Participatory Monitoring and Assessment of Ecosystem: Lessons Learned for Development

Thailand Collaborative Country Support Program
Regional Community Forestry Training Center for Asia and the Pacific

Participatory Monitoring and Assessment of Ecosystem : Lessons Learned for Development

Summary of the National Conference
Kasetsart University, Bangkok
26-27 May 2005

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INTRODUCTION

In the kingdom of Thailand, forest ecosystems play a pivotal role in the livelihoods of both rural and urban communities. Rural communities depend upon the forest as a source of food, shelter and income, whereas urban communities rely on forests to sustain the hydrological cycle and as a venue for recreational activities.

Ascertaining the correct balance between utilizing the goods and services that forests can provide in conjunction with sustainable management practices and biodiversity conservation is a highly important and debated topic within Thailand. In recent years there has been a greater societal interest in the sustainable management of forests and their natural resources and this has gradually seen the inclusion of local communities in the forest decision-making processes.

In May 2005, the Regional Community Forestry Training Centre for Asia and the Pacific (RECOFTC) by its Thailand Collaborative Country Support Program (ThCCSP) collaborated with 16 organizations (including the United Nations Development Program) to host a national conference titled "Participatory Monitoring and Assessment of Ecosystems: lessons learned in Thailand". The conference was specifically aimed at facilitating the exchange of knowledge on participatory monitoring and assessment of natural ecosystems and the lessons each organization has learned to date.

THE CONFERENCE

On 26 and 27 May 2005, more than 200 participants attended the "Participatory Monitoring and Assessment of Ecosystems: lessons learned in Thailand" national conference held at Kasetsart University, Bangkok. The attendees comprised: government officials, education and research staff, non-government organization (NGO) workers, community representatives and the media.

Figure 1 - 2 National technical conference on the participatory monitoring and assessment of ecosystems

Aims

The conference was bought about due to the need for the development of participatory monitoring techniques that would ensure the capture of collective knowledge on natural resource management necessary for sustainable development. In particular, there was increasing evidence that participatory monitoring should comprise an integrated approach that combines indigenous knowledge with scientific knowledge in a manner that leads to the development of positive long-term relations among stakeholders. An example of a participatory monitoring approach discussed at the conference was Community-Based Ecosystem Monitoring

(CBEM). This is a form of participatory monitoring that provides community members and NGOs the opportunity to work together in monitoring selected plants, wildlife, habitats and ecosystems. In this case, active community participation and stakeholder collaboration can lead to the development of indicators and data collection methods that are workable and accepted by local communities.

Lessons learned: natural resource and forest monitoring in Thailand

Since the introduction of the national logging ban by the Thailand government in 1989, there has been considerable debate and attention provided to the possibility of allowing community management of forest areas in Thailand. Ongoing awareness of community forestry (CF) in the past decade has led to a significant increase in research activity and the development of indicators that may support CF in Thailand.

Early indicators for CF were constructed with a focus on measurement of resources and their abundance within the forest areas. Concurrently, forest dependent communities had also begun monitoring natural resources within their local areas. This led to some collaboration with a variety of organizations and the adoption of a number of approaches like environmental education and local culture based research. A few case study examples of these approaches that were presented at the conference include:

- River ecosystem monitoring of the Ping river in Chiang Mai;
- Lee watershed monitoring in Lamphun province;
- Nan river monitoring by civil society groups in Nan province;

- Songkhla lake ecosystem monitoring;
- Wetland forest monitoring in Sisaket province; and
- Thung Maha mangrove monitoring in Chumphon province.

Further, many communities have been monitoring keystone species and resources that are of importance to their communities, particularly:

- Grapsoid crab monitoring at Pred Nai mangrove community in Trat province;
- Bamboo shoot monitoring in Khao Rao Thian Tong in Chai Nat province; and
- Opliaceae monitoring at Ban Rom Pho Thong in Chachoengsao province.

At the national level, natural resource and environment monitoring systems were developed consisting of criteria and indicators of sustainable development established by the Office of Natural Resource and Environment Policy Planning. The Royal Development Projects Board also developed a framework (often referred to as the Pressure-State-Response framework) for natural resource and environment assessment. This framework is inclusive of terrestrial and marine ecosystems, silvicultural, agricultural and socio-economic criteria and indicators. Satellite imagery was also widely undertaken to assess the ongoing changes that take place within some forest areas.

By 1998, seven criteria and 67 indicators for sustainable forest management were developed at the national level to be applied to the Model Forest project located in Lampang province. However, continuous reorganization and restructuring of the

Ministry of Natural Resources and the Environment has subsequently led to apparent neglect to the Model Forest project. Essentially, there is still a strong requirement for the government to move forward and develop an effective monitoring system for forest management in Thailand.

The 2005 Conference discussed a number of ecosystem monitoring issues that had been conducted by researchers in Thailand over the past decade. In most cases, the research was quite specific rather than being broad-based and applicable to a large number of cases. Further, most research was representative of short-time frames and a small stakeholder base. Evidently, there is the need for the development of monitoring mechanisms at the local and national level in Thailand. This will only be achieved, however, if information sharing becomes paramount and there is strong institutional support.

Figure 3 - 4 Debate and knowledge exchange in participatory monitoring of ecosystems

The way forward in participatory monitoring approach for forest and other natural ecosystems in Thailand

During the 2005 participatory monitoring and assessment conference there were three group discussions focused on three main ecosystem types, namely: 1) community forests, 2) watershed, and 3) mangroves and wetlands. Two small group discussions also focused on research and the role of the media in participatory monitoring. The discussion on the three ecosystem types was summarized under the following headings: ecosystem monitoring framework; methodologies for participatory ecosystem monitoring; and research development for participatory ecosystem monitoring.

1. Ecosystem monitoring framework

The three ecosystem types discussed during the conference were considered to comprise similar monitoring frameworks. These frameworks are apparent at the community and landscape level. There are three common categories of indicators comprising:

1) A set of indicators on resource conditions and ecosystem integrity. For example, at the community level monitoring tends to focus on fringe forest zones and comprise ecological studies, whereas, the study of larger forest areas (e.g. watersheds) tends to take place on an ad-hoc basis (e.g. measurement of water flow).

2) Indicators related to the resource management such as societal values and perceived importance of the resource.

3) Institutional and social indicators that cover issues such as participation, legislative and local law compliance, collaboration amongst stakeholders, etc.

2. Development of methodologies for participatory ecosystem monitoring

There is a need for a participatory ecosystem monitoring methodology that can be applied at the local level but also can be elaborated at each level of society. For this to occur, cooperation is required from all stakeholders. An appropriate methodology can be developed utilizing existing local knowledge, research and lessons learned. Further development requires the support of local authorities and experts, the Community Forestry Department, water resource management units and the Thailand Research Fund.

Information exchange is critical in developing appropriate methodologies and ensuring they are disseminated via appropriate networks for landscape and watershed management. National forestry groups have a role to play in collecting and collating local community forestry-based monitoring systems in order to facilitate and complement information exchange. Key stakeholders that may assist in the development of these issues are: regional institutes; RECOFTC; forest conservation institutes; provincial natural resource and environment offices; regional education institutes and universities.

The mass media also has a key role to play in the development of participatory ecosystem monitoring methodologies by increasing public awareness and providing a positive contribution to public debate. Environmental journalists themselves have a role to publicize community and inter-agency debates and their access to information should be complemented by information hubs such as RECOFTC which has a sound network in place for natural resource monitoring.

At the national level, there is a desperate need for an agency that has a defined mandate for national ecosystem monitoring by linking regional information. It is suggested this agency could function under the auspices of either: the Office of Natural Resource and Environment Policy and Planning; the Royal Forest Department; Department of National Parks Wildlife and Plant Conservation or the Office of the National Parks.

Figure 5 - 6 Small meeting groups brainstorming on participatory monitoring of ecosystems

3. Research development for participatory ecosystem monitoring

Small scale individual ecosystem issues can be linked in overview to the landscape as a whole by conducting participatory ecosystem monitoring from upstream to downstream. Research should be based on indigenous knowledge. It is paramount that local and scientific knowledge is integrated by collaboration between local communities and experts.

Experts and local communities must alter their attitudes and remove stereotypes in relation to the manner in which research is often conducted. Research cannot be simply defined as a matter of expertise but should be able to take into account local

community approaches and knowledge with respect to ecosystem management. Key issues include the development of appropriate technologies and methodologies that integrate, involve, are easily comprehensible and are regarded as meaningful by local communities. This process can be assisted by:

- *Knowledge management* involving the collection and collation of lessons learned from individuals and documented materials as well as the establishment of networks to pass on this information. RECOFTC has the ability to coordinate knowledge management, establish networks and disseminate information, news and developments in natural resource and ecosystem monitoring.
- *Building collaborative research* or partnerships at same working sites. There are eight field sites managed by RECOFTC, 80 local research sites for the Thailand Research Fund (TRF) and a very large base for the collection of lessons learned on ecosystem monitoring when taking into account the projects of the Royal Forest Department, National Parks, Wildlife and Plant Conservation Department and those of NGOs.
- *Establishing technical networks for ecosystem monitoring* can occur between Kasetsart University, the Faculty of Environment and Resource Studies at Mahidol University, the Office of Natural Resource and Environmental Policy and Planning and other agencies. The mass media can assist by disseminating information on the state of resources and environment by engaging with civil society and the appropriate scientific, environmental and local community networks.

Concluding remarks

Overall there can be three key points that are considered to be lessons learned about participatory monitoring and assessment in Thailand based on the case studies presented in the conference of 2005. The lessons learned are:

1. A lack of education or a poor social background is not an excuse for prejudice that would prevent the introduction of participatory management approaches.

2. Awareness-raising amongst local people and joint management is essential for participatory management.

3. Mutual recognition of the knowledge and skills of all stakeholders is important for successful participatory management outcomes.

PROGRESS IN ECOSYSTEM MONITORING IN THAILAND

Evolution of community-based ecosystem monitoring in Thailand

Prior to 1987, forest land in Thailand was managed exclusively by the national government and there was little recognition of the forest management practices of forest dependent communities. However, the introduction of the ban on logging in 1989 led to studies of forest dwellers which provided a better understanding to researchers and officials of their forest management practices. At the same time, many educational institutions began to develop innovative tools and approaches for forest management, such as Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA), Community Forest Appraisal (CFA) and Participatory Action Research (PAR). This created a revolution in community forestry and led to practical application in over 10,000 communities throughout Thailand. Subsequent development of a CF Bill took place (although yet to be passed through Parliament) and by the year 2000, discussions on people and forests, biodiversity conservation and poverty alleviation for forest dependent communities became common public issues.

Today, community forestry requires an improvement in the efficiency of forest management to provide a solution to a range of societal dilemmas. To begin with, the inequities in enjoying the benefits of the forests should be addressed. Community forest management should focus on those who depend on the forest and all other relevant stakeholders. The emphasis should be on active management and the development of forest management

monitoring and assessment systems that cater for adaptive management practices.

Many communities have developed their own indicators for community forests and have cooperated with experts in the collection and analysis of data. Generally, the assessment of indicators is compiled by establishing village boundaries, forest boundaries and total forest area. Following this, permanent sample plots are developed for evaluating parameters such as the percentage density of bamboo clumps in a given area. In each case, for monitoring to occur on a regular basis, it is dependent upon community participation whether it is voluntary or through a particular interest group.

National forest monitoring in Thailand

The development of criteria and indicators for forest management in Thailand began in earnest in 1998 after Thailand accepted the resolution of the 1st ASEAN Senior Forestry Officials Conference held in Malaysia that same year. The conference implored ASEAN countries to develop criteria and indicators that will illustrate progress in sustainable forest resource management for each ASEAN country. In Thailand, the Royal Forest Department assumed responsibility for this task and appointed a committee to determine the criteria and indicators necessary for assessing sustainable forest management. The criteria were to serve as national standards with a focal point toward a forest management development group and demonstration forest zones.

Once the criteria was finalized and the indicators developed, a seminar was arranged for more than 200 persons to attend consisting of government and non-government experts. The basis of the seminar was to gather expert opinion on the criteria and

indicators and to make amendments where necessary. On 22 June 2000, the committee issued the Thailand National Criteria and Indicators for Sustainable Forest Management comprising seven criteria and 67 indicators (outlined in Table 1).

