**Japan International Cooperation Agency**

**Office of the Permanent Secretary and**
**Agricultural Land Reform Office,**
**Ministry of Agriculture and Cooperatives,**
**The Kingdom of Thailand**

# DEVELOPMENT STUDY
# ON
# PLANNING AND CAPACITY BUILDING
# FOR
# NATURAL RESOURCES MANAGEMENT
# AND
# SUSTAINABLE RURAL AND
# AGRICULTURAL DEVELOPMENT
# IN THE NORTH THAILAND

# FINAL REPORT

**December 2007**

**SANYU CONSULTANTS INC.**

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# PREFACE

In response to a request from the Government of Thailand, the Government of Japan decided to conduct a study, the Development Study on Planning and Capacity Building for Natural Resources Management and Sustainable Rural and Agricultural Development in the North Thailand, and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Takanori TAKATSUKA of Sanyu Consultants Inc. between September 2004 and December 2007.

The team held discussions with the officials concerned of the Government of Thailand and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of the project proposed therein and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Thailand for their close cooperation extended to the study.

December 2007

MATSUMOTO Ariyuki
Vice-President
Japan International Cooperation Agency

December 2007

Mr. MATSUMOTO Ariyuki
Vice-president
Japan International Cooperation Agency
Tokyo, Japan

## Letter of Transmittal

Dear, Mr. MATSUMOTO,

We are pleased to submit herewith the Final Report on the Development Study on Planning and Capacity Building for Natural Resources Management and Sustainable Rural and Agricultural Development in the North Thailand. This Report was prepared with the advices and suggestions of the authorities concerned of the Government of Japan and your Agency. Also included were comments made by the steering committee chaired by the Ministry of Agriculture and Cooperatives (MOAC), and the related organizations and local people during the technical discussions on the draft final report which were held at Bangkok and Phrae province in October 2007.

The super goal of this Study is to realize proper management of natural resources and to improve livelihood of the rural population through sustainable agriculture and thus to contribute to poverty eradication in the North Thailand. The Study has been conducted in partnership with and by guidance from the Office of the Permanent Secretary and the Agricultural Land Reform Office, MOAC, and incorporated the views of the beneficiaries and other stakeholders such as Ministry of Natural Resources and Environment, relevant organizations and local government. The process of this Study centered on the following which themselves were the objectives of the Study:

1) To formulate the Master Programs in order to implement sustainable rural and agricultural development mainly in Land Reform Areas (LRAs) with people in the local community and related organization, promoting proper management of natural resources,
2) To implement pilot projects in the course of the Study mainly for capacity building of Thai counterpart personnel, related organizations and communities concerned, and
3) To carry out technology transfer to the counterparts personnel and related organizations through on-the-job training in the course of the Study.

To attain the above objectives, this Study was carried out in a phasing manner divided into three; namely, Phase I dealing with inventory survey and selection of four provinces for preparation of the draft Master Programs (M/Ps), and Phase II which was to prepare the draft M/Ps for the LRAs in the selected provinces and select the pilot project areas through situation analysis and participatory survey, and Phase III which was to implement the pilot projects and finalize the Master Programs based on the lessons learned from its implementation. The Phase I started in September 2004, and the Study itself completed in December 2007 upon presenting this Final Report.

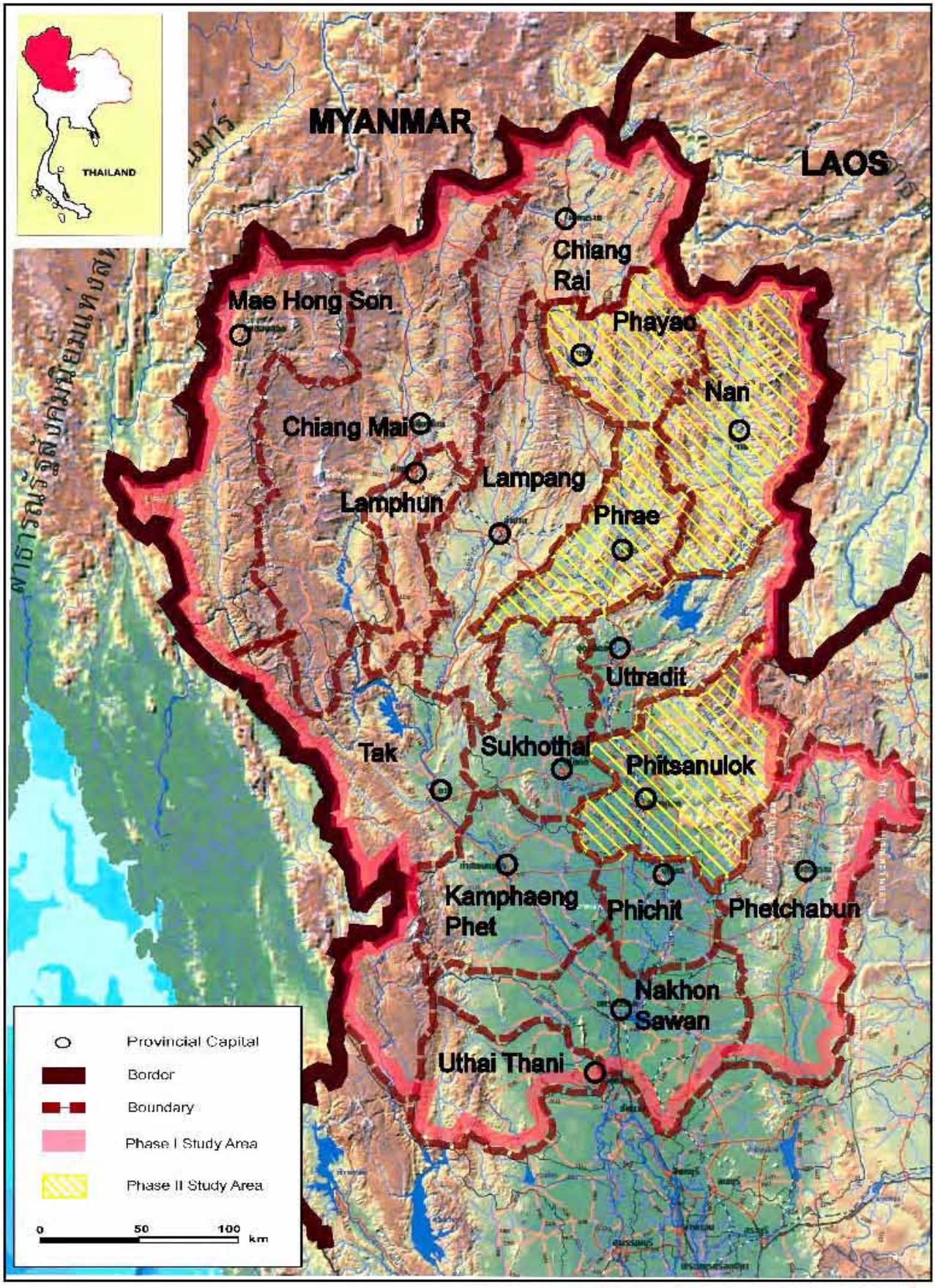
We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and relevant authorities of the Government of Japan. We also wish to express our deep gratitude to MOAC, the counterpart agency, in the Government of Thailand for the close cooperation and assistances extended to us during our investigation and study.

Very truly yours,

TAKATSUKA Takanori
Team Leader of the Study Team

# Location Map

## Development Study on Planning and Capacity Building for Natural Resources Management and Sustainable Rural and Agricultural Development in the North Thailand



# PART- I

# MASTER PROGRAM

# EXECUTIVE SUMMARY

## 1. BACKGROUND AND OBJECTIVES OF THE STUDY

### 1.1 Background

The forest area in Thailand is classified into three zoning areas, namely, conservation area (C zone) administratively under the Royal Forestry Department, agricultural area (A zone) and economic forest area (E zone). In compliance with the zoning, Agricultural Land Reform Office (hereinafter referred to "ALRO"), under the Ministry of Agriculture and Cooperatives (MOAC) distributes lands to landless farmers in the A zone and some areas of the E zone, but no distribution is allowed in the C zone.

Some farmers often immigrate into conservation forests to earn cash income due to unclear boundary lines of zonings and no strict control management systems. Many people who live adjacent to forest area face with difficult agricultural conditions caused by hilly or undulating lands. They cannot help utilize natural resources in the forests to generate incomes, implying that lack of income sources is the major cause of intrusion into conservation forests.

Under the conditions, the Japan International Cooperation Agency (JICA) dispatched as requested by Thai Government a Study Team in October 2004 to perform the study. ALRO and Agricultural Technology and Sustainable Agriculture Policy Division (hereinafter referred to "ATSAP") of Office of the Permanent Secretary (OPS), MOAC are the counterpart (C/P) agencies for the subject Study.

### 1.2 Objectives

The objectives of the Study are :

- To formulate the Master Programs (M/Ps) in order to implement sustainable rural and agricultural development mainly in Land Reform Area (LRA) with people in the local community and related organization, promoting proper management of natural resources
- To implement pilot project(s) in the course of the Study mainly for capacity building of Thai counterpart personnel, related organizations and communities concerned
- To carry out technology transfer to the counterpart personnel and related organizations through on-the-job training in the course of the Study.

### 1.3 Structure of the Study

The Study consists of three phases such as:

**Phase I: Inventory Survey**

- Inventory survey on natural resources and socio-economic situation for the 17 provinces in the North Thailand
- Identification of issues on natural resources management and sustainable rural and agricultural development
- Selection of four provinces for preparation of the draft M/P

**Phase II: Formulation of Draft Master Program (M/P)**

- Preparation of the draft M/P for the LRAs in the four provinces
- Preparation of the draft monitoring guideline for natural resources management
- Selection of pilot project areas for Phase III

**Phase III: Implementation of Pilot Projects**

- Implementation of the pilot projects
- Monitoring and evaluation on the implementation progress of the pilot projects
- Completion of the M/P and the guideline based on the lessons learned from the pilot projects implementation

### 1.4 The Study Area

The Study Area of the Phase I (Inventory survey) covered all the 17 provinces in the North Thailand. For the Phase II (Formulation of the draft Master Program), it covered the LRAs in the selected 4 provinces in the North Thailand. Pilot project areas including 7 tampons were selected from the LRAs of the 4 provinces for the Phase III (Implementation of the pilot projects).

## 2. PRESENT SITUATIONS OF THE NORTH THAILAND

### 2.1 Natural Resources

In the northern part of the region, the topographical feature is mountainous, hence, plains are scattered between the mountains. Daen Laos and Luang Phra Bang Mountain Ranges separate the country from the Union of Myanmar and the Democratic People's Republic of Laos. In the western part of the region, Thanon Thongchai Mountain Range lies from the north to the south. Plain areas with paddy cropping stretch over the southern part of the region.

Headwaters of several major rivers are in these mountain ranges. There are seven major river basins in the region, namely Ping, Wang, Yom, Nan, Khong, Salawin and Kok. Three of them (Khong, Salawin and Kok) are international rivers, which covers some areas in Laos and Myanmar.

According to the statistics (2000), the largest actual forest area is in Chiang Mai (nearly 16,000 sq. km.), followed by Tak (13,500 sq. km.) and Mae Hong Son (11,500 sq. km.). Nan and Lampang also have a relatively large forest area each (about 9,000 sq. km.), followed by Uttaradit, Phrae and Chiang Rai, in the range of 4,500 - 5,500 sq. km. The six provinces of Phayao, Lamphun, Kamphaeng Phet, Sukhothai, Phitsanulok and Uthai Thani, have smaller areas, from 2,100 to 3,900 sq. km. The smallest areas of forest are again in the two provinces of Phichit and Nakhon Sawan (only 10 and 900 sq. km. respectively).

### 2.2 Socio-economic and Rural Conditions

According to the statistics on labor forces, a half of the labor force (51.6%) is engaged in an agriculture sector in the North Thailand. In Mae Hong Son, a remote and mountainous province, 83.1 % of labor forces work in the agriculture sector, although the total labor force size is the smallest.

On the other hand, in Lamphun and Chiang Mai, share of the agriculture sector is relatively low, 36.5 % and 35.9 %, respectively. The average per capita GPP of the North Thailand (39,402 Baht) is only a half of the national average (78,783 Baht).

From the statistics, the average monthly household income in the North Thailand is calculated as 9,530 Baht, which is much lower than the national average, 13,736 Baht. Concerning the monthly income of agricultural household, the average in the region is 7,874 Baht, and it is also lower than the national average, 8,753 Baht. Among the 17 provinces, four provinces (Kamphaeng Phet, Phichit, Uttaradit and Phetchabun) have higher income than others. Lower monthly income is found in Mae Hong Son, Tak, Nan and Phrae, less than 5,500 Baht.

In the North Thailand, 60 % of households have heavy debt. The average monthly debt amount per household in the region is 94,346 Baht, which represents 82.5% of the total income (114,360 Baht). Much heavier debt is found in Lamphun, Chiang Mai, Phitsanulok and Phichit. The total poor population under the poverty line is estimated at 1,114,328 in the North Thailand. The ratio of poor population to provincial population is higher in Tak, Mae Hong Son, Uthai Thani, where 23-30 % suffer poverty, while the lowest ratio, less than 1.0 %, is found in Kamphaeng Phet.

On average, safe drinking water is accessible for more than 80 % of households. Availability of the flush and molded bucket latrine is higher than that of the safe drinking water, more than 90 % of households. The rate of household using cooking facilities with gas or electricity is 52 %. This means that about a half of population still uses firewood and charcoal for cooking. Particularly in Mae Hong Son and Nan, more than 70 % of households rely on firewood from forest.

Motorcycle is an important means of transportation for rural people. On average, 70 % of households in non-municipal areas possess their own motorcycles. Comparing the provincial data, Mae Hong Son (44 %) and Tak (56.8%) are lower than the regional average. On the other hand, cars are owned by only one fifth of the rural households.

### 2.3 Agricultural Conditions

As for the average farm holding land per household, big differences are observed among the 17 provinces in the North Thailand. Phichit has the largest farm holding land per household, while Chiang Mai has the least, less than one forth of the Phichit. In the three provinces (Chiang Rai, Phitsanulok, Phichit), paddy land occupies more than two thirds of the agricultural land. In the four provinces which include Tak, Phetchabun, Nan and Kamphaeng Phet, upland crops land occupies about half of the agricultural land. In Lamphun and Chiang Mai, orchards are characteristic among the 17 provinces since the distribution ratios are 58% and 32% while the regional average is merely 15%.

From the viewpoint of cultivated crops, the 17 provinces are classified as follows.

| Crop group | Distinctive crops | Provinces |
|---|---|---|
| Paddy | Major rice | Lampang, Chiang Rai, Phayao |
| | Second rice | Phitsanulok, Phichit |
| Upland crops | Maize/mungbeans | Tak, Sukhothai, Nan, Phetchabun |
| | Cassava/sugarcane | Kamphaeng Phet, Uttaradit, Nakhon Sawan, Uthai Thani |

| Crop group | Distinctive crops | Provinces |
|---|---|---|
| | Soybeans | Mae Hong Son, Phrae |
| Others | Longans/others | Lamphun, Chiang Mai |

From the viewpoint of animal population densities, the 17 provinces are classified as follows.

| Animal size | Distinctive animals | Provinces |
|---|---|---|
| Large | Cattle/buffaloes/swine | Mae Hong Son |
| Medium | Cattle | Lampang, Tak |
| | Swine/chickens | Phrae |
| | Swine/Native chickens | Lamphun, Chiang Mai |
| | Chickens | Chiang Rai, Phayao, Nan |
| Small | Duck | Phitsanulok, Phichit, Uthai Thani |
| Low livestock activities | | Kamphaeng Phet, Sukhothai, Uttaradit, Nakhon Sawan, Phetchabun |

## 2.4 Land Reform Area (LRA)

The LRAs in the 17 provinces are distributed on the designated lands of 11,373,000 rai (1,820,000 ha). These lands where the forests were deteriorated or already cultivated by farmers have been transferred from RFD to ALRO for land reform according to the Forest Act and the Agricultural Land Reform Act. Most LRAs are located on the flat to sloped lands at the foot of mountainous areas.

Population and household in the LRAs are estimated from the data of NRD2C (National Rural Database 2003) and GIS. The number of selected villages is 1,314 or 9% of the total 14,899 villages in the region. Total households are estimated at 152,075 with the population of 584,023, while the regional total is 1,849,848 with the population of 6,911,244. The average number of households per village is 116 (households) in the LRAs while the regional average is 124. Average family size is the almost same in the LRAs and region, 3.8 and 3.7 persons/family, respectively.

## 2.5 Theme of the North Thailand

The North Thailand is the most significant region in the country for management and conservation of natural resources from the following viewpoints.

- Forest area of the region represents more than half of the country's forest.
- There are origins of several major rivers in the country such as Chao Phraya.
- Forest functions as effective water retention areas for these major rivers.

On the other hand, the above results revealed the following features of the North Thailand.

- 80% of population of this region lives in rural areas and more than half of total population engages in the agricultural sector.
- Average monthly household income of this region (9,530 Baht, from the "Report of Household Income, 2003") is 30 % lower than that of the national average, 13,736 Baht.
- Average monthly household income of farmers is much smaller than others.

Considering all of these situations, following theme is significant for the North Thailand.

*"From the viewpoint of conservation of natural resources such as forest and land, it is essential to improve livelihoods of rural people through sustainable agriculture and rural development"*

Based on such understandings, it is required to integrate two notions, “proper natural resources management” and “sustainable agricultural and rural development”.

## 3. SELECTION OF THE FOUR PROVINCES FOR MASTER PROGRAM FORMULATION

### 3.1 Procedures for Selection

In order to select the four provinces for formulation of the M/P, following processes were taken.

1) First screening:

First screening process was taken to select candidate provinces. Parameters were chosen according to the selection criteria based on the problem analysis and were measured from the viewpoints of significance and potentiality of the M/P formulation. These parameters were compared among the 17 provinces and then candidate provinces were selected.

2) Second screening:

Reconnaissance was conducted in the candidate provinces to assess possibility of cooperation with provincial offices and local institutes including NGOs. Based on the reconnaissance result, the provinces were further screened, and necessary parameters were added to select the provinces. By taking these processes, selection of four provinces was finalized.

### 3.2 First Screening

Following data were chosen as parameters for first screening.

| Viewpoints | | Parameters to show seriousness of problems/issues |
|---|---|---|
| Proper natural resources management | | % of forest area to provincial land, Topography (land slope), River (elevation), Protected area, Community forest area |
| Sustainable agriculture and rural development | Rural development | Per capita GPP, % of poor population, Household income, Share of agricultural sector to GPP, Population density |
| | Agriculture development | Household farm holding land, % of irrigation land to farm land, Productive farm land use (paddy, field crops and vegetables, Fruits and tree crops), Livestock activity |
| Land Reform Areas | | Titled land size per household, % of LRAs to provincial land |

As the result of the first screening process with the discussions with the C/P personnel’s, 6 provinces, namely Chiang Rai, Phayao, Phrae, Nan, Uttaradit and Phitsanulok, were selected as the candidate provinces.

### 3.3 Second Screening

Field reconnaissance was conducted in the selected 6 candidate provinces to 1) evaluate the institutional capacities and willingness in terms of cooperation with the PLRO and other agencies concerned, 2) survey and confirm present situations of the LRAs in terms of significance of the M/P formulation, and 3) survey possibilities of future cooperation with local institutes and NGOs at provincial and local levels. The reconnaissance result was assessed by the C/P personnel and the Study Team with a rating score method. Finally four provinces (Phayao, Phrae, Nan and Phitsanulok) were selected for the M/P formulation in the Phase II.

## 4. PRESENT SITUATIONS OF THE FOUR SELECTED PROVINCES

### 4.1 Participatory Survey in the Four Provinces

In the beginning of the Phase II period, participatory survey was done to clarify the present situations of the LRAs by the local people, not by the outsiders, in several selected Tambons as shown below.

| Province | Total area (rai) | Selected PRA site | | | |
|---|---|---|---|---|---|
| | | Local administration | | Area (rai) | No. of Villages |
| | | Amphoe | Tambon | | |
| Phayao | 75,233 | Muang Phayao | Ban Mai | 9,748 | 9 |
| | | | Mae Ka | 2,830 | 18 |
| | 25,973 | | Mae Ka | 11,411 | |
| Nan | 44,289 | Tha Wang Pha | Jom Phra | 17,728 | 8 |
| | | | Yom | 4,897 | 8 |
| Phrae | 132,241 | Long | Bor Lek Long | 29,043 | 8 |
| | | | Thung Laeng | 48,973 | 10 |
| Phitsanulok | 148,578 | Chattakan | Ban Dong | 75,679 | 14 |

The Participatory Survey Report revealed that villagers found the same problems described in the Problem Analysis in most of the sites as shown below.

| Sector | Problems in the Problem Analysis | Problems found by villagers |
|---|---|---|
| Natural resources | Forest areas are deteriorated. | Deteriorated forest area |
| | Illegal logging is still done. | Forest tree often cut illegally. |
| | Forest fire is induced. | Burning for animal hunting. Fire prone |
| | Forests to be protected are not clearly delineated. | Not clear boundary of conservation forest |
| | Knowledge on natural resources utilization and management is low. | Lack of knowledge on forest plants and their utilization and management |
| Socio-economy, rural life | People enter forest area. | Encroachment into conservation forest and community forest |
| | Agricultural income is limited. | Unstable market price of products |
| | Household expenditure is high. | High in the balance, High agricultural production cost, Food purchased from outside market |
| | Amount of household debt is large in finance management. | Much debt in the balance, to maintain farming, High production cost |
| | Opportunities to earn non-agricultural income are limited. | Less occupation promotion, Low labor cost |
| Agriculture | Fertile arable land is limited. | Low soil fertility, Overuse of chemicals. |
| | Infrastructures are not well developed. | Lack of water resources |
| | Cash crops cultivation is dominant. | Corn, Lychee, Orchard, Chili, Paddy, Cassava, Sugarcane, etc |
| | Farm gate prices of cash crops are often fluctuated. | Low market price of products |
| | Agricultural extension services are not enough. | Insufficient technical support, Lack of linkage knowledge with products and processing. |

Based on the findings of the participatory survey, farmers living in the LRAs were characterized as follows.

- They rely on natural resources from forest.
- Their farmlands are unsuitable for farming. (low fertility, soil erosion prone, difficult access to water)
- They depend on cash crop farming. (unstable market price)
- They fall into difficult financial management. (unstable income, high production cost, debt)

Through the survey, the villagers prepared the Community Development Plan (CDP), which includes the strategies and proposals of activities with anticipated resource persons and expected operation levels of household, community and Tambon. According to the CDPs, villagers regarded the achievement of self-reliance as the overall development target.

### 4.2 Grouping of the Land Reform Areas for M/P Formulation

Although the present operation method with the ALRO project code is manageable for land distribution works, it may be inappropriate to deal with comprehensive natural resource management. For the M/P formulation, it was proposed to revise the present ALRO project code areas. To make such groups, present ALRO project code areas were integrated or separated based on the present location and physical information.

### 4.3 Characteristics of Phayao Province

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| **Target group:**<br>Number of LRAs (M/P code areas); 14 Total area; 378,166.2 rai<br>Number of Tambon concerned; 51 Number of village concerned; 280<br>Beneficiaries (LRA declared); 160,656 persons Potential beneficiaries; 479,646 (based on Tambon pop.) |
| **Natural resources:**<br>Soils suitable for pasture and fruit tree represent a large portion. Areas with high soil erosion rate are widely distributed. All of the areas are adjacent to reserved forest. M/P code areas have community forest except for PYO09. |
| **Socio-economy:**<br>SPK4-01farmers comprise 25% of total provincial population. Household income; 33,003Baht (NRD2C). As for household expenditures, share of “food” and “finance” is relatively large, and most households have debts. |
| **Agriculture:**<br>Average land holding size of SPK4-01 farmers is smaller than that of provincial average. Paddy field is dominant in half of the M/P code areas. Field crops are dominant in the six M/P code areas. In general, livestock activities are relatively inactive. Farm machines are more widely extended compared to Phrae and Nan. |

### 4.4 Characteristics of Phrae Province

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| **Target group:**<br>Number of LRAs（M/P code areas）; 14 Total area; 496,048.2 rai<br>Number of Tambon concerned; 42 Number of village concerned; 184<br>Beneficiaries (LRA declared); 175,865 Potential beneficiaries; 229,966 (based on Tambon pop.) |
| **Natural resources:**<br>Steep terrain (over 6.5%) occupy more than one third of total M/P code areas. Soils suitable for pasture and fruit tree occupy a large portion. Soils unsuited and rather unsuited for farming are widely distributed. All of the M/P code areas are adjacent to reserve forests. Most areas have community forest except for PRE05, 12 and 13. |

| |
|---|
| **Socio-economy:**<br>SPK4-01farmers comprise 13% of the provincial population. Household income; 32,139 Baht (NRD2C) (Based on the participatory survey, it is around 60% of the provincial average). As for household expenditures, share of “food” and “finance” is relatively large, and most households have debts. |
| **Agriculture:**<br>Average land holding size of SPK4-01 farmers is 9.1 rai, smaller than the provincial average. Paddy field is dominant in many M/P code areas, however, fruits cultivation is also widespread in the south. In general, livestock activities are relatively inactive. |

### 4.5 Characteristics of Nan Province

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| **Target group:**<br>Number of LRAs (M/P code areas) ; 20 Total area; 565,366.1 rai<br>Number of Tambon concerned; 76 Number of village concerned; 416<br>Beneficiaries (LRA declared); 214,874 Potential beneficiaries; 255,757 (based on Tambon pop.) |
| **Natural resources:**<br>Steep sloped land over 6.5% occupies more than one third of the total M/P code area. Soils suitable for pasture and fruit tree represent a large portion. Soils unsuited and rather unsuited for farming are widely distributed. Soil erosion rate, 4.4 mm/year, is the highest among the four provinces. Twelve (12) M/P code areas have community forest of 39,190 rai, the largest among the four provinces. |
| **Socio-economy:**<br>SPK4-01 farmers represent 51% of provincial population, the largest among the four provinces. Household income; 43,175 Baht（NRD2C）. As for household expenditures, in general, expenses for “food” and “finance” are relatively high. In addition, households have debts. |
| **Agriculture:**<br>Average land holding size of SPK4-01 farmers (8.8 rai) is smaller than the provincial average. Field crops are dominant in the M/P code areas. There are only 4 areas where paddy is prevalent. Livestock activities are more active than other three provinces. |

### 4.6 Characteristics of Phitsanulok Province

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| **Target group:**<br>Number of LRAs（M/P code area）; 4 Total area; 237,242.5 rai<br>Number of Tambon concerned; 17 Number of village concerned; 79<br>Beneficiaries (LRA declared); 39,858 Potential beneficiaries; 539,923 (based on Tambon pop.) |
| **Natural resources:**<br>M/P code areas are largely located in the northeastern part of the province. Average land slope of the M/P code area is 5.3%, more gentle than that of other three provinces. Soils suitable for pasture and fruit tree represent a large portion. Soil erosion seems to be prominent in PIK01 and 02 (estimated at 2.79mm/year). Three M/P code areas are adjacent to community forest (10,910 rai) except for PIK03. Five reserved forest areas out of 13 are in close proximity to the PIK01 and 02. |
| **Socio-economy:**<br>SPK4-01farmers comprise 3% of the provincial population, the least among the four provinces. Household income; 41,673 Baht（NRD2C）As for household expenditures, share of “food” and “finance” is relatively large, and most households have debts. |
| **Agriculture:**<br>Land holding size of SPK4-01 farmers is, on average, 19.9 rai, the largest in the four provinces. Field crops are generally dominant, and corn and cassava are prevailing in PIK01 and 02. Farm machines are more common compared to Phrae and Nan. |

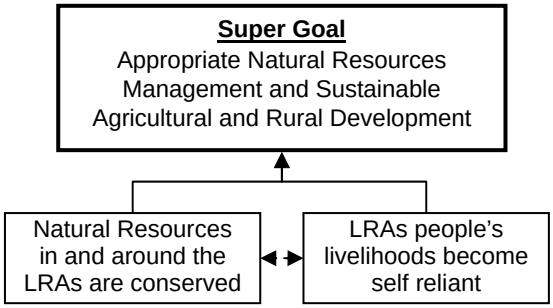
## 5. FORMULATION OF THE MASTER PROGRAM

### 5.1 Basic Concept of the Master Program (M/P)

The M/P shows a mechanism composed of programs and components, which indicate a development frame and direction toward the super goal, and a function how government organizations, local people and local human resources cooperate each other to implement the programs and components in the LRAs. Human resources development process is incorporated into the M/P implementation process. People living in the LRAs are expected to be the main actors for their own LRAs development. Governmental organizations at Central, Provincial and Tambon levels and local human resources are considered to work as supporters who promote development activities in and around the LRAs.

The super goal of the study is to achieve the followings in the North Region.

1. To realize an appropriate natural resource management
2. To improve rural livelihood through sustainable agriculture
3. To contribute to poverty eradication in the North Region through achieving the above two goals




To attain the super goal, the M/P is formulated in the selected four provinces ***in order to implement sustainable rural and agricultural development mainly in the LRAs with people in local communities and related organizations, promoting a proper management of natural resources.***

To attain the objectives, following two targets were set for formulating the M/P.

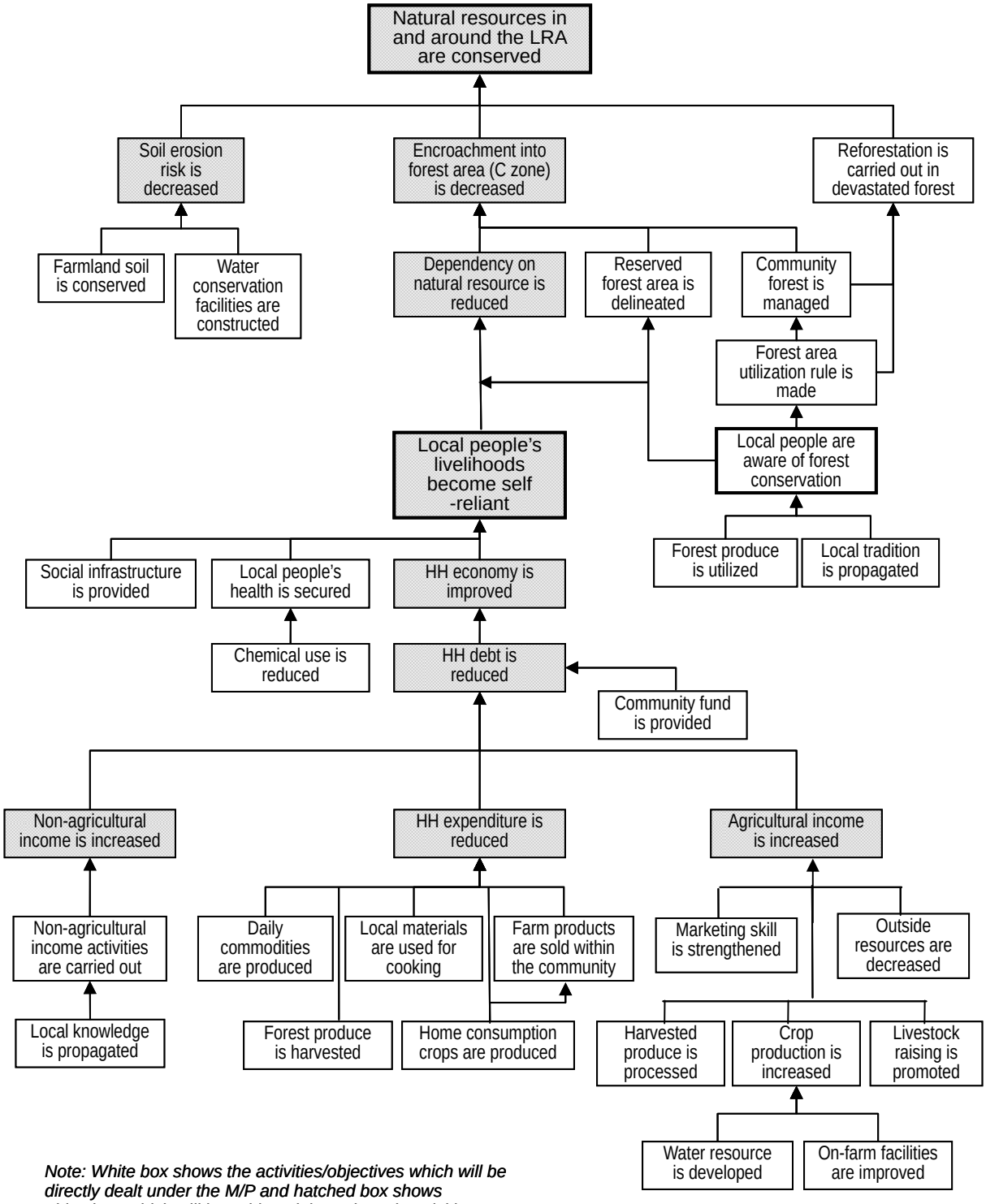
- Local people's livelihoods become self-reliant.
- Natural resources in and around the LRAs are conserved.

To clarify the interrelationships of the situations in the LRAs, their cause and effect relations are sorted out taking the above two targets into account.

A basic road map, to achieve the targets, is designed on the basis of the problem discussions in context of the four selected provinces in the participatory survey. The context is 'If livelihood of local people who are utilizing natural resources and receiving benefits from them becomes improved and self-reliant, the natural resources can be managed and conserved as planned to sustain the benefits obtained from there'. As a basic development policy, first, achievements from livelihood improvement lead to 'Dependency on natural resource is reduced' and 'Encroachment into forest area (C zone) is decreased'. Furthermore, they connect to ' Natural resources in and around the LRA are conserved'.

As a development direction toward livelihood improvement and self-reliance, reducing inputs from outside, and utilizing natural resources in the community lead to 'HH expenditure is reduced', 'Agricultural income is increased' and 'Non-agricultural income is increased'. As a result, 'HH economy is improved' is realized through 'HH debt is reduced'. Finally, 'Local people's livelihoods

become self-reliant' is achieved. (Note: The figure below does NOT show the sequence or order of the activities. The initiation of each activity is depending on the situation of the area.)



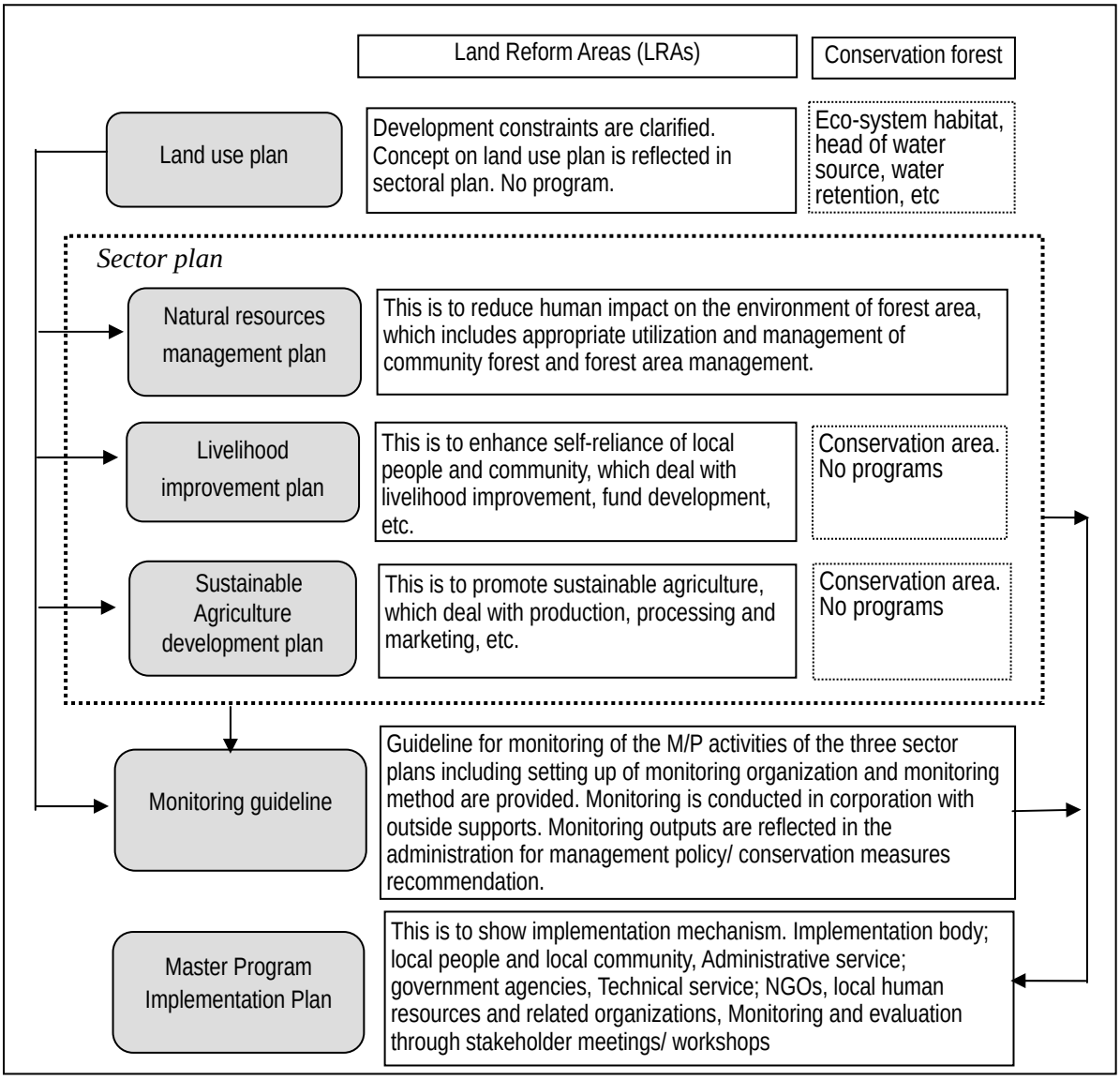

*Note: White box shows the activities/objectives which will be directly dealt under the M/P and hatched box shows objectives which will be achieved through such activities.*

**Development Approaches to the Targets**

## 5.2 Framework of the Master Program

### (1) Basic concept of the Master Program (M/P)

The approaches indicated above were sorted out by the three main sectors; "Natural resources management," "Livelihood improvement" and "Sustainable agriculture development". The sectors are composed of thirteen programs and twenty-seven components. The framework of the M/P and relationships among the plans are shown below. Three sector plans are the cores of the M/P.




**Framework of the Master Program**

In order to implement the programs and components effectively, an active participation of local people is required and learning processes of the people should be practiced by their own initiatives. Therefore, the M/P incorporates learning opportunities into its activities, and capacity building of local people and strengthening of their ownership to the activities can be realized.

**(2) Framework of the M/P implementation process**

The M/P is implemented in the Tambon basis, taking the following processes.

- Facilitators together with PLRO conduct a participatory survey in the selected Tambons.
- Through the participatory survey, local people learn about their life and natural resources in and around LRAs and find development problems and constraints, deepen their understanding about necessity of natural resources management and conservation. Moreover, study tours and learning opportunities may be conducted for advanced areas/ communities as necessary to learn concrete solutions to cope with the problems.
- After the learning, a CDP (Community Development Plan) is prepared by them. In the CDP, action plan, which is in line with the programs and components of the three-sector plans, is proposed in cooperation with facilitators, considering balances and linkage among three sectors. Necessary supports from the government organizations and local human resources to implement the plan are incorporated in the CDP.
- Based on the CDP, the action plan is implemented through the processes of learning/ trials/ practices. Effective and beneficial activities will be continuously implemented.
- Activities may be grouped as 1) activities which people can easily participate in, 2) 'entry activity' which encourage people to be 'aware', 3) 'required activity' for the natural resource management and conservation, 4) 'joint activity' which is cross-sectional of three sectors.
- These activities are progressed considering people's 'awareness' and 'motivation'.

## 5.3 Land Use Plan

Cultivation right is granted according to the current cultivation situation within the regulated range that is 50 rai/household at almost all the land of the LRAs. Therefore, it is difficult to change individual cultivation right and land use drastically, unless a large-scale water source development plan is implemented or the land use policy is significantly changed. As premise for that, the land use plan is designed, basically esteeming individual land use and the boundary of the cultivation right. The basic policy of the land use plan is premised by the following three-sector plan.

## 5.4 Natural Resources Management Plan

Although there are laws and regulations imposed by the government, declining of forest area is still going on. Then, it was recognized that involvement of local people would be crucial for sustainable use and management of forest area. Local people found that forest decline caused deterioration of headwater source areas and forest products, and losses of biodiversity of vegetations and wildlife. To alleviate human impact on natural resources, the Master Program supports natural resources management and conservation activities by local people and local communities who are living with natural resources in the forest. Main programs, components are summarized below. Some components consist of several expected activities.

| Program | Objective | Component |
|---|---|---|
| 1. Forest produce utilization | Forest produces are harvested in sustainable manner. Livelihood is improved. Forest conservation and management sense is grown. | 1.1 Food utilization |
| | | 1.2 Non-food utilization |
| 2. Forest resources management | Natural resources in community forest are properly managed. | 2.1 Community forest establishment |
| | | 2.2 Community forest management |
| | | 2.3 Forest valuations |
| 3. Forest rehabilitation | Boundary of conservation forest/ community forest is clarified. Devastated forest areas are rehabilitated. | 3.1 Forest rehabilitation |
| | | 3.2 Reserved forest area delineation |
| 4. Forest resources conservation | Soil and water in the forest and farmland are conserved. | 4.1 Soil conservation |
| | | 4.2 Water conservation |

### 5.5 Livelihood Improvement Plan

In general, farmers in the LRAs are obliged to live unstably. While non-agricultural income opportunities are limited, agricultural income is not sufficient, either. Therefore, with the failure of farm harvest in one season, especially cash crops, farmers can easily become in their extremity. Furthermore, a relatively high household expenditure compared with their income leads them to be in debt conditions. An overuse of chemical in farming practices is a recent concern of health and welfare for them. That enhances concepts for health and welfare improvement of local people. To sustain the rural society, improvements for people's health and welfare are important. Thus, the following programs and components are proposed.

| Program | Objectives | Component |
|---|---|---|
| 1. Livelihood improvement | Household livelihood is improved through an increase in income and reduction of expenditure. | 1.1 Non-agricultural income generation |
| | | 1.2 Expenditure reduction |
| | | 1.3 Energy saving |
| 2. Fund development | A community bank is established. | 2.1 Locally accessible capital / fund development |
| 3. Health and welfare improvement | Health and welfare of local people are improved. | 3.1 Health improvement |
| | | 3.2 Culture dissemination |
| 4. Infrastructure development | Basic infrastructure for rural life is provided. | 4.1 Social infrastructure |
| | | 4.2 Living conditions improvement |

### 5.6 Sustainable Agriculture Development Plan

The participatory survey revealed that paddy cultivation is a base of the agricultural production system. In addition, there are M/P code areas where have some local specialties such as chili and lychee in various locations. These specialty crops could have potentials for processing and marketing related programs/components. According to the participatory survey, people raised an issue of high production cost mainly resulting from agricultural inputs. Some people also concern a health problem caused by side effects of chemical application and environmental destruction. If locally available resources are

effectively utilized and the agricultural production system is synthesized with other activities such as livestock and fish raising, a low input agriculture production system could be realized, which consequently can reduce the production cost. Main programs and components are summarized below.

| Program | Objectives | Component |
|---|---|---|
| 1. Agriculture production | Farming technology is improved using local resources. Crop production is increased. | 1.1 Crop production |
| | | 1.2 Farming technology improvement |
| 2. Livestock development | Livestock raising including inland fishery with improvements of feed production is promoted. | 2.1 Livestock raising |
| | | 2.2 Feed production |
| 3. Farm produce processing | Local made plant and animal materials are processed and marketed. | 3.1 Plant material processing |
| | | 3.2 Animal material processing |
| 4. Marketing | The market channel of farm produce is developed. The profit margin of the market is reduced. | 4.1 Enhancement of local circulation of farm produce |
| | | 4.2 Marketing improvement of local specialties |
| 5. Infrastructure development | Infrastructural facilities for food production are provided. | 5.1 Water resources development |
| | | 5.2 On-farm facilities |

## 5.7 Monitoring Guideline

Programs and components are materialized through activities by insiders (local people) with supports from outsiders (government, related organization and local human resources). The insiders and outsiders cooperate. Concrete components and activities are planed and conducted according to the area. Activities are monitored by the monitoring guideline. The insiders apply a participatory monitoring method in the monitoring. It is base on collecting/analyzing/recording data with supports from the outsiders. The participatory monitoring method is composed of six steps.

- Discussion of reasons for monitoring
- Reviews of objectives
- Setting of indicators
- Measurements and data collection
- Analyzing data, and
- Sharing the information and defining actions to be taken.

The results of monitoring will be reflected in the M/P implementation methods and policy making.

## 5.8 Prioritization of the M/P Code Areas and Components

The three-sector plan in the Master Program contains several programs and components, and there are some expected activities in each component. The M/P code areas were prioritized in accordance with the following processes for each area code (referred in 4.2).

1) Prioritization of the M/P code areas by component:

   In each component, the M/P code areas were comparatively prioritized by analyzing data that indicate present conditions of the concerned component. In case that the component consists of several expected activities, comparative prioritization was firstly done by activity and then the data were synthesized as a prioritization of the M/P code areas.

2) Prioritization of programs and components at the provincial level:
   The above prioritization of the M/P code areas by component was integrated in one. That is defined as a priority of the component at province. Furthermore, several components are integrated in one. That becomes a priority of the program.
3) Prioritization among three sectors is not determined.

The priority recommendation among the M/P code areas is based on the GIS and NRD2C data, and is not targeted at individual villages and Tambons. Considering that, the priority recommendation can be used as a general guideline and/or reference when the local government and PLRO select targeted Tambons and villages to conduct any prior consultation with villagers for the M/P implementation. Therefore, when programs/components are concretized at a Tambon or village, a current situation survey is required to review the priority.

The priority recommendation of programs and components by province are shown below. The priorities between parentheses are opinions derived through discussions with each PLRO.

| Program and Component | Phayao | Phrae | Nan | Phitsanulok |
|---|---|---|---|---|
| Natural Resources Management | | | | |
| 1 Food produce utilization | +++(++) | +++(++) | +++(++) | +++(++) |
| 1.1 Food utilization | +++(++) | +++(++) | ++ | ++ |
| 1.2 Non-food utilization | +++(++) | +++(++) | ++ | ++ |
| 2. Forest area management | +++ | +++ | +++ | ++(+++) |
| 2.1 Community forest establishment | ++(+++) | ++(+++) | +++ | +(+++) |
| 2.2 Community forest management | +++(++) | +++ | ++ | ++ |
| 2.3 Forest valuations | ++ | ++ | +++(++) | ++ |
| 3. Forest rehabilitation | +++ | +++ | +++ | +++ |
| 3.1 Forest rehabilitation | +++ | +++ | +++ | ++ |
| 3.2 Reserved forest area delineation | +++ | +++ | +++ | ++(+++) |
| 4. Soil and water conservation | +++ | +++ | +++ | +++ |
| 4.1 Soil conservation | +++ | +++ | +++ | +++(++) |
| 4.2 Water conservation | ++(+++) | ++(+++) | +++ | +(+++) |
| Livelihood Improvement | | | | |
| 1. Livelihood improvement | +++ | +++ | +++ | +++ |
| 1.1 Non-agricultural income generation | +++ | +++ | ++(+++) | +++ |
| 1.2 Expenditure reduction | +++ | ++(+++) | +(+++) | +++ |
| 1.3 Energy saving | +(++) | +(++) | +++ | +(++) |
| 2. Fund development | +++(++) | +++(++) | +++(++) | +++(++) |
| 2.1 Locally accessible capital / fund development | ++ | ++ | +++(++) | ++ |
| 3. Health and welfare improvement | ++(+) | ++(+) | ++(+) | ++(+) |
| 3.1 Health improvement | ++(+) | ++(+) | ++ | ++ |
| 3.2 Culture dissemination | + | +(++) | +(++) | +(++) |
| 4. Infrastructure development | + | + | + | + |
| 4.1 Social infrastructure | + | + | + | + |
| 4.2 Living conditions improvement | + | + | +(++) | +(++) |
| Sustainable Agriculture Development | | | | |
| 1. Agriculture Production | +++(++) | +++ | +++ | +++(++) |
| 1.1 Crop production | +++ | ++ | ++ | +++(++) |
| 1.2 Farming technology improvement | ++ | ++(+++) | ++(+++) | ++ |
| 2. Livestock development | ++(+++) | ++ | ++ | +++ |
| 2.1 Livestock raising | +++ | +++ | +++(++) | +++ |

| Program and Component | Phayao | Phrae | Nan | Phitsanulok |
|---|---|---|---|---|
| 2.2 Breeding improvement | ++ | ++ | ++ | ++ |
| 2.3 Feed production | +(++) | + | + | +(++) |
| 3. Farm produce processing | + | + | + | + |
| 3.1 Plant material processing | +(++) | +(++) | +(++) | + |
| 3.2 Animal material processing | + | + | + | + |
| 4. Marketing | ++(+) | ++ | ++ | ++(+) |
| 4.1 Enhancement of local circulation of farm produce | ++ | ++ | ++ | ++ |
| 4.2 Marketing improvement of local specialties | + | + (++) | +(++) | + |
| 5. Infrastructure development | ++ | + | + | ++ |
| 5.1 Water resources development | + | +(++) | +(+++) | ++(+++) |
| 5.2 On-farm facilities | + | + | + | + |

Note: +++: Highly recommendable, ++: Moderately recommendable, +: Recommendable
The above priorities are derived from the analysis of component comparison among M/P code areas. Scores are derived from the calculation based on the figure 3 (+++), 2 (++), 1 (+) and 0 (-). For programs, "+++" is given to the scores with more than 2.0, "++" to the scores between 2.0 and 1.5, and "+" to the scores less than 1.5. For components, "+++" is given to the scores with more than 2.5, "++" to the scores between 2.0 and 2.5, and "+" to the scores less than 2.0.

## 6. MASTER PROGRAM IMPLEMENTATION PLAN

### 6.1 Results of the Pilot Projects

Pilot projects were conducted at seven Tambons in four provinces from May 2006 to March 2007, in order to verify the element of the M/P and reflect lessons obtained from the implementation on the M/P. Through the pilot projects, effectiveness of learning/trials/practice processes under the supports from government organizations, related organizations and local human resources, and validities of programs/ components/ activities which are formulated in order to achieve the targets of "Natural resources in and around LRAs are conserved" and "Local people become self-reliant", was examined. Lessons learned from the pilot projects were reflected in this "M/P implementation plan".

### 6.2 M/P Implementation Method.

#### (1) Qualitative development and area expansion

The two targets can be achieved through implementing activities that materialize the programs and components in Tambons and villages. In order to achieve the targets, it is required to repeat the following 'qualitative development' and 'area expansion' in the Tambons.

Qualitative development ;

This approach is to take necessary activities to realize the programs and components in the targeted Tambon and villages. Various activities in line with the programs and components are initiated by LRAs people/ villagers/ farmers. In this process, people prepare CDP. Based on the CDP, various activities are learned, tried and practiced in their own community and lands. The activities are progressed for the two targets.

Area expansion ;

This approach is to expand the qualitative development into other Tambons. Outcomes of the

activities achieved in the qualitative development process should be disseminated among the Tambons.

**(2) Qualitative development method**

Qualitative development is a process taken by villagers to achieve the targets in their own villages. Concept of the M/P emphasizes that capacity development with learning process is essential in order to realize programs and components. Then, villagers are considered to be an implementation body in the M/P implementation.

Although villagers should operate and manage development process on their own initiatives, they do not have sufficient capacity. Any support from outside is necessary. Then, outside resources such as governmental organizations, related institutions and local human resources such as NGOs are expected to support them technically and financially.

**1) Villagers driven operation**

Villagers are expected to drive the qualitative development process with the outside resources. In the process, they make action plans to materialize programs and components through survey and analyze their village/ community. After making the plans, they begin to act along them.

Through participating in the above processes, villagers can create development sense and motivation to develop their village/ communities. They can learn real needs, constraints and available local resources for development as well as related rules and regulations. Through such learning, they can build up their capacity to step for the targets and to organize themselves to deal in the process. Thus, the villagers driven operation is expected to contribute to the sustainability of the M/P.

**2) Supports from governmental organizations, related institutions and local resources**

Qualitative development may be stepped forward gradually by repeating activities such as learning, trial and practice. In this process, villagers need technical and financial supports from outside as mentioned above.

Technical supports are given to villagers through learning opportunities provided by government organizations, related institutions and local human resources such as advanced farmers, existing learning center, universities and NGOs. Villagers can get necessary knowledge and technology from such outside resources on local needs.

Financial supports are provided by government organizations such as ALRO/ATSAP, PLRO and TAO when villagers operate the development process.

**3) Supports from Facilitator**

A facilitator helps villagers to drive the qualitative development, is to be in the village as needed, and acts as an interface or connector between villagers and outside human resources such as government organizations, such as arrangement of learning opportunities.

### (3) Key issues in the process from planning stage to expansion of components/ activities

Qualitative development processes taken by villagers may differ among the LRAs/ villages, depending on local conditions such as natural resources in/around their lands and community forest, development sense and planning capability of villagers. Although such different processes may be taken, following issues learned from the pilot projects, should be incorporated as key issues in the operation.

#### 1) Supports from outside should be planned flexibly on local needs.

Development activities would be customized for local needs. The timing and contents of the supports should be designed on the real requirement arisen in the development process. Then, it is important to make technical supports flexibly on local needs.

#### 2) Providing learning opportunity of 'awareness' for villagers

For the natural resources management plan, conservation 'awareness' of natural resources should be cultivated when programs/ components/ activities are initialized. In the process, villagers learn their daily life/ farming practices linked with natural resources such as soil, water and forest. Through the learning, 'awareness' and 'motivation' to activities can be grown among participants. Activities are created with growing awareness. The key issue is to find activities that may bring awareness in the learning. (In the pilot project, participatory-based forest valuation survey was conducted. Through this survey, participants have learned about linkage with forest produce harvesting such as medical herb, mushroom, bamboo shoot and livelihood, dry season water flow and water head conservation, devastation of forest and decrease of wild animal and plants. Through the learning, 'awareness' of activities such as construction of water conservation weir, community forest management and putting forest area boundary were grown among participants.)

Such awareness can be cultivated among local people through study tour and learning into the advanced areas/ communities where the same activities were practicing.

#### 3) Required collective activities can be provided through awareness

There are some collective and required activities in the natural resources management plan. These are the activities such as strengthening of community forest committee, putting of forest boundary marker and setting of fire-break line, which are considered to be collective and required activities which local people should cope with together to enjoy the benefits in future. It is essential to guide from awareness to such required collective activities in the qualitative development.

#### 4) Motivation should be given to local people when components/ activities are materialized.

When activities are materialized, motivation to the activities should be concerned. (In the pilot projects, villagers became aware of necessity of natural resources management and conservation through learning process. As a result, the activities such as 'construction of small scale water conservation weir' and 'making fire break line' are led as required collective activity. These activities were created, since they understood that the activities brought the better conditions such as increase of dry season water, quantitative change of wild animal and tree/ vegetation. However, the activity 'soil

erosion prevention' was not promoted since its motivation was not clear among them. In the sustainable agriculture development plan, the 'integrated farming' activity was not proceeded to trial and practice processes, since farmers could not catch the entire picture of the integrated farming in place of present farming style.)

It is obvious from the pilot projects that motivation which may lead to benefits, should be given to local people when activities are initiated.

**5) Entry activities found in the awareness can make expansion easy.**

It is important to share awareness and development steps among people in order to achieve the targets. To do so, it is required to find entry activities which people can easily try and practice. (In the pilot project, the activities such as 'making daily commodities' and 'organic farming' were considered to be the entry activities in the livelihood improvement plan and sustainable agriculture development plan. Those activities are expanded easily among local people.)

**6) It is important that villagers feel 'happiness' in the activities in order to continue/ promote/ expand components/ activities**

In order to expand the activities in the livelihood improvement plan and sustainable agriculture development plan, it is essential that actors are aware of 'happiness' from the activity. (In the pilot project, activities such as 'making daily commodities' and 'plant vegetables around house' were promoted and expanded to the other villagers more easily, because the actors felt 'happiness' in the activity process.)

### (4) Key issues for sustainability of components/ activities

Components/ activities, which are planned and practiced by local people are gradually progressed while being affected by each. In the implementation, sustainability of components/ activities should be concerned in the progresses. For the sustainability, the following issues that have been learned from the pilot projects, should be put on the implementation progresses.

| Program | Component | Issues for sustainability |
|---|---|---|
| **Natural resources management** | | |
| 1. Forest produce utilization | 1.1 Forest produce utilization | To sustain utilization of forest resources in the community forest, making rules and monitoring of the activities should be conducted by the community forest management committee. |
| | 1.2 Non-food utilization | |
| 2. Forest area management | 2.1 Community forest establishment | Targets should be determined from establishment of community forest to strengthen it, networking with another community forest and capacity building of community forest management. |
| | 2.2 Community forest management | |
| | 2.3 Forest valuation | Conservation awareness of forest resources should be promoted among LRAs people through sharing of knowledge of forest resources and awareness of sustainable use of forest produce. |
| 3. Forest rehabilitation | 3.1 Forest rehabilitation | Frame of reforestation activities which valuable trees can be planted by people, should be established. "Making firebreak line" should be put on the Tambon's annual plan. |

| Program | Component | Issues for sustainability |
|---|---|---|
| | 3.2 Reserved forest area delineation | "Reserved forest delineation" should be conducted by MONRE, on the other hand, "Community forest boundary" should be conducted by ALRO, cooperation with TAO. |
| 4. Forest conservation | 4.1 Soil conservation | To promote soil erosion prevention activity, motivation and awareness should be given to LRAs people through study tours. Financial support should be given by related organizations for people's activities. |
| | 4.2 Water conservation | To promote construction of water conservation weir in the conserved forest, the regulation of MONRE should be improved so that people can enter in the conservation forest. |
| **Livelihood improvement** | | |
| 1. Livelihood improvement | 1.1 Non-agricultural income generation | Market development should be incorporated in non-agricultural income generation activities. Then, present on-going activities should be qualitatively strengthened rather than generating new activities. |
| | 1.2 Expenditure reduction | Making household account book should be promoted. "Making daily commodity" should be linked with community market activity. Expenditure reduction is useful to make household account stable. But, increase in household income should be achieved to pay back debt. |
| | 1.3 Energy saving | |
| 2. Fund development | 2.1 Locally accessible capital/ fund development | Since present funding system exists, a long-term time span is necessary to establish a community fund initiated by community members. |
| 3. Health and welfare improvement | 3.1 Health improvement | It is important to cooperate with traditional doctors (medical herb) and local health centers. Tambons should support health improvement activities. |
| | 3.2 Culture dissemination | Forest sprit ceremony and knowledge from traditional doctors and seniors are effective to develop conservation awareness of natural resources. |
| 4. Infra. development | 4.1 Social infrastructure | All of components/ activities may be incorporated into Tambon development plan and other related organizations' plan. |
| | 4.2 Living conditions improvement | |
| **Sustainable agriculture development** | | |
| 1. Agricultural production | 1.1 Crop production | It is important to provide learning opportunity in actual practicing sites, existing learning centers, which are practicing integrated farming and organic farming, considering technical level of LRAs farmers. Through learning, they can recognize that these farming practices are helpful for expenditure reduction and food security. It is important to support the activities from "compost making" and "plant vegetables around house" to the activities "organic farming" and "integrated farming". It is useful that farm products from these farming are brought to the community market. |
| | 1.2 Farming technology improvement | |
| 2. Livestock development | 2.1 Livestock raising | It is useful to learn at actual practicing farmers. Technical supports in the trial and practice processes to link the activities such as fish raising, pig raising and chicken raising with the integrated farming should be provided for trial farmers. |
| | 2.2 Feed production | |
| 3. Farm produce processing | 3.1 Plant material processing | Farm processing products should be put on community market activities, since it is hard to develop a long-distance market channel. |
| | 3.2 Animal material processing | |

| Program | Component | Issues for sustainability |
|---|---|---|
| 4. Marketing | 4.1 Enhancement of local circulation of farm produce | To realize both components, a learning opportunity in the actual practicing sites/ community should be provided for farmers. A long-term follow up activities after learning is also important to establish the components in their lands. The community market is the place where farm products from integrated farming are brought. |
| | 4.2 Marketing improvement of local specialties | |
| 5.Infra. development | 5.1 Water resource development | As well as the infrastructures in livelihood improvement, some of components/ activities may be incorporated into the Tambon plan and related organizations' plan. |
| | 5.2 On-farm facilities | |

**(5) Area expansion method**

Since the area expansion is implemented in a Tambon basis, M/P implementation will be started from a selection of target Tambon where qualitative development is planned. Targeted Tambons may be selected in the course of M/P implementation. The selection is repeated for area development and qualitative development. The way of selection of targeted Tambons should be based on the lessons from the pilot project implementation as follows.

- First of all, a priority river basin is selected as candidate, considering that components/ activities in natural resources management and conservation plan should be promoted in the watershed basis.
- Next, discussion with the candidate Tambons is conducted to seek feasibility and make consensus of M/P implementation.
- In the discussion with the candidates, representatives of villagers should be required to participate to understand concept/ frame and way of the M/P implementation

As the discussion with PLRO, it was planned that the Tambon selection would be done in the course of the M/P implementation, monitoring the progresses of the activities in the selected Tambons and discussion process with candidate Tambons. Thus, the M/P implementation is progressed repeating alternately the qualitative development and the area development.

In the area development, it makes easy to transfer the activities into other related Tambons by showing the experiences in the qualitative development. It is supported through networks organized by activity groups with local human resources.

The network is effective to make communication and mutual help among local people more smoothly. (In the pilot project, the activity groups of 'making daily commodity' and 'kitchen garden' contributed to expansion of the activities through sharing experiences in the stakeholder meeting/ workshop. In Phitsanulok, a community forest management network was established with neighboring communities. It supported to build capacity among the community forest management committee members through sharing experiences. )

**(6) Operation and management method of M/P implementation**

The implementation process of the M/P is operated and managed in each level of ALRO, PLRO, TAO, village and activity group. Since qualitative development is operated in several villages together

within a Tambon, its progress is monitored and evaluated by Tambon, villages and activity group. ALRO or PLRO support financially and technically its operation. Area development is monitored by PLRO under the supports of ALRO. ALRO manage implementation progress of the M/P comprehensively.

Achievements of activities and adjustments of implementation progress among each level are shared in stakeholder meetings (In the pilot project, outcomes and implementation progress were shared among participants in the stakeholder meetings such as monthly meeting and quarter joint meeting. The meetings and workshops were useful to promote and expand the activities among participants through exchanging knowledge and experiences. It also contributed to making networks and capacity building of participants.)

## 6.3 Roles of Stakeholder for M/P Implementation

### (1) Roles of ALRO, PLRO, Tambon, villagers, and facilitators

Responsibility of ALRO is to operate and manage overall implementation of the M/P at the four provinces. It includes provision of administration environment and public relation to the related organizations in order to realize M/P implementation.

The major role of PLRO is to operate and manage the provincial M/P implementation. It includes selection of targeted Tambons and overall monitoring and evaluation of implementation progress of the M/P. PLRO should establish cooperation system with related provincial organizations in the course of the implementation (for example, the activities such as “making firebreak line” could be materialized in cooperation with TAO.). PLRO also should provide technical and financial supports required in the qualitative development processes.

Tambon supports local people in operating the qualitative development. Especially, in natural resources management and conservation plan, Tambons play a leading role to incorporate the required collective activities such as ‘putting boundary makers’, ‘making firebreak’, ‘construction of small-scale check dams/weirs’ into Tambon development plan. Tambon should support the activities financially and technically.

Villagers should conduct activities as main actors. They should participate in various processes of learning/ trials/ practices. Facilitators should support villager’s operation activities cooperating with PLRO and Tambons.

### (2) Roles of government organizations and local human resources

Considering lessons learned from the pilot projects, the way of technical supports should be flexibly designed in the frame of present administrative system depending on villager’s technical levels. The support should be flexibly provided as needed. (It is not easy to establish cooperation system among related government organizations. In the pilot project, then, contents and timing of support were not planned prior. When any supports were required from villagers, a most appropriate organization was found in the present conditions. Then, the contents and timing of the support were discussed with the organization. The support was conducted after discussion and arrangement. For example, in natural resources conservation and management plan in the pilot projects, through discussions, the activities such as

‘construction of check dam/ weirs’ was conducted under the support from MONRE.)

Cooperation system among related organizations and way of supports are not fixed in advance. The support and cooperation may be realized through discussion among stakeholders, which may be designed depending on the local needs and capacity of the related organizations.

In the pilot projects, the technical supports from LDD, learning centers of MONRE, advanced areas/ communities, provincial related organizations and local human resources were effective for activities in the natural resource management plan. Meanwhile, for the livelihood improvement plan and the sustainable agriculture development plan, the technical supports from local human resource such as advanced livestock farmers, organic farming farmers and the university were more effective than those from the governmental organizations. Those supports should be continued until the skills and technology would be established in the farm lands/ communities.

It is recommended that ATSAP and ALRO support to establish model farms and learning centers to show practical integrated farming style.

**(3) Roles of stakeholders in promotion for natural resources management plan**

There are required activities in the natural resources management plan. These should be implemented in cooperation with stakeholder such as MONRE, TAO and farmer leaders. In order to realize these activities, responsibility and roles of each are emphasized as follows.

- PLRO with MONRE should organize study tours (e.g., ‘learning center’ on natural resources at Chiang Mai) to provide learning opportunity for local people/ villagers, in order to encourage them to grow ‘awareness’ for realization of required activities.
- MONRE should provide technical information and supports in the presence of the sites concerned for the activities such as ‘putting boundary markers’, ‘food utilization’, ‘forest valuation’, ‘construction of small-scale check dam/weir’. Moreover, MONRE, PLRO and related organizations should introduce any study tours at advanced areas/ communities to show future picture after completion of these activities. In addition, MONRE should cooperate with PLRO to materialize the ‘reforestation activities’ such as provision of seedlings.
- For promotion of the ‘soil erosion prevention farming’, responsible organizations such as LDD, DOAE, and universities should provide any appropriate study tours and learning opportunities in which LRAs people can learn its practical way and motivation. The organizations should support farmers technically and financially to apply soil erosion prevention farming on their farm lands.
- Related Tambons should incorporate the required activities such as ‘construction of check dams/ weirs’ and ‘making fire break line’ into the Tambon development plan as regular annual activities.
- Official and/or unofficial leaders in villages and communities should encourage villagers to participate in joint and required activities and facilitate such activities in the fields.

## 6.4 Project Implementation Plan

### (1) Scenarios of project implementation plan

Scenarios of project implementation plans of the M/P are supposed based on funding sources.

The two targets of the M/P are achieved with accumulation of achievements of qualitative and area development. The progress is largely depending on fund available for the M/P implementation. Scale of project is also affected by funding sources. Considering present implementation capacity of ALRO, following three scenarios are described depending on funding for project implementation.

Scenario-1 ; Funding is not provided.

PLRO may utilize the M/P as a guideline for development. The pilot project sites are functioned as model areas or learning centers, and ALRO may promote development at the LRAs in the province within its regular budget. Due to the limited regular budget, the number of Tambons where are able to implement activities may be uncertain. Therefore, qualitative development is limited into some individual activities depending on farmers' self-fund and limited budget of TAO. Progress may be extremely slow and achievement may be uncertain with low speed.

Scenario-2 ; M/P is incorporated into on-going programs of ALRO.

Concepts of the M/P are incorporated into the on-going programs of ALRO such as 'Sufficiently Economy Settlement', 'Learning Center for Sufficiency Economy Community', and 'Local Intellectual Network'. Concept of livelihood improvement/ sustainable agriculture development plans may be reflected into these programs. However, natural resources management plan should be newly incorporated. To do so, related to the implementation of 'Sufficiently Economy Community', a 'learning center' for the natural resources management plan should be established based on the M/P code areas and river basins. Qualitative development in Tambon level is possible with implementation of 'Sufficiency Economy Settlement', but its progress is limited at a Tambon/ year. Employment of facilitators is needed to reflect concepts of the M/P into these programs. Achievements/ impacts are limited within Tambon level implemented.

Scenario-3 ; Special fund is provided for M/P implementation with setting of target year

M/P implementation is attempted with a target year. It is implemented as a special project of which implementation process is more effective than the scenario-1 and 2. Since scale of the projects is larger than the pilot projects, special fund is necessary. Considering anticipated scale of the project, a project implementation organization should be established independently of the existing organization.

The achievement of the targets in the scenario-1 is uncertain since the M/P implementation may be limited into individual components/ activities under budget limitation. In the scenario-2, the achievements are unstable since its implementation to be incorporated in on-going programs, may be affected by progress of those programs. Considering the outcomes, impacts and achievement of three scenarios, the scenario-3 is necessary in order to ensure the achievements

However, administration environment to stand up the project implementation plan should be arranged. Meanwhile, considering present government budget constraints for realization of the project, long-term preparation period may be needed to authorize the project. If it will be taken long-term, the

M/P implementation may be initiated with the scenario-2. Then, it is recommended to provide the administration environment for the scenario-3 in the course of the implementation of the scenario-2. After the project preparation, the scenario-3 can be conducted.

Under such consideration, it is proposed that the project is implemented with the scenario-3. Then, project implementation plan is designed based on the scenario-3 in this study.

**(2) Basic concept for project implementation plan**

**Phasing of the project implementation**

- M/P project is implemented in the two phases.
- Target year is set at ten-years. Implementation period of each phase is planned at five-years.
- Target Tambons should be selected based on the boundary of river basin and M/P code area.
- Five Tambons are selected as the core of the project implementation.
- The five Tambons and neighboring Tambons are targeted in the Phase-I. The other remainders are targeted for phase-II.
- A project implementation plan of phase-II may be formulated in the course of the implementation of Phase-I, based on the review of the phase-I including outcomes and progress of making networks.
- Project implementation process such as Tambon selection and provision of supports is flexibly changed in the course of the implementation, depending on monitoring and evaluating the progress in each implementation level.

**Project implementation agency**

The project implementation agencies are ALRO and PLRO.

**Project implementation Organization**

Project Management Unit (PMU) should be established as an independent organization of existing organizations in the ALRO and PLRO for smooth project implementation to engage in the project implementation which functions as an implementation body of administration side.

PMU consists of full-time project staffs. Considering the mechanism of project implementation, a project manager, three project management officers and two coordinators are allocated in central level. Two management staffs are allocated in PLRO in provincial level. It is required that the allocated staffs are well versed in participatory approach and three sector plans of the M/P.

ALRO/ATSAP should provide appropriate training for them to develop capacity of the project implementation including understanding of frame and concepts of the M/P and operation/ management methods. Training programs should be conducted sharing experiences and outputs of the pilot projects and on-going similar projects.

The necessity of facilitators was verified through the pilot project implementation. The facilitators should be incorporated in the project implementation.

Based on the review of capacity of government organization, it is difficult to allocate facilitators from

governmental organizations. On the other hand, there exist NGOs, who are familiar with participatory approach and have enough skill and experiences to be facilitator. It is the most realistic to utilize such NGOs as facilitators.

Allocation of field workers who help facilitator to facilitate people's qualitative development, lead and promote activities is planned in the Tambon basis in the project implementation.

**(3) Project implementation plan (phase-I)**

**Target Tambons for the phase-I**

Considering the basic concept of the project implementation, for the phase-I, target Tambons are selected based on the M/P code areas and river basins, as follows. The number to be selected is Phayao (15), Phrae (9), Nan (10) and Phitsanulok (5).

The number of targeted Tambons is different from four provinces. Implementation progress may be arranged among Tambons concerned in activity level such as joint study tours and mutual visits, which should be the key for smooth and effective implementation. Related with the selected Tambons, core Tambons are listed as follows.

**Core Tambons and M/P code Areas for Phase-I**

| Phayao | | Phrae | | Nan | | Phitsanulok | |
|---|---|---|---|---|---|---|---|
| Tambon | PYO | Tambon | PRE | Tambon | ANN | Tambon | PIK |
| Ban Tun | 11 | Wiang Ta | 05 | Yap Hua Na | 13 | Suan Miang | 01 |
| Tha Jam Pee | 10 | Pak Kang | 08 | Ai Na Lai | 15 | Tha Sakae | 01 |
| Mae Suk | 11 | Phai Thon | 04 | Mae Sakhon | 15 | Pa Daeng | 01 |
| Nong Lom | 12 | Thung Sri | 04 | Lai Nan | 18 | Khan Chong | 02 |
| Pong Jen | 07 | Mae Sai | 03 | Tan Chum | 18 | Hin Lat | 02 |

**Project implementation period**

The project implementation period is targeted at five years. Area development is launched in from four to five Tambons in a year. Implementation period of the qualitative development in each Tambon is preliminary set at three-years. (Three times of the cycle of planning/ implementation/ feedback are practiced. Enhancing the ability of villagers and networking are attained during the period aiming for sustainability of components/ activities.)

**Approximate project implementation cost**

Project implementation cost of the Phase-I consists of; 1) cost for learning / trials / practice, 2) construction of infrastructure, 3) employment of facilitators and fieldworkers, 4) operation and maintenance of the project. The cost is estimated at 1,720 million Bahts. About 78% is shared for construction of infrastructure.

In principle, infrastructure should be provided by related organizations through CDP. In the M/P implementation, those infrastructures are picked to be the infrastructure facilities such as small ponds in the LRAs, farm road, small scale irrigation and drainage canals which ALRO/ PLRO can deal in as their tasks. Those infrastructures may be incorporated into the development plans of Tambon and related organizations. Requested infrastructure may not relate directly to the processes of learning/

trials/ practice. Considering these conditions, infrastructure may not always be provided in the project, which are planned independently depending on budget available.

