant interview, that focus group discussion need more than one person to lead, to record and to observe the group discussion. Map is a critical tool in focus group discussion to help researchers to gather information with spatial dimension, such as where is the stream, springs, lakes, rice fields, dykes and community forest area. Flip chart is another key supporting tool to ensure the discussion is in track. The strength of focus group is the interviewees will discuss together before provide the information. Through their discussion, researcher can realize what kinds of issues have consents and disputes. Another strength is less time-consuming that researcher have interviewed several at once, instead of interview one person each time. However, some people may not like to speak or participate in the discussion, and the groups may dominate by one or two people. In many rural areas, women feel uncomfortable to talk publicly in front of men, so make necessary adjustment is needed. In Lao, for example, the survey team divided the focus group into female and male groups and interviewed them separately, to encourage women to talk about their understanding on watershed, especially in household water usage, child care and education, different production activities. Another challenge is to organize the focus group schedule that suit for both local people and researchers. Villagers in the daytime are often busy with agricultural activities, yet, conduct focus group in the evening may not achieve good results because people are tired from their works. Therefore, organizing the focus group discussion need to consult with the local people, and provide some token or allowance if necessary.

Participatory Observation is another vital survey method for researcher to experience the events and activities at the spot. For instance, go with the fishermen to experience how to set the fishing tools, walk with villagers to the rice fields see their irrigation scheme, visit the market to observe the fish trade, and participate in rituals and festivals. The two former methods help researcher to gain information from the talks and description, whereas the participation observation help researcher to see and experience the real situation and further clarify and reconfirm the conversation during the interviews. This is also a good opportunity to build better relationship with the local people. Some of the activities need to gain permission from local people, especially some spiritual rituals, research must ask before attending. During the observation, taking pictures and notes are quite necessary, and in the end of observation, re-check your interpretation with knowledgeable person is also essential to avoid the misunderstanding. However, this activity is also time consuming and researcher may not have enough time to complete the certain activities, such as particular rituals.

These above methodologies are commonly used in qualitative social research and provide researcher in-depth and comprehensive information on particular topics, which fit into the research requirement of the local knowledge collection. It is important to note that these methods should be used together to show an inclusive and unbiased overview, researcher should based on the local context to choose the combination of these different methods.

4Case studies in four pilot watersheds

This section will examine the local knowledge collection that have done in four pilot watersheds, namely, Nam Ton Watershed in Laos, Siem Reap Watershed in Cambodia, South Krong Ana Watershed in Vietnam and Huai Sam Mo Watershed in Thailand. The case studies will illustrate the methods that have used and adjusted in different context, examine the lessons learnt, and highlight

the key findings in the watershed with some suggestions.

4.1 Nam Ton Watershed, Laos

Background: The Nam Ton pilot watershed locates 60 kilo meters east of Vientiane, covers 80,455 hectare and spans over two districts: Hinhuep District (upper stream) and Sangthong District (lower stream). The watershed boundary reaches from the source of Nam Ton River to the Mekong River in the south, the east boundary is the ridge of Phuphanang National Biodiversity Conservation Area (NBCA) and west edge is along the Nam Sang River (GTZ report 2004:7). The population is 32,382 residents with a mixture of Lao Loum and Lao Kang, while Lao Loum people are most indigenous and Lao Kang people are mostly migrated during last three decades. (Ingalls 2008:42).

Research methods: the survey team combined the researcher, translator and several local staffs. The research methods are focus group discussion with gender division and participatory observation. The survey covered 11 villages along up, middle and lower streams, both in the mainstream of Nam Ton River and in selected tributaries. The focus group discussion were followed a series of questions that topics were shown on figure 1. The question guidelines have been adjusted and reduced during the survey based on the local village situation. For instance, villagers who live in tributaries may not go to fish in the Nam Ton River, due to long distance, but they may raise the fish in ponds near their house, therefore questions related to fishing in Nam Ton River will not apply to them. The observation were also used mainly after the survey, such as to walk through the rice fields with villagers while discuss about the rice plantation, to visit the deep pools area in the river, and to observe people activities in the different sections of river, such as fishing, washing, fetching water for household usage.

During the survey, the team has faced few challenges on the survey schedule and focus group preparation. The survey was conducted during the busy agriculture preparation time, though the survey team had tried to minimize the disturbance to the villagers, and planned the survey in either morning or evening, but surveys in evening make the participatory observation impossible, and survey time need to be shortened as most villagers are tired after a long day in the fields. Preferably the survey schedule should be planned to avoid the busy farming periods. The selection of participants in the focus group discussion is crucial, yet due to the tied schedule of survey team that assessing the interviewees are not possible. Thus, some focus groups have participation of over 20 villagers while others may have only 7 or 8 villagers, and many interviewees were reluctant to speak in front of others. In future surveys, conduct the preliminary conversation and selection with villagers before the focus group discussion is necessary.