Table 1: Criteria and indicators for national sustainable forest management

	Criteria	**Number of Indicators**
1	Elements facilitating forest management	9
2	Forest resource security	7
3	Forest ecosystem status and abundance	9
4	Sustainability of forest yields	8
5	Biodiversity	6
6	Water and Soil	9
7	Economic, social and cultural conditions	19

Progress in Thailand

1. Forest ecosystem restoration monitoring

Monitoring forest ecosystem restoration in Thailand began with reforestation projects and research projects on various ecosystems, such as the case study of participatory monitoring on forest rehabilitation at Mae Sa Mai village, Chiang Mai province.

Box 1 Case study of Mae Sa Mai community: Chiang Mai Province (paper presented at the conference by K.Boonsai, S.Sangkam, N.Thanomvorakul, N.Kwamdeedumrong and S.Elliott)

The Mae Sa Mai community is located in the Pongyaeng sub-district of Chaing Mai province and is a Hmong ethnic minority village. It is an agricultural community surrounded by the hills of the Mae Sa watershed located within the Doi Sutep-Pui National Park. However, forty years ago the community was located at the top of the hills but later had to migrate to their current location due to ecosystem changes and lack of plentiful fresh water supply.

Originally, Mae Sa Mai community comprised barely eight households and practiced swidden rice and vegetable cultivation on flat areas in the hills and utilized opium as a cash crop. The suppression of addictive drugs imposed by the government and other strict measures imposed for forestry conservation led to the planting of mono-crops such as peach and seasonal vegetables that include carrot, cabbage and potatoes. Today, Mae Sa Mai has almost 2,000 persons living in more than 300 households and mono-crops (especially lychee) as a response to consumer preferences.

Mae Sa Mai has a lengthy history of deforestation in the watershed of Doi Sunthep-Pui National Park which tends to have a direct impact on the quality of life of people in the village, as well as other villages located in the nearby Lae Sa watershed. The direct impacts are typically a reduction of quantity and quality of water flow, increased severity of drought, erosion and a general decline in forest game and forest resources.

An increase in population has seen the severity of the negative direct impacts on the quality of the village livelihoods and the state of their surrounding environment. However, continuous utilization of the forest resources, degradation of soil quality and an increasing use of freshwater resources has led to the people of Mae Sa Mai bearing the

brunt of considerable criticism over their livelihood practices. This criticism is often stronger towards villages of this nature given the negative perceptions the government and society in general tends to portray ethnic minorities. In essence, Mae Sa Mai village was regarded as the sole contributor to the environmental problems faced in the Doi Suthep-Pui national park, despite similar practices occurring in nearby villages.

Mae Sa Mai village afforestation

During the early 1990s, a rehabilitation and conservation forest area surrounding Mae Sa Mai village was designated by the village. A natural resource and environment conservation club was formed and plans were drafted and activities implemented soon after for protection of the forest. Rules, regulations and penalties in the form of fines and community service to compensate for infractions were introduced. Soon after, the hunting of fauna was banned and the expansion of areas under cultivation was under control of the conservation club. Overall, the club was initiated to promote restoration of natural resources within the forest area and overseeing the building of shared responsibilities and alliances for the management of the forest.

In 1996, the Mae Sa Mai conservation club requested cooperation and assistance from the Forest Restoration Research Unit (FORRU) of Chiang Mai University for the application of scientific knowledge to the rehabilitation of forest ecosystems in Northern Thailand. The FORRU duly assisted the village by:

- gathering funding for a community nursery;
- the collection of seeds from the surrounding forest and the germination of those seeds;
- management of the nursery and care of the seedlings;
- preparation of reforestation sites;
- reforestation;
- post-reforestation treatment;
- forest fire prevention; and

- holistic reforestation monitoring.

For the success of the FORRU method in Mae Sa Mai, it was important that the selected species for replanting were indigenous species that are easy to germinate and had high survival rates in this region.

Monitoring forest rehabilitation in Mae Sa Mai village: post-planting
Following the replanting that took place in the Mae Sa Mai area, three objectives were developed as part of the plan to monitor and evaluate the success of the replanting scheme. These objectives were:

1. To select relevant species from the list of structural species used in forest rehabilitation in the Northern Thailand region.
2. To test, develop and improve the structural species approach undertaken by the FORRU.
3. To monitor, measure and evaluate the return of biodiversity in the rehabilitated forest area.

Since the time of the initial replanting, there are today many joint activities between Mae Sa Mai community and FORRU. An initiative of FORRU sees local school children measure nearby trees for their height, shape and overall health within the reforested plots. This has not only taught many village children the ability to monitor tree survival and growth rates, but also the importance of monitoring.

The success of the initial replanting combined with education has led to the villagers taking ownership of the community nurseries and conducting their own surveys of a variety of plant species. For example, villagers now conduct fortnightly surveys on the flowering and fruiting of trees planted in previous years and compile this information for monitoring purposes. Further, when the villagers see any wild animals within the replanted areas, this information is recorded and provided to FORRU.

The lessons learned from Mae Sa Mai
Since the rehabilitation of the local forest and implementation of monitoring techniques to Mae Sa Mai village in 1997, to date there has

been no less than 32 hectares of rehabilitation carried out by the villagers in conjunction with the assistance of FORRU. There is some evidence of the reforested areas joining together with other parts of the forest due to the diligence of management by the villagers. For example, trees that are less than three years old are regularly weeded and fertilized. Furthermore, the villagers often undertake fire watch patrols to prevent and control forest fires and this has seen the number of forest fires in this area decline markedly.

The monitoring of the reforested area has shown that within three years the replanting can lead to a closed forest canopy and the flowering and fruiting of many of those trees. This has naturally seen an increase in bird numbers in the replanted areas. The number of bird species found in reforested plots that were five years or older tended to increase dramatically. For example, bird nests were also found in 17 different species of trees in the five-year old plots and 53 bird species were identified as utilizing the forests for roosting and hunting purposes. Some medium-sized mammals were also found in the rehabilitated plots, including pangolins, Burmese ferret-badgers, civets, barking deer and wild boar.

Essentially, the structural approach applied by FORRU and the local villagers has enabled the rehabilitation of the forest and led to an increase in biodiversity to the forest within just a few years of plantings. Evidently, the number of new tree species that has been generated by the activity of wildlife in the rehabilitated plots has increased two-fold.

Concluding remarks

Mae Sa Mai village today has more than 32 hectares of rehabilitated forest as an example of forest renewal that can take place in an ethnic minority village. Many observers from a wide variety of backgrounds travel to the village to observe their natural resource management and conservation practices. Furthermore, the relationship between the village and Doi Suthep-Pui National Park and the Queen Sirikit Botanical Garden has improved and joint agreements and activities are now in place.

After eight years of collaboration, most stakeholders have come to recognize that a lack of education or a poor social background is not a barrier to the ability for villagers to learn, understand and apply scientific knowledge and the necessary tools for the effective monitoring and management of the forest. In essence, communities similar to that of Mae Sa Mai should not suffer from discrimination or access to scientific information and expertise due to prejudice based on poor knowledge capabilities of the villagers.

In the past three years, FORRU has undertaken more than 30 training and exposure trips (involving more than 700 participants) to the rehabilitated areas. This is because Mae Sa Mai village is a thriving example that demonstrates as a learning resource the ability for ethnic minority communities to establish forest plots with the aim of forest rehabilitation in a highland evergreen forest ecosystem.

2. Monitoring of streams and water sources

The monitoring of streams and rivers in Thailand has made much progress. Criteria indicators and manuals for monitoring benthic animals and aquatic insects have been developed by the Green World Foundation (GWF). Examples include monitoring of Songkhla Lake, under the Biodiversity Research and Training (BRT) project, the monitoring of Tha Jin River by Mahidol University, the monitoring of the Lee watershed by communities in Lamphun and the Raksthai Foundation. Additionally, many streams and rivers of the country are monitored by the water detectives approach, initiated by the Green World Foundation (GWF). In addition, monitoring can be carried out by using a cultural-based approach; for example, the river life treks *(Dharma Yatra Seap Chata)* for the Mun, Chi and Khan rivers, organized by community organizations,

in conjunction with NGOs and Department of Environmental Quality Promotion; Ministry of Natural Resources and Environment.

3. Wetlands Monitoring

Wetlands management and monitoring systems have been developed in many areas of Thailand employing bio-indicators such as fish and aquatic plants, and chemical indicators. Examples of monitoring by bio-indicators include fish monitoring of wetland forests in Ise village, Po Si Suwan branch district, Sisaket province.

Box 2 Case study of Haui Thapthan community, Sisaket Province (paper presented at the conference by P.Wonglert)

Ise village is located near the Huai Thapthan River in the Po Si Sumwan branch district of Sisaket Province, Thailand. The village is situated in an area of riverine forest that is regarded as one of the most important wetland areas for Northeast Thailand. Most of the communities in this region are depend on rice harvesting and fishing for their livelihood. However, rapid population growth has led to an overall scarcity in the natural resources in this region in recent years.

Chemical-based agriculture is widespread in this region. This has led to a rapid decline in the number of aquatic species in the river due to the lack of understanding of the negative impacts of chemical use in wetland areas. Water contamination is widespread and often the drinking water is hazardous to humans. Furthermore, modern agricultural practices have led to substantial erosion along the waterway.

The negative impacts of human resource use and agricultural practices in the Ise village area resulted in the Ise school (*Khururad Withaya*) incorporating conservation and environmental awareness into the school curriculum. Collaboration with the primary and secondary school pupils led to the establishment of the Non Yai youth conservation group aimed at developing activities to raise awareness of conservation for

communities living in the Non Yai forest region and along the banks of the Huai Thapthan River.

Monitoring in Huai Thapthan

Monitoring of Huai Thapthan River first took place in 1997. The initial activity was known as *Eating Wild Rice – Wetlands Fishery* and took place on a specified day in the dry season during April each year. On the day, villagers would come together and conduct a ceremony to pay respect to the 'grandfather' or ancestor spirit to ask permission to catch fish in their indigenous traps. The ceremony and fish gathering was led by the village elders in an effort to unite everyone in the village and all fish that was caught would be distributed equally.

The most important aspect of this annual activity was that villagers were gathering to discuss the conditions of the surrounding forest and wetlands. On the day, specific monitoring and data collection would also be carried out and sampling nets and traps would be placed at three wetland forest zones. The number of fish species captured would then be recorded for future comparison.

The results of the Huai Thapthan River surveys during the period of 2002 to 2004 illustrated the quantity of fish captured had declined markedly. The Non Yai youth club found that modern fish traps, fishing during the breeding season, increased drought severity that reduced river flow into the wetlands and especially the use of chemicals in nearby chilli plantations and rice field pesticides, were each significant contributors to the poor state of the river.

The *Eat wild rice – wetland fishery* ritual is seen in Thailand as a successful lesson in management and awareness-raising of the importance of local wetlands and joint responsibility in management. The study results have created an opportunity to educate the community in best practice. A follow-up project has been discussed with the community to allow systematic management of the wetlands in Huai Thapthan and a variety of monitoring procedures to occur, namely:

- An annual survey of fish traps and varieties;
- A survey of aquatic plants;
- Survey of the impact of the use of chemicals that negatively affect organisms in the wetlands;
- A clean water project; and
- A project to plant Garcinia and other plant species along the banks of the Huai Thapthan River.

4. Participatory mangrove monitoring

Participatory monitoring of mangrove management has been developed in some areas of differing issues. Benchamas (2005) of the Thailand Environment Institute (TEI) studied the progress of monitoring of mangrove management at Thung Maha mangrove forest. The local communities in association with educational and research institutions have also been engaged with many mangrove monitoring projects, such Khlong Lidee mangrove project in Satun province, where the community cooperated with the Thailand Research Fund (TRF) in an action research project. In other areas, mangrove monitoring methods have been implemented at the ecosystem level and the species level, such as the monitoring of the grapsoid crab monitoring at Prednai mangrove in Trat province (a study area which is profiled later) and mangrove monitoring in Khlong Lidee, Satun Province.

Benchamas (2005) provided a comprehensive description of earlier studies on local level mangrove ecosystem monitoring, which were done by Tambon Administration Organizations (TAO) and the Office of Natural Resource and Environmental Policy and Planning (ONEP) in cooperation with the communities. These earlier

studies have been largely of mangrove plant species, their productivity, and management efficiency through consideration of:

- Plant type;
- Distribution;
- Growth rate;
- Wood density;
- Wood volume; and
- Natural propagation.

These studies typically were not continuous except for the monitoring of post-planting growth and assessment of the survival rates of seedlings.

