Final Report of Work Package 1: Multidisciplinary Situation Appraisal of Mangrove Ecosystems in Thailand

Project full title: "Mangrove ecosystems, communities and conflict: developing knowledge-based approaches to reconcile multiple demands"

Contract Number: FP6-003697

Reporting and Fieldwork by:

Varunthat Dulyapurk
Wara Taparhudee
Ruangvit Yoonpundh
Sirisuda Jumnongsong

Faculty of Fisheries, Kasetsart University, Bangkok, Thailand

Version: September 2, 2007


Mulawarman University

Kasetsart University


Vietnam National University

ACKNOWLEDGEMENT

We would like to express our gratitude to all those who provided us the possibility to complete the Report of Work Package I: Multidisciplinary Situation Appraisal of Mangrove Ecosystems in Thailand. We would like to thank our advisory board which provided very useful suggestions and vivid encouragement to motivate us into the right direction. Also, for our local assistant team, we have to thank all of them for their valuable efforts and great helps. The complete name list of these most valuable resource persons are specially presented as follows:

The Project Advisory Board

- Associate Professor Prawit Suraniranat – Faculty of Fisheries, Kasetsart University
- Mr. Viroj Teratanatorn - Mangrove Research and Development Division, Department of Marine and Coastal Resource (DMCR)

The Local Assistant Team

- Mr. Somchai Kao Ian - Head of the Pak Phanang River Basin Development Station
- Mr. SaNgaim Tamrarieng – Officer of the Pak Phanang River Basin Development Station
- Mr. Amorn Mosikamas – Head of the Mangrove Research and Development Station No. 15 , DMCR
- Mr. Suwit Rattanamanee - Director of the Protected Areas Regional Office No. 5, National Park, Wildlife and Plant Conservation Department
- Mr. Sawetrachat Bunming – Officer of the Protected Areas Regional Office No. 5, National Park, Wildlife and Plant Conservation Department

We would like to thank the representatives of the local people as well as the community leaders in the three communities, (1) Ban Kong Khong, Pak Phanang Fang Tawan Ok Subdistrict, Pak Phanang District, (2) Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District and (3) Ban Talad Has, Pak Phun Subdistrict, Mueang District. This package will never be completed without their participation.

ABSTRACT

The Nakhon Si Thammarat Province from the southern part of Thailand has been selected due to their highest priority and score provided by expert evidence. The 3 communities have been selected to represent different characteristics of the mangrove ecosystem; (1) Ban Kong Khong, Pak Phanang Fang Tawan Ok Subdistrict, Pak Phanang District to represent a community with healthy and old mangrove forest, (2) Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District to represent a community with new mangrove plantation areas from abandoned shrimp ponds and (3) Ban Talad Has, Pak Phun Subdistrict, Mueang District to represent a community with new mangrove area from a new sedimentation area, respectively.

The ecosystem health and function (Section 4), including biogeochemical, hydrological and ecological aspects, had been presented based on reviews of published information and data.

The livelihoods of the poor people, goods and services (Section 5) had been analysed based on the Sustainable Livelihoods Framework and Gender Analysis Framework. In general, compared among three communities, Ban Kong Khong had been indicated as the lowest access score to all important assets.

The ranking importance of mangrove goods and services section, for all three communities, had indicated the high level of their income and livelihood dependence on their mangrove system via direct uses of mangrove wood for household use, a prevention of coastal erosion and indirect use benefits from their fishing activities, respectively.

For the mapping flows of goods supporting communities, main targeted species such as, mud crap (*Scylla serrata*), banana shrimp (*Penaeus merguiensis*)/ Indian white shrimp (*Penaeus indicus*) and sesarmid crab (*Sesarma eumolpe*), for all three communities had been selected for their common harvested species. These fishing products generally passed through their varieties of marketing channels (e.g. middlemen in/outside the communities, local/provincial markets and exported goods to other countries).

The cause ranking of impacts to mangrove forest and mangrove aquatic resources can be categorized into two main causes; natural causes (e.g., erosion and severe storm problems) and human uses (e.g., cutting and waste water discharged).

For the trend line of natural resource quantity, economy, social relation, conflicts in different periods, all communities perceived that their economic status has been worsen from the Cabinet Resolution in 1989. Their fishing activities can be adapted throughout the year depending on the weather condition and peak or off-peak fishing seasons.

The community's assets maps had been created by all participants and included in the report for each community. Most participants from all communities perceived that a male partner is generally more dominant in productive role compared to a female one. The needs of land ownership, termination of illegal fishing activities and increase in mangrove plantation area had been ranked with a high priority for Ban Kong Khong, Ban Pak Nam Pak Phaya and Ban Talad Has, respectively.

The institution and stakeholder analysis (Section 6) had included the summary of main mangrove related organizations, reviews on policies and laws related to mangrove and the Venn diagram analyzing stakeholder for Thailand Mangrove project.

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

LISTS OF FIGURES

LISTS OF TABLES

SECTION 1
INTRODUCTION

The first work package, a multidisciplinary situation appraisal of the mangrove ecosystem in Thailand, is conducted by the Faculty of Fisheries, Kasetsart University to support the "Mangrove Ecosystems, Communities and Conflict: Developing Knowledge-based Approaches to Reconcile Multiple Demands Project (MANGROVE)". This is an interdisciplinary project involving partners from various areas of expertise. A list of participants is presented below:

1) Centre for Environment and Society, University of Essex (UOF), England
2) Fisheries and Fish Culture Group, Wagenigen University (WUR), The Netherlands
3) Stockholm Environment Institute (SEI), Sweden
4) Mulawarman University (MU), Indonesia
5) Kasetsart University (KU), Thailand
6) Vietnam National University (VNU), Hanoi, Vietnam
7) Network of Aquaculture Centres in Asia-Pacific (NACA), Thailand

The MANGROVE Project aims to "develop action plans to reconcile multiple demands placed on mangroves and adjacent coastal zones in Southeast Asia; local and national level stakeholders will participate in action planning, ensuring widespread support and increasing the likelihood of implementation of the recommendations. New knowledge concerning the most effective approaches to action planning, involving coastal communities and national institutions, will be communicated to the agencies responsible for coastal zone management and planning. This knowledge will assist in developing codes of practice and policies that acknowledge and aim to reconcile the multiple demands placed on mangroves and adjacent zones".

The objectives of work package 1: situation appraisal, are:

1) To identify representative communities and raise awareness of the project *(Section 3)*
2) To study and understand mangrove functionality *(Section 4)*
3) To study and understand livelihood strategies of the communities *(Section 5)*
4) To describe market networks and explore influence on the livelihoods of the poor *(Section 5)*
5) To examine and discuss the institutional, policy and legal frameworks with the key stakeholders *(Section 6)*
6) To establish dialogue with key stakeholders, describe and understand their roles and position *(Section 6)*

The situation appraisal has been running from March until July 2007. It presents the general background of the mangrove ecosystem in Thailand, selection of suitable sites, institutional and stakeholder analysis, mangrove ecosystem health and functioning, and livelihoods dependent on goods and services derived from mangrove ecosystem. There has also been a synthesis of the situation, in addition to feedback and recommendations from the State of the System (SOS) Workshop.

SECTION 2
MANGROVE FORESTS IN THAILAND

There are 87 mangrove species belonging to 41 families of mangroves and mangrove associates found in Thailand (National Research Council of Thailand, 2002). Five families of mangroves, Rhizophoraceae, Avicenniaceae, Combretaceae, Palmae and Sonneratiaceae, are the major components of mangroves around the country. Mangroves and associated mangroves were used for charcoal, firewood, wood distillation, poles and *Nypa* products (FAO, 1985). Mangrove species used mainly for charcoal and firewood were *Rhizophora apiculata, R. mucronata, Avicennia marina* and *Xylocarpus* spp. Mangrove poles can be used for foundation piling, scaffolding and fishing stakes. *Nypa fruticans* was mainly used for roofing materials. The mangrove forest has other benefits for the local ecosystem and people. For example, it provides both juvenile and mature fish species for aquaculture and commercial fisheries, in addition to ecotourism in the mangrove forest areas. The trend of the size of the mangrove forest area in Thailand has been a decrease since 1973 until 2000 from 312,732 to 244,085 ha (Figure 2.1) (Wilkie and Fortuna, 2003). Some of the main causes of the loss of mangrove area between 1961 and 1996 are presented in Table 2.1. Of the total area of mangrove forest that disappeared, 33% was converted into shrimp ponds, 4% to resettlement areas and 63% were used for other purposes, including agriculture, urbanization, ports and harbours (Charuppat and Charuppat, 1997).

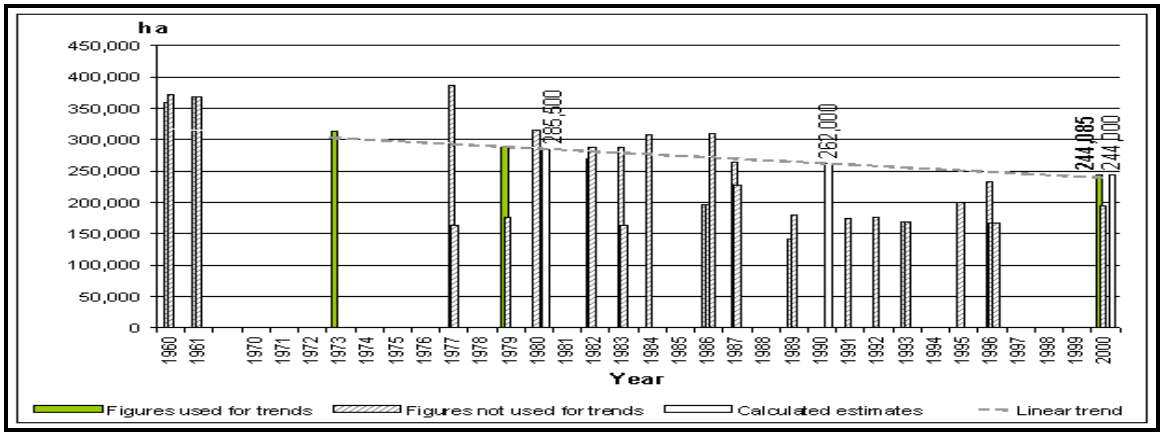


Figure 2.1 Trend in mangrove forest area extent (1960 – 2000) (Wilkie and Fortuna, 2003)

Table 2.1 The extent of existing mangrove forests and other land use, by different regions in 1996 compared to original mangrove forest prior to 1961

Region	Total area 1996 (ha)				Total original mangrove forest before 1961 (ha)
	Mangrove forest	Shrimp pond	Resettlement	Other uses*	
Eastern	12,658.00	24,295.30 (58 %)	3,957.10 (9 %)	13,934.60 (33 %)	54,845.00
Central	5,449.00	15,629.20 (25 %)	3,099.90 (5 %)	42,803.70 (70 %)	66,981.80
South: Gulf of Thailand	16,517.40	21,919.60 (55 %)	1,001.10 (3 %)	16,957.00 (42 %)	56,449.20
South: Andaman Sea	132,904.00	5,153.80 (9 %)	742.30 (1 %)	55,371.90 (90 %)	194,172.00
Total	167,582.40	66,997.90 (33%)	8,800.40 (4%)	129,067.20 (63%)	372,448.00

Source: Charuppat and Charuppat (1997)
* Other uses including agriculture, urbanization, ports and harbors

At present, the Mangrove Resource Conservation Bureau has the main responsibility to manage mangrove forests in Thailand mandated under the DMCR by the MONRE. The Royal Forest Department (RFD) also has responsibility, under the Forest Act B.E. 2484 (1941), for protection and supervision of mangroves. The Provincial Offices represent central administration for inspection in the provinces. The Thai government has recognized the importance of mangroves and the impact of mangrove forest degradation. The government has developed distinct national policies and proper management practices for mangrove resources. These policies and management practices are comprised of many important issues including mangrove concession, mangrove utilization measures, division of the mangrove land into zones, and silvicultural systems. There are also policies for conservation that include mangrove reforestation, aquaculture development in mangrove areas, sustainable use of mangrove forest, mangrove research program and community participation in mangrove rehabilitation and conservation.

The distribution of mangrove forest of Thailand in 2004 was recently investigated in a survey by DMCR. Out of 76 provinces in the country, the mangrove forest areas are distributed along the 23 provinces, consisting of 17 provinces on the Gulf of Thailand Coast and 6 provinces on the Andaman Sea Coast (Figure 2.2). The total mangrove area was 233,699 ha. This consists of 174,334.82 ha (74.60%), 28,637.71 ha (12.25%), 24,369.56 ha (10.43%), and 6,357.41 ha (2.72%) in the Andaman Sea, Gulf of Thailand, Eastern, and Central parts of the country respectively (Table 2.2) (DMCR, 2005).

Table 2.2 Distribution of mangrove forest areas in Thailand in 2004

No.	Regions/ Provinces	Mangrove forest area in 2004	
		ha	%
Eastern Region (Gulf of Thailand)		**24,369.56**	**10.43**
1	Trat	9,189.85	3.93
2	Chantaburi	11,722.32	5.02
3	Rayong	1,555.02	0.67
4	Chon Buri	727.66	0.31
5	Chachoengsao	1,174.72	0.50
Central Region (Gulf of Thailand)		**6,357.41**	**2.72**
6	Samut Prakarn	1,213.62	0.52
7	Bangkok	405.96	0.17
8	Samut Sakhon	1,684.87	0.72
9	Samut Songkhram	2,004.84	0.86
10	Petchaburi	1,048.11	0.45
Southern Region (Gulf of Thailand)		**28,637.71**	**12.25**
11	Prachuap Khirikhan	270.78	0.12
12	Chumphon	6,445.44	2.76
13	Surat Thani	6,509.47	2.79
14	Nakhon Si Thammarat	10,277.90	4.40
15	Phatthalung	67.58	0.03
16	Songkhla	1,369.57	0.59
17	Pattani	3,696.96	1.58
Southern Region (Andaman Sea)		**174,334.82**	**74.60**
18	Ranong	26,072.51	11.16
19	Phangnga	44,301.58	18.96
20	Phuket	1,680.67	0.72
21	Krabi	36,103.85	15.45
22	Trang	30,610.75	13.10
23	Satun	35,565.45	15.22
Total		**233,699.50**	**100.00**

Source: DMCR, 2005 (Unpublished data)

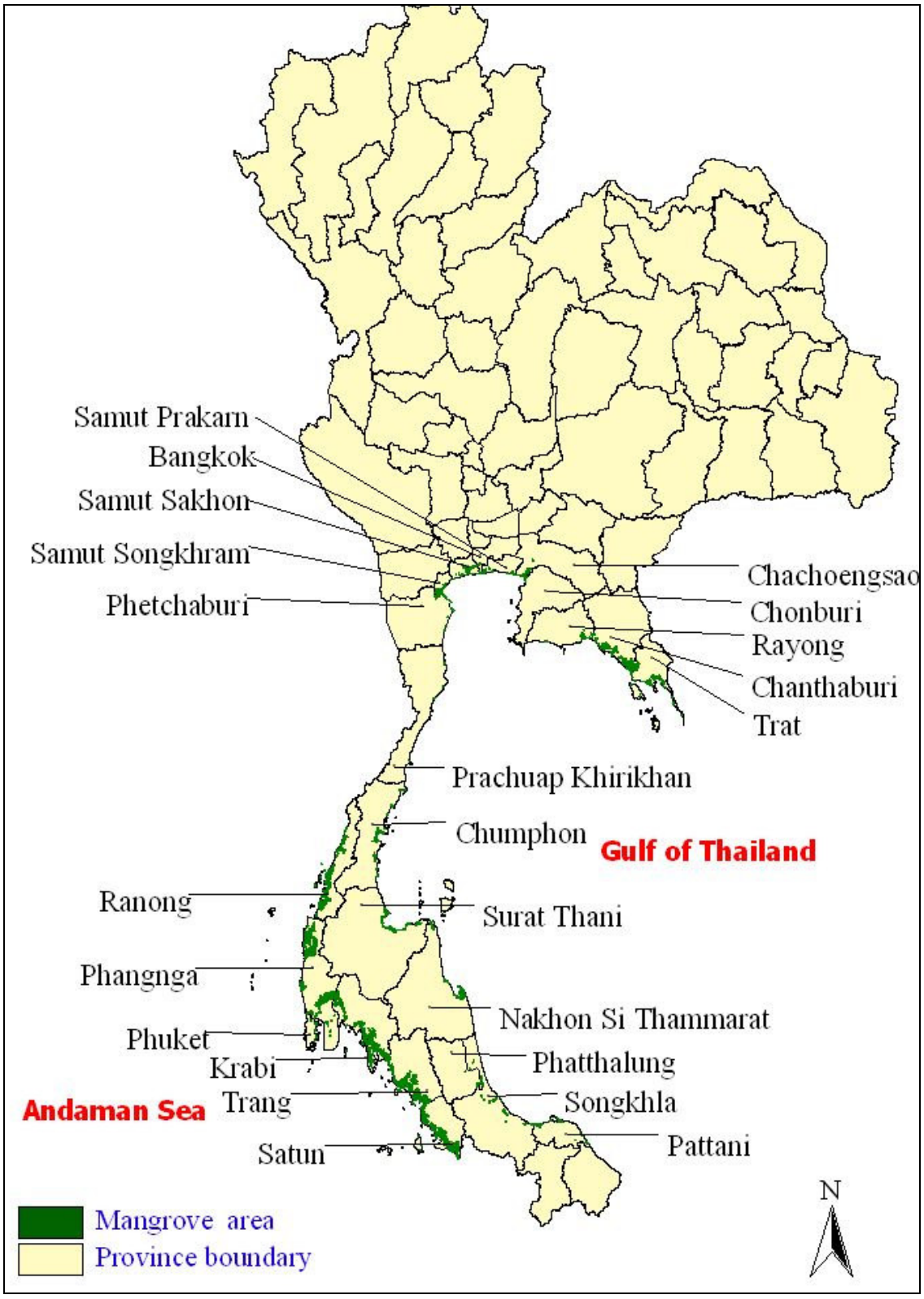


Figure 2.2 Distribution of mangrove forest of Thailand in 2004
(Source: Jumnongsong, 2005 based on data from the DMCR GIS Database, 2005)

SECTION 3
SELECTION OF PROJECT SITES

This section is developed with the aim to achieve Objective 1: to identify representative communities and raise awareness of project.