4.1.1 Lessons Learnt

1. Forest, agriculture and fishery are the most important sources for livelihoods of villagers in the watershed, and therefore different sophisticate management methods and techniques exist. For instance, the forest has been classified into different functions based on location and biodiversity and intensity. Many old villagers also know these wild plants as vegetables and herbs, or poison and use them accordingly. Yet, such knowledge has been slowly faded due to the depletion of forest and external influence.

2. The local knowledge and local rules in natural resource management that were existed have been covered over by



Illustration 2: Traditional stilts house

the current government rules and regulation. Although there are some similarities but a lot of resources management authority has been transferred to governmental officials and village heads that appointed by the government.

3. Most Lao houses are built on stilts with ladders. The advantages are to avoid the flooding in monsoon season and to keep the house cooler with natural wind. Nevertheless, the space that under the house must not neglect by local knowledge survey, because the space contains a variety of traditional tools for daily livelihoods, such as for agriculture, fishing, livestock, house maintenance, and most of these tools are Non Timber Forest Products (NTFPs). These tools also provide us an idea how local people manage the surrounding natural resources.

4.1.2 Key Finding:

1. The concept of watershed and watershed management is new to most villagers. Nevertheless, the villagers understood the impacts of forest to river, and some people are aware of the impacts of upstream to downstream, which have formed a good foundation for watershed awareness raising activities.

2. The Buddhism religion is vital in the heart of the Lao Loum people and monks are well respected in the village. Every full moon day, the families will visit temple and listen to the preaching of monks. Temples are public gathering places for big events and rituals that related to farming and even to forest protection, if temple is built beside the holy forest. Therefore, they can play an important role in assisting education and awareness raising activities on watershed management.

3. Fish is a main staple food for villagers in the watershed and is an important indicator for water quality. Through centuries of catching fish, local people have developed different fishing tools for different fishes in different location. The tools that used by men and women are different, that men tend to use large fishing tools and fishing in the main stream such as fishing nets and fishing hock, while women using smaller fishing tools and in tributaries, women tend to collect a diversity of aquatic animals, such as crabs, shrimps eels and edible snails. The local knowledge on fishing also appears in different seasons. Before monsoon and the rise of Mekong River, villagers who live along the Nam Ton mainstream will clear the obstacles in the river to ensure fish will swim as far as they can. By doing so, they can ensure sufficient fishes are available for consumption during the raining season, and will put different fishing tools in the end of raining season to catch the fish when they back to the Mekong River. Most of these tools are found traditional and made of bamboo, but during the survey, many villagers were complained the decline of fish catch and usage of destruction fishing tools.

4. Rice agriculture, via paddy and upland shifting cultivation, is the main livelihood for villagers in Nam Ton Watershed. The rice cultivation techniques and rice seeds are diverse, based on the quality, productivity and grow lengths of the rice. Local people normally cultivate more than one kinds of rice to share the agricultural risks. Therefore, they have different ways of keeping the rice seedlings. Lao Loum people mainly cultivate paddy and farmers who have paddy near to the tributaries are consider better off, because they have more manoeuvrability in managing water for his paddy. One-season crop is very common in the watershed, and many villagers dream to have irrigation schemes to grow two-season crop and increase the productivity, as they and outsiders perceive the field were unused in dry season, but in fact, the fields are the grazing ground for cows. When two-season crops are operable, alternative pasture practices need to be thought, otherwise the cows will be grazed in the forest and will increase the environmental pressure on forest.

5. Shifting cultivation is another topic to be aware of in this watershed. The Lao Kang (mainly Khmu people) migrants from north have their own system of shifting cultivation based on their former geographic context. This includes land identification, fire management, fallow schedule and seedling selection and storage. Nevertheless, these migrants have settled here only thirty years, their living condition was poorer than their original village, and they are striving to improve their livelihoods while learning to adapt to the environment and slowly develop the belongingness to the environment. This learning process has actually contained a lot of trials and errors, for instance from 2002 and 2006, many of them were collaborated with logging company in logging, which had a big influence to the forest resources that they are depend on and it was at the later stage that they have realized the mistake. Another example is the shifting cultivation. Due to the fast population increase, more and more villagers have shortened the fallow periods, tried to seek and transform degraded forest to shifting cultivation area, and neglect the suitable cultivation slope. These practices imply that they are still learning the environment, and try to improve their livelihoods. However, these practices may cause soil erosion and affect the ecological dynamic of whole watershed.