Currently, there is extensive mangrove ecosystem monitoring at the Princess Ubol Ratana mangrove forest at Klong Khon sub-district, Mueang District, Samut Songkhram province. Here the growth of the trees planted by HRH Princess Maha Chakri Sirindhorn is monitored for ecological changes in the mangrove ecosystem to be used as baseline data for other mangrove sites. In the three zones of the Princess Ubol Ratana mangrove forest, the height of mangrove trees is measured periodically 2-6 times. The data collected suggest that growth rates differ among zones, depending on the strength of tidal currents, wind, salinity, and rock barnacle damage.

5. Participatory wildlife monitoring

Previous wildlife monitoring projects in Thailand were carried out by wildlife specialists as part of research studies on wildlife by various academic institutions; however, community participation was often minimal. Later, a participatory approach to wildlife monitoring was introduced by the World Wide Fund for Nature (WWF), Thailand. This resulted in wildlife sanctuaries and the surrounding communities monitoring the focal species in their local areas. For example, monitoring gaur populations in the habilitated forest ecosystem area at Khao Phaeng Ma, Wang Nam Khiaw district, Nakhon Ratchasima province was undertaken by the Wildlife Fund Thailand, under the Royal patronage of H.M. the Queen.

There are several examples of participatory wildlife monitoring studies that have subsequently led to participatory wildlife management. For example, Robert et al (2005) studied the development of the "focal species technique" for wildlife monitoring under the research project on a system to monitor assess the status of wildlife in the Western Thung Yai Naresuan Wildlife Sanctuary (see Box 3).

Box 3 Participatory monitoring of wildlife on the western side of Thung Yai Naresuan Wildlife Sanctuary, Kanchanaburi Province (paper presented at the conference by W.Shutipong, R.Steinmetz and N.Seuthurian)

This project comprised village representatives, forestry officials, the World Wide Fund for Nature (WWF) and saw the development of a number of workshops that covered wildlife monitoring and assessment. Successful outcomes from the workshops led to new or improved skills in:

- Conducting surveys;
- Data collection and analysis;
- Compass and map use; and
- Operating global positioning systems.

Following the workshops, the head of the Thung Yai Naresuan Wildlife Sanctuary appointed members of both communities as "Thung Yai Naresuan Wildlife Conservation Volunteers". Their responsibilities included:

- Participating in patrols within the Thung Yai Naresuan Wildlife Sanctuary with other staff in order to prevent and resolve the problems of wildlife poaching by other community members and outsiders.
- Exchanging the information from patrols within the Thung Yai Naresuan Wildlife Sanctuary with officials from the sanctuary, WWF and Lai Wo Tambon Administration Organisation.
- Monitoring and assessing the population status and trends of selected wildlife species.

In the case of this project, it was found that the most important factor that complemented the fieldwork was the acceptance of the role and status of government officials and the local community which created mutual recognition of the abilities of each other.

Table 2 Focal species in wildlife monitoring

Herbivore	**Carnivore**
1. Elephant *(Elephas maximus)*	7. Wild Dog *(Cuon alpinus)*
2. Wild Ox or Gaur *(Bos gaurus)*	8. Asiatic Black Bear *(Ursus thibetanus)*
3. Asian Tapir *(Tapirus indicus)*	9. Malayan Sun Bear *(Ursus malayanus)*
4. Deer *(Cervus unicolor)*	10. Leopard *(Panthera pardus)*
5. Barking Deer *(Muntiacus muntjak)*	
6. Wild Pig *(Sus scrofa)*	

	11. Tiger *(Panthera tigris)*

6. Holistic Ecosystem Monitoring

In 2004-2005, the Office of Royal Development Project Board (RDPB) developed indicators to monitor Royal Development Projects. The indicators are related to monitoring soil, agriculture, and forests, and water source ecosystems, as well as social, economic and environmental factors.

The monitoring projects are examples of ecological monitoring systems in Thailand. There are agencies, various institutions, and communities with lessons and experience which should be compiled and form the foundation for learning networks.

PARTICIPATORY FOREST MANAGEMENT MONITORING:

Case studies from Thailand Collaborative Country Support Program (ThCCSP), RECOFTC

The Thailand Collaborative Country Support Program (ThCCSP), under the Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC), has been developing and promoting community participation in forest management monitoring since 2003. ThCCSP is fully funded by the Danish International Development Agency (DANIDA). Action research methodologies are used in different sites in Thailand which have diverse ecosystems, community contexts and relationships between stakeholders and forest resources. The following six case studies are from different areas. They illustrated the use of participatory monitoring and the results of monitoring that contributing to management of community forests in those areas.

Case study 1: Monitoring of sustainable management of monastery bamboo forests: Khao Rao Thian Thong community forest, Noen Kham branch district, Chainat province

Bamboo forests and Khao Rao Thian Thong community

Khao Rao Thian Thong community, Mu 10 of Noen Kham sub-district, Noen Kham branch district, Chainat province, is located 60 kilometers southwest of Chainat provincial town, and about 18 kilometers from Hanka district. The community is situated in the central region of Thailand, and the topography consists of plains interspersed with low hills 89-319 meters above sea level. The hill areas are in Khao Rao Thian Thong national reserved forest.

The forest area which the community is managing covers 720 hectares in total of which 158.8 hectares have been established as community forest, under the regulations of the Royal Forest Department in 1999. In practice, the villagers look after the entire area, including both the registered community forest and Khao Rao Thian Thong reserved forest. The forest is mostly deciduous forest in which ironwood *(Xylia xylocarpa* var. *kerrii*), Burmese rosewood *(Pterocarpus Macrocarpus)*, Burmese sal *(Shorea siamensis)*, are the major tree species, but the area is mostly covered by monastery bamboo *(Thyrsostachys siamensis*). Communities distinguish 2 types of forest (1) real forest which is covered mostly by trees with some monastery bamboo, and (2) bamboo forest where most of the cover is monastery bamboo with sparse trees.

The most important resources that the community makes use of is monastery bamboo, the shoots of which are collected for household consumption and for income from sales. Bamboo shoots are collected in the rainy season between May and October. Apart from this, bamboo poles are used for household purposes. Another important forest product is *Termitomyces fuliginosus*, which provides a good income for the community. Wild vegetables,

medical plants and another forest products such as *Meliantha suavis, Adenia viridiflorai, Zingiber spectabile,* Siam tupil *(Curcuma aeruginosa), Stemona burkillii,* water primrose *(Diospyros variegata), Jatropha gossypifolia,* and wild honey are also favorite forest products.

Figure 7 Topography of Khao Rao Thian Thong community forest, Chainat province

This forest area is important for 14 nearby communities that are located outside the irrigation zone, above the Chao Phraya dam. They rely on rain for growing field crops such as sugar-cane and cassava. There are very few rice fields. The majority of villagers buy rice for consumption. They are rather highly dependent on the forest for their livelihoods. Over 50% of families rely on the collection of forest products for consumption and income. It can be seen that mixed deciduous forest with monastery bamboo as the main species, has an important role in poverty alleviation in each community, with over 100,000 baht annual income for each community. Processed bamboo shoots have become a community-based enterprise, and are shipped in tins to central Thailand and Bangkok for urban consumers.

Figure 8 Mixed deciduous forest with monastery bamboo as main species

Figure 9 Monastery bamboo shoots from community forest

Community learning and adaptation in natural resource management

Khao Rao Thian Thong community has developed a systematic learning process on forest resource management in order to promote the rehabilitation of deciduous forest with bamboo, without negative impact especially from bamboo collection, which is considered a key resource, earning income for the landless poor. As the matter of fact that community very much depends on the forest and forest products, special attention is then paid on the bamboo shoot due to its major role of extra income generation, especially for the non-property pauperized families. The community has developed a system of bamboo forest management by building agreements on closed and open seasons for harvesting, to allow the forest to regenerate. Meetings are held to establish community consensus on closing the forest at the end of the rainy season when the last batch of shoots have emerged, so that these can grow to become poles. The community has established the following regulations on bamboo shoot harvesting.

- Collection by digging is prohibited
- Collecting shoots longer than 1 meter is prohibited

- The dates of the closed season are announced every year (between August and September) Khao Rao Thian Thong community forest network and everyone is prohibited from collecting bamboo shoots for sale after closing.
- Penalty for violations is a 100-500 baht fine per kilo (depending on motive)

In addition the community has also been working with ThCCSP to develop a monitoring system for the sustainable harvesting of bamboo shoots as the mean to ensure sustainability community forest management, by brainstorming indicators of good bamboo forests and joining in the design of data collection procedures. The community also collects data on bamboo yields for analysis of sustainability and trends, and for deciding on adjustments for improved bamboo forest management, aiming to emphasize the use of a species at a sustainable level. This relies on quantitative data in managing and monitoring that status of that species.

Figure 10 Stakeholders' meeting to set the indicators to monitor bamboo

Monastery bamboo monitoring:

- **Monastery bamboo monitoring issues**

Community researchers and project staff have chosen issues in bamboo monitoring which may provide answers to the question of the sustainability of bamboo forests. These can be summarized in 2 key issues.

1) Ecological issues on the status of bamboo clumps in the forest area.
2) Socio-economic issues on the volume of shoots gathered and the number of gatherers.

Each issue would lead to the development of a set of criteria and indicators including data collection processes with a particular emphasis on the participation of the villagers involved, especially bamboo shoot gatherers, local experts, community leaders, community forestry committee members and schools. This collaborative knowledge generation process integrates indigenous knowledge, certain forest survey techniques, and community forest data collection.

- **Monitoring methodologies**

1) Monitoring the status of monastery bamboo clumps
Status monitoring employed a participatory survey and assessment of forest resources. A meeting was organized to design data collection procedures in coordination with bamboo shoot gatherers. An exchange to select indicators that have been brainstormed by local experts and gatherers, led to the joint development of tools and methodologies by integrating technical forest knowledge and local knowledge, to arrive at simple but systematic methods that the villagers can implement. These include:

(1) 3 important indicators were selected for monitoring the bamboo forest

- Indicator 1: Density of clumps, number of poles per clump
- Indicator 2: Proportion of immature:old:dead stem
- Indicator 3: Stem size

(2) Joint data collection design by categorizing the status of bamboo forest into 3 conditions: healthy; moderately healthy; and recovering.

(3) Two randomly selected permanent bamboo plots of 10x40 meters in every bamboo forest division

(4) Data collected on general condition, location, and topography

(5) Data collected on bamboo conditions, number of bamboo clumps, number of immature, old and dead stems in each clump in sample plots

(6) Random sampling of stem size of five bamboo clumps in the sample plots, one in the middle and one 5 steps north, one 5 steps south, one 5 steps east, and one 5 steps west, the sampled clumps being tagged for monitoring in the following year

(7) Data collection on the other species found in the area, such as the wild vegetables and wildlife tracks.

(8) Compilation of data in each area, using basic the statistics, such as total, average, number of clumps per hectare, proportion of immature, old and dead stems, and average stem size

2) Monitoring of bamboo shoots gathering

The main indicator employed for monitoring the gathering of shoots was annual quantity of shoot gathered. The size of bamboo shoots was also considered as an accompanying indicator, such as number of shoots per kilogram. Survey forms for data collection were completed by each household, and the data was compiled at monthly meetings at the coordination center. The data is recorded on a bulletin board at the coordination centre for everyone to see the bamboo shoot production each month.

Figure 11 Plotting monastery bamboo survey

Figure 12 Collecting data on monastery bamboo shoots by gatherer

Results of the study

- **Monastery bamboo status**

The results of bamboo forest assessment were differentiated, due to the divergent data provided, for specific area analysis and management. Data for areas, mountains, and the entire forest were systematically compiled and interpreted in the final stage for an overall explanation so as to achieve better participatory management of the entire forest.

- The first sites represent the healthiest bamboo forest in the Khao Yao area. There were two sampling plots done in this area.
- The second sites were in Khao Ang area, representing bamboo forest of medium health. There were two sampling plots.
- The third sites, representing recuperating bamboo forests, were in Mo Ta Khruea area and Khao Yai Ka area, with one sampling plot per area.

Table 3 Comparison of sites studied

Area	Bamboo status			
	Density (clumps/ hectare)	Average stems per clump	Proportion of immature: old :dead stems	Average stem size (cm)
Khao Yao, 1st plot	1,500	7	17:41:42	7.3
Khao Yao, 2nd plot	1,350	14	19:44:37	6.9
Khao Ang, 1st plot	3,450	14	18:42:39	5.2
Khao Ang, 2nd plot	3,075	13	18:45:37	5.5
Mo Ta Khruea	1,375	10	30:49:21	5.6
Khao Yai Ka	2,125	9	25:50:25	4.14
Average	1,506	11	-	5.7

Summary of monastery bamboo forest condition at Khao Rao Thian Thong community in 2004

1) The densest area of bamboo clumps could be found in the Khao Ang area where 3,200 bamboo clumps per rai were recorded. Other areas had 1,350-2,000 bamboo clumps per rai.