## 6.5 Formulation of Development Strategy for Super Goal.

### (1) Overall development strategy

The pilot projects to verify the M/P are the first step to achieve the super goal. After the pilot projects, the project of the M/P will be continuously implemented in the four provinces. In the course of the M/P implementation, expansion strategy of the M/P concept should be formulated for other 13 provinces in north region. According to the strategy, the concepts of the M/P will be expanded in the 13 provinces. The super goal can be achieved through implementing these processes.

### (2) Formulation of road map

The M/P should be implemented in the long-term timeframe. However, political environment to support long-term implementation is unstable. In addition, socio-economic conditions in the north region are changing rapidly. It is rather difficult to make consensus of the project implementation for all Tambons and prepare implementation schedule on the long-term timetable in advance. However, to direct toward the super goal, at least, the following milestones should be set on the timetable as a road map.

#### 1) Continuation of the pilot projects

The pilot project sites/ communities should be functioned as model sites or learning centers for next M/P project. Performance including people's activity process and supports from outsiders are shown for neighboring Tambons. Considering the significance of the pilot projects, on-going activities should be followed and supported. The activities should be monitored and evaluated until they would become established in the sites/ communities.

#### 2) Provision of administration environment for realization of the M/P project

During the continuation of the pilot project, administration environment for the M/P project implementation should be arranged based on the scenario-3. ALRO/ATSAP should deal in making consensus among related organizations such as concepts of the M/P, mechanism and method of project implementation and funding for the project implementation plan.

#### 3) M/P project implementation in the four provinces

<u>Project implementation (phase-I)</u>

Phase-I project is implemented as planned. Considering way of next phase-II project implementation, phase-I project should be reviewed based on the outcomes.

<u>Project implementation plan of phase-II</u>

The project implementation plan of phase-II is designed after evaluation and analysis of the phase-I. The project may be planned as a special project with five-years target as well as the phase-I, but, it is decided based on the evaluation of the phase-I results.

Implementation of the phase-II project

The targeted number of Tambons for phase-II is larger than that of the phase-I. Thus, the implementation needs to be more efficient than the phase-I. Considering an efficient implementation method and future expansion method into 13 provinces, the following points are emphasized in the Phase-II project implementation.

- By utilizing networks and fieldworkers established in the phase-I, mutual supporting systems among Tambons concerned are built to make promotion of activities more easily.
- The implemented Tambons in the Phase-I are designated as 'learning centers'. Tambons concerned in the Phase II are able to learn the processes form the implemented Tambons through study tours in the 'learning centers'.
- Fieldworkers allocated at each implemented Tambon are educated so that they can play as facilitators for neighboring Tambons.
- PLRO officers in neighboring provinces are invited to stakeholder meetings/ workshops and people's learning opportunities so that they can understand frame, concepts and mechanism of the M/P.

**4) Overall evaluation of the projects**

When the phase-II is completed, the phase-I and II project implementation should be evaluated. Based on the evaluation, expansion strategies for the M/P concept in the 13 provinces are formulated.

**5) Formulation of expansion strategies of the M/P concept for 13 provinces.**

Based on the evaluation of the M/P projects, promotion and expansion strategy of the M/P concepts is formulated for 13 provinces.

In terms of selection of target provinces, in line with the 'Strategic Development of Cluster, Office of the Prime Minister, Nov.2003', five provinces of cluster of the upper north may be prioritized, since the natural resource management plan is put as an important issue in these provinces.

Basic concept for formulation of expansion strategy

Although the project implementation in the four provinces is planned as special project with funding, PMU and facilitators, expansion strategy for 13 provinces should be formulated based on the followings.

- It is the basic concept that the M/P concepts such as villagers driven development with learning process, implementation of the three-sector plans should be expanded by incorporating into the ordinary tasks of PLRO, not the special project with fund.
- Considering the present organization of PLRO, the 'Land reform management' unit may be the core for expansion.

**6) Project implementation with the M/P concepts in the 13 provinces**

Based on the expansion strategy, the M/P concepts are gradually promoted/ expanded from prioritized upper north five provinces. LRAs development is implemented with the M/P concepts.

Although people's activities and supports from outside might be limited under budget limitation, the concept of the M/P could be expanded making use of widen networks and accumulated outcomes. Especially, the five provinces are close to the four provinces of the project implementation. Thus, it is easy to learn from there.

Although expansion and promotion activities are the small-scale in grass root level, the super goal can be achieved with accumulating these activities.

**(3) Roles and capacity development of government organizations**

The important roles of government organizations for project implementation are to make a better environment conductive and/enabling to make it possible with related organizations and local human resources to implement activities proposed by local people and rural communities for improvement of their living and farming practices with natural resources management and conservation in their lands and communities. Moreover, the other roles are to promote and expand such local people's activities in the related LRAs and Tambons. ALRO and PLRO need to cooperate with related organizations such as MONRE and related departments under the MOAC, and TAO, to work with local people and rural communities.

ALRO should realize capacity development for the PMU to make project implementation more smooth and effective. Necessary subjects to improve the capacity are in those such as "understanding of M/P concept" and "learning of project cycle management". Capacity development for them may be conducted by making use of human resources such as university and local intellectuals, and experiences from on-going similar projects and pilot projects. ALRO should provide appropriate learning opportunities for them even in the course of the project implementation, monitoring the project implementation progress and workability of PMU.

It is proposed that the fundamental direction to promote and expand the M/P concept in the northern 13 provinces is to incorporate activity processes with M/P concept into the regular tasks of the existing working unit of PLROs. The PLROs should operate expansion and promotion activities of the M/P concept as the routine works. To do so, it is required to improve ALRO/ PLRO institution such as review of work regulations and regular budgeting so as to make M/P concept implementation as their routine works in the course of the project implementation. It is also required to enhance capacity of related organizations so as to make it possible to improve their capacity in both individual and organization levels. Related organizations and staffs are required to learn the M/P concept and its implementation mechanism such as cooperation manner with related organizations and utilization of local human resources and networks, and facilitation of implementation process. ALRO should push PMU to provide learning opportunity for PLROs of 13 provinces, related ALRO and TAOs staff, so that they can learn implementation process and improve their capacity.

# 7 CONCLUSION AND RECOMMENDATIONS

## 7.1 Conclusion

The ‘‘Development Study on Planning and Capacity Building for Natural Resources Management and Sustainable Rural and Agricultural Development in the North Thailand’’ was conducted based on the Scope of Works (S/W) concluded between the Ministry of Agriculture and Cooperatives (MOAC), Thai Government and the Japan International Cooperation Agency (JICA) on March 31, 2004. In the study, a Master Program (M/P) in order to implement sustainable rural and agricultural development mainly in Agricultural Land Reform Area with people in the local community and related organization, promoting proper management of natural resources was formulated in the four provinces selected from the northern seventeen provinces. Study results are presented in this report.

The M/P shows a framework of development with 13 programs and 27 components of three sector plans of natural resources management, livelihood improvement plan and sustainable agriculture development plan, to achieve the study objectives. The implementation means is that people have the initiative to conduct the activity in cooperation with governmental organizations, related organizations and local human resources.

In the study, the pilot project was implemented to verify the M/P. Through its implementation, it was verified that these programs and components including implementation mechanism in which local people are the implementation body, are fully effective to achieve the objectives. As the results, it was concluded that the M/P presented in this study should be materialized immediately in the four provinces.

## 7.2 Recommendations

### (1) Earlier implementation of the Master Program (M/P) and setting up of the M/P implementation organization

The M/P was formulated under the joint works with C/P organizations such as ALRO/ ATSAP and PLROs, provincial related organizations, TAO, local human resources, NGOs and local people/ villagers at LRAs. Therefore, it is recommended that the MOAC initiates necessary works to implement at the earliest the M/P presented by this study. Moreover, it is suggested that parts of the M/P should be implemented under the present ALRO’s on-going programs until a sufficient budget for the project implementation is to be secured.

It is proposed to establish a Project Management Unit (PMU) in the ALRO to implement the project. The PMU consists of full-time staffs who are well versed with participatory survey and three sector plans. In addition, it is proposed to allocate facilitators in each province. Thinking of their roles, it is realistic that experienced NGOs are employed. ALRO is requested to take actions to secure experienced facilitators in the subject M/P implementation.

### (2) Necessity of following up with pilot projects

People’s activities are continued in the pilot project sites, in order to achieve the development targets. It is required that the pilot project sites become learning centers or models for implementations of M/P

where local people and related organizations can learn various activity processes. ALRO/ATSAP and PLRO are required to continue supporting and monitoring the activities until their activities are established in the sites.

**(3) Public relation for the M/P implementation**

Basic concept of the M/P implementation is that local people are considered to be main actors, and related organizations and local human resources are supporters engaging their development processes. This concept is prevailing among related organizations through the pilot project implementation, but that is still insufficient. Thus, it is suggested that ALRO/ATSAP and PLROs make efforts to generalize the concepts of M/P to related organizations and to make an administrative environment conducive for smooth implementation of the project.

**(4) Limitation of participatory approach and necessary intensives in the M/P implementation processes**

Because the natural resources management and conservation in the forest areas is achieved through joint activities by local people who are living in and around there, participatory approach are applied as the means in the M/P implementation. Several activities with motivation and awareness could be implemented on their own initiatives as planned in the pilot project. However, the activities for which awareness and motivation are not grown up among local people, such as soil erosion prevention farming, could not be materialized in their lands. Considering such situations, it can be said that participatory approach has some limitation in causing local people's initiatives in natural resources management and conservation plan. In order to achieve the objectives of natural resources management and conservation plan, it is suggested that government and related organizations consider to take administrative approach such as provision of incentives to local people who participate and practice in the management and conservation activities.

**(5) Need of further cooperation with the MONRE to achieve the natural resources management and conservation**

In order to achieve the target, 'Natural resources in and around the LRAs are conserved', cooperation with the MONRE is absolutely necessary. Several activities such as 'community forest management', 'making firebreaks', 'construction of small-scale check dams', and 'reforestation', are incorporated in the project implementation. Those are considered to be the fundamental and collective activities of local people. The MONRE is required to understand that these activities lead to the natural resource management and conservation in the entire forests including conservation forests adjacent to LRAs. It is recommended that the MONRE provides a supporting system to materialize these activities in the whole forest areas. Conservation and management activities in the conservation forests can be further promoted when the concept of community forest management and conservation manner could be applied to the conservation forests around LRAs. Comprehensive forest management and targeted conservation can be achieved only by accumulating such activities.

### (6) Roles of government organizations and need of capacity development

Local people are considered to be the main actors for the implementation of programs/components and activities. Under this concept, the important roles of government organizations are to make an environment conducive and/or enabling to materialize various activities proposed by local people and rural communities. Moreover, the other roles are to promote and expand the people's activities in the related LRAs and Tambons. ALRO and PLROs need to cooperate with MONRE, LDD, TAOs and related organizations to work with local people and rural communities.

ALRO should realize capacity development for the PMU to make project implementation more smooth and effective. PMU staff should be trained in the subjects related with the M/P implementation, making use of human resources such as university and local intellectuals and using experiences learned from the pilot projects and on-going similar projects. ALRO should provide necessary training programs for them even in the course of the project implementation.

It is proposed that the fundamental direction to promote and expand the M/P concept in the northern 13 provinces is to incorporate development activities with M/P concepts into the regular tasks of the existing working unit of ALRO/PLROs. They should operate expansion and promotion of the M/P concepts as the routine work. In order to realize such situations, it is required to cope with institutional improvement such as establishment of budgeting system and improvement of work regulations so as to make such operation possible. In addition to this, it is required to enhance implementation capacity of ALRO, PLROs, and TAOs in both individual and organization levels. ALRO should encourage PMU to provide appropriate learning opportunities for related ALRO staff, PLROs of 13 provinces and related TAOs in the on-going project sites in the four provinces, so that they can learn implementation process and improve their capacity for future project implementation and make cooperation activities possible.

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# ABBREVIATIONS

| | |
|---|---|
| ALRO | Agricultural Land Reform Office, MOAC |
| ATSAP | Agricultural Technology and Sustainable Agriculture Policy Division, OPS, MOAC |
| C/P | Counterpart |
| CDP | Community Development Plan |
| DOAE | Department of Agricultural Extension |
| DOCP | Department of Cooperative Promotion |
| DOL | Department of Livestock |
| JICA | Japan International Cooperation Agency |
| LDD | Land Development Department |
| LRAs | Land Reform Areas |
| MOAC | Ministry of Agriculture and Cooperatives |
| MONRE | Ministry of Natural Resources and Environment |
| M/P | Master Program |
| NRD2C | National Rural Database |
| NGOs | Non Governmental Organizations |
| OPS | Office of the Permanent Secretary, MOAC |
| PAO | Provincial Administration Office |
| PLRO | Provincial Land Reform Office |
| PP | Pilot Project |
| RFD | Royal Forestry Department, MONRE |
| TAO | Tambon Administration Organization |
| TTC | Technical Transfer Center |

**~ Provinces ~**

| | | | | | |
|---|---|---|---|---|---|
| CRI: | Chiang Rai | PYO: | Phayao | LPG: | Lampang |
| LPN: | Lamphun | CMI: | Chiang Mai | MSN: | Mae Hong Son |
| TKK: | Tak | KPT: | Kamphaeng Phet | STI: | Sukhothai |
| PRE: | Phrae | ANN: | Nan | UTT: | Uttaradit |
| PIK: | Phitsanulok | PCT: | Phichit | NSN: | Nakhon Sawan |
| UTI: | Uthai Thani | PSN: | Phetchabun | | |

**~ Units ~**

rai: A unit for measuring an area in Thailand, equivalent to 1,600$m^2$ or 0.16ha

| | | | | | |
|---|---|---|---|---|---|
| sq. m: | Square meter | sq. km: | Square kilometer | cu. m: | Cubic meter |
| m2: | Square meter | km2: | Square kilometer | m3: | Cubic meter |

**Exchange Rate**: 3.795 Yen/ Baht (as of September 2007, JICA designated rate)

# TERMINOLOGY

**Community:** Society and the people living together or sharing resources but may not be defined by the administrative boundaries such as village, tambon and/or district.

**Community Development Plan (CDP):** A development plan formulated through the learning process of the participatory survey in the selected communities. The plan covers several

communities in same tambon.

**SPK4-01:** A type of land certificate ALRO issues, which allows farmer to cultivate the land but not to sell.

**SPK4-01 farmer(s):** Farmer who has SPK4-01 land certificate.

**Villages Concerned:** Both villages where SPK4-01 farmer *lives* or SPK4-01 farm plot is *located*. Those villages do not always correspond.

# CHAPTER 1 BACKGROUND AND OBJECTIVES OF THE STUDY

## 1.1 BACKGROUND OF THE STUDY

The 9th National Economic and Social Development Plan (2002-2006) points out the fact that the present imbalance of ecosystem has been caused by the overuse of natural resources in the past 40 years. Hence, rational natural resources management and environmental conservation are recognized as a matter of the greatest importance in Thailand today.

The forest area is classified into three zoning areas, namely, conservation area (C zone) administratively under the Royal Forestry Department, agricultural area (A zone) and economic forest area (E zone) as per the classification adopted by the Thai Government. In compliance with the zoning, Agricultural Land Reform Office (hereinafter referred to "ALRO"), under the Ministry of Agriculture and Cooperatives (MOAC) distributes lands to landless farmers in the A zone and some areas of the E zone, but no distribution is allowed in the C zone. In another aspect, ALRO has been making efforts to improve livelihoods of farmers through extension of sustainable agriculture with rural infrastructure development and to strengthen the people's capacity in these Land Reform Areas (LRAs).

In spite of the efforts by ALRO, some farmers often immigrate to conservation forests to earn cash income due to unclear boundary lines of zonings and no strict management systems. Many people who live adjacent to forest area face with difficult agricultural conditions caused by hilly or undulating lands. They cannot help utilize natural resources in the forests to generate incomes, implying that lack of income sources is the major cause of intrusion into conservation forests.

The Thai Government has been promoting a decentralization policy which local governments take the initiatives to implement effective and integrated development in their own areas. Under the circumstances, ALRO and local governments are necessary to prepare plans for effective and integrated natural resources management and sustainable agricultural development with active participation of local people. However, ALRO and local governments do not have enough capacities to promote and organize such participatory development, requiring strengthening their organization and system to implement most suitable development for the LRAs.

Under the conditions, in compliance with the official request made by the Thai Government in September 2002, the Japan International Cooperation Agency (JICA) conducted the preliminary survey in January 2004, and a Minutes of Meeting (M/M) and the Scope of Works (S/W) for the "Development Study on Planning and Capacity Building for Natural Resources Management and Sustainable Rural and Agricultural Development in North Thailand" were signed in January and March 2004. Based on the S/W, JICA dispatched a Study Team in October 2004 to perform the study.

ALRO and Agricultural Technology and Sustainable Agriculture Policy Division (hereinafter referred to "ATSAP") of Office of the Permanent Secretary (OPS), MOAC are the counterpart (C/P) agencies

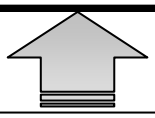
for the subject Study.

## 1.2 OBJECTIVES AND SUPER GOAL

The super goal and objectives of the Study are summarized as mentioned in the Scope of Work, signed on March 31, 2004.

**Super goal**

To realize proper management of natural resources and to improve livelihood of the rural population through sustainable agriculture and thus to contribute to poverty eradication in the North Thailand



**Objectives of the Study**

(1) To formulate the Master Programs in order to implement sustainable rural and agricultural development mainly in Agricultural Land Reform Area with people in the local community and related organization, promoting proper management of natural resources

(2) To implement pilot project(s) in the course of the Study mainly for capacity building of Thai counterpart personnel, related organizations and communities concerned

(3) To carry out technology transfer to the counterpart personnel and related organizations through on-the-job training in the course of the Study.

## 1.3 STRUCTURE OF THE STUDY

The Study consists of three phases such as:

**Phase I**: Inventory Survey

- Inventory survey on natural resources and socio-economic situation for the 17 provinces in the North Thailand
- Identification of issues on natural resources management and sustainable rural and agricultural development
- Selection of four provinces for preparation of the draft M/P

**Phase II**: Formulation of Draft Master Program

- Preparation of the draft M/P for the LRAs in the four provinces
- Preparation of the draft monitoring guideline for natural resources management
- Selection of pilot project areas for Phase III

**Phase III**: Implementation of Pilot Projects

- Implementation of the pilot projects
- Monitoring and evaluation on the implementation progress of the pilot projects
- Completion of the M/P and the guideline based on the lessons learned from the pilot projects implementation

The Study started in October 2004 and will finish in June 2007. The Phase I study completed in January 2005, and the Phase II study started in February 2005. In the course of the Phase II study, however, change of the working schedule with extension of the Phase II study period for implementing participatory survey was made in June 2005, based on the discussions with the C/P agencies and JICA. Consequently, working schedule was slightly changed as shown in Figure 1.3.1.

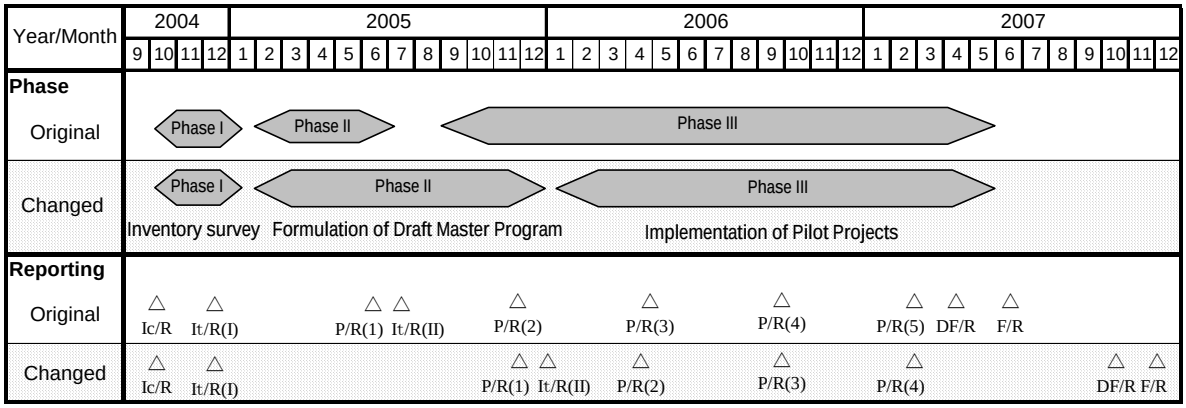



**Figure 1.3.1 Change of the Overall Working Schedule**

## 1.4 THE STUDY AREA

The Study Area of the Phase I (Inventory survey) covered all the 17 provinces in the North Thailand. For the Phase II (Formulation of the draft Master Program), it covered the LRAs in the selected 4 provinces in the North Thailand. Pilot project areas including 7 tambons were selected from the LRAs of the 4 provinces for the Phase III (Implementation of the pilot projects).

# CHAPTER 2 PRESENT SITUATIONS OF THE NORTH THAILAND

## 2.1 THE NORTH REGION IN THAILAND

Comparing with other regions, the North Region is comparatively large, with the area of 169,645 square kilometers, which covers 33 % of the total area of the country. The North Region comprises seventeen provinces and borders on the Union of Myanmar on the north and the west and on the Democratic People's Republic of Laos on the east.

The North Region in Thailand is the most significant region in the country for management and conservation of natural resources because of its extensive forest cover with unique biodiversity. Forest area of the region represents more than half of the country's total forest; however, it has been decreasing due to swidden agriculture by landless farmers and inappropriate felling of trees. Poverty is another serious issue in the region because gross regional products per capita of the region accounts for only 37,905 Baht, which is much lower than the national average, 74,905 Baht, but higher than the average of the Northeastern Region.

In general, the region is divided into two clusters; Upper North and Lower North. The Lower North cluster is further divided into two groups. The 17 provinces in the North Region can be grouped as shown below.

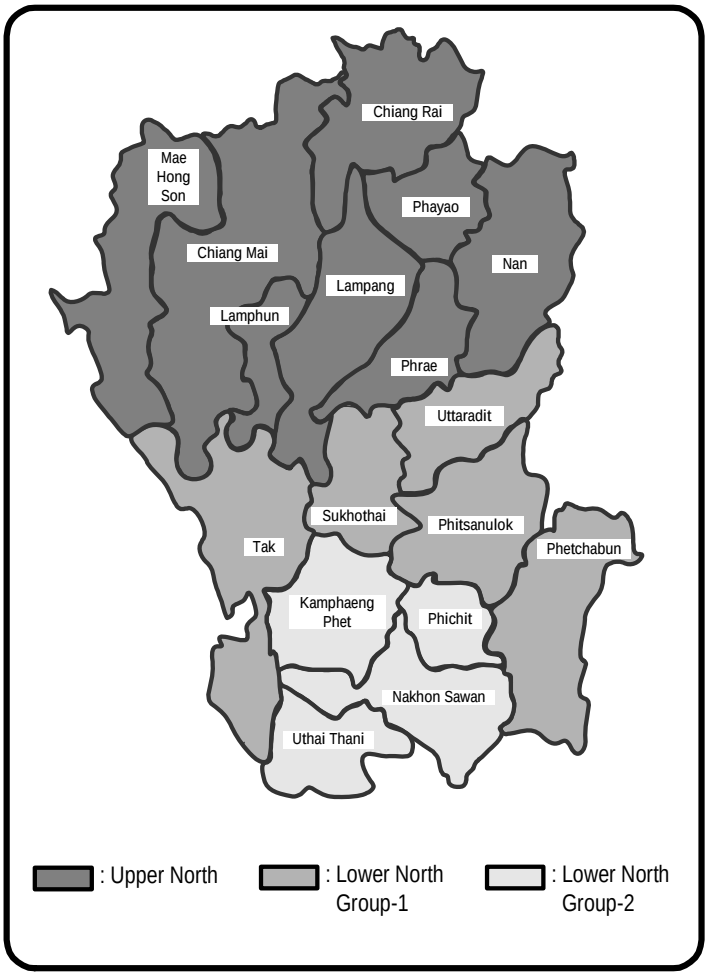



**Figure 2.1.1 Clusters in the North Region**

**Table 2.1.1 Clusters in the North Region**

| Cluster | | Province |
|---|---|---|
| Upper North | | Chiang Rai, Phayao, Lampang, Lumphun, Chiang Mai, Mae Hong Son, Phrae, Nan |
| Lower North | Group-1 | Tak, Sukhothai, Phitsanulok, Uttaradit, Phetchabun |
| | Group-2 | Kamphaeng Phet, Phichit, Nakhon Sawan, Uthai Thani |

## 2.2 NATURAL RESOURCES

### 2.2.1 Topography

In the northern part of the region, the topographical feature is mountainous, hence, plains are scattered between the mountains. The average elevation of the land is about 1,600 meters above the sea level. Daen Laos and Luang Phra Bang Mountain Ranges separate the country from the Union of Myanmar and the Democratic People's Republic of Laos. In the western part of the region, Thanon Thongchai Mountain Range lies from the north to the south. Plain areas with paddy cropping stretch over the southern part of the region. Phetchabun Mountains Range locates in the eastern part.

Headwaters of several major rivers are in these mountain ranges. There are seven major river basins in the region, namely Ping, Wang, Yom, Nan, Khong, Salawin and Kok. Each basin consists of several sub-basins, which include several provinces. Three of them (Khong, Salawin and Kok) are international rivers, which covers some areas in Laos and Myanmar. Some provinces are situated on other major river basins that flow into the Central Region. Summary of the river basins are shown in Table 2.2.1.

**Table 2.2.1 Major River Basins in the North Thailand**

| Name of river basin | Coverage areas (sq. km.) | No. of sub-basin | No. of province covered | Name of province covered | Estimation of annual water shortage in 2006 (million cu. m.) |
|---|---|---|---|---|---|
| Ping | 33,898 | 21 | 5 | Chiang Mai, Lamphun, Tak, Kamphaeng Phet and Nakhon Sawan | 38 |
| Wang | 10,791 | 7 | 2 | Lampang and Tak | 75 |
| Yom | 23,616 | 12 | 9 | Nakhon Sawan, Phayao, Nan, Phrae, Lampang, Kamphaeng Phet, Sukhothai, Phitsanulok and Phichit | 98 |
| Nan | 34,300 | 6 | 6 | Nan, Uttaradit, Phitsanulok Phichit, Phetchabun and Nakhon Sawan | 96 |
| Mekong | 795,000 with only 57,422 sq.km. in Thailand | 38 | 2 in Thailand | Phayao and Chiang Rai | 1,093 |
| Salawin | 29,500 with only 17,920 sq.km. in Thailand | 17 | 3 | Mae Hong Son, Tak and Chiang Mai | 121 |
| Kok | 10,785 with only 7,895 sq.km. in Thailand | 35 | 2 | Chiang Rai and Chiang Mai | 18 |
| Pasak | 16,292 | 12 | 4 | Phetchabun, Lopburi, Saraburi and Ayuthaya | N/A |
| Sakaekrang | 5,192 | 4 | 4 | Nakhon Sawan, Uthai Thani, Kamphaeng Phet and Chainat | 451 |

| Name of river basin | Coverage areas (sq. km.) | No. of sub-basin | No. of province covered | Name of province covered | Estimation of annual water shortage in 2006 (million cu. m.) |
|---|---|---|---|---|---|
| Chao Phraya | 20,125 | 4 | 11 | Nakhon Sawan, Singhburi, Ayuthaya, Pathumthani, Nonthaburi, Samutprakarn, Bangkok, Saraburi, Chainat, Lopburi and Angthong | 1,500 – 2,500 (Estimation is made from Chao Phraya and Tha |
| Tha Chin | 13,682 | 2 | 5 | Uthai Thani, Chainat, Angthong, Supanburi and Nakhon Pathom | Chin due to the joint project of both basins.) |

Source: Water Resources Department, Ministry of Natural Resources and Environment

Nakhon Sawan is situated on the five river basins, namely Sakaekrang and the three of Ping, Yom and Nan that forms the Chao Phraya River. The provinces situated on three river basins are Chiang Mai, Tak and Kamphaeng Phet. Many provinces are located on two river basins, while five provinces of Lamphun, Mae Hong Son, Sukhothai, Phrae and Uttaradit, are on only one basin. (See Table 2.2.2.)

**Table 2.2.2 River Basins and Provinces in the North Thailand**

| Province/River basin | Ping | Wang | Yom | Nan | khong | Sala-win | Kok | Pasak | Sakae-krang | Chao Phraya | Tha Chin | total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chiang Rai | | | | | Y | | Y | | | | | 2 |
| Phayao | | | Y | | Y | | | | | | | 2 |
| Lampang | | Y | Y | | | | | | | | | 2 |
| Lamphun | Y | | | | | | | | | | | 1 |
| Chiang Mai | Y | | | | | Y | Y | | | | | 3 |
| Mae Hong Son | | | | | | Y | | | | | | 1 |
| Tak | Y | Y | | | | Y | | | | | | 3 |
| Kamphaeng Phet | Y | | Y | | | | | | Y | | | 3 |
| Sukhothai | | | Y | | | | | | | | | 1 |
| Phrae | | | Y | | | | | | | | | 1 |
| Nan | | | Y | Y | | | | | | | | 2 |
| Uttaradit | | | | Y | | | | | | | | 1 |
| Phitsanulok | | | Y | Y | | | | | | | | 2 |
| Phichit | | | Y | Y | | | | | | | | 2 |
| Nakhon Sawan | Y | | Y | Y | | | | | Y | Y | | 5 |
| Uthai Thani | | | | | | | | | Y | | Y | 2 |
| Phetchabun | | | | Y | | | | Y | | | | 2 |

## 2.2.2 Forest Areas

(1) Change of Forest Areas

During the period of 1973 – 1998, it was revealed that Nan was the province that has depleted the forest area at the highest rate. In 1973, Nan held about 10,000 sq. km. forest area or 91% to the provincial areas and declined to about 4,800 sq. km. or only 39% in 1998. The second big loss is in Chiang Mai, followed by Mae Hong Son and Tak, which had lost about 4,500, nearly 4,000 and 3,000 sq. km., respectively, in the same the period. Deforestation in the three provinces of Uttaradit, Phitsanulok and Phetchabun was also in the larger range of 2,200 - 2,700 sq. km. There were slight changes in the two provinces, Phichit and Nakon Sawan located on the lower flat area. Phichit had no

forest area existed and Nakhon Sawan had a small change, about 600 sq. km. decreased. (See Figure 2.2.1.) It should be noted that Phayao was in Chiang Rai Province in 1973. This made that the forest area of Chiang Rai was in the larger proportion to provincial area in that year, but it was due smaller one in 1998 after independence.

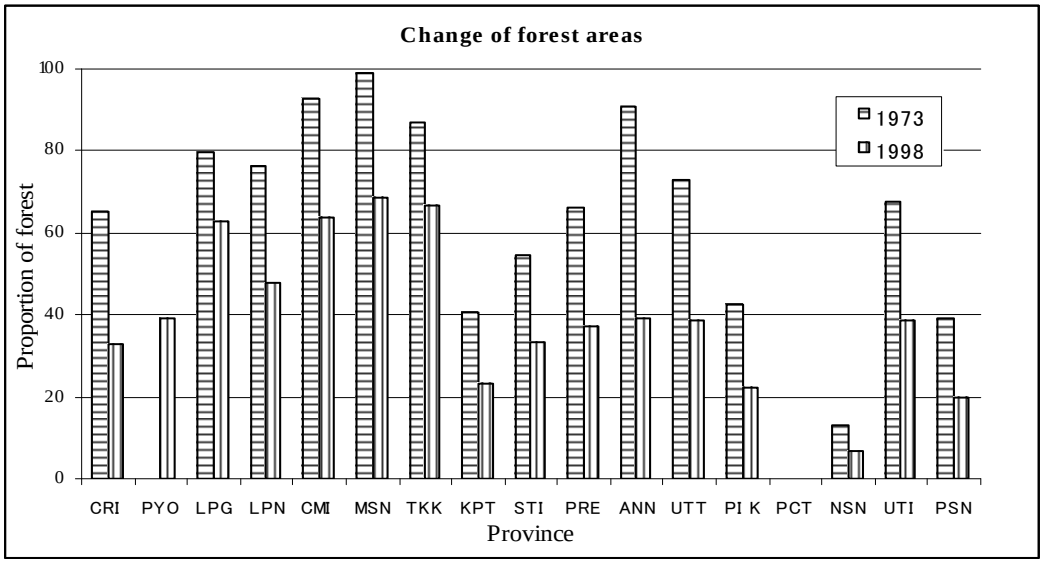



**Figure 2.2.1 Change of Forest Areas during 1973 - 1998 by Province**
Source: Forestry Statistic of Thailand year 1988, 1995, 1999 and 2003

Different scale of interpretation between 1998 and 2000 showed the forest area increase in almost all provinces of the north region. The highest increase rate was in Nan (from 40% to 73% of forest area to provincial area), followed by Phrae, Mae Hong Son and Uttaradit (31%, 21% and 20% larger, respectively). The other provinces changed about from 11 to 17%. Four of them (Kamphaeng Phet, Sukhothai, Phichit and Nakhon Sawan) had a slight change, only 1-2% larger. (See Figure 2.2.2.)

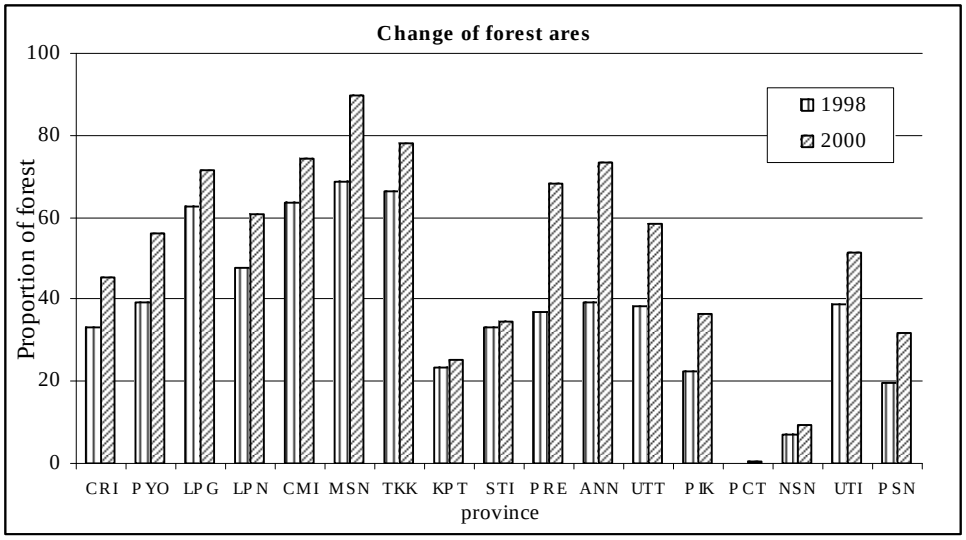



**Figure 2.2.2 Change of Forest Areas during 1998 - 2000 by Province**
Source: Forestry Statistic of Thailand year 2003

According to the recent statistics (as of year 2000), the largest actual forest area is in Chiang Mai (nearly 16,000 sq. km.), followed by Tak (13,500 sq. km.) and Mae Hong Son (11,500 sq. km.). Nan and Lampang also have a relatively large forest area each (about 9,000 sq. km.), followed by Uttaradit, Phrae and Chiang Rai, in the range of 4,500 - 5,500 sq. km. The six provinces of Phayao, Lamphun, Kamphaeng Phet, Sukhothai, Phitsanulok and Uthai Thani, have smaller areas, from 2,100 to 3,900 sq. km. The smallest areas of forest are again in the two provinces of Phichit and Nakhon Sawan (only 10 and 900 sq. km. respectively). (See Figure 2.2.3.)

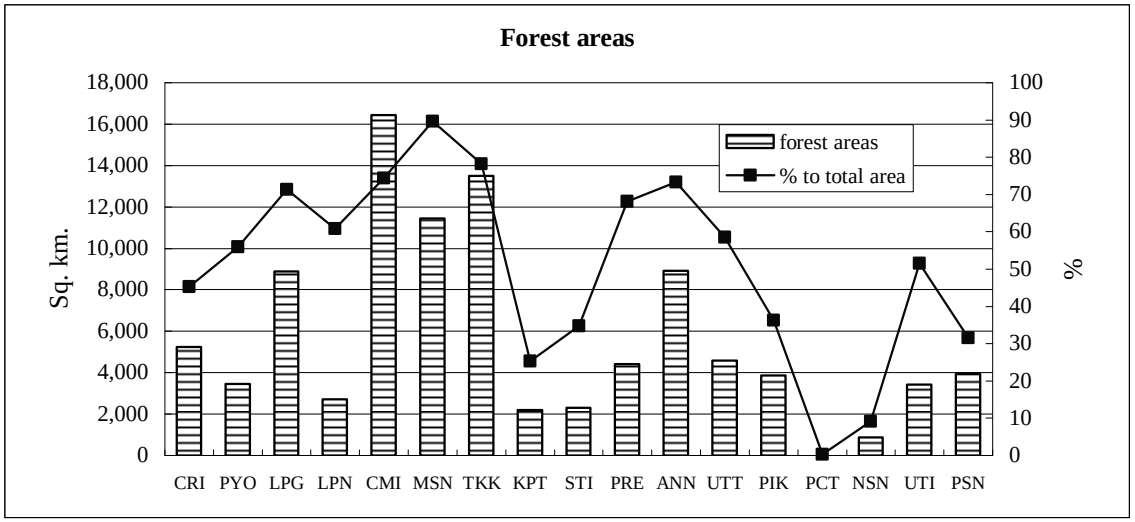



**Figure 2.2.3 Forest Areas and Forest Areas to Provincial Areas by Province (2000)**
Source: Forestry Statistic of Thailand year 2003

Although Chiang Mai holds the largest area of forest which covers about three-quarter of the provincial area (74%), it is smaller than the two provinces, Mae Hong Son and Tak, where 90% and 80% of provincial areas are covered with forest, respectively.

Despite the highest forest-declining rate in Nan, nearly three-quarter (73%) of the province is still covered by forest. This proportion is similar to Lampang and Phrae (about 70% of forest areas in both provinces). The provinces which hold forest areas more than a half to 60% are Lamphun, Uttaradit and Phayao and Uthai Thani, while its share in Chiang Rai is only 45%, and even smaller in the three provinces of Kamphaeng Phet, Sukhothai and Phitsanulok (only 25 - 36%). The smallest proportion is in the two provinces of Phichit and Nakhon Sawan (0 - 9%).

(2) Community Forest

Community forest reflected the hardship of maintaining forest resources even though there are several laws and regulations concerned as a list shown below.

- Forest Act 1941 (amended in 1948, 1982 and 1989): regulates forest management
- National Reserve Forest Act 1964: controls and maintains national reserve products
- The Comprehensive National Forest Policy 1985: targets to set forest areas at 40% (15% for

conservation, 25% for economic forest)
- The ban on logging concession in 1989
- The reverse of area ratio (%) of conservation to economic forest areas from 15/25 to 25/15 in 1989
- Cabinet resolutions 1992: classification into three zones of Conservation (C), Agriculture (A) and Economic (E)
- Wildlife Reservation and Protection Act 1992 (replacement for Wildlife Reservation and Protection Act 1960)

The above laws and regulations, however, were ineffective to stop forest exploitation because they were highly competitive among many users, combined with inefficient resource utilization management under centralized authorities. In the past forest management policy, villagers living with forest were regarded as forest destroyers. However, nowadays, they are recognized as key players for environmental conservation, since a vital cause of the destruction is regarded as inflexible top-down rules and regulations without adequate feedback system that involve villagers and local people.

With the above recognition, the Royal Forestry Department (RFD) drafted the first community forest bill in 1992. This started with encouraging local people to participate in government reforestation programs. The bill was revised and amended many times by both government and non-government organizations. Although the bill has not been ratified yet, the RFD keeps support on community forest program. This is also in line with the new paradigm of decentralization policy. The new Constitution of the Kingdom of Thailand 1997 promotes and encourages public participation in the preservation, maintenance and balanced exploitation of natural resources and biological diversity, and in the protection, promotion and preservation of environmental quality. This complements the establishment of community forest based on the request from local communities, aiming at protecting forest area for multi-purpose uses on sustainable basis.

The requested community forest areas must be outside the C zone and the protected areas such as National Parks, Wildlife Conservation, Non-hunting and Watershed Class 1A areas. They may be in the national reserve forest of A and E zones, which have to be active in forest preservation at least past five years. While any protection activities for deforestation and rehabilitation are included in the context of natural resource conservation, any collection activities of forest products, such as wild vegetables, mushrooms, bamboo, and dried wood, can be allowed to some extent. The type of forest products is supposed to be agreed with the related forest committee.

As of the year 2004, there are about 1,400 community forest projects in 1,487 villages, supported by the RFD in the North Thailand. Among these, Lampang and Phrae hold the largest number, 137 and 134, respectively, followed by 122 in Nan and 105 in Chiang Rai. Five provinces of Phayao, Lamphun, Tak, Chiang Mai and Kamphaeng Phet are following them, between 92 and 96. There is small number of projects in Sukhothai and Uthai Thani, about 30 projects each. (See Table 2.2.3.)

The number of projects is slightly smaller than that of villages involved. This reflects the share of resources and the same rules and regulations seem to be used among other villages. In this context, Phrae has the largest village number (164), followed by Lampang and Nan (141 and 125). Chiang Rai, Phayao, Tak, and Lamphun are between 102 and 107. In terms of the areas involved, Chiang Rai holds the largest area, 105 sq. km., followed by Tak, 98 sq. km. Two provinces of Lamphun and Nan hold similar size, 90 sq. km. The smaller areas are found in three provinces of Sukhothai, Phichit and Nakhon Sawan, less than 10 sq. km. each.

**Table 2.2.3 Community Forest Supported by the RFD during Year 2000 - 2004**

| province | No. of Village | No. of Project | Forest reserve area (sq.km). | Forest area (sq.km). | total area (sq.km). |
|---|---|---|---|---|---|
| Chiang Rai | 107 | 105 | 56 | 49 | 105 |
| Phayao | 102 | 94 | 26 | 15 | 41 |
| Lampang | 141 | 137 | 37 | 6 | 43 |
| Lamphun | 103 | 92 | 63 | 24 | 87 |
| Chiang Mai | 94 | 94 | 16 | 5 | 21 |
| Mae Hong Son | 45 | 46 | 58 | 1 | 59 |
| Tak | 104 | 95 | 91 | 8 | 98 |
| Kamphaeng Phet | 96 | 96 | 31 | 9 | 40 |
| Sukhothai | 36 | 30 | 8 | 0 | 8 |
| Phrae | 164 | 134 | 69 | 7 | 76 |
| Nan | 125 | 122 | 33 | 54 | 88 |
| Uttaradit | 80 | 80 | 49 | 14 | 63 |
| Phitsanulok | 70 | 67 | 12 | 3 | 14 |
| Phichit | 42 | 42 | 2 | 1 | 3 |
| Nakhon Sawan | 63 | 63 | 0 | 1 | 1 |
| Uthai Thani | 35 | 32 | 8 | 5 | 13 |
| Phetchabun | 80 | 71 | 25 | 50 | 75 |
| North | 1487 | 1400 | 583 | 252 | 835 |

Source: Forestry Statistic

## 2.3 SOCIO-ECONOMIC AND RURAL CONDITIONS

### 2.3.1 Demography

Chiang Mai has the largest area of 20,107 sq. kms and the largest population among the 17 provinces, about 1.6 million. Chiang Rai has the second largest population, around 1.2 million. As for the population density, the largest one is in Phichit, 132.0 (person/sq. km.), located in lower flat land with active paddy cultivation. On the other hand, Tak and Mae Hong Son are the least populated provinces with 30.4 and 18.8 (person/sq. km.), respectively. Both provinces are located in mountainous area and border on Myanmar. (See Table 2.3.1.)

**Table 2.3.1 Demographic Data by Province**

| Province | Area (sq.km)*1 | Population (2002)*2 | % of Population in munincipal area*3 | Population density (persons / sq.km) (2002)*2 | No. of Dwelling (2001)*2 | Population Growth Rate (%) (1998-2002)*2 | House -holds size*4 | %of in-migrate *5 | % of out-migrate *5 |
|---|---|---|---|---|---|---|---|---|---|
| Chiang Rai | 11,678 | 1,214,913 | 16.6 | 104.0 | 373,623 | -0.9 | 3.5 | 3.9 | 3.9 |
| Phayao | 6,335 | 501,509 | 21.1 | 79.2 | 151,102 | -0.6 | 3.4 | 4.3 | 4.2 |
| Lampang | 12,534 | 797,216 | 7.9 | 63.6 | 233,187 | -0.3 | 3.5 | 4.5 | 4.3 |
| Lamphun | 4,506 | 409,041 | 22.6 | 90.8 | 130,087 | 0.0 | 3.4 | 2.9 | 2.5 |
| Chiang Mai | 20,107 | 1,603,220 | 24.4 | 79.7 | 526,496 | 0.3 | 3.4 | 5.4 | 5.1 |
| Mae Hong Son | 12,681 | 238,241 | 2.9 | 18.8 | 67,047 | 0.4 | 3.9 | 3.3 | 3.2 |
| Tak | 16,407 | 498,714 | 21.6 | 30.4 | 133,300 | 0.8 | 3.8 | 4.9 | 4.1 |
| Kamphaeng Phet | 8,607 | 774,225 | 4.1 | 89.9 | 194,331 | 0.1 | 3.6 | 4.0 | 3.6 |
| Sukhothai | 6,596 | 621,693 | 18.0 | 94.3 | 166,170 | -0.3 | 3.5 | 4.9 | 4.2 |
| Phrae | 6,539 | 482,232 | 19.9 | 73.8 | 140,943 | -0.6 | 3.4 | 4.2 | 3.8 |
| Nan | 11,472 | 482,181 | 12.1 | 42.0 | 128,490 | -0.2 | 3.8 | 4.6 | 4.1 |
| Uttaradit | 7,839 | 481,640 | 21.0 | 61.4 | 129,432 | -0.1 | 3.4 | 4.5 | 4.2 |
| Phitsanulok | 10,816 | 867,356 | 17.2 | 80.2 | 241,141 | 0.0 | 3.5 | 5.3 | 5.4 |
| Phichit | 4,531 | 597,882 | 19.5 | 132.0 | 145,570 | -0.2 | 3.5 | 4.4 | 4.3 |
| Nakhon Sawan | 9,598 | 1,126,739 | 20.4 | 117.4 | 307,783 | -0.2 | 3.5 | 4.7 | 4.6 |
| Uthai Thani | 6,730 | 339,483 | 15.8 | 50.4 | 89,347 | 0.5 | 3.5 | 4.6 | 3.6 |
| Phetchabun | 12,668 | 1,052,286 | 3.2 | 83.1 | 257,409 | 0.1 | 3.9 | 4.6 | 4.6 |
| North Region | 169,644 | 12,088,571 | | 71.3 | 3,415,458 | -0.1 | 3.5 | 4.4 | 3.9 |
| Whole country | 513,115 | 63,079,765 | | 122.9 | 16,910,473 | | 3.7 | | |

*1 Provicial Data Base in 2000, National Statistical Office

*2 Bureau of Registration Administration, Department of Local Administration, Ministry of Interior

*3 Bureau of Registration Administration, Department of Local Administration, Ministry of Interior. Data of Phetchabun and Lampang(1998), Mae Hong Son(2000), Kamphaeng Phet (1999), and the others(2002)

*4 The 2000 Population and Housing Census, National Statistical Office

*5 Bureau of Registration Administration, Department of Local Administration, Ministry of Interior, lined number (1997), the others (2002)

As for population growth, provincial population has decreased in recent 5 years in more than a half of the provinces. Especially, in Chiang Rai, its population has decreased at the highest rate of 4.0 (%/year) during 1998 - 2002. Recent lower/minus population growth in the North Thailand can be partly explained by a lower birthrate and a high death rate.

On average, the population in municipal area occupies 20 %, and the highest rate is found in Chiang Mai, 24.4 %. However, it is less than 10 % of total in Lampang, Mae Hong Son, Kamphaeng Phet and Phetchabun. As for migration, both in- and out-migration rates are higher in Chiang Mai and Phitsanulok, while the provinces that the in-migration rate is higher than the out-migration rate are Tak, Sukhothai and Uthai Thani, and both rates are low in Lamphun.

### 2.3.2 Industrial Structure

According to the statistics on labor forces, a half of the labor force (51.6%) is engaged in an agriculture sector in the North Thailand. In Mae Hong Son, a remote and mountainous province, 83.1 % of labor forces work in the agriculture sector, although the total labor force size is the smallest. Also in Nakhon Sawan and Uthai Thani that are located in the lowland, a relatively larger share of labor forces, 64.4 % and 67.5 % respectively, is engaged in the agriculture sector. On the other hand, in Lamphun and Chiang Mai, share of the agriculture sector is relatively low, 36.5 % and 35.9 %, respectively. Lamphun has a fairly higher ratio of population in the manufacture sector (32.0 %), comparing with the average of the North Thailand (15.6 %). In Chiang Mai, the service sector

occupies 41.0 % of the labor forces (hotel and restaurants sector occupies 16.5% of the total) comparing with the regional average, 29.4 %. The unemployment rate is highest in Kamphaeng Phet, 14.5 %, much higher than the regional average, 3.4 %. (See Figure 2.3.1.)

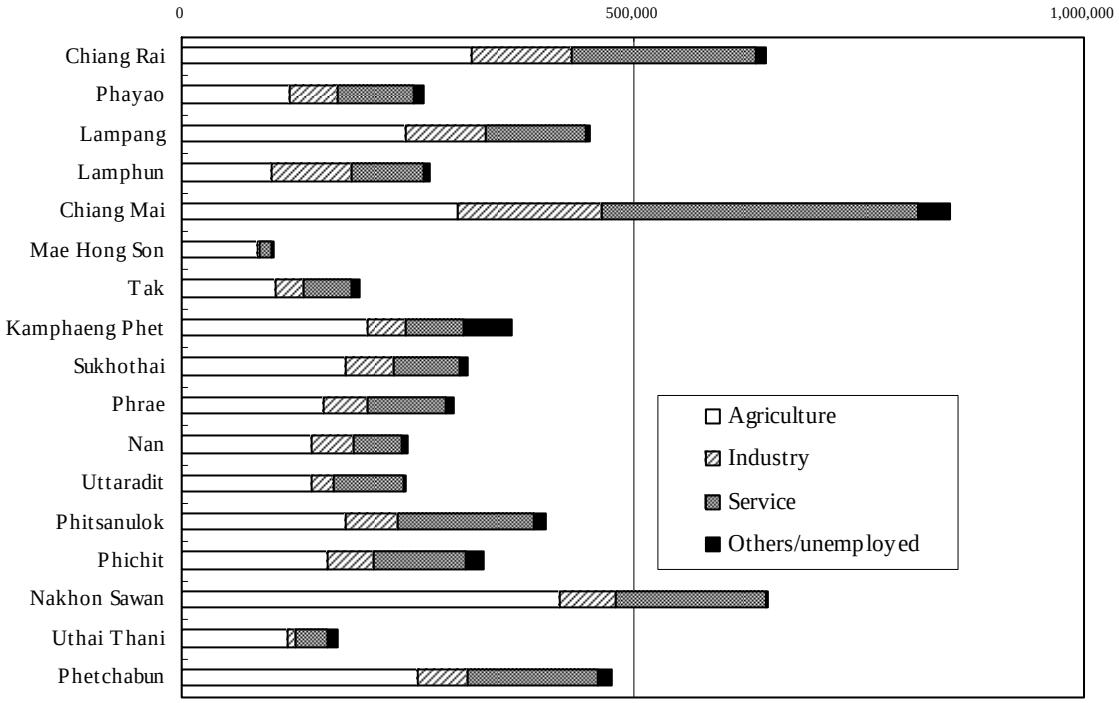



**Figure 2.3.1 Number of Employed Persons Aged 15 Years and Over by Industry**

Note: All data come from 2002-2003, except Mae Hong Son (2000) and Kamphaeng Phet (1999).
Source: Statistical Reports of the Provinces, National Statistical Office

The total Gross Provincial Product (GPP) in the North Thailand is 443,392 million Baht, which is only 10 % of the total GPP of the whole country. Compared with the provincial GPP among the 17 provinces, Chiang Mai has the largest (83,245 million Baht), which occupies about 19 % of the region. (See Figure 2.3.2.)

The average share of the agriculture sector to the total GPP in the North Thailand is 19%. As compared to the national average, the agriculture sector takes a more important role in the region, except for Chiang Mai, Lamphun and Lampang where the share of non-agricultural sectors including the service sector occupies about 90%. In other provinces, the share of the agriculture sector is over 15%. In particular, Phichit, Uthai Thani and Phetchabun rely more heavily upon the agriculture sector: the shares are 30.0%, 33.7% and 29.7%, respectively.

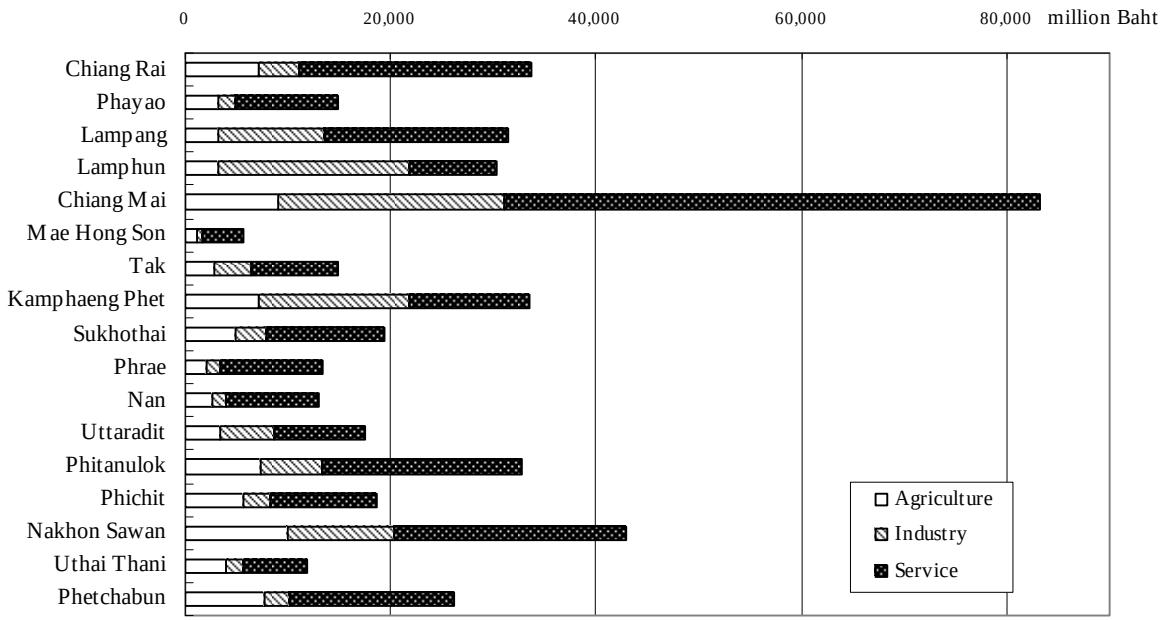



**Figure 2.3.2 Gross Provincial Product at Current Market Prices (2000)**

Source: Office of the National Economic and Social Development Board

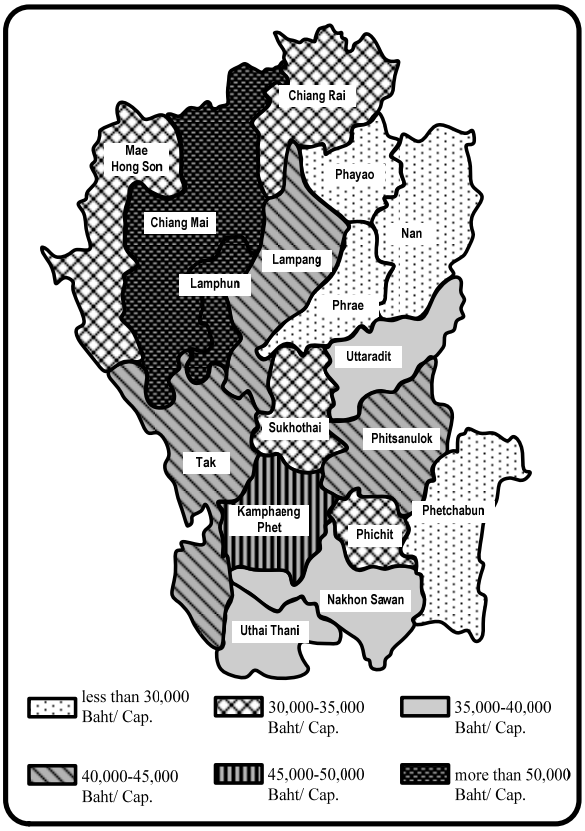



**Figure 2.3.3 Average per capita GPP**

The average per capita GPP of the North Thailand (39,402 Baht) is only a half of the national average (78,783 Baht). Some provinces such as Phayao (29,486), Phrae (25,963), Nan (29,410), Chiang Rai (30,244), and Phetchabun (28,350), are in the lower range. On the other hand, Lamphun (69,622), Chiang Mai (57,095) and Kamphaeng Phet (48,980) are relatively high in the region. (See Figure 2.3.3.)

### 2.3.3 Poverty

From the statistics, the average monthly household income in the North Thailand is calculated as 9,530 Baht, which is much lower than the national average, 13,736 Baht. Concerning the monthly income of agricultural household, the average in the region is 7,874 Baht, and it is also lower than the national average, 8,753 Baht. The income gap of agricultural household between the North Region and the whole country is not as large as that of whole households.

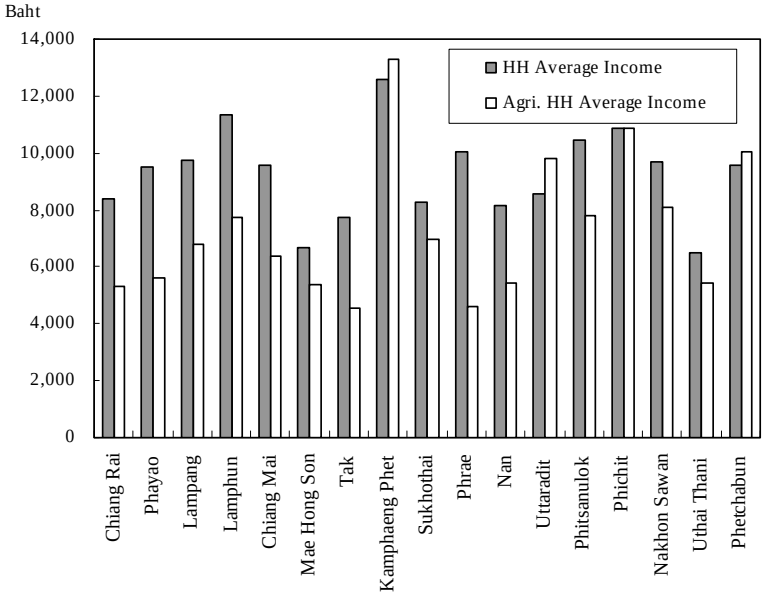



**Figure 2.3.4 Average Monthly Household Income**

Source: NESDB and Report of Household income and Income distribution by province in 2003

Though the income amount of agricultural household is generally lower than that of whole households, average agricultural household income in Kamphaeng Phet, Phitsanulok, Phetchabun and Phichit is more than the average of whole households. Among them, Kamphaeng Phet has the highest income, 13,303 Baht. This may be explained that farm households of these provinces have more income sources by cultivating various cash crops such as rice, cassava and sugarcane on relatively large farmland with easy access to water resources. The agricultural household income in Chiang Rai, Phayao, Mae Hong Son, Phrae, Tak and Nan, is below the poverty line, so that, it can be said that farmers in these provinces are forced to rely on other income sources. (See Figure 2.3.4 and Figure 2.3.5.)

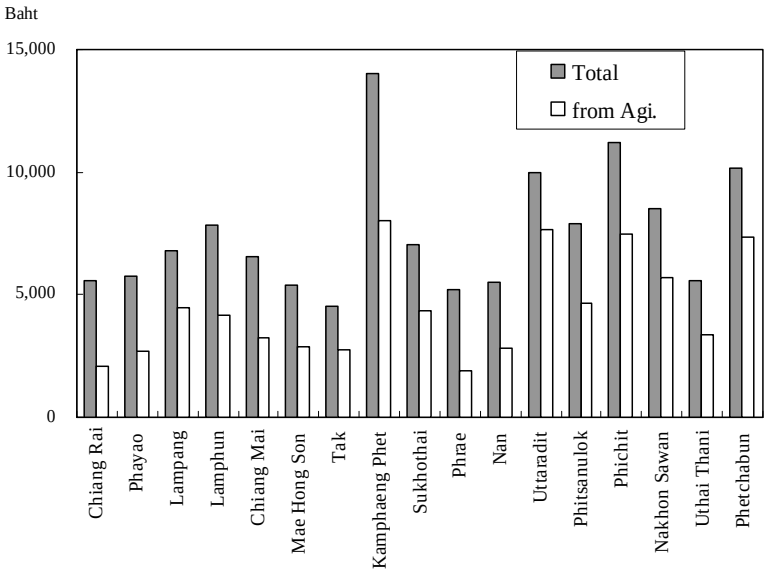



**Figure 2.3.5 Average Monthly Income of Agricultural Household**

Source: NESDB and Report of Household income and Income distribution by province in 2003

Comparing with monthly income of agricultural household on map, four provinces (Kamphaeng Phet, Phichit, Uttaradit and Phetchabun) have higher income than others and income from the agricultural sector is more than 7,300 Baht in these four provinces. Lower monthly income is found in Mae Hong Son, Tak, Nan and Phrae, less than 5,500 Baht. (See Figure 2.3.6.)

According to the survey, 60 % of households have heavy debt in the North Thailand. Kamphaeng Phet records the highest rate, 75%, while four provinces (Mae Hong Son, Lampang, Uttaradit and Tak) have low rate, less than 50 % of the provincial population. As for the agricultural household, the average rate rises to 80 %. The rate of agricultural household with debt in Mae Hong Son, Lampang and Tak is relatively low, more or less 50 %, while more than 90 % in Phichit and Uthai Thani.

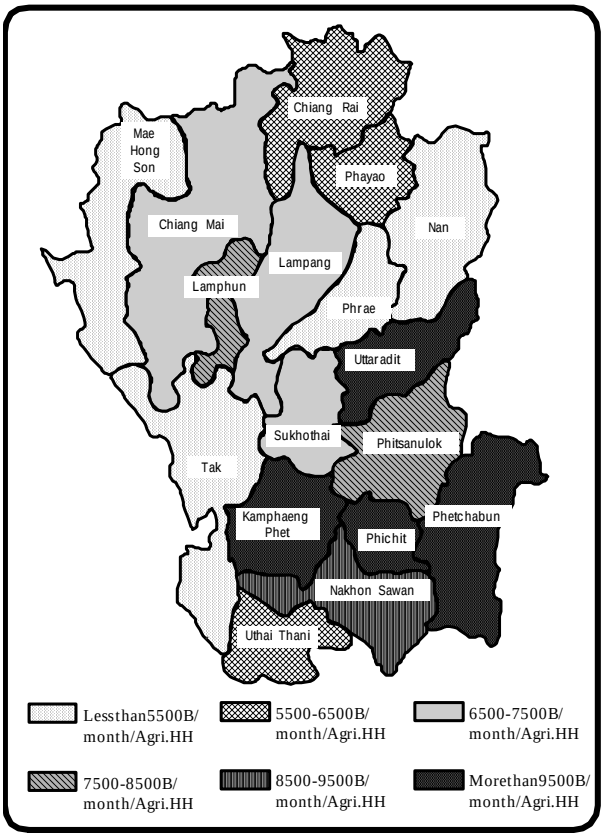



**Figure 2.3.6 Map of Average Monthly Income of Agriculture Household**

The average monthly debt amount per household in the region is 94,346 Baht, which represents 82.5% of the total income (114,360 Baht). Much heavier debt is found in Lamphun, Chiang Mai, Phitsanulok and Phichit. Particularly, in Chiang Mai and Phichit, the amount of debt exceeds the average income. The debt amount in Mae Hong Son and Uthai Thani is relatively small, less than 50,000 Baht.

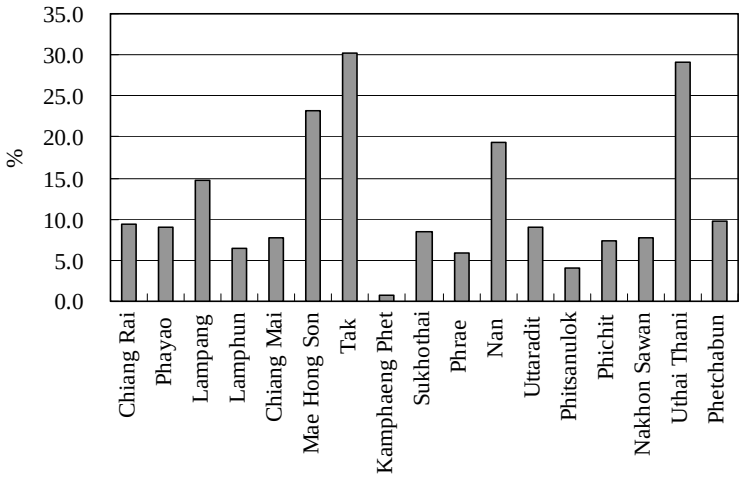



**Figure 2.3.7 Percentage of Poor Population**

Source: NESDB and Report of Household income and Income distribution by province in 2003

The total poor population under the poverty line is estimated at 1,114,328 in the North Thailand. The ratio of poor population to provincial population is higher in Tak, Mae Hong Son, Uthai Thani, where 23-30 % suffer poverty, while the lowest ratio, less than 1.0 %, is found in Kamphaeng Phet. (See Figure 2.3.7.)

### 2.3.4 Living Environment

(1) Education and Health

The average school attendance period in this region (6.3 years) is shorter than the national average (7.3 years). In Mae Hong Son, the average school attendance period is only 4.5 years. Chiang Rai, Nan and Tak also show short period, less than 6 years. It is observed that the provinces with longer period have higher per capita GPP. (See Figure 2.3.8.)

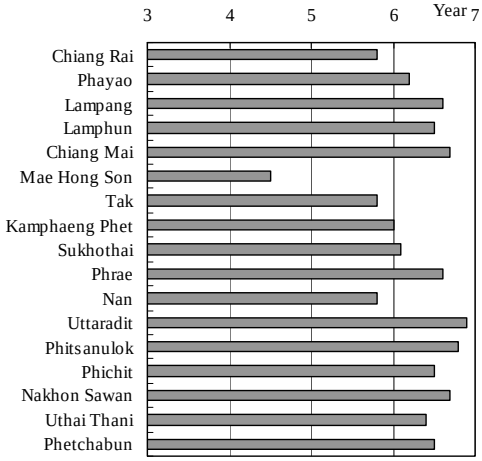



**Figure 2.3.8 Average School Attendance Period (2001)**

Source: Provincial Education Office, Ministry of Education, Statistical Reports of the Provinces, National Statistical Office
Note: Kampheang Phet (1999), Mae Hong Son (2000), Tak (2001), and the others (2002)

Comparing with the other regions, the North Thailand has higher death rate and lower birthrate. This is especially prominent in the northeast quarter of the region, where the birthrate is 6-9 per 1,000 population, (the national average: 12.49), while the death rate is 8-10 per 1,000 population, (the national average: 5.91). As for the birth rate, it is lower in Lamphun (6.78) and Phrae (7.22), while higher in Mae Hong Son (14.2) and Tak (14.39). The higher death rate is also concentrated on these northeastern provinces, like Chiang Mai (9.85) and Phayao (9.75), while the lower death rate is found in Kamphaeng Phet (4.l6) and Mae Hong Song (4.74). One of the reasons for the higher death rate in these provinces may result from the spread of AIDS / HIV. (See Figure 2.3.9.)

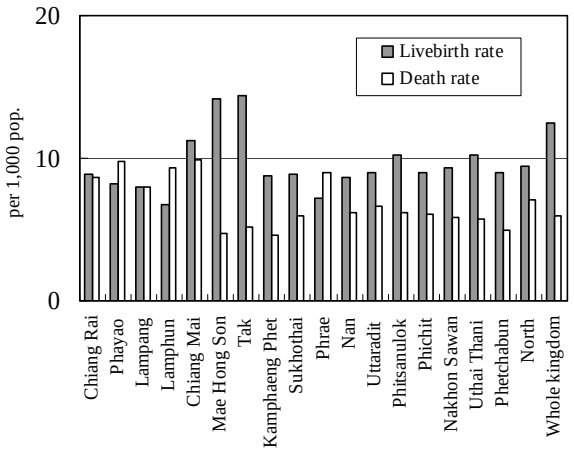



**Figure 2.3.9 Birthrate and Death Rate (2000)**

Source: Public Health Statistics A.D.2000

As for the number of medical facilities such as hospital and bed, it can be said that some provinces with large population (Chiang Rai, Chiang Mai and Nakhon Sawan) have more medical facilities. The number of population per one hospital bed is smallest in Chiang Mai (246.2), while it is large in Kamphaeng Phet (897.1) and Phetchabun (896.3), which is about 3.5 times of the Chiang Mai value. Judging from the number of health service personnel, Chiang Mai has a good level, while Kamphaeng Phet and Phetchabun are relatively at a low level. The number of population per physician is smallest in Chiang Mai (1,888), while it is large in Kamphaeng Phet (9,445) and Phetchabun (14,064). The number of population per nurse is smallest in Chiang Mai (527),

while it is large in Kamphaeng Phet (2,439) and Phetchabun (2,224). (See Figure 2.3.10.)

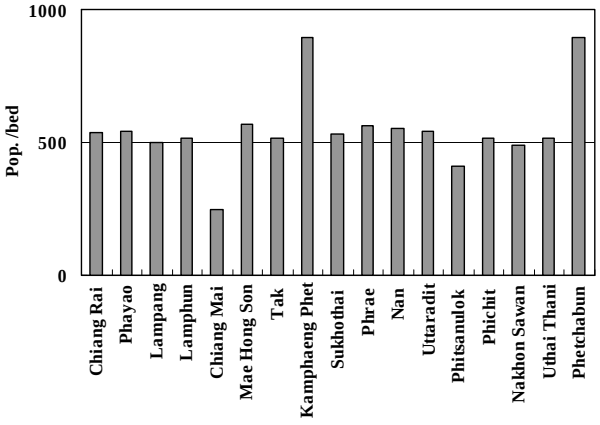



**Figure 2.3.10 No. of Population per One Hospital Bed (2002)**

Source: Statistical Reports of the Provinces, National Statistical Office

(2) Domestic Facilities

Domestic facilities for safe drinking water, and flush and molded bucket latrine are equipped with most houses in the North Thailand except for Mae Hong Son. On average, safe drinking water is accessible for more than 80 % of households. Mae Hong Son and Nan are still at a low level for safe drinking water. Availability of the flush and molded bucket latrine is higher than that of the safe drinking water, more than 90 % of households. Lower figures are found only in Mae Hong Son and Tak. (See Figure 2.3.11 and Figure 2.3.12.)

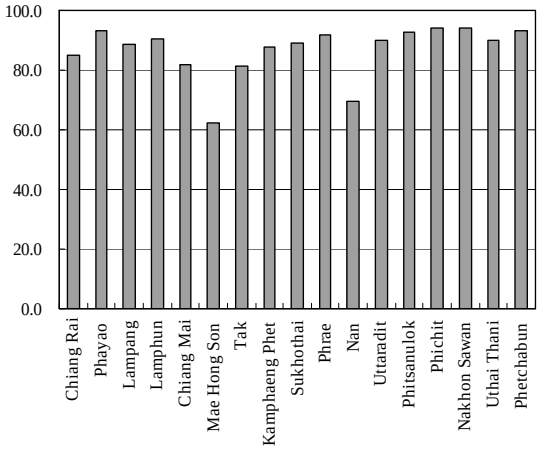



**Figure 2.3.11 Percentage of Household with Safe Drinking Water**

Source: The 2002 Population and Housing Census

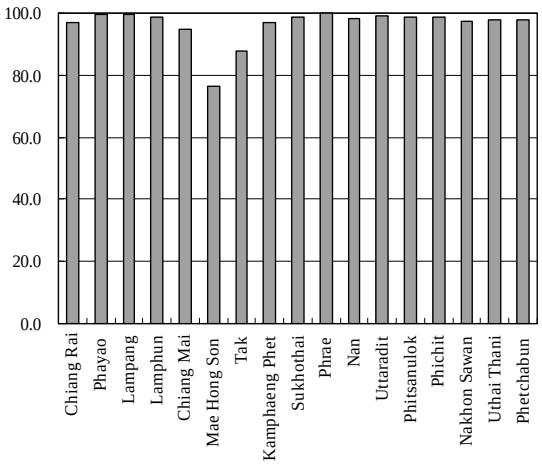



**Figure 2.3.12 Percentage of Household with Flush and Moulded Bucket Latrine**

Source: The 2002 Population and Housing Census

In the North Thailand, more than 67 % of households living in non-municipal areas have refrigerators, but the low rate (less than 40 %) is found in Chiang Rai and Mae Hong Son. The rate of household using cooking facilities with gas or electricity is 52 %, which is much lower than that of refrigerator. This means that about a half of population still uses firewood and charcoal for cooking. Particularly in Mae Hong Son and Nan, more than 70 % of households rely on firewood from forest. (See Figure 2.3.13 and Figure 2.3.14.)