Illustration 3: Shifting cultivation

6. Forest plays an important role in Laotian way of life, it is the source of food and commodity, and the spiritual place for bury the ancestors. The forests in the watershed have been divided by their functions into the protected forest, conservation forest, utilization forest, sepulture forest and regeneration forest. The division forest and community forest management rule were result of government rules and local villagers opinions. The collection of non-timber forest products (NTFPs) are allowed in all kinds of forest, timbers and bamboos collection are only allowed in utilization forest with approval of the village head. The forest products are closely linked with every aspect of villagers livelihoods, from house materials, to different livelihood tools, and daily consumption food and herbs. Therefore, they were encouraged to report the illegal loggers, however, the ultimate rule enforcer is the village head and often is enforcement is very weak that only gives verbal warnings instead of follows the rules and made villagers felt disappointed and helpless.

4.1.3 Suggestions to the watershed committee:

1. Watershed education and awareness raising activities should design based on their understanding of forest, river, agriculture and fishery and the interaction of upper stream and downstream. Field visits between villagers in upper stream and lower stream could be a good way to demonstrate the importance of watershed management, and stimulate villagers' participation in watershed management activities.

2. Rice production and fish catch are influenced crucially by the water fluctuation in Nam Ton River that affected by the Mekong River, especially in the lower and middle streams. In recent years, the local villagers have found the water fluctuation has amplified, and destructive floods during monsoon reason have occurred more frequent, and they have felt difficult to cope with flood and consequent losses. Hence, further studies on flood mitigation and adaptive management will be

helpful to the watershed management.

3. In Lao, the real power on decision making of natural resource usage and management is often in the hand of the few government officials, which limits the public participation, neglects the importance of local knowledge in natural resource management, and increases the vulnerability of the watershed environment and local people to the outside influences. The pilot watershed has no exception that many villagers were upset about the environmental depletion but they felt powerless to make any changes. Local knowledge embeds in the way local peoples use natural resources to improve livelihoods, their participation in watershed management decision and implementation are vital for watershed management success. For detailed activities please refer to the Annex 1. Report on Nam Ton Watershed.

4.2 Siem Reap Watershed, Cambodia

Background: Siem Reap Watershed covers 361,898 hectare, almost the size of Siem Reap Province. It divided into three catchments namely, Siem Reap catchment, Stung Roluos sub-catchment, and Ou Samraong catchment. The total residents are 504,472, mostly are the Khmers and mostly engage in agriculture (Kirsch, 2008). The watershed comprises one of the famous world heritages — the Angkor Wat. And thus, the tourism is booming very fast. However, the survey have found the tourism booming has not brought significant benefits to the local people by and large.

Research Methods: In Siem Reap Watershed, the survey team was a mixture of researcher and several experts for watershed profile update and watershed training workshop. The workshop, local knowledge survey and watershed profile update were reciprocated each other. The survey covered 17 villagers in upper, middle and lower streams of the three catchments. The research methods were similar to the survey in Laos that used focus group discussion and participatory observation. The questions guidelines have been adjusted based on the watershed geographic condition. During the discussion, maps were frequently used to clarify the boundary of community forest and natural resource protection areas, to identify the challenges over land use, and to learn the impacts of monsoon flooding. Participatory observations were also used in visiting the sources of water supply and approaches in water treatment, and in surveying different water diversion channels both new and ancient, the rice field sand-mining, community forest, and community reservoirs.

4.2.1 Lessons Learnt:

1. Siem Reap watershed is wide and complex water body, the survey try to cover the up, middle and lower stream of the watershed and conducted surveys in 17 villages, but due the complexity and condensed schedule, the information gained on local knowledge is general and limited.
2. The survey participants were mostly the members of the community based forest management committees; who have been trained and have more understanding on the surrounding environment, but may over emphasize their opinion on forestry than other resources in the watershed. Nevertheless, these community-based committees have formed the foundation to assist the public participation in watershed management planning and implementation.

4.2.2 Key Findings:

1. Watershed environment consists of fragmented and complex web of ground and surface water in different scales of ponds and of connected and unconnected streams, and link closely to the seasonal fluctuation of the Tonle Sap Lake. To adjust to the complexity of the environment, the Khmers, the only ethnic groups who live in different parts of the watershed, have developed different means of livelihoods and associated with different local beliefs.



Illustration 4: Community forest with spirits

2. In the upper and middle stream, forest and rice fields are the most important source of food and livelihoods. Many communities have community forest and spiritual forest. Community forests are initiated in past 15 years with support of FAO, while spiritual forests often associated with certain superficial stories that have been passed by several generations. Villagers often believe and respect sincerely the spirits in the forest as their protector, temple is often built beside forest, as symbol of respectfulness, and community worship rituals are often hold beside the forest to ask for protection and prosperity. Cambodian have special

believe that forest protects rice fields through mitigating the impacts of storms and providing sufficient water for the crops.