2) Approximately 7-14 bamboo stems were found in each clump. In the Khao Ang area, 13-14 bamboo stems per clump were documented, clumps in the Khao Yao area were the second largest and the bamboo clumps at Mo Ta Khruea and Khao Yai Ka were the smallest.

3) Proportion of immature stems to old and dead stems was less than 20% in the Khao Ang area and 20-25% in the Mo Ta Khruea and Khao Yai Ka areas

4) Overall average stem size was between 4-7 centimeters, which can be classified into three grades of (1) 4-5 centimeters, (2) 5-6 centimeters, and (3) 7 centimeters and larger

- **Monastery bamboo shoot productivity**

According to the communities' study, over 60 households were engaged in shoot gathering in 2004, equivalent to 52% of the community. The harvesting season was between May and October. The productivity harvesting in 2004 can be displayed in Table 4.

Table 4 Volume collected and economic value of monastery bamboo shoots

Month	Volume collected (kilogram)	Value (baht)	%
May	115	920	0.8
June	328	2,624	2.4
July	2,467	19,736	17.7
August	4,988	39,904	35.9
September	3,360	26,880	24.2
October	2,650	21,200	19.1
Total	13,908	111,264	100

Note: The economic value of shoots was approximately 8 baht per kg. The price in the previous harvest season was 15 baht per kg, declining to 7 baht at peak productivity.

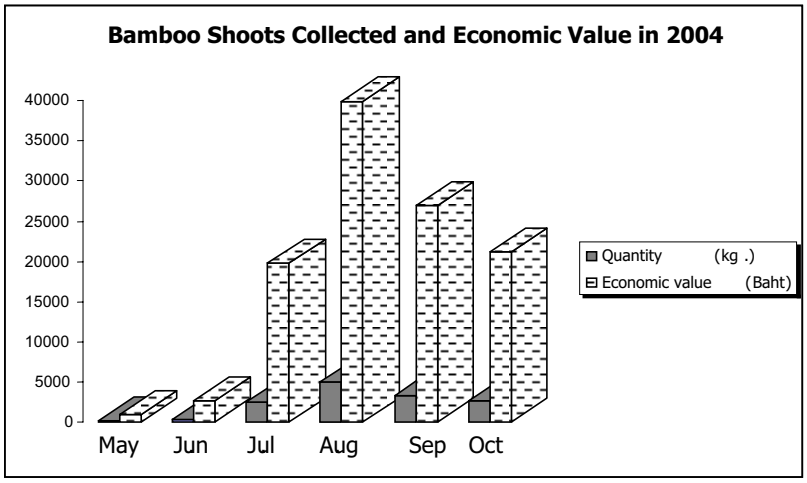


Figure 13 Volume collected and economic value of monastery bamboo shoots in 2004

Conclusion of the study and implications for adaptive community forest management

From the data gathered in 2004 according to the indicators, it was found that the conditions of the bamboo forest vary in each area, both in density of clumps, number of stems per clump, ratio of immature, old and dead stems, including the products gathered each month during the harvest season. However, there were important ecosystem and socio-economic issues which required management and monitoring.

- **Ecosystem management issues**

(1) The proportion of old and dead stems at Khao Yao and Khao Ang was relatively high. Therefore the communities could appropriately plan the use of these old and dead stems, as a way of maintaining the health of the bamboo forest.

(2) The bamboo in Mo Ta Khruea and Mo Yai Ka in the process of regeneration from earlier die-back, so there is a large proportion of immature stems and the stems are small. Therefore, there is a need for a plan to promote clump growth, to take great care in exploitation.

(3) It was found that during the August and September period, when productivity is high and the forest is considered closed, there may be an impact on gatherers. However, during October, there is a quantity of shoots that can be gathered. Nevertheless, it is necessary to consider the size and quality of shoots and seasonal fluctuations, which in 2005 were part of the decision about the closed season for harvesting.

- **Socio-economic issues**

(1) The participatory study on bamboo production quantities provided a greater chance for gatherers to join in monitoring and forest management decision-making systems. The information supplied on quantity allowed everyone to reach a common understanding on forest conditions.

(2) The procedures for research and the development of bamboo monitoring systems can be related to the process of developing local-level studies by building cooperation with schools. Schools can have upper primary level students use the community forest learning process in studying mathematics and biology by students at all levels. This will provide ongoing forest ecosystem monitoring and at the same time develop the capacity of individuals in the community.

Case Study 2: Grapsoid crab and mangrove ecosystem monitoring: Prednai community forest, Mueang district, Trat province

Prednai community: from orchard to coast

Prednai village is located in Mu 2, Huang Nam Khao sub-district, Mueang district, Trat province. The total 378 hectares area of the village includes residential plots, public land, and agricultural land. The community situated on high ground approximately 200 meters above mean sea level. To the east of the village are para rubber plantations and fruit orchards. To the west are shrimp farms, and beyond these are mangroves.

The community mangrove forest area that Prednai community uses is approximately 1 kilometer to the west of the village. It covers approximately 1,920 hectares with 12 main canals and 6 minor canals. The area was under a concession in the past. The forest species found can be divided to several vegetation zones. On the high ground, *Olerodendron inerme,* banyan, paper-gum, hibiscus tillaceus, and cycad can be found. The soil composition is clay over mixed soil with sufficient leaf litter. The second zone has *Duabanga grandiflora, Xylocarpus granatum, Bruguiera sexangula*, and *Palmae*. The next zone has *Xylocarpus granatum, Xylocarpus gangeticus, Lumnitzera littorea, Rhizophora apiculata*, and *Duabanga grandiflora*. The coastal zone has *Avicennia alba* and *Avicennia officinal*. Near the canals are found *Rhizophora mucronata*. The undergrowth includes treebine, sea holly, and *Flagellaria indica*. The soil in lower areas is mud with peat swamp in flooded areas.

Orchards of durian, rambutan, mangosteen, pineapple, etc., and para rubber plantations are the main occupation of Prednai villagers. Fruits can be harvested between April and June. The para rubber plantations can be tapped between August and May. For fishery, some villagers catch fish in the canals, catch

grapsoid crabs and sea crabs, operate natural shrimp farms and raise *Cromileptes altivelis* fish. Most products are sold to middlemen who buy in the orchards, while some is sold by the villagers themselves. It can be seen that the occupations of Prednai people are diverse throughout the year.

Figure 14 Prednai mangrove forest, 1,920 hectares restoration area

Grapsoid crab business: the mangrove's fostering

Grapsoid crab catching has been undertaken ever since the village was established. Apart from growing paddy rice and fruit orchard, some villagers have used free time to enter the mangrove to catch grapsoid crab for household consumption. Some pickled crab for sale in the town. Some bartered for rice with other communities. Prior to 1985, the community's mangrove forest was in very fertile condition and covered over 48,000 hectares (Somsak et al., 2004). There were large numbers of crabs and catching was easy using gas lanterns and a technique of stepping on crab holes and catching them by hand. Villagers would normally go out catching between approximately 7 p.m. and 9 p.m. In the past there were no restrictions on catching grapsoid crab since there were many crabs and few catchers.

Later, in 1984, the mangrove was put under a concession for charcoal. Capitalists came in and excavated a huge pond in the middle of mangrove. The coastal dikes were constructed which

killed trees. The mangrove forest was encroached on and heavily degraded. Furthermore, the concession holder banned villagers who used to catch crabs from entering the mangrove to catch crabs. This had an impact on the villagers' exploitation of resources to gain a livelihood and earn an income. Because of the problems of encroachment and degradation, the villagers joined together to call for the revocation of the concession and organize as a group to conserve the remaining 1,920 hectares of mangrove forest. The crab gatherers' group observed that the number of crabs was lower, and catching needed more time due to an increase in the number of crab catchers.

Apart from the original crab catchers, some people came to catch crabs because they had no other way of making a living after shrimp farming collapsed. Besides, the price of grapsoid crab was good, since there was increasing market demand. In 1998, the crab gatherers tried to find a way to solve these problems by proposing an approach to stop crab collecting during the period when the crabs lay eggs during peak tides in order to give the crabs a chance to multiply. This is the background to the slogan of **"don't catch hundreds, wait to catch millions"** which later became the community's policy on crab catching. However, it needed two years to build an understanding and to negotiate until it became a community agreement and village governance concerning catching crabs.

Figure 15 Catching aquatic animals in mangrove area

Figure 16 Grapsoid crab

Management of mangrove resources and grapsoid crab

Since the leaders of the community saw the changes in the mangrove resources, which were reduced, and the problem of push-net trawlers in the sea, they joined together to form a mangrove conservation group to keep a close watch and conserve mangrove forest resource, including animals and plants in the mangrove forest. A management planning process was done through participatory data collection, and forums to collect ideas of the villagers, especially those who utilizing the mangrove forest resources, community leaders, and other groups in the village. The main points of forest management plan are:

1) Division of the area to be managed
2) Agreements on mangrove utilization
3) Rules for resource protection and maintenance
4) Organization structure and administration
5) Expanding the network of mangrove forest management.

Previously the emphasis of the management was on the building of understanding, and rehabilitation of mangrove forest ecosystems. At present, the community is trying to emphasize the sustainable use of resources, especially those economically importance species like grapsoid crab. There are agreements on the mangrove forest utilization which has been divided into zones, along with data collection to monitor the resource conditions, data will be analyzed among gatherers, forest users, and community members.

The villagers have integrated their knowledge about mangrove ecosystems and of grapsoid crab life cycle into the management plan to decide detailed agreements on catching crab. For example, they agree to not catching crabs in canals 7 and 8 which are the direct center of the forest and the source of

natural breeding, crab catching is prohibited on the 4th -6th days of the waxing moon, and the 4th -6th days of the waning moon in October etc.

Persons outside the community can catch crabs but must inform the committee and follow community rules. Additionally, the community has requested the cooperation of crab buyers is not buying the crabs during the closing period as well as not buying juvenile or small-sized crabs. If any small specimens are found, they shall be returned to the forest.

Mangrove ecosystem and coastal zone monitoring

Currently, there are three main aspects to the community's resource and mangrove ecosystem monitoring.

(1) Grapsoid crab monitoring employs the quantity of crabs and number of gatherers as indicators. The monitoring methodology is to study the volume of sales to shops that buy crabs, information exchanged with crab gatherers, and community meetings.

(2) The coastal erosion monitoring uses the extent of erosion as an indicator. Community lays rubber blocks and bamboo stakes to reduce wave strength and to host the marine habitats.

(3) Area and fertility of rehabilitated forest restoration is also monitored.

Table 5 Mangrove monitoring data

Resource/indicator	1998	2003	2004	2005
1. Grapsoid crab				
1.1Volume/day/economic value	8kg/day/ 50 baht	15kg/day/ 50 baht	15kg/day/ 50 baht	15kg/day/ 50 baht
1.2 Crab gatherers	6	20	30	40
1.3 Total catch(30 days/year)	7,200 kg	15,000 kg	47,500 kg	49,800 kg
2. Mangrove ecosystem				

Resource/indicator	1998	2003	2004	2005
2.1 Total mangrove area (including degraded area)	1,920 ha	1,920 ha	1,920 ha	1,920 ha
2.2 Rehabilitated area	8 ha	24 ha	344 ha	No data recorded
3. Coastal erosion				
3.1 Extent of erosion span	No data recorded	2 meters	2 meters	Under study

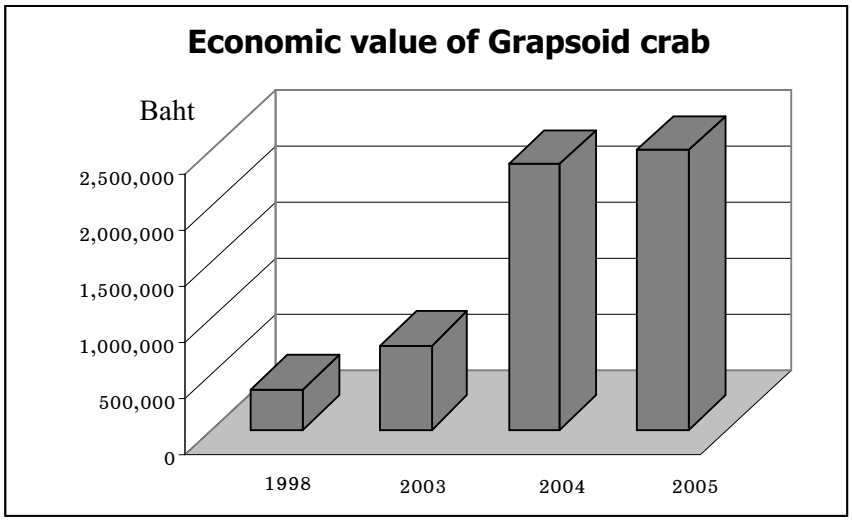


Figure 17 Economic value of grapsoid crab caught in Prednai mangrove community

The resources which have returned to fertility and which most clearly indicate the rehabilitation of the mangrove are aquatic animals including shrimp, shellfish, crab, and fish. Grapsoid crab in particular has continually increased in numbers. In 1998 the average crab catch was 7-8 kilograms per person with a maximum of 30 kg., which would take the gatherers all night. By 2003-2005, the average crab catching was 15-20 kg. per person per night taking just a few hours. Crab gatherers' income has also

increased, which is a good trend for crab gatherers. At present, it is found that an increasing number of people in the community catch the crabs which over 40 doing it as an occupation. Others catch occasionally during term breaks or when the number of crabs is large, so there will be almost 100 persons per night of various aging both sexes. 11-12-year-olds will go with their parents to catch crabs. Some 20-year-olds catch crabs as an occupation since no investment is needed other than labor and a few hours work in the mangrove yields an income of 500-600 baht per night.