3.1 Criteria to select project sites

To select a potential site for the MANGROVE Project, there was meeting of the Thailand team. An assessment was made of the eastern and central regions of Thailand which indicated that there was only a limited area of mangrove. In the area around the Andaman Sea, the impact of the tsunami of December 2005 has made it difficult to implement the proposed project activities, because of the current relief work and reconstruction of the affected areas. There is a significant area of mangrove in the south of the country, which borders the Gulf of Thailand, which is suitable for use as the main study area. The project team developed a set of selection criteria to identify areas in the south of Thailand that can be used in the study. There is seven provinces within this area that have been identified as suitable based on the criteria. The highest priority was given to the Nakhon Si Thammarat Province (Table 3.1).

Table 3.1 Selection criteria for MANGROVE Project sites in Thailand

	Phatthalung	Prachuap Khiri Khan	Chumphon	Surat Thani	Nakhon Si Thammarat	Songkhla	Pattani
Area	1	2	4	4	5	2	3
Forest types	1	1	4	3	5	1	2
Diversity	1	1	4	3	5	1	2
Abundance[1]	1	1	4	3	5	1	2
Economic sp.	3	3	3	4	5	3	3
Communities	2	2	2	4	5	4	2
Households	2	2	2	4	5	4	2
Resource uses	4	4	4	4	5	4	4
Logistics[2]	4	4	4	4	5	4	1
Secondary data	3	2	2	2	5	4	1
Conflicts	2	2	2	5	5	5	1
Total score	24	24	35	40	**55**	33	23

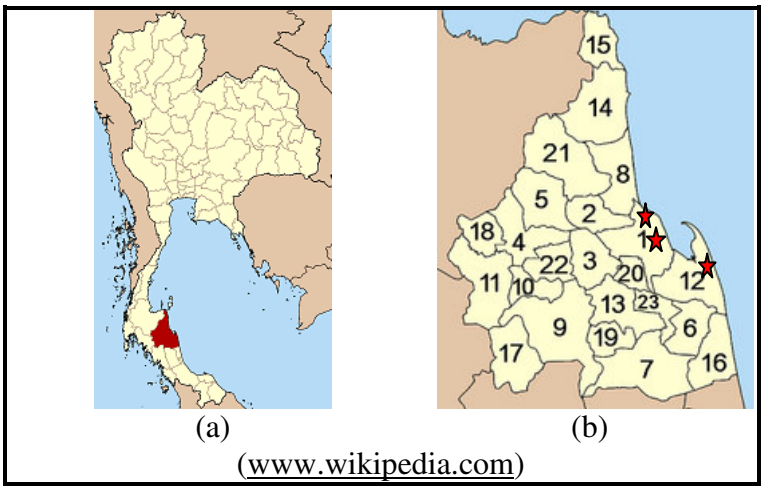
[1]Abundance (density, biomass)
[2]Logistics (transportation and accommodation)

3.2 MANGROVE Project sites

Nakhon Si Thammarat was selected as a study site for the project. It is located in southern Thailand on the coast of the Gulf of Thailand and on the east side of the Malay Peninsula (Figure 3.1a). Its terrain is mostly rugged hilly forest area. The province has 21 districts (Amphoe) and 2 minor districts (King Amphoe) (Figure 3.1b). The districts are further subdivided into 165 communes (Tambon), and 1,428 villages (Muban).

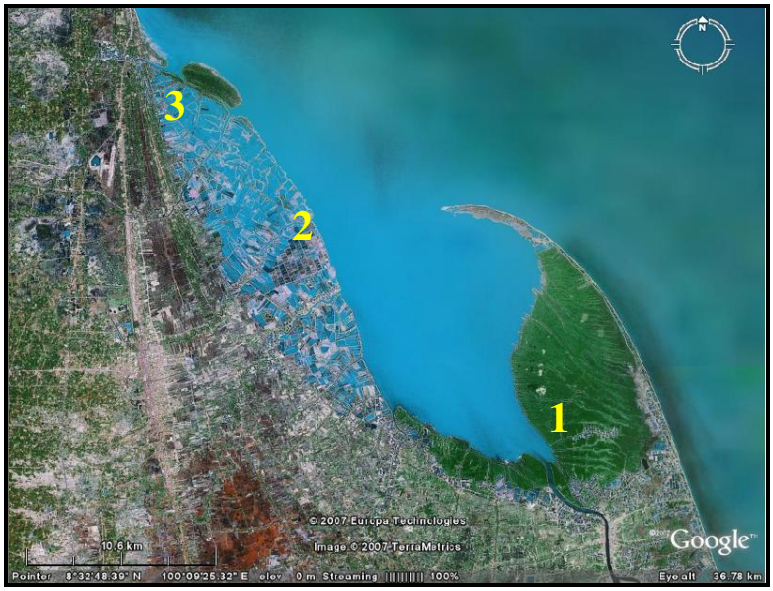
Following discussions with DMCR staff, both locally and at a national level, and using maps from the Google Earth software, recommendations were made to use the 3 mangrove communities as the study sites. These recommendations were made because of differences in the characteristics of the mangrove ecosystems at each of these sites. Local people in these 3 communities depend on goods and services originating from the

mangrove ecosystems. The three communities are; (1) Ban Kong Khong, Pak Phanang Fang Tawan Ok Subdistrict, Pak Phanang District - a community with healthy and old mangrove forest (2) Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District - a community with new mangrove plantation areas in abandoned shrimp ponds and (3) Ban Talad Has, Pak Phun Subdistrict, Mueang District – a community where mangrove forest has grown up on new island (Figure 3.1c).



(a) (b)

(www.wikipedia.com)



(c)

(www.earth.google.com)

Figure 3.1 Location of MANGROVE Project sites

(a) Location of Nakhon Si Thammarat Province,
(b) 21 districts and 2 minor districts in Nakhon Si Thammarat Pvovince;
No. 1=Mueang District and
No. 12=Pak Phanang District,
(c) 3 communities as MANGROVE Project sites;
1) Ban Kong Khong, Pak Phanang Fang Tawan Ok Subdistrict, Pak Phanang District
2) Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District
3) Ban Talad Has, Pak Phun Subdistrict, Mueang District

SECTION 4
ECOSYSTEM HEALTH AND FUNCTION

This section is developed with the aim of achieving Objective 2: to study and understand mangrove functionality: biogeochemical, hydrological and ecological functions.

Information for ecosystem health and function, including biogeochemical, hydrological and ecological aspects was reviewed using existing data and indigenous knowledge (local, regional, and national levels).

4.1 Biogeochemical function

4.1.1 Chemical transport into mangrove ecosystem

Wattayakorn and Saramul (2004) studied the exchange of nutrients between Klong paknakorn and Pak Phanang Bay between October 2000 and April 2001. They found that in the wet season, all nutrients (nitrate + nitrite, ammonia, organic nitrogen, phosphate, and organic phosphorus) were transported out of the Paknakorn estuary to Pak Phanang Bay by the freshwater. In the dry season, most nutrients were found to be transferred from the Pak Phanang Bay into the Paknakorn estuary, except for nitrate + nitrite that traveled in a seaward direction. Salt flux in the dry season (1.71×10^7 kg per day) was found to be higher than in the wet season (8.77×10^5 kg per day).

4.1.2 Chemical Mass Balance of mangrove ecosystem

The biogeochemical processes including distribution, behaviour and mass balance of nutrients occurring in Pak Phanang Bay system was assessed by Wattayakorn (2004) from 2000 to 2002. In the bay, dissolved organic nitrogen was found with greater abundance in concentration than dissolved inorganic nitrogen. In the wet season, the system appears to denitrify in excess of fixing nitrogen and to be net heterotrophic. In the dry season, the bay is a net autotrophic system.

4.2 Hydrological function

4.2.1 Seasons and monsoons

The local climate of Nakhon Si Thammarath province is tropical and characterised by monsoons. Table 4.1 shows that there are two seasons, which are:

1) **Rainy season** starts from May to January. The season can be divided into two periods characterised by the two monsoons. There is a Southwest monsoon, which results in persistent rain from May to October as well as a Northeast monsoon, which results in heavy rain from November to January.
2) **Summer season** starts from February to April.

Table 4.1 Seasons and monsoons in Nakhon Si Thammarat

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rainy (Heavy) (NE)	Summer			Rainy (South West)						Rainy (Heavy) (North East)	

The Table developed based on the data in Website of Meteorological station at Kakhon Si Thammarat http://www.nakhonsithammarat.go.th/air.php: Accessed on June 26, 07.

4.2.2 Precipitation

In Nakhon Si Thammarat, the total amount of rainfall between January and December 2005 was 2,987.2 mm. The highest volume, which is 927.9 mm, was measured in December. There was no rainfall recorded in February. The total number of days with rainfall was 148 days (Table 4.2).

Table 4.2 Meteorological data in Nakhon Si Thammarat in 2005

Month	Temperature			Relative Humidity			Precipitation	
	Max (°C)	Min (°C)	Average (°C)	Max (%)	Min (%)	Average (%)	Per month (mm.)	No. of rainy days (days)
Jan	33.1	18.7	26.39	97	50	80.74	85.70	8
Feb	34.2	19.0	26.94	97	44	77.63	0.0	0
Mar	33.9	19.4	27.15	97	51	79.45	241.5	9
Apr	36.7	21.7	28.96	98	30	77.22	12.4	3
May	36.9	23.0	29.49	98	45	78.81	132.2	13
Jun	36.4	22.7	28.43	97	43	76.42	121.0	12
Jul	35.5	22.0	28.00	96	41	76.51	147.1	14
Aug	36.0	21.8	28.21	97	40	76.14	65.2	14
Sep	35.2	22.5	27.81	97	43	78.64	136.5	13
Oct	34.7	22.3	26.52	99	50	86.18	384.4	23
Nov	33.0	22.0	26.33	98	55	85.79	643.1	15
Dec	31.0	21.0	24.87	100	64	89.84	927.9	24
Total	-	-	-	-	-	-	2,987.2	148

Source: Meteorological station at Kakhon Si Thammarat
http://www.nakhonsithammarat.go.th/air.php: Accessed on June 26, 07.

4.3 Ecological

4.3.1 Plants in mangrove ecosystem

Among the provinces in the Southern Gulf of Thailand, Nakhon Sri Thammarat Province has the largest mangrove forest area (36%). The mangrove forest covers an area of approximately 10,278 ha or 4.40% of the total mangrove forest area in Thailand (Table 2.2) DMCR, 2005 (Unpublished data). In Nakhon Sri Thammarat, the largest mangrove forest area is found in Pak Phanang District when compared to other three districts in the province: Muang, Tha Sala, and Khanom Districts.

Mangrove forest species found in Pak Phanang are *Rhizophora apiculata, R. mucronata, Avicennia officinalis, A. alaba, Sonneratia* sp., *Bruguiera* sp., *Ceriops* sp., *Acanthus* sp, and *Nypa fruiticans* (CORIN and ONEP, 2003). These mangrove species and other mangrove associated species in the mangrove forest area of Pak Phanang serve

as a nursery ground and fishery habitat for fish, shrimp, crab and other aquatic faunas. Fishermen are using the mangrove forest area as a fishing ground. A variety of products from *Nypa fruiticans* are also produced by the community (CORIN and ONEP, 2003).

The Nakhon Sri Thammarat Province has lost a mangrove forest area of about 52,783.84 ha between 1961 to 1996,. The greatest loss of mangrove forest area was found in 1975 (45,700 ha or about 29% of total loss in the province) (Table 4.3) (Charuppat and Charuppat, 1997 cited in Aksornkoae et al., 2004). Shrimp farming is one of the main causes that lead to a rapid loss of mangrove forest area in Nakhon Sri Thammarat Province as well as in Pak Phanang District. However, other causes of mangrove area loss and degradation, which probably lead the mangrove forest into a vulnerable situation, should be also examined.

Table 4.3 Mangrove forest area (ha) in Nakhon Sri Thammarat Province (1961 – 1996)

1961	1975	1979	1986	1991	1993	1996
61,200.00	15,500.00	12,832.00	8,835.84	8,024.96	7,996.00	8,416.16

Source: Charuppat and Charuppat, 1997 cited in Aksornkoae et al., 2004

4.3.2 Animals in the mangrove ecosystem

Paphavasit, et al. (2004a) conducted a study on fish communities in mangrove plantations in Pak Phanang Bay in March 2000 and April 2002. A total of 30 species of fish was recorded. The fish community was dominated by *Chelon macrolepsis* and *C. tade* in the family Mugilidae, *Mystus gulio* in the family Engraulidae, and *Arius sagor* in the family Ariidae.

In 2001 and 2002, Paphavasit, et al. (2004b) studied the benthic diversity in Pak Phanang Mangrove Forest areas planted in different years; 1967, 1977, and 1987. Low benthic diversity of 60 species was found. Dominant species of macrofauna were polychaetes, crustaceans and mollusks respectively. Dominant species of meiofauna were nematodes and foraminifera.

A study on population dynamics of grapsid crab *Sesarma eumolpe* was conducted by Sobmore, et al. (2004) in August 2001 to July 2002. They found the ratio of male to female crabs was 1: 0.78. The spawning period occurred almost all year round with the peak during the period August to January. Total mortality (Z) of male crabs was 2.98 per year. Total mortality of female crabs was 5.46 per year. The recruitment of crabs takes place throughout the whole year.

Some other aquatic faunas were identified by the villagers in Ban Kong Khong, Ban Talad Has, and Ban Pak Nam Pak Phaya during the PCA as shown in Table 5.4, 5.5, and 5.6, including some species of birds and bees.

SECTION 5
LIVELIHOODS OF THE POOR PEOPLE, GOODS AND SERVICES

This section is developed with the aim of achieving Objective 3: to study and understand livelihood strategies of community and Objective 4: to describe market networks and explore influence on poor livelihoods.