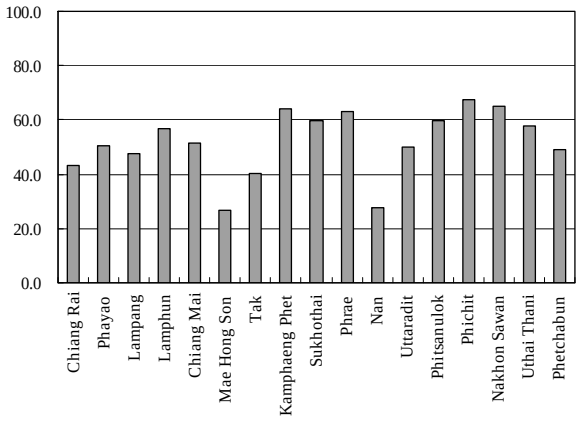



**Figure 2.3.13 Percentage of Household Cooking with Gas or Electricity**

Source: The 2002 Population and Housing Census

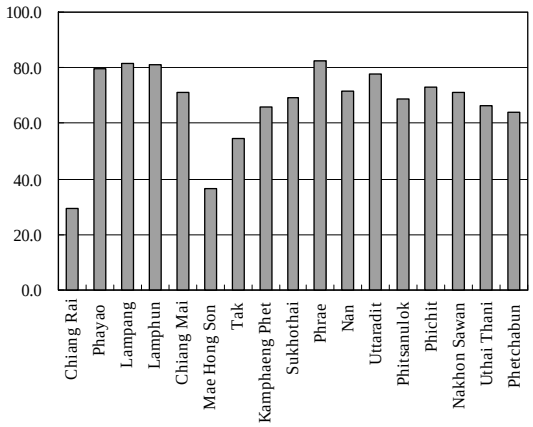



**Figure 2.3.14 Percentage of Household with Refrigerator**

Source: The 2002 Population and Housing Census

(3) Transportation

Motorcycle is an important means of transportation for rural people. On average, 70 % of households in non-municipal areas possess their own motorcycles. Comparing the provincial data, Mae Hong Son (44 %) and Tak (56.8%) are lower than the regional average. On the other hand, cars are owned by only one fifth of the rural households. In Lamphun and Chiang Mai, about 30 % of households have them, while the percentage decreases to 10 % in Mae Hong Son. (See Figure 2.3.15 and Figure 2.3.16.)

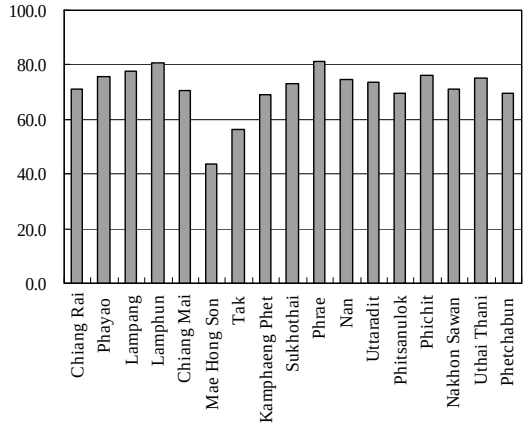



**Figure 2.3.15 Percentage of Household with Motorcycle**

Source: The 2002 Population and Housing Census

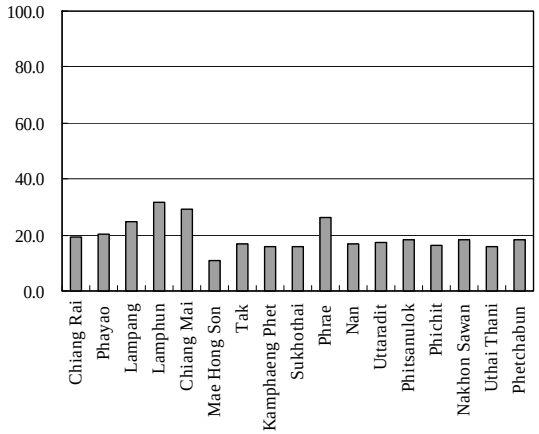



**Figure 2.3.16 Percentage of Household with Car**

Source: The 2002 Population and Housing Census

## 2.4 AGRICULTURAL CONDITIONS

### 2.4.1 Land Tenure

In general, the average farm holding land per household has been decreasing at a national level.

**Table 2.4.1 Average Farm Holding Land per Household (1981-1999)**

| Province | Actual Figures (rai/H.H.) | | | | | Percentage (1981=100) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1981 | 1986 | 1991 | 1995 | 1999 | 1981 | 1986 | 1991 | 1995 | 1999 |
| Phichit | 44.5 | 43.0 | 40.7 | 42.6 | 41.2 | 100 | 97 | 92 | 96 | 93 |
| Nakhon Sawan | 43.3 | 41.1 | 38.7 | 38.3 | 36.4 | 100 | 95 | 89 | 88 | 84 |
| Kamphaeng Phet | 39.9 | 40.7 | 37.6 | 39.0 | 35.6 | 100 | 102 | 94 | 98 | 89 |
| Phetchabun | 38.0 | 33.4 | 38.7 | 33.7 | 34.6 | 100 | 88 | 102 | 89 | 91 |
| Uthai Thani | 34.4 | 33.6 | 34.2 | 33.5 | 31.2 | 100 | 98 | 99 | 98 | 91 |
| Phitsanulok | 31.9 | 32.9 | 33.0 | 31.9 | 28.9 | 100 | 103 | 104 | 100 | 91 |
| Tak | 18.4 | 19.7 | 21.4 | 23.3 | 24.9 | 100 | 107 | 116 | 127 | 135 |
| Uttaradit | 21.3 | 23.0 | 24.0 | 21.3 | 23.4 | 100 | 108 | 112 | 100 | 110 |
| Sukhothai | 26.7 | 27.8 | 27.0 | 24.7 | 23.2 | 100 | 104 | 101 | 92 | 87 |
| Chiang Rai | 16.4 | 15.8 | 16.1 | 15.7 | 15.3 | 100 | 97 | 98 | 96 | 93 |
| Phayao | 14.2 | 14.4 | 15.3 | 15.3 | 13.9 | 100 | 102 | 108 | 108 | 98 |
| Nan | 10.1 | 12.5 | 14.2 | 12.9 | 11.9 | 100 | 123 | 140 | 127 | 117 |
| Mae Hong Son | 6.8 | 8.6 | 9.5 | 13.5 | 11.5 | 100 | 127 | 140 | 199 | 171 |
| Phrae | 8.8 | 11.2 | 11.2 | 10.4 | 11.2 | 100 | 127 | 127 | 119 | 128 |
| Lampang | 8.4 | 11.1 | 11.8 | 11.6 | 10.3 | 100 | 132 | 140 | 138 | 123 |
| Lamphun | 8.7 | 8.3 | 8.5 | 11.1 | 9.9 | 100 | 95 | 97 | 127 | 113 |
| Chiang Mai | 9.1 | 8.8 | 9.2 | 9.3 | 9.5 | 100 | 97 | 101 | 102 | 104 |
| North Region | 22.6 | 22.4 | 22.9 | 22.6 | 21.8 | 100 | 99 | 102 | 100 | 97 |
| Thailand | 26.8 | 26.3 | 25.9 | 25.2 | 23.2 | 100 | 98 | 97 | 94 | 87 |

(Data source: Agricultural Statistics of Thailand, Office of Agricultural Economics, MOAC)

However in some provinces in the North Thailand, such as Tak, Mae Hong Song and Phrae, the time series data indicate that average farm holding land per household has increased in the two decades. These three provinces increased the average farm holding land per household more than 25% in 1999 as compared to the corresponding figures in 1981. (See Table 2.4.1. The data are sorted out in descending order of 1999 area data.)

Among the 17 provinces in the North Thailand, big differences are observed. Phichit has the largest farm holding land per household, while Chiang Mai has the least, less than one forth of the Phichit. Among the 17 provinces, there are 8 provinces (Chiang Mai, Lamphun, Lampang, Phrae, Mae Hong Son, Nan, Phayao and Chiang Rai) where average farm holding land per household is below 20 rai and less than the regional average size. (See Figure 2.4.1.)

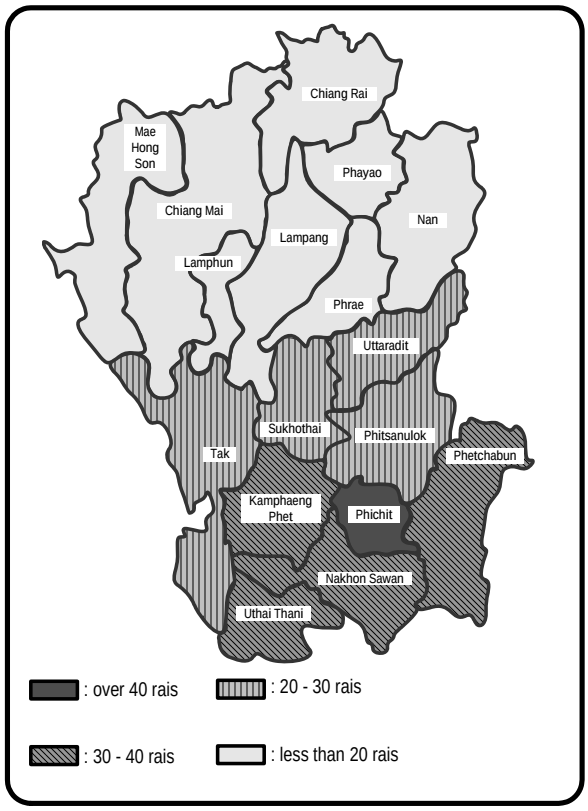



**Figure 2.4.1 Average Farm Holding Land per Household (1999)**

As for land holding type, three provinces (Mae Hong Son, Phichit and Nakhon Sawan) are distinctive in the North Thailand because less than half of the farm holding land is categorized under owned land. This means that, in other 14 provinces, more than half of farmland is cultivated by the land owners themselves.

### 2.4.2 Land Use

According to the statistics, total provincial area consists of three land categories: farm holding land, forest land and unclassified land. In some provinces, the distribution ratios of these land categories indicate unique features in terms of land use. (See Figure 2.4.2.) For instance, in 1999, farm holding land occupies more than 40% of its provincial area in the 5 provinces as compared to the average of the 17 provinces, 30%. In the 4 provinces, forest land dominates their provincial areas (over 60%) while the regional average is 38%. However, there are no substantial time series changes of land use since 1991 in the 17 provinces.

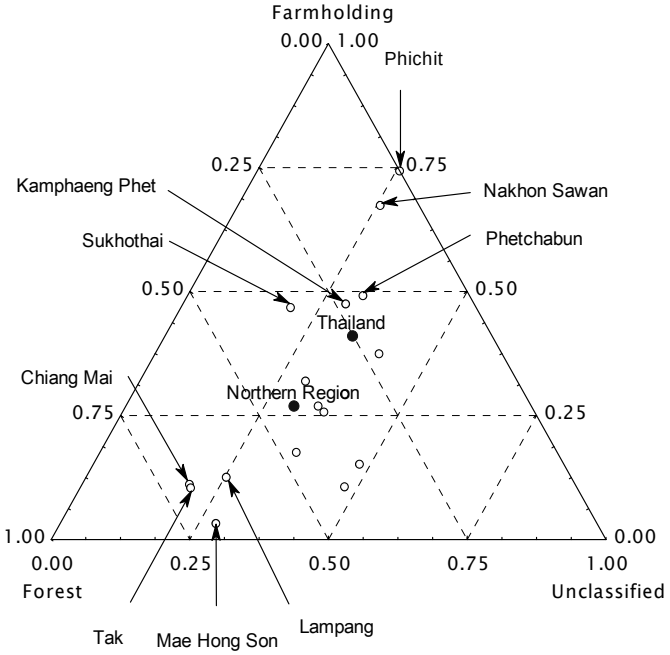



**Figure 2.4.2 Ternary Graph of Land Use (1999)**

**Table 2.4.2 Province Groups by Land Use**

| Features of land use | Provinces |
|---|---|
| Farm holding land is prominent. | Phichit, Nakhon Sawan |
| Forest land is prominent. | Lampang, Chiang Mai, Mae Hong Son, Tak |
| Unclassified land is prominent. | Phrae, Nan, Phitsanulok |
| No specific features | Chiang Rai, Lamphun, Phayao, Sukhothai, Kamphaeng Phet, Uttaradit, Uthai Thani, Phetchabun |

Farm holding land is further classified into eight types: paddy, field crop, fruit trees and tree crops, vegetables and flowers, grassland, idle land, other land, and housing area. In terms of agricultural land use, the first four categories are fundamentally important, and the data of field crop, vegetables and flowers are combined into upland crops, so they are reclassified into three major categories, namely paddy land, upland crops land (field crop + vegetables and flowers), and orchards (fruit trees and tree crops). The distributions of the three types of farmland in the 17 provinces indicate features of agricultural land use.

In the three provinces, paddy land occupies more than two thirds of the agricultural land. Particularly, 81% of productive farm land is under paddy cultivation in Phichit, while the North Thailand average is 52%. In the four provinces which include Tak, Phetchabun, Nan and Kamphaeng Phet, upland crops land occupies about half of the agricultural land. In Lamphun and Chiang Mai, orchards are characteristic among the 17 provinces since the distribution ratios are 58% and 32% while the regional average is merely 15%. (See Figure 2.4.3.)

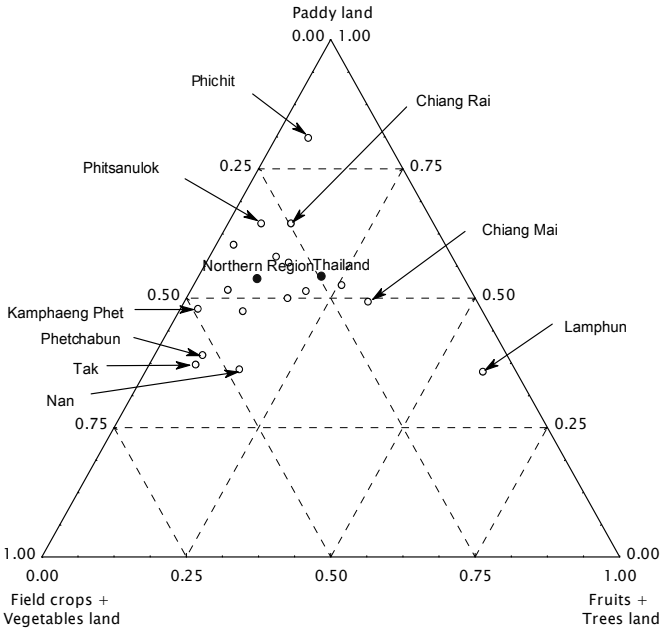



**Figure 2.4.3 Ternary Graph of Farm Land Use (1999)**

Since 1981, farm land use drastically changed in the following five provinces, Phayao, Lamphun, Chiang Mai, Tak and Sukhothai. In Lamphun and Chiang Mai, orchards have considerably increased in exchange for paddy decrease. In Tak, upland crops land has enlarged in exchange for paddy decrease. In Phayao and Sukhothai, the decrease of paddy land has been replaced by both upland crops land and orchards. In other 12 provinces, there are no significant changes of productive farm land use from 1981 to 1999. As a result, the 17 provinces are grouped by distinctive crops as shown below.

**Table 2.4.3 Province Groups by Utilization of Farm Land**

| Features of farm land | Provinces |
|---|---|
| Paddy land is prominent. | Chiang Rai, Phitsanulok, Phichit |
| Field crops and vegetables lands are prominent. | Tak, Kamphaeng Phet, Nan, Phetchabun |
| Fruits and tree crops lands are prominent. | Lamphun, Chiang Mai |
| No specific features | Phayao, Lampang, Mae Hong Son, Sukhothai, Phrae, Uttaradit, Nakhon Sawan, Uthai Thani |

## 2.4.3 Cropping Systems

Based on crop distribution ratios to the total harvested area of 17 crops, characteristic crops are identified in each province. In five provinces, paddy is distinctive as compared to other provinces. Among them, major rice is the most characteristic crop in Lampang, Chiang Rai and Phayao since it accounts for 60% or more as compared to the regional average, 47.5%. In Phichit and Phitsanulok, second rice occupies 40.1% and 28.2% of the total harvested area, respectively, while the regional average is only 9.9%. (See Figure 2.4.4 indicating in order of the major rice ratio.)

As for upland crops, there seems to be three sub groups, namely maize/mungbeans, cassava/sugarcane, and soybeans. Tak, Sukhothai, Nan and Phetchabun are included in the first maize/mungbeans sub group. In Tak and Phetchabun, maize occupies 53.2% and 36.8% of the total harvested area in

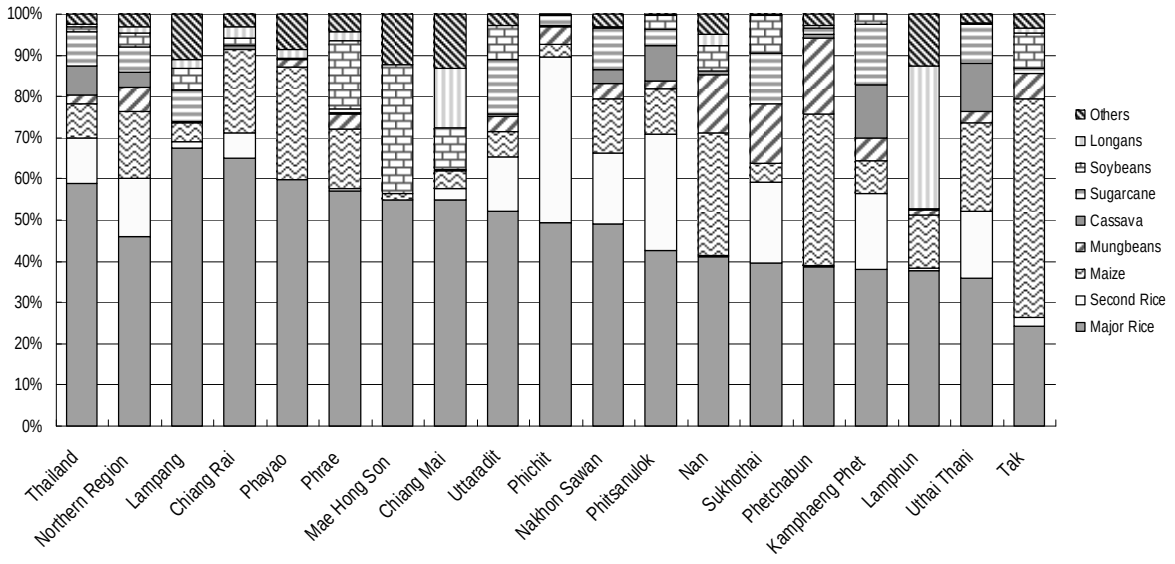



**Figure 2.4.4 Proportion of Harvested Area by Crop (2002)**

comparison with the regional average, 16%. Cassava and sugarcane are generally minor crops in the North Thailand because of the small regional averages, 2.4% and 4.6%. But they are characteristic in four provinces, Kamphaeng Phet, Uttaradit, Nakhon Sawan and Uthai Thani. Cassava accounts for more than 10% of the total harvested area in Kamphaeng Phet and Uthai Thani while sugarcane is distinctive in Kamphaeng Phet, Uttaradit and Nakhon Sawan because the area distribution ranges 10-14%.

Mae Hong Son and Phrae are characterized by soybean cultivation since it occupies 31.4% and 16.6% of the total harvested area although the regional average is only 6.2%. Lamphun is unique because longans accounts for more than one third of the total harvested area. Chiang Mai also has a large longans share in terms of the total harvested area, and it has various crops since the share of other crops is the biggest in the region, 13.1% in comparison with the regional average, 5%. As a result, the 17 provinces are grouped by distinctive crops as shown below.

**Table 2.4.4 Province Groups by Distinctive Crops**

| Crop group | Distinctive crops | Provinces |
|---|---|---|
| Paddy | Major rice | Lampang, Chiang Rai, Phayao |
| | Second rice | Phitsanulok, Phichit |
| Upland crops | Maize/mungbeans | Tak, Sukhothai, Nan, Phetchabun |
| | Cassava/sugarcane | Kamphaeng Phet, Uttaradit, Nakhon Sawan, Uthai Thani |
| | Soybeans | Mae Hong Son, Phrae |
| Others | Longans/others | Lamphun, Chiang Mai |

Irrigation development progress is considered as one of the indicators that describe infrastructure development in rural areas. From the agricultural statistics, the percentages of irrigation water resource development completed area to the total farm holding area were calculated together with the data for pumping irrigation for paddy cultivation. (See Table 2.4.5.)

**Table 2.4.5 Irrigation Development Indicators (2002)**

| Province | Irrigation completed area (rai) | Major rice: pump irrigated area (rai) | Second rice: pump irrigated area (rai) | Irrigation completed area / farm holding land (%) | Major rice: pump irrigation rate (%) | Second rice: pump irrigation rate (%) |
|---|---|---|---|---|---|---|
| Chiang Rai | 603,430 | 8,880 | 0 | 28.4 | 0.8 | 0.0 |
| Phayao | 276,630 | 10,450 | 0 | 27.3 | 2.3 | 0.0 |
| Lampang | 501,965 | 44,971 | 0 | 51.7 | 11.1 | 0.0 |
| Lamphun | 406,883 | 4,620 | 2,300 | 82.6 | 3.3 | 100.4 |
| Chiang Mai | 1,357,929 | 5,700 | 19,280 | 99.0 | 1.1 | 77.4 |
| Mae Hong Son | 80,754 | 540 | 0 | 32.9 | 0.5 | 0.0 |
| Tak | 177,275 | 21,900 | 2,000 | 16.7 | 10.7 | 11.3 |
| Kamphaeng Phet | 503,360 | 7,390 | 8,460 | 19.8 | 0.7 | 1.7 |
| Sukhothai | 310,364 | 21,380 | 20,660 | 16.1 | 3.7 | 7.2 |
| Phrae | 445,400 | 25,090 | 0 | 72.2 | 9.8 | 0.0 |
| Nan | 290,391 | 8,640 | 0 | 38.2 | 4.3 | 0.0 |
| Uttaradit | 148,420 | 6,360 | 11,700 | 11.3 | 1.5 | 10.6 |
| Phitsanulok | 489,143 | 2,900 | 18,910 | 19.4 | 0.3 | 3.1 |
| Phichit | 992,500 | 22,300 | 25,620 | 47.3 | 2.5 | 3.5 |
| Nakhon Sawan | 982,033 | 69,196 | 91,400 | 24.3 | 3.4 | 12.5 |
| Uthai Thani | 672,800 | 19,000 | 6,480 | 50.4 | 4.1 | 3.1 |
| Phetchabun | 309,370 | 19,520 | 9,020 | 8.0 | 1.8 | 61.9 |
| North Region | 8,548,647 | 298,837 | 215,830 | 38.0 | 3.6 | 17.2 |

(Data source: Agricultural Statistics of Thailand, Office of Agricultural Economics, MOAC)

As the above data indicated, irrigation development is still under way in most of the provinces. Only five provinces (Lampang, Lamphun, Chiang Mai, Phrae and Uthai Thani) have more than 50% of completion rate for irrigation. Irrigation water is particularly crucial for second rice but there are only three provinces, namely Lamphun, Chiang Mai and Phetchabun, where the irrigation rate for second rice exceeds 50%.

### 2.4.4 Livestock Systems

Because animal population itself seems to be largely affected by the provincial area (In general, it is supposed that larger provinces have larger population of domestic animals than others.), population density – raising number/1,000 rai of farm holding land – is calculated by province. (See Table 2.4.6.)

Large size domestic animals seem to be more widely reared in mountainous provinces such as Mae Hong Son, Tak and Lampang. Based on analysis of the data above, the 17 provinces are grouped by animal population densities as shown in Table 2.4.7.

**Table 2.4.6 Animal Population Densities by Domestic Animal (2002)**

(Unit: No./1000 rais)

| Province | Cattle | Buffaloes | Swine | Chickens | Duck | Native Chickens |
|---|---|---|---|---|---|---|
| Chiang Rai | 40.7 | 7.6 | 42.9 | 1,598.6 | 49.7 | 420.5 |
| Phayao | 80.4 | 10.8 | 41.6 | 1,541.9 | 43.8 | 166.4 |
| Lampang | 117.1 | 19.7 | 54.9 | 1,022.2 | 39.4 | 117.1 |
| Lamphun | 71.9 | 10.1 | 128.3 | 1,404.2 | 40.1 | 1,797.5 |
| Chiang Mai | 75.4 | 16.4 | 165.0 | 1,403.4 | 55.8 | 2,360.2 |
| Mae Hong Son | 96.1 | 43.6 | 129.7 | 940.7 | 51.4 | 30.0 |
| Tak | 104.2 | 7.5 | 25.1 | 645.3 | 13.2 | 29.9 |
| Kamphaeng Phet | 25.6 | 2.8 | 22.6 | 408.8 | 102.9 | 90.9 |
| Sukhothai | 40.3 | 3.4 | 27.9 | 554.5 | 62.5 | 69.6 |
| Phrae | 77.1 | 15.3 | 126.5 | 1,656.6 | 22.4 | 163.5 |
| Nan | 63.9 | 20.5 | 86.2 | 1,711.6 | 31.6 | 208.8 |
| Uttaradit | 32.8 | 5.1 | 38.5 | 583.7 | 51.1 | 699.4 |
| Phitsanulok | 26.7 | 3.9 | 28.5 | 424.9 | 337.8 | 365.3 |
| Phichit | 23.1 | 2.4 | 24.9 | 406.2 | 463.5 | 64.5 |
| Nakhon Sawan | 29.6 | 2.4 | 17.0 | 427.6 | 136.5 | 290.4 |
| Uthai Thani | 31.9 | 7.4 | 26.8 | 857.2 | 262.2 | 401.7 |
| Phetchabun | 32.3 | 2.8 | 14.7 | 457.3 | 36.2 | 274.9 |
| North Region | 57.0 | 10.7 | 58.9 | 943.8 | 105.9 | 444.2 |

(Data source: Agricultural Statistics of Thailand, Office of Agricultural Economics, MOAC)

**Table 2.4.7 Province Groups by Animal Population Densities**

| Animal size | Distinctive animals | Provinces |
|---|---|---|
| Large | Cattle/buffaloes/swine | Mae Hong Son |
| | Cattle | Lampang, Tak |
| Medium | Swine/chickens | Phrae |
| | Swine/native chickens | Lamphun, Chiang Mai |
| | Chickens | Chiang Rai, Phayao, Nan |
| Small | Duck | Phitsanulok, Phichit, Uthai Thani |
| Low livestock activities | | Kamphaeng Phet, Sukhothai, Uttaradit, Nakhon Sawan, Phetchabun |

## 2.5 LAND REFORM AREAS (LRAs)

### 2.5.1 Distribution of LRAs

**The LRAs in the 17 provinces are distributed on the designated lands of 11,373,000 rai (1,820,000 ha). These lands where the forests were deteriorated or already cultivated by farmers have been transferred from RFD to ALRO for land reform according to the Forest Act and the Agricultural Land Reform Act. The largest LRA in the North Thailand, 2,169,000 rai (347,000 ha), is located in Phetchabun, and the smallest one is in Mae Hong Song, 37,000 rai (5,900 ha). Most LRAs are located on the flat to sloped lands at the foot of mountainous areas. (See**

**Figure 2.5.1.)**

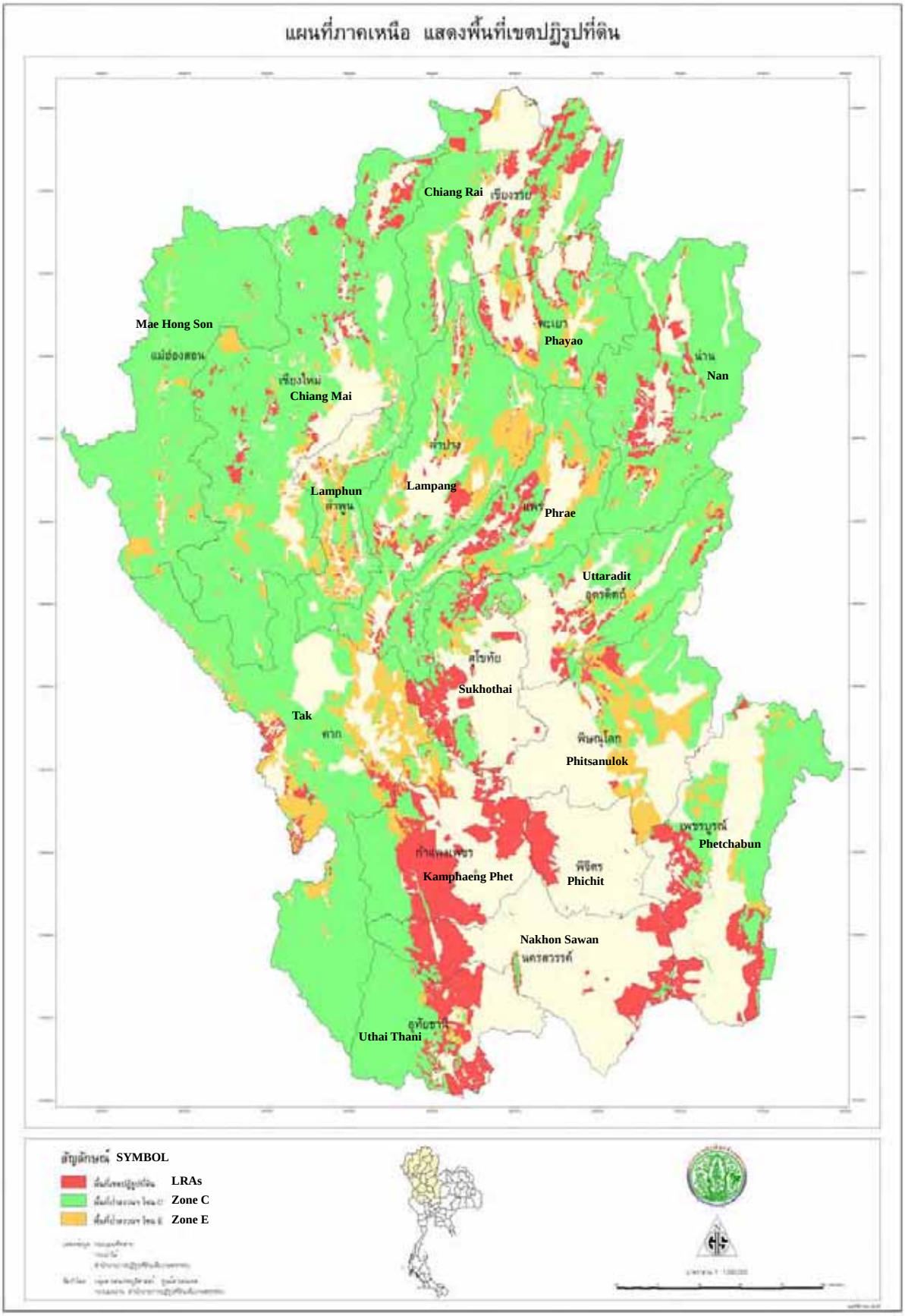



**Figure 2.5.1 Location Map of the LRAs**

### 2.5.2 Zoning and LRAs

The forest areas are classified into three zones: agricultural land (A zone) where the forests were already cultivated and no forests existed; economic forest (E zone) where some forests or trees are remained but deteriorated and used for collecting forest products or as community forest by surrounding people and; reserved forest (C zone) where the forests are well preserved as natural forests. Among the three zones, A zone and some parts of E zone have been transferred from RFD to ALRO according to the said Acts. After detailed examination of the transferred land by ALRO, some parts of E zone may be returned to RFD if the area is judged as suitable for forest.

Out of the total LRAs (11,373,012 rai), cadastral survey was carried out in 7,930,123 rai (70 %) and the land titles of 5,899,223 rai (52 %) were transferred to 419,909 farmers as of November 2004. (See Table 2.5.1.)

**Table 2.5.1 Area of LRAs, Status of Survey and Land Transfer**

| Province | Whole LRAs | | Survey as of November 2004 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | No. | Area | Surveyed Area | | | Land titled | | | |
| | | (rai) | (rai) | (%) | (plots) | (rai) | (%) | (plots) | (Farmers) |
| Chiang Rai | 33 | 857,930 | 644,607 | 75 | 84,946 | 444,612 | 52 | 62,584 | 49,550 |
| Phayao | 14 | 409,447 | 304,883 | 74 | 49,374 | 227,630 | 56 | 38,293 | 31,504 |
| Lampang | 31 | 510,866 | 217,694 | 43 | 44,410 | 132,294 | 26 | 28,035 | 21,440 |
| Lamphun | 14 | 112,397 | 108,797 | 97 | 16,608 | 58,663 | 52 | 10,087 | 8,476 |
| Chiang Mai | 20 | 548,730 | 171,968 | 31 | 27,424 | 80,375 | 15 | 14,061 | 11,896 |
| Mae Hong Son | 9 | 37,299 | 26,655 | 71 | 5,788 | 13,207 | 35 | 3,785 | 3,253 |
| Tak | 7 | 326,555 | 326,555 | 100 | 22,197 | 196,111 | 60 | 11,623 | 9,376 |
| Kamphaeng Phet | 18 | 1,929,357 | 1,415,322 | 73 | 80,055 | 1,034,065 | 54 | 65,595 | 55,754 |
| Sukhothai | 16 | 628,190 | 458,400 | 73 | 37,058 | 383,978 | 61 | 33,713 | 28,605 |
| Phrae | 18 | 302,359 | 231,083 | 76 | 32,263 | 132,697 | 44 | 19,272 | 15,233 |
| Nan | 26 | 755,743 | 353,707 | 47 | 59,331 | 301,571 | 40 | 51,857 | 38,493 |
| Uttaradit | 17 | 350,630 | 305,200 | 87 | 27,824 | 210,075 | 60 | 20,926 | 16,541 |
| Phitsanulok | 6 | 233,846 | 233,846 | 100 | 39,293 | 157,077 | 67 | 11,654 | 9,562 |
| Phichit | 6 | 392,665 | 354,632 | 90 | 20,225 | 291,020 | 74 | 17,727 | 15,777 |
| Nakhon Sawan | 12 | 845,533 | 845,533 | 100 | 52,841 | 719,100 | 85 | 39,846 | 34,994 |
| Uthai Thani | 12 | 962,116 | 570,225 | 59 | 30,906 | 522,248 | 54 | 29,727 | 25,726 |
| Phetchabun | 11 | 2,169,349 | 1,361,016 | 63 | 68,233 | 994,500 | 46 | 50,441 | 43,729 |
| Total | 270 | 11,373,012 | 7,930,123 | 70 | 698,776 | 5,899,223 | 52 | 509,226 | 419,909 |

(Source) Figures of surveyed areas informed by Engineering Division, ALRO

On the other hand, although data on zoning and area of the LRAs were provided by ALRO GIS Section as shown in Table 2.5.2, these figures don't correspond to the figures in Table 2.5.1.

**Table 2.5.2 Zone Categories of LRAs by Province**

| Province | Areas by Zone Categories (rai) | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Agricultural Land | Economic Forest | Trial Forest | Prime Forest | Classified 1 | Public Land | Royal Property Land | Private Land | Total of Zone Areas (a) |
| | A | E | T | F | J | PU | R | P | |
| 01 CRI | - | - | - | - | - | - | - | - | - |
| 02 PYO | 175,141 | 163,639 | - | 31,647 | 8,420 | - | - | - | 378,847 |
| 03 LPG | 114,521 | 400,497 | 17,016 | - | 57,587 | - | - | - | 589,621 |
| 04 LPN | 12,565 | 17,495 | - | - | 67,192 | - | - | 7,251 | 104,503 |
| 05 CMI | 34,171 | 420,007 | - | 24,224 | 72,014 | - | - | 1,476 | 551,891 |
| 06 MSN | 10,197 | 5,883 | - | - | 7,743 | - | - | - | 23,823 |
| 07 TKK | 5,533 | 273,697 | - | - | - | 1,118 | - | - | 280,348 |
| 08 KPT | 677,410 | 1,159,065 | - | - | 49,913 | 66,142 | - | - | 1,952,530 |
| 09 STI | 28,829 | 904,334 | - | 25,669 | - | 59,304 | - | - | 1,018,136 |
| 10 PRE | 32,708 | 432,320 | 5,646 | - | 25,644 | - | - | - | 496,318 |
| 11 ANN | 23,176 | 416,963 | - | - | 126,332 | - | - | - | 566,471 |
| 12 UTT | - | 356,191 | - | 14,715 | 14,079 | 9,875 | - | - | 394,860 |
| 13 PIK | - | 151,732 | - | - | 27,260 | - | - | - | 178,992 |
| 14 PCT | 3,233 | 23,090 | - | 362,428 | 5,818 | - | - | - | 394,570 |
| 15 NSN | 253,874 | 517,409 | - | 148,168 | 591,903 | 6,752 | 65,464 | - | 1,583,570 |
| 16 UTI | 150,430 | 800,583 | - | - | - | - | - | - | 951,014 |
| 17 PSN | 9,591 | 953,769 | - | - | 138,355 | - | - | - | 1,101,715 |
| Total | 1,531,380 | 6,996,675 | 22,663 | 606,851 | 1,192,259 | 143,191 | 65,464 | 8,727 | 10,567,209 |

(Source) GIS Section, ALRO

(Notes)

A: Agricultural Land, that is to be titled to individual farmers.
E: Economic Forest, that is to be utilized as Agricultural land, Community Forest or to retrieved to RFD.
T: Trial Forest
F : Prime Forest
J: Classified 1 Land
PU: Public Land, that is to be utilized as Public Land.
R: Royal property land, tha is to be utilized as Public Land.
P: Private Land

## 2.5.3 Specific Features in the LRAs

(1) Population and Households

Population and households in the LRAs was estimated by the data of Kor-Chor-Chor 2546 (National Rural Database 2003, NRD2C) based on the villages of which locations were identified within the LRAs by GIS data analysis. Number of selected villages is 1,314 or 9% of the total 14,899 villages in the region. Total households are estimated at 152,075 with the population of 584,023, while the regional total is 1,849,848 with the population of 6,911,244. The average number of households per village is 116 (households) in the LRAs while the regional average is 124. Average family size is the same in the LRAs and the region, 3.7 persons/family.

**Table 2.5.3 Population and Households in the LRAs**

| Province | Villages | Population | | | Households | Households/ Village | Average Family Size |
|---|---|---|---|---|---|---|---|
| | | Male | Female | Total | | | |
| LRAs | | | | | | | |

| Province | Villages | Population | | | Households | Households/ Village | Average Family Size |
|---|---|---|---|---|---|---|---|
| | | Male | Female | Total | | | |
| Chiang Rai | 91 | 23,965 | 23,748 | 47,713 | 12,752 | 140 | 3.7 |
| Phayao | 20 | 3,948 | 4,044 | 7,992 | 2,218 | 111 | 3.6 |
| Lampang | 43 | 9,768 | 9,696 | 19,464 | 5,120 | 119 | 3.8 |
| Lamphun | 14 | 2,467 | 2,398 | 4,865 | 1,391 | 99 | 3.5 |
| Chiang Mai | 44 | 10,791 | 10,519 | 21,310 | 4,790 | 109 | 4.4 |
| Mae Hong Son | 8 | 1,718 | 1,674 | 3,392 | 910 | 114 | 3.7 |
| Tak | 25 | 5,861 | 5,713 | 11,574 | 2,601 | 104 | 4.4 |
| Kamphaeng Phet | 292 | 70,834 | 73,098 | 143,932 | 37,368 | 128 | 3.9 |
| Sukhothai | 20 | 5,047 | 5,086 | 10,133 | 2,773 | 139 | 3.7 |
| Phrae | 16 | 3,964 | 3,826 | 7,790 | 2,135 | 133 | 3.6 |
| Nan | 79 | 14,734 | 14,284 | 29,018 | 7,732 | 98 | 3.8 |
| Uttaradit | 29 | 5,105 | 4,959 | 10,064 | 2,730 | 94 | 3.7 |
| Phitsanulok | 36 | 7,080 | 7,013 | 14,093 | 3,810 | 106 | 3.7 |
| Phichit | 59 | 9,578 | 10,031 | 19,609 | 5,059 | 86 | 3.9 |
| Nakhon Sawan | 246 | 54,360 | 56,776 | 111,136 | 29,320 | 119 | 3.8 |
| Uthai Thani | 146 | 26,460 | 27,064 | 53,524 | 14,099 | 97 | 3.8 |
| Phetchabun | 146 | 33,783 | 34,336 | 68,119 | 17,267 | 118 | 3.9 |
| Total | 1,314 | 289,463 | 294,265 | 583,728 | 152,075 | 116 | 3.8 |
| Outside of LRAs | 13,585 | 3,098,892 | 3,215,039 | 6,327,516 | 1,697,773 | 125 | 3.7 |
| Region | 14,899 | 3,388,355 | 3,509,304 | 6,911,244 | 1,849,848 | 124 | 3.74 |

(Note) estimated based on NRD2C (Kor-Chor-Chor 2546) (2003)

(2) Road Density

According to the GIS data, Nakhon Sawan has the highest road density, about 1,400 m/km$^2$, followed by Phetchabun and Lamphun. On the other hand, Mae Hong Son and Tak have the least road density, about 400 m/km$^2$. (See Figure 2.5.2.)

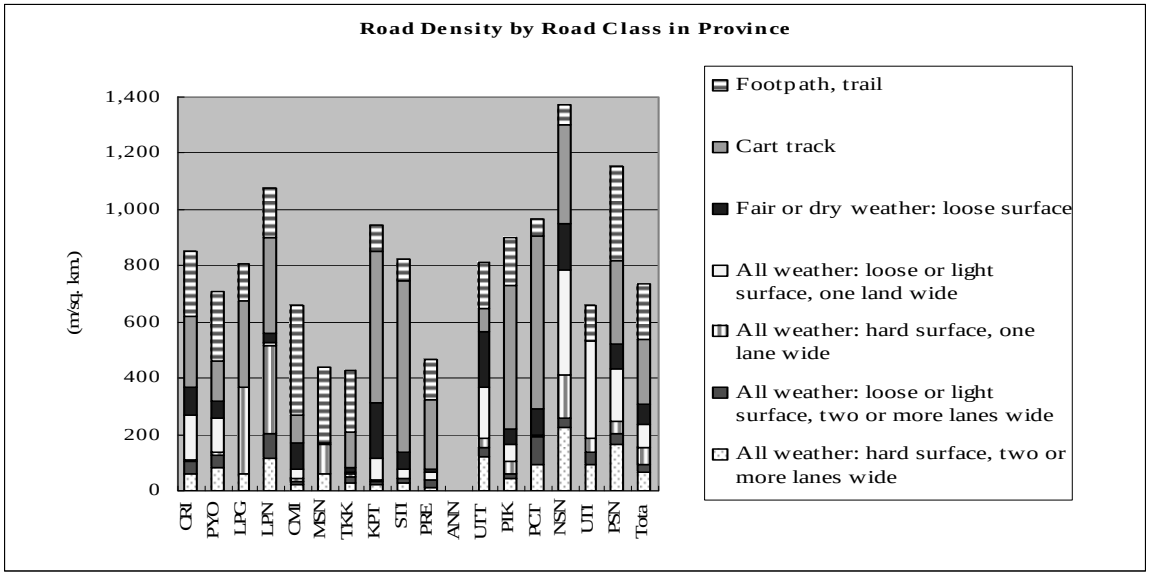



**Figure 2.5.2 Road Density by Province**

(3) Electricity

In rural areas, electrification ratio reached to 96% in the North Thailand. In the LRAs, the ratio is slightly lower than the regional average, but it reaches to 90%. (See Figure 2.5.3.)

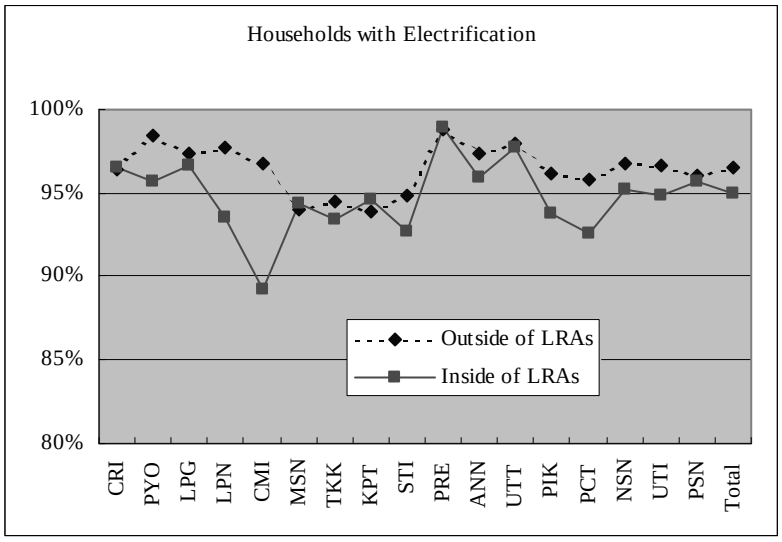



**Figure 2.5.3 Electrification Ratio of the Villages in and outside the LRAs**

(4) Water Supply

Clean water is provided in 90% of the villages both inside and outside the LRAs, although the data of villages in the LRAs are slightly lower. In Nan, the figure of the LRAs villages is rather low, about 70%. (See Figure 2.5.4.)

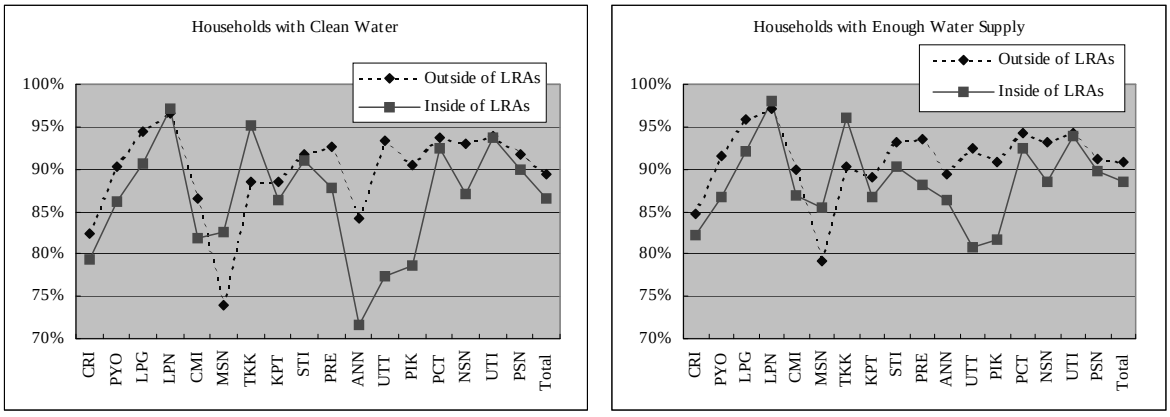



**Figure 2.5.4 Ratios of Water Supply of the Villages in and outside the LRAs**

(5) Fuel Source for Cooking

About 45% of the households use charcoal, firewood or husks for cooking in the LRAs. However, there are big differences among the 17 provinces as shown in Figure 2.5.5. In particular, many

villagers in Chiang Mai, Mae Hong Son and Nan still use them (more than 70%). This tendency can be also observed outside the LRAs. (See Figure 2.5.5.)

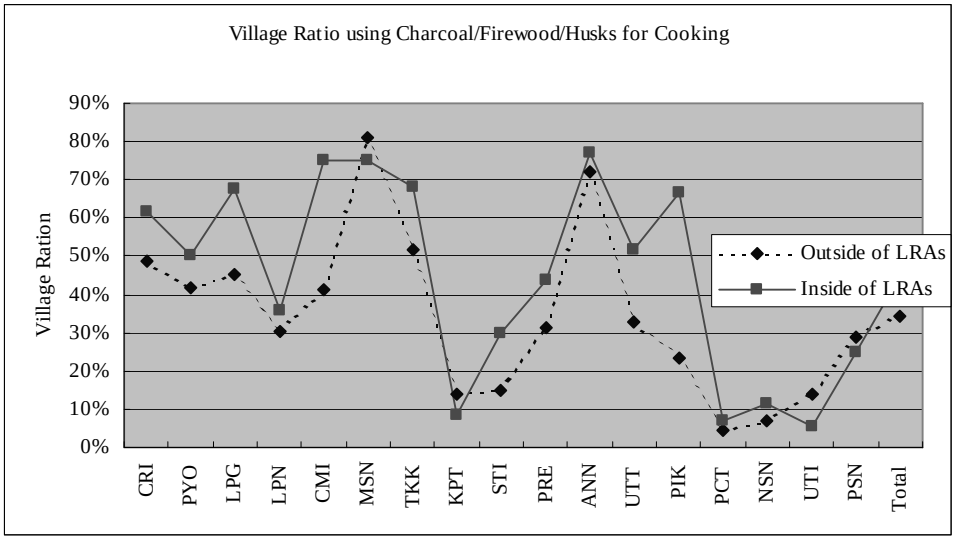



**Figure 2.5.5 Ratio of Villages using Charcoal, Firewood or Husks for Cooking**

(6) Soil Problems

Soil problems are more serious in the LRAs than outside the LRAs. The most serious one is poor fertility, reported in 40 % of the villages in the LRAs, followed by erosion, gravelly soil and hardness of soil. (See Figure 2.5.6.)

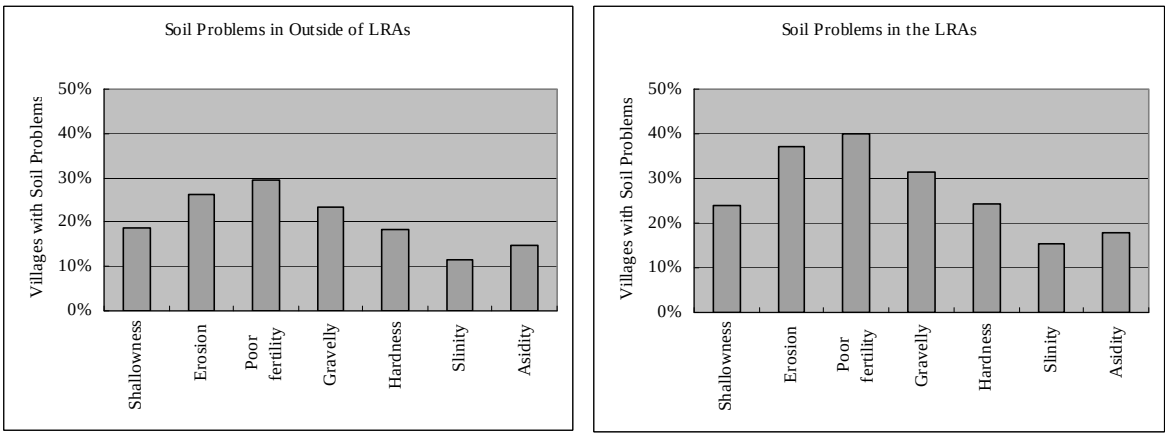



**Figure 2.5.6 Soil Problems in and outside the LRAs**

## 2.6 PROBLEMS AND THEIR INDICATORS

### 2.6.1 Understandings of Problems in the North Thailand

The North Thailand is the most significant region in the country for management and conservation of natural resources from the following viewpoints.

- Forest area of the region represents more than half of the country's forest.
- There are origins of several major rivers in the country such as Chao Phraya.

- Forest functions as effective water retention areas for these major rivers.

However, forest area in the region has been decreasing since 1961 as the data show that the percentage of forest area to total North Thailand area declined from 69 % in 1961 to 42% in 1998.

Based on the inventory survey results, following features of the North Thailand are revealed.

- 80% of population of this region lives in rural areas and more than half of total population engages in the agricultural sector.
- Average monthly household income of this region (9,530 Baht, from the "Report of Household Income, 2003") is 30 % lower than that of the national average, 13,736 Baht.
- Average monthly household income of farmers is much smaller than others.

In addition, the following features are generally pointed out as characteristics of the region, even though they can not be supported by any quantitative data.

- Poor landless farmers reclaim forest lands.
- Some people practice swidden agriculture that causes degradation of natural resources in forests.

Considering all of these situations, following theme is significant for the North Thailand.

*"From the viewpoint of conservation of natural resources such as forest and land, it is essential to improve livelihoods of rural people through sustainable agriculture and rural development"*

Based on such understandings, it is required to integrate two notions, "proper natural resources management" and "sustainable agricultural and rural development".

### 2.6.2 Problem Analysis

Based on the results of inventory survey, problems observed in the North Thailand are sorted out in line with the cause and effect relationships as shown in Figure 2.6.1.

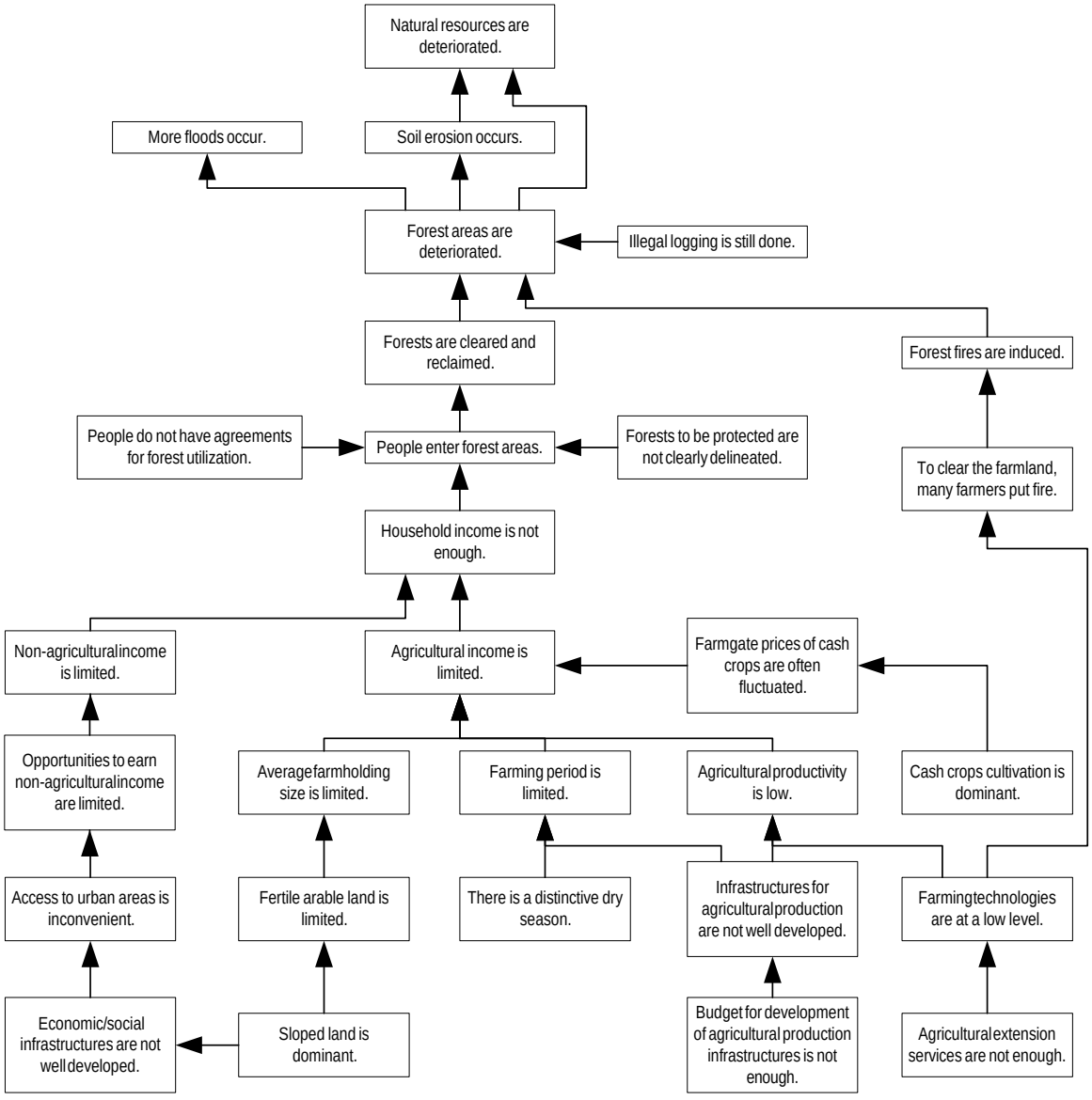



**Figure 2.6.1 Problem Analysis Chart of the North Thailand**

### 2.6.3 Selection of Indicators

(1) Indicators on the Problem Analysis

The inventory survey collected various kinds of provincial data, and indicators which denote the seriousness of the problem in the Problem Analysis are chosen from the inventory survey results.

**Table 2.6.1 Kinds of Collected Provincial Data**

| Sector | Kinds of Collected Provincial Data |
|---|---|
| Natural resources | Forest area and its depletion, Forest type, Timber production, Community forest, Protected area, Meteorology (rainfall, temperature, humidity) |
| Socio-economy, Rural life | Population, Migration, Industry (labor force, Gross Provincial Product, Establishments, Cooperatives), Social infrastructures (electricity, water supply, communication, transportation, etc), Poverty line and population, Household income/expenditure/debt, Education infrastructure, Health service, Household living |

| Sector | Kinds of Collected Provincial Data |
|---|---|
| | infrastructures, Highland community |
| Agriculture | Land tenure, Land use (farm holding, forest, unclassified), Farm land use (paddy, field crops and vegetables, fruits and tree crops), Cropping systems, Livestock system, Irrigation area |
| Land reform areas | LRAs, Surveyed area, Land titled area<br>Social infrastructures (based on Kor-Chor-Chor) |
| Relevant on-going projects/plans | Provincial relevant projects/plans (agriculture, natural resources management, institution development) |

Through discussions with the C/P personnel, the following indicators, which are considered to denote the seriousness of the problem, were finally selected.

**Table 2.6.2 Problems and Indicators**

| Sector | Problems observed in Problem Analysis | Indicators that denote seriousness of the problems (selected from collected data) | Remarks |
|---|---|---|---|
| Natural resources | Forest areas are deteriorated | Percent of forest area to provincial area<br>Depletion rate of forest (%) | |
| | Illegal logging is still done | Timber production 1998-2003 (admitted and confiscated) | |
| | People do not have agreements for forest utilization. | Area size of community forest supported by RFD | |
| | Sloped land is dominant. | Topography (land slope) | |
| | More floods occur | River (elevation ) | Flood occurs at down stream is a result of forest depletion at upstream. |
| | Forests to be protected are not clearly delineated. | Area size of protected area (Natural park, Wildlife consevation, Non-hunting areas) | |
| Socio-economy, rural life | People enter forest areas. | Population density 2002 | Over population induces forest intrusion |
| | | Population of highland community | Swidden agriculture |
| | Household income is not enough. | Per capita Gross Provincial Products (GPP) (Baht) | |
| | | Percent of poor population | |
| | | Monthly household income | |
| | Non-agricultural income is limited. | Share of agricultural sector to GPP | |
| Agriculture | Cash crops cultivation is dominant. | Distinctive crops (dominance of paddy) | Paddy is a stable crop. |
| | | Livestock activities (Rearing number of domestic animals per farm land) | Alternative income sources |
| | Average farmholding size is limited. | Household farm holding land | |
| | Infrastructures for agricultural production are not well developed. | % of irrigation land to farm land | |
| Land reform areas | Provincial LRAs are limited. | Total LRAs (rai), % of LRAs to provincial land | M/P is made for the LRAs. |
| | Average farmholding size is limited. | Land titled per household | |

For example, seriousness of the problem, “Forest areas are deteriorated.”, can be denoted by the indicators, “% of forest area to provincial area” and “Depletion rate of forest (%)” from the inventory survey data. The problem, “People do not have agreements for forest utilization.”, may not be directly denoted in terms of quantitative data, but, the data, “Community forest”, is applicable as an indirect indicator.

(2) Indicators for Proper Natural Resources Management

Problems and their indicators are sorted out by province from the viewpoint of proper natural resources management.

**Table 2.6.3 Selected Indicators for Proper Natural Resources Management**

| Problems observed in Problem Analysis | Forest areas are deteriorated. | | Illegal logging is still done. | People do not have agreements for forest utilization. | Sloped land is dominant. More floods occur. | Sloped land is dominant. | Forests to be protected are not clearly delineated. |
|---|---|---|---|---|---|---|---|
| Indicators | % of forest area to provincial area (%) | Depletion rate of forest (%) (depleted 1982-1998)/ forest 1982) | Timber production 1998-2003 | Community forest supported by RFD (sq.km) | Topography (elevation), (Origin of major rivers) | Topography (land slope) (%) | Protected area (sq.km) (*) |
| Chiang Rai | 45 | 27 | 730 | 105 | 612 (Ing, Kog) | 10-15 | 664 |
| Phayao | 56 | 35 | 778 | 41 | 548 (Yom) | 10-15 | 1,047 |
| Lampang | 71 | 21 | 7,527 | 43 | 460 (Wang) | 5-10 | 1,706 |
| Lamphun | 61 | 28 | 823 | 87 | 544 | 5-10 | 881 |
| Chiang Mai | 74 | 19 | 1,796 | 21 | 822 (Ping) | 10-15 | 5,510 |
| Mae Hong Son | 90 | 10 | 14,500 | 59 | 810 | 15-20 | 5,093 |
| Tak | 78 | 11 | 19,690 | 98 | N.A | N.A. | 4,534 |
| Kamphaeng Phet | 25 | 39 | 7,787 | 40 | 184 | N.A. | 3,045 |
| Sukhothai | 35 | 33 | 130 | 8 | 145 | 0-5 | 580 |
| Phrae | 68 | 14 | 2,580 | 76 | 373 (Yom) | 10-15 | 1,146 |
| Nan | 73 | 17 | 3,310 | 88 | 535 (Nan) | 10-15 | 1,990 |
| Uttaradit | 59 | 16 | 339 | 63 | 317 | 5-10 | 1,649 |
| Phitsanulok | 36 | 32 | 864 | 14 | 310 | 5-10 | 1,809 |
| Phichit | 0.003 | - | 1 | 3 | N.A | 0-5 | 0 |
| Nakhon Sawan | 9 | 57 | 908 | 1 | N.A | 0-5 | 447 |
| Uthai Thani | 52 | 11 | 4,521 | 13 | 376 | 10-15 | 1,390 |
| Phetchabun | 32 | 53 | 1,110 | 75 | 347 | 5-10 | 1,526 |

Note: *Protected area is estimated from statistical data.

For example, problems and their seriousness in Chiang Rai can be summarized as follows.

- Forest areas seem to be decreasing.
- Logging is on-going although it can not be clarified whether it is illegal or not.
- The province has community forest areas, which indicates that there are possibilities to make agreements for forest utilization among the local people.
- Sloped land is dominant and origins of rivers exist, which implies the necessity of

conservation.

- There are protected areas to be clearly delineated.

On the other hand, problems and their seriousness in Phichit can be judged as less important, from the following features.

- There are very few forest areas and flat land is dominant.
- No origins of rivers exist since the province is located in low lying downstream basin.
- There are no protected areas.

(3) Indicators for Sustainable Rural Development

Problems and their indicators are sorted out by province from the viewpoint of sustainable rural development.

**Table 2.6.4 Selected Indicators for Sustainable Rural Development**

| Problems observed in Problem Analysis | People enter forest areas. | | Household income is not enough. | | | Non-agricultural income is limited. |
|---|---|---|---|---|---|---|
| Indicators | Population density 2002 (persons / sq.km) | Population of highland community | Per capita GPP (Baht) | % of poor population | Household income | Share of agricultural sector to GPP (%) |
| Chiang Rai | 104.0 | 221,196 | 30,244 | 9.35 | 5,583 | 21.4 |
| Phayao | 79.2 | 21,925 | 29,486 | 9.10 | 5,778 | 21.5 |
| Lampang | 63.6 | 16,674 | 40,497 | 14.70 | 6,770 | 10.3 |
| Lamphun | 90.8 | 29,124 | 69,622 | 6.45 | 7,828 | 10.5 |
| Chiang Mai | 79.7 | 322,709 | 57,095 | 7.79 | 6,581 | 10.9 |
| Mae Hong Son | 18.8 | 127,503 | 32,328 | 23.18 | 5,375 | 19.3 |
| Tak | 30.4 | 145,079 | 41,677 | 30.13 | 4,548 | 19.1 |
| Kamphaeng Phet | 89.9 | 8,594 | 48,980 | 0.73 | 14,045 | 21.1 |
| Sukhothai | 94.3 | 6,025 | 32,613 | 8.40 | 7,011 | 25.2 |
| Phrae | 73.8 | 18,877 | 25,963 | 5.83 | 5,224 | 15.5 |
| Nan | 42.0 | 90,787 | 29,410 | 19.33 | 5,499 | 20.4 |
| Uttaradit | 61.4 | - | 38,163 | 8.94 | 9,980 | 19.2 |
| Phitsanulok | 80.2 | 28,671 | 40,540 | 3.96 | 7,883 | 22.7 |
| Phichit | 132.0 | - | 31,941 | 7.40 | 11,199 | 30.0 |
| Nakhon Sawan | 117.4 | - | 38,658 | 7.74 | 8,520 | 23.0 |
| Uthai Thani | 50.4 | 8,936 | 38,360 | 29.17 | 5,571 | 33.7 |
| Phetchabun | 83.1 | 24,938 | 28,350 | 9.83 | 10,165 | 29.7 |

For instance, problems and their seriousness in Chiang Rai can be summarized as follows.

- Due to high population density, there seems to be more pressures to forest intrusion.
- Per capita GPP that closely relates to household income is in a lower group.
- Provincial economy is dependent on the agricultural sector to some extent.
- Poor people represent 9 % of the provincial population.
- Average household income is in a lower group.

(4) Indicators for Sustainable Agriculture Development

Problems and their indicators are sorted out by province from the viewpoint of sustainable agriculture development.

**Table 2.6.5 Selected Indicators for Sustainable Agriculture Development**

| Problems observed in Problem Analysis | Cash crops cultivation is dominant. | | | | | Average farmholding size is limited. | Infrastructures for agricultural production are not well developed. |
|---|---|---|---|---|---|---|---|
| Indicators | Productive farm land use (%) | | | | Livestock | Land tenure | Irrigation |
| | Paddy | Field crops + Vegetables | Fruits + Trees | Others | Distinctive animals in terms of rearing number / 1,000 rai | Household farm holding land | % of irrigated land to farm holding land (*) |
| Chiang Rai | 60 | 23 | 10 | 6 | Chickens | 15.3 | 28 |
| Phayao | 54 | 28 | 11 | 6 | Chickens | 13.9 | 27 |
| Lampang | 48 | 20 | 23 | 10 | Cattle | 10.3 | 52 |
| Lamphun | 34 | 5 | 56 | 5 | Swine+N. chickens | 9.9 | 83 |
| Chiang Mai | 46 | 18 | 29 | 7 | Swine+N. chickens | 9.5 | 99 |
| Mae Hong Son | 46 | 24 | 12 | 18 | Cattle+Buffaloes | 11.5 | 33 |
| Tak | 35 | 52 | 8 | 6 | Cattle | 24.9 | 17 |
| Kamphaeng Phet | 46 | 47 | 3 | 4 | Low activities | 35.6 | 20 |
| Sukhothai | 45 | 39 | 10 | 5 | Low activities | 23.2 | 16 |
| Phrae | 47 | 30 | 16 | 7 | Swine+ Chickens | 11.2 | 72 |
| Nan | 33 | 44 | 15 | 8 | Chickens | 11.9 | 38 |
| Uttaradit | 48 | 27 | 19 | 6 | Low activities | 23.4 | 11 |
| Phitsanulok | 61 | 28 | 5 | 6 | Duck | 28.9 | 19 |
| Phichit | 78 | 13 | 5 | 4 | Duck | 41.2 | 47 |
| Nakhon Sawan | 58 | 35 | 3 | 4 | Low activities | 36.4 | 24 |
| Uthai Thani | 49 | 39 | 6 | 6 | Duck | 31.2 | 50 |
| Phetchabun | 38 | 51 | 8 | 3 | Low activities | 34.6 | 8 |

Note: *Water resources development completed (2002) / Farm holding land (1999)

For example, problems and their seriousness in Chiang Mai can be summarized as follows.

- Compared with other provinces, fruits and tree crops are prominent.
- Small scale farmers with small farm holding land are dominant.
- Since percentage of irrigated land to farm land is the highest, agricultural infrastructures are more developed than other provinces.

On the other hand, Phichit can be characterized by relatively large scale farming with paddy cropping.

(5) Indicators for Land Reform Areas

Problems and their indicators are sorted out by province from the viewpoint of importance of land reform area development.

**Table 2.6.6 Selected Indicators for the LRAs**

| Problems oberved in Problem Analysis | Land Reform Areas | | | Average farmholding size is limited. |
|---|---|---|---|---|
| Indicators | No. of area | Total LRAs (rai) | % of LRAs to provincial land | Land titled per household (rai/household) |
| Chiang Rai | 33 | 857,930 | 11.8 | 9.0 |
| Phayao | 14 | 409,447 | 10.3 | 7.2 |
| Lampang | 31 | 510,866 | 6.5 | 6.2 |
| Lamphun | 14 | 112,397 | 4.0 | 6.9 |
| Chiang Mai | 20 | 548,730 | 4.4 | 6.8 |
| Mae Hong Son | 9 | 37,299 | 0.5 | 4.1 |
| Tak | 7 | 326,555 | 3.2 | 20.9 |
| Kamphaeng Phet | 18 | 1,929,357 | 35.9 | 18.5 |
| Sukhothai | 16 | 628,190 | 15.2 | 13.4 |
| Phrae | 18 | 302,359 | 7.4 | 8.7 |
| Nan | 26 | 755,743 | 10.5 | 7.8 |
| Uttaradit | 17 | 350,630 | 7.2 | 12.7 |
| Phitsanulok | 6 | 233,846 | 3.5 | 16.4 |
| Phichit | 6 | 392,665 | 13.9 | 18.4 |
| Nakhon Sawan | 12 | 845,533 | 14.1 | 20.5 |
| Uthai Thani | 12 | 962,116 | 22.9 | 20.3 |
| Phetchabun | 11 | 2,169,349 | 27.4 | 22.7 |

From the above data, it can be observed that Mae Hong Son has a very small land reform area.

# CHAPTER 3 SELECTION OF THE FOUR PROVINCES FOR MASTER PROGRAM FORMULATION

## 3.1 APPROACHES TO SELECTION

(1) Expansion of the Study Outcomes to Other Provinces

There are some approaches to attain the super goal of the Study, “to realize proper management of natural resources and improve livelihood of the rural population through sustainable agriculture and thus to poverty eradication in the north Thailand”.

1) Subject based approach: Grouping of provinces is done based on the subjects such as dominant farming system, topography and economic activities, etc. Target subjects and prioritized provinces are selected based on the characteristics. The similar development approaches could be applied to the provinces in the same subject based group.
2) Cluster based approach: Four provinces are selected according to the governmental clusters (upper north, lower north group-1, lower north group-2). Outcomes of M/P could be expanded to other provinces in the same cluster.
3) Integrated development priority based approach: Four provinces are selected according to seriousness of the issues and priority assessment of significance of the M/P formulation. Outcomes could be expanded to other provinces based on the development priority.
4) Geographical grouping approach: Province groups are geographically made among any adjacent provinces. Development outcomes could be expanded in the same group.

After these approaches were examined in regular meetings of the C/P and the Study Team, the integrated development priority based approach was adopted in consideration of expanding the Study outcomes to other provinces. Followings are main points agreed among the attendants of the meetings.

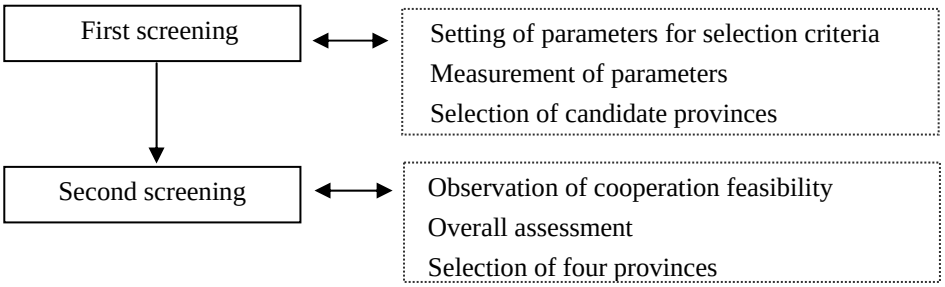
- As indicated in the problem analysis, formulation and execution of well-balanced integrated policy/plan such as improvement of livelihood and natural resources management based on the participation of local people, communities related local government organizations and local institutes are vital to cut off the vicious cycle of poverty and devastation of natural resources.
- Both the subject based approach and the geographical grouping approach could be impossible to concurrently solve the two combined issues, poverty and devastation of natural resources.
- As for the cluster based approach, the main development theme of the “lower north group-2” cluster is rice cultivation improvement rather than the natural resources management. Accordingly, this approach is inconsistent with the main subject of this Study.
- The integrated development priority based approach is considered to be more effective since various subjects and learned lessons in the integrated approaches are applicable to other provinces based on the similarity of the subject.

(2) Selection Process of the Four Provinces

Through the regular meetings with the C/P, selection process of the four provinces was discussed and agreed as described below.

- To achieve the super goal, the four provinces that have urgent and various issues/problems with higher significance of the M/P formulation are selected.
- Selected provinces are considered as models in the North Thailand, which urgently require formulation of the M/P for proper natural resources management and sustainable agricultural and rural development.
- "Capacity building" is one of major themes of the Study. In the selection process, therefore, it is important to share a variety of learning opportunities with participation of stakeholders and the C/P personnel.
- Accordingly, the selection process is carried out by mutual consent in the regular meetings, from setting of selection criteria to its assessment.
- Willingness and readiness of the provincial officers to participate in the Study should be examined in the selection process because establishment of cooperation system with the PLRO, related provincial organizations, local institutes and NGOs is crucial for the practical M/P formulation. Therefore, it was decided to conduct field reconnaissance to survey the eligibility of candidate provinces in the selection process.
- Considering future expansion of M/P, the development direction of the M/P is desirable to be consistent with the national cluster development strategy.

In order to select the four provinces for formulation of the M/P, following processes were taken.




- First screening

  First screening process was taken to select candidate provinces. Parameters were chosen according to the selection criteria based on the problem analysis and were measured from the viewpoints of significance and potentiality of the M/P formulation. These parameters were compared among the 17 provinces and then candidate provinces were selected.
- Second screening

  Reconnaissance was conducted in the candidate provinces to assess possibility of cooperation with provincial offices and local institutes including NGOs. Based on the reconnaissance

result, the provinces were further screened, and necessary parameters were added to select the provinces. By taking these processes, selection of four provinces was finalized.