3. In the lower stream of the watershed, fishes and rice are the most sources of the livelihoods, and practices are vitally linked with the Tonle Sap Lake ecology. People in this region, grow rice in dry season and catch fish in raining season. Dozens of fish tools can be found in each household, and these fishing tools are specifically used in different places, such as in the Lake, floating forest, rice fields, and small rivers. Group fishing is often used in the Lake and floating forest, each trip may takes several days and sometimes the whole family lives on the boat. Fishing techniques are often learnt from elder family members and practised with parents and peers. Before seasonal and commercial fishing starts, community organized rituals to ask different spirits in the Lake and floating forest for good harvest and safety of fishers. The community fishery activities were actively operated in patrolling the illegal fishing tools and community fishery rules on fishing techniques are strictly check by the village head and fishery committees before the fishing activities started. The fishery management in the downstream is supervised and well coordinated with the Tonle Sap Lake Fishery Supervision Committee, which demonstrated a good example of collaboration of government and local villagers.



Illustration 5: Fishing tools

4. Rice farming in Cambodia has undergone a series of ups and downs, in the Angkor period the sophisticated irrigation scheme has provided three-season rice in the Siem reap region. During the recent Khmer Rouge Regime, the contribution on irrigation has both pros and cons. The Regime killed thousands of intellectual and knowledgeable people, and built a lot of irrigation schemes, however majority of irrigation scheme did not last long, they either collapsed or malfunctioned, and many people who survived from the regime do not know how to repair them. Currently, most of area can only grow one season crops. Rice farming has two kinds, the paddy and shifting cultivation or “Chamkar”. Shifting cultivation is the most traditional way of cultivation and can still be found in the upper stream, the fallow cycle used to be 12 to 15 years, and the productivity of the Chamkar are claimed to be 30% higher than the paddy. However the fallow period has been shortened, and

often it was often misused for forest encroachment.

5.Despite, the colourful local knowledge on the watershed management and on livelihoods. The watershed environment is undergoing a big change due to the external influences. The booming of tourism and urbanization has boosted the construction sectors, fostered the sand-mining in middle stream of Siem Reap River and increased the streams' turbidity, intensive and unregulated groundwater exploitation by hotels have endangered the groundwater level, masses of urban wastes have polluted the surrounding rice fields and the Tonle Sap Lake, and land and forest encroachment from the external land speculators have seriously intervened the community based natural resource management. These activities have shaped the watershed dynamic environment rapidly and are reforming the people's knowledge in following up the environmental changes.

6.Some of the local knowledge and local practices, however, could not fit well into the current commodity consumption lifestyle, such as the sanitation and waste management that solid wastes are often lays everywhere and jungles or backyards are used as latrines. The impacts of these practices could threaten the health of local people and the environment and will increase at fast rate, as most wastes contain chemical and non-degradable components, and human waste often contain disease larva that could easily transmitted through the food chain.

4.2.3 Suggestions to the watershed committee:

1.Siem Reap watershed covers an extensive spatial area, and has diverse water user groups that impact the water quantity and quality in the watershed. The local knowledge could play a vital role on environmental protection education and awareness rising to the local people and tourists, and provide useful information to decision makers on the watershed management plan. For local people in the rural areas, the mixture of environmental friendly rural practices with the existing local knowledge could facilitate them to master the sustainable agricultural and natural resource management. The local worships and rituals on different natural resources are not only the way of environmental education but also the mechanism to tie up the community network. The local knowledge is local and geographic specific, which could provide tourists more insights and cultural information on Siem Reap and on Angkor Wat. The local knowledge should also be understood and used by the decision makers, especially the watershed committees. The knowledge could provide a lot of information on the current water usage condition, problems and even conflicts for the watershed committees to plan for their actions.

2.The community forestry and fishery committees have sufficient knowledge and capability on natural resources management, which are the valuable sources of information and could support watershed committee in planning and implementation. The watershed committee should in return continuous building up their capacity and support their natural resource management works with other government departments.

3.The large economic gap between the urban and rural would impede the sustainable development of the watershed, therefore rural livelihood improvement become increasingly important, and related activities that related to livelihood improvement and environmental protection ought be promoted and collaboratively implemented with different organizations. For instance, trainings on proper usage of fertilizers and pesticides in rice cultivation, organic farming promotion, capacity building and networking of different community based natural resource management teams, sanitation and health care education. For detail activities suggestion please refer to Annex 2 Report on Siem Reap Watershed.

4.3 Southern Krong Ana Watershed, Vietnam

Background: Southern Krong Ana Watershed (SKAW) locates in the Central Highland region. It is one of the tributaries of the Srepok River that flows into the Mekong in Cambodia. This watershed covers 155,200 hectare and inhabits 122,660 residents with a diverse set of ethnic groups that are both indigenous (i.e. the Ede and M'Nong) and emigrated (i.e. the Kinh, H'Mong, and Tai) (Hung, 2008:21).