5.1 Sustainable Livelihoods Framework and Gender Analysis Framework

To achieve these two objectives, the study was based on the following two frameworks; "Sustainable Livelihoods Framework" (DFID; Guidance Sheet 1, 1999) and "Gender Analysis Framework" DFID Infrastructure Department (1999).

The Sustainable Rural Livelihoods Advisory Committee defined the livelihood in Guidance Sheet 1 as "it consists of capabilities, assets (both material and social resources) and activities required for a means of living. A livelihood will be sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" DFID (1999).

Sustainable Livelihoods Frameworks provide a view of the vulnerability of people's situation. Under this context, people have accessed to certain assets or poverty reducing factors. The main factors that influence people's livelihood strategies include social, institutional and organizational environment - ways of combining and using assets that are open to people in order to achieve their livelihood outcomes that will meet their objectives. The framework is centered on people. It should help in the identification of suitable means to support the livelihoods (Figure 5.1) (DFID; Guidance Sheet 1, 1999).

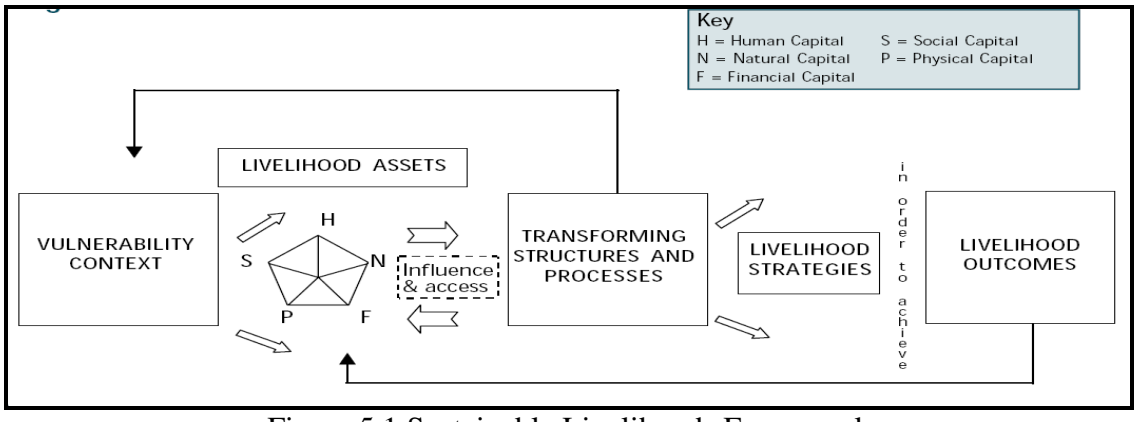


Figure 5.1 Sustainable Livelihoods Framework
(DFID; Guidance Sheet – Section 1, 1999)

There is a distinction between the livelihoods of women and men in society, across a variety of issues such as social relations, activities, access and control, and general needs. Gender Analysis, which aims to uncover the dynamics of gender differences across such issues, was recommended by DFID as one of several tools in the Sustainable Livelihoods Guidance Sheets (DFID, 2000).

The gender analysis framework, which was designed by DFID Infrastructure Department (1999), was adapted in this MANGROVE Project to assess the livelihoods of

people who are involved in the mangrove ecosystem in addition to goods and services that are derived from mangrove ecosystem (Table 5.1).

Table 5.1 Gender Analysis Framework

Category of enquiry	Issues to consider
1) Assets (natural, physical, financial, human, social)	• What livelihood assets/opportunities do men and women have access to? • What constraints do they face?
2) Roles and responsibilities	• What do men and women do? (1) Productive roles - paid work, self-employment, and subsistence production, (2) Reproductive roles (domestic work, child care and care of the sick and elderly)
3) Power and decision-making	• What decision-making do men and/or women participate in or control? (1) Household level (2) Community level
4) Needs, priorities and perspectives	• What are women's and men's needs and priorities?

Adapted from DFID Infrastructure Department (1999)

5.2 Assessment of livelihoods, goods and services

To assess livelihood strategies of people who are dependent on the mangrove ecosystem as well as goods and services that they received from the ecosystem, we have listed 4 specific objectives in the table below. In this section, we used Participatory Community Analysis (PCA) as the main approach to achieve objectives 2, 3 and 4. A review of secondary data, site observation, and focus group techniques was used to assess the assets including natural, physical, financial, human, social assets of each community (see Table 5.2).

The PCA events were conducted in the three communities in June 2007 (Figure 5.2 a, b, c).

Table 5.2 Specific objectives and methodologies for assessment of livelihoods, goods and services

Objectives	Methodologies/Tools
(1) To assess the assets of each community	**Review of secondary data, site observation, questionnaire, and focus group** (natural, physical, financial, human, and social assets)
(2) To assess the role of mangrove for providing goods and services in the livelihoods of poor people	**PCA - Brainstorming** • Rank the importance of mangrove goods and services • Map the flow of goods and services supporting the communities (Marketing channel)
(3) To assess the vulnerability context of each community	**PCA- Brainstorming** • Rank the causes of impacts on the mangrove forest and mangrove aquatic resources • Trend line of the quantity of natural resources, the economy, social relation, and conflicts in different periods • Seasonal calendar of activities related to the mangrove ecosystem
(4) Address specific gender issues	**PCA- Participatory Gender Framework Analysis** • Mapping of community assets (natural, physical, financial, human, and social) • Perceptions of roles and responsibilities, • Perceptions of power and decision-making • Rank the needs and priorities

F. 5.2 a Ban Kong Khong

F. 5.2 b Ban Pak Nam Pak Phaya

F. 5.2 c Ban Talad Has

Figure 5.2 PCA events conducted in the 3 communities

5.2.1 Assessment of community's assets

There are five core asset types of capital upon which livelihoods are built are discussed in the sustainable Livelihood Framework. These assets can be presented visually in the asset pentagon, which was developed to enable information about people's assets (Figure 5.3). Options of livelihood strategies are probably influenced by people's access to difficult levels and combinations of these assets. Each asset has a direct impact upon other types of assets. The shape of the pentagon can be used to show variation in people's access to the various assets. The centre point of the pentagon, where the lines meet, represents zero access to all assets. The outer perimeter represents maximum access to assets (DFID; Guidance Sheet – Section 2, 1999). These five assets are listed below.

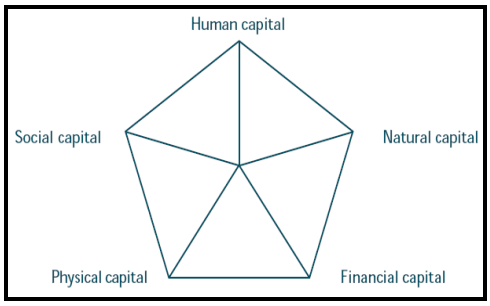


Figure 5.3 The asset pentagon
(DFID; Guidance Sheet – Section 2.3, 1999)

- Human assets (H) - e.g. health services, education, and information access
- Natural assets (N) - e.g. natural goods and services derived from the mangrove ecosystem, resources and the system of land allocation
- Financial assets (F) - e.g. capital/income, credit, and levels of trust
- Physical assets (P) - e.g. Infrastructure, tools and equipment that people use to work more productively
- Social assets (S) - e.g. social networks (vertical/ horizontal), membership of formalized groups

We assessed the situations and changes in access to assets in each study site by reviewing the secondary data, observations made at the sites, questionnaires, and focus groups with individuals and the community leaders, local authority staff and local government staff. The results of the assessment are presented in Table 5.3 for each community. Situations of access to each type of assets were given a point score ranging from 0 and 10. Number 0 refers to a negative situation where there is no access to assets or severed conflicts happening there. A score of 10 refers to a positive situation where there is perfect access or no conflicts. Changes in access to assets were also identified and classified as a decline, increase or no significant change to level of access.

Different shaped pentagons representing situations and changes in access to assets in different study sites are developed as shown in Figure 5.4. Explanations for the shapes of the different pentagons for each community are described below.

1) Ban Kong Khong, Pak Phanang Fang Tawan Ok Subdistrict, Pak Phanang District

Among the three communities for the study sites, Ban Kong Khong attained the lowest point scores when assessed with respect to access to human (5), natural (4), financial (5), and physical (4) assets. Only the highest point was given to Ban Kong Khong when assessing the situation with regard to access to social assets (6). Changes in access to human, physical, and social assets tend to be improved. There is a plan by central government and local organization for a water supply project as well as construction of concrete roads. People are generally willing to participate in mangrove conservation and other group activities. Changes in natural and financial assets tend to show a decline as people are still worried about their situation and do not accept the government solution. There is no clear plan to solve these problems, in particular those associated with land titles and financial difficulties.

- Human assets (H) – 5 points – Even though an elementary school is situated in the village, many old people have no ability to read or write. People can access information by using landline phones or mobile phones. Community leadership is strong and usually disseminates information to the community efficiently. However, internet connection is not apparently accessed by the community.
- Natural assets (N) – 4 points – The mangrove ecosystem surrounding the village is in very good condition. However, the system of land allocation for the villagers is not considered satisfactory by the villagers. They do not have land titles or even any legal document to prove that the land belongs to them because the area is a conservation area under government mandate.
- Financial assets (F) – 5 points – The result from the 32 respondents to the questionnaire found that average household income (median) per month is 5,500 Baht. (Min=3,000, Max=10,000, SD=1,831.35). Since people have no land title, which can be used to gain credit from the banks, therefore they cannot access such loan from the bank.
- Physical assets (P) – 4 points – The community has electricity but no water supply from tap. People sometimes face water shortages for household consumption during the dry season.
- Social assets (S) – 6 points – There is no conflicts among villagers in the village. However, there are no formalized groups in the village e.g., mangrove conservation group, occupation group or cooperatives in the village.

2) Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District

Most scores given to Ban Pak Nam Pak Phaya are in the middle level compared to the other two communities; human (8), natural (7), physical (6), and social (6) assets. The village only achieved its highest score for financial assets (7). Human assets tend to be improving as people are willing to participate in group activities and mangrove conservation. Physical assets tend to be extending as well as infrastructure improvement, especially for road construction, has been put in

the development plan for local organization. People perceived that natural and financial assets tend to be decreasing as they can catch fewer fish from fishing and a number of abandoned shrimp farms are found in the community. Moreover, there is no obvious livelihood program from the government to help people in generating their income.

- Human assets (H) – 8 points – From observation during PCA with 32 people most people (more than 80%), even old people, have the ability to read and write. Landline and mobile phones are available in the community. Community leadership is strong and has the ability to disseminate information to the community efficiently. However, internet connection is not apparently used or accessed by the community.
- Natural assets (N) – 7 points – The village is located near by a town, and people face problems about water quality when waste water are drained from the town to community via a canal, which is near to the mangrove forest. However people have no problem about land ownership.
- Financial assets (F) – 7 points – The result from the 31 respondents to the questionnaires found that average household income (median) per month is 7,000 Baht. (Min=600, Max=36,000, SD=7897.34). Average income in this community is higher than other communities however, the difference between minimum and maximum income per household is larger than other communities.
- Physical assets (P) – 6 points – The community has both electricity and water supply from tap. In general from the observation, road condition in the community is also good and convenient for transportation.
- Social assets (S) – 6 points – There is no conflict among villagers. People have formed mangrove conservation group in the community but there is no formalized groups for occupation or cooperatives in the village.

3) Ban Talad Has, Pak Phun Subdistrict, Mueang District

High scores were given to Ban Talad Has when assess the following assets; human (8), natural (8), financial (6), physical (8). The community achieved the lowest score for social (5) assets. As with other communities, financial assets tend to be declining as there are no obvious financial programs from the government that will help to support the community.

- Human assets (H) – 8 points – Situation in access to human asset of this community is not significantly different from Ban Pak Nam Pak Phaya but higher than Ban Kong Khong as from observation during PCA in Ban Talad Has there are more people who are able to read and write.
- Natural assets (N) – 8 points – The village got benefit from natural characteristics. New mud flat areas increase daily as a result of sedimentation. This new mud flat will create a larger mangrove area

in the future from both natural and human activities. However there are some conflicts among villagers especially about competition for resources.

- Financial assets (F) – 6 points – The result from the 30 respondents to the questionnaires found that average household income (median) per month is 6,000 Baht. (Min=1,000, Max=30,000, SD=7574.17).
- Physical assets (P) – 8 points – The community has both electricity and water supply from tap. From observation, road conditions are better than other two communities.
- Social assets (S) – 5 points – There is a mangrove conservation group in the village but some conflicts still occur based on the opinions of the participants in PCA. No formalized groups for occupation or cooperatives in the village are found in the community.

Table 5.3 Situations and changes in access to assets in study sites

Asset Types*	Study sites					
	Ban Kong Khong		Ban Pak Nam Pak Phaya		Ban Talad Has	
	Situation**	Changes ***	Situation*	Changes **	Situation*	Changes **
H	**5**	**(+)**	**8**	**(+)**	**8**	**(+)**
N	**4**	**(-)**	**7**	**(-)**	**8**	**(+)**
F	**5**	**(-)**	**7**	**(-)**	**6**	**(-)**
P	**4**	**(+)**	**6**	**(+)**	**8**	**(+)**
S	**6**	**(+)**	**6**	**(NS)**	**5**	**(NS)**

* H=Human asset, N=Natural asset, F=Financial asset, P=Physical asset, S=Social asset

** Points are ranging between 0-10, (0= completely no access and severed conflicts, 10 = perfectly access and no conflicts)

*** Declined (-), extended (+), or not significant changes (NS)

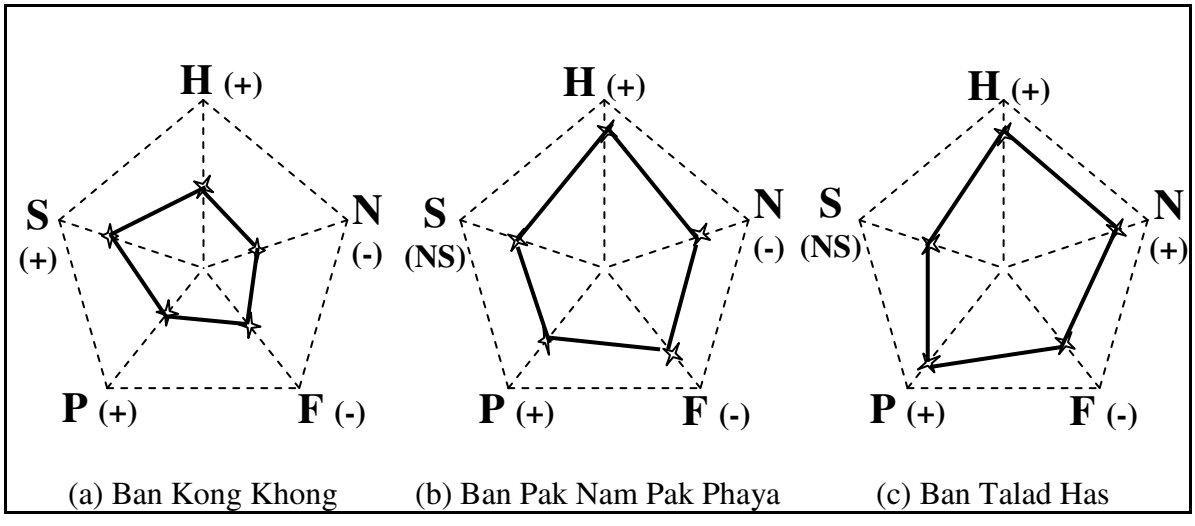


Figure 5.4 Different shaped pentagons – changes in access to assets in study sites
H=Human asset, N=Natural asset, F=Financial asset, P=Physical asset, S=Social asset
Declined (-), extended (+), or not significant changes (NS)

5.2.2 Assessment of roles of mangrove ecosystem providing goods and services in livelihoods of poor people

Ranking the importance of mangrove goods and services and mapping flows of goods and services that support the communities were two main activities that were conducted during the PCA. These were undertaken in the three communities separately to assess the roles of mangrove ecosystem that provide goods and services for the communities.