It is found from sales to the 3 grapsoid crab traders in the community that annual production is 40-50 tons, with an economic value of 2-2.5 million baht per year. Households which catch grapsoid crab as an occupation can earn 80,000-100,000 baht yearly. Households which catch crabs as a supplementary occupation in the middle of the night and have another day-time occupation to earn a living earn 50,000-70,000 baht yearly from catching crabs. Since 1997, the number of grapsoid crab has been found to increase gradually. This reflects the efficient management of the mangrove ecosystem and the community's management of crabs which is moving in a positive direction.

Conclusion

The crab gatherers have a greater role in mangrove resource management than in the past, for example in developing participatory agreements on crab catching. Also, crab catching methods involve watching over the state of the forest, so that groups entering the forest to destroy it must be more careful. Moreover, the crab gatherers are a key factor in conservation activities, research studies and monitoring of mangrove forest conditions and studies and of coastal erosion fish sanctuaries, since they are aware of changes in the conditions of the mangrove and can use this information to improve community forests in the future.

<u>Case study 3</u>: Monitoring of *Meliantha suavis* Pierre (phak wan) for sustainable management: Rom Pho Thong community forest, Tha Takiap district, Chachoengsao province

Rom Pho Thong community forest is located in Mu 7, Khlong Trakrao sub-district, Tha Takiap district, Chachoengsao province, in the east of the province, 20 kilometers from Tha Takiap district town and 103 kilometers from Chachoengsao provincial town. The general topography is made up of hills interspersed with undulating plains. High mountains to the east of the village border Khao Ang Reunai Wildlife Sanctuary. The community forest is mixed with agriculture areas on flat land. The area is 120-240 meters above mean sea level.

Rom Pho Thong is an agricultural community. The community forest occupies 240 hectares of dry evergreen forest. The crucial resource is Opilliaceae *(Meliantha suavis Pierre)* or 'phak wan'. It is found that villagers from within the community and from outside the community entered the forest to harvest a large amount of Opilliaceae for household consumption and yearly supplementary income. Research studies to assess the status of phak wan and set the agreements for sustainable harvesting is important. Local research was therefore undertaken for a concrete form of management seeking techniques and methods for Opilliaceae management for continuing sustainable production. The objective of the study was to investigate the distribution and status of Opilliaceae in Rom Pho Thong community forest, to gather local knowledge on Opilliaceae management, as well as to seek an approach to develop and manage an Opilliaceae monitoring system by the community.

Community forest resources

The 240 hectares community forest comprises of three mountains located to the west of the village. The vegetation is dry evergreen forest with two forest conditions of secondary forest

and healthy forest. The secondary forest at the foothills borders agricultural land is in the process of regeneration after damage from forest fires which thinned out the forest. The upper canopy is comprises *Lagerstroemia floribunda* Jack, *Afzelia xylocarpa* (Kurz) Craib, and *Pterocymbium tinctorium* (Blanco) Merr., while the lower canopy is immature trees from natural seedlings and from the old stumps. The land is covered by grass and weed. The undamaged central core of healthy forest has received no damage from forest fires and is in good condition with the important species *Pterocymbium tinctorium* (Blanco) Merr with *Memecylon myrsinoides* Bl., *Baccaurea ramiflora* Lour, *Hydnocarpus ilicifolia* King, and *Melientha suavis* Pierre in the undergrowth.

Local wisdom in Opilliaceae management

- **Harvesting**

The period for gathering young Opilliaceae shoots runs from November to April, approximately 6 months. Harvesting techniques include removing mature Opilliaceae leaves to stimulate new growth, which the villagers call binding the leaves. Only by the young shoots at the tip of stems are harvested and the trees are then left for one week or one rotation to allow new shoots to grow back. So Opilliaceae can be harvested 3-4 times each month. In the Rom Pho Thiang Thong community dry evergreen forest, fire is not used to stimulate growth as it is in dipterocarp forests which can withstand fire.

Figure 18 Removal of mature Opilliacea leaves to stimulate new growth

Figure 19 Harvesting shoots on 1 week rotation

- **Propagation in agricultural areas**

Propagation in agricultural areas uses three techniques.

(1) Propagation from seeds is relatively successful with good budding. However, this technique is somehow problematic. When the seedlings are replanted, they are stunted and growth rates are very slow. Therefore, this technique needs to be developed with methods for looking after the seedlings after re-planting. Moreover, there are trials of planting in the open and in an environment similar to forest shade conditions, which suggest that planting under custard apple trees will yield good growth.

(2) Propagation by root cuttings has a 70% success rate. This technique is currently at the trial stage.

(3) Digging up young trees from the forest for replanting has been found to be unsuccessful since only 20% survived, which is held to be very few and destroys Opilliaceae resources in the forest.

Figure 20 Opilliaceae seedling under custard apple tree

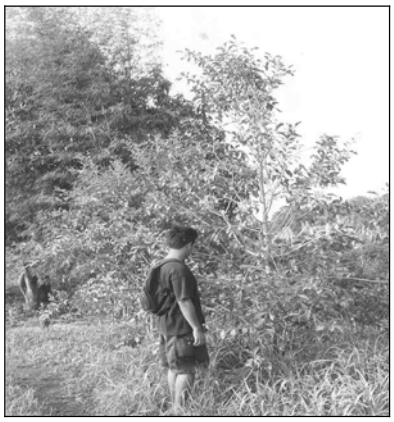


Figure 21 Opilliaceae in an agricultural area

Development of indicators for sustainable Opilliaceae harvesting

The harvesters, experts, and community leaders brainstormed on developing the indicators from the community's point of view. Many indicators were proposed. Using all indicators in monitoring would be difficult, and would use a lot of resources, time, and personnel. Therefore the important indicators should be selected to form a minimum set with the following principles:

1. The indicators should give clearly qualitative or quantitative measurements
2. The villagers have the ability to use them in monitoring
3. Indicators should have a role as umbrella indicators with influence over other indicators

The methodologies and instruments for selecting indicators are prioritization or weighting and analysis of the relationship with other indicators. Three important indicators were selected: annual

production, number of trees cut, and the increase in the number of Opilliacea.

Table 6 Community Opilliaceae monitoring system

Indicator	Methodology	Frequency	Site	Comparable value
Annual production	1. Harvester meetings 2. Harvester interviews 3. Statistical records by harvesters	Once a year	Within the community	Production in 2004 was 650 kg
Number of trees cut	Participatory surveys among harvesters and leaders or interested persons	Once a year	Khao Phak Wan community forest	Less than 40%
Increase in number of trees	Participatory surveys	Once a year	Community forest	301 trees in 2004

Results of monitoring

- **The status of Opilliaceae**

The survey of the status of Opilliaceae on Khao Phak Wan was carried out by the community on transects in 6 study areas divided by the valleys of streams. Data was collected on growth, height and condition according to three classifications: (1) healthy or almost healthy plants with a good shape and branches; (2) broken crown, and trimmed branches and shoots; and (3) broken trunk. The data was analyzed to develop a management plan for sustainable harvesting and increased natural productivity. The study suggested that the Opilliaceae in Rom Pho Thong community forest were mainly immature but growing plants. 90% were smaller than 20 centimeters in circumference measured at chest height. Very few plants, only 3.3%, were found capable of producing seeds for natural propagation. When the condition of

plant stems was considered, over 40% were found to be degraded, with shoots and trunks broken, resulting in low productivity. This situation reflects previous harvesting methods, especially the practice of cutting trees and so destroying their propagating potential, with implications for the long-term sustainability of Opilliaceae.

Table 7 Circumference and Height of Opilliaceae trees in 2004

Zone	Number of Trees	Circumference (cms)			Height (meters)		
		Max	Min	Ave	Max	Min	Ave
1	41	65	9	15.7	9	1.5	3.30
2	64	70	9	13.75	10	1	3.11
3/1	86	76	4	11.95	9	0.8	3.09
3/2	39	38	9	15.66	8	1.2	3.50
4/1	46	40	4	10.96	9	1	2.60
4/2	25	32	10	16.56	5	1	3.45
Total	301	76	4	14.09	10	0.8	3.17

Table 8 Status of Opilliaceae trees in 2004

Zone	Status			Total
	(1) Healthy	(2) Damaged	(3) Broken trunk	
1	22	16	3	41
2	41	20	3	64
3/1	60	19	7	46
3/2	21	12	6	39
4/1	25	20	1	86
4/2	13	7	5	25
Total	182	94	25	301
Percentage	61	31	8	100

- **Opilliaceae harvesters, Opilliaceae quantities, and Opilliaceae economic value**

Studies show that Opilliaceae harvesters can be categorized into two main groups. Approximately 17 community members are regular gatherers and gain an annual supplementary income. A second group comprises harvesters from outside the community whose agricultural lands share border the forest but who live elsewhere. In 2004, the total amount collected by community members was, over the whole year, at least 650 kg of which approximately 50 kg was for household consumption. The remaining approximately 600 kg go to the local markets where middlemen buy from the community. Some retail by themselves, both in the community and in Nong Khok market. The annual economic value was at least 65,000 baht, an annual supplementary income of 60,000 baht to each of 17 families. This is profit from zero investment, merely from maintaining the forest and gathering.

At present, it is found that the productivity of Opilliaceae is 2.65 kg per tree, with an annual economic value of 212 baht per tree. It is found that the productivity from the forest could be increased if harvesting was sustainable technique, if the number of trees in the natural forest can be increased, and if techniques were developed for propagation in community agricultural areas.

Figure 22 Opilliaceae retailed in the community

Figure 23 Opilliaceae sold wholesale to city markets

Table 9 Opilliaceae Harvesting in 2004 *(harvesters from RPT community)*

Harvester number	Harvest volume (kilogram)	Household consumption	Supplementary income (baht)	Note
1	100	0.5 kg/time	8,000	Once a week
2	200	N/A	16,000	
3	500	0.5 kg/time	2,000	
4	500	0.5 kg/time	2,000	
5	800	0.5 kg/time	4,000	
6	10	0.5 kg/time	500	
7	20	0.5 kg/time	1,000	
8	10	0.5 kg/time	500	
9	50	0.5 kg/time	2,000	
10	5	N/A	-	For household consumption
11	10	N/A	-	For household consumption
12	10	N/A	-	For household consumption
13	5	0.5 kg/time	-	For household consumption
14	22	4 kg	1,440	
15	12	12 kg	-	For household consumption
16	13	4 kg	900	
17	4	4 kg	-	
Total	**651**			

Approach to community Opilliaceae management and monitoring

There are three approach to community Opilliaceae management and continuous monitoring in the future.

- **Sustainable harvesting in natural forest**

From survey data on the condition of Opilliaceae in the community forest, it is found that over 40% of harvesting practices use incorrect methods. Therefore an agreement should be reached on harvesting with the gatherers' participation. There should be a village meeting to build agreements on proper harvesting methods. Also an understanding should be reached with harvesters from outside the community through conversation to build an ongoing understanding, and public relations.

- **Increasing productivity and promotion of natural propagation**

There is very little natural propagation because there are few plants capable of propagating. Also young flowers and fruits are harvested for consumption. Therefore it is necessary to develop agreements not to harvest young flowers and fruits, not to cut trees capable of propagating, to ban the digging up of Opilliaceae plants from the forest for replanting in agricultural areas, and to increase the number of trees by the method of propagation by cutting suckers to create separate plants which will help to promote natural propagation and increase future production in the natural forest.