## 3.2 FIRST SCREENING

(1) Setting of Parameters

In accordance with the above approach, parameters that are used to select candidate provinces were chosen from the results described in the previous chapter. The parameters need to have following features.

- Linked with the key theme of the Study, "appropriate natural resources management (reduction of negative human impact)" and "sustainable agricultural and rural development"
- Showing seriousness of problems/issues in the province
- Covering a wide range of problems/issues
- Based on the present situations of the LRAs

According to the above necessary features, parameters were selected based on the problems/subjects clarified in the problem analysis indicated in 2.6. Through discussions in the regular meetings, following parameters were chosen as parameters for selection.

**Table 3.2.1 Kinds of Parameters Selected**

| Viewpoints | | Parameters to show seriousness of problems/issues |
|---|---|---|
| Proper natural resources management | | % of forest area to provincial land, Topography (land slope), River (elevation), Protected area, Community forest area |
| Sustainable agriculture and rural development | Rural development | Per capita GPP, % of poor population, Household income, Share of agricultural sector to GPP, Population density |
| | Agriculture development | Household farm holding land, % of irrigation land to farm land, Productive farm land use (paddy, field crops and vegetables, Fruits and tree crops), Livestock activity |
| Land Reform Areas | | Titled land size per household, % of LRAs to provincial land |

（Note: Data are processed to compare each province.）

Relationships of the parameters and problems observed in the problem analysis are shown in Figure 3.2.1.

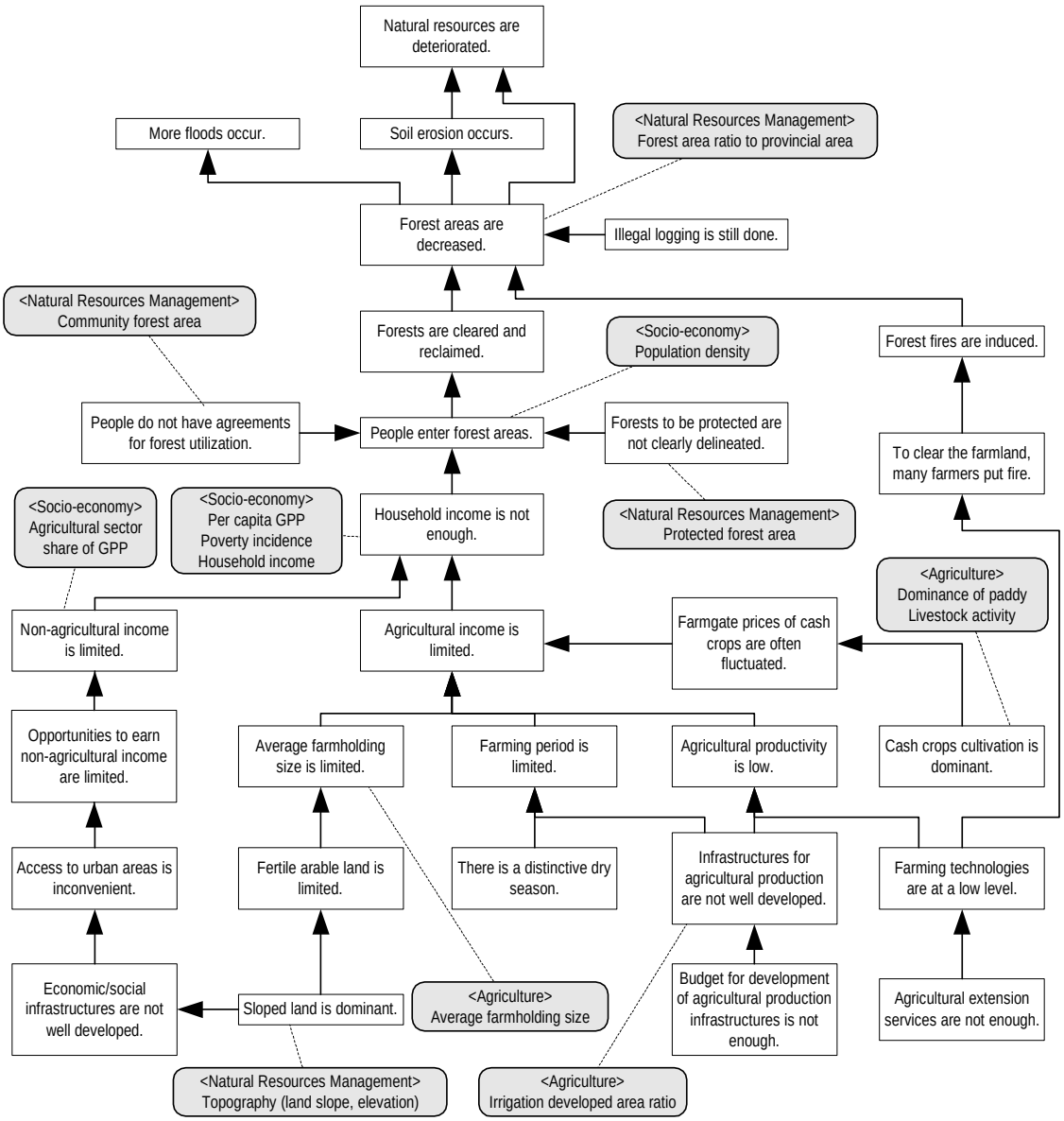



**Figure 3.2.1 Problem Analysis and Parameters**

(2) Measurement and Comparison of Parameters

Parameters were measured and compared based on the criteria “less seriousness of the problem” as shown in Table 3.2.2. For example, in case of the parameter, “% of forest area to provincial land”, smaller percentage of forest area denotes less seriousness of the problem, which means less significance of the M/P formulation and lower development priority. In case of the parameter, “Population density”, smaller population density implies less seriousness of the problem, “people enter forest area”, which means less significance of the M/P formulation and lower development priority.

**Table 3.2.2 Measurement of Parameters**

| Parameters | Parameters to show "less seriousness of the problem" |
|---|---|
| Proper natural resources management | |
| - % of forest area to provincial land | Percentage of forest area is small. |
| - Topography (land slope) | Small slope. |
| - River (elevation) | Lower elevation |
| - Protected area | Area is small. |
| - Community forest area | Area size is small. |
| Rural development | |
| - Per capita GPP | Per capita GPP (baht) is high. |
| - Share of agricultural sector to GPP | Non-agricultural industry is active with high share. |
| - % of poor population | Share (%) is small. |
| - Household income | Income (baht/month) is high. |
| - Population density | Population density is small. |
| Agricultural development | |
| - Household farm holding land | Size is large. |
| - % of irrigation land to farm land | Percentage is large. |
| - Productive farm land use | Paddy crop is distinctive. |
| - Livestock activities | Low activities |
| LRAs | |
| - Land titled per household | Land titled is large. |
| - % of LRAs to provincial land | Percentage is small. (LRAs is small) |

To clarify the relative position of each province in the North Thailand, statistical analysis was applied. The provinces that have figures more/less than the regional average plus/minus standard deviation value are marked in the Table 3.2.3. (In the table, parameters of "less seriousness" are marked.)

**Table 3.2.3 First Screening**

| Sector | Proper natural management | | | | | Sustainable agricultural and rural development | | | | | | | | | LRAs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Rural development | | | | | Agricultural development | | | | | |
| Parameters | % of forest area to provincial land | Topography (land slope) | River (elevation) | Protected area | Community forest | Per capita GPP | Share of agricultural sector to GPP | % of poor people. | Household income | Population density | Household farm holding land | % of irrigated land to farm land | Productive farm land use | Livestock activities | Land titled per household | % of LRAs to provincial land |
| X; Less seriousness of the problem | Percentage of forest area is small. | Small slope | Lower elevation | Area is small. | Area size is small. | Per capita GPP (baht) is high. | Non-agricultural industry is active with high share. | Share (%) is small. | Income (baht/month) is high. | Population density is small. | Size is large. | Percentage is large. | Paddy crop is distinctive. | Low activities | Land titled is large. | Percentage is small. (LRAs is small) |
| Chiang Rai | | | | | | | | | | | | | X | | | |
| Phayao | | | | | | | | | | | | | X | | | |
| Lampang | | | | | | | X | | | | | | X | | | |
| Lamphun | | | | | | X | X | | X | | | X | | | | |
| Chiang Mai | | | | | | X | X | | | | | X | | | | |
| Mae Hong Son | | | | | | | | | | X | | | | | | X |
| Tak | | | | | | | | | | X | | | | | X | |
| Kamphaeng Phet | X | | X | | | | | X | X | | X | | | X | | |
| Sukhothai | | X | X | | X | | | | | | | | | X | | |
| Phrae | | | | | | | | | | | | X | | | | |
| Nan | | | | | | | | | | X | | | | | | |
| Uttaradit | | | | | | | | | | | | | | X | | |
| Phitsanulok | | | | | | | | | | | | | X | | | |
| Phichit | X | X | X | X | X | | | | X | | X | | X | | | |
| Nakhon Sawan | X | X | X | | X | | | | | | X | | | X | X | |
| Uthai Thani | | | | | X | | | | | | | | | | X | |
| Phetchabun | | | | | | | | | | | X | | | X | X | |

For example, figures of farm size per farm household in Phetchabun, Kamphaeng Phet, Phichit and Nakhon Sawan are larger than the regional average plus standard deviation value. It is assumed that there are fewer pressures to reclaim forest area. Hence, these provinces are considered to be less significance of M/P formulation and lower development priority. (See Table 3.2.4.)

**Table 3.2.4 An Example of Comparison**

| Province | Average household farm holding (rai/HH) | Difference from the regional average | Larger than "average + standard deviation value (=32.96)" (Less significance of M/P formulation) |
|---|---|---|---|
| Phichit | 41.25 | 19.30 | x |
| Nakhon Sawan | 36.41 | 14.47 | x |
| Kamphaeng Phet | 35.58 | 13.64 | x |
| Phetchabun | 34.61 | 12.67 | x |
| Uthai Thani | 31.17 | 9.23 | |
| Phitsanulok | 28.87 | 6.93 | |
| Tak | 24.91 | 2.97 | |
| Uttaradit | 23.41 | 1.46 | |
| Sukhothai | 23.24 | 1.30 | |
| **North Region** | **21.94**（Standard deviation :11.02） | 0.00 | |
| Chiang Rai | 15.30 | -6.64 | |
| Phayao | 13.93 | -8.01 | |
| Nan | 11.89 | -10.05 | |
| Mae Hong Son | 11.55 | -10.40 | |
| Phrae | 11.24 | -10.70 | |
| Lampang | 10.32 | -11.62 | |
| Lamphun | 9.86 | -12.09 | |
| Chiang Mai | 9.49 | -12.45 | |

Based on the statistical analysis, the parameters of the17 provinces were evaluated and compared from the significance or potentiality of the M/P formulation. The result is summarized as follows.

**Table 3.2.5 Number of Parameters with Less Significance of the M/P Formulation**

| Province | Proper natural resources management | Sustainable agricultural and rural development | Land reform areas | Total | Candidate provinces |
|---|---|---|---|---|---|
| Chiang Rai | 0 | 1 | 0 | 1 | Candidate |
| Phayao | 0 | 1 | 0 | 1 | Candidate |
| Lampang | 0 | 2 | 0 | 2 | |
| Lamphun | 0 | 4 | 0 | 4 | |
| Chiang Mai | 0 | 3 | 0 | 3 | |
| Mae Hong Son | 0 | 1 | 1 | 2 | |
| Tak | 0 | 1 | 1 | 2 | |
| Kamphaeng Phet | 2 | 4 | 0 | 6 | |
| Sukhothai | 3 | 1 | 0 | 4 | |
| Phrae | 0 | 1 | 0 | 1 | Candidate |
| Nan | 0 | 1 | 0 | 1 | Candidate |
| Uttaradit | 0 | 1 | 0 | 1 | Candidate |
| Phitsanulok | 0 | 1 | 0 | 1 | Candidate |
| Phichit | 5 | 3 | 0 | 8 | |
| Nakhon Sawan | 4 | 2 | 1 | 7 | |
| Uthai Thani | 1 | 0 | 1 | 2 | |
| Phetchabun | 0 | 2 | 1 | 3 | |

Based on the above table, the provinces which have fewer parameters with less significance of the M/P formulation are considered to have a wide range of problems/issues (higher development priority provinces). Size of the LRAs is one of the most crucial factors for the M/P formulation because they

are the target areas of the M/P. Hence, Mae Hong Son with the extremely small LRAs was considered to be less significant and potential.

As the result of the first screening process with the discussions with the C/P personnel, 6 provinces, namely Chiang Rai, Phayao, Phrae, Nan, Uttaradit and Phitsanulok, were selected as the candidate provinces.

## 3.3 SECOND SCREENING

(1) Field Observation of Cooperation Feasibility

Field reconnaissance was conducted in the selected 6 candidate provinces. The objectives of the reconnaissance were: 1) to evaluate the institutional capacities and willingness in terms of cooperation with the PLRO and other agencies concerned, considering potentiality of integration of the M/P with a provincial development plan, 2) to survey and confirm present situations of the LRAs in terms of significance of the M/P formulation, and 3) to survey possibilities of future cooperation with local institutes and NGOs at provincial and local levels to incorporate their experiences and resources into the M/P contents. (See Table 3.3.1.)

**Table 3.3.1 Subjects of the Second Screening**

| Office/organization | Subjects |
|---|---|
| Government offices concerned, PRLO | - Understanding of the participatory M/P formulation<br>- Possibility of cooperation with the related organizations<br>- Confirmation of parameters applied in the first screening process<br>- Significance of the M/P formulation |
| NGO, Local institutions (university) | - Consistency with their activities and the M/P objectives<br>- Possibility of human resources mobilization for the M/P formulation<br>- Cooperation feasibility with the Study Team, ALRO, ATSAP |

(2) Selection of the Four Provinces

The reconnaissance result was assessed by the C/P personnel and the Study Team with a rating score method. As a result, Chiang Rai was ranked to be the lowest among the 6 provinces.

In addition, the parameter, “national development strategy”, was added to screen the provinces, since provincial development should be in line with the national development strategy. Consistency with provincial development direction and the national development strategy was analyzed referring to the “Development Strategy of Cluster in the North region”. More emphasis on natural resources management was put on the cluster of Upper North. (See Table 3.3.2.)

By taking the above screening processes, following four provinces were selected for the M/P formulation in the Phase II.

- Phayao

- Phrae
- Nan
- Phitsanulok

**Table 3.3.2 Second Screening Process**

| Subjects | Observation of cooperation feasibility | | | | | National development strategy | | |
|---|---|---|---|---|---|---|---|---|
| | Readiness in ALRO office / agencies concerned | Significance of M/P formulation | Corporation with NGOs and local institutes | Total score | Ranking | Consistency with national development strategy and M/P formulation direction | | |
| | Discussion with provincial ALRO office and agencies concerned | Discussion with office concerned and field reconnaissance | Discussion with NGOs / local institutes and field reconnaissance | | | Study of the "Development Strategy of Cluster in the North Region" (Office of the Prime Minister, Nov. 2003) | | |
| Assessment | Rating with score | | | | | Cluster | M/P formulation is consistent with the national development strategy. | |
| | Max score: 45 | Max score: 20 | Max score: 35 | Max score: 100 | | | +++; fully consistent, ++;moderately, +; inconsistent | 2nd screening |
| Chiang Rai | 19.10 | 12.60 | 24.50 | 56.20 | 6 | Upper north | +++ | |
| Phayao | 34.60 | 15.70 | 27.10 | 77.40 | 1 | Upper north | +++ | Selected |
| Phrae | 29.75 | 14.60 | 24.50 | 68.85 | 3 | Upper north | +++ | Selected |
| Nan | 34.95 | 14.70 | 19.25 | 68.90 | 3 | Upper north | +++ | Selected |
| Uttaradit | 34.40 | 12.40 | 24.00 | 70.80 | 3 | Lower north group-1 | ++ | |
| Phitsanulok | 38.80 | 14.00 | 26.55 | 79.35 | 1 | Lower north group-1 | ++ | Selected |

# CHAPTER 4 PRESENT SITUATIONS OF THE FOUR SELECTED PROVINCES

## 4.1 IMPLEMENTATION OF PARTICIPATORY SURVEY IN THE FOUR PROVINCES

In the beginning of the Phase II period, participatory survey was done to clarify the present situations of the LRAs by the local people, not by the outsiders, in several selected tambons in each province.

### 4.1.1 Method

The method and principle of the participatory approach were decided through the discussions with the C/P agencies and stakeholders. At the beginning of the discussions, Project Cycle Management method was briefly introduced by the Study Team, as one of the alternative methods. After that, a workshop was held on 28 and 29 March 2005 with the participants from various kinds of organizations such as ALRO/ATSAP, PLRO, NGOs as well as intellectuals. In the workshop, major participatory approach methods as well as the case study of similar participatory approaches applied in Thailand were introduced. Participants discussed these methods, principles and anticipated schedule. Through the discussions, the followings were agreed among the participants.

- Participatory method should be selected from the ones which are widely used in the country and learning process should be incorporated.
- Surveyors should be selected from the people who thoroughly know the participatory approach methods.
- Implementation organization with such surveyors should be established.
- Activities should be implemented with the partnership between the surveyors and the PLRO officials.

### 4.1.2 Site Selection

(1) Target Groups

In general, local people and communities share natural and social resources in rural societies, which means that resources cannot be split into the LRA farmers and the non-LRA farmers. Considering such situation, a part of formulated M/P may be incorporated into tambon development plan. Therefore, participatory approach sites should be selected in consideration of tambon administration unit. For smooth operation within a fixed time frame, the target number of the tambon should be limited one or two at one site. The targeted LRAs are selected from the LRAs which are located in the selected tambon. Target villages are the villages where LRA farmers exist.

(2) Site Selection Process

Considering the objectives of the participatory approach, social and natural resource conditions of the

selected LRAs and villages should be representatives of the province. In addition, there should be opportunities that villagers can learn any lessons along the Study themes. Therefore, the selection criteria were set as follows.

- The sites are adjacent to conservation forest from which resources are used by nearby villagers.
- Community forest that the villagers utilize cooperatively exists in/near the site.
- Land use pattern in the selected site represents the province in terms of land conditions. (Mountainous, sloped and flat lands are distributed).
- Livelihood conditions such as land tenure and household finance are at the average level in each province.
- The site is located on the watershed of major rivers and its conservation is an urgent issue.
- The villagers and tambon administration concerned are cooperative for participatory approach.
- For smooth operation, villages are not located far and they are accessible each other.

The PRLO officials know circumstances of the LRAs in the province. Therefore, they were requested to select candidate sites. As a result, they proposed the sites of tambon, the LRAs and the relevant villages based on the selection criteria.

Reconnaissance survey with the PLROs and the Study Team were executed in the proposed sites to verify rationality of the selection. Through the field reconnaissance, discussions with the tambon officials and interview survey with village representatives, the following sites were selected. (See Table 4.1.1.)

**Table 4.1.1 Selected Participatory Survey Sites**

| Province | M/P code | Total area (rai) | Selected PRA site | | | |
|---|---|---|---|---|---|---|
| | | | Local administration | | Area (rai) | No. of Villages |
| | | | Amphoe | Tambon | | |
| Phayao | PYO11 | 75,233 | Muang Phayao | Ban Mai | 9,748 | 9 |
| | | | | Mae Ka | 2,830 | 18 |
| | PYO12 | 25,973 | | Mae Ka | 11,411 | |
| Nan | ANN04 | 44,289 | Tha Wang Pha | Jom Phra | 17,728 | 8 |
| | | | | Yom | 4,897 | 8 |
| Phrae | PRE08 | 132,241 | Long | Bor Lek Long | 29,043 | 8 |
| | | | | Thung Laeng | 48,973 | 10 |
| Phitsanulok | PIK01 | 148,578 | Chattakan | Ban Dong | 75,679 | 14 |

Note: For M/P codes, please refer to the next section, 4.2. Figures are based on the data provided by ALRO GIS section.

### 4.1.3 Framework

Objectives of the participatory survey include;

- To collect data and information on natural resources, socio-economy of rural life, and agriculture for the M/P formulation,

- To enable participants to learn the social and natural resources,
- To bring the ownership sense of the M/P to participants, and,
- To learn the participatory approach method to participants.

Participants are expected to conduct the following activities.

- To collect data and information on farming, living and natural resources in the sites
- To analyze strengths and weakness of their society, farming practices, and natural resources
- To discuss community development plan based on the findings and analysis

The participatory survey adopts wide range of methods to enable participants to express and share their opinion. A series of workshops and meetings, transect field works, focus group discussions at tambon and village level are the major ones, and tools such as mapping and diagramming, observation and analysis, were also used in the operations. Principle is to enable participants to take their own initiatives in the course of survey.

Learning from case studies, innovative farmers and intellectuals were incorporated into the survey processes. Output of the participatory survey was targeted to prepare a community development plan (CDP) based on their own initiatives.

The participatory survey was essentially based on the initiatives of villagers. Therefore, working plan was flexibly made in accordance with the progress of learning and awareness of development constraints and needs. In the course of the survey, discussions with stakeholders were held to design the survey schedule, and it was agreed that the survey period was set from April to middle of September 2005. Plan of learning process was set as follows.

1) Making consensus to participate in the M/P formulation process

Objectives of the participatory survey and its methodology were explained to village leaders and tambon officials. The followings were emphasized in the explanation.

- Significance of the participatory approach, especially, bottom-up approach with learning process and differences from top-down style in the past
- Significance of sharing self-reliance development ideas with their own resources
- Expected impacts by analyzing their resources
- Making community development plan

Related information was disseminated and questionnaires were distributed if necessary. Working groups were organized independently in the villages to make the operation more effectively.

2) Sharing information on socio-economy and rural life

Based on the collected data and information, present situations of socio-economy and rural life were analyzed by villagers themselves. Knowledge and skills to analyze their resources were learned through the processes. Household finance analysis was also useful to know development constraints and needs.

3) Sharing information on natural resources with farming practice

Present situations on natural resources such as land, soil, forest products and water, were surveyed at village level. Especially utilization of these resources and accessibility to them were analyzed from the viewpoint of farming practice and livings. These were learned through field transect works and focus group discussions by crop, forest products and water resources. To reinforce learning process, local intellectuals and researchers sometimes joined in the workshops and meetings. Learning from present and past in the forest was useful for villagers to be aware of conservation consciousness.

4) Discussion on development constraints and potentials

Based on the lessons learned in the processes, development constraints and potentials were identified by the villagers. After that, internal discussions were repeated to share and seek development direction and solutions. Development direction was created from such discussions and sharing. Experiences from similar case studies were introduced.

5) Preparation of Community Development Plans (CDPs)

As the output of the learning process, a community development plan was produced by villagers. A workshop was held to share the lessons learned and proposed plans among the stakeholders.

### 4.1.4 Findings

Based on the site selection, the participatory surveys were implemented in the following sites.

**Table 4.1.2 Participatory Survey Implemented Sites**

| Province | Amphoe | Tambon | Number of villages | Number of household* |
|---|---|---|---|---|
| Phayao | Muang Phayao | Ban Mai | 9 | 1,510 |
| | | Mae Ka | 18 | 4,026 |
| Phrae | Long | Bor Lek Long | 8 | 1,102 |
| | | Thung Laeng | 8 | 1,867 |
| Nan | Tha Wang Pha | Chom Phra | 11 | 1,341 |
| | | Yom | 10 | 1,268 |
| Phitsanulok | Chattakan | Ban Dong | 14 | 1,240 |

Note: *; Source; District Registration Office, etc.

At the beginning, the participatory survey was commenced with the explanation of its objective. In the process, a series of meetings, workshops, group discussions and transect field works were organized.

As planned, villagers analyzed current situation of their own life. They found problems, development constraints and potentials, and discussed solutions to overcome the constraints. The results were separately compiled in the Participatory Survey Report. For the Study, however, their performance derived from the Report is summarized in the following tables.

**Table 4.1.3 Performance of the Participatory Survey (Phayao)**

**a) Tambon Ban Mai, 9 villages**

| Present resources | Problem | Solution |
|---|---|---|
| ***Rural life;***<br>5,040 population, 1,510 HH<br>TAO (1 executive, 2 vice executives and 18 TAO members)<br>Land use; Total area 36,174 rai (forest 15,474 rai, orchard 3,500, paddy 12,000, residence 4,000, public land 1,200)<br>**Group in the community**<br>• **Wat Rong Hai;**<br>There is a regulation on community forest conservation.<br>Community rice breeding group, alternative agriculture group, cattle raising group. Occupation group (provided by TAO)<br><br>Farmer's debt reaches to total 30 million baht.<br>• **Wat Ban Mai Luang;**<br>Group of forest management and community forest conservation.<br>Middle age people work as employees in off-farming season.<br>Community rice group<br>Cattle dung utilization group (organic fertilizer)<br>Occupation group<br>OTOP groups of polished rice production<br>Wat Ban Yuan;<br>There is a community regulation for Mae Yien reservoir management<br>Innovative farmers produce liquid bio-fertilizer and dung for fertilizer<br>Occupation group is being promoted.<br><br>Wat Ban Pong;<br>A ancient temple, Wat Ban Yuan<br>Traditional event to pray for sprit of water head.<br>Alternative agriculture group (producing organic fertilizer) | Unemployment<br><br>Unbalanced income and expenditure<br>Share of utensil and communication (telephone) cost is high in HH finance.<br><br>Water use conflict between upstream and downstream communities.<br><br>TAO does not take initiative so much for occupation development.<br>TAO focus on road development.<br><br>TAO members are not interested in participatory process. | Enhancement of the group activities<br>Discussion with agencies concerned<br>Improvement of HH finance<br>Decreasing HH expenditures<br>Generation income source<br>Introduction of exchange market<br><br>Management of water use system<br><br>Revitalization of traditional culture |

| Present resources | Problem | Solution |
|---|---|---|
| | | Local people participate in operation and management process |
| ***Agriculture;***<br>Products<br>Lychee (2,800 rai, 560 tons), Corn (370 rai, 148 tons), Longan (120 rai, 84 tons), Paddy (12,000 rai, 480 tons), Cow raising (270 heads) | High input cost<br>Overuse of chemical fertilizer<br>Lack of water use management | Development of food production system<br>Development of sustainable agricultural system through<br>Construction of water management facilities.<br>Improvement of irrigation system |
| ***Natural resources:***<br>Area is located in the head of water source of Mae Yuan river.<br>Water resources; Mae Yian reservoir (12 million cu.m), Nong Bua pond<br>12 streams<br>22 weirs<br><br>Natural products;<br>Bamboo shoot (20,000 can/year, 260 tons), Vegetable, Mushroom | Lack of water management<br>Water and chemical utilization of upstream basin causes negative impact in the downstream. | Water use management<br>Decreasing of use of chemicals<br>Production of organic fertilizer<br><br>Management of forest<br>Sustainable utilization of natural products |

**b) Tambon Mae Ka, 18 villages**

| Present resources | Problem | Solution |
|---|---|---|
| ***Rural life;***<br>11,591 population, 4,026 HH<br>TAO (1 executive, 2 vice executives and 36 TAO members)<br>Tambon is divided into four zones of North, South, East and West.<br>Hinter mountain area is located in the head of water source of three main rivers.<br><br>Land use in Tanbom ;Total area 155,539 rai (agricultural area 51,671 rai, paddy field 14,460 rai, forest and public area 95,958 rai, residence area 7,864 rai)<br><br>Traditional animism for sprit of nature, water head, water resources<br><br>Naresuan University Phayao branch<br>Deep and shallow wells | South zone:<br>No land certificate in about 90% of the land.<br>Less occupation promotion activities<br>Low income<br>Central zone:<br>Land certificates distributed about 30% of the LRAs.<br>High income-expenditures<br><br>Not enough deep well for home consumption<br><br>TAO members are not interested in development. | Discussion with agencies concerned<br>Generating income source<br>Improvement of HH finance<br>Decreasing HH expenditures<br>Saving activities<br>Introduction of exchange market<br><br>Enhancement of the group activities<br>Revitalization of traditional culture<br>Local people participate in operation and management process |
| ***Agriculture;***<br>Crop products;<br>Lychee (270 rai, 22 tons), Corn (18,900 rai, 7,560 tons), Longan (130 rai, 11 tons), Jasmine paddy (4,750 rai, 2,137 tons), Sticky rice | South zone:<br>Sustainable agriculture is not being practiced.<br>No processing of agricultural | Development of food production system<br>Development of sustainable agricultural system |

| Present resources | Problem | Solution |
|---|---|---|
| (9,710 rai, 4,369 tons), Black bean (1,200 rai, 60 tons, Onion 470 rai, 470 tons, garlic<br>Livestock;<br>Cattle(477 heads), Swine (2,250 heads), Buffalo (50 heads)<br>Fishery;<br>Catfish (about 5,000 fishes/cycle), Frog (about 300,000 frogs/cycle)<br><br>South<br>Para-rubber plantation is started in 200 rai<br><br>Central;<br>Major crop is corn.<br>Three groups of cattle raising.<br>One frog raising group | products<br>No maintenance of the weirs<br>Overuse of chemical fertilizer, pesticide and herbicide.<br>Soil erosion prone<br>Central zone:<br>Overuse of chemical fertilizer, pesticide and herbicide.<br>Single farming practice is distinctive.<br>North<br>Overuse of chemical fertilizer, pesticide and herbicide.<br>Soil deteriorated.<br>Water supply system is not used effectively. | Introduction of processing system<br>Decreasing of overuse of chemicals<br><br>Promotion of vegetable and local herb planting<br><br>Construction of water management facilities.<br>Improvement of irrigation system |
| ***Natural resources:***<br><br>Water source;<br>Mae Tam reservoir (37 million Cu.m.<br>Huai Na Poi reservoir (6 million cu.m.)<br>Other 3 reservoirs and one pond<br>32 tributaries of the major four rivers.<br>4 weirs<br><br>Natural products;<br>Deciduous wood, teak, rubber, Bamboo, Mushroom, Wild animals, Herb<br><br>Swidden agriculture conducted. | South zone;<br>Community does not know clear boundary of forest.<br>Encroachment of forest and community forest<br>Forest trees are often cut and stolen by outsiders and insiders.<br>There is forest burning for animal hunting and wild vegetable collection.<br>Central<br>Encroachment of forest area in the university<br>Forest tree frequently cut illegally.<br>Boundary of the forest is not clear.<br>North<br>Forest area and LRAs are being deteriorated.<br>More than 95% of water resources of Mae Tom reservoir are used for outside of this Tambon.<br>Lack of water management concept. | Specification in the regulation<br><br>Understanding rules, regulation and penalties<br><br>Decreasing of overuse of chemicals<br>Production of organic fertilizer<br><br>Management of forest<br><br>Management of water use system |

Note: Table is prepared by the Study Team based on the data and information collected from Participatory Survey Report.

**Table 4.1.4 Performance of the Participatory Survey (Phrae)**

**a) Tambon Bor Lek Long, 8 villages**

| Present resources | Problem | Solution |
|---|---|---|
| ***Rural life;***<br>4,205 Population, 1,012 HH<br>Community economy;<br>total income; 81,328,120 baht/year,<br>total dept; 80,218,257 baht/year<br>Some cooperatives such as elderly | Unbalanced income and expenditure<br>Unemployment | Improvement of HH finance<br>Introduction of internal market<br>Discussion with agencies concerned. |

| Present resources | Problem | Solution |
|---|---|---|
| group, water user's group, handicraft group.<br>One public health center.<br>One groundwater pumping system<br><br>Rubbish<br><br>Knowledge: Leaders; village head, TAO<br>Attitude of community development planning and implementation | Activity of community fund group is poor.<br><br>Lack of understanding on health.<br>Water shortage of consumption water<br>Lack of water management.<br><br>No concept on rubbish management<br><br>Present leaders are not interested in learning new things for development. | Making use of local herbs for health.<br><br><br><br>Introduction of water management<br><br>Grading rubbish in household level then recycling for reuse.<br><br>Local people participate in operation and management process |
| ***Agriculture;***<br>Agriculture income: 45,920,992 baht/year (56% of total)<br>Major crops; paddy (yield 350 kg/rai) 3,584 rai, orchard and field crops 2,523 rai<br><br>Available water resources: 4 reservoirs: water area 7-10rai, depth 0.8-1.5 m. | Lack of management system on food and production.<br>Lack of concept for generating linkage with products, processing.<br>Lack of market<br>Low price of products<br>High expenses<br><br>Water shortage | Development of internal market<br>Finding income source in dry season.<br>Processing<br><br><br>Water resources development |
| ***Natural resources:***<br>Water source; 4 tributaries of Yom<br>Conservation forest; 1,000 rai<br>Crops with natural resources; neem, lemon grass, galingale, moridinda, curcuma, etc.<br>National park (plants and animals)<br>Mineral resources; iron, gold and white soil<br>Head of water source<br>Local herbs are left unutilized. | Lack of knowledge on utilization of natural resources.<br>Crops are sold as fresh stuffs without processing.<br>Wild stuffs are sold as raw materials.<br><br>Water sources and streams are deteriorated.<br>Forest is deteriorated.<br>Logging<br>Conflict of natural resources use among community and government agencies concerned.<br>Corruption of state officials involved in illegal logging | Learning<br><br>Management of utilization<br><br><br>Reforestation |

**b) Tambon Thung Laeng, 8 villages**

| Present resources | Problem | Solution |
|---|---|---|
| ***Rural life;***<br>7,967 Population, 1,867 HH<br>Community economy;<br>total income; 95,701,279 baht/year, total dept; 88,757,300 baht/year<br>Three saving groups for production<br>One village bank (village 5)<br>Two public health center, nursery center.<br>Huai sana reservoir (area of 20rai) | Unbalanced income and expenditure<br>Unemployment<br><br><br>Lack of understanding on health.<br>. | Improvement of HH finance<br>Introduction of internal market<br>Discussion with agencies concerned.<br><br>Introduction of water management<br><br><br>Grading rubbish in household |

| | | |
|---|---|---|
| Main occupation: paddy cultivation (6,300 rai, yield 700 kg/rai)<br>Rubbish<br><br>Knowledge: Leaders; village head, TAO, intellectual persons | No concept on rubbish management<br><br>Lack of good knowledge management and making use of those persons. | level then recycling for reuse.<br>Establishment of management of knowledge base for self-reliance.<br>Local people participate in operation and management process |
| ***Agriculture;***<br>Agriculture income: 42,761,819 baht/year (45% of total)<br>Agricultural area 17,352 rai on the hill, 6,300 rai of whole area 72,367 rai in the plain.<br><br>Available water resources: 2 reservoirs (water area 15 rai, 2.5 m in depth, 5 rai, 0.8 m as of June 05)<br>Community pond: water area 5 rai, 1.5 m as of June 05. | Lack of management system on food and production.<br>Lack of concept for generating linkage with products, processing.<br>Lack of market<br>Low price of products<br>High expenses<br>Water shortage | Development of internal market<br>Finding income source in dry season.<br>Processing<br><br><br><br>Water resources development |
| ***Natural resources:***<br>Natural resources in the community area, in the forest and natural water.<br>Water source; Yom<br>Community forest and public forest; 1878 rai<br>Crops with natural resources; neem, lemon grass, galingale, moridinda, curcuma, etc.<br>Conservation forest and National park (plants and animals)<br>Forest | Lack of knowledge on utilization of natural resources.<br>Crops are sold as fresh stuffs without processing.<br>Wild stuffs are sold as raw materials.<br><br>Water sources and streams are deteriorated.<br>Forest is deteriorated.<br>Logging<br>Conflict of natural resources use among community and government agencies concerned.<br>Corruption of state officials involved in illegal logging | Learning<br><br>Management of utilization<br><br>Huai Mae Sanhan is conserved as the community forest 1,000 rai, based on the village regulation.<br>Reforestation |

Note: Table is prepared by the Study Team based on the data and information collected from Participatory Survey Report.

**Table 4.1.5 Performance of the Participatory Survey (Nan)**

**a) Tambon Yom, 10 villages**

| Present resources | Problem | Solution |
|---|---|---|
| ***Rural life;***<br>Tribe: native Thai, Lue (hill tribe)<br>9 temples, one church<br>Level 5 TAO<br>Huai Chang San reservoir<br>Population 4,959. HH 1,268<br>HH finance: dept from BAAC<br>One agro-processing group of bamboo shoot canning<br>Two groups of weaving groups<br><br>Saving group in each village<br><br>Health<br>Knowledge: Chief of the tambon | Unbalanced income and expenditure<br>Unemployment<br><br><br><br>Lack of fund<br>Poor activity of village fund<br><br>Lack of good knowledge management and making use of those persons. | Improvement of HH finance<br>Finding of income source<br>Discussion with agencies concerned.<br><br><br><br><br>Growing health and welfare consciousness<br>Establishment of management of knowledge base for self-reliance.<br>Local people participate in operation and management process |

| | | |
|---|---|---|
| ***Agriculture;***<br>Paddy field; 5,068 rais (yield of sticky rice 300kg/rai)<br>Drought<br>Chili after paddy.<br>Upland crop (corn) 3,170 rai | Price of chili is being decreased.<br>Lack of management system on food and production.<br>Most of products (chili and corn) are sold to outside.<br>Lack of irrigation system.<br>Not enough water resources.<br>No suitable sites for pond excavation.<br>Lack of concept for generating linkage with products, processing.<br>Lack of market<br>Low price of products<br>High expenses<br>Water shortage | Finding income activities in dry season.<br>Processing<br><br><br>Water resources development<br>Farm road construction |
| ***Natural resources:***<br>Community forest<br><br><br>Natural resources management | Timber production<br>Low soil fertility<br>Overuse of fertilizer<br>Forest is deteriorated. | Suitable use of natural resources for living. (use of bamboo)<br>Making bio-fertilizer<br>Fire protection<br>Reforestation |

**b) Tambon Chom Phra, 11 villages**

| Present resources | Problem | Solution |
|---|---|---|
| ***Rural life;***<br>Tribe: native Thai, Lue (hill tribe)<br>Population 2,753, HH: 1,341<br>HH finance: much dept from BAAC<br><br>No saving group in each village<br>***Health***<br>Knowledge: no organizations, groups or leader | Unbalanced income and expenditure<br>Unemployment<br><br>Lack of good knowledge management and making use of external resource persons. | Improvement of HH finance<br>Finding of income source<br>Discussion with agencies concerned.<br><br>Growing health and welfare consciousness<br>Establishment of management of knowledge base for self-reliance.<br>Local people participate in operation and management process |
| ***Agriculture;***<br>Major crops; paddy, chili, corn<br>Nam How reservoir<br>Water resources: Yom | No pumping system from Yom<br>No irrigation system<br>Price of chili is being decreased.<br>Lack of management system on food and production.<br>Most of products (chili and corn) are sold to outside.<br>Not enough water resources in dry season.<br><br>Lack of concept for generating linkage with products, processing.<br>Lack of market<br>Low price of products (chili)<br>Production cost is high<br>No processing of products<br>Lack of knowledge in agriculture | Irrigation system development<br>Finding income source (raising of cattle, swine, chicken, etc).<br>Processing<br><br>Construction of pond<br>Construction of road<br>Improvement of the existing reservoir<br>Dredging of the existing stream and reservoir |

| Present resources | Problem | Solution |
|---|---|---|
| | Water shortage in dry season | |
| *Natural resources:*<br>Community forest managed by Village Ban Thon<br>Natural resources management | Low soil fertility<br>Overuse of fertilizer<br>Forest is deteriorated. | Suitable use of natural resources for living. (bamboo, charcoal, etc)<br>Making bio-fertilizer<br>Fire protection<br>Reforestation<br>Establishment of non-toxic agriculture group, cattle group linked with organic fertilizer |

Note: Table is prepared by the Study Team based on the data and information collected from Participatory Survey Report.

**Table 4.1.6 Performance of the Participatory Survey (Phitsanulok)**

**a) Tambon Ban Dong, 14 villages**

| Present resources | Problem | Solution |
|---|---|---|
| *Rural life;*<br>Population: 4,869, HH:1,240<br>Land use area: total 151,907 rai (Agricultural area 67,671 rai, Residence 835 rai, Forest 83,401 rai)<br>Three characters of occupation (major income source)<br>- Plantation of cassava, sugarcane and corn for HH economy<br>- Paddy crop and vegetable for living<br>- Cattle raising<br>(At present, rubber plantation is being extended.) | High production cost causes much HH debt.<br>HH expenses are high<br>Labor cost is low<br>HH finance management is difficult.<br>Health and welfare consciousness is low.<br>High electricity fare<br>Habit forming drug<br>Un-transfer of local knowledge, culture, language and traditional cooking. | Development of central marketing system in the community.<br><br>Establishment of revolving fund with internal and external sources<br><br><br><br><br><br>Opportunities of learning process to get knowledge from:<br>Formal leaders; TAO, village chief<br>Intellectuals; traditional medicines, ritual persons, local technicians, etc. |
| ***Agriculture;***<br>Agricultural land use (rai):<br>Paddy 8,076 rai, Field crop 53,703, Fruit 3,588, Perennial crops 1,810, Vegetable 494 | Agricultural production is decreasing.<br>Lack of knowledge and skill<br>Lack of water reservoir<br>Lack of water management<br>High production cost (qualified seed, fertilizer, etc.)<br>Low market price<br>Lack of animal raising skill and place<br>Inconvenient transportation | Improvement of production system for internal consumption oriented<br>Increase production and decrease cost for food.<br>Diversification of products for food security in the community.<br>Harmonization between agricultural activities and surrounding environment in the fields of agronomy, animal raising, traditional agriculture and diversification) |
| ***Natural resources:***<br>Canal, stream and swamp exist close to the Phumieng Phuthong reserve forest | Soil deterioration<br>Less interest in soil improvement<br>Forest area is decreasing.<br>Loss on natural food source<br>Overuse of chemical fertilizer<br>Natural water resources are | Participation in decision making process<br>Development of community forest management network.<br>Enhancement of public awareness in cooperation with government |

| Present resources | Problem | Solution |
|---|---|---|
| | decreasing in dry season.<br>Soil siltation<br>Land use conflict between conservation and living, and between government and local community | agencies concerned<br>Introduction of Phumiang Phuthong sanctuary concept (forest tree, water resources, wild plants, wildlife herb, natural fertilizer as humus)<br>Establishment of forest fire break line<br>Establishment of zoning of protected area and reforestation area. |

Note: Table is prepared by the Study Team based on the data and information collected from Participatory Survey Report.

The participatory survey revealed that villagers found the same problems described in the Problem Analysis in most of the sites as shown below.

**Table 4.1.7 Common Problems Found in the Sites**

| Sector | Problems in the Problem Analysis | Problems found by villagers* |
|---|---|---|
| Natural resources | Forest areas are deteriorated. | Deteriorated forest area |
| | Illegal logging is still done. | Forest tree often cut illegally. |
| | Forest fire is induced. | Burning for animal hunting. Fire prone |
| | Forests to be protected are not clearly delineated. | Not clear boundary of conservation forest |
| | Knowledge on natural resources utilization and management is low. | Lack of knowledge on forest plants and their utilization and management |
| Socio-economy, rural life | People enter forest area. | Encroachment into conservation forest and community forest |
| | Agricultural income is limited. | Unstable market price of products |
| | Household expenditure is high. | High agricultural production cost often shows a loss. Food purchased from outside market |
| | Amount of household debt is large in finance management. | Due to the high production cost, maintain farming may result in debt in the balance. |
| | Opportunities to earn non-agricultural income are limited. | Less occupation promotion, Low labor wages |
| Agriculture | Fertile arable land is limited. | Low soil fertility, Overuse of chemicals. |
| | Infrastructures are not well developed. | Lack of water resources |
| | Cash crops cultivation is dominant. | Problems on farming of Corn, Lychee, Orchard, Chili, Paddy, Cassava, Sugarcane, etc |
| | Farm gate prices of cash crops are often fluctuated. | Low market price of products |
| | Agricultural extension services are not enough. | Insufficient technical support, Lack of linkage on knowledge with products and processing |

Note: *; Problems found by villagers are picked up from the Participatory Survey Report.

Among the above findings, the following issue was recognized as serious by villagers.

Most of villagers are facing economic constraints at each household level. Namely, it was found that their household income does not meet its expenditure. While they can get income through agriculture, they spend a significant part of their income to purchase agricultural inputs. Moreover, they often spend much cost for purchasing foods such as rice, vegetables and meats from market, although some of them can be produced by themselves. In addition, they borrow money from

BAAC and other financial institutions to maintain their farming practice. Under such situations, they cannot make self-reliance in food and household management.

Based on the findings of the participatory survey, farmers living in the LRAs were characterized as follows.

**LRA farmers**

- They rely on natural resources from forest.
- Their farmlands are unsuitable for farming.
  (low fertility, soil erosion prone, difficult access to water)
- They depend on cash crop farming. (unstable market price)
- They fall into difficult financial management.
  (unstable income, high production cost, debt)

### 4.1.5 Output

(1) Community Development Plan

Villagers prepared the Community Development Plan (CDP) as the output of their performance. The CDP included the strategies and proposals of activities with anticipated resource persons and expected operation levels of household, community and tambon. According to the CDPs, villagers regarded the achievement of self-reliance as the overall development target. Considering the contents of the CDPs, its frame was summarized as shown in Figure 4.1.1.

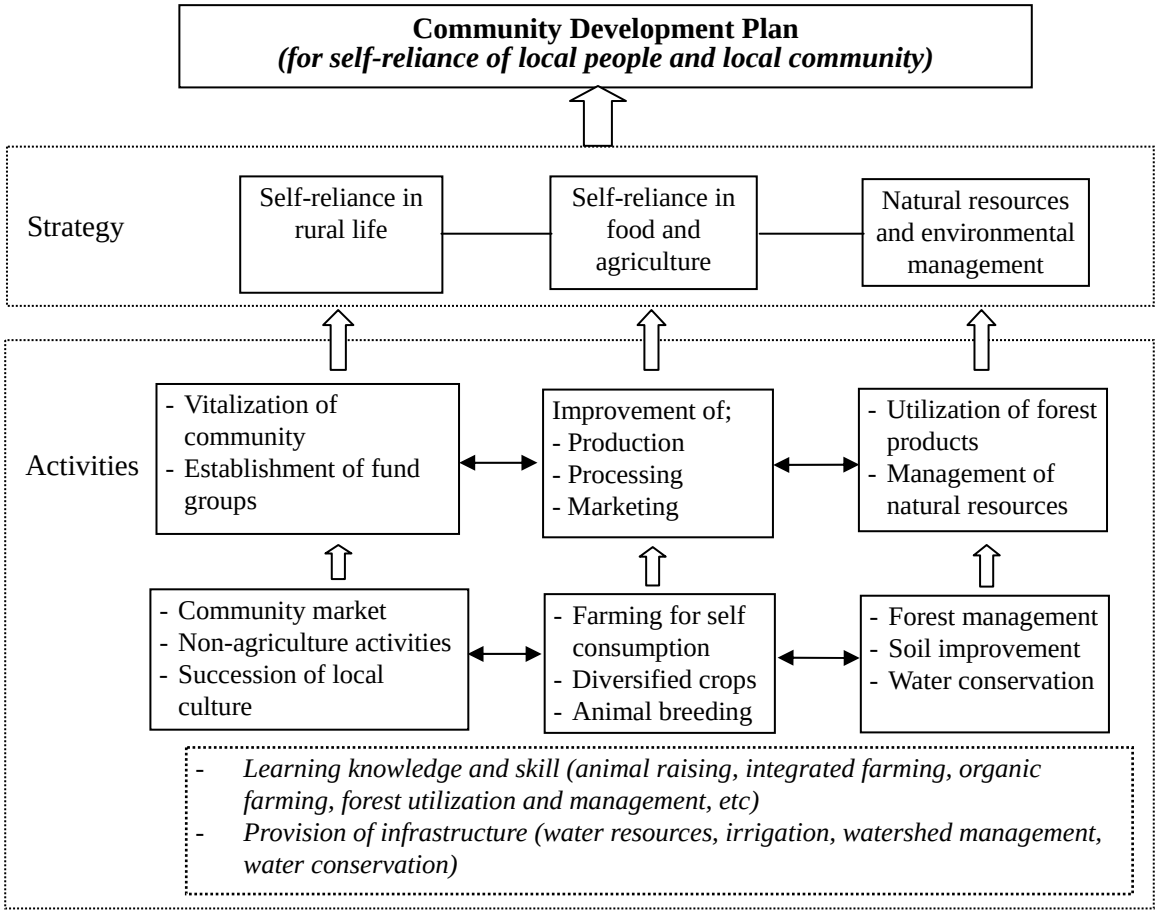



**Figure 4.1.1 Frame of the Community Development Plan**

Although descriptive form of CDP is different among the sites, the activities proposed in the CDPs were sorted out in line with the items of the Study (natural resources, rural development, sustainable agriculture). (See Table 4.1.8.)

(2) Public Hearing

A series of public hearings were carried out to discuss the contents of the CDP. From 4 to 7 October 2005, one-day workshop was held in each province with the participants from the village, tambons, ALRO, ATSAP, PLRO, other related agencies in the province, and representatives from the province such as vice governor. Many participants ranging from 99 to 133 attended the public hearings.

Presentation on the CDP and the process of participatory survey was made and some of the officials made comments. They expressed their concerns on community development and necessity of community-driven development approach. It was proposed to discuss further the detail of each activity listed in the CDPs.

(3) Lessons Learned

After the public hearings, follow-up meeting was held on 10 October 2005, with the ALRO central staff, the Study Team and the local staffs working in the four provinces. In the meeting, lessons learned were discussed and summarized as shown below:

1. Participatory approaches required long time and it made difficult to get involved all the villagers and cultivate their ownership in some sites. The officers should continue explaining villagers the importance of their participation.
2. Participatory approach is the learning process that emphasizes the importance of trial and error. The learning process continues until the lessons can be learned and transferred to the other persons.
3. To improve the CDPs, local staff and the provincial officials should deepen the understanding of village leaders and let them discuss with the concerned persons in each activity; what is the goal; how to get there; who are the participants; and what the methodology is. After the specific activities are identified, relationship between persons and activities are clarified.
4. To improve the present community situations, following items should be incorporated.
    1) Goal of activity
    2) Potential in the community such as human resources and knowledge
    3) Responsible agencies
    4) Processes to achieve the goal

## Table 4.1.8 Activities Proposed in the Community Development Plan

### a) Phayao and Phrae

| Phayao | Phayao | Phrae | Phrae |
|---|---|---|---|
| **Tambon Ban Mai** | **Tambon Mae Ka** | **Tambon Bor Lek Long** | **Tambon Thung Laeong** |
| **Sustainable agriculture**<br>(Food production and agricultural self reliance)<br>**Production**<br>Planting local and common vegetables and after the paddy<br>Fish raising<br>Organic pig raising in trench<br>Local cattle raising<br>Frog raising<br>Production of organic rice<br>Production of milled rice but not polished rice<br><br>*- Production of organic fertilizer from microorganism IMO (white fungus)*<br>*- Integrated farming* | **Sustainable agriculture**<br>(Food production and agricultural self reliance)<br>**Production**<br>Planting local and common vegetables and after the paddy<br>Fish raising<br>Organic pig raising in trench<br>Local cattle raising<br>Frog raising<br>Production of organic rice<br>Production of lychee and longan<br>Production of pottery<br><br>*- Production of organic fertilizer from microorganism IMO (white fungus)*<br>*- Integrated farming*<br>*- Organic farming*<br>*- Compost of microorganism IMO for consumption*<br>*- Construction of bio-gas pond*<br>*- Construction of agricultural road*<br>*- Extension area for using water in Tong Jieb and Tong Phra Kramong*<br>*- Construction of water supply system from Huai Na Poi and Huai Sai Dreng rivers to the community* | **Sustainable agriculture**<br>(Food production and agricultural self reliance)<br>**Production**<br>Planting vegetables at household<br>Chicken raising for self consumption<br>Fish raising in free time<br>Swine raising for extension<br>Swine raising for self consumption<br>Hen raising<br>Frog cultivation<br>Production of animal feed<br><br>*- Compost making (compost and liquid fertilizer)*<br>*- Organic farming in Doi mae La-bor hill*<br>*- Chemical free farming*<br>*- Collection of local plants*<br>*- Planting of local crops in Doi Mae la-bor*<br>*- Diversification of crops*<br>*- Rubber plantation in Do mae la Bor hill*<br><br>*- Weir construction at the Mae Long river*<br>*- Dredging of Mae Long reservoir*<br>*- Construction of Huai Pla Kong reservoir*<br>*- Improvement of Nang Luang Mae Khaem reservoir* | **Sustainable agriculture**<br>(Food production and agricultural self reliance)<br>**Production**<br>Chemical free agriculture for vegetables<br>Native chicken raising<br>Fish raising<br>Frog raising<br>Swine raising<br>Mushroom cultivation<br>Planting physic nut for alternative energy<br>Production of animal feed<br><br>*- Knowledge improvement for breeding corn seed* |
| **Processing**<br>Production of fish sauce<br>Processing of bamboo shoot<br>Processing of herb | **Processing**<br>Processing of bamboo shoot, fruits,<br>Processing of cattle meat, swine meat<br><br>*- Establishment of community rice mill* | **Processing**<br>Fish sauce<br>Fruits juice | **Processing**<br>Wine production from vegetables and fruit |
| **Marketing**<br>Establishment of community market | **Marketing**<br>Establishment of community market<br>Development of marketing network | **Marketing**<br>Development of marketing network at community level | **Marketing**<br>Networking of community market at tambon level |

| Phayao | Phayao | Phrae | Phrae |
|---|---|---|---|
| **Tambon Ban Mai** | **Tambon Mae Ka** | **Tambon Bor Lek Long** | **Tambon Thung Laeong** |
| (Production of energy crop)<br>Planting physic nut in own farm | (Production of alternative energy crop)<br>Planting physic nut in own farm | (Production of alternative energy crop)<br>Planting combustible nut for making fuel | |
| **Natural resources management**<br>**Products**<br>Herb<br>Bamboo shoot | **Natural resources management**<br>**Products**<br>Bamboo<br>Herb<br><br>Processing<br>Processing of herb<br>Marketing | **Natural resources management**<br>**Products**<br>Planting bamboo in community forests and along natural streams to be the base of community welfare management | **Natural resources management**<br>**Products**<br>Herbal planting in community forest for health |
| **Management**<br>Management of community forest 2,600rai<br><br>*- Construction of weir in upstream of Mae Yian reservoir (check dam)*<br>*- Improvement of canal system (sediment*) | **Management**<br>Reforestation<br>Specification of regulation<br>- Construction of weir in head of Mae Tam river | **Management**<br>Specification of suitable period for keeping forest products<br>- Getting knowledge of herbal medicine | **Management**<br>Construction of check dam<br>Development of headwater of Huai Sanan |
| **Land use** | **Land use**<br>Forestation in own land | **Land use**<br>Delineation of forest boundary (conservation and utilization area)<br><br>*- Development of water resources and management of community forest*<br>*- Survey of water resources area in Tambon Mae Long* | **Land use**<br>Area development in public land and community forest |
| **Rural development**<br>**Non-agriculture production**<br>Making utensils (detergents and shampoo, etc) | **Rural development**<br>**Non-agriculture production**<br>Making utensils (soap, detergents and liquid shampoo)<br>Production of paper flower from fiber plant | **Rural development**<br>**Non-agriculture production**<br>Utensils making (shampoos, detergents, etc.) | **Rural development**<br>**Non-agriculture production**<br>Making utensil |
| **Capital, fund** | **Capital, fund**<br>Saving group activity | **Capital, fund**<br>Study of saving and welfare | **Capital, fund**<br>Management of capital, saving group development for welfare<br>Establishment of welfare fund<br>Establishment of bamboo fund |
| **Health, welfare, rural life**<br>Enhancement of “sprit” of river (local believe, tradition) | **Health, welfare, rural life**<br>Ecological tourism<br>Making Thai dessert | **Health, welfare, rural life**<br>Establishment of community information center | **Health, welfare, rural life**<br>Knowledge improvement on health control |

| Phayao | Phayao | Phrae | Phrae |
|---|---|---|---|
| **Tambon Ban Mai** | **Tambon Mae Ka** | **Tambon Bor Lek Long** | **Tambon Thung Laeong** |
| Study in old city of Mae Yiam (eco-tour) | Planting contest of local vegetables<br>Arrangement of welfare for the group members | Establishment of council of community leaders<br>Revitalization and retrieving tradition<br>Promote on conservation tourism in Bor Lek Long and village 6, ban Khang Tana<br><br>Preparation of community improvement plan<br>Cooperation activities for connecting network<br>Training of community leaders | (Rural development)<br>*- Construction of water distribution system from Huai Sanan reservoir to the farming area with P.E. pipe*<br>*- Construction of Huai Mae Jok Bok reservoir*<br>*- Improvement of Huai Sanan reservoir*<br>*- Dredging of Huai Na Kiew pond*<br>*- Dredging of Huai Mae Sak river*<br>*- Construction of water distribution system of Huai Hua Thung reservoir*<br>*- Dredging of Huai Kaeng Kae river*<br>*- Construction of stone weir in Ban Mae Jok*<br>*- Dredging of Huai Nam Pu river* |

## b) Nan and Phitsanulok

| Nan | Nan | Phitsanulok |
|---|---|---|
| Tambon Yom | Tambon Chom Phra | Tambon Dan Dong |
| **Sustainable agriculture**<br>(Food production and agricultural self reliance)<br>**Production**<br>Cattle raising<br>Raising for breeding extension<br>Arrangement of pasture<br>Feed production<br>Raising for consumption<br>Swine raising<br>Raising for breeding extension<br>Raising for consumption<br>Feed production<br>Chicken raising<br>Selection of cock/hen for breeding<br>Hatching by hen, Nursery,<br>Young chicken raising<br>Feed production<br>Fish raising | **Sustainable agriculture**<br>(Food production and agricultural self reliance)<br>**Production**<br>Cattle raising<br>Raising for breeding extension<br>Arrangement of pasture<br>Feed production<br>Raising for consumption<br>Swine raising<br>Raising for breeding extension<br>Raising for consumption<br>Feed production<br>Chicken raising<br>Selection of cock/hen for breeding<br>Hatching by hen, Nursery<br>Young chicken raising<br>Feed production<br>Fish raising | **Sustainable agriculture**<br>(Food production and agricultural self reliance)<br>**Production**<br>[For household consumption]<br>Support for home garden culture<br>Mushroom production<br>Fish raising<br>Non-agricultural activities (soap production, detergent)<br>Paddy, fruits and livestock<br>Forestation, Herb planting<br><br>*- Fertilizers, Fishpond*<br><br>[Cow raising]<br>(Cow breeding development)<br>*- Providing bulls suitable for local area for the services*<br>*- Learning for breeding development*<br>*- Artificial Insemination (AI) unit with staff for extension* |

| Nan | Nan | Phitsanulok |
|---|---|---|
| Tambon Yom | Tambon Chom Phra | Tambon Dan Dong |
| Breeding, Nursery of fish, Fish raising<br>Frog raising<br>Breeding, Nursery, Raising, Feed production<br>Chili plantation (local variety)<br>Varieties selection, Nursing, Drying by sun<br><br>*- Bio fertilizer*<br>*Dry compost*<br>*Liquid compost made from vegetables waste*<br>*Liquid compost as for insecticide*<br>*Starter made from vegetable and animal*<br>(Production of energy crop)<br>Plantation of local physic nut<br>*- Learning*<br>*Selection of local chilli*<br>Chicken raising, Cattle raising<br>*Feed production*<br>*Bio fertilizer production* | Breeding, Nursery of fish, Fish raising<br>Frog raising<br>Breeding, Nursery, Raising, Feed production<br><br>*- Bio fertilizer*<br>*Dry compost*<br>*Liquid compost made from vegetables waste*<br>*Liquid compost as for insecticide*<br>*Starter made from vegetable and animal*<br>Plantation of local physic nut<br>*- Learning*<br>*Animal feed production*<br>*Production of bio fertilizer*<br>*Organic pig raising in the trench*<br>*Frog raising*<br>*Corn breeding* | *services*<br>*- Exclusion of the middlemen*<br>(Feed development)<br>*- Improvement of small scale pastures*<br>*- Providing seeds of pasture suitable to local area for feeding cattle in dry season*<br>*- Provide equipments to cut pasture for feeding cattle in dry season*<br>*- Small scale water supply development*<br>*- Support of equipments for making mix concentrate feeds*<br>(Cattle raising group development)<br>*- Support of information for group and networking development of cattle raising group*<br>*- Training/study tour*<br>*- Exchange information of livestock marketing in the community*<br>*- Support of mechanism for administration* |
| **Processing**<br>Cattle, Swine, Chicken, Fish, Frog<br>Chili<br>Bamboo shoot (canning bamboo shoot, salting bamboo shoot) | **Processing**<br>Cattle, Swine, Chicken, Fish, Frog<br>Bamboo shoot<br>Canning bamboo shoot<br>Salting bamboo shoot | |
| **Marketing**<br>Chili | **Marketing**<br>Selling pork | **Marketing**<br>Development of exchange market<br>Developing marketing center based on the existing market |
| **<u>Natural resources management</u>**<br>**Products**<br>Making small charcoal brazier (stove)<br>Wood vinegar making<br><br>**Making cooking stove with high efficiency**<br><br>*- Learning*<br>*Mushroom and bamboo shoot management in forest* | **<u>Natural resources management</u>**<br>**Products**<br>Making small charcoal brazier (stove)<br>Wood vinegar making<br><br>**Making cooking stove with high efficiency**<br><br>*- Learning*<br>*Making charcoal brazier (stove) with capacity of 200 litters* | **<u>Natural resources management</u>**<br>**Products** |

| Nan | Nan | Phitsanulok |
|---|---|---|
| Tambon Yom | Tambon Chom Phra | Tambon Dan Dong |
| | *Making cooking stove with high efficiency* | |
| **Management**<br>Reforestation<br>Conservation of old trees | **Management**<br>Reforestation | **Management**<br>Protection of community forest<br>(Firebreak, Forest zoning, Reforest, Guard, Check dam, Regulation, Learning and awareness, Knowledge dissemination)<br>Network development<br>(Providing budget, Study tour, Training, Meeting place) |
| **Land use**<br>Fire protection boundary | **Land use**<br>Enlightenment of community forest conservation<br>Boundary area for fire protection | **Land use**<br>Forest use (regulation, committee, training, guard, conservation group, classify rare species, collection data, youth training)<br>Participation (PR, Eco-tour, encouragement to be forest owner) |
| **Rural development**<br>**Non-agriculture production**<br>Weaving/ bamboo works<br>Furniture<br>Weaved utensils<br>Mat made of bamboo strips | **Rural development**<br>**Non-agriculture production** | **Rural development**<br>**Non-agriculture production**<br>Collect local knowledge<br>- Data collection (handicraft, medicine, ritual medicine, woodcraft, weaving)<br>- Marketing system development (basket fishing, lamp made from coconut shell, weaving) |
| **Capital, fund**<br>- Study for development of village fund and poverty reduction fund | **Capital, fund** | **Capital, fund**<br>Exchange in the group / tambon for community bank<br>Public relation for community bank<br>Pilot fund in the village 1,2,7 and 8<br>Capacity building of the staff training, study tour for community development<br>Contract with other bank |
| **Health, welfare, rural life**<br>Health<br>Thai massage<br>Massage with a hot compress containing medical herbs<br>Aerobic dancing<br>Meditation<br>Curing with witchcraft (magic)<br>- *Learning*<br>*Revitalization of local tradition* | **Health, welfare, rural life**<br>Promotion on tourism of Phra Phat Chom Nang<br>Health<br>Thai massage<br>Massage with a hot compress containing medical herbs<br>Revitalization of local doctor / witchery<br>Revitalization of traditional meditation<br>- *Learning*<br>*Thai massage* | **Health, welfare, rural life**<br>Leader development (study tour, training, skill and knowledge improvement)<br><br>(Water resources development)<br>*Weir construction at;*<br>- *4 locations (Nam Khlueng)*<br>- *2 locations (Huai Pla Sut)*<br>- *2 location each (Nam Thog Yai, nam Thong Noi)* |

| Nan | Nan | Phitsanulok |
|---|---|---|
| Tambon Yom | Tambon Chom Phra | Tambon Dan Dong |
| *Production of crab paste (northern food)*<br><br>- Construction / implementation of reservoir or pond<br>- Construction of farm road<br>- Electrification | *Household finance management*<br><br>(Rural development)<br><br>*- Construction of pond at the scale of 5 rais*<br>*- ALRO road at Huai Pong*<br>*- Laterite road at Huai Hi*<br>*- Dredging of Huai Wat Reservoir*<br>*- Dredging of Nam How river*<br>*- Construction of Huai Khao Lam road*<br>*- Improvement of reservoir in village No.9*<br>*- Improvement of water supply in village No. 9* | - *Huai San Si, Huai Luek Water supply (village 16 and 9)*<br>*Bridge (village 2)*<br>*Canal (village 7)*<br>*Dredging of Bung na lom pond* |

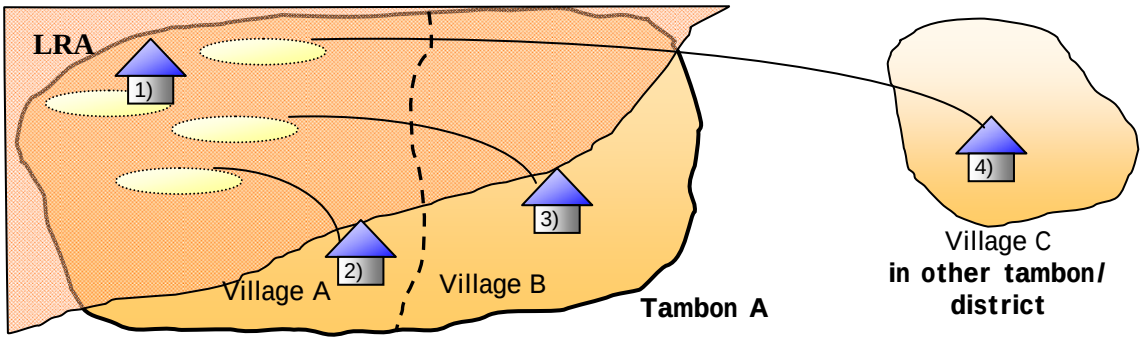
## 4.2 GROUPING OF THE LAND REFORM AREAS

### 4.2.1 Characteristics of the Land Reform Areas

The land reform areas (LRAs) are composed of the lands which are delineated as agricultural zone (A zone) and economic zone (E zone) in the state-owned forest and other classified or public lands. Through survey with the related government offices such as RFD and LDD, these lands are identified as the LRAs. When the lands are declared as the LRAs, these are registered by ALRO/PLROs, with the "Project Code" with the name of the forest or the river bank ("ALRO project code"). One LRA is often composed of several geographically separated areas. There are also many cases that a LRA crosses the administration boundary of district or tambon.

Data and information of the LRAs are compiled in accordance with the ALRO project code, by PLRO and GIS section of ALRO. These are the location information (LRA - Amphoe - Tambon - Village) and the physical information (e.g. land use, elevation, slope, and soil erosion, etc.) brought from the related government offices such as LDD. Both data are available as database.

In terms of the locations of the farm plots and house of the land holders including those who are yet to receive the certificate, there is a couple of land holding variations in the LRAs. The LRA farmers (SPK 4-01 holders) do not always live in or around their own farm plots. Some of them live even in another tambon or district. These situations can be briefly described as follows:




Type 1: Farmer lives in the LRA where his/her farm plot locates.
Type 2: Farmer lives in the village where his/her farm plot locates but outside of the LRA.
Type 3: Farmer lives outside of the village but in the same tambon where his/her farm plot locates.
Type 4: Farmer has farm plot in the LRA but lives in other tambon (sometimes other district).

**Figure 4.2.1 Variety of the Land Holding Types of SPK4-01**

History of the land exploitation could be one of the reasons. In general, the LRA farmers did not have enough land to produce their subsistence in the past. To expand their farm land, they reclaimed the land unfavorable for cultivation such as hilly area or periphery of the forest. As the exploitation went on, the farmers were obliged to occupy further lands. As a result, they possess the land far from their living places.

In addition, it should be noted that the LRA farmers do not always cultivate only the farm plot in the LRAs but sometimes possess or cultivate other type of land such as title deed and/or land in unclassified area, although some of which are not regally recognized. For example, a farmer cultivates 10 rais of paddy in the area of title deed as well as 30 rais of corn in the LRA. Given the fact that the land holding status varies and mixed with other villagers, it is practically impossible to distinguish the LRA farmers and other farmers in the same village.

Issue of the land certificate (SPK 4-01) is operated by PLROs under the responsibility of Provincial Land Reform Committee. According to the provincial annual report, present status of SPK 4-01 distribution is summarized as follows.

**Table 4.2.1 Present Status of SPK 4-01 Distribution**

| Province | No. of Area | (1) Area (rai)*1 | Present status of SPK 4-01 distribution | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | No. of Farmers | No. of Plots | (2) Total area (rai) | Area (rai) / Farmer | (2)/(1) (%) | As of |
| Phayao | 15 | 378,166.1 | 27,449 | 34,784 | 209,341 | 7.6 | 55 | Sept. 2003 |
| Nan | 20 | 565,366.1 | 31,308 | 46,677 | 275,115 | 8.8 | 49 | Nov. 2004 |
| Phrae | 18 | 496,048.2 | 14,480 | 19,281 | 132,380 | 9.1 | 27 | Feb. 2005 |
| Phitsanulok*2 | 7 | 237,242.5 | 7,404 | 10,183 | 147,475 | 19.9 | 62 | Sept. 2003 |

Note: *1: Declaration area before survey. *2: The area does not include the "Area not declared yet (area; 714,627 rai, Number of area; 11)", in which necessary procedures for declaration will be done in near future.

### 4.2.2 Grouping of the Present LRAs for M/P Formulation

Although the present operation method with the ALRO project code is manageable for land distribution works, it may be inappropriate to deal with comprehensive natural resource management. For the M/P formulation, it was proposed to revise the present ALRO project code areas. To make such groups, present ALRO project code areas were integrated or separated based on the present location and physical information. Technical criteria to reorganize them were prepared as follows.

- Grouping is basically made based on the ALRO project code unit.
- Integration and separation of each LRA is basically made on the watershed boundary.
- Separation is made on the administrative boundary of district.

Based on the above criteria, draft of the LRA groups was prepared by the Study Team, and it was finalized through the discussions and examination with PLROs. For the M/P formulation, M/P codes were set on the newly grouped LRAs as follows.

**Table 4.2.2 Number of M/P Code Areas by Province**

| Province | Grouping | | |
|---|---|---|---|
| | No. of Areas | M/P code | Total area (rai) |
| Phayao | 14 | PYO01 – PYO14 | 378,166 |
| Nan | 20 | ANN01 – ANN20 | 565,366 |
| Phrae | 14 | PRE01 – PRE14 | 496,048 |
| Phitsanulok | 4 | PIK01 – PIK04 | 237,243 |

The relationship between the M/P code areas and the ALRO project codes are shown below.