5.2.2.1 Ranking importance of mangrove goods and services

People's livelihoods in three communities are dependent on goods and services which are provided by the mangrove ecosystem. PCA was used as an approach to assess how people in each community understand the importance of goods and services derived from mangrove ecosystem in their communities. The gender aspect was also used to understand any differences in how men and women perceive their environment. During the PCA we observed that participants in all 3 communities paid attention and spent time to discuss the benefits that they can gain. We also observed that separation of men and woman in different group make woman more relaxed in providing information. These discussions were considered more productive than those within mixed groups. Presenting the results by male and female representatives enable men and women to exchange comments and discuss these with each other.

In general, all three communities appreciated the importance of the mangrove ecosystem both for goods and services. The variety of benefits that they received from the mangrove ecosystem in the community is presented in Tables 5.4, 5.5 and 5.6.

The steps for this activity are listed below:

1) Create separate groups for male and female participants
2) For each group, discuss the importance of mangrove goods and services to their livelihoods.
3) Record the results in a colour card
4) Two representatives from man's group and woman's group present the rankings to the whole group and discuss the major outputs from the discussions together (Figure 5.5).

(a) Representative of male group from Ban Kong Khong (21 June 07)

(b) Representative of female group from Ban Pak Nam Pak Phaya (24 June 07)

Figure 5.5 Representative presenting the result of male group about ranking importance of mangrove's goods and services

Table 5.4 Ban KongKhong, PakPhanang FangTawanOk Subdistrict, PakPhanang District

Female Group	Male Group
1. Use of mangrove wood for house construction and charcoal	1. Collection of Sesarmid crab
2. Prevention of coastal erosion	2. Collection of mud crab
3. Drainage of water for aquaculture (Giant Seaperch, mud crab, Giant Tiger Prawn, Sesarmid crab)	3. Collection of fish
4. Source of food for the community	4. Collection of shrimp
5. Habitat of aquatic fauna	5. Use of mangrove wood for house construction
6. Collecting Sesarmid crab and shells	6. Selling Rhizophora seedlings for mangrove planting project
7. Use of mangrove's parts for herb and medicine	7. Collection of muolusk
8. Collection of white shrimp (*Penacus indicus)*	8. Habitat for Nohk Gwak (a white-breasted waterhen, *Amaurornis phoenicurus)*
9. Collection of mud crab and fish	9. Habitat for Heron
10. Use of Nipa palm's leaves for roof material and tobacco wrapping, used of Nipa palm's stem for fishing gear	10. Prevention of coastal erosion
11. Selling Rhizophora seedlings for mangrove planting project	11. Use of Nipa palm's leaves as material for thatched house or dwellings
12. Place for ecotourism	12. Breeding areas of aquatic fauna
13. Use of *Sonneratia griffithii* as plant for house decoration, fruit for consumption	13. Habitat and food source of Nest Swiftlets bird
	14. Use of mangrove poles for fishing gear

Table 5.5 Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District

Female Group	Male Group
1. Use of mangrove resources as a source of income	1. Breeding areas of aquatic fauna
2. Nursing ground for aquatic fauna and its importance for food chain in mangrove area	2. Protection of coastal erosion
3. Use of mangrove wood for house construction, fishing gear, and charcoal	3. Collection of mud crab
4. Use of Nipa palm's leaves for tobacco wrapping	4. Use of *Rhyzophora*'s poles for house construction and bridge
5. Use of mangrove's leaves for roof materials e.g., *Rhizophora* spp., *Thespesia populnea* (Pho Talae), *Avicennia* spp.	5. Collection of Sesarmid crab
6. Collection of honey from bee hives	6. Collection of Giant Seaperch
7. Collection of mud crab	7. Collection of Horse Mussel (Hoi Kapong) (*Musculus senhousia*)
8. Collection of Giant Seaperch	
9. Collection of cockle	
10. Collection of Tilapia	
11. Use of mangrove's parts for herbs and medicine e.g., *Acanthus* spp., *Thespesia populnea* (Pho Talae, *Ceriops* spp., *Xylocarpus* spp., *Rhizophora* spp.)	
12. Protection of the community from strong wind/wave and coastal erosion	

Table 5.6 Ban Talad Has, Pak Phun Subdistrict, Mueang District

Female Group	Male Group
1. Collection of aquatic fauna e.g., Mullet, Giant Seaperch, Giant Tiger Prawn, cockle, Horse Mussel (Hoi Kapong) (*Musculus senhousia*), Walking Catfish, Sesarmid crab, Mud crab, oyster, green mussel	1. Collection of fish, shrimp, mud crab, and shells
2. Breeding and nursing ground for the above aquatic fauna	2. Protection of strong wind
3. Use of mangrove wood for house construction	3. Breeding and nursing ground for aquatic fauna
4. Use of Nipa palm's leaves for roof material and tobacco wrapping, use of Nipa palm's fruit for dessert	4. Prevention of coastal erosion
5. Use of *Sonneratia* spp. as plant for house decoration, habitat for firefly and birds, fruit for consumption	5. Use of mangrove wood for house construction
6. Use of poles of *Rhizophora* spp., and *Avicennia* spp. for charcoal	6. Use of mangrove wood for fishing gear
7. Use of Rhizophora forest as bunker protecting community from strong wind	7. Use of mangrove wood for charcoal for household use
8. Use of Nipa palm for coastal erosion protection	
9. Habitat for ghost crab (Pu Lom), and mudskipper fish (Pal Teen)	

5.2.2.2 Mapping flows of goods supporting communities

From the results of the previous activity, "ranking importance of mangrove goods and services", the communities were asked to rank the important goods that support their communities. Then they were asked to work in small groups on mapping the flow of these goods lead by a person who is involved with the goods under discussion. The ranking of importance for goods supporting each community are shown in Table 5.7.

Mud crab (*Scylla serrata*) and Banana shrimp/Indian white shrimp (*Penaeus merguiensis* and *P. indicus*) are commonly found as very important goods from mangrove ecosystem in the three communities. Bluespot Grey Mullet *(Valamugil seheli)* is the most important goods for Ban Talad Has while it is ranked as the 4th and 6th most important in Ban Kong Khong and Ban Pak Nam Pak Phaya, respectively. Sesarmid crab (*Sesarma eumolpe*) is found as the most important for Buddist community in Ban Kong Khong while it is ranked as the 7th and 9th in Ban Talad Has and Ban Pak Nam Pak Phaya, respectively, in which most of the Muslim people live and work. Walking Catfish (*Clarias spp.*) and Horse Mussel (*Musculus senhousia*) are also found as important goods for the three communities. Giant Seaperch (*Lates calcarifer*) is also important in Ban Kong Khong and Ban Pak Nam Pak Phaya. Nipa Palm (*Nypa fruticans*) is a common mangrove species found in Ban Kong Khong and Ban Talad Has. They are made use of by people as important goods from the mangrove ecosystem, contributing greatly to their livelihoods. Some other goods ranked during PCA are Java Tilapia (*Tilapia mossambica*), Common Geloina (Hoi Gan) (*Polymesoda erosa),* Blue Swimming Crab (*Portunus pelagicus*), Cockle (*Anadara granosa*), Cockle (*Anadara granosa*), and Shieldheaded Catfish (Pla God) (*Arius nella)* (Table 5.7).

Table 5.7 Ranks of importance of goods supporting 3 communities

Ban Kong Khong	Ban Pak Nam Pak Phaya	Ban Talad Has
1. Sesarmid crab (*Sesarma eumolpe*)	1. Banana shrimp/Indian white shrimp (*Penaeus merguiensis* and *P. indicus*)	1. Bluespot Grey Mullet *(Valamugil seheli)*
2. Mud crab (*Scylla serrata*)	2. Mud crab (*Scylla serrata*)	2. Banana shrimp/Indian white shrimp (*Penaeus merguiensis* and *P. indicus*)
3. Banana shrimp/Indian white shrimp (*Penaeus merguiensis* and *P. indicus*)	3. Walking Catfish (*Clarias* spp.)	3. Mud crab (*Scylla serrata*)
4. Bluespot Grey Mullet *(Valamugil seheli)*	4. Blue Swimming Crab (*Portunus pelagicus*)	4. Horse Mussel (*Musculus senhousia*)
5. Java Tilapia (*Tilapia mossambica*)	5. Giant Seaperch (*Lates calcarifer*)	5. Walking Catfish (*Clarias spp.*)
6. Walking Catfish (Pla Duk Talae) (*Clarias spp.*)	6. Bluespot Grey Mullet *(Valamugil seheli)*	6. Nipa Palm (*Nypa fruticans*) – Tobacco wrapping
7. Giant Seaperch (Pla Kra Pong) (*Lates calcarifer*)	7. Horse Mussel (*Musculus senhousia*)	7. Sesarmid crab (*Sesarma eumolpe*)
8. Common Geloina (Hoi Gan) (*Polymesoda erosa)*	8. Cockle (*Anadara granosa*)	8. Shieldheaded Catfish (Pla God) (*Arius nella*)
9. Horse Mussel (Hoi Kapong) (*Musculus senhousia*)	9. Sesarmid crab (*Sesarma eumolpe*)	
10. Nipa Palm (*Nypa fruticans*) – Roof material	10. Green Mussel (Perna viridis) (Culture)	
11. Nipa Palm (*Nypa fruticans*) – Tobacco wrapping	11. Mysids (*Acetes* spp.)	
12. Nipa Palm (*Nypa fruticans*) – Pure vinegar	12. Honey	

Mud crab, White shrimp, and Sesarmid crab are considered as the most important by all three communities. Goods flow diagrams of these two resources were developed by local people who are involved directly to these goods for each community. They were then summarized in a single map for each resource to provide an overview of marketing channels in the area.

1) Mud crab (*Scylla serrata*)

Fishers in three villages have caught Mud Crab from the mangrove forest by using a gill net and the traditional crab trap (or called Raew). Fishes in Ban Kong Khong sell Mud Crab to middlemen in the village, who then sell the Mud Crab to sellers in the market in Pak Phanang District. These were then sold again to vendors in markets in Bangkok and other provinces.

Fishermen in Ban Pak Nam Pak Phaya sell Mud crab to middlemen in the village. The middlemen sell Mud crab to the seller in market in Nakhon Town. People in Ban Pak Nam Pak Phaya mentioned that Mud crab collected from the village was sold to sellers Bangkok and other provinces through Nakhon Town market and this Mud crab was probably exported to other countries. They are not sure of the actual countries who import the Mud Crab. Sometimes they sell Mud crab at markets in the village.

Fishers in Ban Talad Has sell Mud crab to both middlemen in the village and outside the village. These Mud crabs were sold to Bangkok via both middlemen. Sometimes they sold Mud crab directly to local people at the market in the village and at market in Nakhon Town.

Some Mud crabs were also used by households in the three villages (Figure 5.6).

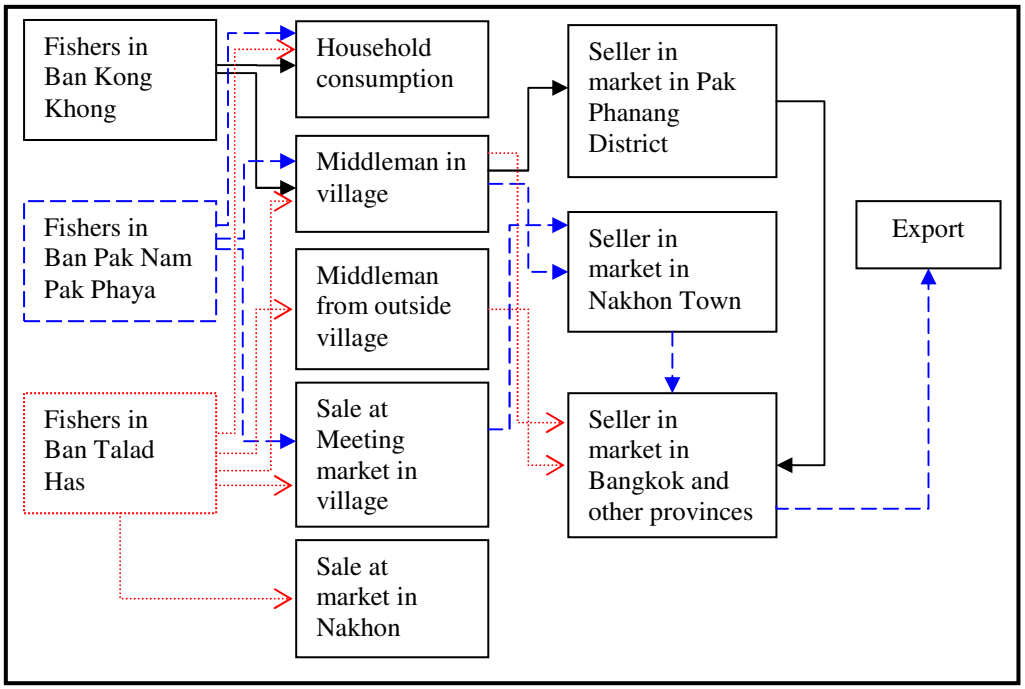


Figure 5.6 Mud crab flow diagram in study sites
(Summarized from three diagrams that were developed during PCA)

2) Banana shrimp *(Penaeus merguiensis)* /Indian white shrimp (*P. indicus*)

White shrimp collected from mangrove forest by gill net and lifted net in Ban Kong Khong is sold to middlemen in the village. It is then sold to middlemen outside of the village and sold on to sellers in the market in Pak Phanang District. They in turn sell to consumers in Pak Phanang District. Some fishermen sold White shrimp directly to local people at the market in the village.

Middlemen in Ban Pak Nam Pak Phaya play an important role in collecting White shrimp caught from mangrove areas in the village and sell to collectors in Pak Nakhon Subdistrict. These collectors later sell White shrimp to sellers in market in Nakhon, Town and in Mueang District, which sell White shrimp to Bangkok and other provinces. These two collectors also exported White shrimp to Malaysia as mentioned by participants during the PCA.

Fishers in Ban Talad Has sell White shrimp to middlemen in the village then the shrimp is sold to middlemen from outside the village and to Bangkok and other provinces, respectively. Some White shrimp was also sold to local villager at market in the village.

White shrimp collected from the mangrove forest and surrounding area are also used for household consumption by local people in all three communities (Figure 5.7).

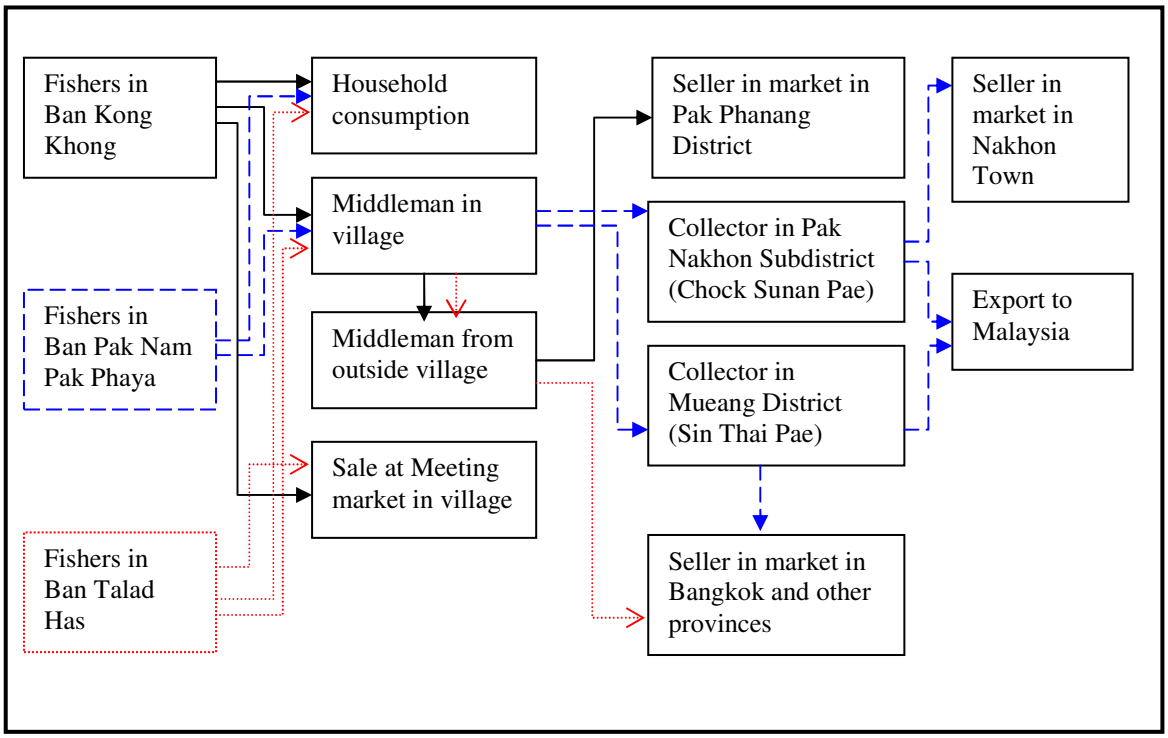


Figure 5.7 Banana shrimp/Indian white shrimp flow diagram in study sites (Summarized from three diagrams that were developed during PCA)

3) Sesarmid crab (*Sesarma eumolpe*)

Sesarmid crabs were collected using special traps from the mangrove forest in Ban Kong Khong. These crabs were then sold to the middlemen in the village. These middlemen will process the crabs, which will be fermented into a new product. These products will be sold at the market in the village. These fermented crabs will be transferred to the consumers in the town through the market in Pak Phanang District.