- **Domesticated propagation**

The community today is knowledgeable about propagation by seeds and root cuttings. The Opilliaceae can be planted in kitchen gardens or in odd spots in areas agricultural land. This will increase community production and be a source of food and annual supplementary income.

Case Study 4: Monitoring of sustainable use of timber and bamboo products: Huai Hin Dam community forest, Dan Chang district, Suphanburi province

Community context

Huai Hin Dam community is located in Mu 6 of Wangyao sub-district, Dan Chang district, Suphanburi province. The community is Thai Karen with a history of community settlement in the area for over 200 years. Huai Hin Dam villagers call themselves '*Ploew*', which means Pwo Karen, one of largest ethnic groups in Thailand.

The forest area is connected to Huai Kha Khaeng forest and is part of the western forest complex, the largest forested area in Thailand which covers 6 provinces in the west. At present, part of the fields and especially the area of the community's rotational agriculture has been included in Phu Toei National Park (approximately 192 Ha.), which was formally gazetted at the end of 1998.

Relationship between community and forest

Huai Hin Dam's Karen community makes a living from rotational agriculture and gathering food plants and game from the forest near the community. The traditional culture of the community is closely linked to the surrounding resource base. At present, despite rapid economic and social changes which has had an impact on the way of life of community members and the resources which the community has in abundance, the community has tried to adapt so as to survive in changing circumstances. At the same time, they are trying to conserve their identity as a community dependent on the forest. This involves the practice of rotational agriculture on both sides of the two main streams of Huai Khanun and Huai Hin Dam. The community forest is managed with the basic goal of conserving the watershed forest and the

forest areas that the community uses as an important source of food and timber for house repairs. The agreements which the community has collectively set are based on cultural traditions linked to sustainable resource management.

Huai Hin Dam forest comprises mixed deciduous forest and dry evergreen forest. The major forest plants that the Huai Hin Dam community makes use of are timber and bamboo poles are for house renovation, field shelters, and maize and rice storehouses. Bamboo shoots, especially the shoots from *Dendrocalamus membranaceus Munr* and *Bambusa arundinacea (Retz.) Willd* are important for almost every family in the community. The forest not only provides direct benefits as a source of food and indirect benefits to the community, but the forest is also linked to the Karen culture. This can be seen from the ceremonies that demonstrate the respect for sacred spirits which look after the soil, water, and forest. The practice of looking after the management of the community forest has for a long time been the positive basis of Karen culture and tradition.

Figures 24-25 Utilization zone in the community forest; to collect timber, bamboo poles and bamboo shoots for livelihoods

Community forest management

Community initiated the process of managing the forest in the form of a community forest in 1994 with the support of Project for Agro-ecology and Plant Genetic Resource Conservation. The forest being managed by the community is divided into two management zones; conserved community forest (approx. 1,600 ha.) and utilized community forest (approx. 240 ha.). Demarcation was participatory, as was determination of management objectives and regulations on use. In summary, the conserved forest will be conserved as the source of water for the community and habitat of rare animal species. Community members can collect certain non-wood forest products, but there is a strict prohibition on logging and hunting including resident animals and those with young. The utilized forest is an area for gathering of medicinal herbs, wild vegetables, dyestuffs, and household wood supplies as long as this does not in any way degrade the forest.

The regulations that the community agreed on limited the use of perennial trees to 25 trees per year, which must be permitted at a meeting of the CF committee. With respect to bamboo poles and shoots, permission is not needed but notice must be given for gathering for sale. Bamboo poles should not be sold to outsiders. Medicinal plants and dyestuff should be gathered to a level that does not cause any damage to nature. The rules for rotational agriculture areas have the objective of producing sufficient food for the community's needs. The regulations forbid selling land to outsiders, private ownership, cultivating on mountain ridges, and clearing areas within 3 *wa* (6 meters) of streams, which would have an impact on the natural environment and the forest.

The process of community forest management monitoring

- **Deciding monitoring issue and objective**

The initial stage is a review of the management objectives and key community management issues, with reference to the community's management zones. From an evaluation of the current state of community forest management, the community chose to carry out monitoring of sustainable utilization of the utilized forest over 2-3 years since this is an issue that the community saw as important in the development and improvement of the community's management and since it is an issue that will help relevant outsiders and nearby communities see that the forest management of Huai Hin Dam does not affect forest productivity.

- **Identifying monitoring indicators for Huai Hin Dam forest management**

The process of developing monitoring indicators was brainstorming by community leaders and related agencies such as forestry officials, development workers, and academics or knowledgeable outside persons. Meetings were arranged where there was a broad exchange of opinions, which were condensed into a set of indicators which are most suitable for the community situation in terms of the feasibility for monitoring studies where the community can participate at all stages.

Therefore species will be monitored which the community uses to a great degree, i.e. wood and bamboo, so as to answer important questions as to whether the level and methods of exploitation have an impact on natural regeneration and the ecology. The indicators on sustainable use of timber were appropriate control mechanisms, the density of trees, especially of the species that are used, canopy cover, and natural regeneration level. The indicators for bamboo monitoring were the proportion of immature, old and dead stems, and clump density.

• Planning the study and team preparation

The study on sustainable utilization is separated into two parts.

(1) Study on community exploitation, including species used, methods of use, quantities used, and other mechanisms relative to community utilization of timber and bamboo shoot. The study of quantity used is gathered by the community team by developing a data form related to use which is systematically recorded. With regard to the quantity of bamboo shoots used, there is an agreement that the data should be collected from buyers. In Huai Hin Dam community, there are only 2-3 buyers; therefore it is easy to record purchases every day. Data on methods of use and factors relating to use can be gathered by talking to the users.

(2) The study of resource conditions in the forest means timber and bamboo. Since the community clearly divided the area, it is possible to specify the area on a 1:50,000 scale map. Therefore the plan for the study of the area emphasized the community's utilized forest, which has an area of approximately 240 ha. The procedure used random 10x10 meter sampling plots covering actual utilized community forest. Records were made of the general physical condition of the plot, the number and size of all trees above 2 meters in height, and the number of bamboo clumps and stems. The number of seedlings is recorded in smaller 2x2 meter plots to see natural regeneration rates. The survey was done in April and November, before and after the harvesting season of bamboo shoot. There was training on sampling plot technique provided for the villagers before carry out the plot in the forest. There were 55 sampling plots carried out in 2004.

Figure 26 Forest monitoring meeting

Figure 27 Collection of data on forest structure, biodiversity and natural regeneration

Results of the monitoring

- **Timber**

The monitoring by Huai Hin Dam community shows that the community's use on timber did not affect the natural regeneration of trees in the forest or the forest ecosystem. This is the result of to several factors.

1. The method of tree harvesting and level of harvest by the community was mostly for house repair and construction, so trees were selected for good characteristics and size of core. Another feature was that the tools used for processing and transporting the timber out of the forest limited the size of trees cut to those with a circumference of 90-120 cm. The removal of tress from the forest is a form of selection based on the need quality and size of the tree.
2. The scale of cutting is set by the community at a maximum of 25 trees per year. The estimated use is even lower than the estimated carrying capacity of this forest.
3. The number of mature and juvenile trees was moderately good. Measures must be considered for better maintenance so regeneration improves.

4. Physical data on the utilized forest showed that the canopy in general is at an appropriate level and there have not been any wide exposed areas. In addition, the community has other agreements and prohibitions on tree harvesting, e.g. a prohibition on harvest in the vicinity of streams. These are further control mechanisms.

- **Bamboo shoots**

The ratio of juvenile, mature, and dead stems of 'pii nuan' (*Dendrocalamus membranaceus Munro)* in figure 28 and 29 could equivalently shows similarity to ratios in natural bamboo forests. Generally, the ratio of bamboo in natural forests in Thailand is 8-10% of juvenile stems of one year, 60-70% of mature stems of 2 years or more, and 20-30% of dead standing stems (Watanabe, 1972) with an average density of 53 clumps per rai. This indicates that the capacity of the bamboo in terms of soil cover and soil adhesion is at an appropriate level.

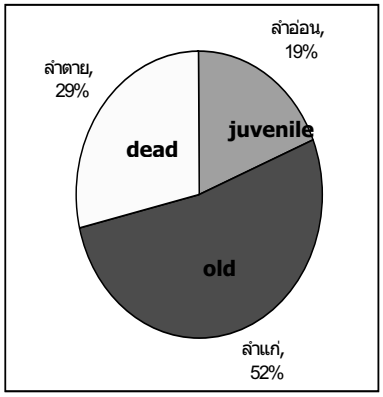


Figure 28 ***Dendrocalamus membranaceus Munro*** *ratios in April, 2004*

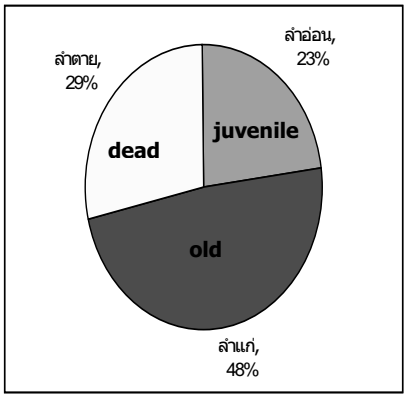


Figure 29 Dendrocalamus ***membranaceus Munro*** *ratios in November, 2004*

Note: immature or juvenile trunk is 1 year old, old trunk is 2 years old and older

However, there should be more studies on the specific ecological characteristics of *Dendrocalamus membranaceus Munro* and its shooting to provide data for decision-making on open and closed harvest periods. The current study would be baseline data for monitoring Huai Hin Dam's bamboo forest in following years.

Conclusion

The experience of Huai Hin Dam' has shown that the tendency that the current level of use both poles and shoots has not impacted the general health of the forest. This took into consideration 1) many social and institutional factors that still have a role in, or are conditions that control the current level of use by the community which is lower than the forest productive capacity; 2) data on the status of resources that have been jointly studied by the community and the external technical teams, which confirms that the quantity and level of propagation of key species being made use of by the community is still at an appropriate level.

In addition, the monitoring results have effectively led to discussions to consider and adjust community management methods. This is the key principle of monitoring. However, monitoring processes would be effective and would build learning and greater acceptance of forest management by the community if state agencies participated more in learning within the monitoring process. The challenge for all sectors involved is that sustainable forest management should not ban direct use by the community, even in natural areas. On the contrary, if any community has effective social mechanisms which lead to the formulation of sustainable use, the state should support the development of management plans and indicators, monitoring mechanisms and appropriate joint monitoring of forest management which would make joint forest resource management and monitoring a reality.

<u>Case study 5:</u> Monitoring of forest for poverty alleviation at Mae Tha sub-district community forest, Mae On branch district, Chiang Mai province

General context of Mae Tha

Mae Tha sub-district is situated on Mae Tha watershed which is a tributary of the upper Ping River lays. Mae Tha sub-district occupies over 11,873 ha. The topography consists of surrounding high mountains, and the flat areas for settlements and agriculture. The area is 500-1200 meters above mean sea level and is divided into 3,436 ha., or 29%, of residential and agricultural areas and 8,437 ha., or 71%, of forest. The forest consists of dry evergreen forest, dipterocarp forest and mixed deciduous forest which contains teak and many bamboo species. The forest itself can also be demarcated into 5,572 ha. of conserved forest in watershed areas and 2,865 ha. of utilization forest.

The monitoring system was conducted to find answers to the questions of how much the Mae Tha communities are dependent on the use of community forest resources what is an economic value of their uses and who is dependent on the forest, including knowledge in the management and monitoring of resources. The scope of this study was on the use of the key resources i.e. bamboo shoots, timber, and cattle-raising. This was participatory action research using a methodology of small group meetings, in-depth interviews, participatory surveys and assessment of forest and community conditions through the use of simple collection forms, joint analysis of the data through meetings to find conclusions and simple statistics, including reflection and drawing lessons together.

Forest dependency and monitoring of natural resources

The communities of Mae Tha sub-district are mainly occupied in agriculture and are highly dependent on the forest,

because there is little flat land, with an average of 3 rai each family. It is found that the villagers depend on the forest for products for household consumption and for sale for supplementary income. The significant products are six kinds of bamboo shoots. The gathering season is from July to September. The gathering is mainly by men.

Apart from bamboo shoot gathering, bamboo stems are used in the household for strips for tying agricultural produce. Wild honey is also harvested and numerous kinds of mushroom are gathered. Many varieties of mushrooms fetch high prices and gathering is mostly done by women. Various insects are also gathered, including red ants' eggs and bamboo caterpillars (or 'express trains').