**Table 4.2.3 The M/P Code Areas and ALRO Project Codes**

**a) Phayao**

| M/P Code | ALRO project code | | | | | Area (rai) |
|---|---|---|---|---|---|---|
| | No | Project Code | Zone at disposal | Name | | |
| PYO01 | 11 | 72407<br>72420 | A<br>E | ป่าน้ำเปื๋อย,ป่าน้ำหย่วนและป่าน้ำลาว | Nam Puai, Nam Yuan and Nam Lao | 22,098 |
| PYO02 | 7 | 72408<br>72423 | A<br>E | ป่าดอยบ่อส้มและป่าดอยโป่งนก | Doi Bor Som and Doi Pong Nok | 13,188 |
| PYO03 | 13 | 72429 | E | ป่าแม่ลอยไร่,ป่าสักลอและป่าแม่น้ำพุง | Pa Mae Loi Rai, Pa Sak Lor and Pa Mae Nam Phung | 1,129 |
| PYO04 | 11 | 72407<br>72420 | A<br>E | ป่าน้ำเปื๋อย,ป่าน้ำหย่วนและป่าน้ำลาว | Nam Puai, Nam Yuan and Nam Lao | 26,431 |
| PYO05 | 8 | 72410<br>72421 | A<br>E | ป่าน้ำแวนและป่าห้วยไคร้ | Nam Waen and Huai Khai | 20,653 |
| PYO06 | 9 | 72409<br>72424 | A<br>E | ป่าแม่จุน | Mae Jun | 45,686 |
| PYO07 | 10 | 72401 | A | ป่าห้วยดอกเข็มและป่าแม่อิงฝั่งขวา | Huai Doke Khem and Right Bank of Mae Ing | 30,458 |
| PYO08 | 5 | 72403 | A | ป่าแม่ฮ่องป๋อ,ป่าห้วยแก้วและป่าแม่อิงฝั่งซ้าย | Mae Hong Por, Huai Kaew and Left Bank of Mae Ing | 11,222 |
| PYO09 | 5 | 72403 | A | ป่าแม่ฮ่องป๋อ,ป่าห้วยแก้วและป่าแม่อิงฝั่งซ้าย | Mae Hong Por, Huai Kaew and Left Bank of Mae Ing | 35,123 |
| | 1 | 72432 | E | ป่าห้วยบงและป่าห้วยเคียน | Huai Bong - Huai Khian | |
| PYO10 | 6 | 72414<br>72422 | A<br>E | ป่าแม่ลาวฝั่งขวา,ป่าแม่ส้านและป่าแม่ใจ | Right Bank of Mae Lao, Mae Sarn and Mae Jai | 20,634 |
| | 14 | 72327 | Classified | ที่จำแนกฯ ป่าห้วยแม่ใจ–ห้วยคอกหมู–ห้วยป่าแฝก–ห้วยแม่เย็น | Huai Mae Jai - Huai Khok Mue - Huai Pa Faek - Huai Mae Yen (classification area) | |
| PYO11 | 4 | 72406<br>72425<br>72426 | A<br>E<br>E | ป่าแม่ต๋าและป่าแม่นาเรือ | Mae Ta and Mae Na Rua | 75,233 |
| | 3 | 72405 | A | ป่าแม่ต๋ำ | Mae Tam | |
| PYO12 | 2 | 72404<br>72417 | A<br>E | ป่าแม่ร่องขุย | Mae Rong Khui | 25,973 |
| | 3 | 72405 | A | ป่าแม่ต๋ำ | Mae Tam | |
| PYO13 | 15 | 72311 | Classified | ที่จำแนกฯ ป่าแม่ร่องขุย | Pa Mae Rong Khui (classification area) | 22,504 |
| | 2 | 72404<br>72417 | A<br>E | ป่าแม่ร่องขุย | Mae Rong Khui | |
| PYO14 | 12 | 72402 | A | ป่าแม่ยม | Mae Yom | 27,834 |
| | | | | | | **378,166** |

**b) Phrae**

| M/P Code | ALRO project code | | | | | Area (rai) |
|---|---|---|---|---|---|---|
| | No | Project Code | Zone at disposal | Name | | |
| PRE01 | 8 | 40405 | A | ป่าแม่สอง | Mae Song | 1,732 |
| PRE02 | 17 | 40409 | E | ป่าห้วยป้อม | Huai Pom | 8,788 |
| PRE03 | 9 | 40404<br>40434 | A<br>E | ป่าแม่ยาง | Mae Yang | 9,337 |
| PRE04 | 18 | 40422 | E | ป่าแม่ค่ามี | Mae Kham Mi | 25,383 |

| M/P Code | ALRO project code | | | | | Area (rai) |
|---|---|---|---|---|---|---|
| | No | Project Code | Zone at disposal | Name | | |
| PRE05 | 3 | 40402<br>40430 | A<br>E | ป่าแม่ต้าตอนขุน | Mae Ta Don Khun | 130,263 |
| | | | | | | |
| PRE06 | 13 | 40407 | E | ป่าห้วยเบี้ยและป่าห้วยบ่อทอง | Huai Bie and Huai Bo Thong | 11,698 |
| PRE07 | 5 | 40410 | E | ป่าแม่ลานและป่าแม่กาง | Mae Larn and Mae Kang | 88,959 |
| | 7 | 40424 | E | ป่าแม่ต้าฝั่งขวาตอนใต้ | Southern Part of Right Bank of Mae Ta | |
| | 2 | 40406<br>40431 | A<br>E | ป่าแม่ปงและป่าแม่ลอง | Mae Pong and Mae Long | |
| PRE08 | 1 | 40418<br>40433 | E<br>A | ป่าแม่ยมฝั่งตะวันออก | East Bank of Mae Yom | 132,241 |
| | 2 | 40406<br>40431 | A<br>E | ป่าแม่ปงและป่าแม่ลอง | Mae Pong and Mae Long | |
| | 11 | 40303 | classified | ที่จำแนกฯป่าแม่ยมฝั่งตะวันออกแม่น้ำยม | Mae Yom (classified land), east bank of Mae Yom | |
| | 4 | 40401 | E | ป่าแม่ลู่และป่าแม่แป้น | Mae Lue and Mae Paen | |
| PRE09 | 16 | 40408 | E | ป่าแม่แย้และป่าแม่สาง | Mae Yae and Mae Sang | 20,078 |
| PRE10 | 15 | 40414 | E | ป่าแม่เข็ก | Mae Khek | 1,260 |
| PRE11 | 10 | 40415<br>40432 | A<br>T | ป่าแม่ปาน | Mae Parn | 6,108 |
| PRE12 | 12 | 40411 | E | ป่าแม่จั๊วะฝั่งซ้าย | Left Bank of Mae Jua | 1,510 |
| PRE13 | 14 | 40421 | E | ป่าแม่เกิงและป่าแม่ปง | Mae Koeng | 12,432 |
| PRE14 | 1 | 40418<br>40433 | E<br>A | ป่าแม่ยมฝั่งตะวันออก | East Bank of Mae Yom | 46,259 |
| | | | | | | **496,048** |

**c) Nan**

| M/P Code | ALRO project code | | | | | Area (rai) |
|---|---|---|---|---|---|---|
| | No | Project Code | Zone at disposal | Name | | |
| ANN01 | 2 | 26409<br>26421 | A<br>E | ป่าน้ำยาวและป่าน้ำสวด | Nam Yao and Nam Suad | 9,712 |
| | 23 | 26411 | E | ป่าดอยภูคาและป่าผาแดง | Doi Phu Kha and Pa Pha Daeng | |
| ANN02 | 2 | 26409<br>26421 | A<br>E | ป่าน้ำยาวและป่าน้ำสวด | Nam Yao and Nam Suad | 1,823 |
| ANN03 | 2 | 26409<br>26421 | A<br>E | ป่าน้ำยาวและป่าน้ำสวด | Nam Yao and Nam Suad | 11,906 |
| | 23 | 26411 | E | ป่าดอยภูคาและป่าผาแดง | Doi Phu Kha and Pa Pha Daeng | |
| ANN04 | 1 | 26501 | classified | ที่จำแนกฯอำเภอท่าวังผา | Tha Wang Pha District (classification area) | 44,289 |
| | 3 | 26502 | classified | ที่จำแนกฯอำเภอปัว | Pua District (classification area) | |
| ANN05 | 2 | 26409<br>26421 | A<br>E | ป่าน้ำยาวและป่าน้ำสวด | Nam Yao and Nam Suad | 37,119 |
| ANN06 | 4 | 26303 | classified | ที่จำแนกฯป่าแม่น้ำน่านตะวันออกตอนใต้ | Southern Part of East Bank of Nan River (classification area) | 54,350 |
| | 19 | 26422<br><br>26429 | E<br><br>A | ป่าแม่น้ำน่านตะวันออกตอนใต้ | Southern Part of East Bank of Nan River | |
| ANN07 | 4 | 26303 | classified | ที่จำแนกฯป่าแม่น้ำน่านตะวันออกตอนใต้ | Southern Part of East Bank of Nan River (classification area) | 46,624 |
| | 19 | 26422<br><br>26429 | E<br><br>A | ป่าแม่น้ำน่านตะวันออกตอนใต้ | Southern Part of East Bank of Nan River | |
| ANN08 | 17 | 26412 | E | ป่าถ้ำผาตูบ | Tham Pha Tub (Pa Nam Tum) | 2,749 |
| ANN09 | 11 | 26419 | E | ป่าน้ำว้าและป่าห้วยสาลี่ | Nam Wa and Huai Salee | 5,199 |
| | 22 | 26420 | E | ป่าห้วยงวงและป่าห้วยสาลี่ | Huai Nguang and Huai Salee | |

| M/P Code | ALRO project code | | | | | Area (rai) |
|---|---|---|---|---|---|---|
| | No | Project Code | Zone at disposal | Name | | |
| ANN10 | 19 | 26422<br><br>26429 | E<br><br>A | ป่าแม่น้ำน่านตะวันออกตอนใต้ | Southern Part of East Bank of Nan River | 14,478 |
| | 21 | 26418<br>26430 | E<br>A | ป่าน้ำว้าและป่าแม่จริม | Nam Wa and Mae Charim | |
| ANN11 | 6 | 26308 | classified | ป่านาซาวฝั่งซ้ายถนนสายแพร่-น่าน | Left Bank of Na Saow (Phrae-Nan Road) (classification area) | 55,358 |
| | 9 | 26307 | classified | ที่จำแนกฯป่านาซาว | Na Saow (classification area) | |
| | 16 | 26413 | E | ป่าเขาน้อย | Khao Noi | |
| | 18 | 26423 | E | ป่านาซาวฝั่งซ้ายถนนสายแพร่-น่าน | Left Bank of Na Saow (Phrae-Nan Road) | |
| | 20 | 26426 | E | ป่านาซาว | Na Saow | |
| ANN12 | 7 | 26305 | classified | ที่จำแนกฯป่าฝั่งขวาแม่น้ำน่าน แปลงที่ 31 | Right Bank of Nan River, plot 31 (classification area) | 59,951 |
| | 15 | 26417 | E | ป่าห้วยแม่ขะนิง | Huai Mae Khaning | |
| ANN13 | 8 | 26306 | classified | ที่จำแนกฯป่าแม่สาครฝั่งขวาถนนสายแพร่-น่าน | Right Bank of Mae Sakhon (Phrae-Nan Road) (classification area) | 71,058 |
| | 12 | 26414 | E | ป่าสาลีก | Sa Lik | |
| | 13 | 26415 | E | ป่าน้ำสาและป่าแม่สาครฝั่งซ้าย | Nam Sa and Left Bank of Mae Sakhon | |
| | 14 | 26416 | E | ป่าแม่สาครฝั่งขวา | Right Bank of Mae Sakhon | |
| | 15 | 26417 | E | ป่าห้วยแม่ขะนิง | Huai Mae Khaning | |
| ANN14 | 10 | 26410<br><br>26424 | A<br><br>E | ป่าฝั่งขวาแม่น้ำน่านตอนใต้ | Southern Part of Right Bank of Nan River | 15,811 |
| ANN15 | 12 | 26414 | E | ป่าสาลีก | Sa Lik | 35,976 |
| ANN16 | 10 | 26410<br><br>26424 | A<br><br>E | ป่าฝั่งขวาแม่น้ำน่านตอนใต้ | Southern Part of Right Bank of Nan River | 33,757 |
| ANN17 | 10 | 26410<br><br>26424 | A<br><br>E | ป่าฝั่งขวาแม่น้ำน่านตอนใต้ | Southern Part of Right Bank of Nan River | 2,872 |
| ANN18 | 5 | 26304 | classified | ที่จำแนกฯป่าฝั่งซ้ายแม่น้ำน่าน แปลงที่ 29 | Left Bank of Nan River, plot 29 (classification area) | 31,622 |
| | 11 | 26419 | E | ป่าน้ำว้าและป่าห้วยสาลี่ | Nam Wa and Huai Salee | |
| | | | | | | |
| ANN19 | 5 | 26304 | classified | ที่จำแนกฯป่าฝั่งซ้ายแม่น้ำน่าน แปลงที่ 29 | Left Bank of Nan River, plot 29 (classification area) | 28,229 |
| | 11 | 26419 | E | ป่าน้ำว้าและป่าห้วยสาลี่ | Nam Wa and Huai Salee | |
| ANN20 | 22 | 26420 | E | ป่าห้วยงวงและป่าห้วยสาลี่ | Huai Nguang and Huai Salee | 2,483 |
| | | | | | | **565,366** |

### d) Phitsanulok

| M/P Code | ALRO project code | | | | | Area (rai) |
|---|---|---|---|---|---|---|
| | No | Project Code | Zone at disposal | Name | | |
| PIK01 | 2 | 37415 | E | ป่าน้ำภาคน้อย | Nam Phak Noi | 148,238 |
| | 3 | 37410 | E | ป่าดงตีนตก | Dong Tean Tok | |
| | 5 | 37408 | E | ป่าสวนเมี่ยง | Suan Miang | |
| PIK02 | 4 | 37405 | E | ป่าสองฝั่งแม่น้ำแควน้อย | Both Bank of Nam Khaew Noi | 74,308 |
| | 6 | 37301 | classified | ที่จำแนกหมายเลข 5 (ป่าแควน้อย) | Classification Area No. 5 (Khaew Noi) | |
| PIK03 | 7 | 37120 | public land | ที่สาธารณประโยชน์ทุ่งทะเลแก้ว | Thung Tha-le Kaew (public land) | 2,022 |
| PIK04 | 1 | 37302 | classified | ป่าหมายเลข 7 แปลง 1 | No. 7, plot 1 | 12,674 |
| | | | | | | **237,242** |

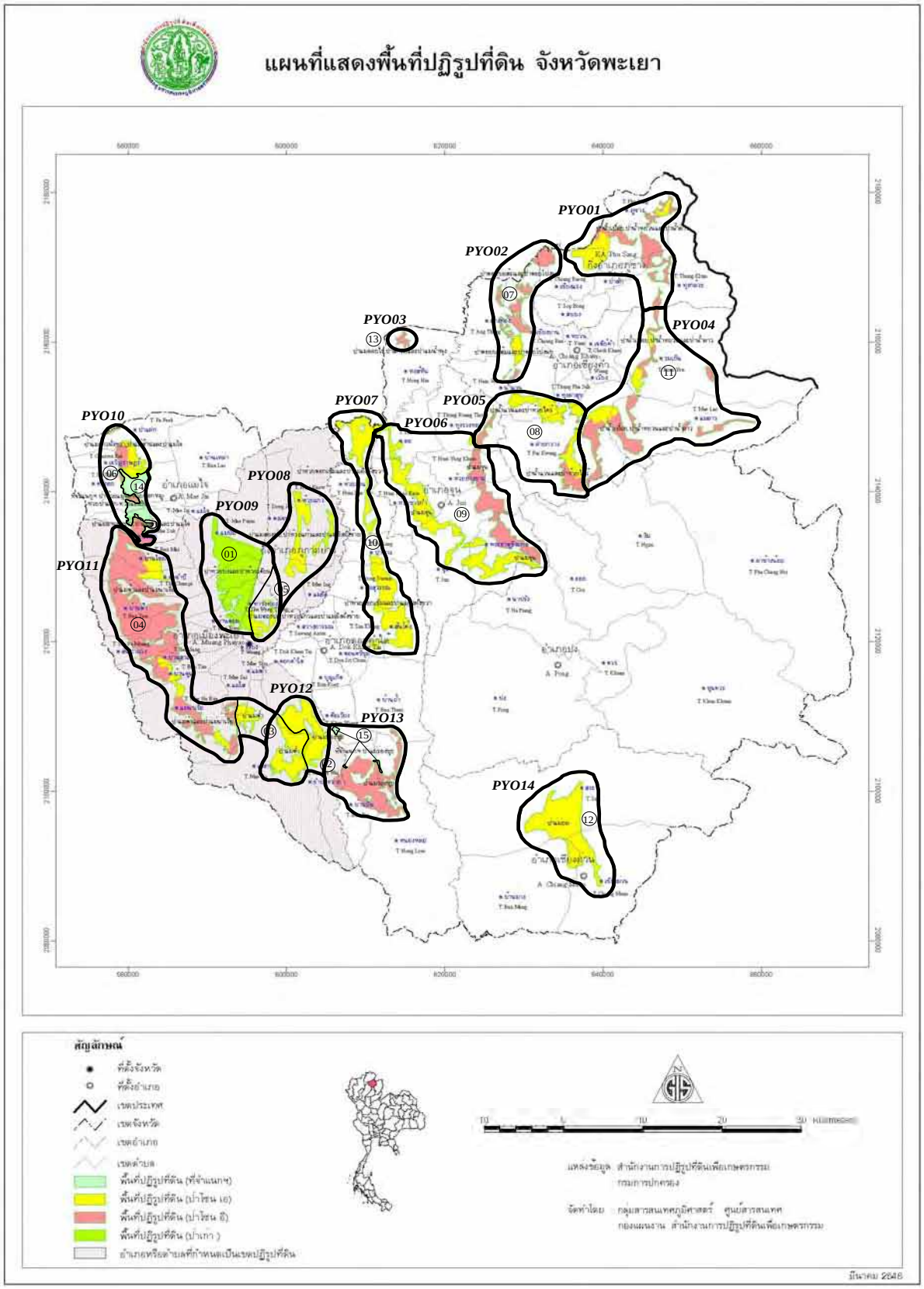



**Figure 4.2.2 Location of the M/P Code Areas (Phayao)**

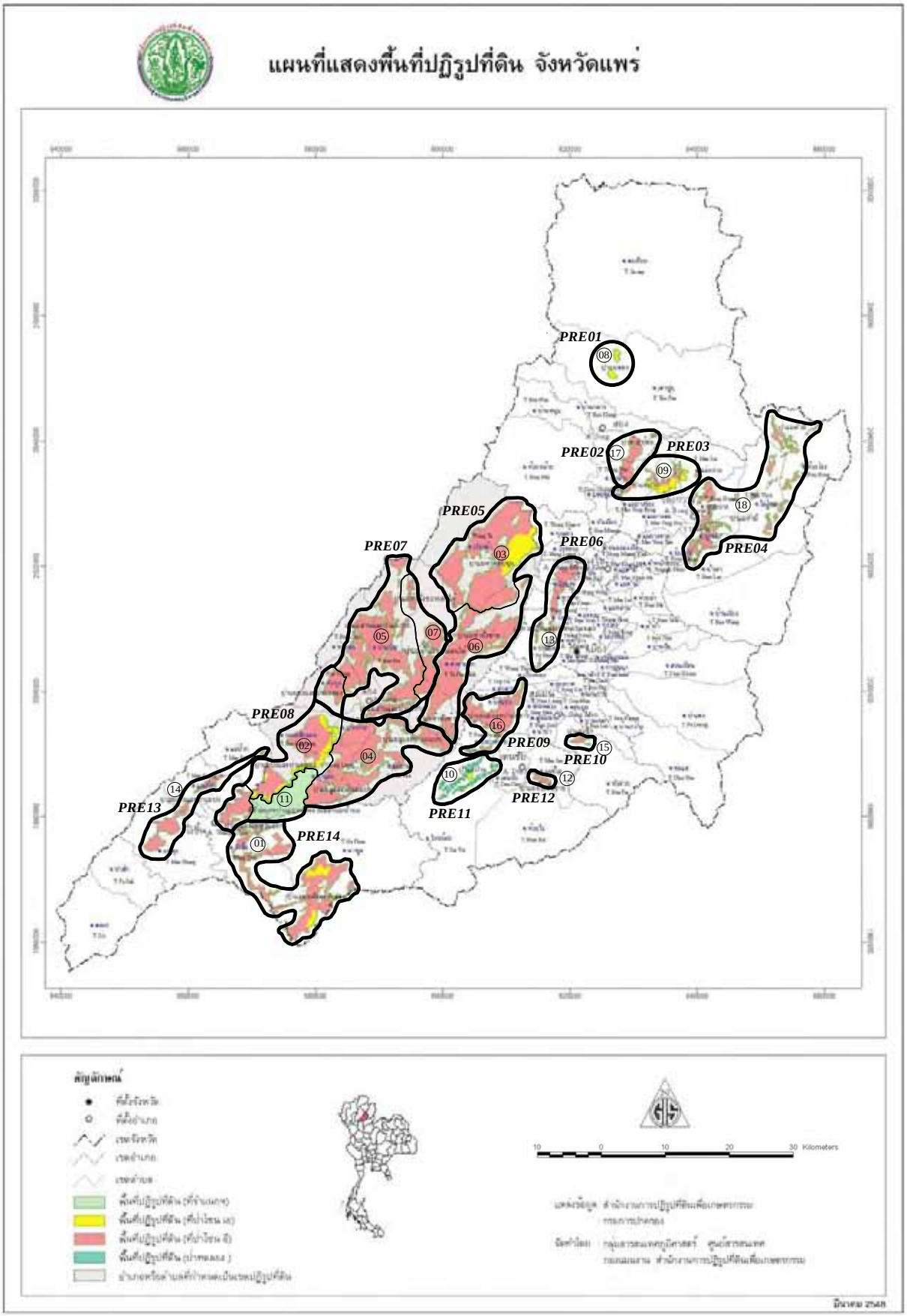



**Figure 4.2.3 Location of the M/P Code Areas (Phrae)**

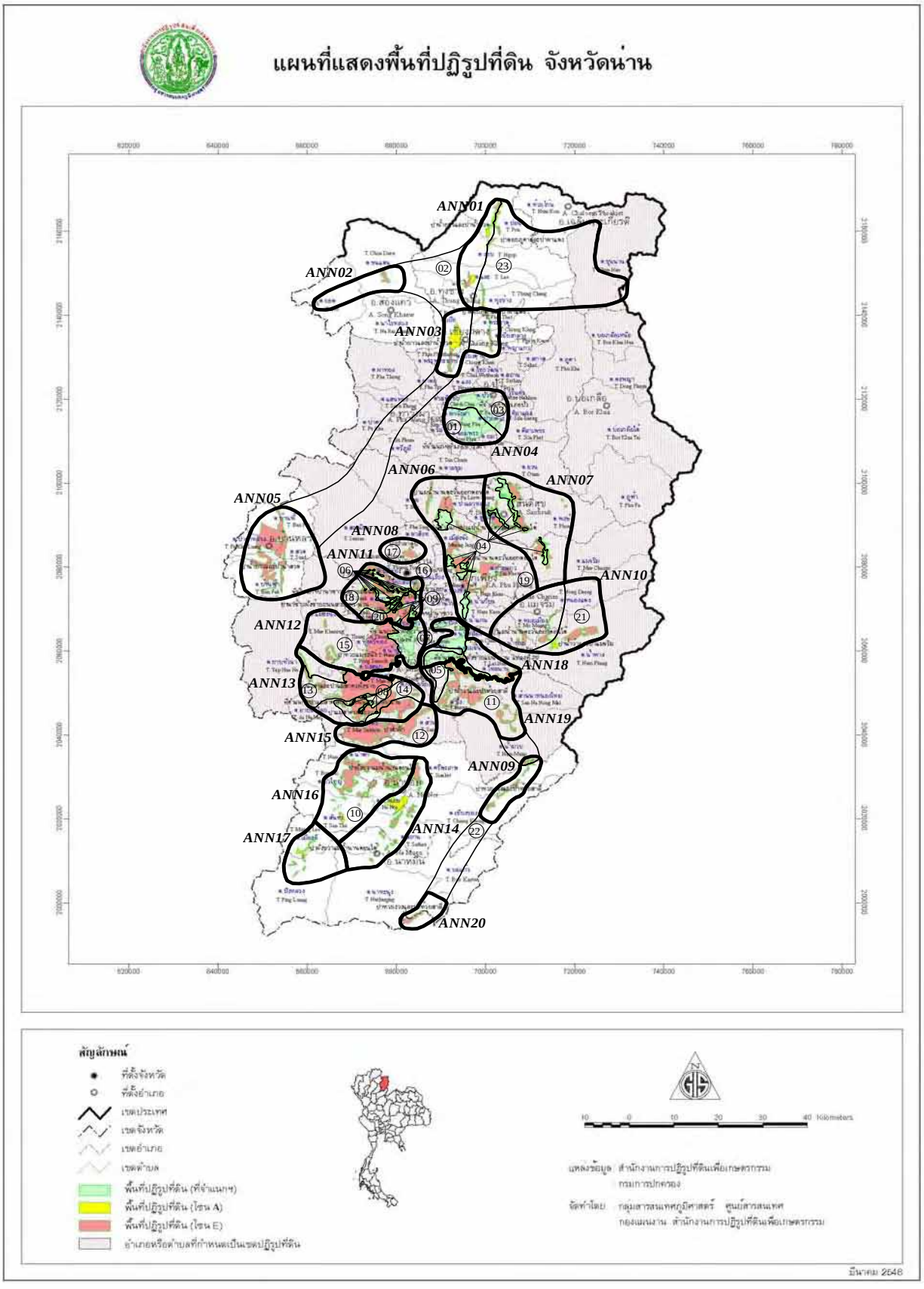



**Figure 4.2.4 Location of the M/P Code Areas (Nan)**

# ที่แสดงพื้นที่ปฏิรูปที่ดิน จังหวัดพิษณุโลก

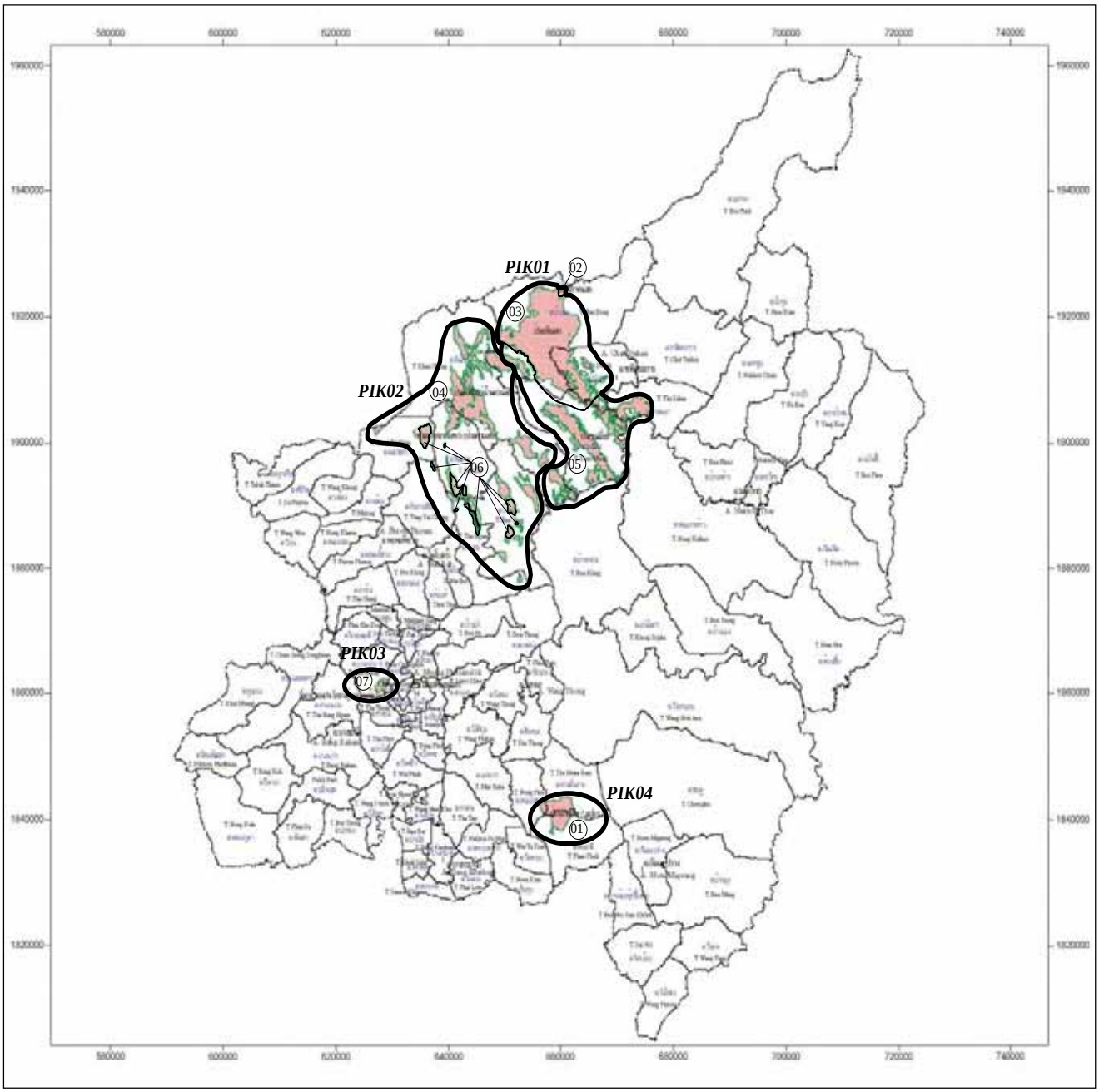



**Figure 4.2.5 Location of the M/P Code Areas (Phitsanulok)**

## 4.3 NATURAL RESOURCES IN THE FOUR PROVINCES

### 4.3.1 Phayao

(1) Topography

With the acreage of nearly 4 million rai, about two-third of the province is mountainous and the rest is low land. Thus its elevation is varied in a wide range of 300 - 1,800 meters above average sea level (MASL). According to its topography, Phayao can be classified into 3 parts of low land areas in the eastern and western parts and high terrain, as shown below. (See Table 4.3.1.)

**Table 4.3.1 Topographical Features in Phayao**

| Features | Elevation (MASL) | Location |
|---|---|---|
| Low land area in the western part | 300 - 400 | Situated in Ing and Kwan Phayao River basins, covered the 4 Districts of Mae Jai, Muang, Dok Kamtai and Jun. |
| Low land area in the eastern part | 300 - 400 | Situated in Yom and Lao River basins, covered the 3 Districts of Pong, Chiang Muan and Chiang Kham. |
| High terrain and upland between mountains, and along mountain ridge | 400 - 1,800 | Scattering in every district, all over province. |

The major mountain range is namely the Phi Pan Nam, which comprises of several high spots such as Doi Langka, Doi San Pan Nam, Doi Mae Suk, Doi Khun Mae Phak, Doi Khun Mae Tam and Doi Khun Mae Tom. This range is aligning in a north-south direction. The high mountainous areas cover the eastern, north eastern and south eastern parts of the province, in Chiang Kham, Pong, Chiang Muan and western part of Muang and Mae Jai Districts. Highland is gradually sloped down from the middle part of the province to the low terrains in Mae Jai, Muang, Dok Kamtai and Jun Districts.

Soil group in relation to topography can be classified into 3 main categories. About half of total provincial areas are mountainous soil (about 52%), which is not suitable for farming. Low land and gentle undulating slope share the same portion (about 24 % each). These areas are suitable for paddy and upland crop respectively. (See Table 4.3.2.)

**Table 4.3.2 Major Soil Groups in Phayao**

| Soil group | Characteristics | % to total provincial area | Area covered |
|---|---|---|---|
| Low land | Majority is clay, with poor drainage, suitable for paddy. | 23.46 | Muang, Mae Jai, Dok Kamtai and Jun districts |
| Gently undulating areas | Fine texture soil, with good drainage, suitable for upland crops, orchard and perennial trees | 23.61 | Pong, Jun and Muang districts |
| Mountainous soil, with 13% slope and higher | Shallow soil, mixed with rock, not suitable for farming | 51.74 | Chiang Kham, Chiang Muan, Pong and the western part of Muang district |

In general, most of land reform areas are situated in the areas of upland between mountains, and along mountain ridge. Therefore characteristics of land are mostly gentle undulating, which is suitable for

upland crops, orchard and perennial trees. However, small portion of land in every site can be used for paddy areas, at the foot of mountains.

(2) Water

Phayao comprises of 2 major river basins, namely combination of Ing and Kong and Yom River basins. Each basin consists of 4 - 5 sub-basins. Area coverage and adjacent to the M/P code areas are listed below. (See Table 4.3.3.)

**Table 4.3.3 Major and Sub-River Basins in Phayao**

| River basin | Area covered (sq.km.) | Location (district) | Adjacent to the M/P code |
|---|---|---|---|
| **Ing and Kong river basin: 5,458 sq. km.** | | | |
| Phung River basin | 54.95 | Mae jai | PYO10 |
| Upper part of Ing River basin | 944.42 | Mae Jai, Pu Kamyao and Muang | PYO09, 010 and 011 |
| Middle part of Ing River basin | 1,782.60 | Mae Jai, Pu Kamyao, Jun, Dok Kamtai and Muang | PYO02, PYO03, PYO06, PYO07, PYO08, PYO12 and PYO13 |
| Lao River basin | 960.63 | Pusang and Chiang Kham | PYO01, PYO02, PYO04 and PYO05 |
| **Yom river basin: 1,524.3 sq. km.** | | | |
| Upper Yom River basin | 1,432.50 | Chiang Kham, Pong and Chiang Muan | PYO05, PYO08 and PYO14 |
| Khuan River basin | 721.97 | Pong and Chiang Muan | N/A |
| Pi River basin | 219.77 | Chiang Muan | N/A |
| Sa River basin | 61.30 | Chiang Muan | N/A |
| Samun River basin | 3.65 | Pong | N/A |

With the reference to the OEPP watershed classification, about 30% of total areas in Phayao are classified as class 5 (more than 1 million rai). Thus the areas are gently sloped. Most of forest lands are cleared for farming, dominated by paddy. These areas are situated mostly in Mae Jai, Muang, Dok Kamtai, Jun and Chiang Kham while some parts are in Pong and Chiang Muan Sub-districts. In short, the LRAs in Phayao are scattered in the 4 among the 7 sub basins covering all over the province.

Nearly a quarter of the provincial area (nearly 900,000 rai) is classified as watershed class 1A, where there forests are still in intact condition. These are high mountainous areas, situated in Mae Jai, Muang, Dok Kamtai, Pong, Chiang Kham and Pusang. They are preserved for headwater sources. However the largest area is in class 5 (about 30%), which is suitable for farming.

**Table 4.3.4 Watershed Classification in Phayao**

| Watershed classes | Characteristics | Area (rai) | % to total areas |
|---|---|---|---|
| 1A | Head water sources areas, at higher elevations, still remain under permanent forest cover. | 876,297.33 | 22.67 |
| 1B | Same physical features and environments as Watershed Class 1A, but portions of the areas have been cleared for agricultural use or occupied by villagers. | 74,729.00 | 1.93 |
| 2 | Areas can be utilized, but no harm to forest. Normally in form of commercial forest. Usually in high elevation. | 597,944.80 | 15.47 |

| Watershed classes | Characteristics | Area (rai) | % to total areas |
|---|---|---|---|
| 3 | Upland areas with steep slope. Usually in form of fruit tree plantations or grazing | 553.786.00 | 14.33 |
| 4 | Gentle sloping land, normal use for upland farming. | 623,571.26 | 16.13 |
| 5 | Gentle sloping to flat areas, suitable for lowland farming. | 1,139,329.39 | 29.47 |
| Total | | 3,865,657.78 | 100.00 |

Source: Department of Geography, Chiangmai University

The 14 sites of land reform areas (PYO01-14) are situated mostly on upland between mountains, and along mountain ridges. The areas are situated in various classes of watershed, depending upon its site. The majority of PYO03, PYO07, PYO13 and PYO14 are covered with mountainous areas, in watershed class 1A, 1B and 2. The upper part in PYO02 and western part in PYO08, PYO09, PYO10, PYO11 and PYO12 are lower, in watershed class 4 and 5 while areas in PYO01, PYO05 and PYO06 are mixed of class 1A to 5.

**Table 4.3.5 Relation of LRAs and Watershed Class in Phayao**

| Land reform areas | Topography | Major watershed class |
|---|---|---|
| PYO03, PYO07, PYO13 and PYO14 | High terrains | 1A, 1B and 2 |
| PYO01, PYO05 and PYO06 | Mixed of high terrains and upland | 1A to 5. |
| PYO02, PYO08, PYO09, PYO10, PYO11 and PYO12 | Lower land | 4 and 5 |

According to the survey and classification done by the Department of Underground Water Resources, quantity of ground water in the LRAs in Phayao is small (10-100 gallon/min.). The quality is varied from good to poor, but the area with good quality is more than the area with poor quality.

(3) Forest

With the reference to the Phayao provincial statistic, area designated to reserve forest is about 2.6 million rai. This accounts about two thirds of total provincial areas. According to the statistics of the RFD (2000), its area is nearly 450,000 rai larger than the actual forest area, which covers more than half of total areas in Phayao (56% or nearly 2.2 million rai).

Following the cabinet resolutions in March 1992, national reserve forest is classified into 3 zones of Conservation, Economic and Agriculture (C, E and A). The largest forest area in Phayao is in Zone C, accounting about 80% of the total reserve forest area, while the size of Zone E and A is much smaller, only 10% and 8% respectively.

**Table 4.3.6 Forest Classification in Phayao**

| Zonation | Area (rai) | Percentage |
|---|---|---|
| Conservation zone (C) | 2,148,477 | 82 |
| Economic (E) | 270,821 | 10 |
| Agriculture (A) | 201,425 | 8 |
| Total reserve forest area | 2,620,723 | 100 |

Source: Phayao provincial statistic

These national reserve forest areas are distinguished into 15 sites. Zone C, A and E are classified in every site. Most areas in Zone E and A in the 13 sites have been transferred to ALRO.

**Table 4.3.7 Sites of Reserve Forest in Phayao in Relation to the M/P Code Areas**

| No | Sites of reserve forest | Location (district) | Area (rai) | Zonation | | | M/P code |
|---|---|---|---|---|---|---|---|
| | | | | C | E | A | |
| 1. | Mae Tam | Muang and Dok Kamtai | 163,625 | 134,180 | 15,196 | 14,250 | PYO11, PYO12 |
| 2. | Huai Doke Khem and Right Bank of Mae Ing | Dok Kamtai | 98,750 | 66,841 | 10,036 | 21,875 | PYO07 |
| 3. | Mae Rong Khui | Dok Kamtai | 77,688 | 57,965 | 5,924 | 13,800 | PYO12 |
| 4. | Pa Mae Loi Rai, Pa Sak Lor and Pa Mae Nam Phung | Jun | 93,750 | | | | PYO03 |
| 5. | Mae Jun | Jun | 104,062 | 38,299 | 12,890 | 52,875 | PYO06 |
| 6. | Mae Hong Por, Huai Kaew and Left Bank of Mae Ing | Muang | 75,450 | 39,139 | 21,361 | 14,950 | PYO08, PYO09 |
| 7. | Huai Bong - Huai Khian | Muang | 34,737 | | 20,199 | 3,150 | PYO09 |
| 8. | Mae Ta and Mae Na Rua | Muang | 148,407 | 123,747 | 12,710 | 11,950 | PYO11 |
| 9. | Right Bank of Mae Lao, Mae Sarn and Mae Jai | Mae Jai | 170,625 | 158,875 | 6,750 | 5,000 | PYO10 |
| 10. | Mae Puem-Mae Pung | Mae Jai | 169,087 | | | | N/A |
| 11. | Mae Puem-Dong Pradoo | Mae Jai | 31,000 | 20,038 | 10,963 | | N/A |
| 12. | Mae Yom | Pong and Chiang Muan | 1,290,200 | 1,152,843 | 111,109 | | PYO14 |
| 13. | Nam Waen and Huai Khai | Chiang Kham and Jun | 86,250 | 62,915 | 9,860 | 13,475 | PYO05 |
| 14. | Nam Puai, Nam Yuan and Nam Lao | Chiang Kham | 323,181 | 283,770 | 19,611 | 17,800 | PYO01 |
| 15. | Doi Bor Som and Doi Pong Nok | Chiang Kham | 28,125 | 7,864 | 14,213 | 6,050 | PYO02 |

The protected area in Phayao comprises of wildlife sanctuary and national park. The 2 sites of wildlife sanctuary in Phayao cover nearly 600,000 rai, which is 25% comparing to the total reserve forest in Phayao. The 4 sites of national park and 1 site of wildlife sanctuary also cover areas of nearby provinces of Nan, Chiang Rai and Lampang. It should be noted that the Doi Phu Nang National Park, which covers two districts of Pong and Chiang Muan in Phayao account about 20% of the total reserve forest in Phayao. The 5 sites of LRAs (PYO01, 006, 010, 011 and 014) are close to these protected areas.

There are nearly 94 sites of community forests which were established in Phayao during 2000-2004. These forests are distributed on 100 villages, 36 sub-districts, 9 district of the province. Normally one site of community forest is managed by one village, but its size varies from 15 to over 2,000 rai per site. This results from the availability of areas and proposal of villagers. In Phayao, the community forests are located mostly in the reserve forest (over 90%) while only 4% and 3% of them are in permanent forest and in other public land allowed by the province respectively.

**Table 4.3.8 Distribution of Community Forest in Phayao**

| District | No. of site | No. of village | No. of sub-district | Area (rai) | | | Total area (rai) |
|---|---|---|---|---|---|---|---|
| | | | | Reserve forest | 1941 forest | Others | |
| Muang | 6 | 6 | 2 | 2375 | | 57 | 2432 |
| Dok Kham Tai | 4 | 4 | 4 | 324 | | 82 | 406 |
| Jun | 21 | 21 | 9 | 3532 | 115 | 256 | 3903 |
| Pong | 12 | 12 | 5 | 2081 | 242 | | 2323 |
| Chiang Kham | 19 | 21 | 7 | 3848 | 401 | 126 | 4375 |
| Chiang Muan | 3 | 3 | 1 | 1226.5 | | | 1226.5 |
| Phu Sang | 6 | 7 | 3 | 467 | 60 | 102 | 629 |
| Phu Kamyao | 16 | 19 | 2 | 9741 | | | 9741 |
| Mae Jai | 7 | 7 | 5 | 128 | 257 | | 385 |
| Total | 94 | 100 | 36 | 23722.5 | 1075 | 623 | 25420.5 |

Source: Phayao Forestry Office

About two thirds of community forest areas (66%) are located in the LRAs, scattering in the 13 M/P code areas. These comprise of 51 sites of community forest, covering 56 villages. PYO08 covers the largest areas of more than 7,500 rai, followed by PYO06 which covers more than 2,500 rai and PYO02 and PYO11 covering more than 2,300 rai each. PYO09 has no access to community forest.

**Table 4.3.9 Community Forest Located in the M/P Code Areas in Phayao**

| M/P code | No. of site | No. of village access | Area (rai) | | | |
|---|---|---|---|---|---|---|
| | | | Reserve forest | 1941 forest | Others | Total |
| PYO01 | 4 | 4 | 467 | | | 467 |
| PYO02 | 4 | 4 | 2378 | | | 2378 |
| PYO03 | 2 | 2 | 770 | | | 770 |
| PYO04 | 6 | 7 | 1398 | 111 | | 1509 |
| PYO05 | 2 | 2 | 72 | | | 72 |
| PYO06 | 15 | 16 | 2607 | 115 | 302 | 3024 |
| PYO07 | 1 | 1 | 184 | | | 184 |
| PYO08 | 14 | 17 | 7601 | | | 7601 |
| PYO10 | 3 | 3 | 60 | 16 | | 76 |
| PYO11 | 2 | 2 | 2330 | | | 2330 |
| PYO12 | 1 | 1 | 45 | | | 45 |
| PYO13 | 3 | 3 | 140 | 82 | | 222 |
| PYO14 | 2 | 2 | 806.5 | | | 806.5 |
| Total (13 sites) | 51 | 56 | 16,013.5 | 324 | 302 | 16,639.5 |

Summary of natural resources being accessed by the villagers living in the LRAs is shown below. All sites are accessible to water body and their stream network.

**Table 4.3.10 Accessibility to Natural Resources by the M/P Code Area in Phayao**

| M/P code areas | Basin | Major water sources nearby | Protected forest nearby | Accessible to community forest |
|---|---|---|---|---|
| PYO01 | Mae Lao | Mae Loa river and its tributaries | Phu Sang National Park | 4 sites, 467 rai |
| PYO02 | Middle part of Ing | Ing river and its tributaries | | 4 sites, 2378 rai |
| PYO03 | Middle part of Ing | Tributaries of Ing river | | 2 sites, 770 rai |

| M/P code areas | Basin | Major water sources nearby | Protected forest nearby | Accessible to community forest |
|---|---|---|---|---|
| PYO04 | Mae Lao | Mae Loa river and its tributaries | | 6 sites, 1509 rai |
| PYO05 | Upper part of Yom | Yom river and its tributaries | | 2 sites, 72 rai |
| PYO06 | Middle part of Ing and upper part of Yom | Ing and Yom river and their tributaries | Wiang Lor wildlife sanctuary | 15 sites, 3024 rai |
| PYO07 | Middle part of Ing | Ing river and its tributaries | | 1 site, 184 rai |
| PYO08 | Middle part of Ing | Ing river and its tributaries | | 14 sites, 7601 rai |
| PYO09 | Upper part of Ing | Ing river and its tributaries | | |
| PYO10 | Phung and upper part of Ing | Leng Sai swamp, Phung and Ing river and their tributaries | Doi Luang National Park | 3 sites, 76 rai |
| PYO11 | Upper part of Ing | Ing river and its tributaries | Doi Luang National Park | 2 sites, 2330 rai |
| PYO12 | Upper and middle part of Ing | Ing river and its tributaries | | 1 site, 45 rai |
| PYO13 | Middle part of Ing | Ing river and its tributaries | | 3 sites, 222 rai |
| PYO14 | Upper part of Yom and Nam Pi | Yom river and its tributaries | Doi Phu Nang National Park | 2 sites, 806.5 rai |

### 4.3.2 Phrae

(1) Topography

The majority of Phrae is mountainous and covered by forest. There is a small portion of flat land for agriculture, which is situated in the middle of province (Rong Kwang, Muang, Sung Men and Den Chai) and surrounded by mountains. Another part of flat area is located in the south of province in Long and Wang Chin. Hence large areas are on sloped land, especially the land reform areas which are situated in the reserve forest.

In relation to the topography, mountainous soil dominates the large area of the province. Its coverage is about 40%, followed by shallow soil, nearly 35%. Upland and paddy soil groups are in the smaller areas, 15% and 10% respectively.

(2) Water

There are many major rivers with plenty of their tributaries in Phrae. The largest and most important one is the Yom River which flows through north-south direction of the province. This river and its tributaries flow through a number of the LRAs. Most rivers flowing through Phrae join the Yom River finally.

In relation to rivers and stream network, there are 8 river basins classified in Phrae. The middle Yom basin covers the largest area. There are the 8 M/P code areas (PRE01, PRE02, PRE03, PRE06, PRE09, PRE10, PRE11 and PRE12) situated in the middle Yom basin. The second largest area is in the lower Yom basin, where the 3 M/P code areas (PRE07 PRE08 and PRE13) are situated. The site of PRE04, PRE05 and PRE14 is in Mae Kham Mi, Mae Ta and Huay Sin basins respectively.

**Table 4.3.11 Area Coverage of River Basin in Phrae**

| River basin | Area coverage (rai) | Related M/P code areas |
|---|---|---|
| Mae Kham Mi | 292,812.96 | PRE04 |
| Mae Ta | 323,761.38 | PRE05 |
| Mae Ngao | 15,664.77 | N/A |
| 3rd part of Nan | 32,129.98 | N/A |
| Middle Yom | 1,911,792.48 | PRE01, PRE02, PRE03, PRE06, PRE09, PRE10, PRE11 and PRE12 |
| Upper Yom | 365,932.35 | N/A |
| Lower Yom | 880,314.09 | PRE07, PRE08 and PRE13 |
| Huay Mae Sin | 224,907.20 | PRE14 |

Major watershed area in Phrae is classified as watershed 1A and class 5. 1B covers small areas in this province. The LRAs are situated in mixed classes of watershed, varied from the class 2 to class 5, with the small areas of 1A and 1B is observed over the province.

Quantity of ground water in Phrae is not abundant. It varies from small to fair and its quality is varied from good to poor. In general, ground water in the LRAs is in a small quantity, in the range of 10 - 100 gallon/min. Only small area located in PRE05 and PRE08 along the Yom River has a fair quantity of ground water (100 - 200 gallon/min.). The water is in good quality, can be used for drinking.

Irrigated area in Phrae is as large as about 70% of agricultural land. The area under 82 small scale irrigation projects is only two thirds of the area irrigated by 5 large and medium scale projects.

(3) Forest

Forest cover in Phrae is about 1.5 million rai or about 37% to the total provincial area (1998). However its size is about half of area designated as reserve forest, which is nearly 3 million rai or nearly three quarter (73%) to total provincial areas. This discrepancy reflects the deterioration of the forest in the past. There are 27 reserve forests in Phrae and the LRAs are scattering over the 17 sites of them.

**Table 4.3.12 Reserve Forest and the M/P Code Areas in Phrae**

| No. | Sites of reserve forest | Location (district) | Area (rai) | Adjacent M/P code areas |
|---|---|---|---|---|
| 1. | Mae Sroy | Wang Chin | 160,625 | N/A |
| 2. | Mae Koeng | Wang Chin | 102,275 | PRE13 |
| 3. | Mae Pong and Mae Long | Long | 50,275 | PRE07 |
| 4. | Mae Lue and Mae Paen | Long | 84,375 | PRE08 |
| 5. | Mae Larn and Mae Kang | Long | 116,250 | PRE07 |
| 6. | Mae Ta Don Chum | Long | 152,775 | PRE05 |
| 7. | Left Bank of Mae Ta | Long | 104,968 | PRE05 |
| 8. | Southern Part of Right Bank of Mae Ta | Long | 62,500 | PRE07 |
| 9. | West Bank of Mae Yom | Song | 245,625 | N/A |
| 10. | Mae Song | Song | 359,593 | PRE01 |
| 11. | Mae Pong and Mae Pao | Song | 137,500 | N/A |
| 12. | Huai Pom | Song | 17,037 | PRE02 |
| 13. | Mae Haed | Song | 11,990 | N/A |

| No. | Sites of reserve forest | Location (district) | Area (rai) | Adjacent M/P code areas |
|---|---|---|---|---|
| 14. | Mae Yang | Rong Kwang | 59,737 | PRE03 |
| 15. | Mae Kham Mi | Rong Kwang | 210,000 | PRE04 |
| 16. | Mae Terk – Mae Thang – Mae Kampong | Rong Kwang, Muang | 162,500 | N/A |
| 17. | Mae Kon and Mae Sai | Muang | 181,250 | N/A |
| 18. | Huai Bie and Huai Bo Thong | Muang | 49,500 | PRE06 |
| 19. | Mae Khaem | Muang | 73,750 | N/A |
| 20. | Mae Jua and Mae Maan | Sung Men | 40,625 | N/A |
| 21. | Mae Yae and Mae Sang | Sung Men, Den Chai | 79,687 | PRE09 |
| 22. | Mae Parn | Den Chai | 38,125 | PRE11 |
| 23. | Mae Puak | Den Chai | 108,062 | N/A |
| 24. | Bor Kaew – Mae Sung – Mae Sin | Den Chai, Wang Chin | 137,500 | N/A |
| 25. | East Bank of Mae Yom | Wang Chin | 178,489 | PRE14 |
| 26. | Mae Khek | Sung Men | 35,000 | PRE10 |
| 27. | Left Bank of Mae Jua | Den Chai | 16,875 | PRE12 |
| Total | | | 2,976,888 | |

About half of reserve forest is classified as Zone C while Zone E and A account about nearly 30% and 20% respectively. There are 5 sites of national park and 1 site of wildlife sanctuary in Phrae. These areas also spread over the neighboring provinces of Lampang and Uttaradit. 2 sites of the M/P code areas are proximity to the protected areas.

**Table 4.3.13 National Park and Wildlife Sanctuary in Phrae**

| Sites | Location (district) | Area (rai) | Area covered the other provinces | Adjacent area to the M/P code |
|---|---|---|---|---|
| **National park:** | | | | |
| Mae Yom | Song | 284,218.75 | Inclusion areas situated in Lampang province | N/A |
| Wiang Kosai | Wang chin | 256,250.00 | Inclusion areas situated in Lampang province | PRE08 |
| Lam Nam Nan | Muang | 834,687.00 | Inclusion areas situated in Uttaradit province | N/A |
| Doi Pha Klong | Long | 91,875.00 | | Near by PRE05 |
| Pae Muang Pi | Muang | 500.00 | | |
| **Wildlife sanctuary:** | | | | |
| Doi Luang | Song | 60,625.00 | Inclusion areas situated in Lampang province | N/A, but the reserve area near this resource will be transferred to ALRO soon. |

Community forest, which has been initiated since 2000, covers an area of more than 45,000 rai in Phrae. They are distributed in 8 districts (Rong Kwang, Long, Song, Wangchin, Denchai, Nong Muang Khai, Sungmen and Muang). The largest areas are found in Long and Muang (more than 10,000 rai each) while the smallest is found in Denchai (about 1,700 rai). Total area of community forest however is only 1.5% of the total reserve forest areas.

**Table 4.3.14 Distribution of Community Forest in Phrae**

| District | No. of project | No. of village | No. of tambon | Area (rai) |
|---|---|---|---|---|
| Rong Kwang | 23 | 28 | 9 | 6,456 |
| Long | 15 | 15 | 5 | 10,166 |

| District | No. of project | No. of village | No. of tambon | Area (rai) |
|---|---|---|---|---|
| Song | 38 | 41 | 8 | 7,311 |
| Wangchin | 11 | 11 | 6 | 2,398 |
| Denchai | 11 | 11 | 3 | 1,698 |
| Nong Muang Kai | 9 | 9 | 2 | 2,149 |
| Sung Men | 8 | 19 | 4 | 5,934 |
| Muang | 19 | 23 | 7 | 10,517 |
| Total (8 Amphoe) | 134 | 157 | 44 | 46,629 |

About half of the community forest in the LRAs is distributed over the 11 M/P code areas. The 65 community forests are managed by 81 villages. The largest areas (over 6,000 rai) are in PRE07. In terms of accessibility, there are 14 community forest sites in PRE04 and they are being utilized by 14 villages. In PRE10, there is a large size of community forest, 2,000 rai, where local people in 12 villages can use.

**Table 4.3.15 Community Forest Located in the M/P Code Areas in Phrae**

| M/P code area | No. of site | No. of access villages | Total area (rai) |
|---|---|---|---|
| PRE01 | 10 | 10 | 1,263 |
| PRE02 | 8 | 8 | 2,218 |
| PRE03 | 5 | 10 | 2,914 |
| PRE04 | 14 | 14 | 3,309 |
| PRE06 | 4 | 4 | 600 |
| PRE07 | 7 | 7 | 6,313 |
| PRE08 | 3 | 3 | 2,521 |
| PRE09 | 3 | 3 | 1,657 |
| PRE10 | 1 | 12 | 2,337 |
| PRE11 | 7 | 7 | 777 |
| PRE14 | 3 | 3 | 617 |
| Total | 65 | 81 | 24,526 |

Summary of natural resources being accessed by the villagers of each site of the LRA is shown below. All sites are accessible to water body and their stream network of the Yom River.

**Table 4.3.16 Accessibility to Natural Resources by the M/P Code Area in Phrae**

| Land reform areas | Basin | Protected forest nearby | Accessed Community forest |
|---|---|---|---|
| PRE01 | Middle Yom | | 10 sites, 1263 rai |
| PRE02 | Middle Yom | | 8 sites, 2218 rai |
| PRE03 | Middle Yom | | 5 sites, 2914 rai |
| PRE04 | Mae Kham Mi | | 14 sites, 3309 rai |
| PRE05 | Mae Ta | Doi Pha Klong national park | N/A |
| PRE06 | Middle Yom | | 4 sits, 600 rai |
| PRE07 | Lower Yom | | 7 sites, 6313 rai |
| PRE08 | Lower Yom | Wiang Kosai national park | 3 sites, 2521 rai |
| PRE09 | Middle Yom | | 3 sites, 1657 rai |
| PRE10 | Middle Yom | | 1 site, 2337 rai |
| PRE11 | Middle Yom | | 7 sites, 777 rai |
| PRE12 | Middle Yom | | |
| PRE13 | Lower Yom | | |
| PRE14 | Huay Mae Sin | | 3 sites, 617 rai |

### 4.3.3 Nan

(1) Topography

Due to the majority of high mountainous area in Nan (about 85%) with the steep slope of more than 30%, these areas are not suitable for agriculture. High mountainous range is bordering between Thai and Laos. The highest elevation is at Doi Puka, about 2,000 metres above average sea level (MASL), situated in Pua District. Height of the low land is about 200-300 MASL, aligning along the Nan River, accounting only 3% of the total provincial area.

**Table 4.3.17 Topography in Nan**

| Topography | % | Crop suitability |
|---|---|---|
| Mountainous/steep slope | 85 | Not suitable for agriculture |
| High land | 2 | Suitable for orchard such as tamarind, mango, lychee, longan |
| Upland | 10 | Situated between flat land and high land, with gentle slope |
| Low land | 3 | Aligning along the Nan River and its tributaries |

Therefore the mountainous soil shares the largest proportion (60%) while paddy land accounts the smallest (5%). Upland and shallow soil groups represent similar portions, 15% and 20% respectively.

(2) Water

Nan has only 1 main river basin, namely the Nan River basin, which is comprised of 10 sub-basins. LRAs in this province are scattering on nearly every basin. The largest areas are in upper Nan, 3rd part of Nan and Nam Wa (over 1 million rai each) comprise of the 2-3 M/P code areas while the smaller areas of Nam Wa alone comprise of 4 sites of the M/P code areas.

**Table 4.3.18 Coverage of River Basin in Nan**

| River basin | Area coverage (rai) | Related M/P code areas |
|---|---|---|
| Nan | 379,399.49 | ANN06 |
| Upper Nan | 1,387,973.51 | ANN01 and ANN03 |
| 2nd part of Nan | 532,074.41 | N/A |
| 3rd part of Nan | 1,177,624.76 | ANN09, ANN18 and ANN19 |
| Huay Nam Yao 1 | 512,654.84 | ANN02 |
| Huay Nam Yao 2 | 369,022.24 | ANN04 |
| Nam Sanian | 486,958.26 | ANN08, ANN11 |
| Nam Sa | 735,681.73 | ANN05, ANN15, ANN12, ANN13 |
| Nam Wa | 1,370,418.80 | ANN07 and ANN10 |
| Nam Haeng | 654,441.16 | ANN16, ANN14 |

Nan has a relatively large area, should be preserved as headwater sources. Nearly half of the total provincial area is classified as class 1A (44%) of watershed classification. Class 4 and 5 where some activities including farming are possible occupy nearly 30%. The majority of LRAs in Nan are classified as class 2 - 4.

Due to its mountainous topography, areas under irrigation in Nan account only about 5% of the total provincial area. While there are 114 small-scale irrigation projects, its irrigated area, 119,000 rai, is smaller than the irrigated area by 23 large- and medium-scale projects.

(3) Forest

The size of designated reserve forest is about 6.5 million rai, which is equivalent to 90% of total provincial area. However the 1998 statistics shows that, actual forest area in Nan is only 3 million rai, which is equivalent to 42% of the total provincial area. This means that more than 40 % of forest is degraded forest. Reserve forest areas are distributed to 16 sites and the LRAs are there in nearly all sites. There are 3 sites (Southern part of right bank of the Nan River, Nam Yao and Nam Suad, and Doi Phu Kha and Pa Pha Daeng), which cover more than 1 million rai.

**Table 4.3.19 Reserve Forest and the M/P Code Areas in Nan**

| Reserve forest | Area (rai) | Adjacent M/P code area |
|---|---|---|
| 1. Khao Noi | 1,185 | ANN11 |
| 2. Sa Lik | 63,285 | ANN15 |
| 3. Tham Pha Tub | 11,875 | ANN06 |
| 4. Left Bank of Na Saow (Phrae-Nan Road) | 70,625 | ANN11 |
| 5. Na Saow | 38,593 | ANN11 |
| 6. Nam Sa and Left Bank of Mae Sakhon | 120,000 | ANN13 |
| 7. Right Bank of Mae Sakhon | 49,016 | ANN13 |
| 8. Huai Mae Khaning | 128,608 | ANN12 |
| 9. Nam Wa and Mae Charim | 465,375 | ANN10 |
| 10. Nam Wa and Huai Salee | 429,688 | ANN09 |
| 11. Huai Nguang and Huai Salee | 360,625 | ANN09 |
| 12. Right bank of Nam Sa | 123,308 | N/A |
| 13. Southern Part of Right Bank of Nan River | 1,009,609 | ANN 14, 16 and 17 |
| 14. Southern Part of East Bank of Nan River | 582,688 | ANN06 |
| 15. Nam Yao and Nam Suad | 1,565,312 | ANN01,02 and 03 |
| 16. Doi Phu Kha and Pa Pha Daeng | 1,477,500 | ANN03 |
| Total | 6,497,292 | |

Forest zonation data of Nan show that the largest area is in conservation zone (C), which accounts 77% of the total reserve forest area while the area under Zone E and A represents only 9% and 0.3% respectively. About 14% was designated as non-forest area.

There are 11 sites of protected areas in Nan (7 national parks, 1 forest park, 1 wildlife sanctuary and 2 botanical gardens). The largest site is the Doi Pukha National Park, covering over 1 million rai, followed by the Sri Nan National Park and the Nanthaburi National Park which cover more than 500,000 rai each.

Community forests are located on 11 districts out of 15 in Nan. There are 122 community forests in 124 villages of 44 tambons. This reflects the ownership of 1 village per 1 site of community forest. However the total coverage area is only 54,187 rai, which is less than 1% of total reserve forest of the province.

**Table 4.3.20 Distribution of Community Forest in Nan**

| District | No. of site | No. of village | No. of tambon | Total area (rai) |
|---|---|---|---|---|
| Muang | 26 | 28 | 8 | 9,115 |
| Ban Luang | 2 | 2 | 1 | 30 |
| Pua | 8 | 8 | 4 | 4,553 |
| Mae Charim | 8 | 8 | 2 | 174 |
| King Amphoe Pu Piang | 29 | 29 | 7 | 19,721 |
| Tha Wang Pha | 13 | 13 | 5 | 5,826 |
| Wiangsa | 16 | 16 | 6 | 1,734 |
| Santisuk | 7 | 7 | 3 | 6,935 |
| Tung Chang | 7 | 7 | 3 | 5,775 |
| Boh Klua | 2 | 2 | 2 | 80 |
| Chaing Klang | 4 | 4 | 3 | 244 |
| Total 11 Amphoe | 122 | 124 | 44 | 54,187 |

Nearly 40,000 rai community forest, which is equivalent to over 70% of community forest, is situated in the LRAs. This area is comprised of 79 sites and being benefited by 81 villages which are living in the 13 M/P code areas. Among them, ANN06 holds the largest areas, which has nearly 15,000 rai, located on 15 villages of 15 sites followed by ANN11 which has nearly 10,000 rai, of 26 sites, being benefited by 26 villages.

**Table 4.3.21 Distribution of Community Forest by the M/P Code Area in Nan**

| M/P code | No. of site | No. of village access | Total area (rai) |
|---|---|---|---|
| ANN01 | 4 | 4 | 1,775 |
| ANN03 | 2 | 2 | 107 |
| ANN04 | 12 | 12 | 6,266 |
| ANN05 | 2 | 2 | 30 |
| ANN06 | 15 | 15 | 14,293 |
| ANN07 | 11 | 11 | 6,995 |
| ANN10 | 1 | 1 | 5 |
| ANN11 | 26 | 26 | 9,115 |
| ANN13 | 1 | 1 | 56 |
| ANN15 | 2 | 2 | 40 |
| ANN18 | 2 | 2 | 108 |
| ANN19 | 1 | 1 | 400 |
| Total (13 sites) | 79 | 81 | 39,190 |

### 4.3.4 Phitsanulok

(1) Topography

Phitsanulok has a wide range of elevation. The high elevation is located in the eastern and northeastern parts of the province. The highest elevation is over 1,900 meters above average sea level (MASL). More than a half of the areas are in the low land, situated in the Yom and Nan River Basins. The lowest elevation is only 40 metres above average sea level (MASL).

In relation to the topographic features, soil characteristics in Phitsanulok can be classified into 4 major groups. Mixed soil covers the largest area (about 46%), followed by paddy soil (about 28%),

mountainous soil (about 19%) and upland soil (7%). Most land reform areas in Phitsanulok, especially the PIK01, 02, are located on plateau with mixed soil characteristics. The PIK03 and PIK04 are situated on the low land with paddy soil characteristics.

(2) Water

There are 5 major rivers flown through Phitsanulok. Two of them, the Yom and Nan Rivers, are tributaries of the Chao Phraya River. There are seven river basins in the province. The largest one is the Kwai Noi Basin, where the PIK01 and PIK02 are located. The second largest one is the Lower Nan Basin where the PIK03 and PIK04 are situated.

**Table 4.3.22 Area Coverage of River Basin in Phitsanulok**

| River basin | Area coverage (rai) | % | Adjacent M/P code area |
|---|---|---|---|
| Nam Pak | 331,593 | 5 | N/A |
| Kwai Noi | 2,774,349 | 42 | PIK01 and PIK02 |
| Klong Tron | 85,110 | 1 | N/A |
| 4th part of Nan | 275,574 | 4 | N/A |
| Lower part of Yom | 903,421 | 14 | N/A |
| Wang Thong | 729,296 | 11 | N/A |
| Lower part of Nan | 1,560,420 | 23 | PIK03 and PIK04 |

In contrary to Nan, about half of total provincial areas are classified in watershed class 5, which are suitable for farming. They are located in the southern part of the province. Headwater source areas (class 1A and 1B) account a small potion (only 12% to the total provincial areas), situated in the northwestern part of the province. The majority areas of the PIK01 and PIK02 are situated in of class 2, 3, 4 and 5 while all the areas of PIK03 and PIK04 are in class 5.

Quantity of groundwater in Phitsanulok is varied from small to fair while its quality is varied from poor to good. Groundwater potentiality in the Districts of Chartrakan and Wat Bote, where the PIK01 and PIK02 are situated, is classified as small quantity (10 - 100 gallon/min.), with poor quality. Groundwater availability in PIK03 in Muang District is fair (100 - 200 gallon/min.), with good quality.

(3) Forest

Although the forest cover in Phitsanulok is only 36% (about 2.5 million rai) of the total provincial area, designated reserve forest size is still 3,177,301 rai, which is equivalent to nearly a half of provincial area (47%). They are scattered over 13 sites. The PIK01 and PIK02 are related to 5 reserve forests.

**Table 4.3.23 Reserve Forest and the M/P Code Areas in Phitsanulok**

| No. | Sites of reserve forest | Location (Amphoe) | Area (rai) | Related M/P code area |
|---|---|---|---|---|
| 1. | Right bank of Wang Thong | Muang, Wat Bote, Wang Thong | 343,000 | N/A |
| 2. | Left bank of Wang Thong | Wang Thong, Nern Maprang | 479,375 | N/A |
| 3. | Both Bank of Nam Khaew Noi | Wat Bote, Muang, Prom Piram | 324,478 | PIK02 |

| No. | Sites of reserve forest | Location (Amphoe) | Area (rai) | Related M/P code area |
|---|---|---|---|---|
| 4. | Khoe krayang | Chatrakarn, Nakorn Thai, Wang Thong | 332,000 | N/A |
| 5. | Nam kheg | Wang Thong | 17,450 | N/A |
| 6. | Suan Miang | Wat Bote, Chatrakarn | 151,250 | PIK01 |
| 7. | Nern Perm | Nakorn Thai | 468,750 | N/A |
| 8. | Dong Tean Tok | Chartrakarn | 173,267 | PIK01 |
| 9. | Nam Pak and left bank of Khaew Noi | Chartrakarn, Nakorn Thai | 308,362 | N/A |
| 10. | Right bank of Nam Pak | Chartrakarn | 279,375 | N/A |
| 11. | Daeng and Chatrakarn | Nakorn Thai, Chartrakarn | 220,750 | N/A |
| 12. | Pong kae | Wat Bote, Chartrakarn | 30,125 | N/A |
| 13. | Pak Noi | Chatrakarn | 49,219 | PIK01 |
| | Total | | 3,177,301 | |

There are 11 sites of protected areas in Phitsanulok (3 national parks, 4 forest parks, 1 wildlife sanctuary, 2 non-hunting areas and 1 botanical garden). The largest site is the Doi Pukha National Park, covering over 1 million rai, followed by the Sri Nan National Park and the Nanthaburi National Park which cover more than 500,000 rai each. Only the Phu Miang – Phu Thong Wildlife Sanctuary is adjacent to the M/P code of PIK01.

**Table 4.3.24 Protect Areas in Phitsanulok**

| Type | Name | Area (rai) | Location | In relation to M/P |
|---|---|---|---|---|
| Wildlife sanctuary | Phu Miang – Phu Thong | 410,320 | Only 480.25 rai is in Phitsanulok, the rest is in Uttaradit | PIK01 |
| Non-hunting area | Tampha – Thapol | 1,775 | Amphoe Nern Maprang | N/A |
| | Nong Nam Khoe | 358 | Amphoe Bang Rakam | N/A |
| National park | Tung Salaeng Luang | 789,000 | Phitsanulok 559,313 rai and Petchabun 229,687 rai | N/A |
| | Phu Hin Rongkla | 191,875 | Phitsanulok 130,625 rai and Loey 61,250 rai | N/A |
| | Chartrakarn waterfall | 339,375 | Phitsanulok | N/A |
| Forest park | Phu Daeng Ron | 6,141 | Amphoe Wang Thong | N/A |
| | Phu Soi Dao | 48,962 | Amphoe Chartrakarn | N/A |
| | Kaeng Jed Kwai | 13,212 | Amphoe Wat Bote | N/A |
| | Khoe PanomThong | 12,500 | Amphoe Wang Thong and Nern Maprang | N/A |

The total area of community forest in Phitsanulok is only about 17,500 rai while the areas of reserve forest and actual forest are over 3 million and 2.5 million rai respectively. Area size of community forest varies from less than 10 rai to 1,000 rai. The large areas of community forest in the Chatrakan, Wangthong and Prompiram Districts are mostly situated in the LRAs.

**Table 4.3.25 Distribution of Community Forest in Phitsanulok**

| District | No. of Project | No. of Village | No. of tambon | Area (rai) |
|---|---|---|---|---|
| Muang | 5 | 5 | 3 | 42 |
| Prom Piram | 7 | 7 | 3 | 1,319 |
| Bangrakham | 26 | 26 | 7 | 369 |
| Nern Maprang | 8 | 8 | 4 | 153 |

| District | No. of Project | No. of Village | No. of tambon | Area (rai) |
|---|---|---|---|---|
| Nakorn Thai | 4 | 4 | 3 | 91 |
| Wangthong | 10 | 10 | 4 | 6,284 |
| Chatrakarn | 7 | 10 | 1 | 9,248 |
| Total (7 districts) | 67 | 70 | 25 | 17,506 |

About two thirds of total community forest area is located on the 3 M/P code areas, PIK01, PIK02 and PIK04. All of the community forest areas are relatively large in scale, covering nearly 400 rai up to over 700 rai each.

**Table 4.3.26 Distribution of Community Forest by the M/P Code Area in Phitsanulok**

| M/P code area | No. of site | No. of village access | Total area (rai) |
|---|---|---|---|
| PIK01 | 7 | 10 | 9248 |
| PIK02 | 2 | 2 | 1285 |
| PIK04 | 1 | 1 | 377 |
| Total | 10 | 13 | 10910 |

## 4.4 PRESENT SITUATIONS OF THE LRAs

### 4.4.1 Data for Analysis

In order to grasp the present situation of the LRAs, firstly, the collected data which are supposed to indicate the seriousness of the problem in each M/P code area were scrutinized in accordance with the Problem Analysis Chart (See Figure 3.2.1.). It was found that the National Rural Database 2003 (NDR2C) and GIS data of ALRO were possible to compare the M/P code areas in the four provinces. The characteristics of the two data sources are shown below.

**Table 4.4.1 Characteristics of the GIS and NRD2C Data**

| Data Type | GIS data of ALRO | NRD2C data* |
|---|---|---|
| Kinds of available data | Natural resources and physical conditions within the LRAs. Name list of the village where LRA farmers live. | Socio-economy and agricultural data of the villages where LRA farmers live. |
| Base of the data | M/P code area based data: Basically, the image data are tailored to each M/P code area. The year of data obtained varies by the original image map. | Village based data: The original data are composed of each village data. The villages related to the LRAs are selected whether SPK holders live or not, and are sorted out in accordance with the M/P code areas. The data were collected in the Year 2003. |
| Advantage | Since the original data are map images, it is easy to visually grasp the geographical features.<br>Data are specific to the M/P code areas. | Various kinds of data, not only land information but also socio-economic information, which are unable to get from GIS data, are included.<br>Various kinds of data are based on the number of people and households. |
| Weakness | Social data, particularly on human activities, are not included. | The data contains the information of non-SPK 4-01 farmers since both SPK 4-01 farmers and non-SPK 4-01 farmers live in the same village.<br>Since the data were collected by local officers at village level, some of them seem to be less reliable. |

Note; *: Some villages are related to several M/P code areas since there are farmers who have SPK 4-01 lands in different M/P code areas, but live in the same village.

After thorough examination of the two data sources, specific data were selected and analyzed by

sector.

**Table 4.4.2 Selected Data for Analysis**

| Sector | Sub-sector | Data selected for analysis | Data source |
|---|---|---|---|
| Natural resource | Land | Elevation, Land slope, Zoning and land use | GIS |
| | Soil | Soil erosion, Soil suitability, Soil group | GIS |
| | | Soil problem | NRD2C |
| | Water | Water stream, Groundwater | GIS |
| Socio-economy, rural life | Demography | Administration, Population, Households | GIS, etc |
| | Household finance | Household income, Expenditure, Debt | NRD2C, Participatory survey |
| | Non agro-industry | Non-agriculture employee, Village industry, Economic and social facilities (shop, cooperatives, training center) | NRD2C |
| | Social infrastructure | Road, School, Health center, Community center, etc. | NRD2C |
| | Living conditions | Village water supply, Wastewater and waste materials, Fuel source for cooking | NRD2C |
| Agriculture | Land use | Agriculture land, Forest land, Others | GIS |
| | Land holding | SPK 4-01 certificate data | PLRO office, GIS |
| | Cropping system | Land use categories by crops (paddy, field crop, fruit tree, vegetables, rubber, others) | GIS NRD2C |
| | Livestock | Household livestock activities for sale (beef, milk cow, buffaloes, swine, poultry) | NRD2C |
| | Agriculture input | Farm machines, Natural & chemical fertilizer, Use fertilizer for paddy, Use promoted seed for paddy, Expenditure for agricultural inputs for paddy cultivation | NRD2C |
| | Agricultural technology | Availability of technology transfer center service, Problem of little knowledge for other cropping | NRD2C |
| | Irrigation infrastructure | Surface water resources, irrigation system, water shortage | NRD2C |

### 4.4.2 Natural Resources

(1) Land and Topography

Average landholding size of SPK04-1 farmer is 7.6 rai in Phayao, 10.4 rai in Phrae, 10.4 rai in Nan and 19.6 rai in Phitsanulok. Categorization of the M/P code areas by landholding size is shown below.

**Table 4.4.3 Categorization of the M/P Code Areas by Landholding Size**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| <= 6 rai | 08, 10 | 06, 09, 10, 12, 13 | 11 | | 8 |
| 6 - 9 rai | 01, 02, 03, 04, 09, 11, 14 | 01, 02, 04, 07 | 01, 02, 03, 04, 05, 10, 14, 16, 17 | | 20 |
| 9 - 12 rai | 05, 06, 07, 12, 13 | 03, 08, 11, 14 | 06, 07, 09, 18, 19, 20 | 03, 04 | 17 |
| 12 rai < | | 05 | 08, 12, 13, 15 | 01, 02 | 7 |
| Total | 14 | 14 | 20 | 4 | 52 |

Slope is categorized into 8 classes as described in the table below.