In Ban Pak Nam Pak Phaya, fishers will sell sesarmid crabs to their neighbours. Some neighbours will use sesarmid crabs for consumption while some neighbours will use as them as bait for catching Mud crabs. Some fishermen will sell sesarmid crabs at the market in the village while some groups of fishermen will sell the crabs to the middlemen in the village. These fishermen will produce fermented crabs from the sesarmid crabs.

There were no participants who catch sesarmid crabs attending the PCA in Ban Talad Has as the majority of them are Muslim. They provided us with information that Muslims will not catch things that they do not eat. They do not eat sesarmid crabs so that is why they do not catch any. However, the participants confirmed that in the village there are many Buddhists who collect sesarmid crabs (Figure 5.8).

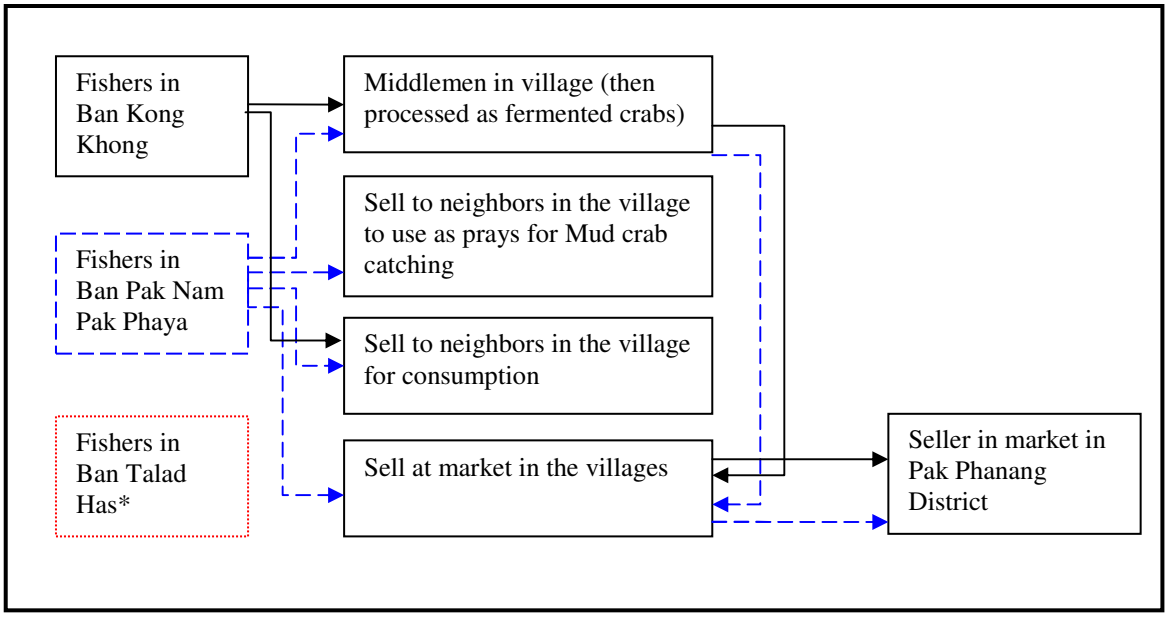


Figure 5.8 Sesarmid crab flow diagram in study sites
(Summarized from two diagrams that were developed during PCA)
* There are no fishers in Ban Talad Has who collect sesarmid crab attended the PCA

5.2.3 Assessment of vulnerability context of each community

Sustainable Livelihoods Framework views that people based on the vulnerabilities associated with their living in vulnerability context. People's livelihoods and availability of assets are fundamentally affected by critical trends as well as by shocks and seasonality. Figure 5.9 provides examples of trends, shocks and seasonality (DFID; Guidance Sheet – Section 2.2, 1999).

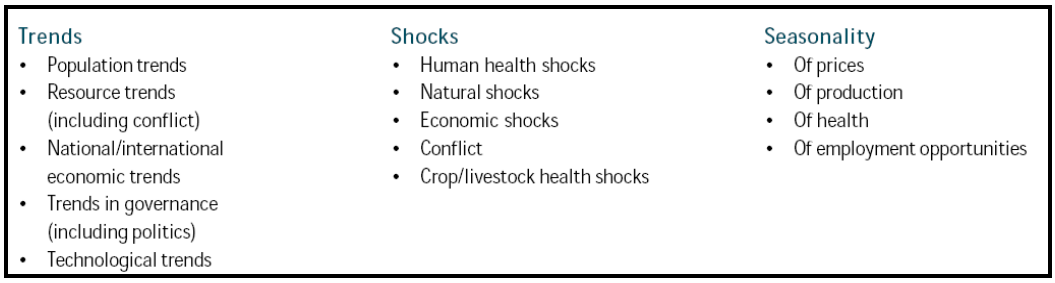


Figure 5.9 Vulnerability context
(DFID; Guidance Sheet – Section 2.2, 1999)

During PCA, living conditions within context of vulnerability was also discussed in the communities. People in each community were asked to group them into three groups to work on different components of the vulnerability context. Results are shown below.

5.2.3.1 Ranking the causes of impacts to mangrove forest and mangrove aquatic resources

People in three villages perceived that both human and natural activities have an impact on the mangrove forest. Strong wind and wave was listed from all three villages. The evidence of coastal erosion in these three communities can be also used to confirm their perceptions. Mangrove cutting was also found in the rank as a serious cause of mangrove degradation in these three communities (Table 5.8).

Table 5.8 Ranking the causes of impacts to mangrove forest and mangrove aquatic resources

Ban Kong Khong	Ban Pak Nam Pak Phaya	Ban Talad Has
1. Severe storm- damaged mangroves **2. Mangrove cutting** **3. Private sector** - Cause of decrease in catch as they cannot survive in low quality of water contaminated by waste water discharged from industrial plants - Cause of loss in mangrove area for different purposes - Waste from shrimp farm may be cause of reduction in catch from mangrove forest	1. Strong wave cause of coastal erosion 2. Strong winds and storms 3. Mangrove cutting 4. Low survival rate of mangrove seedlings planted because of boat, big poles, strong winds 5. Discharged Waste water from industrial plants and town to canal nearby mangrove forest 6. People throw waste and rubbish into canal nearby mangrove forest	1**. Human** - Mangrove cutting - Shrimp farm - Waste from shrimp farm may be cause of reduction in catch from mangrove forest - People throw waste and rubbish into canal nearby mangrove forest - Discharged Waste water from industrial plants and town to canal nearby mangrove forest - Use of illegal fishing gear - Fishing in breeding season **2. Natural hazard** - Strong storms and wave create coastal erosion - Flooded area by raised sea water level

Water pollution is another problem perceived by all three communities as they believe that the problem was caused by untreated water discharged from both town and industrial plants near the study areas. Waste from shrimp farms was present in the rankings of Ban Kong Khong and Ban Talad Has. Rubbish was also found in the canal near to mangrove forests as mentioned by people in Ban Pak Nam Pak Phaya and Ban Talad Has. Some other causes of impacts to mangrove forest and mangrove aquatic resources can be found in Table 5.8.

5.2.3.2 Trend line of natural resource quantity, economy, social relation, conflicts in different periods

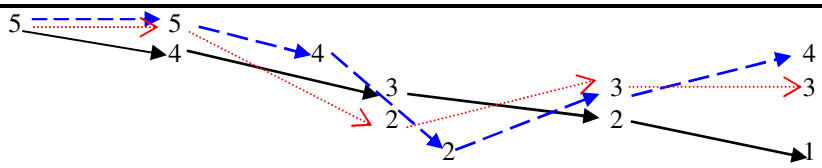
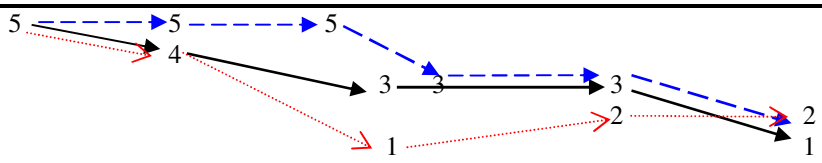
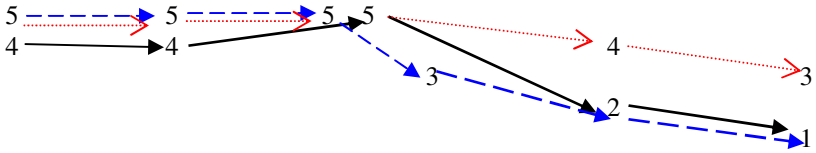
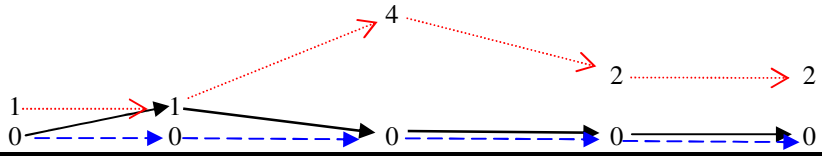
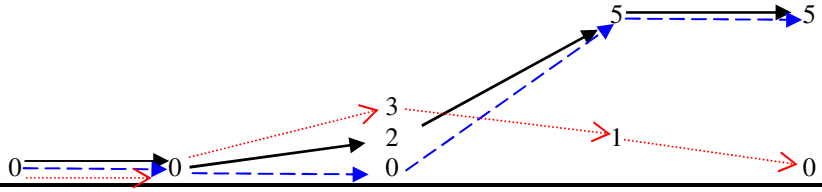
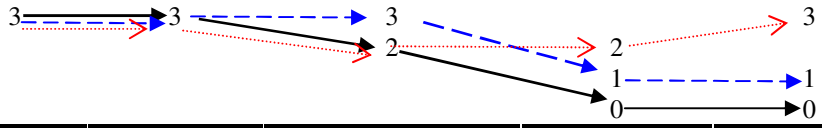
To develop trend lines of natural resource quantity, economy, social relation, conflicts in the communities, we have first reviewed the secondary data to find out types of shocks that occurred in the study areas in the past to use as referenced periods in the trends. Shocks that probably gave impacts on situation of people's livelihoods and mangrove forest in the past were found as:

In 1962	Typhoon "Harriet" with wind speeds over 90 km/hr swept through the province during October 24-25. Laem Talumpuk was swept clean. More than 1,000 people lost their lives and 422 were injured.
In 1970	Mangrove forest areas were cleared for shrimp farming.
In 1989	Thai government launched the Cabinet Resolution on August 1st, 1989 – The reservation and protection for mangrove forest areas in Surat Thani and Nakhon Si Thammarat Provinces.
In 1995	Dam was constructed.

Participants in PCA were asked to brainstorm and discuss the trend lines of six topics in different periods based on the shocks identified above. These six topics are; 1) Mangrove forest area in the communities, 2) Catch amount, 3) Economic situation in the communities, 4) Level of conflicts among local people in the village, 5) Level of conflicts between local people and government, and 6) Level of Appreciation for efficiency of government work. To indicate the situation of the topics, participants gave scores ranging between 0 and 5; (0=None, 1=Very low, 2=Low, 3=Medium, 4=High, 5=Very high). Then lines were drawn to see observe the trends over time. Different trend lines of six topics from three communities are summarized in Table 5.9.

Only people in Ban Kong Khong perceived that mangrove forest area has declined continuously since the period before storm occurred (1962) until at present. The other two communities have perceived that after the cabinet resolution was launched in 1989 mangrove area has increased. People in Ban Pak Nam Pak Phaya divided shrimp farming system into two periods which are extensive farming and intensive farming. They gave comment that the real reason for the destruction of mangrove forest area in their community is intensive shrimp farming, because in the beginning people used extensive shrimp farm system in areas where the mangrove forests were growing. After the intensive farming system was promoted to the area, mangrove forests in the ponds were cut in order to apply intensive system in their ponds.

Table 5.9 Trend line of natural resource quantity, economy, social relation, conflicts in different periods

Items/ Shocks	Before the storm occurred	After storm- Before shrimp farm started	After shrimp farm started – Before resolution declared	After resolution declared – Before dam constructed	After dam constructed – After present
			Extensive / Intensive		
1) Mangrove forest area in the communities					
2) Catch amount					
3) Economic situation in the communities					
4) Level of conflicts among local people in the village					
5) Level of conflicts between local people and government					
6) Level of Appreciation for efficiency of government work					

0=None, 1=Very low, 2=Low, 3=Medium, 4=High, 5=Very high

Ban Kong Khong
Ban Pak Nam Pak Phaya
Ban Talad Has

People in three communities had the same perceptions that catch amount they can collect from mangrove forest are decreasing when compared to the situation in 1962. Catch amount rapidly decreased in particular during shrimp farming period.

An interesting result we found is that people in all communities perceived that their economic situation has been worse since government launched the cabinet resolution in 1989. However, they all accepted that this resolution has helped to increase the mangrove forest area. Many rules and regulations were used in the area after the resolution was declared.

There are no conflicts in the communities found at the present in Ban Kong Khong and Ban Pak Nam Pak Phaya. People in Ban Talad Has mentioned that conflicts especially about competition for land use have been occurred since shrimp farm was started in 1970 in the community. Such conflict in the community still exists but only at a low level.

People in Ban Kong Khong and Ban Pak Nam Pak Phaya accepted that the conflicts between local people and government have been started since the resolution was declared in 1989. This is why trend lines of level of appreciation for efficiency of government's work that were drawn by the two villages have been decreasing since 1989. Only Ban Talad Has has opposite trends for these two topics compared to the other two communities (Table 5.9).