Research Methods: the survey team combines researcher, translator and project officers. This pilot watershed locates within a political sensitive region that for foreigners to conduct local survey need a series of approvals and restriction. Question guidelines have been adjusted to be apolitical and to fit the local people's understanding. The survey used focus group discussion, interviews of local experts, and few opportunities of observation due to the restriction and time limit in the field. The focus group discussion covered 7 villages in 6 communes, in the up, middle and low streams of the watershed. The focus group discussions were conducted in commune offices and interviewees were selected by local government staffs to facilitate the appropriate interviewees' participation and to ensure the conservation apolitical. Interviews with local experts and literatures reviews are used to complement the survey results. Interviews with the local experts are found very helpful in term of sharing and exchanging the local condition, the survey experiences and findings. If local knowledge collection needs to follow up, domestic researcher is recommended to ease the approval process, avoid the restriction during the survey, and have more freedom in meeting with local villagers with a friendly setting.

4.3.1 Lessons Learnt:

1. Intensive ethnic migrations that bring different knowledge and practices to the watershed could significantly change the watershed landscape and the associated local knowledge. Such changes often lead to over exploitation of natural resources, and distortion and modification of local people's understanding and perception of their environment. This is a learning process for people with different knowledge background to study and to re-adjust their understanding to the watershed environment, which may take few decades and through the process, knowledge of local residence will be reformed.

2. Government Policy often plays a vital role in influencing the local knowledge and local practices, especially on the transmission of natural resources' ownership. The transmission forest ownership from indigenous people to government agencies and their logging practices have radically affect the belief and respectfulness people had on forest spirits, the way people use forest, and subsequently new way of understanding on forest will be formed.



Illustration 6: Deforestation in Khue Ngoc Diem, upper stream of SKAW

4.3.2 Key Findings:

The vast migrations have brought different means of livelihoods into the watershed, have stirred up the competition of resource usage among different ethnic groups, and have gradually fade

away the indigenous beliefs and practices on natural resource management.

1. Due to the strong influence of government policy on economic development and the associated activities such as commercial logging and massive agricultural area expansion and crop productivity maximization, the attitude of most local people toward environment protection become passive or apathetic that they feel the current result is the government's policy, now the it is the government's duty and task to issue good policies and to organize appropriate activities.

2. The strong control of government in this region has limited and transformed the usage of local knowledge of ethnic people for other purposes. For instance, the customary law of Ede and M'Nong people are often substituted by the government issued law and regulation, which impacts the social order of the community. Many indigenous rituals to worship forest and water have also discontinued in the local village but transformed to entertainment shows to attract tourists. Different kinds of the daily tools for livelihoods are transformed to tourist souvenirs instead they follow what the Kinh people used for agriculture.

3. The risk of discontinuous local knowledge among the indigenous people from different influences, including, the different ethnic groups, the government, and the market, and the already modified environment. For instance, many older people said they no longer teach their children on forest protection, because there is no more forest in their community, or the forest is belong to the government, what children learn from school is different from what they understand and they don't want to confuse them.

4.3.3 Suggestions to the watershed committee:

1. The local knowledge, especially the indigenous knowledge and practice in this watershed is undergoing a gradually fade out process. Yet, these information and practices are valuable to alert people the changes and current situation, and to attract them into the watershed management. Therefore, the local knowledge on watershed should well fit with scientific knowledge into the environmental awareness raising and watershed management education for local people and local government officers.

2. Many of the indigenous rituals on worship nature and celebrate the harvests should be encouraged and could jointly participate by different ethnic groups to encourage their cultural understanding. These activities could revive the people's respectfulness toward the nature, and these are good environmental education opportunities for people with different ethnic background to learn the traditional way of environmental protection.

3. Government policy is crucially important in the watershed management and in local knowledge formation. Therefore, favourable government policies that not only provide environmental education but also give incentive or rights in natural resource management to local people could increase their awareness and responsibilities to the watershed management and sustainable development. Some of the detailed activities can be referred to Annex 3 Report on South Krong Ana Watershed

4.4 Huai Sam Mo Watershed, Thailand

Background: Huai Sam Mo is a tributary upper Chi River that flow into Mekong River from Thailand. The watershed area is 72,900 hectare, which inhabit 53,972 local residents who are Thai ethnic groups (Singsong, 2007:1). Farming is the main source of livelihoods that over 70% of the watershed area are agriculture fields, but periodically droughts constrain the crop yield and push people to migrate to urban areas for job searching. This pilot watershed has an active and

committed watershed committee with members from grass roots and local administration authorities, and the committee is well supported by the provincial water resource department.