Figures 30-31 Bamboo shoots and poles

At present, timber is used for house construction only. There is no trade in timber. A request for permission must be made to the committees, specifying the volume needed, wood type, and intended use. The committee must inspect the trees requested and consider whether to approve or not.

The villagers also use the area of the community forest to raise cattle. According to the study of five communities in Mae Tha sub-district, there are 1,038 households raising 2,814 cows, of

which 544 were raised in pens in the household fed on cut grass rather being allowed to graze on agricultural land. It was found that 140 village households, or 1.3% of total households, raised 2,270 cattle in the forest which is 80% of all cows or 16 cows per household.

The study on economic values from forest

Table 10 Economic values from local resources

Resource	2004 (baht)	2005 (baht)	Number of household (baht)	Total (baht)	Average annual (baht)
Bamboo shoots	831,895	1,131,970	1,011	1,963,865	981,932
Construction timber	1,553,037	507,315	82	2,060,352	1,030,176
Cattle raising	N/A	2,742,025	140	-	2,742,025
TOTAL	**-**	**-**	**1233**	**-**	**4,754,133**

The study of the use of 3 basic resources found that the economic value was at least 4,754,133 baht per annum. 1,233 households, or 90% of the sub-district, were depended on these resources. The quantity of bamboo shoots collected in 2 months from the middle of July to the middle of September averaged 196,382 kilograms. The average economic value was 981,932 baht per season. 400- 500 families gather bamboo shoots each year. A study of timber used by the community within the community, specifically in Mu 2, 3, and 4, under the rules on use agreed by each community, found that 12-18 households made use of timber, 70% for house building and repairs, 22% for granary construction, and 8% for cattle pens. An average of six trees per annum per household was harvested on request. Without the community forest the cost would be 1,030,176 baht.

It was found that 140 households grazed 2,270 cows in the forest in the rainy season between June and November. The economic value of the grass eaten by the cows was calculated at 2.7 million baht per season and the rotating value of the cattle themselves was 11-13 million baht.

It can be summarized that Mae Tha sub-district communities are highly dependent on the forest. Every household is dependent on a piped water supply and *mueang fai* irrigation system. Over 90% use timber, gather bamboo shoots, and graze cattle in the forest, which can reduce expenditure and provide supplementary income, building a good level of community economic security. Thus there should be support for the community in managing the use of forest products to respond to needs and to raise the quality of life of the community, by enabling them to start systematic management and raise the level of their approach to sustainable forest management by creating processes for the periodic and participatory monitoring of the condition of forest resources in order to improve techniques and methodologies for sustainability.

Community monitoring of forest and bio-resource conditions

The monitoring of the forest and bio-resources found an integration of traditional monitoring that was practiced as part of daily life. This monitored the condition and causes of changes in the forest, and was conducted through regular community activities such as propitiation rituals for the river spirits, forest livestock inspections, making fire breaks, forest surveys, etc. The community has also become interested in quantitative monitoring using simple surveying techniques to estimate changes in forest structure, components, biological diversity, and regeneration. The community is thus more able to adjust forest management a much clearer direction. Apart from monitoring the status of the forest that they use, the community also monitors the quantity of products extracted from the forest, looking for changes in any direction that should be part of any decision about forest management. However, the Mae

Tha community has not yet created a clear forest resource monitoring system with clear indicators. This needs to be developed jointly with the relevant government and academic agencies and organizations.

Table 11 Trees density of utilized community forest at Mu 2, Mu 3

Year	10x10 m Observation plots	Tree species found	Number of trees by size class (per rai)					Regeneration (per rai)
			<30 cms.	30-60 cms.	61-90 cms.	90-120 cms.	>120 cms.	
2003	32	70	175	109	49	26.5	9.5	1600
2004	48	101	218	201	138	67	56	1450

Table 12 Trees density of utilized community forest at Mu 4

Year	10x10 m Observation plots	Tree species found	Number of trees by size class (per rai)					Regeneration (per rai)
			<30 cms.	30-60 cms.	61-90 cms.	90-120 cms.	>120 cms.	
2003	16	66	163	119	29	14	6	1,175
2004	16	52	143	94	24	11	3	2,487

Table 13 potential Timbers and community real consumption

Mu	Utilization forest (rai)	Number of tree at 90-120 cm size (per rai)	Number of trees in the forest at 90-120 cm size (in utilization forest)	Potential timber (ready to be harvested) (at 60%)	Community real consumption
2,3	5,319	26	138,294	82,976	175 (0.2%)
4	1,850	11	20,350	12,210	75 (0.6%)

Problems and obstacles in monitoring

1) The accuracy of data depends on the trustworthiness and cooperation of those providing the data. For example, data on the quantity of products used may be under-reported by the users for fear of having to pay a fee for forest products.

2) The participation of users in the study was only to provide data. However they should participate in the process of developing the study of sustainable forest management using accurate data.

Figures 32-33 Data analysis and interpretation with stakeholders and relevant parties

Recommendations

From the research data presented to different stakeholders such as from the government, NGOs, villagers, and leaders, the recommendations for community research are:

1. The research data and findings should be published as information to be communicated to community members for an understanding of the value of Mae Tha forest and to extend the results to the entire Mae Tha watershed network.

2. Studies should be made of the appropriate level of forest utilization for the cattle-raising, timber, and bamboo shoots to give direction to sustainable local resource management and to develop participatory forest management monitoring systems.

3. The study shows a high level of economic value from forest products. However, there is a recommendation that this

figure should not be considered to be basic. It does not mean that the forest will create wealth from overselling products, but should raise awareness that the forest has a value in everyday life with respect to food security, water, and promotion of a system of sufficiency economy to regenerate community agriculture. The forest is significant as natural capital, which is more important for sustainable development than economic capital.

4. An approach should be sought to build sustainability and continuity in institutions and organizations and to promote a greater role for new generations in local resource management

5. Those whose benefit from the forest should participate more in future research and take a lead in presenting research findings.

<u>Case study 6:</u> Seep management and monitoring: Sam Pak Nam community forest, Chumphae district, Khon Kaen province.

Introduction

Sam Pak Nam community is located at Mu 10 of Na Nong Thum sub-district, Chumphae district, Khon Kaen province. The total area occupied is approximately at 1,720 rais and lies completely inside Phu Pha Man National Park. The community settlement is on a plain surrounded by limestone hills in all four directions. The surrounding forests are dry evergreen forest and mixed deciduous forest. Since the areas are surrounded by limestone hills, there are many natural water seeps, known as *nam sap*, or called *nam sam* by the villagers. These seeps are very important to the livelihoods of Sam Phak Nam village, since these are source for domestic water consumption, and in their occupations, especially the main occupation of agriculture.

Sam Phak Nam at present has 85 households with a population of 464. The main occupation of the majority of the villagers is agriculture, that is, paddy rice, corn, soybeans, chilies, and livestock. Even though Sam Phak Nam is a new community, it has cultural beliefs about the forest like other Northeastern communities. This includes shrines in the village forest to the ancestors, making the forest sacred, where the villagers conduct various rituals concerning their faith in the ancestral spirits. These forests are normally dense, since the villagers will not cut any trees at all.

Sam Phak Nam villagers have practiced community forest management for local natural resource conservation since 1995. There is a community forest committee, which undertakes monitoring of forest conditions, protection and rehabilitation of the forest, and issuing rules and regulations about the forest and

community forest management plans, which have produced satisfactory results.

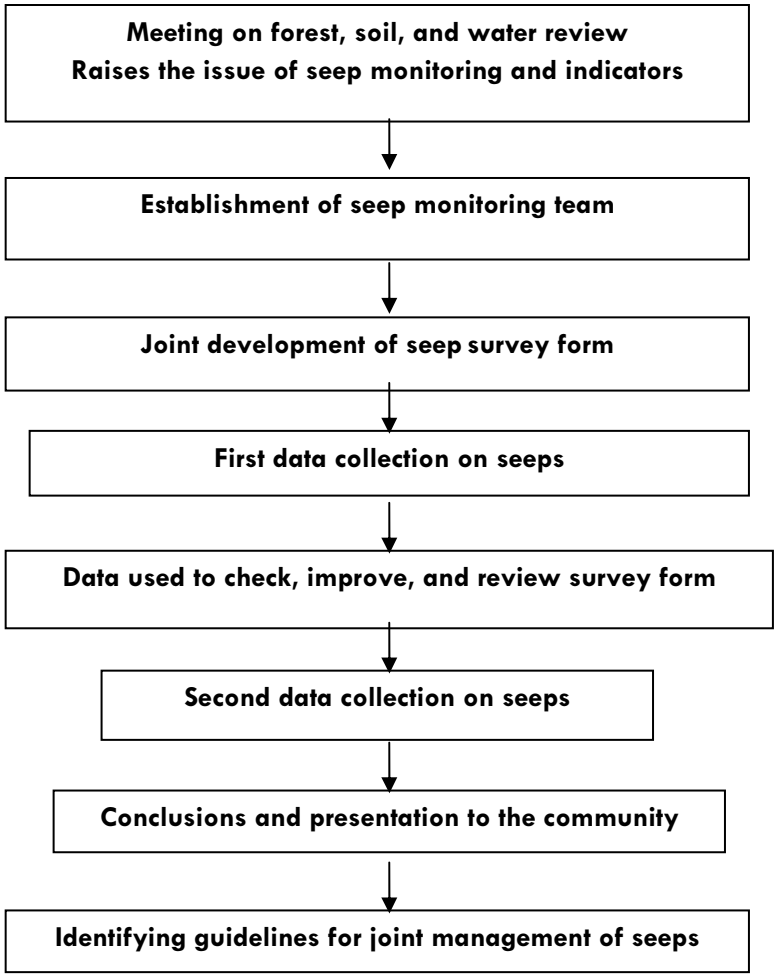
Monitoring the seeps of Sam Phak Nam village

Sam Pak Nam villagers have regular meetings to review forest conditions and to adjust management in accordance with the changing situation of the community. From these meetings on natural resource monitoring (soil, water, and forest) two issues arose which have attracted the interest of the villagers. The first issue is the survey of the health of the forests around the community, which has been done. The second issue is monitoring the community's seeps. The villagers have recognized the importance of these water sources to the livelihood of the people in the community, and that these seeps are important to the characteristics of their settlement which is surrounded by limestone hill ecosystems. From their past monitoring of forest conditions, the villagers believes that "a healthy forest can store enough water under the limestone hills, which have interconnected underground streams, for a year-round flow in the streams"

Figure 34 Sam Phak Nam Community forest

Figure 35 Limestone hill

Seep Monitoring Process



Definition of seep

Nam sap, or *nam sam* in the northeastern dialect, are waterlogged areas recharged from groundwater seeping slowly to the surface in the form of streams with a low rate of flow. In some areas, the water may flow from the surface of the soil, and in others it flows from holes in the limestone. The quantity and quality of water depends on the topography, climate, and land uses in the area. There are different terms for seeps in local dialects according to the way the water arises. In the north it is known as *jam*; in the south it is called *phru*. The origin of these seeps can be explained by the water cycle. Part of the rainfall seeps down into underground aquifers. The amount depends on the topography, climate, season and geological characteristics, and the natural flora that cover the area. If the quantity is more than the aquifer can absorb, coupled with factors of gravity and topography, the water will be discharged back to the surface, creating a waterlogged area with constant seepage.

Figure 36 Nam sap water source in the forest

Figure 37 Nam sap water course in an agricultural area

Water quality indicators from the villagers' perspective

Sam Pak Nam villagers have long been using the seeps and have ways of observing what good quality water should look like.

1) The health of forest flora covering the seep area. If the forest is healthy, the amount of water is plentiful.

2) The quantity of aquatic animals. If a large quantity and variety of aquatic animals is found, then the water is good quality, especially if stone crab, and mountain freshwater prawns are found, they only inhabit good water.

3) Water clarity and odor. If the water is clear and has no smell, it is good quality water.

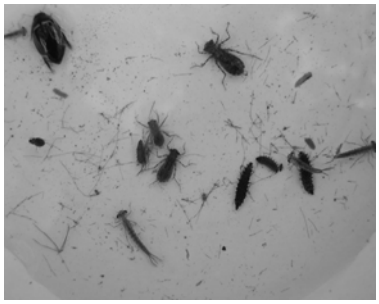
4) The amount of water compared to previous years. If there is les water, this indicates a deterioration of water quality.

5) Observation of the frequency of sediment blockages of seep holes. If the seeps are often blocked, it implies there is some activity creating sediment which is swept down to block holes and make the water cloudy.