5.2.3.3 Seasonal calendar of activities related to mangrove ecosystem

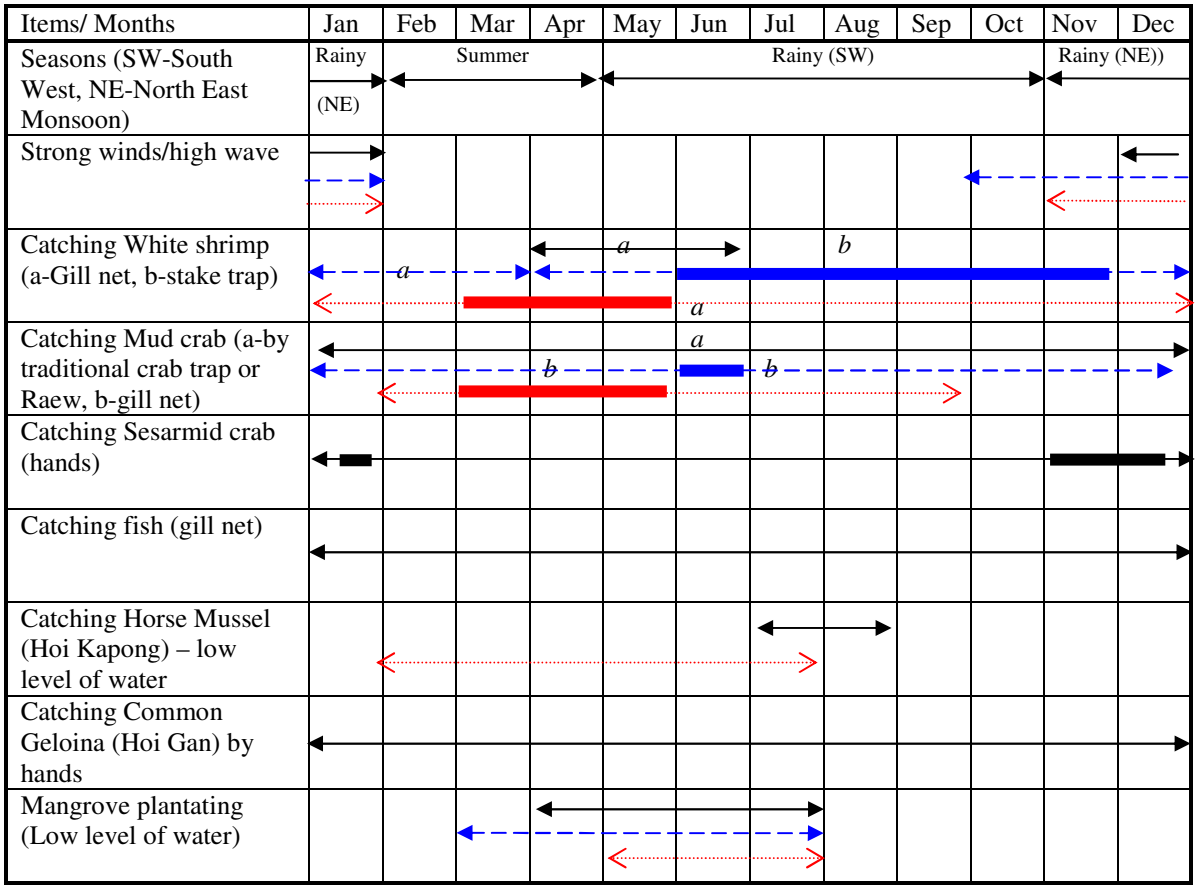
Seasonal calendars through out a year were developed during PCA conducted separately for the three communities. Three calendars were combined in the calendar shown below (Table 5.10).

In Nakhon Si Thammarat, there are two seasons, which are (1) summer season from February to April and (2) rainy season from May to January. South West monsoon has an impact from May until October and North East monsoon has an influence from November until January.

During the strong winds or high wave in the rainy season caused by the North East monsoon, fishermen cannot go fishing far from the shore by boat. However, people are not vulnerable because of such strong winds or waves because at this period they usually looked for other alternative livelihoods such as collecting aquatic fauna near the shore, inside canals or in the mangrove forest. There are many different activities that people can go fishing throughout the whole year e.g., catching White shrimp, Mud crab, Sesarmid crab, fish, and Common Geloina (Hoi Gan). Large amounts of White shrimp collected by stake trap for fishers in Ban Pak Nam are caught in the period from June to November while large volumes are collected by gill net by fishermen in Ban Talad Has in the period from March to May. People in Ban Talad Has caught the highest amount of Mud crab in the period from March to May while in June for people in Ban Pak Nam Pak Phaya. Whole year round, people in Ban Kong Khong can catch sesarmid crab, which was ranked as the most important goods derived from mangrove forest in the previous part. Large amounts of sesarmid crabs can be collected in rainy season from November to

January. Mangrove seedlings are usually planted when there is low level of water which is in March to July (Table 5.10).

Table 5.10 Seasonal calendars of activities related to mangrove ecosystem



5.2.4 Assessment of specific gender issues

During the PCA, we adapted the Gender Analysis Framework (Table 5.1) which was designed by DFID Infrastructure Department (1999) to the livelihoods of people based on these 3 aspects:

1) Mapping of community assets (natural, physical, financial, human, and social)
2) Perceptions of people about the roles and responsibilities, power, and decision-making
3) Ranking their needs and priorities

5.2.4.1 Mapping of community's assets

In each community, participants were asked to draw a map of the community's assets including natural, physical, financial, human, and social assets. The focus of this activity was not the accuracy of the maps. We were interested in the differences in understanding between women and men about the assets that they have in their communities. As we used Gender Analysis Framework as a guideline, we divided participants into two groups; female and male groups. The output from this activity was two community assets maps developed by the female and male groups from each community as shown in Figure 5.10 – 5.15. The male and female representatives from each group were assigned to present their drawing to the whole group.

From the maps developed by different sexes in the three communities, the main difference in the views of women and men about their assets is that maps developed by women have less detail than maps developed by men. This is probably because, in their livelihoods, men usually work outside the household and see more things than women. This result is accord with the result we got from the next section, which is "perceptions of people about roles, responsibilities, power and decision-making".

Regarding the 5 assets; human, natural, financial, physical, and social, we observed some important points from the maps listed below:

- **Human assets**: We noticed that a picture of the school was obviously found in all maps from both women and men. Children in this generation can access the elementary school, which is an education service of the community and one of the human assets in the community.

- **Natural assets**: The mangrove forest area was drawn in all maps by both women and men as they have the perception that the mangrove forest is one of the most important natural assets for their livelihoods.

- **Financial assets**: All maps developed by men showed some important occupations such as fishery and aquaculture as we can see some boats and ponds on the maps. These occupations are important as they are sources of their incomes. While there are none of these pictures related to occupation on the maps developed by women.

- **Physical assets**: The map of female participants in Ban Kong Khong showed some jars or water containers near by their houses. During the presentation they explained that there is no supply water system in the community and people have to collect water in these water containers to use in dry season. We have presented this problem in the "assessment of community's assets section earlier. The other two communities can access water supply system provided by the government.

- **Social assets**: The temple and mosque can be considered as the places at which people in the community have met each other as a group. Some social activities are conducted at the temple and mosque. We can see the temple in the maps of women and men in Ban Kong Khong as most of them are Buddhists. While we can find mosque in other two communities as most of them are Muslims.

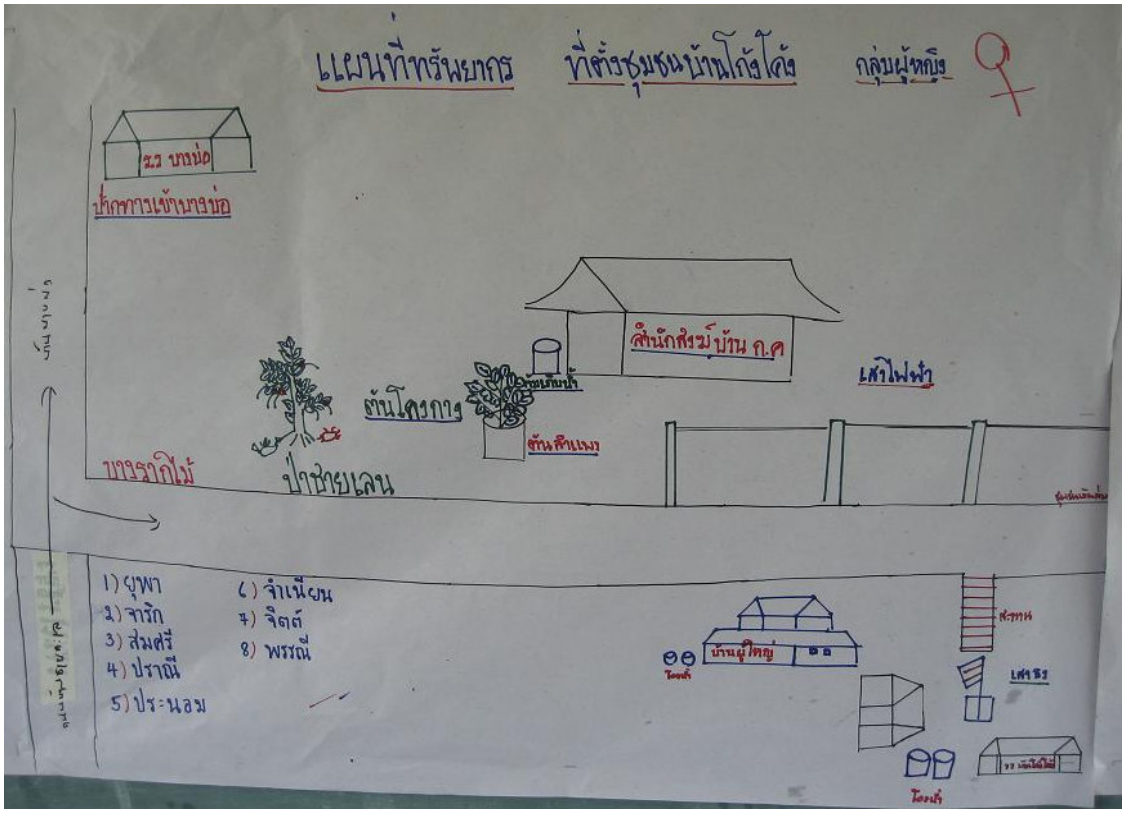


Figure 5.10 Asset map developed by female participants in Ban KongKhong, PakPhanang FangTawanOk Subdistrict, PakPhanang District

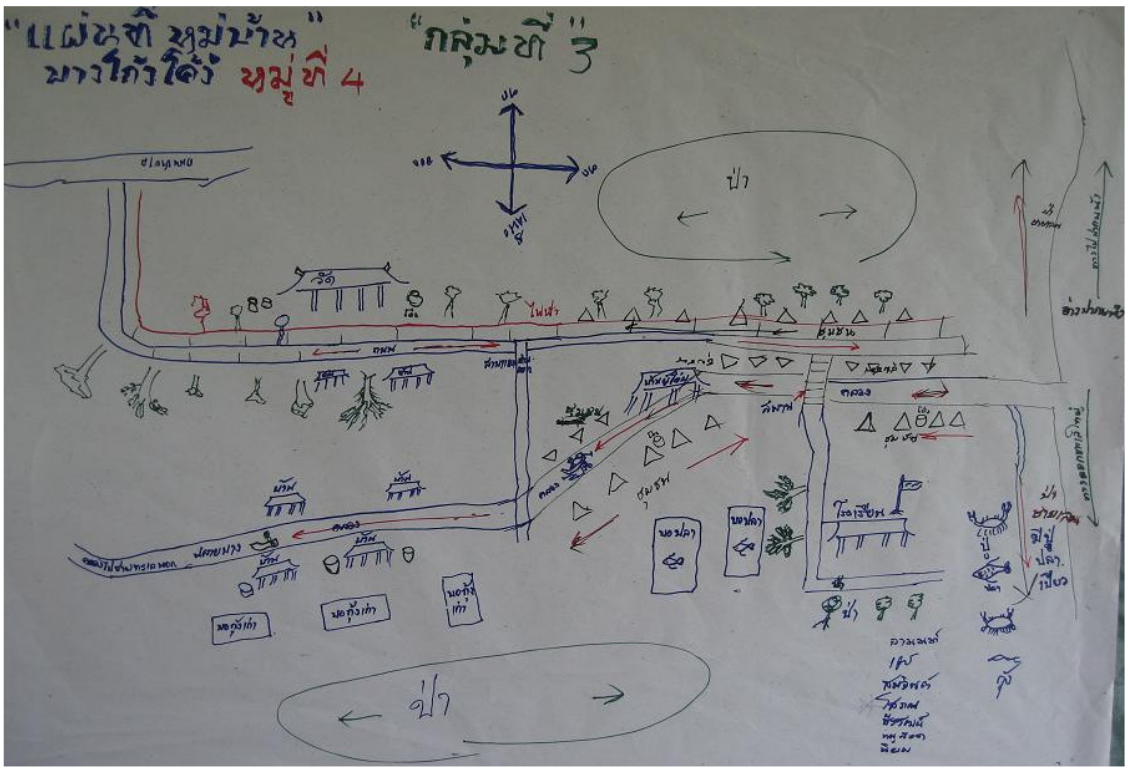


Figure 5.11 Asset map developed by male participants in Ban KongKhong, PakPhanang FangTawanOk Subdistrict, PakPhanang District

Figure 5.12 Asset map developed by female participants in Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District

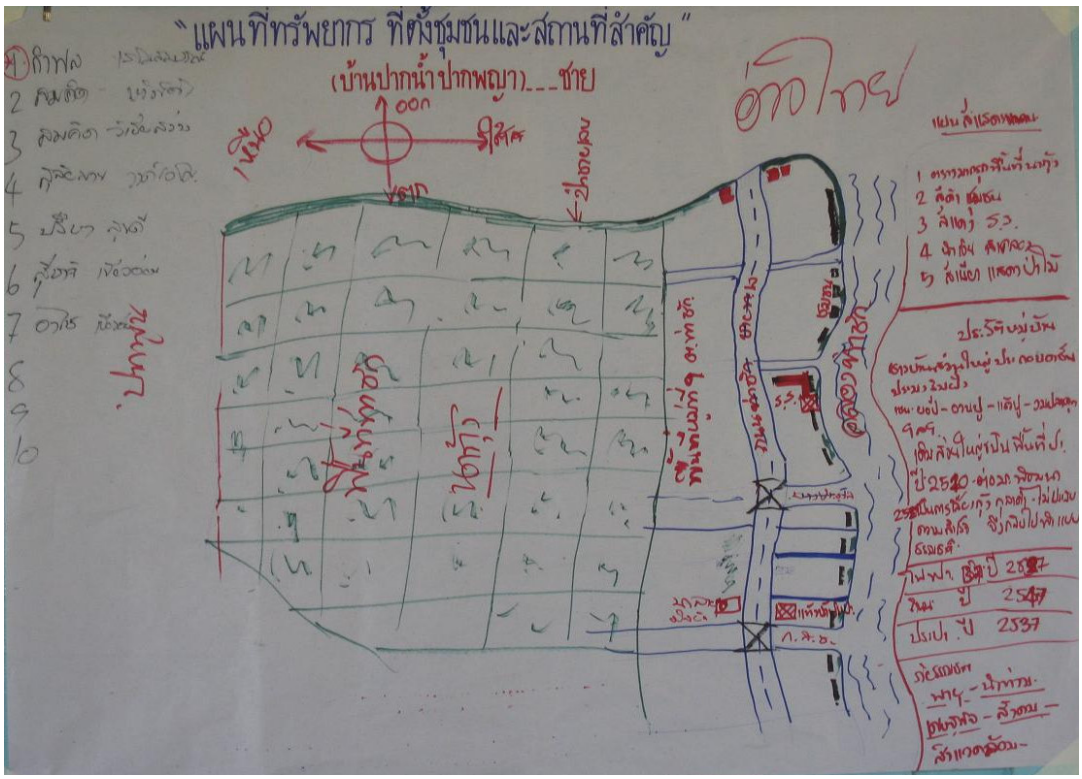


Figure 5.13 Asset map developed by male participants in Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District

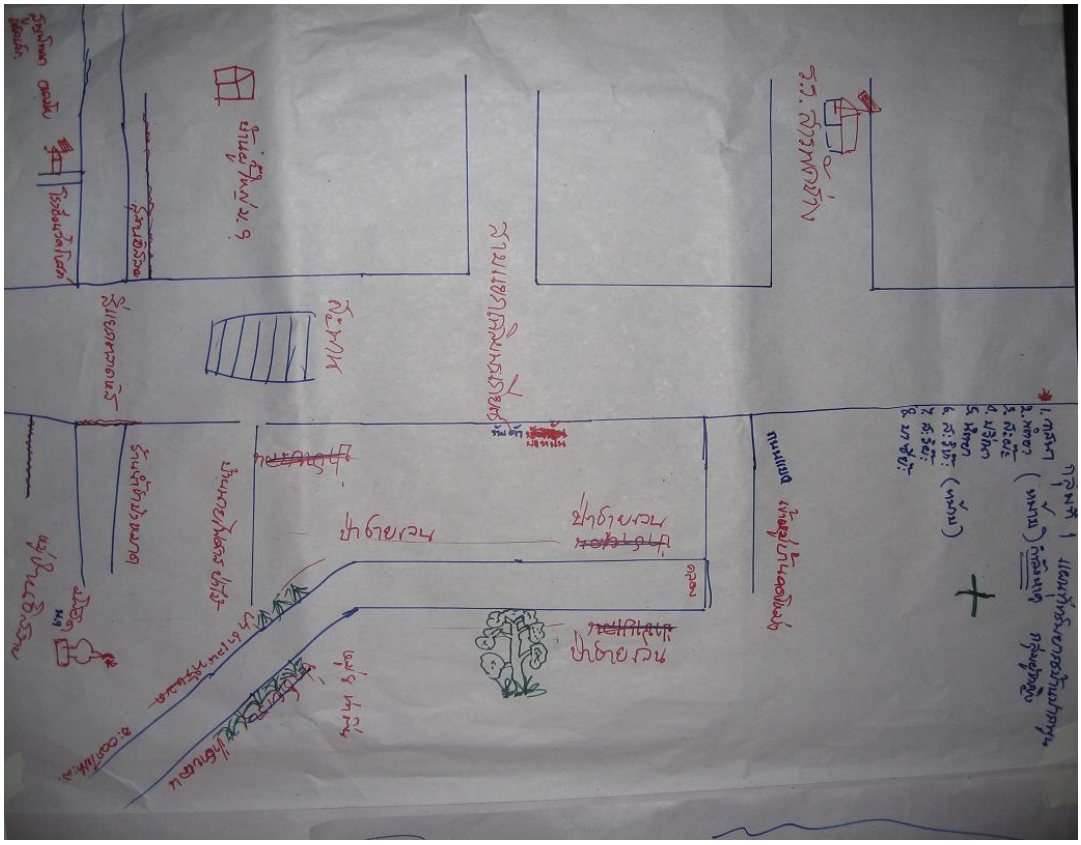


Figure 5.14 Asset map developed by female participants in Ban Talad Has, Pak Phun Subdistrict, Mueang District

Figure 5.15 Asset map developed by male participants in Ban Talad Has, Pak Phun Subdistrict, Mueang District

5.2.4.2 Perceptions of people about roles, responsibilities, power and decision-making

This section aims to understand roles, responsibilities, power, and decision making of men and women in the community. Questionnaires were distributed to participants during PCA with the aim to get more accurate data from all participants. After participants filled up the questionnaires we have concluded the result and presented during PCA meeting. Then we let participants exchange their ideas within the group. The results from the three communities are summarized and shown in Table 5.11.