Research Methods: In Huai Sam Mo Watershed (HSMW), all the research methods were used: literature review, focus group, interviews of key informants and participatory observation. The survey in HSMW is very different from the surveys that have done in other three countries with two reasons. The first reason is there are abundant literatures on local knowledge of the whole Chi River Basin, which have been conducted by various academic institutions, such as Khon Kaen University and Thai Research Fund. Thus, to continue the same survey duplicates the existing work. Secondly the watershed committee has already conducted several surveys to study about the watershed and have used the information to organize various environmental activities. For instance, they use the watershed survey results to merge into the curricula of local schools, and to organize several watershed environmental public education activities in different parts of the watershed. They could explicitly present the watershed boundary, different tributaries and relevant environmental problems that affect local people's livelihoods in the watershed, such as the drought problem, the soil fertility problems, and the pollution problems, and have thought of coping strategies.



Illustration 7: Watershed committee explain the watershed area and boundaries

The research team, therefore, decided to conduct the surveys that correspond to the needs of watershed committee and their strategic plans. A focus group discussion with the representatives of watershed committee was initially organized to learn and understand their needs, and set the objectives of the survey. The objective was to seek for the integration mechanisms of local knowledge and practices on natural resource management to fit into the watershed plan and to duplicate them in different areas of the watershed. The discussion raised several existing and appealing natural resource management models, such as, community fishery conservation zone, usage of ground water for agriculture, organic fertilizer and pesticides making, riverbank conservation, irrigation scheme, and temple forest. The survey conducted intensive investigation on these topics, and analysed the key contributing factors for success and provided some ideas for expansion and improvement.

During the survey process, an experienced local consultant has been invited, whose personal experiences and knowledge on the local contexts has complemented to the survey's arrangement and interview contents. This local consultant has also facilitated in searching and briefly translating the relevant literature reviews about the watershed and the people that provided the research team a good understanding on the context. In the key informants interviews the information sharing should be reciprocal, which researchers should not just gain information from the interviewees, but also provide ideas and related examples to them as an exchange. By doing so, it shows you are supporting them and will build up the good relationships for future cooperation. Participatory observations take times that normally require half day or one day to really understand the topic. And for observation, suitable outfit should be prepared to avoid unnecessary injuries.

4.4.1 Lessons learnt:

1. Local people's self initiated watershed management could generate diverse effective ways of local knowledge usage in watershed management, which not only benefit the local livelihoods and

increase local people's confidence in natural resource management, but also encourage their awareness and responsibility in participatory watershed management.

2. Local knowledge and scientific knowledge can be well mixed in various ways to create better results for local people. The organic fertilizer and pesticides making is a typical example that different local herbs and pest can be used to make fertilizers and pesticides with biological tested organisms. The outcome, not only reduced the farmers' financial burden on chemical fertilizer and pesticides but also decrease the impact of these chemical leftovers to the river quality.

4.4.2 Key Findings:

1. Huai Sam Mo Watershed has over-exploited five decades ago through the first national development plan, and local people have experienced the impact of the watershed change long before other three pilot watersheds. They have also realized the importance of watershed management and associated responsibilities belong to everyone that lives in the watershed.

2. The local knowledge has been gradually revived with the participation of local people in the watershed management. For instance, the community fishery management has not only improved the local water supply source, but has also enhanced the local livelihoods from daily fish diet and fish income generation. The activity has motivated people to learn and conserve the surrounding environment better, the traditional fishing tools have revived and used in fish catching, different traditional fishing techniques have been used applied and spread around villagers, and self-regulated fishing rules are formed among villagers.



3. The environmental friendly livelihood practices with local knowledge component are easy to promote among local villagers in the watershed with similar geographic context. The organic farming, fishery management, and planning different herbs and fruit trees to stabilize the riverbank are all the examples that

found in the watershed. These examples contain a lot of knowledge that local people have already known, which ease the information spreading process and gain better acceptance from the villagers.

4. Local religion often play crucial roles in environmental protection, the temple forest is a classic example. The Buddhist monk, in past 30 years, have enlarged and planted a small forest for mediation. Apart from the surrounding villagers could enjoy the forest for relax and mediation, each year over 500 people come to attend the annual meditation workshop. These events bring people close to the nature and learn the relationship of human and nature. The monks, moreover, study and provide different tree seedling to ordinary people and to monks from other temple, and teach them how to plan different kinds of trees. All these activities are part of local and informal environment protection education, that watershed committee should think to coordinate and support.



Illustration 8: Image of temple forest from satellite

5. Local knowledge needs scientific monitoring to ensure its sustainability. Seasonal drought is the key

challenge that villagers in the watershed are facing. Therefore, in several places, using ground water for irrigation is used. The traditional way of searching for wells are also developed, such as using bowls to cover the soil and check overnight the water in the bowl, using two brown metal sticks with reversed “L” style, and using personal feeling of the environment to determine the suitable well location. Nevertheless, without proper monitoring of ground water quantity, overuse of ground water could cause problem in the future.