**Table 4.4.4 Category of Slope**

| Slope category | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Range | 0-5% | 5-10% | 10-15% | 15-20% | 20-25% | 25-30% | 30-35% | >35% |
| Mean (*1) | 2.5% | 7.5% | 12.5% | 17.5% | 22.5% | 27.5% | 32.5% | 35.0% |

Data source: GIS Manual (*1: estimated and applied mean slope for the study by the Study Team.)

Average slope of the M/P code areas ranges from 5.3% in Phitsanulok to 9% in Phrae. (See Figure 4.4.1.) There are many steeply sloped M/P code areas in Phrae, and gently sloped areas are in Phitsanulok. Gently sloped area (less than 5%) occupies about 60% in Phayao, Phrae and Nan while it reaches 80% in Phitsanulok.

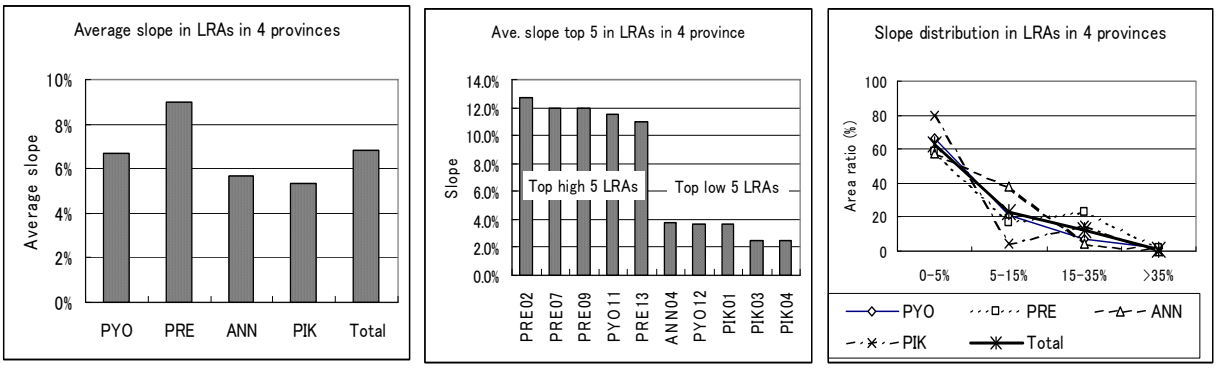



**Figure 4.4.1 Land Slope of the M/P Code Areas**

**Table 4.4.5 Categorization of the M/P Code Areas by Elevation and Slope**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Average Elevation (EL. m)** | | | | | |
| <= 180 m | | 14 | | 02, 03, 04 | 4 |
| 180 - 290 m | | 01, 02, 03, 05, 06, 07, 08, 09, 10, 11, 12, 13 | 03, 04, 06, 07, 08, 09, 11, 12, 13, 14, 17, 18, 19,20 | 01 | 27 |
| 290 - 400 m | 14 | 04 | 01, 02, 05, 10, 15, 16 | | 8 |
| 400 m < | 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13 | | | | 13 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **Average Slope of the Area less than 35% slope** | | | | | |
| <= 4% | 07, 12 | 03 | 04 | 01, 03, 04 | 7 |
| 4% - 6.5% | 02, 03, 05, 06, 08, 09, 10, 13, 14 | 01, 04, 10, 11, 12, 14 | 03, 05, 06, 07, 08, 11, 12, 13, 14, 18, 19 | 02 | 27 |
| 6.5% - 9% | 01, 04 | 05, 06 | 01, 02, 09, 16, 17 | | 9 |
| 9%< | 11 | 02, 07, 08, 09, 13 | 10, 15, 20 | | 9 |
| Total | 14 | 14 | 20 | 4 | 52 |

(2) Water Resources

Mountains in the North Thailand are mainly formed from limestone; consequently runoff coefficients

of most streams are extremely low as 5% or less. Majority of rainfall water infiltrates into ground and appears at the far downstream stream as groundwater discharge. Therefore, the M/P code areas at higher elevation as in Phayao are generally scarce on surface water resources. However, some perennial flows can be expected where the LRAs extent to the lower and flatter areas. Streams are classified into 9 categories according to the GIS.

**Table 4.4.6 Category of Stream in GIS**

| Category | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| | Major river | Perennial stream | Intermittent stream | Irrigation canal | Manmade canal | Manmade reservoir | Perennial lake | Intermittent manmade canal | Intermittent lake |

Stream densities of the M/P code areas were calculated in order to investigate the potential of surface water resources by classifying streams based on the output of GIS. Perennial stream is rather easier for utilization for development. (See Figure 4.4.2.)

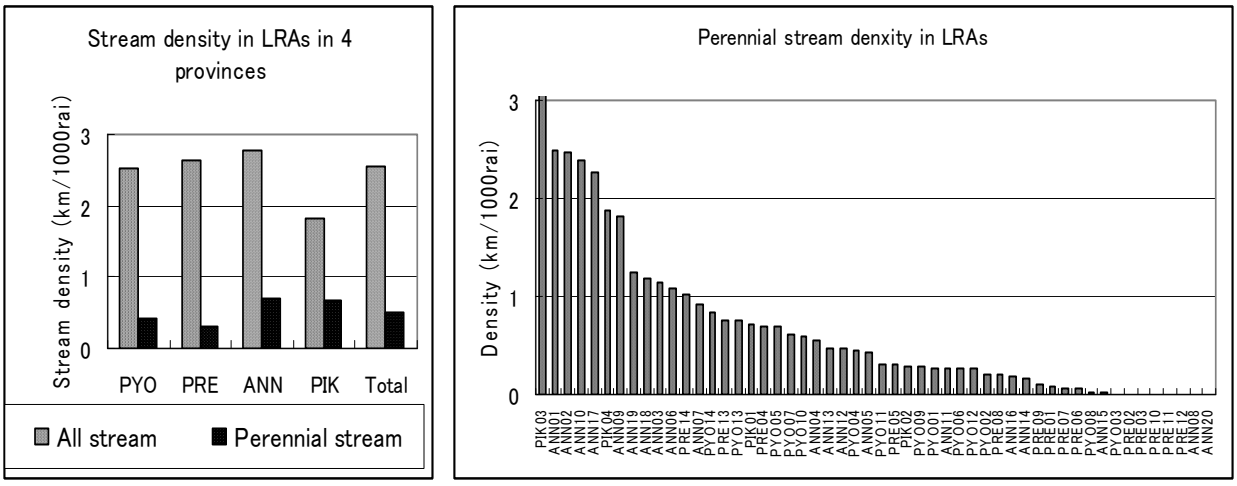



**Figure 4.4.2 Density of Streams in the M/P Code Areas**

Perennial stream density is rather higher in Phitsanulok and Nan, and lower in Phayao and Phrae.

**Table 4.4.7 Categorization of the M/P Code Areas by the Perennial Stream Density**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| <= 0.1km/1000rai | 03, 08 | 01, 02, 03, 06, 07, 10, 11, 12 | 08, 15, 20 | | 13 |
| 0.1 - 0.7 km | 01, 02, 04, 05, 06, 07, 09, 10, 11, 12 | 05, 08, 09 | 04, 05, 11, 12, 13, 14, 16 | 02 | 21 |
| 0.7 - 1.4 km | 13, 14 | 04, 13, 14 | 03, 06, 07, 18, 19 | 01 | 11 |
| 1.4 km < | | | 01, 02, 09, 10, 17 | 03, 04 | 7 |
| Total | 14 | 14 | 20 | 4 | 52 |

Groundwater potential is investigated by the data available in GIS, and is categorized as shown in Table 4.4.8. According to the groundwater potential category, potential of the M/P code areas were analyzed as shown in Figure 4.4.3.

**Table 4.4.8 Category of Groundwater Potential**

| Category | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Yield ($m^3$/hr) | <2 | 2-10 | 10-20 | >20 |

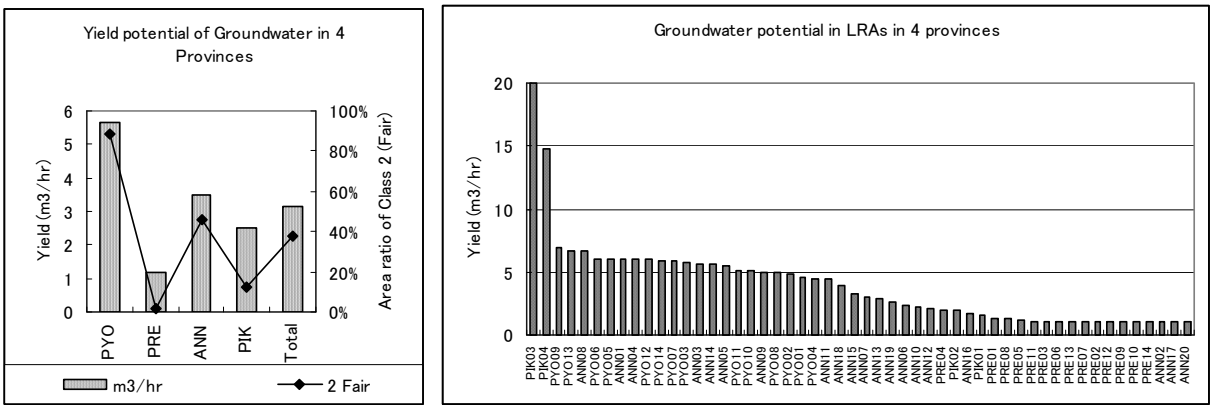



**Figure 4.4.3 Groundwater Potential in the M/P Code Areas**

Yield potential is rather high in Phayao and low in Phrae. Fair potential area (2-10 $m^3$/hr) dominantly covers 90% of the LRAs in Phayao, while it does only 1% in Phrae. On the other hand, extreme high potential is expected in PIK03 and 04 due to existence of large groundwater basin under alluvial deposit.

**Table 4.4.9 Categorization of the M/P Code Areas by the Groundwater Potential**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| <= 1 $m^3$/hr | | 09, 10, 14 | 02, 17, 20 | | 6 |
| 1 - 4 $m^3$/hr | | 01, 02, 03, 04, 05, 06, 07, 08, 11, 12, 13 | 06, 07, 10, 12, 13, 15, 16, 18, 19 | 01, 02 | 22 |
| 4 - 7 $m^3$/hr | 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14 | | 01, 03, 04, 05, 08, 09, 11, 14 | | 22 |
| 7 $m^3$/hr < | | | | 03, 04 | 2 |
| Total | 14 | 14 | 20 | 4 | 52 |

(3) Soil

The most prevailing soil group is 62 in Phrae and Nan, and 48C in Phayao, 35B in Phitsanulok according to the GIS data. These soil groups cover 23%, 37%, 13% and 21% of the M/P code areas in the 4 provinces respectively. Soil group 62 is commonly found in mountainous areas with steep slope. It is not suitable for growing any crops, but rather suitable for conservation of watershed and forest. Soil group 48C is sandy and gravelly, and is found on steeply sloping land. It is suitable to grow sugarcane, fruit trees and pasture. Soil group 35B is rather suitable to grow various field crops but has low moisture holding capacity due to sandiness. Soils distributed in the M/P code areas are mostly classified into rater unsuitable or unsuitable for cropping due to poor texture, fertility and slope. Soils suitable for growing paddy rice are very limited except for PIK03 and 04 in Phitsanulok.

Moreover soil problems for agriculture were surveyed in NRD2C. 45% of villages have both problems of soil erosion and poor fertility. Gravelly and shallow soils represent 31% and 35%, respectively. Erosion problem occurs in more than 50 % of villages in Nan. Salinity and acidity problem is not so serious as compared to other problems.

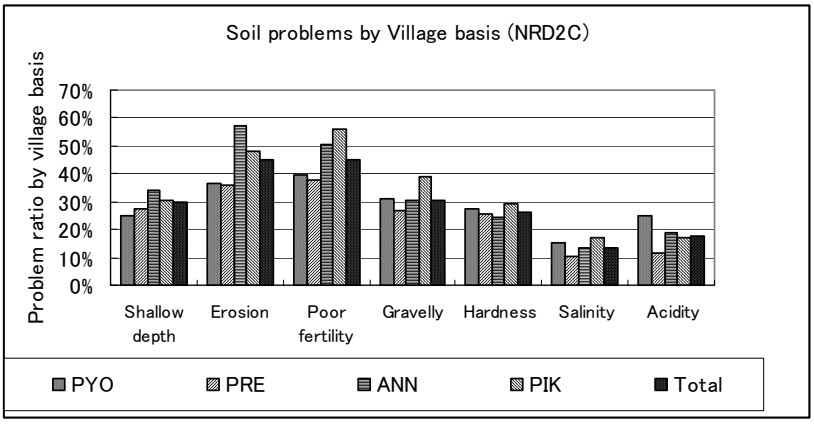



**Figure 4.4.4 Types of Soil Problems**

(4) Erosion

Based on USLE (Universal Soil Loss Equation) by LDD, the erosion data of GIS were analyzed. Soil erosion rate is categorized as shown in Table 4.4.10.

**Table 4.4.10 Category of Soil Erosion Rate**

| Plain Land | Highland | Erosion Class Category | Soil Loss | |
|---|---|---|---|---|
| | | | (ton/rai/yr) | (mm/yr) |
| 1 | H1 | slight | 0 - 2 | 0 - 0.96 |
| 2 | H2 | moderate | 2 - 5 | 0.96 - 2.4 |
| 3 | H3 | severe | 5 - 15 | 2.4 - 7.2 |
| 4 | H4 | very severe | 15 - 20 | 7.2 - 9.6 |
| 5 | H5 | extremely severe | >20 | >9.6 |

Note: 1) Plain land: Flat area of river and slope of hill that slope is less than 35%. Soil belongs to Soil Group 1-61.
2) Highland: Steep slope of mountain that slope is more than 35%. Soil belongs to only Soil Group 62.
3) Soil loss is estimated by USLE.
Source: Land Development Department

Estimated erosion rates of the M/P code areas are 1.40 mm/yr in Phayao, 1.64 mm/yr in Phrae, 4.42 mm/yr in Nan and 2.79 mm/yr in Phitsanulok. Among the 4 provinces, the average rate in Nan is extremely high, and followed by Phitsanulok, Phrae and Phayao. The erosion rate in highland is much higher than that in plain land, so the highland should be carefully protected from erosion from the viewpoint of natural resources management. (See Table 4.4.11.)

**Table 4.4.11 Estimated Erosion Rate of the Four Provinces**

| Province | Area Ratio | | Erosion rate (mm/yr) | | |
|---|---|---|---|---|---|
| | Plain land | High land | Plain land | High land | Total |
| PYO | 89% | 11% | 1.14 | 3.60 | 1.40 |
| PRE | 78% | 22% | 1.46 | 2.27 | 1.64 |
| ANN | 58% | 42% | 1.96 | 7.76 | 4.42 |
| PIK | 62% | 38% | 1.53 | 4.80 | 2.79 |
| Total | 71% | 29% | 1.51 | 5.60 | 2.69 |

Source: GIS

NRD2C also surveyed the existence of soil erosion problem in village. As shown in the Table 4.4.12 together with the erosion ratio by GIS, the percentage of villages with erosion problem reported by NRD2C does not exactly correspond to the erosion rate by GIS, but the tendency of erosion problem are similar in terms of the M/P code areas.

**Table 4.4.12 Categorization of the M/P Code Areas by Erosion Rate**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Erosion in Plain land (mm/yr)** | | | | | |
| <= 0.5 mm/yr | 03 | | 02, 17 | 03, 04 | 5 |
| 0.5 - 1.75mm/yr | 02, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14 | 02, 05, 06, 07, 08, 10, 11, 13, 14 | 03, 05, 09, 11, 12, 14, 15, 16, 19 | 02 | 30 |
| 1.75 - 3.0mm/yr | 01 | 09, 12 | 01, 04, 07, 13 | 01 | 8 |
| 3.0 mm/yr < | 04 | 01, 03, 04 | 06, 08, 10, 18, 20 | | 9 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **Erosion problem by NRD2C (Village ratio)** | | | | | |
| <= 16% | 08, 10 | 07, 09, 10, 11 | 03, 04, 08, 09 | 03 | 11 |
| 16% - 46% | 02, 03, 05, 06, 07, 11, 12, 14 | 01, 03, 06, 08, 14 | 11 | 01 | 15 |
| 46% -76% | 01, 04, 09, 13 | 02, 04, 13 | 01, 06, 07, 12, 14, 16, 17, 19 | 02, 04 | 17 |
| 76% < | | 05, 12 | 02, 05, 10, 13, 15, 18, 20 | | 9 |
| Total | 14 | 14 | 20 | 4 | 52 |

(5) Zoning and Land Use

There are 6 zones concerning the LRAs. Among them, 5 zones (Zone A, E, F, J and T) correspond to the LRAs.

A: Classified as Agricultural Land that is to be titled to individual farmers.

C: Classified as Reserved Forest which is not included in the LRA.

E: Classified as Economic Forest, that is to be returned partly or fully to RFD in case the area is identified as Zone C after investigation. There is, therefore, no more Zone C in this zone at present due to completion of investigation and turn back of Zone C. In general, there are no clear borderlines between Zone A and E.

T: Classified as Trial Forest, that is the deteriorated forest transferred from RFD to ALRO for investigation. ALRO investigated and classified the area into Zone A, E and C, and would

return to RFD as Zone C. Consequently, Zone T is actually composed of Zone A and E, but Zone T still remains as a classification of Zone.

F: Classified as Prime Forest that is the deteriorated forest which is transferred from RFD to ALRO for land reform before 1992. This zone is the same as Zone T, but distinguished from it by the year of transferring.

J: Classified as Classified 1 Land, that was separated from permanent forest for other utilization by the resolution of Cabinet Council. Based on the resolution, LDD investigated and classified the area as permanent forest and land for other purposes such as Zone A and E.

According to the data of zoning and land use of GIS and NRD2C, zoning classification and land use were analyzed.

**Table 4.4.13 Zoning Classification in the Four Provinces**

| Province | Total (rai) | A | E | F | J | T | Survey (%) |
|---|---|---|---|---|---|---|---|
| PYO | 378,166 | 46% | 43% | 8% | 2% | 0% | 74% |
| PRE | 496,048 | 7% | 87% | 0% | 5% | 1% | 76% |
| ANN | 565,366 | 4% | 74% | 0% | 22% | 0% | 47% |
| PIK | 237,242 | 0% | 89% | 0% | 11% | 0% | 100% |
| Total | 1,676,822 | 14% | 73% | 2% | 11% | 0% | 70% |

Source: Zoning: GIS, Survey progress as of Nov. 2004: Engineering Section, ALRO

**Table 4.4.14 Land Use in the Four Provinces based on the NRD2C Data**

| Province | Total area (rai) | Agriculture | Planted/Natural forest |
|---|---|---|---|
| PYO | 350,934 | 91.4% | 8.6% |
| PRE | 253,190 | 75.0% | 25.0% |
| ANN | 785,123 | 54.7% | 45.3% |
| PIK | 329,049 | 92.7% | 7.3% |
| Total | 1,718,296 | 72.0% | 28.0% |

Source: NRD2C (Note: Excluding conservation forest)

Survey year of the GIS land use data is differed by province, from 1991 in Phayao to 2000 in Phrae and Phitsanulok. On the other hand, NRD2C was surveyed in 2003. Therefore the GIS data of the two provinces were revised based on the data of NRD2C. Agricultural land shares a large portion in Phayao and Phrae while it does less in Nan where forest represents more.

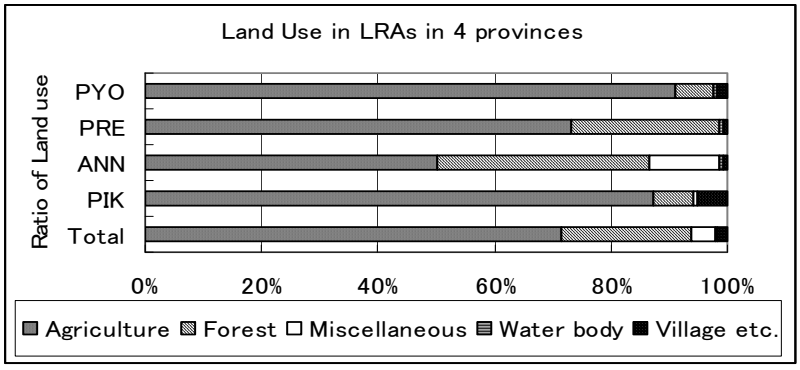



**Figure 4.4.5 Percentage of Land Use in the Four Provinces**

**Table 4.4.15 Categorization of the M/P Code Areas by the Agricultural Land Ratio**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| <= 40% | | 12 | 02, 04, 05, 06, 09, 13, 20 | 04 | 9 |
| 40% - 70% | 03 | 01, 02, 07, 10, 14 | 01, 03, 07, 08, 10, 11, 12, 14, 15, 17, 18, 19 | | 18 |
| 70% - 95% | 01, 02, 04, 06, 07, 08, 09, 10, 11, 13, 14 | 03, 04, 05, 06, 08 | 16 | 02 | 18 |
| 95% < | 05, 12 | 09, 11, 13 | | 01, 03 | 7 |
| Total | 14 | 14 | 20 | 4 | 52 |

### 4.4.3 Socio-economy and Rural Life

(1) Demography

Among the four provinces, Nan has the most farmers of 244,945 who have SPK4-01, and it shares 51.3% of the total population of the province. On the other hand, Phitsanulok has the least number of SPK4-01 holders of 23,775 and it shares only 2.8% of the population of the whole province.

Concerning the population density per 100 rai, average density of the four provinces at SPK4-01 distributed land is 59 persons. Among the four provinces, the density of Phitsanulok shows the lowest, 16 persons/100 rai; less than half of other provinces. Thus, Phitsanulok has relatively small size LRAs and low population density, which means large farm plot per person. The demographic data of the four provinces are shown in Table 4.4.16.

**Table 4.4.16 Demographic Data in the Four Provinces**

| Province | Population | | | | Area (rai) | | | Density per 100rai | |
|---|---|---|---|---|---|---|---|---|---|
| | SPK 4-01 | Declared Land | Tambon concerned | Province | SPK 4-01 | Declared Land | Whole Province | SPK 4-01 | Declared Land |
| PYO | 120,640 | 178,259 | 479,646 | 488,343 | 209,341 | 378,166 | 3,959,375 | 58 | 42 |
| % | 24.7 | 36.5 | 98.2 | 100.0 | 5.3 | 9.6 | 100.0 | | |
| PRE | 62,965 | 175,870 | 229,966 | 473,361 | 132,380 | 496,048 | 4,086,875 | 48 | 35 |
| % | 13.3 | 37.2 | 48.6 | 100.0 | 3.2 | 12.1 | 100.0 | | |
| ANN | 244,945 | 338,447 | 255,757 | 477,754 | 275,115 | 565,366 | 7,170,000 | 89 | 38 |
| % | 51.3 | 70.8 | 53.5 | 100.0 | 3.8 | 7.9 | 100.0 | | |
| PIK | 23,775 | 39,858 | 539,923 | 841,524 | 147,475 | 237,242 | 6,760,000 | 16 | 17 |
| % | 2.8 | 4.7 | 64.2 | 100.0 | 2.2 | 3.5 | 100.0 | | |
| Total | 452,325 | 732,434 | 1,505,292 | 2,280,982 | 764,311 | 1,676,833 | 21,976,250 | 59 | 35 |
| % | 19.8 | 32.1 | 66.0 | 100.0 | 3.5 | 7.6 | 100.0 | | |

Source: Area of LRAs- ALRO GIS section, Number of the farmers in the villages located in the LRAs- Statistic data 2004
Note: Population of the declared land is estimated from the SPK4-01 distributed data and declared land area.

Numbers of agricultural and non-agricultural households in each M/P code area were estimated from the NRD2C data. Share of the agricultural households in the LRAs in the 4 provinces (72.8%) is slightly higher than that of whole 4 provinces (66.8%).

In each M/P code area, the share varies a lot. For instance, share of the agricultural households in PRE13 and PRE14 reached more than 90% of the total households, while that of PRE03 and PRE12

were less than 30%. As a result, there are only 8 M/P code areas out of fourteen in Phrae, in which more than 50% of the households are agricultural households. In Phayao, there are 12 M/P code areas out of 14, which have more than 50% of the agricultural households; there are eighteen out of twenty in Nan; and there are two out of four in Phitsanulok. Thus, in Phrae and Phitsanulok, there are relatively large numbers of the M/P code areas, which have less agricultural households. (See Table 4.4.17.)

**Table 4.4.17 Population and Number of Agricultural and Non-agricultural Households**

| M/P code | Population | Average family size | Agricultural Household | | Non agricultural household | | Total |
|---|---|---|---|---|---|---|---|
| | | | Household | % | Household | % | Household |
| PYO01 | 7,791 | 3.6 | 1,938 | 88.5 | 251 | 11.5 | 2,189 |
| PYO02 | 4,046 | 3.7 | 900 | 82.0 | 198 | 18.0 | 1,098 |
| PYO03 | 4,783 | 3.5 | 802 | 59.5 | 547 | 40.5 | 1,349 |
| PYO04 | 12,722 | 3.6 | 2,211 | 62.1 | 1,348 | 37.9 | 3,559 |
| PYO05 | 8,928 | 3.6 | 2,114 | 85.0 | 374 | 15.0 | 2,488 |
| PYO06 | 15,172 | 3.6 | 3,435 | 82.6 | 726 | 17.4 | 4,161 |
| PYO07 | 11,641 | 3.7 | 2,550 | 81.1 | 595 | 18.9 | 3,145 |
| PYO08 | 6,221 | 3.6 | 573 | 33.5 | 1,139 | 66.5 | 1,712 |
| PYO09 | 3,153 | 3.5 | 418 | 46.1 | 489 | 53.9 | 907 |
| PYO10 | 10,049 | 3.5 | 2,412 | 83.7 | 469 | 16.3 | 2,881 |
| PYO11 | 23,481 | 3.6 | 4,671 | 71.7 | 1,844 | 28.3 | 6,515 |
| PYO12 | 6,492 | 3.8 | 1,228 | 71.6 | 487 | 28.4 | 1,715 |
| PYO13 | 11,423 | 3.7 | 2,938 | 94.0 | 189 | 6.0 | 3,127 |
| PYO14 | 4,292 | 3.5 | 1,136 | 92.1 | 97 | 7.9 | 1,233 |
| Total LRAs | 130,194 | 3.6 | 27,326 | 75.7 | 8,753 | 24.3 | 36,079 |
| Province | 293,994 | 3.6 | 56,520 | 69.9 | 24,340 | 30.1 | 80,,860 |
| PRE01 | 6,787 | 3.4 | 614 | 30.7 | 1,384 | 69.3 | 1,998 |
| PRE02 | 3,236 | 3.6 | 581 | 63.8 | 329 | 36.2 | 910 |
| PRE03 | 6,454 | 3.4 | 533 | 28.2 | 1,354 | 71.8 | 1,887 |
| PRE04 | 11,345 | 3.6 | 1,413 | 45.0 | 1,727 | 55.0 | 3,140 |
| PRE05 | 5,275 | 3.9 | 1,149 | 85.0 | 203 | 15.0 | 1,352 |
| PRE06 | 10,085 | 3.5 | 1,112 | 39.0 | 1,740 | 61.0 | 2,852 |
| PRE07 | 11,578 | 4.0 | 2,363 | 82.0 | 519 | 18.0 | 2,882 |
| PRE08 | 14,575 | 3.6 | 3,590 | 88.4 | 469 | 11.6 | 4,059 |
| PRE09 | 5,912 | 3.9 | 980 | 64.5 | 539 | 35.5 | 1,519 |
| PRE10 | 797 | 3.9 | 141 | 68.1 | 66 | 31.9 | 207 |
| PRE11 | 4,509 | 3.6 | 568 | 45.4 | 683 | 54.6 | 1,251 |
| PRE12 | 561 | 3.7 | 20 | 13.1 | 133 | 86.9 | 153 |
| PRE13 | 5,772 | 3.6 | 1,451 | 90.5 | 153 | 9.5 | 1,604 |
| PRE14 | 7,653 | 3.8 | 1,958 | 96.6 | 68 | 3.4 | 2,026 |
| Total LRAs | 94,539 | 3.7 | 16,473 | 63.8 | 9,367 | 36.3 | 25,840 |
| Province | 329,182 | 3.7 | 56,578 | 63.1 | 33,133 | 36.9 | 89,711 |
| ANN01 | 17,187 | 3.7 | 4,027 | 85.8 | 666 | 14.2 | 4,693 |
| ANN02 | 13,340 | 3.6 | 3,009 | 82.0 | 659 | 18.0 | 3,668 |
| ANN03 | 31,037 | 3.7 | 7,071 | 84.8 | 1,267 | 15.2 | 8,338 |
| ANN04 | 12,379 | 3.8 | 2,707 | 84.1 | 512 | 15.9 | 3,219 |
| ANN05 | 17,587 | 3.8 | 3,495 | 74.7 | 1,183 | 25.3 | 4,678 |
| ANN06 | 11,800 | 3.7 | 2,394 | 75.2 | 789 | 24.8 | 3,183 |
| ANN07 | 15,620 | 3.6 | 3,425 | 79.6 | 877 | 20.4 | 4,302 |
| ANN08 | 609 | 3.9 | 92 | 58.6 | 65 | 41.4 | 157 |
| ANN09 | 129 | 3.6 | 35 | 97.2 | 1 | 2.8 | 36 |
| ANN10 | 2,177 | 4.5 | 475 | 98.1 | 9 | 1.9 | 484 |
| ANN11 | 23,960 | 3.7 | 4,231 | 65.7 | 2,206 | 34.3 | 6,437 |
| ANN12 | 11,390 | 3.9 | 2,496 | 84.5 | 457 | 15.5 | 2,953 |
| ANN13 | 11,834 | 4.0 | 1,587 | 53.7 | 1,366 | 46.3 | 2,953 |

| M/P code | Population | Average family size | Agricultural Household | | Non agricultural household | | Total |
|---|---|---|---|---|---|---|---|
| | | | Household | % | Household | % | Household |
| ANN14 | 15,045 | 3.8 | 3,098 | 77.8 | 883 | 22.2 | 3,981 |
| ANN15 | 4,639 | 4.1 | 504 | 44.4 | 631 | 55.6 | 1,135 |
| ANN16 | 14,856 | 3.7 | 3,214 | 79.8 | 813 | 20.2 | 4,027 |
| ANN17 | 2,963 | 3.5 | 802 | 94.6 | 46 | 5.4 | 848 |
| ANN18 | 9,711 | 3.9 | 2,311 | 93.4 | 163 | 6.6 | 2,474 |
| ANN19 | 1,334 | 4.1 | 41 | 12.5 | 287 | 87.5 | 328 |
| ANN20 | 493 | 3.7 | 118 | 88.7 | 15 | 11.3 | 133 |
| Total LRAs | 218,090 | 3.8 | 45,132 | 77.8 | 12,895 | 22.2 | 58,027 |
| Province | 341,674 | 4.0 | 65,088 | 75.4 | 21,179 | 24.6 | 86,267 |
| PIK01 | 16,055 | 3.6 | 2,879 | 63.7 | 1,639 | 36.3 | 4,518 |
| PIK02 | 9,834 | 3.4 | 1,314 | 45.2 | 1,591 | 54.8 | 2,905 |
| PIK03 | 2,156 | 3.6 | 92 | 15.2 | 513 | 84.8 | 605 |
| PIK04 | 3,893 | 3.9 | 629 | 62.3 | 380 | 37.7 | 1,009 |
| Total LRAs | 31,938 | 3.5 | 4,914 | 54.4 | 4,123 | 45.6 | 9,037 |
| Province | 439,767 | 3.7 | 73,500 | 61.3 | 46,319 | 38.7 | 119,819 |
| Grand total of LRAs | 474,761 | 3.7 | 93,845 | 72.8 | 35,138 | 27.2 | 128,983 |
| 4 Provinces in Total | 1,404,617 | 3.7 | 251,686 | 66.8 | 124,971 | 33.2 | 376,657 |

Source: NRD2C

Number is of all the villagers who live in the villages, which are located in the LRAs or where LRA farmers live. This number is different from the number of the LRA farmers but include all the villagers in the concerned village.

Each M/P code area is categorized based on the type of households. It was found that agricultural households are dominant in 40 out of the 52 M/P code areas. Particularly, in 27 M/P code areas, agricultural households share 75% or more. In contrary, there are some M/P code areas, in which non-agricultural households are dominant such as PRE12, ANN19 and PIK03.

**Table 4.4.18 Categorization of the M/P Code Areas by Household Type**

| Category | Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Agricultural households are dominant | Agricultural households is 75% or more | 01, 02, 05, 06, 07, 10, 13, 14 | 05, 07, 08, 13, 14 | 01, 02, 03, 04, 06, 07, 09, 10, 12, 14, 16, 17, 18, 20 | - | 27 |
| | Agricultural households are 50% - 70% | 03, 04, 11, 12 | 02, 09, 10 | 05, 08, 11, 13 | 01, 04 | 13 |
| Non agricultural households are dominant | Non agricultural households are 50% to 75% | 08, 09 | 01, 03, 04, 06, 11, | 15 | 02 | 9 |
| | Non Agricultural Households are 75% or more | - | 12 | 19 | 03 | 3 |
| Total | | 14 | 14 | 20 | 4 | 52 |

Source: NRD2C

(2) Income, Expenditure and Debt

Considering the annual household income from agriculture, the average of provincial data in the four provinces is 24,780 Baht, while average of the LRAs in the four provinces is 30,827 Baht. In the case of total household income, average of the four provinces is 32,376 Baht, while average of the LRAs in the four provinces is 37,497 Baht. Consequently, income level in the LRAs is same or rather higher than the overall average. In particular, income levels in the LRAs are higher for those who cultivate

field crops.

With regard to the income sources, 82.2% of the income comes from agriculture including livestock and fishery in the LRAs, while it does 76.5% in the whole provinces. The LRAs in Phitsanulok indicated highest dependency on agriculture at 88.3%, while the LRAs in Nan showed lowest at 78.9%. In addition, people in the LRAs depend upon field crops other than paddy. On average, only 35.8% of income derived from paddy in the LRAs, while 46.6% of income derived from paddy in whole provinces. This result seems to be related with the lower availability of water resources in the LRAs where farmland is rather hilly.

**Table 4.4.19 Average Household Income by Main Crop Type**

| LRA/ Province | | Paddy | Other Crops* | Livestock** | Fishery*** | Agriculture in Total | Employment | Total |
|---|---|---|---|---|---|---|---|---|
| PYO | LRAs | 16,258 | 8,971 | 1,074 | 58 | 26,361 | 6,642 | 33,003 |
| | % | 49.3 | 27.2 | 3.3 | 0.2 | 79.9 | 20.1 | 100.0 |
| | Province | 16,327 | 5,372 | 1,127 | 54 | 22,880 | 6,504 | 29,384 |
| | % | 55.6 | 18.3 | 3.8 | 0.2 | 77.9 | 22.1 | 100.0 |
| PRE | LRAs | 11,581 | 12,720 | 1,752 | 32 | 26,084 | 6,054 | 32,139 |
| | % | 36.0 | 39.6 | 5.5 | 0.1 | 81.2 | 18.8 | 100.0 |
| | Province | 11,336 | 5,841 | 1,323 | 45 | 18,545 | 5,896 | 24,441 |
| | % | 46.4 | 23.9 | 5.4 | 0.2 | 75.9 | 24.1 | 100.0 |
| ANN | LRAs | 10,736 | 20,465 | 2,816 | 41 | 34,059 | 9,116 | 43,175 |
| | % | 24.9 | 47.4 | 6.5 | 0.1 | 78.9 | 21.1 | 100.0 |
| | Province | 7,118 | 15,040 | 2,334 | 27 | 24,519 | 8,550 | 33,069 |
| | % | 21.5 | 45.5 | 7.1 | 0.1 | 74.1 | 25.9 | 100.0 |
| PIK | LRAs | 15,148 | 19,567 | 2,023 | 68 | 36,806 | 4,867 | 41,673 |
| | % | 36.3 | 47.0 | 4.9 | 0.2 | 88.3 | 11.7 | 100.0 |
| | Province | 25,531 | 5,561 | 1,943 | 143 | 33,177 | 9,433 | 42,610 |
| | % | 59.9 | 13.1 | 4.6 | 0.3 | 77.9 | 22.1 | 100.0 |
| Average | LRAs | 13,431 | 15,431 | 1,916 | 50 | 30,827 | 6,670 | 37,497 |
| | % | 35.8 | 41.2 | 5.1 | 0.1 | 82.2 | 17.8 | 100.0 |
| | 4 Provinces | 15,078 | 7,954 | 1,682 | 67 | 24,780 | 7,596 | 32,376 |
| | % | 46.6 | 24.6 | 5.2 | 0.2 | 76.5 | 23.5 | 100.0 |

Source: NRD2C

*: Short term crop (1)~(3), long term crop (1)~(3), orchard, vegetable, flower, rubber, perennial crop, dry season crop, and others.

**: Livestock: Beef, milk, buffalo, swine and poultry

***: Fishery: Inland fishery and breeding of inland fish

As for the income level, some differences are observed among the M/P code areas. In the 17 M/P code areas, average household income is lower than 25,000Baht/year. (See Table 4.4.20.)

**Table 4.4.20 Categorization of the M/P Code Areas by the Income Level**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Agricultural Household Income (Baht/ year)** [Average in all the M/P code areas: 30,827] | | | | | |
| Less than 25,000 | 03, 04, 05, 06, 08, 09, 11, 12 | 06, 07, 10, 11, 12, 13, 14 | 11, 20 | - | 17 |
| 25,000 ~ 35,000 | 7, 14 | 01, 02, 04, 08, 09 | 01, 03, 04, 05, 09, 12, 13, 14, 17, 18 | 03, 04 | 19 |
| 35,000 or more | 01, 02, 10, 13 | 03, 05 | 02, 06, 07, 08, 10, 15, 16, 19 | 01, 02 | 16 |
| Total | 14 | 14 | 20 | 4 | 52 |

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Total Household Income (Baht/year)** [Average in all the M/P code areas: 37,497] | | | | | |
| Less than 30,000 | 03, 05, 06, 08, 09, 11, 12 | 04, 07, 09, 10, 11, 12, 13 | 20 | - | 15 |
| 30,000 ~ 40,000 | 04, 07, 14 | 01, 05, 06, 08, 14 | 09, 11, 12, 13, 14, 17, 18 | 03, 04 | 17 |
| 40,000 or more | 01, 02, 10, 13 | 02, 03 | 01, 02, 03, 04, 05, 06, 07, 08, 10, 15, 16, 19 | 01, 02 | 20 |
| Total | 14 | 14 | 20 | 4 | 52 |

Source: NRD2C

Levels of incomes and expenditures are also available from the participatory survey as examples of sample communities in the Study Area. In Phrae, average household incomes were found to be 68,774 Baht/year in Tambon Bor Lek Long and 75,359Baht/year in Tambon Thung Laeng respectively. These figures are far lower than average income of the province, 117,336 Baht/year.

**Table 4.4.21 Household Income and Expenditure in the Selected Communities in Phrae**

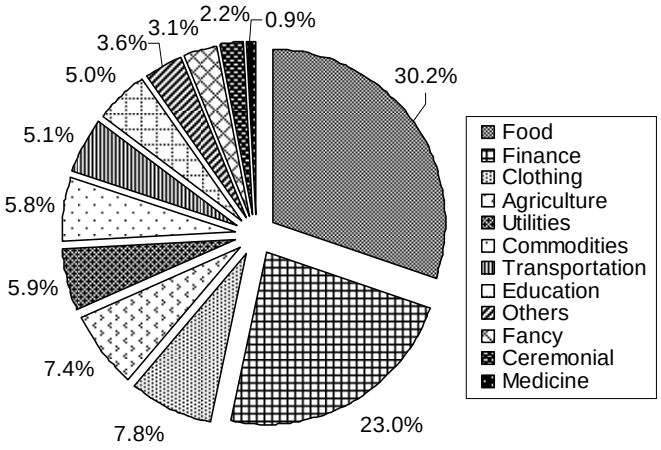
| Tambon | Income (A) | Expenditure (B) | Revenue (C=A-B) | Borrowing (D) | Remaining (C+D) |
|---|---|---|---|---|---|
| Bor Lek Long | 68,774 | 75,248 | ▲ 6,473 | 49,550 | 43,077 |
| Thung Laeng | 75,359 | 107,434 | ▲ 32,074 | 71,052 | 38,978 |
| Average | 72,067 | 91,341 | ▲ 12,849 | 60,301 | 41,028 |

Source: Participatory survey conducted by the Study Team in 2005
Note: Villages which shows unusual data were excluded.

According to the result of the participatory survey in Phrae, it was found that farmers spend much more amount than their incomes. It was also found that “food” and “finance” share 30.2% and 23.0% of the total expenditure, respectively. It implies that, to reduce the household expenditure, countermeasures should focus on food. The following table shows the main items and average amount of the household expenditure in the selected communities in Phrae.

**Table 4.4.22 Items of Average Household Expenditure in the Selected Communities in Phrae**

| Items | Average Expenditure |
|---|---|
| Food (meat, rice, vegetables, etc.) | 27,620 |
| Finance (BAAC repayment, etc.) | 20,972 |
| Clothing | 7,157 |
| Agriculture (input, labor, etc.) | 6,716 |
| Utilities (electricity, etc.) | 5,389 |
| Commodities (detergent, etc.) | 5,309 |
| Transportation (bus, etc.) | 4,626 |
| Education | 4,560 |
| Others | 3,300 |
| Fancy (alcohol and snacks) | 2,840 |
| Ceremonial (wedding, cremation) | 2,019 |
| Medicine | 833 |
| Total | 91,341 |




Source: Participatory survey conducted by the Study Team in 2005
Note: Villages, which shows unusual data were excluded (Village 1 and 3 in Bor Lek Long and village 1 in Thung Laeng).

According to the NRD2C data, people commonly borrow money from various sources such as BAAC, saving groups and/or other individual money lenders. On average, 69.9% of the households in the LRAs borrow money from revolving fund provided by the government. 41.6% of the households borrow money from BAAC and 26.9% from saving groups as well. In addition, no big differences were found between the M/P code areas and whole provinces.

**Table 4.4.23 Number of Households Borrowing Money from Different Sources**

| Type of Credit | PRE | PYO | ANN | PIK | LRAs in 4 Provinces | Whole 4 Provinces |
|---|---|---|---|---|---|---|
| Saving group for production | 3,068 | 9,362 | 18,631 | 3,579 | 34,640 | 108,267 |
| | 11.9% | 25.9% | 32.1% | 39.6% | 26.9% | 28.7% |
| Cooperatives | 4,659 | 4,348 | 13,616 | 885 | 23,508 | 66,515 |
| | 18.0% | 12.1% | 23.5% | 9.8% | 18.2% | 17.7% |
| BAAC | 8,913 | 15,013 | 25,717 | 3,971 | 53,614 | 144,161 |
| | 34.5% | 41.6% | 44.3% | 43.9% | 41.6% | 38.3% |
| Commercial bank or saving bank | 526 | 1,560 | 2,684 | 474 | 5,244 | 15,661 |
| | 2.0% | 4.3% | 4.6% | 5.2% | 4.1% | 4.2% |
| Financial institute for industry | 17 | 54 | 200 | 19 | 290 | 1,078 |
| | 0.1% | 0.1% | 0.3% | 0.2% | 0.2% | 0.3% |
| Money Render | 119 | 518 | 1,274 | 330 | 2,241 | 9,078 |
| | 0.5% | 1.4% | 2.2% | 3.7% | 1.7% | 2.4% |
| Revolving fund of government | 17,436 | 25,536 | 41,968 | 5,283 | 90,223 | 245,096 |
| | 67.5% | 70.8% | 72.3% | 58.5% | 69.9% | 65.1% |
| Total households | 25,840 | 36,079 | 58,027 | 9,037 | 128,983 | 376,657 |

Source: NRD2C

(3) Non Agro-industry

Data on (i) number of households that family member is employee, (ii) number of households which have cottage industry and handicraft and (iii) number of villages which have industry are available in the NRD2C. Averages in all the M/P code areas are 33.6%, 9.0% and 8.1% respectively.

**Table 4.4.24 Categorization of the M/P Code Areas by the Employment Condition**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **No. of households that family member is employee** [Average in all the M/P code areas: 33.6%] | | | | | |
| Less than 20% | 08 | 04, 05, 09, 14 | 09, 19 | 03 | 8 |
| 20% ~ 30% | 05 | 02, 03 | 06, 10, 12, 14, 15, 16 | 01, 02, 04 | 12 |
| 30% ~ 50% | 01, 02, 03, 06, 07, 09, 10, 11, 12, 13, 14 | 01, 06, 07, 08, 10, 11, 13 | 01, 02, 03, 04, 05, 07, 11, 13, 18 | - | 27 |
| 50% or more | 04 | 12 | 08, 17, 20 | - | 5 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **No. of households which have cottage industry and handicraft** [Average in all the M/P code areas: 9.0%] | | | | | |
| Less than 5% | 05, 06, 07, 09, 10, 12, 13 | 01, 02, 03, 04, 05, 10, 11, 12 | 09, 12, 17, 18, 19, 20 | 01, 02, 03, 04 | 25 |
| 5~20% | 01, 03, 04, 08, 11, 14 | 06, 07, 08, 09 | 03, 04, 06, 07, 10, 11, 13, 14, 15, 16 | - | 20 |
| 20% or more | 02 | 13, 14 | 01, 02, 05, 08 | - | 7 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **No. of villages which have industry** [Average in all the M/P code areas: 8.1%] | | | | | |
| Not exist | 01, 02, 03, 05, 08, 09, | 09, 10, 11, 12 | 09, 10, 13, 15, 19, 20 | 02, 04 | 20 |

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| | 13, 14 | | | | |
| ~ 10% | 04, 06, 07, 11, 12 | 08, 13, 14 | 01, 02, 03, 04, 07, 14, 16 | 01 | 16 |
| 10% or more | 10 | 01, 02, 03, 04, 05, 06, 07 | 05, 06, 08, 11, 12, 17, 18 | 03 | 16 |
| Total | 14 | 14 | 20 | 4 | 52 |

Source: NRD2C

(4) Road and Public Facilities

To examine the accessibility to urban area, data of average length and necessary time to the nearest district are available. In all the M/P code areas, average length and time is 12.97 km and 22.0 minutes respectively. Average density of main and rural road (1-4) is 0.30 km in 1000rai. While densities of on-farm road and farming pass are 0.71 km and 0.92 km in 1000 rai.

**Table 4.4.25 Road Condition by Province**

| Province | Road Density (km/1000rai) *1 | | | | To the nearest district (*2) | | |
|---|---|---|---|---|---|---|---|
| | 1-4 | 5-6 | 7 | 5-7 | Distance (km) | Time (hr) | Speed (km/hr) |
| PYO | 0.57 | 0.85 | 0.96 | 1.81 | 13 | 0.37 | 36 |
| PRE | 0.03 | 0.75 | 0.34 | 1.10 | 13 | 0.35 | 36 |
| ANN | 0.38 | 0.42 | 1.83 | 2.25 | 11 | 0.37 | 30 |
| PIK | 0.25 | 0.80 | 0.60 | 1.41 | 22 | 0.56 | 39 |
| Average | 0.30 | 0.71 | 0.92 | 1.63 | 13 | 0.38 | 34 |

(Source) *1 GIS, *2 NRD2C
(Note) 1-4: Main and rural road, 5-6: On-farm road, 7: Farming pass
Density: 1-4 divided by the total area, 5-7 divided by farmland area

There are 7 M/P code areas where average length to the nearest district exceeds 20km. Also there are 9 M/P code areas of which average time to the nearest district takes 30 minutes or more. In these areas, marketing opportunities of agricultural products or other industrial product seems to be unfavorable.

**Table 4.4.26 Categorization of the M/P Code Areas by the Accessibility**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Average length to the nearest district (km)** | | | | | |
| 20km or more | 03 | 05, 14 | 09, 17 | 02, 04 | 7 |
| 10km ~ 20km | 02, 04, 05, 07, 11, 12, 13, 14 | 04, 07, 08, 13 | 06, 07, 10, 11, 12, 13, 15, 18, 19 | 01 | 22 |
| Less than 10km | 01, 06, 08, 09, 10 | 01, 02, 03, 06, 09, 10, 11, 12 | 01, 02, 03, 04, 05, 08, 14, 16, 20 | 03 | 23 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **Time to the nearest district in 1 trip with popular vehicle (minute)** | | | | | |
| 30 or more | 03 | 05 | 06, 09, 15, 17 | 01, 02, 04 | 9 |
| 15 ~ 30 | 01, 02, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14 | 01, 02, 04, 06, 07, 08, 09, 10, 13, 14 | 01, 02, 03, 04, 05, 07, 10, 11, 12, 13, 16, 18, 19 | - | 36 |
| Less than 15 | - | 03, 11, 12 | 08, 14, 20 | 03 | 7 |
| Total | 14 | 14 | 20 | 4 | 52 |

Source: NRD2C

Quality of village road was also surveyed in the NRD2C. There are no difficulties in 50% of villages and slight difficulties in 30% throughout the year. Therefore, remaining 20% of villages have difficulties in wet season or throughout the year.

**Table 4.4.27 Village Road Conditions by Province**

| Province | Good throughout the year | Fair throughout the year | Good only in Dry S. | Fair only in Dry S. | Poor |
|---|---|---|---|---|---|
| PYO | 41% | 33% | 10% | 8% | 8% |
| PRE | 67% | 29% | 1% | 0% | 2% |
| ANN | 62% | 24% | 3% | 3% | 8% |
| PIK | 29% | 36% | 17% | 8% | 9% |
| Average | 50% | 30% | 8% | 5% | 7% |

Note: Village number basis, Source: NRD2C

**Table 4.4.28 Categorization of the M/P Code Areas by Village Road Conditions**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Villages good throughout the year (NRD2C)** | | | | | |
| <= 30% | 03, 04, 06, 07 | 12 | 04, 09 | 04 | 8 |
| 30% - 57% | 01, 09, 10, 11, 13 | 01, 02, 03 | 06, 08, 10, 11, 13, 18 | 01, 02 | 16 |
| 57% - 84% | 05, 08, 12, 14 | 04, 05, 06, 07, 08, 09, 11, 13 | 01, 03, 07, 12, 14, 15, 16, 17 | | 20 |
| 84% < | 02 | 10, 14 | 02, 05, 19, 20 | 03 | 8 |
| Total | 14 | 14 | 20 | 4 | 52 |

Present status of public facilities is compared among the 4 provinces. Availability of most facilities is around the same levels among the 4 provinces except for community center and hospital.

**Table 4.4.29 Percentage of Villages with Public Facilities by Province**

| Province | Community health | School | Community center | Public garden | Public telephone | Hospital | Agri. coop | Agri. tech. center |
|---|---|---|---|---|---|---|---|---|
| PYO | 84% | 66% | 47% | 23% | 79% | 5% | 24% | 78% |
| PRE | 90% | 79% | 59% | 17% | 80% | 21% | 22% | 84% |
| ANN | 97% | 69% | 69% | 15% | 84% | 13% | 21% | 78% |
| PIK | 89% | 64% | 29% | 16% | 65% | 5% | 23% | 81% |
| Total | 91% | 69% | 57% | 18% | 80% | 11% | 23% | 80% |

Note: Village number basis, Source: NRD2C

(5) Water Supply and Electrification

Village water supply has been carried out vigorously and reached to the coverage rate of 76% in village basis (640 villages) and 67% in household basis (67,600 households). There are still 198 villages and 34,000 households without village water supply systems. On the other hand, clean water availability records 86%, which is considerably higher than the village water supply coverage rate for household. This may result from the fact that many individual households commonly have their own rain storage systems and shallow wells.

**Table 4.4.30 Water Supply Condition by Province**

| Province | Total villages | Total households | Village water supply | Households served | Households with clean water |
|---|---|---|---|---|---|
| PYO | 251 | 32,187 | 73% | 67% | 87% |
| PRE | 163 | 23,048 | 81% | 71% | 90% |
| ANN | 349 | 38,501 | 76% | 64% | 84% |
| PIK | 75 | 7,893 | 80% | 68% | 79% |
| Total | 838 | 101,629 | 76% | 67% | 86% |

Source: NRD2C

**Table 4.4.31 Categorization of the M/P Code Areas by Water Supply Conditions**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Villages equipped with Village Water Supply (NRD2C)** | | | | | |
| <= 65% | 01, 05, 10, 11, 12 | | 04, 14 | | 7 |
| 65% - 81% | 04, 09, 13 | 01, 02, 04, 06, 08, 13 | 03, 06, 11, 13, 16, 18 | 01, 02, 04 | 18 |
| 81% - 99% | 02, 03, 06 | 03, 09 | 01, 05, 07, 10, 12, 15, 17 | | 12 |
| 100% | 07, 08, 14 | 05, 07, 10, 11, 12, 14 | 02, 08, 09, 19, 20 | 03 | 15 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **Households equipped with Village Water Supply (NRD2C)** | | | | | |
| <= 51% | 01, 05, 10, 11 | 01, 12 | 03, 04, 06, 14 | | 10 |
| 51% - 71% | 02, 04, 12 | 02, 03, 04, 06, 08, 11 | 05, 07, 11, 13, 16, 18 | 01, 02, 04 | 18 |
| 71% - 91% | 03, 06, 09, 13, 14 | 09, 13 | 01, 10, 12, 15, 17 | | 12 |
| 91% < | 07, 08 | 05, 07, 10, 14 | 02, 08, 09, 19, 20 | 03 | 12 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **Households with Clean Water (NRD2C)** | | | | | |
| <= 76% | 12, 14 | | 02, 12, 15, 17 | 01 | 7 |
| 76% - 87% | 02, 07, 09, 10, 11, 13 | 04, 05, 06 | 01, 04, 05, 07, 10, 13 | 02 | 16 |
| 87% - 98% | 01, 03, 04, 05, 06, 08 | 03, 07, 08, 09, 11, 14 | 03, 06, 09, 11, 14, 16,18, 20 | 04 | 21 |
| 98% - 100% | | 01, 02, 10, 12, 13 | 08, 19 | 03 | 8 |
| Total | 14 | 14 | 20 | 4 | 52 |

Electrification has also been progressed in the same way as village water supply. Electrification rate of village has reached to almost 100% in the LRAs. Only 2 villages in PYO 07 and PRE 04 are not yet electrified, and around 2,200 households remain without electricity.

**Table 4.4.32 Electrification Rates by Province**

| Province | Total villages | Total households | Village Ratio | Household Ratio |
|---|---|---|---|---|
| PYO | 251 | 32,187 | 99.6% | 97.7% |
| PRE | 163 | 23,048 | 99.4% | 98.8% |
| ANN | 349 | 38,501 | 100.0% | 98.3% |
| PIK | 75 | 7,893 | 100.0% | 93.2% |
| Total | 838 | 101,629 | 99.8% | 97.8% |

Source: NRD2C

**Table 4.4.33 Categorization of the M/P Code Areas by Electrification Rate**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Village electrified (NRD2C)** | | | | | |
| < 100% | 07 | 04 | | | 2 |
| 100% | 01, 02, 03, 04, 05, 06, 08, 09, 10, 11, 12, 13, 14 | 01, 02, 03, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14 | 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 | 01, 02, 03, 04 | 50 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **Households electrified (NRD2C)** | | | | | |
| <= 95% | 07 | 12 | 01, 08 | 01, 02, 04 | 7 |
| 95% - 98% | 06, 10, 11, 12, 13 | 04, 05 | 06, 10, 13, 14, 15, 16, 18, 20 | | 15 |
| 98% - 99% | 01, 02, 03, 04, 05, 08, 09, 14 | 01, 02, 03, 07, 08, 11, 13 | 02, 03, 04, 05, 07, 11, 17 | | 22 |
| 100% | | 06, 09, 10, 14 | 09, 12, 19 | 03 | 8 |
| Total | 14 | 14 | 20 | 4 | 52 |

(6) Waste and Sewage Management

Waste and sewage are managed by community, village, tambon or NGOs in the area. In the LRAs, 36% and 9% of villages have problems on waste and sewage management.

**Table 4.4.34 Percentage of Villages with Waste and Sewage Problem by Province**

| Province | Waste | | | Sewage | | |
|---|---|---|---|---|---|---|
| | Problem | Treated | Untreated | Problem | Treated | Untreated |
| PYO | 39% | 10% | 29% | 11% | 3% | 8% |
| PRE | 28% | 8% | 20% | 7% | 4% | 3% |
| ANN | 41% | 16% | 25% | 8% | 2% | 6% |
| PIK | 21% | 3% | 19% | 11% | 0% | 11% |
| Total | 36% | 12% | 24% | 9% | 2% | 6% |

Source: NRD2C
Note: Untreated: not treated or not in sanitary way

**Table 4.4.35 Categorization of the M/P Code Areas by Waste Problem**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Waste problem (NRD2C)** | | | | | |
| <= 2% | 03, 04 | 02, 10, 12, 14 | 02, 09, 10, 19, 20 | 03 | 12 |
| 2% - 20% | 05, 08, 14 | 01, 03, 05, 06, 07, 08, 13 | 03, 04, 07, 11, 17 | 02, 04 | 17 |
| 20% - 38% | 02, 06, 07, 09, 10, 13 | 04, 11 | 01, 06, 12, 13, 14, 15, 16, 18 | 01 | 17 |
| 38% < | 01, 11, 12 | 09 | 05, 08 | | 6 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **Sewage problem (NRD2C)** | | | | | |
| 0% | 02, 03, 04, 05, 08, 14 | 02, 03, 04, 05, 09, 10, 11, 12, 13, 14 | 02, 06, 08, 09, 10, 17, 19, 20 | 03 | 25 |
| 0% - 5% | 01 | 08 | 12, 14, 16 | | 5 |
| 5% - 11% | 10, 13 | 07 | 01, 03, 04, 05, 07, 11, 13, 15 | 02, 04 | 13 |
| 11% < | 06, 07, 09, 11, 12 | 01, 06 | 18 | 01 | 9 |
| Total | 14 | 14 | 19 | 4 | 52 |

(7) Fuel Source for Cooking

In the 41% of villages, people mainly use gas for cooking while charcoal, wood and husks are used in the remaining villages.

**Table 4.4.36 Fuel Source for Cooking by Province**

| Province | Gas | Charcoal, wood and husks |
|---|---|---|
| PYO | 54% | 46% |
| PRE | 58% | 42% |
| ANN | 24% | 76% |
| PIK | 41% | 59% |
| Total | 41% | 59% |

Source: NRD2C

**Table 4.4.37 Categorization of the M/P Code Areas by Fuel Source for Cooking**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Villages using wood, charcoal and husks (NRD2C)** | | | | | |
| <= 20% | 09 | 01, 02, 06, 09, 10, 14 | 19, 20 | 03, 04 | 11 |
| 20% - 55% | 06, 07, 08, 11, 12, 13, 14 | 03, 04, 08 | 04 | 02 | 12 |
| 55% - 90% | 01, 02, 03, 04, 05, 10 | 07, 11, 13 | 01, 03, 05, 06, 11, 12, 13, 14, 15, 16, 18 | 01 | 21 |
| 90% < | | 05, 12 | 02, 07, 08, 09, 10, 17 | | 8 |
| Total | 14 | 14 | 20 | 4 | 52 |

(8) Effect of the Chemical Use

Farmers in the LRAs have a great concern on the effect of chemical to their health condition. Specifically, they are afraid of negative impacts of pesticide and herbicide. In this regard, a blood test was carried out for some villagers in Village Ban Kong, Tambon Yom, Tha Wang Pha District in Nan on September 6 and 8, 2005 under the partnership with PLRO and Department of Public Health.

**Table 4.4.38 Result of Blood Test on Chemical Contamination**

| Contamination level | No. of Person | Percentage |
|---|---|---|
| Level 0 | 63 | 14.9% |
| Level 1 | 279 | 65.8% |
| Level 2 | 58 | 13.7% |
| Level 3 | 24 | 5.7% |
| Total | 424 | 100% |

Note: Level of chemical contamination is based on the standard of DPH.

### 4.4.4 Agriculture

(1) Land Holding

Average household land holding size can be estimated from the two data sources; namely SPK 4-01 distribution data obtained from the four PLRO and the NRD2C data. Here it needs to pay attention to the definition of both data. The SPK 4-01 distribution data are specific to the SPK farmers who receive

land certificates from ALRO, while the NRD2C data are calculated from the data of agricultural land area and number of agricultural households by village. As a whole, the SPK 4-01 farmers tend to have smaller size of agricultural land compared to other farmers in all the four provinces.

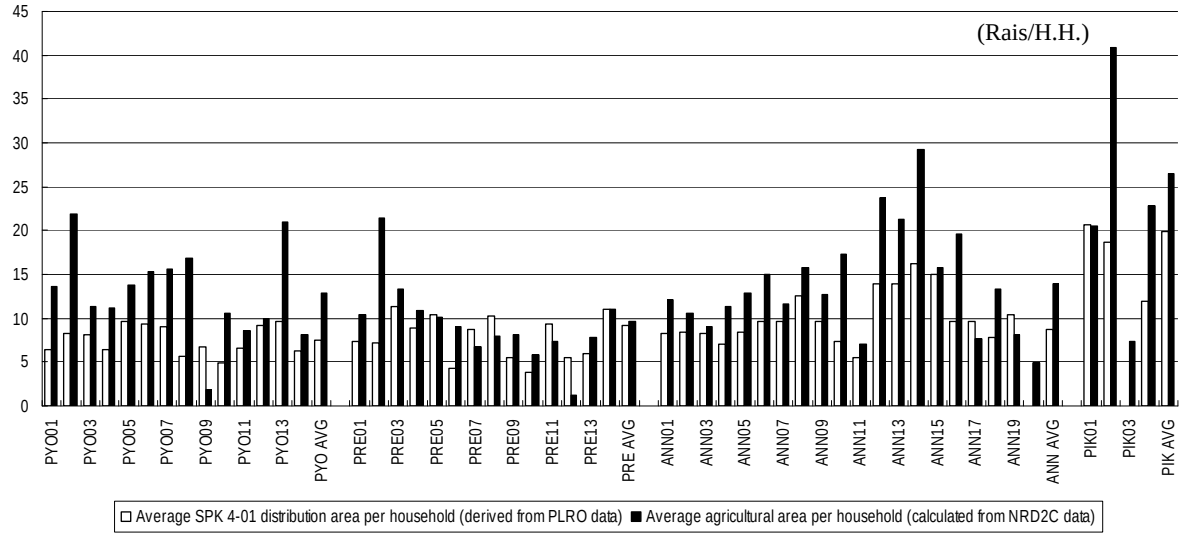



**Figure 4.4.6 Comparison of Average Land Holding Size**

As for land holding of the SPK 4-01 farmers, it is necessary to mention that they often have other land plots outside the LRAs. Questionnaire survey data conducted by the JBIC Loan Project in Northeastern Thai (The Project for Revitalization of the Deteriorated Environment in the Land Reform Areas through Integrated Agricultural Development / Stage 1) indicate that 35% of the SPK 4-01 holders have other land plots outside the LRAs and, in addition, these non-SPK 4-01 lands account for 45% of their total land holding area. It is quite probable that some of the SPK 4-01 farmers in the Study Area also have land plots other than the SPK 4-01 lands, but there are no available data which clarify the real land holding situations of the SPK 4-01 farmers.

(2) Major Crop Type

The NRD2C data include how many rais of land exist within each village by nine crop categories (paddy field, short term crops, long term crops, fruit trees, vegetables, rubber, flowers, perennial crops and others). Here, the nine crops are classified into six categories (paddy field, filed crops composed of short and long term crops, fruit trees, vegetables, rubber and other crops which include flowers, perennial crops and others). Based on these categories, dominant crop type is determined by each M/P code area. (See Table 4.4.39.)

There is another kind of dataset; household based data in the NRD2C data. With them, it is possible to estimate which crops are popular among the villagers since the data include how many households are engaged in specific crop cultivation by village. (See Table 4.4.40.)

**Table 4.4.39 Categorization of the M/P Code Areas by Agricultural Land Use**

| Group | Sub-group | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Paddy field is dominant. | P1: Paddy field represents more than 75%. | 03, 08, 09 | - | - | 03, 04 | 5 |
| | P2: Paddy field represents 50 – 75%. | 02, 05, 06, 07, 10, 11, 12, 13 | 06, 07, 09, 10, 11, 12 | - | - | 14 |
| Field crops are dominant. | FC1: Field crops represent more than 75%. | - | 04 | 08, 09, 10, 14, 15 | 01, 02 | 8 |
| | FC2: Field crops represent50 – 75%. | 01, 04 | 01, 02, 03 | 01, 05, 06, 07, 12, 13, 16, 17, 18 | - | 14 |
| Fruit trees are dominant. | F1: Fruit trees represent more than 75%. | - | - | - | - | 0 |
| | F2: Fruit trees represent 50 – 75%. | - | 14 | - | - | 1 |
| Other | Above features are not applied. | 14 | 05, 08, 12 | 02, 03, 04, 11, 19, 20 | - | 10 |
| Total | | 14 | 14 | 20 | 4 | 52 |

Source: NRD2C data

**Table 4.4.40 Categorization of the M/P Code Areas by Crop Popularity**

| Group | Popularity | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Paddy | More than 75% of households in the area cultivate. | 01, 02, 03, 06, 07, 08, 13, 14 | 05, 06, 07, 08, 09, 13, 14 | 04, 12 | - | 17 |
| | 50 – 75% of households in the area cultivate. | 04, 05, 10, 11, 12 | 02, 03, 10 | 01, 02, 03, 05, 07, 11, 14, 17, 18, 19, 20 | 01, 02, 03, 04 | 23 |
| | 25 – 50% of households in the area cultivate. | 09 | 01, 04 | 06, 10, 13, 15, 16 | - | 8 |
| Field crops | More than 75% of households in the area cultivate. | - | - | 07, 08, 09, 10, 13, 15, 16 | - | 7 |
| | 50 – 75% of households in the area cultivate. | 01, 04, 13, 14 | 01, 03, 04, 05, 09 | 03, 05, 06, 12, 14, 17, 18 | - | 16 |
| | 25 – 50% of households in the area cultivate. | 02, 05, 06, 07, 08, 12 | 02, 06, 08, 11, 13 | 01, 02, 04, 11, 19 | 01, 02 | 18 |
| Fruit trees | 50 – 75% of households in the area cultivate. | 10 | 14 | 08, 12, 18, 19 | - | 6 |
| | 25 – 50% of households in the area cultivate. | 05 | 08, 10 | 01, 02, 05, 06, 13, 14, 15 | - | 10 |
| Vegetables | 25 – 50% of households in the area cultivate. | 01 | - | 04, 19 | - | 3 |

Source: NRD2C data

As expected, paddy is the most popular because more than half of the households in each M/P code area are engaged in paddy farming in the 40 out of 52 M/P code areas (77%). This implies that most households in the M/P code areas do paddy farming even other crops such as field crops and fruit trees are major in their areas.

Paddy cultivation is more popular for households in Phayao and Phrae than in Nan and Phitsanulok. As regard to short term crops such as corn, groundnuts and soybean, they are more popular in Nan than in other three provinces because more than half of households cultivate them in the 14 out of 20

M/P code areas. Fruit growing is rather popular in Phrae compared to other three provinces.

(3) Livestock

Commercial livestock is not a major activity since no livestock is raised in more than 50% of households in the M/P code areas. In particular, very few households do livestock activities in Phitsanulok where any kinds of livestock are not raised even in one tenth of households in each M/P area.

**Table 4.4.41 Categorization of the M/P Code Areas by Livestock Popularity**

| Livestock | Popularity | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Beef cattle for sale | More than 30% of households in the area raise. | - | - | 10 | - | 1 |
| | 20 – 30% of households in the area raise. | - | - | 09 | - | 1 |
| | 10 – 20% of households in the area raise. | 10, 11, 14 | 05 | - | - | 4 |
| Buffaloes for sale | 20 – 30% of households in the area raise. | - | - | 17 | - | 1 |
| Swine for sale | More than 30% of households in the area raise. | - | - | 17 | - | 1 |
| | 20 – 30% of households in the area raise. | - | 05 | 05, 10 | - | 3 |
| | 10 – 20% of households in the area raise. | - | 13, 14 | 01, 02, 03, 04, 07, 12, 13, 14, 15, 16 | - | 10 |
| Poultry for sale | More than 30% of households in the area raise. | 08 | 14 | 15 | - | 3 |
| | 20 – 30% of households in the area raise. | - | 08 | - | - | 1 |
| | 10 – 20% of households in the area raise. | 02, 03, 05, 06 | 06, 07 | 04, 05, 06, 12 | - | 10 |

Source: NRD2C data

(4) Farm Machines

Farm machines are more widely extended in Phayao and Phitsanulok as compared to Phrae and Nan. In Phayao, more than half of the households own small engine for farming in the 4 M/P code areas out of 14. In Phitsanulok, more than a quarter of the households own small engine for farming in every M/P code area.

**Table 4.4.42 Categorization of the M/P Code Areas by Farm Machine Utilization**

| Type | Feature | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Possession of small engine | 50 – 75% of households in the area own small engine. | 02, 03, 07, 13 | - | - | 01, 03 | 6 |
| | 25 – 50% of households in the area own small engine. | 01, 05, 06, 08, 10, 11, 14 | 08, 09, 14 | 12 | 02, 04 | 13 |
| Hiring of small | More than 75% of households in the area hire it. | - | - | 19 | - | 1 |

| Type | Feature | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| engine | 50 – 75% of households in the area hire it. | - | - | - | - | - |
| | 25 – 50% of households in the area hire it. | 01, 04, 05, 06, 11, 12, 14 | 01, 02, 03, 06, 07, 08, 09, 10, 13, 14 | 01, 02, 03, 04, 05, 06, 07, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20 | - | 34 |
| Hiring of big engine | More than 75% of households in the area hire it. | - | - | 15, 19 | - | 2 |
| | 50 – 75% of households in the area hire it. | - | 02 | 12, 13, 18 | 02, 03 | 6 |
| | 25 – 50% of households in the area hire it. | 01, 02, 04, 05, 08, 13, 14 | 01, 03, 04 | 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 14, 16 | 01 | 23 |

Source: NRD2C data

(5) Agricultural Inputs and Farming Technology

There is one M/P code area where application of only natural fertilizer is dominant (PYO02) but this is an exceptional case. In most M/P code areas, people use both chemical and natural fertilizer.

**Table 4.4.43 Categorization of the M/P Code Areas by Agricultural Inputs Utilization**

| Type | Feature | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Use only natural fertilizer | 50 – 75% of households in the area use. | 02 | - | - | - | 1 |
| | 25 – 50% of households in the area use. | - | - | 04, 15 | - | 2 |
| Use both chemical and natural fertilizer | More than 75% of households in the area use. | 01, 03, 07, 08, 13, 14 | 05 | 01, 07, 09, 10, 13, 16, 19 | 01 | 15 |
| | 50 – 75% of households in the area use. | 04, 05, 06, 10, 11, 12 | 01, 02, 03, 04, 06, 07, 08, 09, 10, 13, 14 | 02, 03, 05, 06, 08, 11, 12, 14, 15, 18, 20 | 02, 03, 04 | 31 |
| | 25 – 50% of households in the area use. | 09 | 11 | 04, 17 | - | 4 |

Source: NRD2C data

For paddy cultivation, fertilizer seems to be commonly applied. In addition, seeds of promoted variety are widely used, but rather less common than the application of fertilizer. This difference may attribute to the fact that some people grow upland rice with local variety seeds, mainly on undulating farm land.

**Table 4.4.44 Categorization of the M/P Code Areas by Inputs Utilization for Paddy**

| Type | Feature | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Use fertilizer for paddy | More than 75% of households in the area use. | 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, 13, 14 | 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, | 01, 02, 03, 04, 05, 06, 07, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20 | 01, 02, 03, 04 | 47 |
| | 50 – 75% of households in the area use. | - | 13, 14 | - | - | 2 |
| | 25 – 50% of households in the area use. | - | - | 17 | - | 1 |

| Type | Feature | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Use promoted seed for paddy | More than 75% of households in the area use. | 01, 03, 05, 06, 07, 08, 10, 12 | 01, 02, 03, 04, 05, 06, 09, 10, 11, 14 | 01, 02, 12, 13, 14, 15, 16, 17, 19, 20 | 02, 03 | 29 |
| | 50 – 75% of households in the area use. | 04, 11, 13, 14 | 08, 12, 13 | 03, 04, 05, 06, 07, 10, 18 | 01 | 15 |
| | 25 – 50% of households in the area use. | 02 | 07 | 11 | 04 | 4 |

Source: NRD2C data

As regard to the agricultural extension, the front line offices of DOAE at the tambon level are Technical Transfer Centers (TTCs). Availability of TTCs services as well as the problem of knowledge for other cropping technologies is measured by the number of villages. In the 39 M/P code areas, TTCs services are basically available. There are no differences among the provinces. But in about a half of the M/P code areas, more than 50% of villages have the problem of knowledge for other cropping.

**Table 4.4.45 Categorization of the M/P Code Areas by Extension Services**

| Type | Feature | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|---|
| Availability of Technology Transfer Center Services | Available in more than 75% of villages in the area | 02, 03, 04, 07, 08, 10, 11, 12, 13, 14 | 01, 04, 05, 06, 07, 08, 09, 10, 11, 13, 14 | 01, 02, 03, 04, 05, 07, 08, 09, 10, 12, 13, 16, 17, 18, 19 | 01, 02, 03 | 39 |
| | Available in 50 – 75% of villages in the area | 05, 06 | 02, 03 | 06, 11, 14, 15 | 04 | 9 |
| | Available in 25 – 50% of villages in the area | 01, 09 | - | - | - | 2 |
| Problem of no knowledge for other cropping | More than 75% of villages in the area have. | - | 02, 05, 12 | 09, 17 ,20 | 03 | 7 |
| | 50 – 75% of villages in the area have. | 01, 02, 03, 04, 05, 09, 12 | 03 | 05, 06, 07, 10, 14, 16, 18, 20 | 01, 04 | 18 |
| | 25 – 50% of villages in the area have. | 06, 07, 10, 11, 13, 14 | 04, 08, 11, 13, 14 | 01, 02, 03, 04, 05, 06, 07, 10, 11, 12, 17 | - | 22 |

Source: NRD2C data

(6) Irrigation Facilities

According to the NRD2C data, 92% of villages (770 out of 838) have some kinds of water resources while only 7% of villages (58) are benefited by irrigation projects in the LRAs. From a viewpoint of perennial stream density, ratio of irrigated villages is proportional to the density of perennial stream density.