Table 5.11 Assessment of specific gender issues

	% of respondents								
	Ban Kong Khong (n=33, m=14, w=19)			**PakNam Pak Phaya** (n=32, m=14, w=18))			**Ban Talad Has** (n=31, m=16, w=15)		
	M	W	E	M	W	E	M	W	E
Roles and responsibilities									
1. *Productive roles - work outside home* (paid work, self-employment, and subsistence production)	87.90	0.00	12.1	78.13	3.13	18.75	83.87	0.00	16.13
2. *Productive roles - work at home*	6.45	9.68	83.9	31.25	50.00	18.75	16.13	77.42	6.45
3. *Reproductive roles* (domestic work, child care and care of the sick and elderly)	0.00	100.0	0.00	3.13	84.38	12.50	6.45	90.32	3.23
4. Directly use mangrove goods	90.60	6.25	3.13	90.32	3.23	6.45	66.67	3.33	30.00
5. *Community participation/self-help* (voluntary work for the benefit of the community as a whole)	51.50	21.20	27.30	58.06	16.13	25.81	74.19	6.45	19.35
Power and decision-making									
6. *Household level* (e.g. decisions over household expenditure)	33.30	60.60	6.06	25.00	46.88	28.13	22.58	64.52	12.90
7. *Community level* (e.g. decisions on the management of community water supplies)	60.60	25.20	24.20	71.88	15.63	12.50	74.19	9.68	16.13

M= Perceive that man has more responsible/ role/ power
W= Perceive that woman has more responsible/ role/ power
E= Perceive that man and woman have equal responsible/ role/ power

Most respondents from all communities perceived that men are dominant in productive roles compared than women, especially for working outside home to earn money. Most people in Ban Pak Nam Pak Phaya (50.00%) and Ban Talad Has (77.40%) viewed that women also played a productive role from earning money by working at home. People in Ban Kong Khong believed that both men and women have an equal role for earning money. All respondents in Ban Kong Khong and most respondents in the other two villages (84.38% in Ban Pak Nam Pak Phaya and 90.32 in Ban Talad Has) agreed that women have a very important contribution to the reproductive roles e.g., domestic work, child care and care of the sick and elderly. Approximately 90% of Ban Kong Khong and Ban Pak Nam Phaya understand that usually men are the persons who

use mangrove goods directly while 30% of participants from Ban Talad Has responded that men and women use the goods equally. About 74.19% of respondents from Ban Talad Has, 58.06 % from Ban Pak Nam Pak Phaya, and 51.50% from Ban Kong Khong, answered that men in their community have participated in community activities more than women e.g., volunteer work or any community works. Most respondents from each community agreed that women have strong power in making decision in household level while men have more power in making decision in community level (Table 5.11).

5.2.4.3 Ranking the needs and priorities

We organised this activity with the assumption that men and women have different needs and priorities. All participants got 3 stickers (green for men and pink for women) with number 1, 2, and 3 on the stickers. Therefore, each participant had 6 points to vote for the priority of their needs. The highest score was given to the most important and the lowest score was given to the lowest importance. Needs and priorities of men and women are summarised in Table 5.12, 5.13, and 5.14.

As there is a problem about land ownership in Ban Kong Khong, finding a solution to this problem received the highest scores by both female and male participants in the village. The greatest difference in scores given by men and women was in the availability of help in finance and credit. Only 5.21% of total scores voted by men and 13.16% of total scores voted by women were given for this need (Table 5.12).

Termination of illegal fishing activity, especially calm racking, was voted as the highest priority in Ban Pak Nam Pak Phaya by both men and women. About 14.71% of total scores voted by men were given to seawall construction while only 3.13% of total scores voted by women were given to this need (Table 5.13).

Both men and women in Ban Talad Has agreed that increase in mangrove plantation is the most important need for their community. However, the second priority of men was the need to have healthy mangrove ecosystem while the second priority of women was development of mangrove zones (Table 5.14).

Table 5.12 Ban Kong Khong, Pak Phanang Fang Tawan Ok Sub district, Pak Phanang District (f = frequency)

Rank No.	Needs/ priorities	Men (n=16)		Woman (n=19)		Total (n=35)	
		Points	%	Points	%	Points	%
1	Solution for land title or land ownership	45	46.88	52	45.61	97	46.19
2	Increase in aquatic fauna	14	14.58	20	17.54	34	16.19
3	Sufficient water for household use	14	14.58	11	9.65	25	11.9
4	Availability of help in finance/credit	5	5.21	15	13.16	20	9.52
5	Improvement of infrastructure (Road)	6	6.25	7	6.14	13	6.19
6	Increase in mangrove plantation area	6	6.25	5	4.39	11	5.24
7	Security of occupation	6	6.25	2	1.75	8	3.81
8	Sufficient / availability of medicine	0	0.00	2	1.75	2	0.95
	Total	**96**	**100.00**	**114**	**100.00**	**210**	**100.00**

Table 5.13 Ban Pak Nam Pak Phaya, Ta Sak Subdistrict, Mueang District (f = frequency)

Rank No.	Needs/ priorities	Men (n=17)		Women (n=16)		Total (n=33)	
		Points	%	Points	%	Points	%
1	Termination of illegal fishing	27	26.47	23	23.96	50	25.25
2	Increase in mangrove plantation area	16	15.69	23	23.96	39	19.70
3	Provision of equipment for occupation + additional occupation	18	17.65	15	15.63	33	16.67
4	Conservation of mangrove forest in the community	5	4.90	13	13.54	18	9.09
5	Construction of seawall	15	14.71	3	3.13	18	9.09
6	Use some parts of mangrove woods/pools in mangrove forest	11	10.78	6	6.25	17	8.59
7	Increase in aquatic fauna	6	5.88	10	10.42	16	8.08
8	People's participation in rules and regulation related to mangrove ecosystem	2	1.96	3	3.13	5	2.53
9	Land for agriculture	2	1.96	0	0	2	1.01
	Total	**102**	**100.00**	**96**	**100.00**	**198**	**100.00**

Table 5.14 Ban Talad Has, Pak Phun Subdistrict, Mueang District (f = frequency)

Rank No.	Needs/ priorities	Men (n=14)		Women (n=14)		Total (n=28)	
		Points	%	Points	%	Points	%
1	Increase in mangrove plantation area	26	30.95	22	26.19	48	28.57
2	Healthy mangrove ecosystem	21	25.00	10	11.90	31	18.45
3	Termination of mangrove cutting in the community	10	11.90	11	13.10	21	12.50
4	Need to get knowledge about mangrove ecosystem	10	11.90	10	11.90	20	11.90
5	Increase in mangrove plantation area	12	14.29	6	7.14	18	10.71
6	Development of mangrove zonation	3	3.57	14	16.67	17	10.12
7	Participation in mangrove conservation	2	2.38	11	13.10	13	7.74
	Total	**84**	**100.00**	**84**	**100.00**	**168**	**100.00**

SECTION 6
INSTITUTIONAL AND STAKEHOLDER ANALYSIS

This section is developed with the aim to achieve Objective 5: to examine and discuss with stakeholders about institutional, policy and legal frameworks and Objective 6: to establish dialogue with key stakeholders, describe and understand their role and position

Information presented in section 6.1 and 6.2 was mostly taken from the special study report of Miss Sirisuda Jumnongsong. The report was developed for her Doctoral. study at Asian Institute of Technology in 2005. She interviewed a key person, Mr. Viroj Teratanatorn, from Department of Marine and Coastal Resources (DMCR) and accessed the information from DMCR website, particularly the organizational chart of DMCR and Cabinet's resolutions. The responsibility and organizational chart of RFD were also examined in her special study in order to see the different responsibilities between the DMCR and Royal Forest Department (RFD) about mangrove forest management (Jumnongsong, 2005).

In addition, discussion and interviews with the key person from DMCR was undertaken again during the development of this Work Package 1 for MANGROVE Project.

6.1 Main organisations for mangrove forest management in Thailand

The main agency responsible for mangrove forest management before the reformation of the Thai government system in 2002 was the Mangrove Resource Conservation Bureau under the Royal Forest Department (RFD) mandated by the Ministry of Agriculture and Cooperatives (MOAC). After the reformation a new ministry, the Ministry of Natural Resources and Environment (MONRE), was created. The Mangrove Resource Conservation Bureau was moved to the Department of Marine and Coastal Resources (DMCR) under MONRE. The RFD was also moved to MONRE. At present, the Mangrove Resource Conservation Bureau under the DMCR still has the main responsibility to manage mangrove forest in Thailand. Its missions and responsibilities are as follows: (1) Conservation and rehabilitation of mangrove resources, (2) Extension and development of mangrove forest, (3) Protection and supervision, and (4) Academic. However, the RFD also has responsibility of the Forest Act B.E. 2484 (1941) for protection and supervision in which the Provincial Offices represent central administration for inspection in provincial level.

6.2 Policies and laws related to mangrove forest management in Thailand

There were 10 acts related to mangrove forest management as presented in the timeline below. At present, there are 29 resolutions related to mangrove forest exploitation, conservation and preservation. These resolutions involve different government agencies, each reflecting a different approach of mangrove forest management. Most of the Cabinet's resolutions are related to the measures for mangrove forest utilisation and they have been launched since the first resolution on January 4th, 1966 until the resolution on October 17th, 2000. The government has a firm and persistent policy for mangrove forest conservation since 1978 (B.E. 2521). Several acts related to mangrove forest management were developed in Thailand. Policies and action plans were

also included in the timeline. Timeline of vital policies and laws related to mangrove forest management in Thailand were collected and summarized in Table 6.1.

Table 6.1 Timeline of policies and laws about mangrove forest management in Thailand

No.	Year	Description
1	1938 (B.E. 2481)	National Forest Reserve Act (NFR) B.E. 2481 (1938).
2	1941 (B.E. 2484)	Forest Act (FA) B.E. 2484 (1941)
3	1947 (B.E. 2490)	Fishery Act B.E.2490 (1947)
4	1961 (B.E. 2504)	National Park Act B.E 2504 (1961)
5	1964 (B.E. 2507)	National Forest Reserve Acts (NFR)
6	1964 (B.E. 2507)	Plant Quarantine Act B.E. 2507 (1964)
7	1966 (B.E. 2509)	C.R on Jan 4th, 1966: *"Permission on 15- Year Mangrove Concession Grants"*
8	1967 (B.E. 2510)	Minerals Act B.E. 2510 (1967)
9	1978 (B.E. 2521)	C.R on June 27th, 1978: "*Report on Environmental Impact Assessment on Mangrove Forests for Community and Fishing Port Development Project in TaMaLang Village, Mueang District, Satun Province*".
10	1980 (B.E. 2523)	C.R on August 19th 1980: "*Mangrove Forest Utilization Measures*". Four measured are added from the cabinet's resolution on 27 June, 1978.
11	1982 (B.E. 2525)	C.R. on June 29th, 1982: "*the Measures for Mangrove Forest Utilization by Government Sector*"
12	1983 (B.E. 2526)	C.R on Aug 9th, 1983 (B.E. 2526) on *"Extension of Permission on 15- Year Mangrove Concession Grants* "
13	1983 (B.E. 2526)	Land Development Act B.E. 2526 (1983) s
14	1984 (B.E. 2527)	C.R on May 1st 1984: "*the Recommendations from the 4th Seminar on Mangrove Ecosystem*"
15	1987 (B.E. 2530)	C.R on Dec 15th, 1987: "the G*uideline of Mangrove Forest Zonation*" (1) Conservation Zone, (2) Economic Zone A, and (3) Economic Zone B
16	1989 (B.E. 2532)	C.R on June 6th 1989: "the Consideration of problems related to high cost of raw materials for animal feed production, coastal culture, and impacts on implementation in National Reserved Forest, Khlong Tapao Subdistrict, Sanam Chai Khet District, Chachoengsao Province.
17	1989 (B.E. 2532)	C.R on Aug 1st 1989: "*the Reservation and Protection for Mangrove Forest Areas in Surat Thani and Nakhon Si Thammarat Provinces*".
18	1990 (B.E. 2533)	C.R on Feb 6th 1990, "*Resolving the Mangrove Forest Encroachment in Eastern Thailand*"
19	1990 (B.E. 2533)	C.R on Feb 27th, 1990; "*the Recommendations from the 6th Seminar on Mangrove Ecosystem*"
20	1991 (B.E. 2534)	C.R on June 4th 1991; "*the Urgent Measures for Coastal Resources Concerning Mangrove and Corals 1992-1993*"
21	1991 (B.E. 2534)	C.R on July 23rd 1991; "*the Study Report on the Present Situation of Mangroves and Corals in Thailand*"
22	1992 (B.E. 2535)	Enhancement and Conservation of National Environmental Quality Act B.E. 2535 (1992)
23	1992 (B.E. 2535)	Wildlife Conservation and Protection Act B.E. 2535 (1992)
24	1992 (B.E. 2535)	C.R on Feb 17th 1992; "*the Resolution of the National Environment Board on the Policy, Measures and Working plan for Coastal Resources and environment Management of Thailand*"
25	1993 (B.E. 2536)	C.R on April 27th 1993; "t*he Environmental Policies and Management Plan 1994"*.
26	1996 (B.E. 2539)	C.R on July 16th 1996; "Impacts on Environment from shrimp culture in Thailand resulting from the 4th meeting of the Sustainable Development Committee"
27	1996 (B.E. 2539)	C.R on Nov 19th 1996; "*Cancellation of concession in mangrove forest area*"
28	1997 (B.E. 2540)	C.R on Feb 25th 1997; "*the Reconsideration on the cabinet resolution on July 23rd 1991 that stops all utilization activities in mangrove forest areas*"

C.R. = Cabinet's Resolutions available downloaded from www.dmcr.go.th: Oct 5, 2005. *(In Thai)*
(Source: Jumnongsong, 2005 based on data compiled from different sources mainly from website of Department of Marine and Coastal Resources: www.dmcr.go.th)

Table 6.1 Timeline of policies and laws related to mangrove forest management in Thailand (Cont.)