4.4.3 Suggestions to the watershed committee:

1. The watershed committee has already demonstrated its capacity to use local knowledge and scientific knowledge in the watershed management, and results of the programs have gained warmly support from local residence and have stimulated the committee's passion to continue and enlarge their activities and put them into the watershed planning. As the activities expand to different areas within the watershed, more technical and financial supports will be needed. Therefore, relevant trainings on technical skills and funding raising skills become necessary for watershed committees to carry on the works.

2. Many of the current good practices on watershed management and local livelihood improvement have the potential to expand the scales within the watershed and to other pilot watersheds. These expansion activities could be carried out in experience sharing and exchange manner that local people can share their good practices and ideas with people within the watershed and cross different watersheds. By doing so, the people who live within the watershed will have chance to meet and learn the situation of different parts of watershed, and through experiences sharing, the friendly connectivity among people along the watershed will be formed. Moreover, these activities will expand the usage of local knowledge within the watershed and with the watershed management.

3. These good practices still have a lot of improvement spaces, for instance, the community fishery management can be further organized as a fishery study site for upper Chi River basin to identify the different species of fish, their migration schedules and habitats to improve the sustainable fish catch, a small living museum to demonstrate various fishing tools and fishing techniques will not only teach local young people the local fishing culture, but will also attract the tourists to pay visit and taste the fish, which will help local people to generate income. The suggested detailed activities on other natural resource management models are elaborated in Annex 4 Report on Huai Sam Mo Watershed.

The four case studies demonstrated the key results of local knowledge surveys that have done in four pilot watersheds during March to June, 2008, the methodologies that used in the survey are mixture of at least two social research approaches. There are a number of lessons learnt from different surveys and they all should be put into consideration for future surveys. The key findings and suggestions illustrated the condition of current watershed management related local knowledge in each watershed for watershed committee to know and consider for planning of action. These key issues also showed that the local knowledge often interact with the local social, economic and political structure. To gain further information of each watershed, the detailed reports are available as annexes.

5 Recommendations

The four pilot watersheds that mentioned in the cases studies, namely Nam Ton Watershed in Laos, Siem Reap Watershed in Cambodia, Southern Krong Ana Watershed in Vietnam, and Huai Sam Mo Watershed in Thailand, have many similarities and differences. The main local livelihoods of these four pilot watersheds are rice farming. Forest in all four pilot watersheds is a valuable source of

food and commodities. Due to the same religious influence, the water related traditional rituals and beliefs, and farming practices and techniques in the three pilot watersheds, Nam Ton, Siem Reap and Huai Sam Mo have a lot of commonalities. Fish in these three pilot watersheds also plays an important role as staple food and source of income. Therefore, knowledge and community management mechanisms that developed on rice farming, fish catch and forest products collection are various and diverse based on the local cultural and geographic context.

These four countries, meanwhile, are experiencing the fast economic development in different stages, and are eager to exchange their resources for economic development and livelihoods' improvement. Under different political systems, different government policies, and influences from the international market, the ruling over of natural resources in the watershed are beyond the local people's control. In fact, the current different development activities that carry out in the four pilot watersheds are shaping the way people perceive and use the natural resources within the watershed and are altering the watershed landscape at rapid speed. The most significant change is the exploitation of forest and the conversion of forest to agricultural area, and the immediate impacts of deforestation, which local people have known and experienced, are the increase of vulnerability of crop fields and houses from the impacts of extreme weathers, like storms, floods and droughts, and the deterioration of the surface water quality in the watershed that force them to search for new sources of drinking water from the underground.

The fast changes of watershed environment and the local people's understanding on the changing watershed and coping strategies and capability exist a large gap. In many surveys, villagers claimed that, although their living condition has improved, they felt upset and panic to the big changes in the watershed and the following consequences. For instance, in mid stream of Siem Reap Watershed, villagers stated that two decades ago they rarely experiences floods or droughts, and when the crop yield is not sufficient, they go to search food in the forest. But now the forest have declined, their rice fields have expanded but become more exposed to floods and droughts and food in forest become difficult to find, that many people are force to go to the town and search food for survivals. Despite the Khmer have various rice farming techniques in water management, these techniques often could not cope with the recent big floods.

The traditional and local rituals on pay respects to the gods of natural resources are experiencing gradually vanish in different degrees. The fade out of local beliefs are closely linked with influence of migration. SKAW, for instance, have found only old indigenous people know about the different rituals for worship forest and water, because these rituals were mostly practised before 1970s, but there are no longer practice in present times. These rituals play critical roles in tying up the community social network and regulating villagers' behaviours towards certain natural resource management, hence the vanish of these rituals imply villagers are no longer perceive the value of certain natural resource as important as before, and as the resource become degraded, overuse or carelessly use the resource will be further expanded.