**Table 4.4.46 Availability of Water Source by Province**

| Province | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| Water resources (village basis) | 87% | 92% | 97% | 93% | 92% |
| Irrigation project (village basis) | 4.4% | 1.8% | 10.9% | 9.3% | 7.0% |
| Perennial stream Density (km/rai) | 0.42 | 0.30 | 0.70 | 0.67 | 0.51 |

Source: NRD2C data

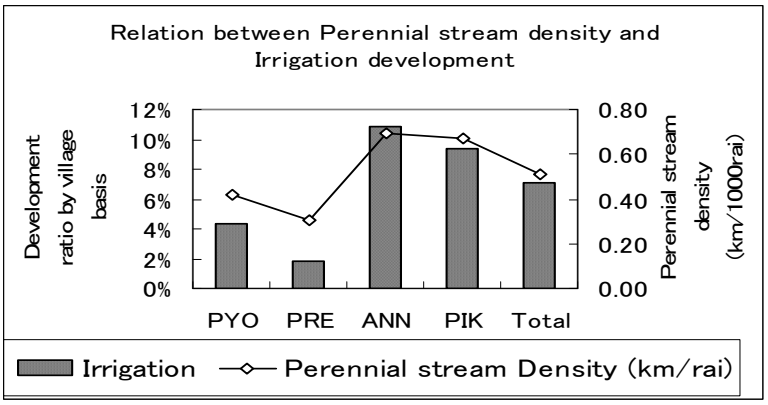



**Figure 4.4.7 Relation of Perennial Stream Density and Ratio of Villages with Irrigaiton**

**Table 4.4.47 Categorization of the M/P Code Areas by Water Resources Availability**

| Sub Category | PYO | PRE | ANN | PIK | Total |
|---|---|---|---|---|---|
| **Availability of Water resources (Village basis)** | | | | | |
| <= 83% | 03, 07, 09, 11, 12 | 01, 03, 06 | | | 8 |
| 83% - 94% | 06, 13 | 04, 07, 08 | 01, 05, 11 | 02, 04 | 10 |
| 94% - 99% | 01, 04 | | 06, 12, 14 | 01 | 6 |
| 100% | 02, 05, 08, 10, 14 | 02, 05, 09, 10, 11, 12, 13, 14 | 02, 03, 04, 07, 08, 09, 10, 13, 15, 16, 17, 18, 19, 20 | 03 | 28 |
| Total | 14 | 14 | 20 | 4 | 52 |
| **Availability of Irrigation project (Village basis)** | | | | | |
| 0% | 06, 10, 14 | 01, 03, 04, 05, 09, 10, 11, 12, 13, 14 | 02, 04, 08, 09, 10, 14, 17, 20 | 03 | 22 |
| 0% - 9% | 01, 07, 11, 12 | 07, 08 | 01, 06, 07, 16 | 01 | 11 |
| 9% - 21% | 03, 04, 08, 09, 13 | 06 | 03, 05, 11 | 02 | 10 |
| 21% < | 02, 05 | 02 | 12, 13, 15, 18, 19 | 04 | 9 |
| Total | 14 | 14 | 20 | 4 | 52 |

Source: NRD2C data

## 4.5 ORGANIZATIONS FOR LRAs DEVELOPMENT

### 4.5.1 ALRO and ATSAP

ALRO has the power and duty to undertake agricultural land reform implementation in accordance with the Agricultural Land Reform Act. The role and responsibilities are summarized as the two activities, land distribution and LRA development. Land distribution involves cadastral survey, checking of ownership, issue of land use certificates, etc. LRA development includes two main activities, infrastructure development, and income generating activities and restructuring of agricultural production. These activities include construction of small irrigation facilities, access roads and farm ponds for integrated farming, and strengthening of cooperatives. Agricultural Land Reform Executive Committee (ALREC) consisted of the Minister of the MOAC as chairperson, the Permanent Secretaries of the Ministry of Agriculture and Cooperatives, Commerce, Interior and Industry, the Director Generals of governmental organizations concerned, the Manager of BAAC and farmers' representatives. The Secretary-General of ALRO acts as member and secretary.

ATSAP, under Office of the Permanent Secretary (OPS), has the responsibility to study, analyze and formulate policy and prospective plan and to facilitate cooperation between government agencies and other related agencies for sustainable agriculture but it has no regional and provincial offices. Followings are the responsibilities of ATSAP.

(1) To study, analyze and formulate the policy and prospective plan for development of agricultural technology and sustainable agriculture proposing to ATSAP Board.
(2) To facilitate cooperation between government agencies, privates sectors, academic institutions and non-organizations in order to improve the development of agricultural technology and sustainable agriculture.
(3) To assist in local scientific research, local biodiversity registers, agricultural technology development, and traditional knowledge development on the economic benefit at all farm level.
(4) To function as the core representative for coordinating foreign donor assistance to Ministry of Agriculture and Cooperative related to agricultural technology and sustainable agriculture.
(5) To promote farmer's rights on scientific research and traditional knowledge.
(6) To coordinate the policies and operation and operations on the agricultural technology and sustainable agriculture with concerned agencies.

### 4.5.2 Organizations at Provincial Level

(1) Provincial Land Reform Office

Provincial Land Reform Offices (PLROs) are under the ALRO and have the power and duties to carry out agricultural land reform activities as prescribed by the Agricultural Land Reform Executive Committee and Provincial Land Reform Committee. PLRO normally consists of five units of Administration, Land reform management, Finance and Accounting, Legal affairs, and Cadastral survey and mapping. The number of staff in the 4 provinces is shown below.

**Table 4.5.1 Number of Staff of the Four PLROs**

| Provincial organization | Phayao | Phrae | Nan | Phitsanulok |
|---|---|---|---|---|
| Director | 1 | 1 | 1 | 1 |
| Administration | 3 | 2 | 2 | 2 |
| Land Reform Management | 5 | 3 | 5 | 3 |
| Account | 4 | 4 | 4 | 4 |
| Legal affair | 4 | 2 | 5 | 2 |
| Survey and Mapping | 4 | 2 | 3 | 2 |
| Permanent employee (driver, etc) | 2 | 2 | 4 | 1 |
| Temporary employee | 1 | 13 | 4 | 5 |

Note: The number of staff is based on the annual report in fiscal year 2003 or 2004.

There is only a few staff to operate any technical matters related with agricultural and rural development. According to the provincial annual report, their budget plan ranges between 3.5 and 11.9 million Baht.

**Table 4.5.2 Budget Plans of the Four PRLOs**

| Province / Budget year | Phayao | Phrae | Nan | Phitsanulok |
|---|---|---|---|---|
| | Y.2003 | Y.2004 | Y.2004 | Y.2003 |
| 1. General land reform works | 6,121,376 | 2,633,050 | 5,604,892 | 529,685 |
| 2. Infrastructure development | 5,827,100 | 59,500 | 91,400 | 7,274,960 |
| 3. Special project | - | 772,560 | - | 1,212,213 |
| Total | 11,948,476 | 3,465,110 | 5,696,292 | 9,016,858 |

Note; Budget was sorted into three categories from the PLRO Annual Report by the Study Team.

Provincial Land Reform Committee (PLRC) consists of the Provincial Governor as chairperson, the directors of provincial offices of governmental organizations concerned. The Director of PLRO acts as member and secretary, and has the power, duties and responsibilities of establishing operational measures and procedures taken by the PLRO.

(2) Related Provincial Government Agencies

Regarding the LRAs development, there are many activities such as agriculture and community development and infrastructure construction. Hence relevant government agencies and departments under the MOAC are involved in related development fields. At the provincial level, the governmental offices such as Provincial Agricultural Extension Office (PAEO), Provincial Land Development Office (PLDD), Provincial Forest Office (PFD), Office of Provincial Natural Resource and Environment (OPNRE), Provincial Agricultural and Cooperatives Office (PACO), etc. are related to the LRA development. PRLO is necessary to cooperate with these offices for the development of LRAs.

The Provincial Development Plan covers all the related development plans including district and tambon development plans. Provincial Administration Organization (PAO) also has its own development plan which is prepared through development and supporting committees consisted of local government officials.

### 4.5.3 Organizations at Tambon Level

(1) Tambon Administration Organization

Tambon Administration Organizations (TAOs) have authority to determine development policies and relevant plans according to the functionality and the scope prescribed in the relevant law and regulations. TAOs are classified from class-1 to class-5 according to the amount of the revenue which comes from three sources; tax from their own jurisdiction, funds allocated from the central offices, and project funds from the related agencies. In general, TAO is administered by the Tambon Council consisted of the members elected by villagers and the Executive Committee organized by chairman and two executive members. TAO also has some full-time staff. (For example, there are three staff in charge of head, finance and civil, in the class-5 tambon).

Tambon Development Plan is prepared and operated by TAO or Tambon Council. TAO has

responsibility to perform the functions such as providing and maintaining of roads, waterways, public places for local people, health care services, preventing diseases and so forth. Although TAO is expected to play an important role in rural development under the recent decentralization policies, there are some constraints such as insufficient resources, lack of development knowledge and coordination among the related government agencies.

(2) Technology Transfer Center

Based on the MOAC's policy, the Technology Transfer Centers (TTCs) have been established in every tambon under the Department of Agricultural Extension (DOAE). The policy intends to change the procedures of agricultural development by putting the farmers at the center of stage, and the TTCs have an important role to develop the capacity of farmers by providing the necessary services at one place (so-called "one stop service" center).

According to the DOAE, the main purpose of establishing TTCs is to coordinate agriculture staff, NGOs and local people in facilitating grass-root development. TTCs shall discuss agriculture-related problems with farmers, collect the necessary data on the areas, and prepare tambon development plans. In general, TTC is composed of DOAE official, members from TAO and advanced farmers in the communities.

### 4.5.4 NGOs and Local Human Resources

There are various local NGOs in the North Thailand, which can work with the communities for rural development. Some of them maintain networks with the farmers, farmers groups and other institutions/organizations. Also some of them cultivate good relationships with the government agencies concerned including PLROs.

In addition, there are individual local resources from province, TAOs and farmers who know rural development and participatory approach method. They are expected to work with local people as trainers or facilitators to support their improvement. According to the participatory survey conducted during the Study period, it was found that there are local human resources such as innovative farmers, local intellectuals and monks who can provide technical and mental support for villagers. There are also a couple of people who have joined a series of training programs provided by JICA. Such individuals have high potential to play key roles in the development activities.

# CHAPTER 5 FORMULATION OF MASTER PROGRAM

## 5.1 CONTEXTUAL OUTLINES OF THE MASTER PROGRAM FORMULATION

### 5.1.1 Policies of the Central Government

(1) 10th Economic and Social Development Plan

The 10th National Economic and Social Development Plan (2007-2011) adopts the “Philosophy of Sufficiency Economy” bestowed by His Majesty the King as the guiding principle in national development and management. In the plan, the following objectives are started.

1. To develop quality of human resources
2. To develop communities and facilitate poverty reduction
3. Economic goals: promoting economic stability and sustainability and developing balanced economic structure
4. To conserve natural resources and practice a suitable environmental management
5. To establish good governance

In order to achieve these objectives, there are strategies, which are related to the Study as described below.

1. To strengthen human resources and communities so as to develop a knowledge-based society
2. To strengthen communities so as to stabilize the nation
3. To develop communities with preserving biodiversity and natural resources so as to stabilize natural environment

(2) Development Strategies

In order to give an appropriate thrust for development in compliance with the stipulated policy, vision and objectives of the National Plan, following strategies for development , which are related to this Study are described.

1. Developing human resources and society; enlighten ideas of moral, build a safety net, build a network of knowledge about economy, society, natural resources and environment in community and national levels
2. Strengthening community; strengthening community through collaborative learning process with utilization of traditional knowledge, promotion of community development balanced with natural resources and sprit of cooperation through identification of natural resources and environment and support for networking of natural resource management in community level.
3. Development of communities with preserving biodiversity so as to stabilize natural

environment; promotion of local people's participation and empowerment about natural resources management in community; promotion of conservation farming and expansion of organic farming and sustainable agriculture areas.

### 5.1.2 Lessons Learned from the Field Survey

Most of the lessons derived from the field survey are related with natural resources/farming practice/ rural life and local human resources in and around the LRAs. It was found that many of the LRAs are located on relatively unfavorable farming lands such as sloping land, low soil fertility and difficult access to water resources. Many local people rely in their living on the forest resources in and around the LRAs.

The Thai government has enforced the banning of logging concession and zoning policy to protect natural resources of forest area. Although large-scale illegal logging has been ceased, natural resources in forest area are still deteriorating because of illegal activities in the forest area and occasional forest fire. In the past, many development projects were implemented under the top-down manner but local people were not well involved into them. In addition, it is often pointed out that many of them were budget-oriented, hence, rarely sustainable.

Even though ALRO/ATSAP and PLRO are in charge of issuing land use title deeds and promoting agricultural and rural development in the LRAs, it is a fact that staff and budget for the agricultural and rural development activities are quite limited. Consequently, operations coordinated with the related organizations are very important for effective agricultural and rural development activities, but they cannot be easily planned or implemented due to the prevailing bureaucratic sectionalism.

Considering the limited governmental capacities in human resources and budget to conserve vast forest area in the North Thailand, participation of local people in conservation and management activities is indispensable to ease deterioration of forest area and to enhance enforcement of the zoning system. Furthermore, local people are also required to be independently involved in development processes to make agriculture and rural development more sustainable.

To realize the participation of local people, they should be involved in the entire development processes including problem analysis, planning, implementation, monitoring and so forth. Ownership for development plans/projects would be deeply cultivated through people's participation. In this context, the Master Program (M/P) needs to include the concept of human development processes for participants. In order to realize such human development, learning process (such as participatory survey described in Chapter 4) was integrated into the formulation processes of the M/P.

Furthermore, in order to enable local people to decide their development processes by themselves, the M/P is required to be flexible and to be a kind of "guideline" which indicate development frame and direction toward development goals. The rigid "blue-print" type program, in which local people are

subordinate to development activities, should be avoided.

However, local people are not always capable to organize themselves toward effective development processes, and technical support from outside is often necessary. Although the government agencies are expected to help local people, timely and appropriate assistance is rarely provided due to the still prevailing sectionalism. Considering that there are local human resources who presently help villagers improve their livelihoods at grass root levels, it is more practical and effective to mobilize them as facilitators and/or supporters and to extend their activities to the related LRAs.

### 5.1.3 Basic Concept of the Master Program

The M/P shows a mechanism composed of programs and components, which indicate development frame and direction toward the super goal, and function how government organizations, local people and local human resources cooperate with each other to implement the programs and components in the LRAs. Human resources development process is incorporated into the M/P implementation process. People living in the LRAs are expected to be the main actors for their own LRAs development. Concerned government organizations at central, provincial and tambon levels and local human resources are considered to work as supporters who promote development activities in and around the LRAs. The above concept is summarized in Figure 5.1.1.

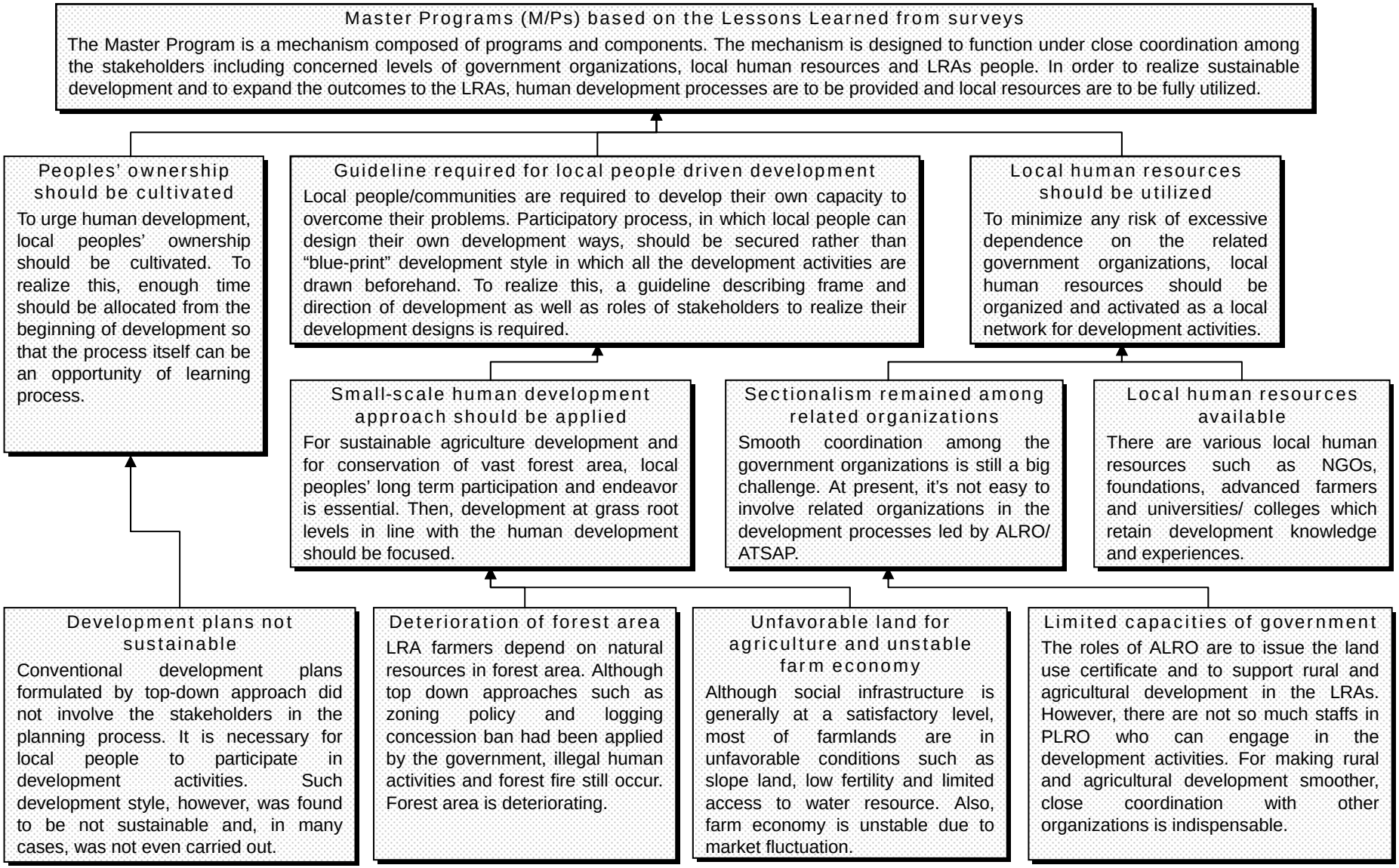


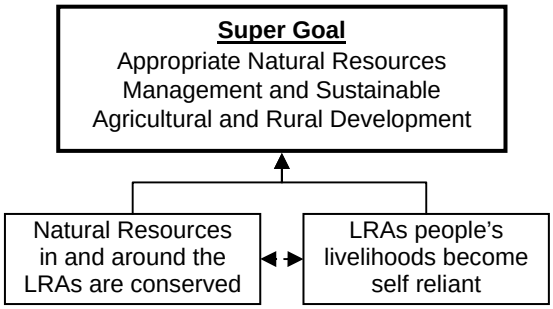

**Figure 5.1.1 Lessons Learned through the Analysis of the Present Situations and Approaches for the M/P Formulation**

## 5.2 DEVELOPMENT DIRECTION OF THE MASTER PROGRAM

### 5.2.1 Toward Achievement of the Super goal

The super goal of the Study is to fulfill the followings in the north region.

1) To realize an appropriate natural resource management
2) To improve the rural livelihood through sustainable agriculture
3) To contribute to poverty eradication in the north region through achieving the above two goals




To attain the super goal, the M/P is formulated in the selected four provinces ***in order to implement sustainable rural and agricultural development mainly in the LRAs with people in the local community and related organization, promoting proper management of natural resources.***

To attain the objectives, following two targets were set for formulating the M/P.

- Local people's livelihoods become self-reliant.
- Natural resources in and around the LRAs are conserved.

Poverty at villages in and around the forest is caused by 'Villagers enter in the forest and excessively collect natural resources'. However, they do not have concepts that they need to improve the situation and they can utilize natural resources in it to improve their livelihood' or 'their choices to achieve the improvement are narrowed'. Based on this understanding, the direction of development to achieve the objectives is described in context of 'If livelihood of people who are utilizing natural resources in and around the forest becomes improved and self-reliant, people manage natural resources utilization sustainedly to obtain benefits from the forest. That leads to realization of the natural resource management in a large area'.

Two issues 'Local people's livelihoods become self-reliant' and 'Natural resources in and around the LRA are conserved' are in a spiral relationship of means/objectives. That is shown in Figure 5.2.1 (Note: The approach does not show the order of the implementation of activities. The initiation of an activity is depending on the situation of the area.).

A basic road map, to achieve the objectives, is designed on the basis of the problem discussions in context of the four selected provinces at Participatory Survey (ref. 4.1). The context is 'If livelihood of people of the LRAs who are utilizing natural resources and receiving benefits from them becomes improved and self-reliant, the natural resources will be managed and conserved to sustain the benefit obtained from there'.

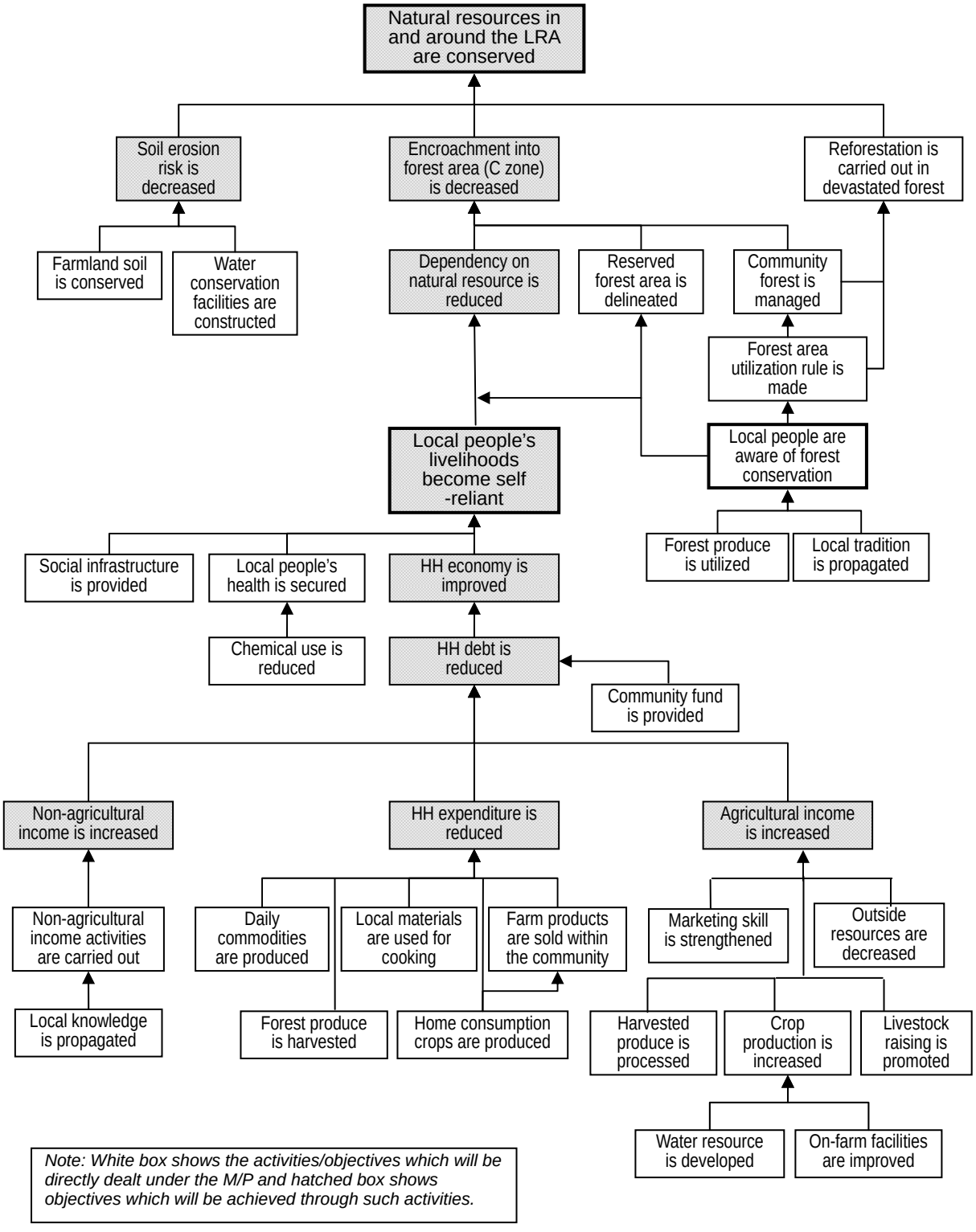



**Figure 5.2.1 Development Approaches to the Targets**

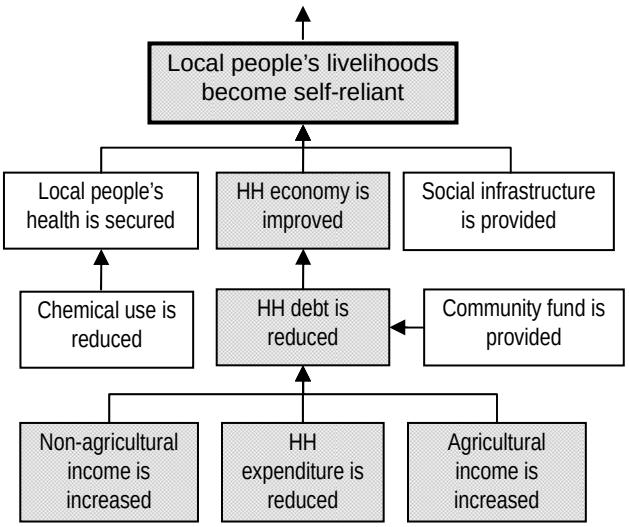
As a basic development policy, first, achievements from 'Income generation and expenditure reduction improve people's livelihood', lead to 'Encroachment into forest area is decreased' and 'Economic dependency on natural resource is reduced'. Furthermore, they lead to 'Natural resources in and around the

LRA are conserved'.

As a development direction toward livelihood improvement and self-reliance, reducing inputs from outside and utilizing natural resources close to the community lead to 'HH expenditure is reduced', 'Agricultural income is increased' and 'Non-agricultural income is increased'. As a result, 'HH economy is improved' is realized through 'HH debt is reduced'. In addition to the above development direction, as a development direction toward natural resource management, first, ''Local people's livelihoods become self-reliant'' and ''Local people are aware of forest conservation '' are achieved through the improvement of income generation and expenditure reduction. Then, the achievements lead to ''Dependency on natural resource is reduced'' and ''Encroachment into forest area is decreased''. Consequently, ''Natural resources in and around the LRA are conserved'' is achieved. (Figure 5.2.1 does not show the sequence of the activities. Concrete activities, which are along means/objectives, are implemented according to conditions (e.g., existence of the community forest, farming method/ livelihood and utilization of natural resources, and people's consciousness for natural resource conservation).

**(1) Approaches to the "Local people become self-reliant"**

In the LRAs on the periphery of forest area, cash crop production has gradually expanded as the capital market system has grown. The fluctuation of farm produce prices often caused unstable household economy to local people. Particularly, the LRAs farmers rely heavily on loans from banks such as BAAC. In this context, improvements of household economy must be one of the primary problems to be solved for attaining their self-reliance. Since they are burdened with heavy debt, development approach should focus on the "Household (HH) debt is reduced".

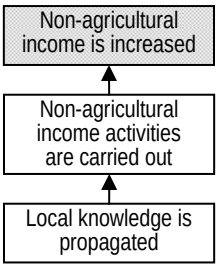



'Social infrastructure is provided' and 'Local people's health is secured' support 'Local people's livelihoods become self-reliant'. The approach of 'Local people's health is secured' is proposed on a basis of the concept that health is fundamental in livelihood. A drastic approach is required to achieve that. In addition to that, health related activities are outside the scope of this M/P. Therefore, some health related activities which were proposed by villagers are only implemented, like 'Chemical use is reduced', for example. Moreover, the approach of 'Social infrastructure is provided' is on a basis of the concept that villagers need a minimum improvement of infrastructure to live self-reliantly in the society.

'Community fund is provided' is an option to achieve 'HH debt is reduced'. That makes possible to

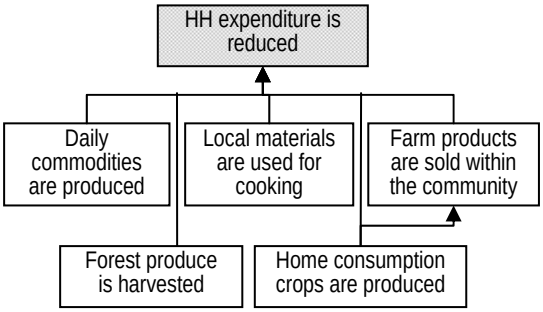
access a low interest loan. However, villagers have to work on 'Agricultural income is increased', 'HH expenditure is reduced', and 'Non-agricultural income is increased' directly to achieve that.

1) Non-agricultural income is increased



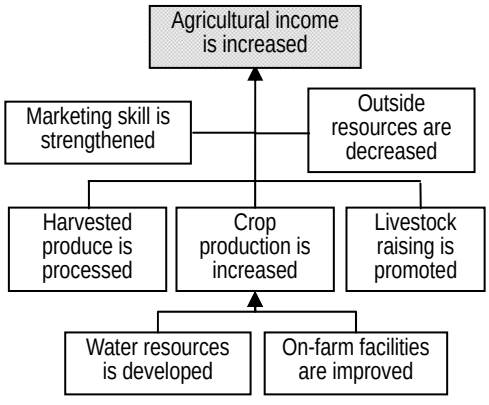

In addition to migrant work, if there are job opportunities of non-agricultural activities, they certainly contribute to improve household economy. However, it is not easy to newly develop any job opportunities such as OTOP linked with stable market channel, in and around the LRAs. Strengthening of the current on-going activities and/or creation of non-agricultural income source through making use of locally available resources should be prioritized. Conceiving that any local idea such as traditional handicrafts may be beneficial to raise non-agricultural income, "Local knowledge is propagated." is also added.

2) Household (HH) expenditure is reduced




This approach should be initiated from review of the current household economy. The basic concept is to make any consumable which local people can make by them to reduce expenditure. Four approaches are proposed, (1) Daily commodities are produced, (2) Local materials are used for cooking, (3) Forest produce is harvested, and (4) Home consumption crops are produced. Also, the "Farm products are sold within the community." is added to accelerate farm produce marketing within their villages/communities. This community market scheme can promote marketing of low-price local products as compared to normal produce transported through long distance market channel.

3) Agricultural income is increased

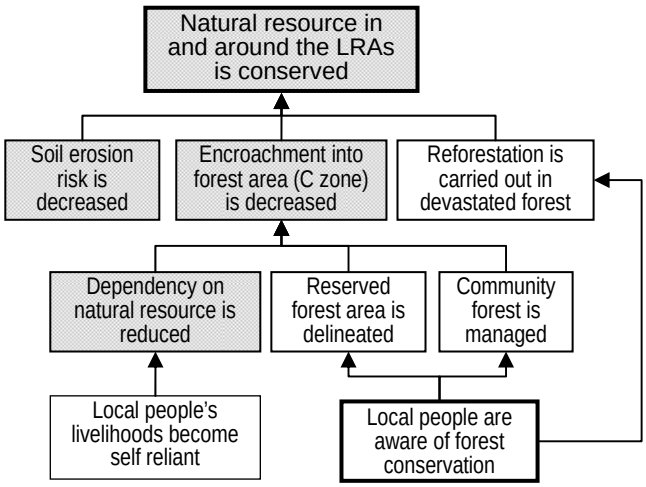



To increase agricultural income, it is required to increase crop production based on the current farming system. However, the current farming system, which concentrates on cash crop production is rather unstable since it is often affected by market price fluctuation. Furthermore, an overuse of chemical fertilizers to maintain the current crop yield causes further deterioration of soil fertility. In addition, there is an alternative to promote production of any special local product in the LRAs. Meanwhile, a small scale integrated farming for self-sufficiency and organic farming should be incorporated as approaches to improve the current unstable farming with debt. To change farm household management more sustainable, practices, which make full use of local resources should

be introduced and promoted.

In addition, to support the above approaches, basic infrastructures such as water resources and on-farm facilities should be improved. From another point of view, it is necessary to tackle post harvest processing of farm produce and add market values to increase agricultural incomes. It is also important to diversify income sources such as livestock raising. To find marketing channels of their produces, marketing skills should be strengthened. As a first step, small scale marketing within the villages/communities as mentioned above is realistic.

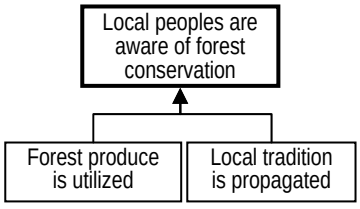
**(2) Approaches to the "Natural resource in and around the LRAs is conserved."**




If the people in the LRAs become more self-reliant and improve their livelihoods, it is easier to realize an appropriate management and conservation of natural resource in and around the LRAs because the people intend to maintain their sources of benefits derived from the forest areas. In other words, villagers need to realize that excessive dependency on natural resources causes disadvantages for villagers in a long period of time. An appropriate management of natural resources contributes to stability of livelihood and agriculture in a long run. Then, 'dependency on natural resource is reduced' results in 'Encroachment into forest area (C zone) is decreased'.

1) Local people are aware of forest conservation

In general, achievements of the natural resources management activities are frequently invisible. (It is different from good effects of agricultural activities by improvements of the irrigation system, for example.) Furthermore, there is no direct profit from the conservation activity, and it is not simple to make a situation that villagers voluntarily implement the conservation activity. Therefore, a special attention to motivate villagers is required.



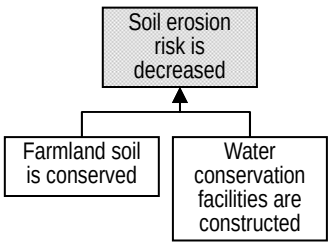

First, villagers need to understand a relationship among agriculture, livelihood and natural resources, and then, they understand benefits from the forest. Specifically, forest produce utilization as food (e.g., mushrooms, bamboo shoots) and non-food results in an improvement of their livelihood, and villagers realize that managing and conserving natural resources are important to maintain the benefit from the forest. The benefit from 'Forest produce utilization' is limited within HH. However, 'values of the forest are recognized

through learning', and 'people's awareness for natural resources management and sustainable collection are heightened' are expected to accomplish. Furthermore, 'Local tradition is propagated' about the forest of local community, contributes to the realization of 'Local people are aware of forest conservation'. In the north region, animism has been traditionally believed for a long period of time and it has played an important role to maintain peoples' respect for nature. Thus, the conservation awareness of forest can also be grown through such traditional activities.

2) Awareness for conservation and activities

'Motivation of villagers' is clarified after 'Local people are aware of forest conservation' is achieved. Subsequently, activities to systematically manage forest resources, are planned and implemented. The activities are, 'Making regulations' for collections of forest products, 'Community forest management' for sustainable utilization of forest in a long period of time, and 'Reforestation activities'. These activities are to manage and conserve their lands and benefits of villagers.

Many of the LRAs are presently located on the periphery of the conservation forest (C zone), which is officially administered by the RFD. The boundaries between the LRAs and the C zones, however, are not clearly delineated; hence, the people do not recognize them. In order to prevent local people from encroaching on the C zones illegally, 'delineation of boundaries' on the grounds and its public announcement are necessary to be implemented in cooperation with the RFD.




In addition, soil erosion in and around farmlands is an important issue to be addressed. There are various kinds of approaches. They are a farming approach and a civil engineering approach. The farming approach is to introduce multiple cultivation and erosion tolerant crops and contour cropping on the fields. The civil engineering approach is to level sloped land and provide drainage canals. Although the engineering measures impact to prevent ''soil erosion in and around farmlands'', they may involve a large-scale civil works. Consequently, there require substantial efforts involved in related organizations to accomplish them. Thus, the M/P particularly focuses on the activities, which can be tackled by the LRAs farmers, such as the "Farmland soil is conserved." and the "Water conservation facilities are constructed". These activities should be modified in accordance with the characteristics of their farmlands such as soil type, land slope, cropping and surrounding river system. These conditions should be carefully incorporated into all of the activities and locally available appropriate technologies should be applied. As for ''Farmland soil is conserved '', if farmers adopt the farming approach, and if they gain a profit from crop production in their own land where they try to prevent soil erosion, its fact motivates them. As for ''Water conservation facilities are constructed'', the necessity to conserve water in the forest as sources of water supply in their land is focused. It may lead to benefits in their farming activities. It motivates farmers. It is suggested to construct weirs (or check dams) as a concrete plan.

### 5.2.2 Approaches to Formulate M/P

There are various kinds of development approaches aiming at the goals; “Local people’s livelihoods become self reliant.” and “Natural resources in and around the LRAs are conserved.” as indicated above. These approaches were sorted out by the three main sectors; “Natural resources management,” “Livelihood improvement” and “Sustainable agriculture development,” and more detailed programs and components in each sector are added as shown below.

**Table 5.2.1 Sectors, Programs and Components of the Master Program**

| Sector | Program | Component |
|---|---|---|
| 1. Natural resources management | 1.1 Forest produce utilization | 1.1.1 Food utilization |
| | | 1.1.2 Non-food utilization |
| | 1.2 Forest area management | 1.2.1 Community forest establishment |
| | | 1.2.2 Community forest management |
| | | 1.2.3 Forest valuations |
| | 1.3 Forest rehabilitation | 1.3.1 Forest rehabilitation |
| | | 1.3.2 Reserved forest area delineation |
| | 1.4 Soil and water conservation | 1.4.1 Soil conservation |
| | | 1.4.2 Water conservation |
| | | 1.4.3 Forest conservation |
| 2. Livelihood improvement | 2.1 Livelihood improvement | 2.1.1 Non-agricultural income generation |
| | | 2.1.2 Expenditure reduction |
| | | 2.1.3 Energy saving |
| | 2.2 Fund development | 2.2.1 Locally accessible capital/fund development |
| | 2.3 Health and welfare improvement | 2.3.1 Health improvement |
| | | 2.3.2 Culture dissemination |
| | 2.4 Infrastructure development | 2.4.1 Social infrastructure |
| | | 2.4.2 Living conditions improvement |
| 3. Sustainable agriculture development | 3.1 Agriculture production | 3.1.1 Crop production |
| | | 3.1.2 Farming technology improvement |
| | 3.2 Livestock development | 3.2.1 Livestock raising |
| | | 3.2.2 Feed production |
| | 3.3 Farm produce processing | 3.3.1 Plant material processing |
| | | 3.3.2 Animal material processing |
| | 3.4 Marketing | 3.4.1 Enhancement of local circulation of farm produce |
| | | 3.4.2 Marketing improvement of local specialties |
| | 3.5 Infrastructure development | 3.5.1 Water resources development |
| | | 3.5.2 On-farm facilities |

These programs/components are intricately linked with each other in the cause and effect relationships. The relationships among the programs are shown in Figure 5.2.2.

People’s participation and spontaneous development are necessary to achieve objectives of these programs/components. Thus, under supports of the government and local human resources, necessary opportunities of learning/trial/practice are provided in the implementation processes of the programs/ components to achieve the objectives. Through those implementation processes, it becomes possible to make people’s sense of ownership and build up their capacity.

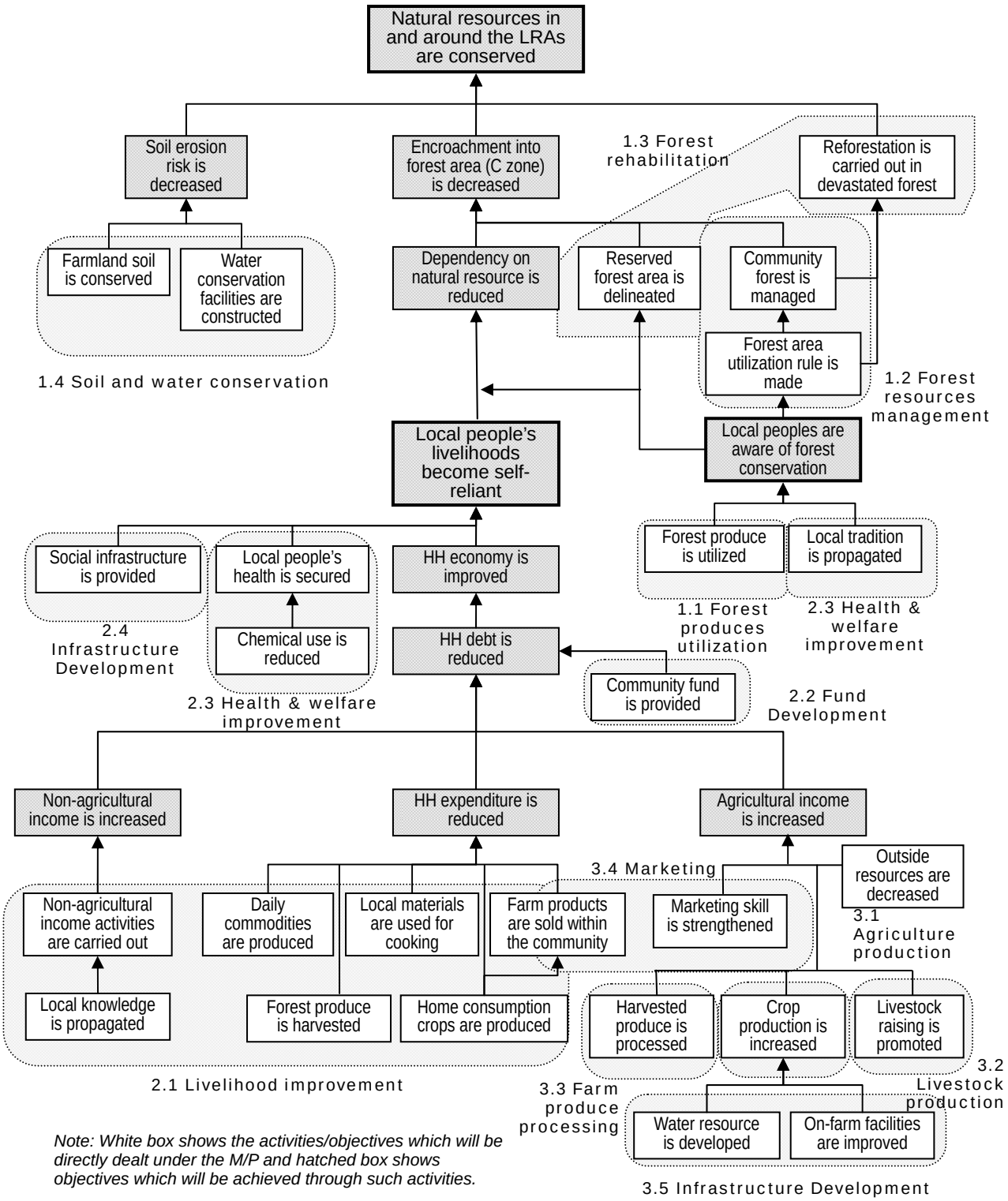



**Figure 5.2.2 Relationship between Development Approaches and Programs**

In order to implement the programs and components effectively, active participation of local people is indispensable and learning processes of the people should be practiced by their own initiatives.

Therefore, the M/P incorporates learning opportunities into its activities, and capacity building of local people and strengthening of sense of ownership to the activities will be realized.

### 5.2.3 Approaches for implementations of the Master Program

#### (1) Outlines of the Master Program

A master program 'in order to implement sustainable rural and agricultural development mainly in the LRAs with people in the local community and related organization, promoting proper management of natural resources' is the development plan which can be utilized as a guideline to conduct programs and components being shown in framework as referred in 5.1.3.

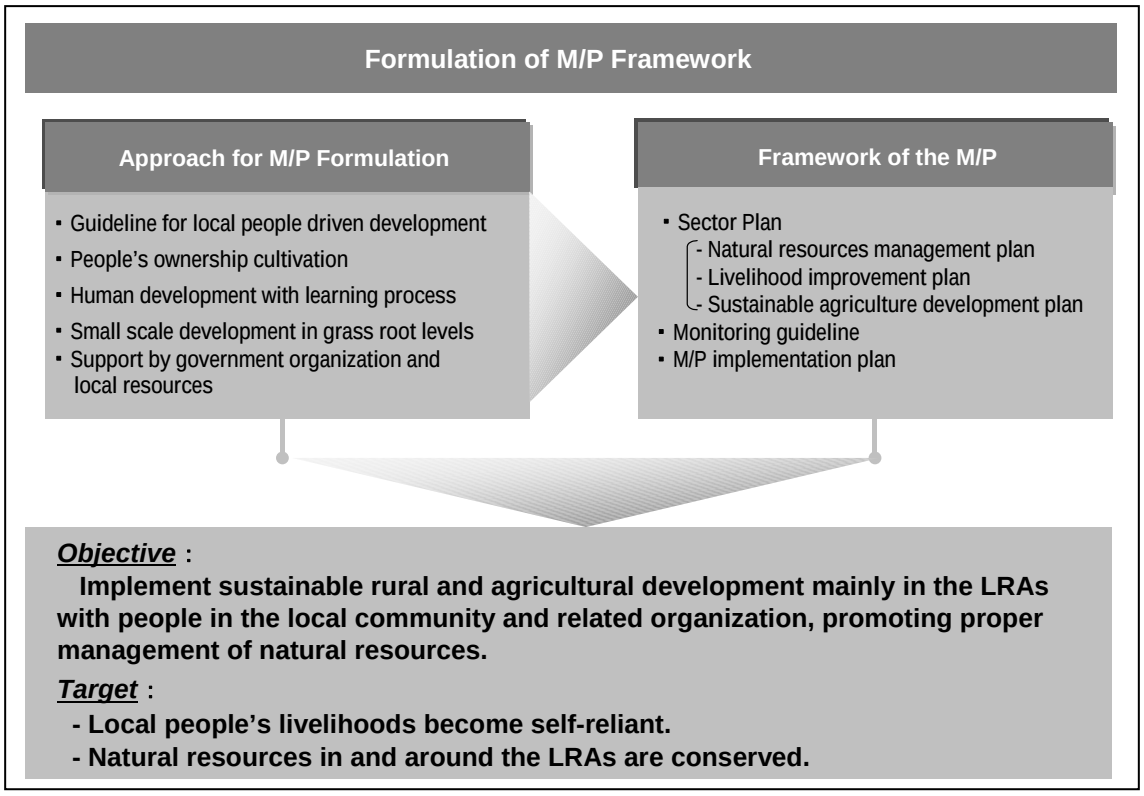



**Figure 5.2.3 Outlines of Master Program**

Master program has basic concept that are cultivating ownership sense of local people through human resource development with learning process, and being driven by local people with small-scale development in glass root levels, in order to achieve the objectives. There, the frame and direction were shown in programs/ components, and they are materialized under cooperation with local human resources, government and related organizations.

#### (2) Process of the implementation of master programs

Master programs are materialized with formulating plans (CDP; Community Development Plan) and implementing priority activities at community and Tambon level based on the plans. (The CDP which is formulated in a Tambon basis, is consistent with the development policy of the Thai government (The 10$^{th}$ national economic and social development plan) which shows that the Thai government delegates authority

about local development in glass root level to local governments. It is possible to integrate formulated CDPs with the three-year-development plan, which is formulated at each Tambon.

After selecting Tambons for implementation of the M/P, facilitators who are familiar with concepts of the M/P and experienced in similar community development, specialize any activity groups and leaders of the local people. Getting help from them, a participatory survey is implemented. Problems that they face in household and community levels such as income, expenditure and debt, farming, and natural resources in and around LRAs, are studied through the participatory survey. There, people themselves who participated in the study, analyze the problems, and understand linkage of farming/ livelihood with natural resources management and conservation. Moreover, appropriate study tours for advanced areas/ communities are conducted to learn community's visions and problems/ solutions to reach its future. After learning such concrete activities and solutions through the study tours, CDP can be formulated.

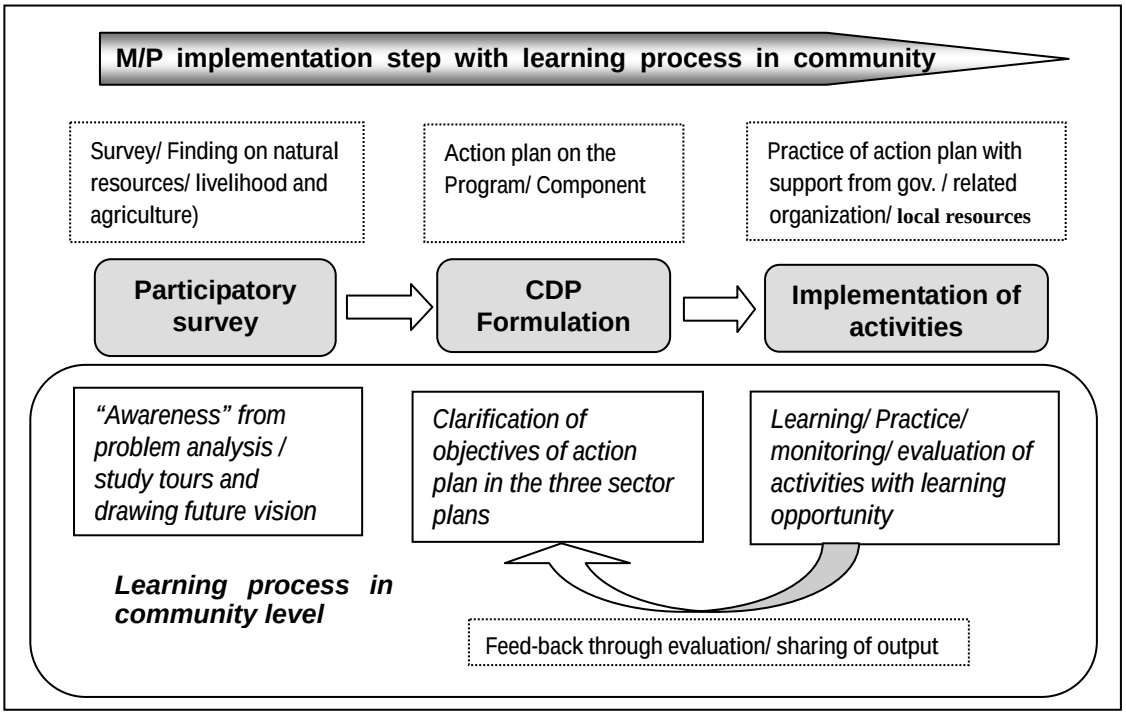



**Figure 5.2.4 Implementaion Flows of the M/P implementation with Learning Process**

Activity list in line with the framework of the M/P and programs/ components of three sector plans, are suggested in the CDP, and their priorities are determined. During the CDP formulation process, facilitators cooperate with ALRO/ATSAP and PLRO, to clarify objectives of the activity and identify necessary resources and supports from outside, with considering balances and connections among three sector plans. As the participatory survey conducted in this study, the CDP are finalized through public hearing from people in Tambons, provinces, related organizations, and participants who are interested in the activity.

Each activity is provided through learning opportunities such as workshops, training and study tours. After learning/ trials and evaluations, the activities are practiced. Even if the activities are conducted with a few participants, they are expected to promote with sharing activities processes and outcomes through any workshops/ forums and learning center.

### (3) Implementation process of activity

The CDP is composed of action plans in line with the concepts of programs/ components of three sector plans, and the activities are implemented by local people with getting supports from outside.

Planned activities are tried and practiced by individuals, organizing groups and community members. Many of them are initiated based on learning and finding problems and solutions in study tours and other learning opportunities, and continued until the objectives are achieved. Implementing order of the planned activities is not specifically determined in advance, and sometimes they are simultaneously and frequently implemented based on the local needs and people's intention. Although achievements of each activity led by different groups may be small at the beginning stage, they are expanded with sharing their results and activity process among the community people. These implementation processes of the activity are viewed as "emergence process".

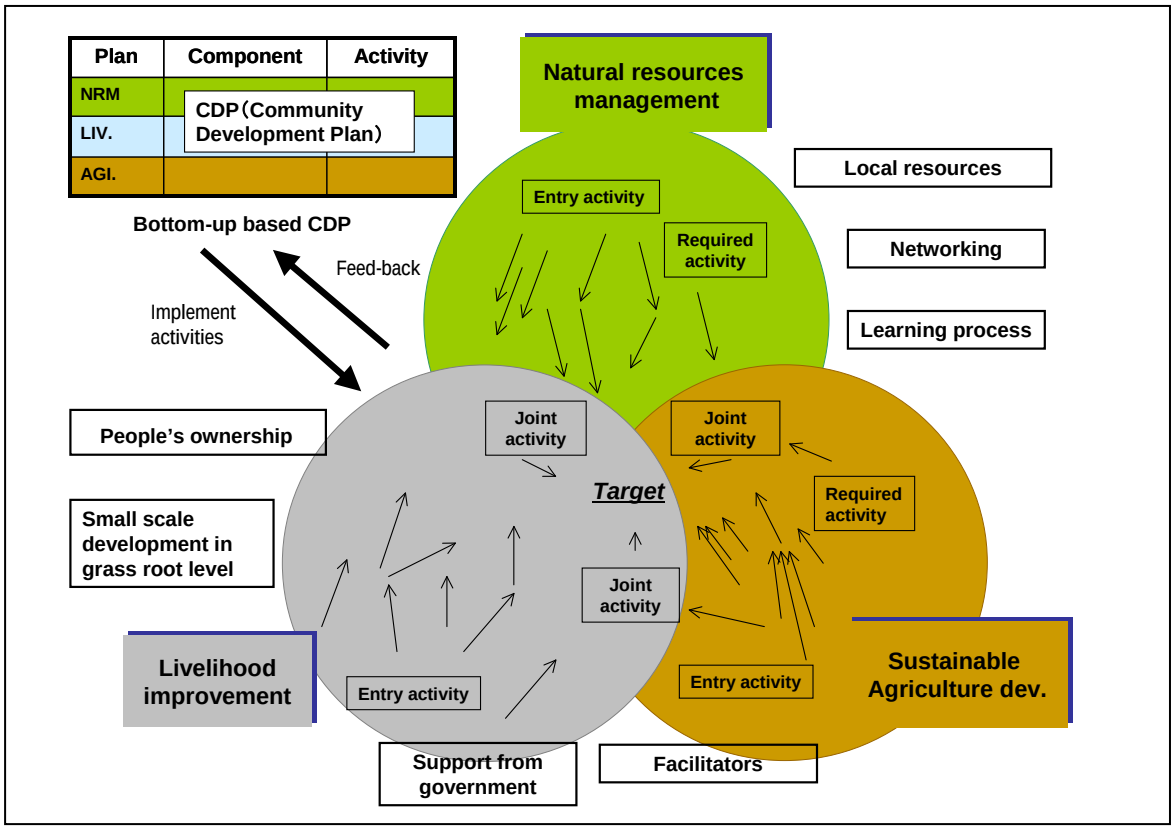



**Figure 5.2.5 Implementation Process of the Three-sector Plans**

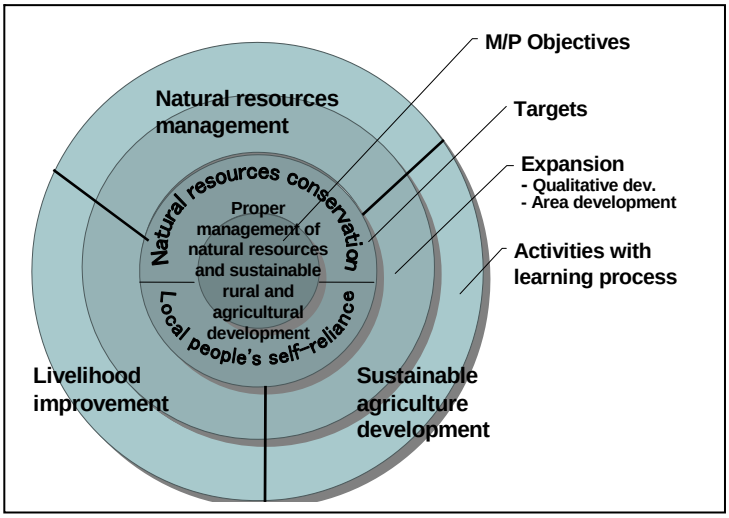
There are kinds of activities such as activities to encourage 'awareness' , 'entry activities' which have expansibility for next activities, and 'definitely necessary activities' which are public benefit especially in the natural resource management plan. Activities that are connected to several programs/components, are implemented after a foundation for proceeding to it is established, as developmental activities. It includes a common activity that is in a cross-sectoral manner.

Facilitators should work with considering various aspects of these activities and people's interest, and facilitate to incorporate supports from government and related organizations into implementation process so as to direct toward objectives.

Mutual understanding is cultivated through capacity building by learning process and networking. People are integrated with collaboration. Moreover, it is expected that human resources (facilitators) for natural resource management and sustainable rural and agriculture development be developed in their community among participants.

### (4) From individual activities to integration to achieve goals

Achievements of the three-sector activities are generated after the processes of learning, trials, practices and establishment of them. In addition, achievements of each activity become influential on the society and natural resource management through promoting it inside and outside the community. They are integrated to 'self-reliance' and 'natural resources management' through the emergent process as mentioned above.




The objective of the M/P can be achieved when the three sector activities are implemented and integrated in community level through making full-use of local networks connecting local human resources with individual/ activity groups.

## 5.3 FRAMEWORK OF THE MASTER PROGRAM

Framework of the M/P and relationships among the plans are shown in Figure 5.2.2. Sector plans are core of the M/P.

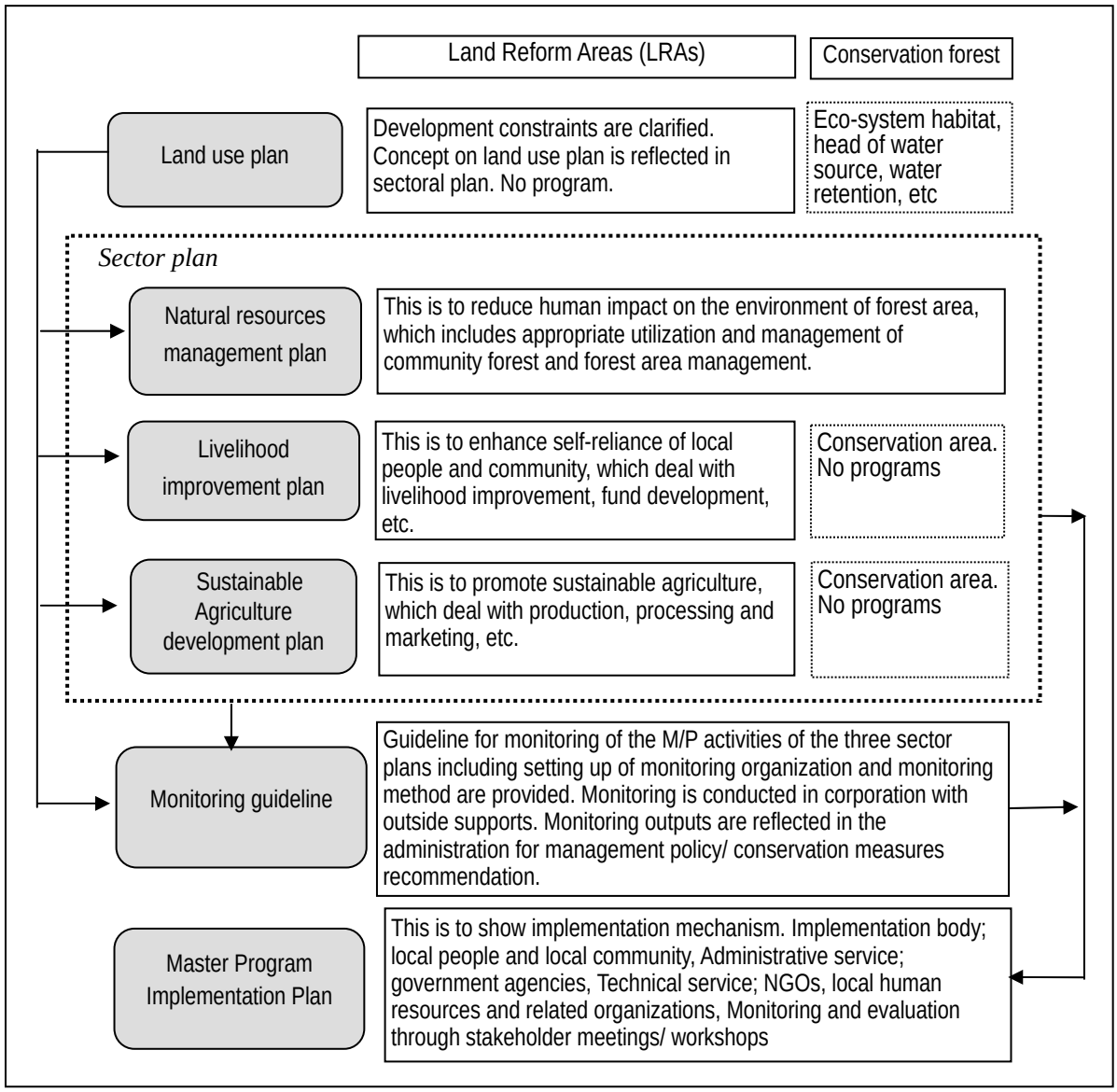



**Figure 5.3.1 Framework of the Master Program**

In order to implement the programs and components effectively, active participation of local people is indispensable and learning processes of the people should be practiced by their own initiatives. Therefore, the M/P incorporates learning opportunities into its activities, and capacity building of local people and strengthening of ownership sense to the activities will be realized.

### 5.3.1 Land Use Plan

(1) Features of present land use manner

**1. Considering the present individual land use manner by the LRA farmers under the Land Reform Act, drastic land use change will not occur in the LRAs.**

Land Reform Areas (LRAs) are composed of 5 zones, namely A Zone (agriculture), E Zone (economic forest), F Zone (prime forest), J Zone (classified 1 forest) and T Zone (trial forest). However, there is no significant difference in land use among these zones at present. Most lands in the LRAs are divided and allocated to the individual farmers as the title of SPK 4-01 in accordance with the occupation of beneficiaries or other activities within the legal limitation of 50 rai to one family as regulated in the Land Reform Act. It is, therefore, difficult to change individual land use drastically. Consequently, individual plot boundaries and their basic land use such as paddy, upland crops and other use would be principally followed in the land use plan. However, the manner of land use or the kinds of crops would be suggested to shift to a more protective manner or crops for the natural resources conservation as well as for the self reliance in line with participatory learning processes.

There still remain the community lands or public lands such as community forests, roads or swamps and ponds or streams and reservoirs in the LRAs. Such lands will be continuously utilized or expanded based on the mutual agreement among the stakeholders concerned for the community or the public welfare within the regulations of the Land Reform Act.

(2) Land use in buffer zone and reserved forest area

**2. Proper local rule and regulation for utilization and management in community forest and area adjacent to reserved forest as well as for preservation of reserved forest area should be established.**

The buffer zone areas adjacent to reserved forests within the LRAs may be defined as the front line of land issues. From an aspect of prevention of encroachment to the reserved forests, the zone is very important so that sophisticated conservation measures should be introduced. With assistance from the related government agencies, local communities should elaborate them.

Although the RFD is responsible for the reserved forest, preservation activities cannot be properly implemented without cooperation with local people and local communities. Firebreaks should be constructed and maintained regularly, and erosions or gullies in the forest area should be confined within its early development stage. On the other hand, people can receive various benefits directly or

indirectly from the reserved forest. Perennial stream and humid air keep better natural conditions for sustainable agriculture and rural life. From the viewpoint of watershed management, regular activities in the reserved forest should be carried out in cooperation with local people.

### 5.3.2 Natural Resources Management Plan

(1) Lessons Learned from Imposing of Legal Enforcement and Public Involvement in Resource Management

**1. Although there are laws and regulations imposed by the government, declining of forest area is still going on. Then, it was recognized that involvement of local people was crucial for sustainable use and management of forest area. Consequently, community forest bill was drafted.**

Declining of forest area is still going on nowadays although there are several measurements, laws and regulations imposed. This reflects non-workable legal frame imposed by the government. Then involvement of local communities aiming to achieve the sustainable use and maintenance of the forest was proposed. The community forest bill that promotes and encourages the public participation in the preservation, maintenance and balanced exploitation of natural resources and biological diversity was drafted in 1992. Establishment of community forest has been started since early 1990s. However it was in the form of reforestation mostly in the public land. It was gradually shifting towards local participation aiming to protect the area for multi-purpose uses on sustainable basis later. This was in line with and supported by the new Constitution of the Kingdom of Thailand 1997. Therefore its picture is clearer from year 2000 on. Since then, community forest spread over the country, particularly, with a rapid rate from 2004 to 2005.

(2) Major Resources for Life

**2. Local people rely on natural resources for their livelihoods.**

Natural resources of water and forest were identified and ranked as the most important resources for livelihoods in the Study Areas. Fact-findings show that major forest products being used are for food, medicine, fuel and construction of shelter and fences.

Data derived from “Time lines technique” show that in the old days when intact forest still existed, local people mainly relied on forest resources. They could access to food and medicine from wild plants and animals, including wood for housing. Crops grown were on subsistence basis due to poor facility of basic infrastructure. However these resources were sufficient for living. Especially natural water resources from rivers and streams were rich in quantity and quality. Rainfall amount and its distribution were higher and better than nowadays.

Based on the field survey, many products from community forest are presently utilized. They are identified by villagers such as various kinds of wild vegetables, various kinds of wild mushroom, ants' eggs, bamboo and bamboo shoot, dried wood for fuel, a certain amount and type of wood for shelter construction, wild fruits and medical herbs

Collection is mostly only for home consumption. Surplus can be sold. However the surplus is not in large amount. Major items of wild vegetables, mushrooms and ants' eggs are seasonal products. People can collect in a short and certain period. If they don't harvest at this particular time, products would be expired soon. Hence the sale is in small amount and in a short duration. Exception is bamboo shoot and some medical herbs that can be preserved and sold later. The former can be canned or preserved in plastic bag and sold sell as food item later while the latter can be processed as traditional medicine.

(3) Local Regulations

**3. Although many products from community forest are utilized, utilization and management manner should follow the local rules and regulations.**

Collection, however must follow rules and regulations formulated by the community forest committees. Regulations are slightly differed from place to place. For example, regulations at Tambon Chom Pra in Nan allow people to cut 5 trees for house construction while regulations in Phrae indicate that wood can be cut only for home use, only special approval will be made on the request for any house construction. Anybody who breaks the rules will get penalty, mostly in form of fine.

(4) Causes of Forest Deterioration

**4. Despite the local rules and regulations, encroachment is still found in forms of illegal logging, man-made forest fire and over utilization of forest products.**

Despite penalty, encroachment is still going on. Villagers declared that it is mostly in forms of:

- illegal logging by external and local people,
- forest fire by man-made for wildlife hunting and wild vegetable collection, and
- over utilization of forest products.

These were identified in many sites in the study area. People found that encroachment is not only in the community forest, but also intrusion into Zone C. Since it is common that community forest areas that situated in the reserve forest of Zone E or A are adjacent to Zone C with no clear boundaries, people always claimed that boundary marks were unseen. Then the conservation and utilization zones could not be distinguished.

Despite delineation of the protected areas of Zone C, illegal logging is still on-going, mostly by the

exploiters who linked with the state officers. This comes from its high value of the resources. Most of exploiters in this case are the one who have power of influence.

An easy way of collecting such products as small animals and birds is by fire making. Nowadays it is man-made, not natural occurrence. It often happened that someone made fire and could not control it. This also causes further forest deterioration. Similarly, other forest products could be over-harvested. Either on purpose or by mistake, both cause deterioration of the resources.

(5) Effects of Forest Deterioration

**5. Local people found that forest decline caused deterioration of headwater source areas and forest products, and losses of biodiversity of vegetations and wildlife.**

Local people identified that great effect of forest deterioration is the deterioration of headwater sources areas, which impacts on less quantity together with poorer quality of water in rivers and streams. They felt that water resources from rainfall, rivers and streams were much in the past. Then it is insufficient for drinking and agriculture uses. Although the negative impact is more serious in Zone C where is classified as watershed class 1A, it also affects community forest.

Deterioration in the community forest is also influential in food and non-food items, which contribute to household consumption and income to some extent. Villagers said that they have to buy food stuff nowadays while they could rely mostly on forest products (e.g. mushrooms, vegetables, meat, etc.) in the past.

Losses of biodiversity of vegetations and wildlife are also identified. Local people recognize that there were more wild animals before. Some species are endangered and unseen now. There are no more woods for people to construct houses. Many medical herbs and plants also disappeared. This also deteriorated indigenous knowledge of traditional medicine.

(6) Measurements Required for Resources Management

**6. To alleviate human impact on natural resources, the Master Program supports the activities by local people and local communities.**

To alleviate problems mentioned above, the people viewed as they should:

- stop and prevent the encroachment, and
- maintain and rehabilitate forest for sustainable use.

Measurement to stop encroachment to headwater sources is:

- Delineation between conservation and utilization zones of the reserve forest, so encroachers have no excuse to intrude into the Zone C, where is preserved for headwater sources. (This measurement is highly recommended for the LRAs.)

In order to maintain and rehabilitate forest for sustainable use, required actions are:

- Construction of small-scale check dam in appropriate location. So water and moisture can be prolonged in the forest. This will gradually regenerate forest. Removal of sediments in small-scale check dam should be carried out later in order to maintain good condition of check dam.
- Reforestation in suitable location in order to keep forest in good condition.
- Making firebreak and formulating the fire control system, in order to protect forest from the fire. Local people will be employed as area inspectors and being key persons to control the fire.
- Establishment of community forest committee, working on public involvement on formulation of rules and regulations being used on the sustainable basis of the forest.
- Formulation of rules and regulations of collecting products and forest maintenance.