6) Surface film. A lot of surface film indicates high limestone sediments (water is hard and alkaline) and the water should not be used for drinking.

7) Observation of contamination with leaves or garbage. If contamination is high, the source is not healthy.

8) Observation of birds or wildlife that prey on aquatic species. A high number indicates a high number of prey which shows good water quality.



Figures 38-39 Aquatic diversity – being bilogical indicators for water quality

Results of the seeps monitoring

- **Changes in the use of seeps from the past to the present**

Table 14 Previous and current patterns of use

Seep	Previous use	Present use
Sam Tin Ped	This was the original settlement site. The water was for domestic consumption and agriculture in the area.	It is now abandoned and unoccupied. It is used by some for livestock, vegetables, and gathering aquatic animals. It is little sued because of the distance from the community.
Sam Khi Ling	In the past it was a settlement of 39 households. The water was used for drinking because it looked clean with no surface film. It was a drinking water source for wild animals, especially monkeys.	A 2,400 meter pipeline has been installed to take the water to Sam Phak Nam forest temple. The water is also used to fight forest fire, for livestock and for gathering vegetables.
Sam	In the past it was the	At present it is used for agriculture

Seep	Previous use	Present use
Khun	largest seep. It was used for gathering forest products, such as bamboo shoots, mushroom, and various vegetables. Hunting camps and shelters for workers on the rubber concession were set up there.	in the surrounding area and for catching aquatic animals.
Sam Pao	Water was used for drinking and household consumption and agriculture.	It is used for drinking and household consumption. Weirs have been constructed to expand the water surface. There is a pipe to send the water to agricultural areas.
Sam Bon	This peat swamp forest area has a lot of *Lasia spinosa Thw*. Use has also been made of timber, bamboo shoots, wild vegetables, and aquatic animals.	It has been dredged and a weir built for agriculture, fish raising and household consumption. A water pipe has been laid to provide running water to the village but this is not completed due to the conflicts among the community and the project has been cancelled.
Sam Nam Tok Noi	This was used for domestic consumption and for bamboo shoots and gathering aquatic animals.	This is the water source for Sam Phak Nam school. It has become a recreation area for villagers and for catching aquatic animals.
Sam Phak Nam	The water was brought to use in the village since its establishment under the Forest Resettlement Project (*Kho Jo Ko*) 15 years previously. It is used	A water pipe was laid to a nearby well for Sam Phak Nam temple and the southern cluster of the community. There is a plan to expand the water collection area for agricultural demonstration plots. It is an area for gathering wild

Seep	Previous use	Present use
	for wild vegetables.	vegetables and more outsiders come to make use of it.
Sam Khi Nak	This was used for gathering wild vegetables and catching the abundant aquatic animals.	Gathering wild vegetables, catching aquatic animals, livestock raising, and as a tourist attraction of the National Park because of located nearby Khi Nak cave.

- **Condition of Sampaknam seeps.**

- In terms of the actual quality of water in the seeps, all seeps observed alkaline, clear and odorless water. However, little sediment was found in Sam Tin Ped and Sam Khun, while some contamination by dead leaves, algae and aquatic plants found in Sam Khi Ling, Sam Pao, Sam Bon, Sam Nam Tok Noi, Sam Phak Nam and Sam Khi Nak.

- Animal species: there are total 73 species of animals found in and around the seeps, comprise of 8 terrestrial animals, 26 aquatic animals, 22 bird species, 8 amphibians and 8 insects.

- The species that indicate good quality of water in the seeps and their small riparian ecosystems are also reported as following;

- Fish: rasbora, barb, red-tailed snakehead, eel, croaking quarami,

- Others aquatic animals : lanchester's freshwater prawn, mountain freshwater prawn, rice crab, river snail, screw shell, dragobfly nymph, damselfly nymph, water bug and water beetle, stone crab.

- Bird: oriental magpie-robin, cormorant, kingfisher and coucal

- Amphibian: frogs and small frogs.

- Plant species found: 18 aquatic plants found and other 49 plants species around the seeps are recorded including trees, shrubs and climbers.

- **Constraints**

- Sam Kun – intrusion and proliferation of alien species such as golden apple snails which could impact the future esosystem.
- Sam Phak Nam -- use by outsiders for vegetables (*phak nam, phak krud*, etc.) for sale leads the community to think of them as people who use natural resources in destructive way.
- Sam Khi Nak -- problem of wild fire and garbage due to proximity of garbage dump pf Phu Pha Man National Park.

Conclusions of Sam Pak Nam community seep monitoring

- **Role of the community in previous seep management**

Seep management in the past was mostly indirect management. That is, it was a component of forest management, which is related to the quality of the seeps, with respect to wildfire prevention, supplementary reforestation, forest rehabilitation, and forest surveys and conservation. This helping the seep areas to become healthy and are the good examples of indirect capillary water resource management. Notwithstanding However, there was direct management at some seeps, such as dredging Sam Khun weir to unblock subterranean water courses or the water pipe system from Sam Khi Ling seep to Sam Phak Nam forest temple where the forest environment was maintained.

Figure 40 Seep monitoring by community

Figure 41 Meeting on seep monitoring

- **Local awareness was built from the seep monitoring**

  In the case of Sam Phak Nam community seep monitoring, if the villagers did not place importance on the monitoring process themselves from the beginning, the data on monitoring would never have been collected. The villagers participated in the design of and development of survey forms as well as collected data themselves. This helped the villagers to understand and realize more the importance of these water sources. The villagers saw the change in use and conditions and the problems more clearly, which led to concrete seep management practice. The status assessment surveys in each locality must ensure the participation of the villagers at every stage. In this manner, the resulting data comes from the integration of indigenous wisdom and technical knowledge, with diverse perspectives, which helps the villagers better to disseminate the findings to others in the communities.

Recommendations for the next phase of seep monitoring development

- Data should be collected on an ongoing basis to identify any changes in seeps and to achieve greater accuracy.
- Techniques, processes, and methodologies of seep surveys should be transferred to other community members by the local survey teams themselves so that there will be more people working on data collection.
- The survey form may be adjusted further if there is community's interest in additional local resource issues
- There should be presentations to build an understanding in the community so that there will be an interest in seeps and common management guidelines in the future.
- Additional scientific principles may be introduced in seep surveys.

Thailand Collaborative Country Support Program (ThCCSP) under RECOFTC's management

General Status of Community Forestry and Natural Resources in Thailand

Since the late 1980's Thailand has actively explored the Community Forest (CF) paradigm and although a CF bill has been proposed and deliberated for 15 years it has not yet been passed by Parliament. Both formal and informal CF activities are however often recognised by government under other legislation, for example the Decentralization Act.

Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC)

The Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC) was established in 1987 to support the development of community forestry. Initially RECOFTC was a Thai based organization and developed to be as international organization following the signature of an international Charter by seven countries. A Strategic Plan 2001-04 attempted a new direction with emphasis on international and regional aspects. The present Strategic Plan 2004-09 took account of the need for organizational changes, and places emphasis on three areas: Regional Analysis and Representation; Capacity Building Services; Country Program Support; with an administrative support system called Program Planning and Delivery. RECOFTC has been and is still is dependent on a few key donors. The present core donors are from Switzerland and Sweden. Denmark has provided funds over a number of years. Since 2003 its funding has been concentrated on the Thailand Collaborative Country Support Program

Initially RECOFTC focused on regional training. In the mid 1990's a linkage to field experience in-country was initiated through the Thailand Outreach Program (TOP). Following successes at selected sites, it was decided to attempt to use these lessons learned and the opportunity

presented by the development of a Community Forest Bill to try to influence policy and promote the formal recognition of CF in Thailand.

The Thailand Collaborative Country Support Program (ThCCSP), Phase I

The ThCCSP was developed as a continuation of the TOP. It was designed under a five year (2003-07) two phase system with a first phase of three years and a second phase of two years. The project is presently at the end of the first phase (2003-05). The ThCCSP was designed as two projects to achieve its development objective:

Project 1, is related to strategic development of a Thailand program. This project has the aim to initiate and develop an appropriate project strategy to develop a Thai program which is sustainable. This project includes; networking, knowledge exchange and sharing, combined with action research to identify innovation and best practices in community forestry and remain up to date.

Project 2, has a focus on enabling community forest learning and sharing; to promote collaborative management with a variety of stakeholders. ThhCCSP's emphasis has been on identifying different modalities, examining capacity requirements for partners and government officers supported by action research at the community level to identify good practice in CBNRM. ThCCSP also supports ongoing decentralization through working with and strengthening the local government organizations for Community Forestry Management.

Project implementation was slow in the first year, but has speeded up in the last two years. Expenditures in the first three year phase were 43% of the total budget. It is unlikely that it will be possible to complete the project within the envisaged five year time frame. There are enough funds available for a no-cost extension of the project by one year up to the end of 2008.

Vision
Local communities in Thailand are actively involved in the equitable and ecologically sustainable management of forest landscapes.

Mission
To enhance capacities at all levels to assist the people of Thailand to develop community forestry and manage forest resources for optimum social, economic and environmental benefit.

Development Objective:
The livelihoods of local people in Thailand are improved through greater access and control over the forest resources on which they depend, and the capacity of local people to exercise their rights to sustainability manage these resources as well as a supportive policy and institutional environment are in place.

Immediate Objectives:

- ThCCSP effectively responds to challenges in community forestry in Thailand

- Targeted community forests in Thailand are collaboratively managed while addressing stakeholders' rights and interests

Strategies:
Based on the experiences and lessons learned from the first phase, the two most important strategies for the next phase will be:

- Information and advocacy on lessons learned and knowledge to support CBNRM implementation disseminated to civil society and policy makers.
- Promoting and expanding good governance in CBNRM in local communities and local government organizations in the project sites and neighborhood communities/TAOs.

Other strategies are as follows:

- Research and lessons learned on local knowledge combined with scientific knowledge to create new innovations in CBNRM.
- CBNRM and participatory monitoring & assessment (PM&A) in 7 current target sites are strengthened and able to maintain community forest management activities through strong collaboration and institutional arrangements.
- Lessons learned are expanded to 26 new communities.
- Capacity building on technical know-how, knowledge and experiences to CF/NRM leaders/ TAO /practitioners of NGOs and Royal Forest Department (RFD).
- Promoting and strengthening the institution of CF networking and CF supporting organization alliances to enhance CF policies and the legal rights of forest user groups in accessing forest resource.
- Promoting resource mobilization and CF Fund for sustainability CBNRM in the project sites.
- Planning for sustainability of the ThCCSP.

Outputs:

There will be seven outputs.

1. Local and innovative knowledge developed and managed that supports the policy framework of CBNRM.
   This output addresses knowledge management, policy and networking issues.

2. Strengthened local CF organizations and communities in current target sites able to maintain CFM activities through strong collaborations and institutional arrangements. This output addresses the consolidation and sustainability of the phase 1 communities.

3. CBNRM and local forest governance models expanded into new communities/networks and TAOs close to the current

target sites. This output deals with the expansion of best practices and experiences to new communities.

4. Collaborative models and mechanisms improved among supporting organizations working on CBNRM. This output is concerned with strengthening networking.

5. Increased capacity of field officers and policy makers in key supporting organizations to implement and facilitate CBNRM processes. This output addresses capacity building in stakeholder institutions.

6. Effective and efficient project delivery to achieve the immediate objectives. This output deals with project management.

7. Approved and funded plan for a sustainable Thailand Community Forest Management Program in RECOFTC. This output addresses the sustainability of the program.

Project Management:
The ThCCSP is implemented through RECOFTC and reports to the RECOFTC Country Program Support Manager and the Executive Director. An eleven member Program Steering Committee (PSC) has been established with members from various government sectors, politicians, educational institutions, NGOs and donor organizations, the Royal Forest Department, National Park Department, Thailand International Collaboration Assistance Department and Department of Local Administration, Kasetsart University, NGOs and DANIDA. The PSC provides advice and policy guidelines to the ThCCSP. The TCCSP Program Manager takes a role as committee member and PSC's secretary. The ThCCSP program manager also works on policy and strategic planning with RECOFTC, donors and providing supervision to program staff with support by the managing core group. PSC meetings take place twice a year for annual planning approval and monitoring the program.

Organization and human resource development are the main internal factors to meet the effective and efficient implementation for the delivery of project activities to achieve the immediate objectives of ThCCSP. Rearrangement of program management and improving organizational performance through strengthening the competency of ThCCSP staff and its monitoring system will to be carried out.

The ThCCSP program manager will work on program management and overall coordination of ThCCSP with RECOFTC and partners. Providing guidance and monitoring of all projects, is the duty of the management core group under the overall guidance of the program manager.