The watershed management is complex and comprehensive natural resource management of all the resources within the watershed boundary to ensure the sustainability of the watershed and improvement of local livelihoods with social equity. Therefore, institutionalize the watershed management with specific committee to plan and oversee the watershed are crucial to realized the success of watershed management. Nonetheless, putting the watershed management tasks to only few committee members could be a heavy burden for them, unless the local people participates into the watershed planning and implementation to share the responsibilities and benefits. In the pilot watersheds of four countries, the different political systems have formed different social structures, different political distances between government and people and different degree of manoeuvrability of people in managing their surrounding environment for livelihoods. In Thailand

and Cambodia, the multi-parties political systems provide people relatively more autonomy in managing their surrounding environment as well choosing the political parties that favourable to their needs, although the system contains many flaws. In Laos and Vietnam, the one party system gives the government more leading roles and controlling power toward the people and the resources. These political differences influence the degree of public participation in different watershed. Nevertheless, there is a fundamental ground for local people to participate in the watershed management, and that is building the local people's knowledge on watershed.

The report would like to recommend the follow up phase – to transfer the local knowledge collection by outsiders to local knowledge building by the local residents of the watershed. The local knowledge building among local residents is the preliminary and essential stage of public participation in watershed management. It is also an important component in the public awareness raising activities on watershed management that local people themselves start to aware and learn the watershed, and which will supplement to the posters and education events that brought by outsiders. The local knowledge building should be a continuous learning process that may initially guided and facilitated by outsiders, and would be continued by the local people after mastering the skills. Through this learning process, the capacity of local people will be built and enhanced, and this capacity and knowledge can later be used as the negotiation resource of local people on the multi-stakeholder table for protecting and utilizing their watershed.

The local knowledge building is a local participatory natural resource learning process. It is not new concept and has been used in various community-based natural resource management activities in Thailand and Cambodia with favourable and successful results. The learning activities can start with two or three villages first and later expand to other areas of the watershed, in order to ensure the local public acceptance and collaboration.

The learning process has several procedures. First is to introduce the ideas and purpose of the learning activities to the local people, encourage them to voluntarily join the learning team. The team can divide into few divisions based on different natural resources, such as forestry and fishery. Secondly, each division needs a facilitator to support and help the villagers during the learning process. This person should have qualified knowledge on that particular subject, such as the university graduates on forestry, fishery and agriculture. Thirdly, the villagers and facilitators need to work together to make the research plan, and project should provide research tools, such as simple note books to take notes and camera to take photos. Giving an example on learning of the Non-timber forest products (NTFPs) within the surrounding forest of the watershed, the team may divide NTFPs into several categories, such as herbs, fruits, vegetables, and fibre products. When the learning team and local people come back from the forest, they can document the items they have collected in the names, the categories, the locations, the ways to collect them, etc.,. The facilitators should either work together with the research team or meet periodically with them to check their notes, exchange the knowledge on different plants, help the local people with problems related to research, and facilitate in organizing local meetings to report the research results. Over a period of time, the accumulation of different NTFPs will raise the local people's attention on the importance of forest and will engage further in forest protection activities. The information from learning activities will also help the government officers to value the importance of different natural resources to the local people, and will facilitate them to make better policies and activities that contribute to the watershed management. And lastly, periodically monitoring, assessment and supports from watershed committees and project officers will encourage their confidence and imitiveness to further participate into the watershed management.

The collection knowledge building process may take more efforts and time than merely providing posters or organize education events, but once the learning process is affirmed and operated by local

people, it paved a more intrinsic, sustainable and concrete foundation for the active public participation in the watershed management.

6 Conclusion

This report summarized the processes of collection of local knowledge on watershed management in four pilot watersheds, from the identification of concepts of local knowledge and watershed management, to the different methodologies that can be applied in local knowledge collection, how these methods have been used in the local knowledge surveys of the four pilot watersheds, together with the lessons learnt and some of the key findings. The report also raised several challenges that have found in the local knowledge survey, which the most important challenges is the local people's understanding and familiarity on watershed is lagging behind with the fast change of watershed environment. The factors of fast change are from various sources, including the wars, migration, governmental policies, market incentives and foreign investment that led by different developmental models and ideologies. The fast developmental changes have eventually marginalized the local people's rights in protecting and using their surrounding natural resources, while they have to bear the impacts from the fast development. To face the challenge and ensure the watershed is developed in a sustainable and equitable manner, the public participation in watershed management is essential. And the researcher suggested a fundamental follow up activity to nurture and motivate the local participation: that is the local knowledge building by the local people. This activity will help local people to revive and enhance their understanding on the watershed, to aware of the changes and related impacts of the watershed, to build up their capacity and confidence in natural resource management, and to take more responsive and active roles in participating in the watershed management together with the watershed committees and other stakeholders.

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