No.	Year	Description
29	1997 (B.E. 2540)	C.R on July 15th 1997; "*the Resolution of the Southern Coastal Areas Development Board No. 2nd"*
30	1997 (B.E. 2540)	C.R on Oct 7th 1997: "*the Resolution of the National Environment Board and the Present Situation of Mangrove Forests and Mangrove Forest Management Plan of the country.*
31[1]	1997 (B.E. 2540)	The Constitution of the Kingdom of Thailand, B.E 2540 (1997)
32[2]	1998 (B.E. 2541)	The 1st National Biodiversity Strategies and Action Plan (NBSAP) (1998–2002)
33	1999 (B.E. 2542)	Plant Variety Protection Act B.E. 2542 (1999)
34	2000 (B.E. 2543)	C.R on Oct 17th 2000: "*the Resolution of the National Board of Forestry Polices on Resolving Problems in Mangrove Forest Areas"*
35[3]	2001 (B.E. 2544)	The 9th National Economic & Social Development Plan (2002 – 2006)
36[2]	2002 (B.E. 2545)	Cabinet on June 11th , 2002; The 2nd National Biodiversity Strategies and Action Plan (NBSAP) (2003-2007)
37	2002 (B.E. 2545)	Reformation of government structure
38	2003 (B.E. 2546)	In 2003 a broad mangrove forest project was initiated to commemorate the 72nd birthday of Her Majesty Queen Sirikit.
39[4]	2004 (B.E. 2547)	The Thai Millennium Development Goals (MDGs), and MDG Plus 2004
40	Late 2004 (B.E. 2547)	5-year Action Plan for Mangrove Forest Management in the Gulf of Thailand
41[5]	2005 (B.E. 2548)	Policy of the Thai government: Policy statement of the government of His Excellency Thaksin Shinawatra Prime Minister of Thailand: Delivered to the National Assembly on Wed, Mar 23rd, 2005
42	At present	Development of National Action Plan for mangrove forest is still going on.

C.R. = Cabinet's Resolutions available downloaded from www.dmcr.go.th: Oct 5, 2005. *(In Thai)*
(Source: Jumnongsong, 2005 based on data compiled from different sources mainly from website of Department of Marine and Coastal Resources: www.dmcr.go.th)

6.3 Stakeholder analysis for MANGROVE Project in Thailand

The Venn diagram in Figure 6.1 was developed by the team members of the Thailand partner as well as discussion with key persons in DMCR. The diagram presented the relationship between different organizations related to mangrove management in Thailand especially for the MANGROVE Project site in Pak Phanang District, Nakhon Si Thammarat Province. The size of the circle is related to the influence of the group while position of a circle is relative to the influence of the group on the project. The larger the circle the greater the influence the group represented by that circle has on mangrove management. Circles inside the boundary represent internal groups. Circles overlapping the boundary are external groups involved in some aspects of mangrove forest management in the communities.

[1] King Prajadhipok's Institute Website. <http://www.kpi.ac.th/en/con_th.asp>: Nov 3, 2005>
[2] Office of Environmental Policy and Planning (OEPP), 2002
[3] Thailand Investor Service Center (TISC) website:
<http://www.thailandoutlook.com/thailandoutlook1/government+policy/>: Accessed on November 1, 2005.
[4] *NESDB and UNRC, 2004*
[5] Royal Thai Embassy Website.
<http://www.thaiembdc.org/politics/govtment/policy/55thpolicy/index_e.html>: Accessed on Nov 1, 2005

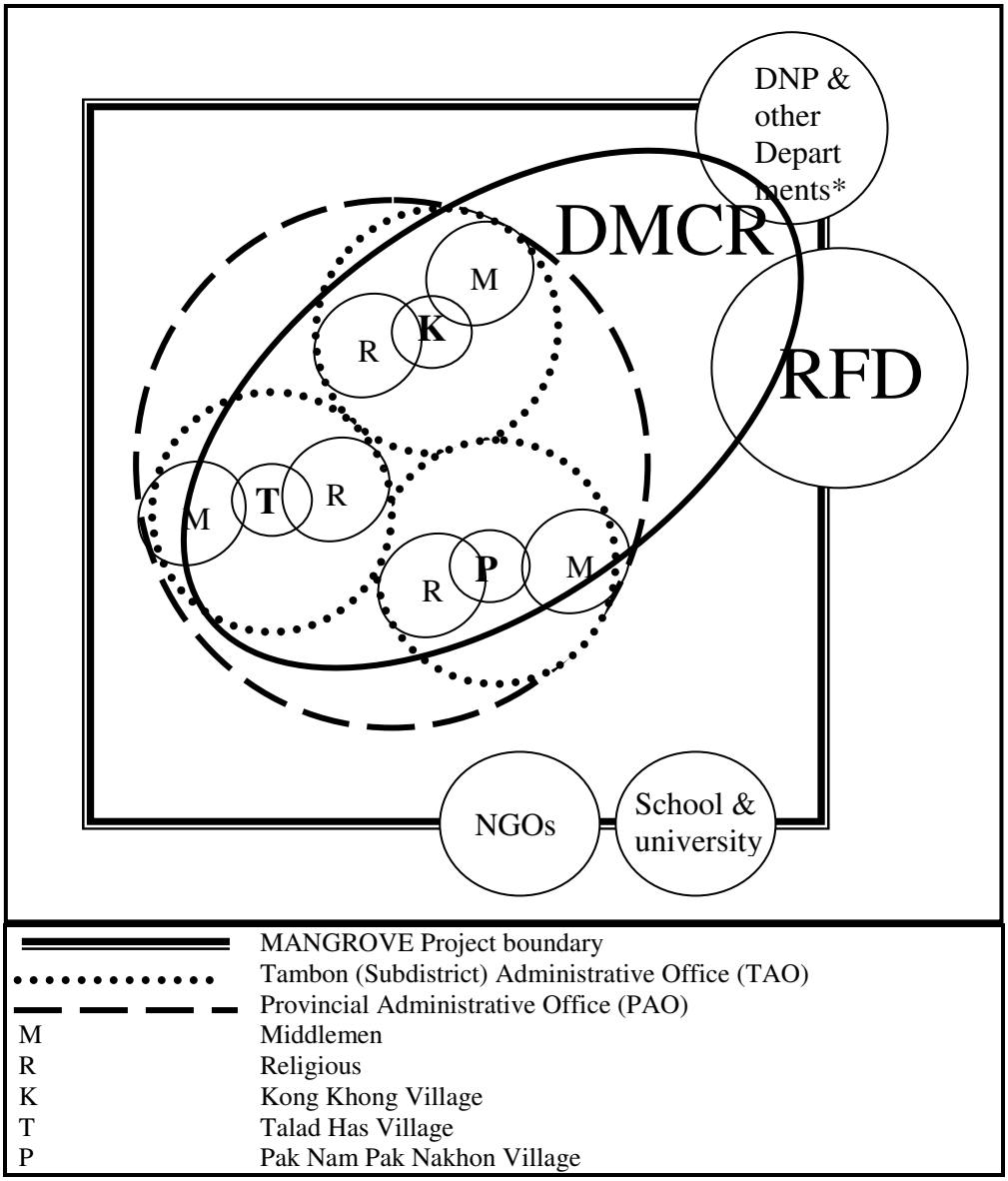


Figure 6.1 Vien diagram showing relationship of stakeholders of MANGROVE Project in Thailand

The rectangle represents the MANGROVE Project boundary. The three communities of Ban Kong Khong, Ban Talad Has, and Ban Pak Nam Pak Phaya are represented by the small circles with the letters K, T and P respectively. These small circles are in the centre of the project boundary, because they are important stakeholders in the project. However, the circles are small because of the small influence they have on decision making in mangrove management in the area. Within each of the three communities there are two main groups that are involved in the Project - a religious group and the middlemen group. The influence of these two groups on mangrove management does not vary significantly between the three communities. The circles of the three Tambon Administrative Offices; Pak Phanang Fang Tawan Ok Subdistrict, Ta Sak Subdistrict, and Pak Phun Subdistrict cover the Ban Kong Khong village, Ban Talad Has village, and Ban Pak Nam Pak Phaya village respectively. These TAOs have responsibility for each of the communities. However, the work of these three TAOs is

covered by the mandate of Nakhon Si Thammarat Provincial Administrative Office (PAO). The circle representing the influence of the PAO covers all three of the TAO and the communities within the TAO. They are all covered by the mandate of the PAO. The DMCR, which has overall responsibility for mangrove conservation, is central to the project and has the largest influence as indicated by the size of its circle. RFD and other departments particularly National Park, Wildlife and Plant Conservation Department (DNP) as well as NGOs, school and university are the external groups with an interest in the mangrove conservation project. The level of their influence on the project differs according to their sizes as presented in the diagram (Figure 6.1). Lists of stakeholders in different groups (people, government, and NGOs) were presented in Table 6.2.

Table 6.2 Stakeholder analysis for the MANGROVE Project in Thailand

People	Government/ Local administrative offices	NGOs

1st stakeholder
• People living in/around mangrove area
• Fisheries based in mangrove area (crap trap, gillnet, etc.)
• Mangrove products collectors
• Aquaculture (Shrimp fish, crab, soft shell crab, etc.)
 	
2nd stakeholder
• Fish processors
• Mangrove product processors
• Restaurant
• Traders/Market
• Resorts & recreational functions
	Local
	• Village head
	• Sub-district head
	• TAO (Tambon Administrative Office)
	• PAO (Provincial Administrative Office)
	• Department of Marine and Coastal Resource: Local office
	• Royal Forest Department: Local office
	• Department of Fisheries: Local office
	• Land Development Department: Local office
	• Provincial education office
	• Royal Irrigation Project: Local office
	
	Central
	• Ministry of Natural Resource and Environment
	  • Department of Marine and Coastal Resources
	  • Royal Forest Department
	  • National Park, Wildlife and Plant Conservation Department
	  • Office of Environmental Policy and Planning
	• Ministry of Agriculture and Cooperatives
	  • Land Development Department
	  • Department of Fisheries
	  • Royal Irrigation Department
	• Ministry of Information and Communications Technology
	  • National Statistical Office
	• National Research Council of Thailand
	• Ministry of Interior
	• Ministry of Health
	• Ministry of Education
	
	Academic Institutions
	• Kasetsart University
	• Walailuck University
	• Prince of Songkhla University
	• Local Technology Institutes
	• Primary & Secondary School
		• Pak Phanang Development Project
		• Community projects/ association
		• Thai Environmental Institute

REFERENCES

Aksornkoae, S., Papawasit, N., Angsupanich, S., Wattayakorn, K., Suwannodom, S., Siwaiphram, A. (ed.). 2004. Integrated Management of Mangrove Plantations for Development of Coastal Resources and Environment of Thailand. Thailand Research Fund (TRF). Bangkok. 684 pages. (in Thai).

Charuppat, T., and Charuppat. J. 1997. The Use of Landsat-5 (TM) Satellite Images for Tracing the Changes of Mangrove Forest Areas of Thailand. Royal Forestry Department. Bangkok. (in Thai).

CORIN and ONEP. 2003. Final Report on Management of Natural Resource and Environment in the Pak Phanang River Basin under the Royal Initiated Project. Coastal Resources Institute (CORIN), Songkhlanakarin University and Office of Natural Resource and Environmental Policy and Planning (ONEP). 262 pages. (in Thai).

Department for International Development (DFID) - Infrastructure Department. 1999. Siyanda-Mainstreaming Gender Equality Website, Accessed on April 30, 07: http://www.siyanda.org/docs_gem/index_sectors/infrastructure/in_tools1.htm

Department for International Development (DFID). 1999. Sustainable Livelihoods Guidance Sheets: Section 1.1. London. <www.livelihoods.org>

Department for International Development (DFID). 1999. Sustainable Livelihoods Guidance Sheets: Section 2. London. <www.livelihoods.org>

Department for International Development (DFID). 2000. Sustainable Livelihoods Guidance Sheets: Section 4.3. London. <www.livelihoods.org>

Department for International Development (DFID). 2001. Sustainable Livelihoods Guidance Sheets: Section 5. London. <www.livelihoods.org>

Department of Marine and Coastal Resource (DMCR). 2005. Mangrove Forest Area Data (Unpublished).

Department of Marine and Coastal Resource (DMCR). 2005. Mangrove GIS Database 2005. (Unpublished).

FAO. 1985. Mangrove Management in Thailand, Malaysia and Indonesia: FAO Environment Paper No. 4. Rome. Italy. 60 pages.

Jumnongsong, S. 2005. Status and Management of Mangrove Forest in Thailand (Special Study). School of Environment Resources and Development, Asian Institute of Technology, Thailand. Bangkok. 64 pp.

King Prajadhipok's Institute Website. <http://www.kpi.ac.th/en/con_th.asp>: Accessed on Nov 3, 2005>.

National Research Council of Thailand. 2002. Bibliography of Mangrove Research in CDROM 2002. (in Thai).

Office of Environmental Policy and Planning (OEPP). 2002. Thailand National Report on the Implementation of Convention on Biological Diversity. Ministry of Science, Technology and Environment. 60 pages.

Office of the National Economic and Social Development Board (NESDB) and United Nations Country Team in Thailand Office of the UN Resident Coordinator (UNRC). 2004. *Thailand Millennium Development Goals Report 2004*. 75 pages. UNDP Thailand. ISBN: 974-92198-3-X. UNDP Thailand Website. <http://www.undp.or.th/focusarea/mdg/index.html> Available downloaded on July 29, 2005.

Paphavasit, N., Termvicharkorn, A., Piumsomboon, A., Sivaipram, I., Somkleeb, N., Tongnunui, P., and Pannarak, P. 2004a. Fish Communities in Mangrove Plantation in Pak Phanang Bay, Nakhon Si Thammarat Province. *In*. Integrated Management of Mangrove Plantations for Development of Coastal Resources and Environment of Thailand. Thailand Research Fund (TRF). Bangkok. pp 346-352. (in Thai)

Paphavasit, N., Wichitwarakhun, W., Sivaipram, I., Piumsomboon, A., Wongkamhaeng, K., Salamul, S., Sikhantakasamit, B., Aumnuch, E., Pannarak, P., Teratanatorn, V., Phaitchart, S., and Wongchinvit, S. 2004b. Benthic diversity in Pak Phanang Mangrove Forests Nakhon Si Thammarat province. *In*. Integrated Management of Mangrove Plantations for Development of Coastal Resources and Environment of Thailand. Thailand Research Fund (TRF). Bangkok. pp 332-345. (in Thai)

Royal Thai Embassy Website. <http://www.thaiembdc.org/politics/govtment/policy/55thpolicy/index_e.html>: Accessed on Nov 1st, 2005.

Sobmore, P., Srijumphol, W., Sudtongkong, C. 2004. Population Dynamic of Grapsid Crabs *Sesarma (Chiromantes) eumolpe* in Ban Pak Nakhon Mangrove Forest, Nakhon Si Thammarat Province. *In*. Integrated Management of Mangrove Plantations for Development of Coastal Resources and Environment of Thailand. Thailand Research Fund (TRF). Bangkok. pp 379-390. (in Thai)

Thailand Investor Service Center (TISC) website: <http://www.thailandoutlook.com/thailandoutlook1/government+policy/>. Accessed on November 1, 2005.

Wattayakorn, G. 2004. Nutrient Status in Pak Phanang Bay, Nakhon Si Thammarat, Thailand. *In*. Integrated Management of Mangrove Plantations for Development of Coastal Resources and Environment of Thailand. Thailand Research Fund (TRF). Bangkok. pp 258-267. (in Thai)

Wattayakorn, G. and Saramul, S. 2004. Exchange of nutrients between Klong Paknakorn and Pak Phanang Bay, Nakhon Si Thammarat Province. *In*. Integrated Management of Mangrove Plantations for Development of Coastal Resources and Environment of Thailand. Thailand Research Fund (TRF). Bangkok. pp 250-257. (in Thai)