(7) Detailed Components of Natural Resources Management Plan

**Table 5.3.1 Project Component of Natural Resource Management Plan**

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| Forest produce utilization | Food utilization | <Herbs, bamboo shoot, wild vegetables, mushroom and ants' eggs harvesting><br>In reality, herbs, bamboo shoot, wild vegetable, mushroom and ants' eggs are used widely for a long time. They are a kind of food bank of the communities. Villagers have learnt about available food produce in their forest areas from local knowledge and intellectuals. However with seasonal produce together with higher demand, this makes supply side lower. Therefore it is necessary to maintain these products in sustainable manner.<br>Field transect walk will be conducted to find production potentiality and constraints of these products. Villagers will learn about setting inventory of food items available and practicing on recording the amount of harvesting, consumption including selling and income generated from these items. This will be used as database for monitoring activities that will also be practiced by local people later.<br>To prolong the use of these products, it is necessary for the communities to learn know-how of production and harvesting control. Thus food-harvesting group should be organized. Besides the practice in the areas by on-job training, it is recommended the group to go for the study tour and exchange information with strengthened communities.<br>In addition, technical knowledge regarding food and herbs processing will be provided to villagers. Indigenous knowledge will be transferred together with learning from appropriate resources persons. | * | * | * | |
| | Non-Food utilization | <Medical Plants)<br>There are plenty of natural medical plants in the forest areas. They are collected and used to some extent. However it is still limited. Only few persons have this knowledge while a lot more do not know and destroy these plants un-intentionally.<br>This knowledge can be transferred traditionally. In addition, the interested group can be formulated. In order to realize the | * | * | | |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | valuations, the study tour will be arranged to medical processing plant in the region. So villagers can learn the available resources in the areas, and have more knowledge on medical plants including the ones that be supplied to the processing plant. | | | | |
| | | <Making wood vinegar><br>Villagers will learn about making charcoal from branches and stem of trees which are normally unused and left over in their own farms. Along the process, villagers will learn about vinegar extraction from these woods.<br>They will learn about making organic pesticide from vinegar and practicing on application in their farms.<br>This will be in form of indigenous knowledge transferring and learning from appropriate resources persons. | * | | | |
| | | <Tree cutting><br>Normally trees in the community forest can not be cut. However some can be used on special purpose. Small dead trees are collected commonly for the fuel use while larger size of live trees are strictly collected and used such as for fence or house construction. However it requires clear proposal and with definite amount cut.<br>By practice, villagers will learn what types of tree can be collected and use. Emphasis on sustainable use, the group will be organized for the study tour to the success model of community forest in the region. | * | * | | |
| Forest area management | Community forest establishment | < Community forest registration><br>There are the public areas in zone E, which can be established as community forest. Its official registration will be done based on the request of local communities.<br>The community forest group will be established and survey the public land together with village or sub-district headman, make a proposal and submit to the TAO and chief of district office. Documents will be transferred to the MONRE at the district, provincial and regional levels respectively. The forestry officers and local leaders will do the site survey, and investigation. The provincial and regional forest officer will report results and submit proposal to the MONRE headquarter, who has authority for approval. After approval, the group will mark boundary and put the notice board on.<br>By practice, villagers will learn about team work and co-ordinate with related agencies.<br>It is recommended to have study tour, exchange information with community that has already established community forest. | | * | * | * |
| | | <Organizing community forest committee><br>Community forest committee is made up from members of villages where the community forest located. They will establish rules and regulations regarding conservation, management and utilization of the community forest under the existing laws.<br>By practice, villagers will learn and recognize about existing laws in relation to forest conservation, management and utilization. On-the-job training, they will learn how to formulate rules and regulations being used to protect and maintain the community forest.<br>It is recommended to arrange for study tour, exchanging ideas and information with experienced committee in the region. | | * | * | * |
| | Community forest management | <Strengthening community forest committee><br>Once the community forest committee has been established, they have to deal with public consultation. Although the emphasis is | | * | * | |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | inside the communities, they have to co-ordinate with the others, outside community too. This aims at the same understandings among local people and other stakeholders.<br>It is recommended to arrange study tour to other committees, who are strong and success in terms of management with public involvement manner. Exchange ideas regarding problems, constraint faced by those committees will be good examples. | | | | |
| | | <Making regulations (harvesting materials/periods)><br>Aiming at sustainable use of resources in the community forest, practical regulations will be formulated. The community forest committee will survey and identify available forest products, which can be collected/harvested. They will consider about proper amount and time of collection/harvesting, including maintenance practice of resources. These regulations will be informed to all villagers in the community and nearby including penalty for the rules breakers.<br>By practice, villagers will learn about available resources in community forest and their uses. Then rules and regulations will be formulated accordingly.<br>It is recommended to arrange for study tour to visit the communities that have a good model in this practice, to share information, especially lessons learned. | | * | * | |
| | Forest valuations | <Identify valuable species/natural resources><br>There are many species of wild plants and animal, which are valuable for multiple uses in terms of nutrient, medicine, energy or bio-logical control such as pest and insect control. Many of them are indigenous species and are in threatened and endangered situation due to the misuse without recognition of their values. Common interested group should be formulated.<br>Villagers will practice on forest survey and identify the existing resources and their valuations.<br>Technical knowledge will be provided by relevant agencies such as Forestry officers and knowledgeable resources persons, both inside and outside communities. Learning by doing, villagers will identify those indigenous, threatened and endangered species and record them. Their functions, especially in terms of uses will be identified. Measurements for conservation and propagation will be established.<br>It is recommended to arrange the study tour to relevant institutes such as botanical garden or museum in the region (Chiang Mai) and visit, discuss and exchange information with the other communities, which carried out the similar activities before. | | * | * | * |
| | | <Knowledge dissemination><br>Local resources valuations should not be kept in a small group. Knowledge will be disseminated to the others, and encourage them to be aware and having forest owner attitude. People in the same communities should be informed so that they can put hands on conservation, propagation and also dissemination of this information. A small group should be formulated on this task, with recruitment of local teachers.<br>There are a number of channels for dissemination, through various meeting in the communities and teaching in schools. The TAO and PLROs will inform this information at the provincial level and request relevant agencies such as PAO, Provincial Natural Resources and Environment Office or the Governor office to support on making and distribution brochures or leaflet. | | * | * | * |
| | | <Eco-tourism promotion><br>Places with potential eco-tourism should be promoted. Local people should be able to investigate, identify and propose through relevant | | * | * | * |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | agencies such as TAO and PAO.<br>Local people will learn how to promote their areas and resources on the commercial basis, being in line with sustainable management. They will also learn how to run this kind of business and adopt to their situations.<br>Interested persons, especially the youth group should be educated and trained. It is recommended to arrange for study tours to discuss and exchange ideas with communities that work in this business before.<br>In addition, the study tour should be arranged for school children to other schools that operate eco-tourism. | | | | |
| Forest rehabilitation | Forest rehabilitation | <Reforestation activities><br>Key persons will mobilize the local people in the community for forest survey and identify the place where there is potential for reforestation. Time for planting will be set within local consultation manner. They will measure the size and request for seedlings from relevant agencies such as the nursery of Forestry Office nearby.<br>Villagers will monitor and maintain growth of trees. Mobilization may be required for replanting in case of poor survival rate. | | * | * | * |
| | | <Making firebreak><br>Forest fire is occurred from time to time in the dry season. Its occurrence is in both sites of community forest and conservation zone. All are man made, not natural fire.<br>Villagers will learn fire protection and control. A group will be organized and survey for proper place of firebreak line.<br>Technical knowledge with demonstration will be provided by the Fire Control Unit of the MONRE, existed nearby. Villagers will be mobilized to make firebreak line at the beginning of the dry season. This group will be key resources to monitor the firebreak line and propose for maintenance as necessary. | | * | * | * |
| | | <Community forest guard activities><br>Monitoring on forest fire should be carried out properly, especially during the dry season. The community should employ few persons to work as guard man. They should be local people and have been trained on fire protection and control. | | * | * | |
| | Reserved forest area delineation | <Putting boundary markers><br>In reality, there is no clear boundary between zone A, E and C. This is always an excuse of all exploiters either on subsistence consumption or commercial basis. Hence boundary should be clearly marked.<br>Villagers will organize a group to work co-operated with concerned agencies such as Forestry and TAO. Series of meeting will be organized in order to make clear understanding to all people concerned. Forest survey will be carried out together and identify such any encroachments occurred. Solutions and agreements will be made among villagers, TAO and MONRE officers. Then they will work together on putting the boundary markers, which are acceptable by all parties. | | * | * | * |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| Soil and water conservation | Soil conservation | <Farm land soil conservation><br>Recently organic farm produce attracts consumers' attention and producers concern about their health because of the side effects of chemical application. It reduces the production cost and utilizes locally available resources in the production processes. Organic produce often has premium prices. Although the complete organic farming is still difficult on large areas, small-scale trials are worthwhile.<br>Villagers can learn by practicing, by asking for resource persons or local innovators to give knowledge/demonstration.<br>Study tours to good model farmers/areas or other institutions such as DOAE or private farms are also recommended. | * | | | |
| | | <Soil improvement: Making bio-fertilizer / compost><br>To improve soil structure and its fertility, making bio-fertilizer/ compost from locally available resources should be promoted. This will help on declining chemical fertilizer application automatically. Although application of bio-fertilizer and compost are being promoted in some areas currently, it is important to accelerate the activity.<br>Villagers can learn by practicing, by asking for resource persons or local innovators to give knowledge/demonstration.<br>Study tours to good model farmers/areas or other institutions such as LDD, DOAE and the Mae Jo University are also recommended. | * | | | |
| | Water conservation | <Construction of small-scale check dam/weir><br>In fact, small-scale check dams have been carried out in the north since more than a hundred years, by using available local materials such as stone and dead tree. This indigenous knowledge and practice is re-promoted in this region now due to simple, easy, no cost involved, but high efficiency in water conservation and forest rehabilitation.<br>Villagers will practice on forest survey and identify the place suitable for check dam construction in the dry season. More people will be mobilized when construction takes place. This indigenous knowledge will be transferred by resources persons. This will be about characteristics, functions and suitable location of check dam. People then will be learning by doing. A voluntary group should be formulated to monitor the check-dam condition periodically and organize for repairing as necessary.<br>It is also worthy to arrange the study tour, visiting communities, which have this kind of experience before. | | * | * | |
| | | <Removal sediments in check dams/weir><br>A voluntary group in the community will be mobilized to remove sediments from check dam periodically, about 2-3 years time. The stuck of sand, leaves, small trees, branches, etc. can create water pollution and poor flow of water along the stream. | | * | * | |
| | | <Dredging of natural water body><br>There are many natural water bodies such as rivers, streams, canals and swamps in LRAs. However almost of them dry up in the dry season. Dredging can be carried out in both forms of man-made and machine.<br>In case of small-scale water body, a voluntary group in the village should be mobilized and do dredging in dry season.<br>In case of larger scale, which river/canal flows through a number of communities, it requires public consultation with all people/agencies concerned. Conflicts in term of water use or encroachment of land use along river bank have to be sorted out. These have to be agreed by all parties concerned. | | * | * | * |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | Since this large scale requires machine to do dredging, resources persons (e.g. technocrat from the TAO, PLROs, PAO, Public Work Office or RID) should provide technical support such as recommendations on tools and methods to be used, estimation its cost, etc. Then work plan should be formulated with methodology and required budget.<br>Learning by doing, villagers will learn public consultation, co-ordination and co-operation with people/agencies concerned, formulation of plan and proposal including submission of request for the support to relevant agencies. | | | | |

(HH): Household, (Vil.): Village, (Ta): Tambon, (D/P): District/ Province

### 5.3.3 Livelihood Improvement Plan

(1) Lessons Learned from the Participatory Survey

With regard to the socio-economic and rural life, there are several problems identified through the participatory survey and data analysis. Among them, remarkable problems are as follows:

**1. Villagers fall into difficult finance management.**

- Agricultural income is low
- Household expenditure is high
- Household debt is big burden

**2. Non-agricultural income opportunities are limited.**

In general, farmers in the LRAs are obliged to live unstably. While non-agricultural income opportunities are limited, agricultural income is not enough. Therefore, with the failure of farm harvest in one season, especially cash crops, farmers can easily become in their extremity. In addition, relatively high household expenditure leads them to be in debt conditions. Overuse of chemical in farming practices is a recent concern of health and welfare for them.

**3. For sustainable rural society, health and welfare improvement of local people linked with natural resources management and utilization should be promoted.**

In order to improve such situations and attain successful goal of rural and agriculture development, following programs are primarily important.

- Livelihood Improvement
- Fund Development
- Health and Welfare Improvement

- Infrastructure Development

(2) Livelihood Improvement Program

Due to the primary problem in the area, low income and high expenditure, livelihood improvement program aims to raise the income and reduce the expenditure. It was found that 72.8% of the households are engaged in agriculture and less than 5% engage in cottage industry. Given the fact, income generating approach through the provision of business opportunities should be emphasized. Significant level of expenditure was emphasized as one of the primary problems. It implies that two different approaches would be required such as (i) to increase the income and (ii) to decrease the expenditure. Therefore following three components are proposed: Income Generation, Expenditure Reduction, and Energy Saving

1) Income Generation

In the LRAs in the four provinces, 72.8% of the households are engaged in agriculture and face the difficulty to earn enough income due to the high expenditure for agricultural inputs. Also non-agricultural income opportunities are limited in the area, because industry is rarely available in such isolated locations. Considering the above situation, income generation activities are quite important to raise income and increase the business opportunities.

Especially in the LRAs, most of which are located at the vicinity of the forest area, there are plenty of natural resources available. As typical natural resources, non-timber forest products such as bamboo shoot, mushroom and some edible insects, contain significant potentials for the income generation activities. However the utilization of such products is not always well organized. Therefore, with the great use of such resources under the appropriate management, income generation should be urged.

The possible items for income generation are some kinds of handicrafts such as paper flower made from plants fiber, mat made with bamboo strips, coconut lamp and weaving as well as selling agro-products such as mushroom, bamboo shoot and fruits wine and Thai-style dessert. Note that it is important to add value to the product. Also, application of traditional handiworks (hand-made skills) should be considered.

2) Expenditure Reduction

As the household expenditures are the big burdens and cause the debt, people need to improve their household economy through reduction of the expenditures. Given the fact that income generation through the increase of agricultural productivity or other means is not promising in a very short time, more emphasis should be placed on the reduction of the household expenditure. Even though the impact of the expenditure reduction is not so significant, it is easy to start. It could be a trigger of

the upturn in the household economy, reduction of the expenditure has great potential for rural development.

The most important challenge is to stop the outflow of the capital from the households. To reduce household expenditure, people should produce whatever they can, instead of buying from outside. Since purchase of foods shares the highest percentage of household expenditure, it is recommended to implement kitchen garden at each household. Furthermore, some daily commodities can also be produced at home such as shampoo, soap and detergents. Thus, the livelihood improvement program emphasizes the importance of the self reliance.

3) Energy Saving

Energy saving can be considered as one of the activities of the expenditure reduction, although it is also related to the appropriate natural resource management. In some places, people still use firewood and charcoals for their daily lives. With the emphasis to reduce negative impacts on the natural resource, people can also save present expenses for energy. Expected activities include; (i) Production and use of high efficiency stove, (ii) Production and use of high quality charcoals, and (iii) Introduction of physic nuts (material for bio-diesel).

(3) Fund Development Program

In parallel with the innovation of agricultural technologies, need for capital fund becomes high. Today, farmers require investment for various items such as farm pond construction, machinery and cattle purchase, and for seasonal operating expenses such as land preparation, seeds and fertilizer purchase. Capitals are also essential for other aspects of rural development such as job creation for income generation, group activities for specific purposes, and village infrastructure construction. In the rural area, the scale of cash flow is not as big as that in urban areas. Credit or loan is, therefore, important to carry on development activities powerfully.

Until now, the government has provided a series of credit sources for rural development. Some of them are bank loans, while others are development funds provided by various ministries. Followings are the examples of those funds.

- Poverty Alleviation Fund
- One Million Baht Village Fund
- Economic Development Fund
- Credit Program for Rural Development
- BAAC
- Agricultural Land Reform Fund
- Internal Trade Department Loan

At present, many farmers are indebted due to lack of income and relatively high expenditure. Given the fact, profitability of the invested activities should be carefully considered not to create further debt. As alternative credit sources for the people in the area, community level revolving fund managed directly by the inhabitants is one option. In this case, it is necessary to set up group with the people who have the same interest. Initial fund can be born by the farmers themselves if the fund scale is not so large. Also people can seek for credit sources from government agencies for specific purposes.

(4) Health and Welfare Improvement Program

1) Health Improvement

In the rural area, availabilities of hospitals/clinics are limited and people do not have enough savings for emergency. Consequently, prevention of the illness is vital. Given the fact that people cannot pay so much cost for medical treatment, health improvement should be accomplished through nutrition improvement and self care activities. Today, aerobics exercise is being promoted by the government throughout the country. In line with the policy, promotion of exercise is preferable for the health improvement. In addition, traditional way of self care should be emphasized such as Thai traditional massage, and use of medical herb.

As for the prevention of illness, it is also important to reduce the risk of injury or illness. There are so many traffic accidents occurred in the area, especially with the inappropriate driving of motor cycle. Therefore, road safety campaign should be implemented in cooperation with the related agencies. Furthermore, particularly in this region, it is necessary to extend appropriate application method of agricultural chemicals since chemical contamination in blood was detected from some farmers. Promotion of appropriate use of chemical should be carried out not only for agricultural purpose but also for the health improvement.

2) Cultural Dissemination

People, especially elders, are anxious to lose traditional culture in their communities. It was found that many of those local traditions are dying out. The more local traditions die out, the more senses of importance on local culture disappear. In the past, animistic ceremonies were often carried out to respect the forest spirit. This ceremony was directly connected to the activities for watershed

management with the communities' participation. Thus, respect of the forest resulted in the proper management of natural resources in the past.

In addition, the traditional knowledge covers medical matters. Some elders have knowledge on medical herbs and it can be applied for health care activities. Technique of handicraft using natural products such as bamboo and rattan has been also developed as one of the local traditions. To accelerate rural development, these local traditions should be disseminated again. Cultural dissemination is very important for the revitalization of local communities.

(5) Infrastructure Development Program

To support the above livelihood improvement programs, seven activities related with infrastructure are proposed such as installation of village water supply, expansion of village water supply, village electrification, expansion of electricity service, village road improvement, garbage disposal improvement and wastewater treatment.

(6) Detailed Components of Livelihood Improvement Plan

**Table 5.3.2 Project Components of the Livelihood Improvement Plan**

| Program | Component | Expected Activity | Implementation Level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| Livelihood Improvement | Income generation | <Non-agricultural income generation activities><br>- Villagers learn opportunities to earn non agricultural incomes with making the most of the resources available in the area, then, produce and sell.<br>- Basic principle is (i) use local resources; (ii) add value; and (iii) start marketing in the communities/ tambon.<br>*(Expected Activities)*<br>• Have a workshop led by facilitator (NGO, advanced farmers) to identify resources available in the area and options villagers are most interested.<br>• Make a plan how to sell, where to sell, and how much quantities produce. If the equipments are necessary, carefully consider the profitability.<br>• Invite trainers (advanced farmers, NGO, etc.) and have training on the necessary techniques.<br>• Purchase necessary equipments by the group.<br>• Practice through on the job training<br>• Monitor the account<br>• Possible options are as follows:<br>Paper flower making from plants fiber, mat making with bamboo strips, coconut lamp making, making Thai-style dessert and weaving as well as selling agro-products such as mushroom, bamboo shoot and fruits wine. | * | | | |

| Program | Component | Expected Activity | Implementation Level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | Linkage: it shall be implemented in coordination with the other programs (Selling forest product---*Forest products utilization* component; Selling at community market---*marketing* component) | | | | |
| | Expenditure reduction | <Household expenditure reduction activities><br>- Villagers learn household account and how to reduce the expenditure through self production of commodities with making the most of the resources available in the area.<br>*(Expected Activities)*<br>• Have a workshop led by facilitator (NGO, advanced farmers) to analyze current household expenditure and identify the items that can be produced in the household with the resources available in the area.<br>• Invite trainers (advanced farmers, NGO, etc.) and have training on the necessary techniques.<br>• Practice through on the job training<br>• Monitor the activities<br>• Possible options are as follows:<br>Bar soap making, liquid detergent making and shampoo making. | * | | | |
| Livelihood Improvement | Energy saving | <Charcoal making, making cooking stove><br>- Villagers learn how to save the energy especially through the making efficient cooking-stove and high quality charcoal, targeting where charcoal and firewood are commonly used.<br>- Particularly, villagers learn about making charcoal from branches and stem of trees which are normally unused and left over in their own farms.<br>- Along the process, villagers will learn about vinegar extraction from these woods.<br>- They will learn about making organic pesticide from vinegar and practicing on application in their farms.<br>- Overall objective is to reduce the expenditures as well as to decrease the negative impact on natural resources.<br>- This will be in form of indigenous knowledge transferring and learning from appropriate resources persons.<br>*(Expected Activities)*<br>• It is recommended to initiate with the activities to enhance peoples' concern on importance on the natural resources.<br>• Have demonstration on making cooking stove as well as charcoal making for the villagers who are interested in.<br>• Practice and promote for dissemination.<br><br>Linkage: This component can also contribute to the conservation of natural resources through the reduction of cutting trees | * | | | |

| Program | Component | Expected Activity | Implementation Level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| Fund development | Locally accessible capital/fund development | <Organizing community bank, village fund, welfare fund, etc><br>- Villagers can satisfy their needs for the capital fund specifically for rural development through this activity.<br>- To avoid the bad debt, the fund should not be applied to supplement of daily expenses but used to the investment of rural development activities.<br>*(Expected Activities)*<br>• Establish group with people who have same interests such as production group. Existing group can also function.<br>• Strengthen local organizations that are already lending money to members.<br>• Seek new credit sources from related agencies, such as DOAE, CDD, CPD and ALRO. These agencies usually implement special projects by giving revolving fund to farmers as one component to invest in agriculture development or generate off-farm income.<br>• Have training on fund management to utilize the fund properly such as book keeping.<br><br>Linkage: Fund may be used for the activities in other component such as purchasing equipments for food processing, etc. | | * | | |
| Health and welfare improvement | Health improvement | *(Expected Activities)*<br>• Have seminar to enhance the awareness on importance of the self care and introduce several traditional means.<br>• Identify the resource persons who are familiar with medical herb and traditional medicine.<br>• Have training on several techniques such as Thai traditional massage and traditional medication for the people who are interested.<br>• Have seminar on basic health care and self care: knowledge on bird flu, impact from agricultural chemicals etc.<br><br>Linkage: Activities on the use of medical herb is deeply related with the “culture dissemination” component. | * | | | |
| | Culture dissemination | <Establishment of community information center, learning local knowledge, etc><br>- Villagers learn the values of local knowledge and traditions, aiming to reconsider the current life style.<br>- Super goal is to cultivate the awareness to the elders and natural resources.<br>*(Expected Activities)*<br>• Have workshop and identify what kinds of tradition, culture are there or used to be in the communities, and organize such information.<br>• Possible activities are animistic ceremony to respect the forest spirit, utilization of medical herb.<br>• Organize eco-tour to re-consider the importance of the natural resources with aims to enhance the unity among the participants. | | * | | |

| Program | Component | Expected Activity | Implementation Level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | Linkage: Traditional knowledge can contribute to the components of "health improvement" or "reduction of expenditure" through the appropriate use of traditional knowledge such as use of medical herb. | | | | |
| Infrastructure development | Social infrastructure | < Installation of village water supply ><br>Village water supply was carried out by DMR and it has been transferred to TAO since 2004. Some villages in LRAs have no village water supply system (ex. 24 % in four (4) provinces). The deep well with 50m depth, lift up pump(s), a standpipe, pipelines, individual faucets will be included in this program. So that the villager's daily life will be improved and it is expected to decrease water born sickness. The hydro geological investigation should be carried out prior to implementation. The cost of installation is shouldered by TAO while in-house meter and piping costs are by villagers as well as O&M costs as water service fee. The water service fee is from 3 to 5 Baht/cum depending on the O&M cost. | * | * | * | |
| | | < Expansion of village water supply ><br>Even though some villages have been equipped a water supply system, there are still houses out of the service area of the existing village water supply system. The distribution pipeline with a diameter less than 1 inch, an in-house meter and a stop valve will be proposed for such houses. The house should pay the water service fee after receiving the water supply from the existing system. The cost for installation is born by TAO. | * | * | * | |
| Infrastructure development | Social infrastructure | < Village electrification ><br>PEA is responsible agency for electrification. (In case of four provinces, only two villages are remaining without electrification in LRAs, namely Wang Khon Daeng in PYO06 and Pha Mu in PRE04.) Electrification can be requested by an individual household, or a group and villages. Although the fund for electrification can be supported by MOI within 25,000 Baht /household in case of solar system in remote area, it is better to carry out the electrification at least in group level or village level taking the cost share of household into consideration. | * | * | * | * |
| | | < Expansion of electricity service ><br>(In four provinces, average coverage rate of electrification is high as 98% in the villages that are electrified.) However, some households remain without electrification. Expansion of electrification is requested in same manner as for electrification. In the case of a remote group of households, solar panel generation system is also applied. | * | * | * | * |
| | | < Village road improvement ><br>To solve the poor condition of village road, improvement and/or new construction of village roads are programmed to secure the stable transportation situation through out a year. The road width of 6.0 m with laterite pavement is proposed under this development. The appurtenant structures such as a RC bridge and a box culvert will be installed at the necessary point to cross a creek or a river. | | * | * | * |

| Program | Component | Expected Activity | Implementation Level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | Living conditions improvement | < Garbage disposal improvement ><br>Most of villages in LRAs are in poor condition on garbage disposal. Most of farmers dispose their garbage to some places in the village, out of the house area. Considering this present situation of garbage disposal, the villagers should open their eyes why they need a garbage disposal system, and how to dispose their garbage. This program should give necessary information of this garbage disposal through a study tour to the advanced villages near their villages. They can learn the necessity of the garbage system for their healthy life. The villagers will make a suitable garbage disposal system by themselves taking into consideration the O&M cost and their technique. | * | * | * | * |
| | | < Wastewater treatment ><br>There are very few villages with a plop wastewater disposal system in LRAs. They discharge their wastewater without any treatment direct to the river and creek in LRAs or spread water around their house. Most villages do not have any wastewater disposal system at present and villagers do not know the necessity of wastewater disposal system. The study tour, therefore, is proposed to lesson and learn of the wastewater disposal system. They can learn how to treat and dispose wastewater to protect or minimize water pollution from their villages. | * | * | * | |

(HH): Household, (Vil.): Village, (Ta): Tambon, (D/P): District/ Province

### 5.3.4 Sustainable Agriculture Development Plan

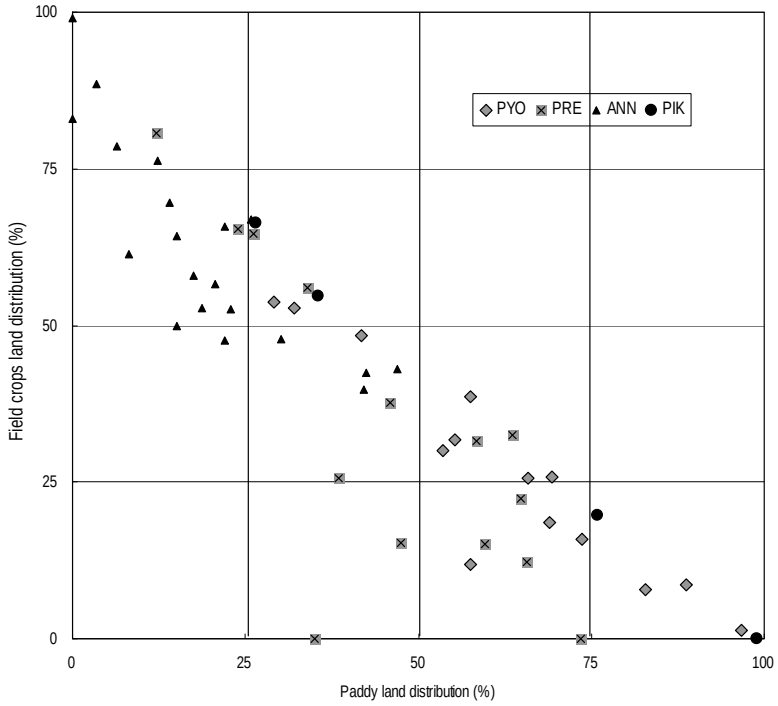
(1) Features of the LRAs Derived from Data Analysis

**1. The SPK 4-01 farmers tend to have small land holding size.**

As one of common features among the four provinces, the SPK 4-01 farmers tend to have less land in comparison with other farmers. This fact implies that the SPK 4-01 farmer families may need; (1) to utilize their land resources more efficiently to earn a certain amount of agricultural income, and/or (2) to diversify their income generation activities – which include both agricultural and non-agricultural ones – to compensate for the income shortage that can be attributed to the small land holding size.

**2. Although the agricultural land use varies by each M/P code area, there is a tendency that Phayao is paddy-dominant while Nan is field crops-dominant.**

If the four provinces are compared in terms of agricultural land use, they can be characterized as shown below.




| Province | Other agricultural lands dominant ⟷ Paddy dominant |
|---|---|
| Phayao | |
| Phrae | |
| Nan | |
| Phitsanulok | |

Data source: Calculated from the NRD2C data by the Study Team

**Figure 5.3.2 Tendency of Present Agricultural Land Use by Province**

In Phayao, paddy is dominant in many areas as compared to other provinces. In Phrae, paddy is major in half of the M/P code areas while other agricultural land use is dominant in another half. Agricultural land use in Phrae is more diversified as compared to other three provinces. Also in Phitsanulok, two M/P code areas are dominated by paddy while other two are dominated by field crops out of the four. Many M/P code areas in Nan are dominated by field crops.

Accordingly, agricultural development may need to pay attention on paddy-based farming in many M/P code areas in Phayao. On the other hand, it may need to focus on field crops-based farming in many M/P code areas in Nan. In Phrae and Phitsanulok, both of them may need depending upon the present land use conditions of M/P code area.

**3. As regard to farming activity diversification, Nan is the most diversified while Phitsanulok is the least diversified.**

From the viewpoint of diversity of crop types, it can be represented by the number of crop types being cultivated by majority of farmers. For instance, if 3 crop types are cultivated by over 50% of households in the area, it is possible to say that the agriculture in the area is more diversified as

compared to other areas where only one crop is cultivated by more than a half of farmers. The following table shows the cropping diversity of the M/P code areas in the four provinces.

**Table 5.3.3 Distribution of M/P Code Areas by Number of Major Crop Types**

| No. of Major Crop types | PYO | PRE | ANN | PIK | Total | Remarks |
|---|---|---|---|---|---|---|
| 3 and more | - | - | 12, 18 | - | 2 | More diversified |
| 2 | 01, 04, 10, 13, 14 | 03, 05, 09, 14 | 03, 05, 07, 08, 14, 17, 19 | - | 16 | |
| 1 | 02, 03, 05, 06, 07, 08, 11, 12 | 01, 02, 04, 06, 07, 08, 10, 13 | 01, 02, 04, 06, 09, 10, 11, 13, 15, 16, 20 | 01, 02, 03, 04 | 31 | |
| 0 | 09 | 11, 12 | - | - | 3 | Less diversified |

Data source: Calculated from the NRD2C data by the Study Team

As observed in the above table, Nan is the most diversified in terms of major crop types while Phitsanulok is the least. It may imply that, in general, agriculture in Nan is more self-supporting oriented (small amount of production quantity for one crop with a variety of crop types) while it is more cash crop oriented in Phitsanulok (large amount of production quantity for one crop with a few crop types). Also it can be stated that households in Nan are more stable than those in Phitsanulok in case of natural disasters such as prolonged rainy season and drought since the possibilities of crop failure are less with cultivation of plural crop types. This is also supported by the fact that small and medium size livestock raising is more active in Nan than in other three provinces.

**4. Agricultural inputs such as chemical fertilizer and pesticide are normally used in most M/P code areas while possession of agricultural machines is more common in Phayao and Phitsanulok.**

There are no significant differences between the four provinces in terms of the input use because the majority of farmers usually apply agricultural inputs including chemical fertilizer and pesticide in most of the M/P code areas. However the possession rate of agricultural machine (small engine) is higher in Phayao and Phitsanulok than in Phrae and Nan. From these facts, programs intending to improve agricultural input utilization should be equally applied in all the four provinces, whereas it needs to change approaches for programs, which presuppose the availability of agricultural machines by province.

(2) Features of the LRAs derived from the Participatory Survey

There are several issues and points which were clarified and proposed through the participatory survey conducted in the four provinces. The followings are important points which are related to sustainable agriculture development and derived from the participatory survey.

**5. In several M/P code areas, there are local specialties of crops such as lychee in PYO11 and chili in ANN04.**

The participatory survey revealed that paddy cultivation is a base of agricultural production system and some local specialties of crops are cultivated like chili in Tambon Yom and Chom Phra (ANN04) and lychee in Tambon Ban Mai (PYO11). These specialty crops could be potentials for processing and marketing related programs/components.

**6. In several M/P code areas, cash crop production such as corn and cassava are practiced and soil degradation has been concerned.**

The participatory survey also revealed that cash crop cultivation (corn, cassava) is commonly practiced in Tambon Mae Ka (PYO11), Tambon Yom and Chom Phra (ANN04) and Tambon Bang Dong (PIK01), and low fertility of soil is indicated as a problem in ANN04 and PIK01. It was observed during the field survey that corns were widely planted in a row along the slope, not across the slope, and, accordingly, soil erosion from these farmlands would occur. To avoid further soil degradation, soil and water conservation farming technologies should be introduced and extended in accordance with the present crop and field conditions. In addition, it revealed that many farmers still rely upon purchased food materials from the outside, while they produce cash crops on their farmlands.

**7. High agricultural production cost mainly due to expensive agricultural inputs and the consequent debt issue are raised.**

Based on the participatory survey, people raised an issue of high production cost mainly resulting from agricultural inputs as well as low farm gate price of crops. Hence many are forced to get loans from various financial institutions such as BAAC. Some people also worry about a health problem caused by side effects of chemical application and environmental destruction. If locally available resources are effectively utilized and agricultural production system is integrated with other activities such as livestock and fish raising, low input agriculture production system could be realized, which consequently can reduce production cost.

**8. There are various kinds of group activities in each M/P code area.**

The participatory survey revealed that there are many kinds of groups in each M/P code area. For instance, there are rice breeding, alternative agriculture, cattle raising and occupation groups in Tambon Ban Mai (PYO11). In Tambon Mae Ka (PYO11), a group of frog raising and three groups of cattle raising exist. In Tambon Bor Lek Long and Thung Laeng (PRE08), one village bank, eight chicken raising groups and four saving groups for production are there. Thus various kinds of group activities are presently working at a village level and they can be good examples, models and advisors for others who intend to organize the similar kinds of activities.

(3) Detailed Components of Sustainable Agriculture Development Plan

**Table 5.3.4 Project Component of Sustainable Agriculture Development Plan**

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| Agricultural production | Crop production | <Promotion of crop cultivation suitable for the soil characteristics><br>Based on the soil suitability information, which is available through each provincial office of LDD, people can learn what kinds of crops are appropriate to be cultivated in the designated area.<br>With the contact of LDD, people also have chances to learn soil and water conservation farming technologies.<br>If people start to cultivate new crops, it is suggested to have study tours to good model farmers/areas or other institutions to learn good practices. | * | | * | |
| | | <Planting local and common crops after harvesting paddy><br>To increase agricultural production and improve household food sufficiency, short term crops are promoted to plant after harvesting paddy.<br>At present, some people don't plant crops after harvesting paddy.<br>Before the implementation of activity, locally available crops should be investigated. This activity is very recommendable for those who have relatively small land holding since it increases land use efficiency.<br>It is suggested to have study tours to good model farmers/areas or other institutions to learn good practices. | * | | * | |
| | | <Planting vegetables around house (kitchen garden)><br>To improve household food sufficiency and decrease expenditure to buy food materials from the outside, kitchen garden is promoted.<br>Since this activity can be done at each household level, it is recommendable in all the areas.<br>It is suggested to have study tours to good model farmers/areas or other institutions to learn good practices. | * | | * | |
| | | <Diversification of crops><br>To improve household economic stability, diversification of crops is promoted since household economy is rather unstable if it relies on a few types of crop production.<br>If people start to introduce new crops, it is suggested to have study tours to good model farmers/areas or other institutions to learn good practices. | * | | * | |
| Agricultural production | Farming technology improvement | <Introduction of integrated farming><br>To decrease production cost and improve household food sufficiency, introduction of integrated farming is promoted. (Integrated farming: several kinds of activities are simultaneously carried out within the same vicinity; thus reduce the cost of production inputs from outside sources and generate stable income/food.)<br>It is recommendable to have study tours to good model farmers/areas or other institutions to learn good practices. | * | | * | |
| | | <Introduction of soil and water conservation farming technologies><br>To avoid further soil and water degradation, which induces low crop yields, soil and water conservation farming is promoted on the sloped areas. (e.g. planting in a row across the slope, covering crops, green manuring, etc.) With the introduction of farming at a village level, larger scale benefits arise.<br>It is suggested to have study tours to good model farmers/areas or other institutions to learn good practices. | * | * | * | |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | <Crop production by organic farming><br>To decrease production cost and avoid health and environmental problems, organic farming is promoted. (e.g. Some kinds of plants such as neem tree, extract of tobacco, soapy water and ash are useful as repellant. Marigold (*Tagetes spp.*) is often used to prevent nematodes for vegetables. )<br>It is suggested to have study tours to good model farmers/areas or other institutions to learn good practices. | * | | * | |
| | | <Knowledge improvement for breeding seeds><br>These days, hybrid seeds are widely used because of their high yield levels. However producers have to buy new seeds together with recommended inputs every year. Hence production cost is also high and net income does not increase very much even if yield level is high.<br>It is suggested to start research for local varieties and breeding seeds which are suitable for local conditions such as soil and climate with other institutions such as DOA and DOAE. | | | * | * |
| Livestock development | Livestock raising | <Promotion of livestock raising><br>Livestock raising is promoted in consideration with local conditions. It is recommended to start with livestock raising of medium and small scale animals since they need less inputs and lands than large one. It helps improve household food sufficiency and decrease expenditure to buy food materials. In addition, it can be combined with a cropping sector, which enables to reduce inputs cost for farming.<br>Because livestock raising is rather unpopular in all the M/P code areas, it is recommendable to prioritize the areas with reasonable criteria.<br>When people newly start livestock raising, it is suggested to have study tours to good model farmers/areas or other institutions such as DOL. | * | | * | |
| | | <Selection of breeders suitable for local conditions><br>If there are local livestock species in the area, it is promoted to conserve and breed them.<br>It is recommendable to start research for selection of breeders suitable for local conditions. Because it needs some technologies, it is suggested to work with other institutions such as DOL. | | | * | * |
| | | <Artificial insemination (cattle)><br>For efficient propagation of locally suitable cattle, artificial insemination is useful.<br>Because it needs some technologies, it is suggested to work with other institutions such as DOL. | | | * | * |
| | Feed production | <Plant pasture seeds suitable for local conditions><br>If large scale livestock raising is practiced in the area, fodder production is promoted with pasture suitable for local conditions. Possibility of grazing in the forest could be an issue for discussion at a village level.<br>It is suggested to work with other institutions such as DOL and LDD. | | * | * | * |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | <Improvement of equipments to prepare feed in dry season and make mix concentrated feed><br>If large scale livestock raising is practiced in the area, improvement of equipments is also promoted to prepare feed in dry season and make mix concentrated feed.<br>It is suggested to work with other institutions such as DOL. | * | | * | * |
| Farm produce processing | Plant material processing | <Rice processing and its by-product utilization (straw, husks)><br>To add value to farm produce and increase household income, processing is promoted. Production of unpolished rice and alcohol beverage making is possible examples.<br>If commercially successful business is intended, certain amount of stock is necessary. Hence it should promote in rice growing areas.<br>On the other hand, by-product utilization which intends to reduce production cost can be done at each household level so it is promoted in all the areas.<br>It is suggested to have study tours to good model farmers/areas or other institutions such as DOAE and Industry Office. | * | | * | * |
| | | <Fruits processing (juice, wine, etc)><br>To add value to farm produce and increase household income, processing is promoted. Production of juice, wine, jam and dried fruits are possible examples.<br>If commercially successful business is intended, certain amount of stock is necessary. Hence it should promote in fruits growing areas.<br>It is suggested to have study tours to good model farmers/areas or other institutions such as DOAE and Industry Office. | * | | * | * |
| | | <Vegetables processing><br>To add value to farm produce and increase household income, processing is promoted. Production of juice, paste, powder and dried vegetables are possible examples.<br>If commercially successful business is intended, certain amount of stock is necessary. Hence it should promote in vegetable growing areas.<br>It is suggested to have study tours to good model farmers/areas or other institutions such as DOAE and Industry Office. | * | | * | * |
| Farm produce processing | | <Utilization of by-product from processing factories><br>If farm produce processing factories are there in the area, utilization of by-product from the factories is promoted for efficient local resource use. They are possible to be utilized as materials for fodder or bio-fertilizer. Volume of by-product could be a certain amount so it is recommendable to work at a group and village levels.<br>It is suggested to have study tours to good model farmers/areas or other institutions such as DOAE and agricultural college. | | * | * | |
| | Animal material processing | <Animal meat processing><br>As compared to plant material processing, this is more difficult and complicated since it needs more hygienic cares.<br>If meat production is enough, its processing is promoted to add value and increase household income.<br>It is suggested to work with other institutions such as DOL and Industry Office. | * | | * | * |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | <Making fish sauce><br>To reduce household expenditure, fish sauce making is promoted if enough materials are available.<br>It is suggested to have study tours to good model farmers/areas or other institutions such as DOF and Industry Office. | * | | * | |
| Marketing | Enhancement of local circulation of farm produce | <Community market development><br>To increase household income, community market is promoted. It helps enhance local circulation of farm produce at a village level. It also has several other positive effects such as improvement of local food sufficiency and revitalization of village economy.<br>It is suggested to have study tours to good model villages. | | * | * | |
| | | <Development of marketing network><br>After experiencing some successful cases of community market, it is promoted to connect them as a marketing network, which enables village people to accelerate their marketing activities without depending upon middlemen.<br>It is suggested to have study tours to good model villages/tambons. | | * | * | |
| | Marketing improvement of local specialties | <Farm produce marketing improvement><br>If there is a locally special farm produce (e.g. chili, soybean, citrus), it is promoted to ship the produce collectively not individually, which enables people to sell their produce at more lucrative prices.<br>It is suggested to have study tours to good model farmers/areas or other institutions such as DOCP. | | * | * | |
| | | <Livestock produce marketing improvement><br>If there is a locally special livestock, it is promoted to ship the livestock collectively not individually, which enables people to sell their livestock at more lucrative prices.<br>It is suggested to have study tours to good model farmers/areas or other institutions such as DOCP. | | * | * | |
| Infrastructure development | Water resources development | <Existing irrigation facilities improvement><br>To solve the water shortage problem of the existing irrigation system, improvement works which compose a weir repair, dredging and widening irrigation and drainage canals, irrigation canal lining (only at necessary portions), check structure improvement are proposed. | * | * | * | * |
| | | <Individual farm pond development and installation of micro irrigation system><br>The individual farm pond development consists sediment removal, minor repair and gate lubrication will be carried out. As installation of micro irrigation system, necessary facilities and equipments such as a shallow and/or deep well, a pump, tube-pipes, etc. are proposed. | * | | * | * |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | <Groundwater development><br>The shallow (and/or deep) well is proposed for suitable areas for micro irrigation system by farmers. The average shallow well depth is assumed at around 30 m. However, for the implementation stage, the hydro geological study and pumping test should be carried out prior to the construction. The construction cost of the shallow well of 16,000 Baht/well will be applied. In case of the four (4) provinces, the most suitable sites of the groundwater development are PIK03 and PIK04, because they are located on an alluvial plain. And there are some suitable areas in Phayao and Nan, too. | * | | * | * |
| | | <Existing reservoir improvement><br>There are some reservoirs and ponds in the LRAs although their numbers are limited. Average numbers of reservoirs in the LRAs are 0.4 reservoirs per village. If water shortage is severe in some villages, it is worth to improve the reservoirs by dredging or strengthening. | * | * | * | * |
| | | <Perennial stream development><br>In order to solve the shortage of water supply for irrigation and domestic water supply, the perennial stream development, which includes repair and construction of a simple weir and intake facility on the stream, is proposed. | * | * | * | * |
| | | <Small scale reservoir development><br>This small-scale reservoir development is limited due to topographic condition and higher cost than other activities as indicated above. The development priority, therefore, is lower than other developments descried before. For execution of this program, careful evaluation is required. This contains the construction of reservoir with intake and spillway structures, and feeder and irrigation canals depending on the topographic conditions. | * | * | * | * |
| | On-farm facilities | <On-farm road improvement and development><br>To secure a stable transportation from a village to outside throughout year, the existing on-farm road should be improved or developed for villagers for not only their farming works but also their daily use. Most of existing roads need widening and paving. The road width of 4.0 m with laterite pavement is proposed. The bridge and box culvert at the crossing point of the creek and river, are also inclusive. | * | * | * | * |
| | | <Farmland soil conservation (structural measures)><br>Average farmland slope is 6.5% in the LRAs, and the maximum slope reaches to 35%. Villages more than 45% report the erosion problem in the farmland. Once farmland is bared and cover vegetation is removed in rainy season, heavy erosion and soil loss are easily caused in farmland. To avoid such heavy erosion and soil loss, it is important to keep cover vegetation in farmland. Apart from vegetative measures, following structural measures or mixed measures are to be considered: | * | * | | |

| Program | Component | Expected activity | Implementation level | | | |
|---|---|---|---|---|---|---|
| | | | HH | Vil. | Ta. | D/P |
| | | 1) Contour cultivation: to cultivate along the contour line and not to make water flow on the slope. This method is rather difficult for mechanical cultivation in the slit shape farmland along the slope, however farmer should consider loss of soil and fertility in his/her farmland. If possible, he should discuss with the adjacent farmers to carry out contour cultivation in their farmlands.<br>2) Contour bund or contour ditch: to shorten the water flow along the slope and to reduce the erosion energy of rainwater. This is also difficult on the above type farmland, but farmer should discuss with the adjacent farmers the possibility in the same manner. Vetiver grass or lemon grass can be utilized as contour bund in the form of mixed measures.<br>3) Small step terrace: for fruit tree cultivation or agro-forestry, this method is rather applicable for the individual farmers within his family labor works or by the cooperative works among the adjacent farmers. Step slope can be protected by vetiver or lemon grasses or other suitable useful vegetation.<br>4) Provision of farm pond: It can work not only for water resources but also as a sediment trap pond although farmer should remove sediment sometime. Sediment can be put back on his farmland and he can save soil and fertility.<br>5) Improvement of catch drain and provision of check dam: contour bund or contour ditch or farmland is connected to the catch drain to drain excessive rainwater. However, if catch drain is not protected, it will be easily eroded by water flow. It is necessary to protect the drains from erosion by check dams and vegetation on the drain slopes. Abandoned materials such as stone and rock are utilized for check dam and vetiver or lemon grass can be utilized for the drain slope protection. The works should be carried out by the farmers concerned. | | | | |
| | | <Flood mitigation><br>Some villages report flood or poor drainage problems. Under this program, the catch drains and drainage canals with some appurtenant structures are proposed to mitigate the flood problem on the farmland. | * | * | | |

(HH): Household, (Vil.): Village, (Ta): Tambon, (D/P): District/ Province

### 5.3.5 Monitoring Guideline

These monitoring guidelines are prepared to help all the parties concerned who work on monitoring process of the M/P in the four provinces of Phayao, Phrae, Nan and Phitsanulok.

(1) Why Monitoring?

Monitoring is required because it is as a process to see that everything goes, as far as possible, according to plan and that resources are not wasted. As monitoring is a continuous feed back system, it is on-going throughout the life of a project or program. It involves periodic review of each activity at every level of implementation to ensure that:

a) Work plan are followed as closely as possible;
b) Inputs are ready on time;
c) People who need to know are always be informed;
d) Resources are used efficiently and effectively;
e) Constraints and bottlenecks can be foreseen, and solutions are prepared for and
f) Adjustments can be made and corrective action taken when necessary.

(2) Approach

Traditional monitoring and evaluation is normally carried out by the people or agencies so called "outsiders.[1]" This is often for accountability purposes, involving mainly on collection of quantitative information in order to measure the outcomes and sometimes the impact. Since it lacks people participation, this type of monitoring can not yield results as good as those that can be achieved through participatory monitoring. This method tends to focus on the collection of more qualitative information by "insiders[2]" in order to understand strategy implementation, accomplishments and lessons learned which can be contributed to local learning for decision making. However it requires considerable skill of insiders regarding the design on monitoring process, including development of data collection instruments, analysis and synthesis of information collected. Support from outsiders is then required in this case. Hence the joint participatory monitoring process is considered as more practical. That means information will be collected and recorded systemically with periodic analysis by insiders with the help of outsiders. By this application, it is expected to:

- Increase the capacity and confidence of community members, local staffs and the relevant agencies to analyze their own needs and to undertake action-planning
- Avoid the problems that outsider-led methods might create.

[1] "Outsiders" refers to consultants, provincial lines agencies officials, central level ministry officials, donor representatives, etc.)
[2] "Insiders" refers to community representatives and local field staff

- Contribute to sustainability of program strategies by increasing the sense of ownership on the part of local development staff and community members of the conclusions and recommendations for future action.

This approach is based on four key principles of:

- Local people are active participants, not just sources of information.
- Stakeholders monitor, while outsiders facilitate and backstopping
- The focus is on building stakeholders' capacity for analysis and problem-solving.
- The process should build commitment to implementing recommended corrective actions.

(3) Plan for Monitoring

Once the community development plans have been approved, the core working team will include a monitoring and evaluation plan with appropriate indicators and tasks assigned for implementation. It is their duty to identify:

- Who will do what,
- How it will be done,
- When it will be done,
- How the performance will be monitored, and
- How the impact will be assessed.

Although the participatory monitoring can be introduced at any stage of implementation, the best time to start is at the beginning stage. All activities identified in community development plan should be listed with the record of tentative timeframe of implementation and key contact persons of monitoring. This will be a kind of benchmark information. Development of simple form is shown in Form A.

(4) Steps of Monitoring

Participatory monitoring can be defined within 6 steps of operation. This comprises of:

1) Discuss reasons for monitoring
2) Review objectives
3) Develop indicators
4) Measurements and data collection
5) Processing, organizing and analyzing data, and
6) Sharing the information and defining actions to be taken.

1) Step 1: Discuss Reasons for Monitoring

In relation to community development plan, purpose, process and benefits of monitoring should be explained to villagers. They will be the ones who make decisions by themselves whether monitoring

will help them and whether they would like to do it or not? At this stage, key persons of each group should be nominated to take responsibilities as representative of the group. They will be contacted persons and carried out monitoring of that particular activity, on voluntary basis.

**Table 5.3.5 Form A: List of Activities in Relation to Responsible Persons**

Place……. Recorder …….

| Component | Activities | Timeframe | Person(s) responsible |
|---|---|---|---|
| Example: (Forest rehabilitation) | Example: (Reforestation) | (to be identified) | (to be identified) |
| | | | |
| | | | |
| | | | |

2) Step 2: Review Objectives

Objectives of each activity will be reviewed in order to confirm the same understanding of villagers who participate in this activity, so that operation can run smoothly.

3) Step 3: Develop Indicators

Indicators seem to be difficult part of the participatory process. However they should be referred to "changes or new findings" occurring along implementation of each activity. They should be seen and measured without difficulties, because it will be carried out mainly by local people. In practice, they should be developed along the process, in parallel with activities. Local indicators in this case will refer to four categories. They are:

1) level of participations,
2) inputs and outputs of activities,
3) assess impact on household, and
4) assess impact on eco-system

In some cases a common set of indicators (i.e. in relation to level of participations or simple items related to inputs and outputs of activities) can be developed easily by local people and pre-identified. The rather complicated ones in relation to assess impacts on household and eco-system may require assistant from outsiders. However decision will be made by local people. Examples of indicators in relation to these aspects are shown in Table 5.3.6.

**Table 5.3.6 Examples of Local Indicators to be Developed**

| **Indicators that measure level of participations** |
|---|
| ♦ Number of groups formed to help implementation the program (such as community forest committee group, forest fire control group, organic compost group) |
| ♦ Number of meetings, data gathering exercises, group production activities that take place over a certain period of time, |
| ♦ Number of demonstrations |
| ♦ Number of people trained, joined study tours |

| |
|---|
| **Indicators that measure inputs and outputs of activities**<br>♦ Area of reforestation<br>♦ Area of community forest<br>♦ Survival rate of reforestation |
| **Indicators to assess impact on household**<br>♦ Amount of items generated from expected activities, serving for home consumption<br>♦ Income generated from expected activities<br>♦ Amount of money spent on expected activities<br>♦ Level of safety due to expected activities |
| **Indicators to assess impact on eco-system**<br>♦ Change of variety and amount of forest products<br>♦ Change of amount of natural water resources<br>♦ Change of quality of natural water resources<br>♦ Change of wild plants and wildlife in both varieties and population |

There can be more than one indicators of each activity, but not too many.

4) Step 4: Measurements and Data Collection

Indicators will be directly linked to information required, measurement methods and responsible persons anyway. Of each indicator, insiders should discuss together to decide:

- What information required?
- How to collect data?
- Who will do data collection?
- When to collect? How often?

In practice, one should act as a facilitator and encourage the local people to do brain storming and answer these questions. Answers should be recorded in simple form (Form B) so that people who join activity can see that. Measurement methods are varied from simple to complicated, depending on types of indicators and data required. These range from simple measurement of quantitative data to qualitative data required, as elaborated below.

**Table 5.3.7 Form B: Indicators and Related Parameters of Each Activity**

| Activities/Indicators | Information required | Measurement Methods | Who will do? | When/How often |
|---|---|---|---|---|
| Example:<br>(Reforestation: Level of participation) | Example:<br>No. of people joined reforestation | Example:<br>Direct head count | (to be specified) | When activity take place in accordance with timeframe |
| | | | | |
| | | | | |
| | | | | |

a) Simple and Direct Measurements on Level of Participation

Required information is directly related to number of people participated in all activities such as joining study tour, training, reforestation, etc. Therefore, measurement method is quite simple,

just head count and record. In this case, any group members who like to assist in data collection should volunteer to do so. Besides number of participants, date, place, results, constraints and remarks form observation should be recorded too. Simple form should be prepared as shown in Form C. Key persons as identified earlier should take this responsibility.

**Table 5.3.8 Form C: Measurement of Level of Participation and Inputs and Outputs of Activities**

Place…… Recorder …….

| Activities | Date/place of operation | Indicators | | Problem/ constraint | Remarks form observation |
|---|---|---|---|---|---|
| | | Level of participation | Inputs/outputs of activities | | |
| Example: Reforestation | | Example: No. of participants | Example: Area of reforestation | | |
| | | | | | |
| | | | | | |
| | | | | | |

b) Indicators that Measure Inputs and Outputs of Activities

Measurement in relation to inputs and outputs activities is not so simple as the head count of level of participation. For example, measurements of number of newly establishment items such as areas of reforestation or plots of medical plants require more skill. These people also should be specified earlier. Normally the measurements should be carried out at the completion of activities. This data set can also be recorded in the same form mentioned above (Form C). The difference is quantity if inputs and outputs of activities are added in.

c) Indicators to Assess Impact on Household

More qualified and experienced persons are required for measurements and collection of quantitative and qualitative data when comparison to existing situation is required. For example, data sets reflecting household expenses, income, production cost and yields arisen from introduced activities at the household level (e.g. kitchen garden) can be compared to present situation. The design of data collection forms may require assistance from experienced persons and outsiders.

Placing emphasis on quality rather than the quantity, it is not necessary to collect data in every household. Hence random samplings can be applied. This will be on purpose random in accordance with the availability of farmers who volunteer to do data collection, on voluntary basis. Example of simple questionnaires is shown in Form D.

**Table 5.3.9 Form D: Example of Data Collection at Household Level**

Recorded by _____, Varieties specified _____

| Date | Inputs / outputs | Amount | Problems/ constraints | Remarks from observation |
|---|---|---|---|---|
| | Inputs<br>(Items to be specified)<br>- | | | |
| | Outputs<br>(Items to be specified)<br>- | | | |

Note: This form should be recorded individually, at the household level.

d) Indicators to Assess Impact on Eco-system

Some types of information can not be collected in quantity, especially when it is associated with impacts on ecology such as the changes referring to quantity and quality of water, forest and soil resources.

The ones who utilize these resources should be key informants to provide this type of information. For example, forest products collectors will be able to observe and inform the others about changes of water quantity or quality or forest fertility after project implementation. They should be specified by group members as well.

Since information in this case is mainly from the survey and site observations, guide questions should be developed for in-depth interview the key informants. Since it is not easy to adjust either the quantity or quality change of these items by one or few persons, then it is necessary to discuss among the group members and others who are concerning or interested in these issues. In this case, there is a requirement of technical support from knowledgeable persons, both insiders and outsiders. Hence collection of qualitative information requires the combination of:

- Survey,
- Site-observation,
- In-depth interview, and
- Focus group discussion.

Recording information obtained from interview or results of meeting/discussion should be done properly. It will be in form of taking notes in diary or logbook on events occurred. Later, group leader should compile and organize all information collected for further analysis.

5) Step 5: Processing, Organizing and Analyzing Data

It is important to analyze their information monitored at specific times throughout the activities. That means raw data should be processed, organized and analyzed by members of each activity group and results should be discussed at the community meeting. These will be compared with original action plan. Problems/constraints that obstruct implementations of each activity will be summarized. In case of distortion of implementation, group members will discussed based on those

findings. They will consider for proper adjustments. This may require higher level of technical support from resources persons including outsiders where necessary (i.e. elaboration on problem analysis and proposal of solutions)

6) Step 6: Sharing the information and defining actions to be taken

Data analysis, results of discussion, summarized findings, situation analysis and developed recommendations should be shared with other stakeholders at this stage, since not all stakeholders can be involved in the previous steps. In practice, the successes, impacts, lessons learned and proposal for improvement arisen from implementation should be summarized and presented to other stakeholders for discussion.

On the other hand, it is probably beyond the local capacity to carry out the mentioned activities alone. This is a time that technical supports, especially in relation to problems solving from outsiders/relevant agencies may be required. This is depending upon expertise of those agencies. However any appropriate actions recommended should be based on the findings and discussed before.

(5) Monitoring System

Although monitoring is on-going process through out the project life, formal meeting should be arranged periodically. It is recommended to carry out on monthly, quarterly, half year and a year basis. Roles of insiders and outsiders participated in these meetings are defined below:

a) Monthly Meeting

Purpose of this meeting will be on reviewing actual activities being carried out during a month. This will be compared to the original action plan. Participants will be local community members and key persons/leaders of every activity groups.

All these activities should be recorded in the monthly monitoring form by key persons identified. As example shown in the Form E, time, location, no. of participants, etc. will be noted down. This will include results, problems/ constraints and remarks from observations of those activities. They will be brought for group discussion. Results should be recorded and documented by identified person.

**Table 5.3.10 Form E: Monthly Monitoring Form of the Community Plan Activities**

Place …….. Month …… Recorder ……

| Date | Activities | Objectives | Target group | Process | Methodology | Place/ No. of participants | Results | Problems/ constraints | Remarks |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

b) Quarterly Meeting

The three-month time meeting will be elaborated in the wider context. This will include preliminary assessment of activities carried out during three months. Then records of monthly monitoring form will be inputs for the assessment. Impacts, lesson learned and proposal for improvement of each activity will be included (Form F). This should be done by identified community members.

**Table 5.3.11 Form F: Summary of Findings, Lessons for Discussion with the Others**

| Activities | Action done | Impact | Lesson learnt | Proposal for improvement |
|---|---|---|---|---|
| Example: (Reforestation) | (to be identified)<br>-<br>- | (to be identified)<br>-<br>- | (to be identified)<br>-<br>- | (to be identified)<br>-<br>- |
| | | | | |
| | | | | |
| | | | | |

At this stage, more stakeholders will be involved. Outsiders such as PLROs and relevant line agencies should provide technical support responded to problems/ constraints and proposal for improvement raised by group members. Besides this, effectiveness and constraints of some subjects such as implementing structure, role of each actor, monitoring mechanism, etc. should be reviewed.

c) Six Month and Yearly Meeting

Participants of these meetings will be the same group as quarterly meeting with inclusion of representatives from policy level (i.e. central ALRO and Ministry of Agriculture and Agricultural Co-operatives). Besides sharing information, lessons learned derived from implementations should be discussed/elaborated and utilized as inputs to policy makers. They should take these results to consider for some modifications/adjustments in accordance with realities.

*REMARKS*

It should be noted that:

- This is a participative method that aims to draw meaning from actual events, rather than being based on indicators. The method involves collecting stories from stakeholders about what they think is the most significant change a project has brought about. These stories are then analyzed, discussed and verified.
- Participatory monitoring is a time-consuming exercise and people concerned. Local people are supposed to do many things along the process. Besides simple data collection, it also cover rather complicated skill of for example, in-depth interviews, participant observation, diaries recording and site survey, data analysis, discuss results, summarize findings, sharing information with the others, situation analysis and develop recommendations. Technical support along the process is highly required, in both aspects of specific matters and facilitating matter. Hence resources persons are necessary to support and supervise along monitoring process. This will be able to transfer technology on job-training mode.

## 5.4 PRIORITIZATION OF THE M/P CODE AREAS AND COMPONENTS

### 5.4.1 Procedures for Prioritization of the M/P Code Areas and Components

(1) Characterization of Natural Resources and the LRAs

Natural resources and the LRAs were characterized by the following methods.

- Natural resources such as land, water and forest are characterized in the provincial level.
- LRAs are characterized by analyzing the M/P code area data that indicate physical and socio-economic conditions of the LRAs.

Data items used for characterization are shown in the following table.

**Table 5.4.1 Data Used for Characterization of Natural Resources and the LRAs**

| Sector | Sub-sector | Data used for characterization |
|---|---|---|
| **Natural resources** | | |
| Provincial natural resource | Land | Land use, Climate, Elevation, Soil |
| | Water | Water body, River system, Watershed area, Groundwater, Irrigation |
| | Forest | Forest zoning, Protected area, Community forest |
| **Agricultural Land Reform Areas (LRAs)** | | |
| LRAs | Target group | M/P code area, Tambon, Villages, Households |
| Natural resources | Land | Area of LRAs, Elevation, Slope, Land use, Community forest |
| | Water | Surface water, groundwater |
| | Soil | Soil groups and problems, Soil suitability, Soil erosion |
| Socio-economy | Demography | Administration, Population, Agricultural households |
| | Household Finance | Household income, Household expenditure, Household debt |
| | Non agro-industry | Non-agriculture employment, Village industry, Economic and social facilities (shop, cooperatives, training center) |
| | Social infrastructure | Road, School, Health center, Community center, Electricity, Water supply, etc. |
| | Living conditions | Wastewater and waste materials, Fuel source for cooking |
| Agriculture | Land use | Agriculture land, Forest land, Others |
| | Land holding | SPK 4-01 land farmers |
| | Cropping system | Land use categories by crops (paddy, field crop, fruit tree, vegetables, rubber, others) |
| | Livestock | Household livestock activities for sale (beef, milk cow, buffaloes, swine, poultry) |
| | Agriculture inputs and Agricultural technology | Farm machines, Natural & chemical fertilizer, Use fertilizer for paddy, Use promoted seed for paddy, Expenditure for agricultural inputs for paddy cultivation, Availability of technology transfer center service, Problem of no knowledge for other cropping |
| | Irrigation infrastructure | Water resources development, Irrigation system, Farm pond, Water shortage |

(2) Procedures for Prioritization

Three sectors in the Master Program contain several programs and components, and there are some expected activities in each component. With the limited resources, it is an important issue to decide in which M/P code area an activity will be implemented. The M/P code areas were prioritized in accordance with the following processes.

1) Prioritization of the M/P code areas by component: In each component, the M/P code areas were comparatively prioritized by analyzing data that indicate present conditions of the concerned component as indicated above. In case that the component consists of several expected activities, comparative prioritization was firstly done by activity and then the data were integrated as the prioritization of the M/P code areas.
2) Prioritization of programs and components at the provincial level: The above prioritization of the M/P code areas by component was integrated and averaged for prioritization of the concerned components in the concerned province. For the prioritization of the programs, the related components prioritization results were integrated.
3) Prioritization among three sectors was not done.

1) Prioritization of the M/P Code Areas by Component

Prioritization of the M/P code areas by component was done according to the following processes.

a) From the data analyzed for characterization, data that are supposed to indicate present conditions of components and/or expected activities are selected as indicators.
b) Criteria for prioritization are set.
c) The indicators are measured based on the criteria to make priority recommendation.
d) Priority recommendation is made as follows.

| | | |
|---|---|---|
| +++ | : | Highly recommendable |
| ++ | : | Moderately recommendable |
| + | : | Recommendable |
| - | : | Not recommendable |

Priority recommendation among the M/P code areas is based on the GIS and NRD2C data, not on the field survey in the M/P code area, and is not targeted at individual villages. It is applicable to the M/P code area which is composed of several tambons and villages and characterized by integrated and/or averaged data. Considering that, the priority recommendation can be used as general guidelines and/or reference when local government and PLRO select the tambons and villages to conduct any prior consultation with the LRA farmers for the M/P implementation. Priority recommendation should be reviewed by field survey before prioritized programs and components will be implemented in the specific villages.

2) Prioritization of Programs and Components at the Provincial Level

Priority recommendation of programs and components in each province was based on the average of those of the M/P code areas.

(3) Natural Resources Management Sector

Natural resources sector is composed of the 4 programs and 10 components, and each component contains several expected activities, as shown below.

**Table 5.4.2 Expected Activities in Natural Resources Sector**

| Program | Component | Expected Activities |
|---|---|---|
| 1. Forest produce utilization | 1.1 Food utilization | 1.1.1 Herbs, bamboo shoot, wild vegetables mushroom and ants' eggs harvesting |
| | 1.2 Non-food utilization | 1.2.1 Medical plants, making wood vinegar, small dead tree cutting |
| 2. Forest area management | 2.1 Community forest establishment | 2.1.1 Community forest registration, Organizing community forest committee |
| | 2.2 Community forest management | 2.2.1 Strengthening community forest committee, Making regulations |
| | 2.3 Forest valuations | 2.3.1 Identify valuable species/natural resources, Knowledge dissemination, Eco-tourism promotion |
| 3. Forest rehabilitation | 3.1 Forest rehabilitation | 3.1.1 Reforestation activities |
| | | 3.1.2 Making firebreak |
| | | 3.1.3 Community forest guard activities |
| | 3.2 Reserved forest area delineation | 3.2.1 Putting boundary markers |
| 4. Soil and water conservation | 4.1 Soil conservation | 4.1.1 Farm land soil conservation, Soil improvement (making bio-fertilizer/ compost) |
| | 4.2 Water conservation | 4.2.1 Construction of small-scale check dam/weir, Removal sediments in check dams/weir, Dredging of natural water body |

Priority recommendation of the M/P code areas by component was judged by the integrated priorities of the expected activities. Based on the processes described in the previous section, quantitative items linked with expected activities were selected as indicators from the available data. Criteria were set to measure these indicators for ranking. Besides quantitative indicators, some non-quantitative indicators were provided in consideration of objectives of the activities concerned. For those indicators, the same priority was given to all the M/P code areas considering significance of the activities and component. The selected items for prioritization are shown as follows.

**Table 5.4.3 Selected Items for Prioritization**

| Expected Activities | Quantitative Data | Indicators Used |
|---|---|---|
| 1.1.1 Food (herbs, bamboo shoot, wild vegetables, mushroom and ant's eggs, etc) harvesting | - | Building awareness on sustainable use of forest resources |
| | - | Creation of learning center for the communities |
| | - | Existing of community (village) |
| | X | Community forest area |
| | X | Farmland utilization (forest area in land utilization) |

| Expected Activities | Quantitative Data | Indicators Used |
|---|---|---|
| 1.2.1 Medical plants, making wood vinegar, small dead tree cutting | - | Building awareness on sustainable use of forest resources |
| | - | Creation of learning center for the communities |
| | - | Existing of community (village) |
| | X | Community forest area |
| | X | Farmland utilization (forest area in land utilization) |
| 2.1.1 Community forest registration, Organizing community forest committee | - | Building awareness on sustainable use of forest resources |
| | - | Existing of community (village) |
| | X | Farmland utilization (forest area in land utilization) |
| 2.2.1 Strengthening community forest committee, Making regulations | - | Building awareness on sustainable use of forest resources |
| | - | Capacity building of local communities in resources management |
| | X | Community forest area |
| | X | Villages access to community forest |
| 2.3.1 Identify valuable species/natural resources, Knowledge dissemination, Eco-tourism promotion | - | Building awareness on sustainable use of forest resources |
| | - | Creation of learning center for the communities |
| | - | Existing of community (village) |
| | X | Community forest area |
| | X | Farmland utilization (forest area in land utilization) |
| | X | Access to center of Amphoe |
| | X | Road conditions |
| 3.1.1 Reforestation activities | - | Building awareness on sustainable use of forest resources |
| | X | Farmland utilization (forest area in land utilization) |
| | X | Ratio of community forest area |
| 3.1.2 Making firebreak | - | Area adjacent to Zone-C |
| 3.1.3 Community forest guard activities | X | Existing of community forest area |
| 3.2.1 Putting boundary markers | - | Existing of Zone-A, E and C, Community forest |
| 4.1.1 Farm land soil conservation, Soil improvement (making bio-fertilizer/ compost) | - | Existing of community (village) |
| | X | Farmland use (agricultural land use) |
| 4.2.1 Construction of small-scale check dam/weir, Removal sediments in check dams/weir, Dredging of natural water body | - | Area adjacent to Zone-C |
| | X | Existing of stream network |
| | X | Area with land slope |

With statistical analysis such as average and standard deviation, criteria are made for the quantitative indicators. However, factor of human activities that cannot represent as quantitative indicators is important to prioritize the activities in this sector. Therefore non-quantitative indicators which imply human activities are put in the criteria. (See Table 5.4.4.)

For example, community forest area size is used as an indicator for the “1.1.1 Food harvesting” activity” and the highest prioritization (highly recommendable: +++) is given to the area size of more than 50 rai. In the same way, the second priority (moderately recommendable: ++) is given to the area size from 50 to 5 rai, the third priority (recommendable: +) to the area size of less than 5 rai, and the least priority (not recommendable: -) to the area with no community forest area. In this sector, there are several activities which “not recommendable (-)” should not be given considering the importance of their objectives. For those activities, the same priority is given between the “+++” and “+”.

Because quantitative indicators are based on the processed data in national level, it is possible to assume that reliability of single indicator is relatively low to denote activities in the specific villages. Hence other data that may reflect the concerned activities were integrated as many as possible. As for the non-quantitative indicators, those related with “awareness” and “capacity building” were provided with the same priority. For instance, the same priority – highly recommendable (+++) – is given to the indicator, “Building awareness on sustainable use of forest resources”.

**Table 5.4.4 Priority Criteria by Indicator**

| Component/Expected activities/Indicators | Unit | Priority recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| **1.1 Food utilization** | | | | | |
| **1.1.1 Food (herbs, bamboo shoot, wild vegetables, mushroom and ant’s eggs, etc) harvesting** | | | | | |
| (1) Building awareness on sustainable use of forest resources | | It is recommendable to all the areas for building awareness on sustainable use (+++). | | | |
| (2) Creation of learning center for the communities | | It is recommendable to all the areas for creation of learning center (+++). | | | |
| (3) Existing of community (village) | | It is recommendable to all the areas where community (village) exists (+++). | | | |
| (4) Community forest area | rai | >50 | 50-5 | 5-0 | No exists |
| (5) Farmland utilization (forest area in land utilization) (forest area/LRA) | % | >25 | 25-10 | 10-1 | 1< |
| Total (((1)+(2)+(3))*(4)+(5))/30 | % | 100-66 | 66-33 | 33- 0 | - |
| **1.2.1 Medical plants, making wood vinegar, small dead tree cutting** | | | | | |
| (1) Building awareness on sustainable use of forest resources | | It is recommendable to all the areas for building awareness on sustainable use (+++). | | | |
| (2) Creation of learning center for the communities | | It is recommendable to all the areas for creation of learning center (+++). | | | |
| (3) Existing of community (village) | | It is recommendable to all the areas where community (village) exists (+++). | | | |
| (4) Community forest area | rai | >50 | 50-5 | 5-0 | No exists |
| (5) Farmland utilization (forest area in land utilization) (forest area/LRA) | % | >25 | 25-10 | 10-1 | 1< |
| Total (((1)+(2)+(3))*(4)+(5))/30 | % | 100-66 | 66-33 | 33-0 | - |
| Total 1.1.1~1.2.1 | % | 100-66 | 66-33 | 33-0 | - |
| **2.1 Community forest establishment** | | | | | |
| **2.1.1 Community forest registration, Organizing community forest committee** | | | | | |
| (1) Building awareness on sustainable use of forest resources | | It is recommendable to all the areas for building awareness on sustainable use (+++). | | | |
| (2) Existing of community (village) | | It is recommendable to all the areas where community (village) exists (+++). | | | |
| (3) Farmland utilization (forest area in land utilization) (forest area/LRA) | % | >25 | 25-10 | 10-1 | 1< |
| Total ((1)+(2))*(3))/18 | % | 100-66 | 66-33 | 33-0 | - |
| Total 2.1.1 | % | 100-66 | 66-33 | 33-0 | - |
| **2.2 Community forest management** | | | | | |
| **2.2.1 Strengthening community forest committee, Making regulations** | | | | | |
| (1) Building awareness on sustainable use of forest resources | | It is recommendable to all the areas for building awareness on sustainable use (+++). | | | |
| (2) Capacity building of local communities in resources management | | It is recommendable to all the areas for capacity building of local communities (+++). | | | |
| (3) Community forest area | rai | >50 | 50-5 | 5-0 | No exists |

| Component/Expected activities/Indicators | Unit | Priority recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| (4) Number of villages accessible to community forest | No. | >4 | 4 -2 | 1 | 0 |
| Total ((1)+(2))*(3)+(4))/21 | % | 100-66 | 66-33 | 33-0 | - |
| Total 2.2.1 | % | 100-66 | 66-33 | 33-0 | - |
| **2.3 Forest valuations** | | | | | |
| **2.3.1 Identify valuable species/natural resources, Knowledge dissemination, Eco-tourism promotion** | | | | | |
| (1) Building awareness on sustainable use of forest resources | | It is recommendable to all the areas for building awareness on sustainable use (+++). | | | |
| (2) Creation of learning center for the communities | | It is recommendable to all the areas for creation of learning center (+++). | | | |
| (3) Existing of community (village) | | It is recommendable to all the areas where community (village) exists (+++). | | | |
| (4) Farmland utilization (forest area in land utilization) (forest area/LRA) | % | >25 | 25-10 | 10-1 | 1< |
| (5) Community forest area | rai | >50 | 50-5 | 5-0 | No exists |
| (6) Access to center of Amphoe | km | <15 | 15-35 | 35-45 | >45 |
| (7) Road conditions (good through year) | % | >75 | 75-50 | 50-25 | <25 |
| Total (((1)+(2)+(3))*(4)+(5)+(6)+(7))/36 | % | 100-66 | 66-33 | 33-0 | - |
| Total 2.3.1 | % | 100-66 | 66-33 | 33-0 | - |
| **3.1 Forest rehabilitation** | | | | | |
| **3.1.1 Reforestation activities** | | | | | |
| (1) Building awareness on sustainable use of forest resources | | It is recommendable to all the areas for building awareness on sustainable use (+++). | | | |
| (2) Farmland utilization (forest area in land utilization) (forest area/LRA) | % | >25 | 25-10 | 10-1 | 1< |
| (3) Ratio of community forest area/LRA | % | >10 | 10-1 | 1-0 | 0 |
| Total ((1)*(2)+(3))/12 | % | 100-66 | 66-33 | 33-0 | - |
| **3.1.2 Making firebreak** | | | | | |
| Area adjacent to Zone-C | | It is recommendable to all the areas adjacent to Zone-C (+++). | | | |
| **3.1.3 Community forest guard activities** | | | | | |
| Existing of community forest area | rai | >50 | 50-5 | 5-0 | No exists |
| Total 3.1.1~3.1.3 | % | 100-66 | 66-33 | 33-0 | - |
| **3.2 Reserved forest area delineation** | | | | | |
| **3.2.1 Putting boundary markers** | | | | | |
| Existing of Zone-A, E and C, Community forest | | It is recommendable to all the areas where Zone-A, E and C, community forest (+++). | | | |
| **4.1 Soil conservation** | | | | | |
| **4.1.1 Farm land soil conservation, Soil improvement (making bio-fertilizer/ compost)** | | | | | |
| (1) Existing of community (village) | | It is recommendable to all the areas where community (village) exists (+++). | | | |
| (2) Farmland use (agricultural land use) | % | >60 | 60-10 | 10-1 | 0 |
| (3) Area with land slope (0-5%) | % | <60 | 60-90 | 90-100 | 100 |
| Total ((1)*(2)+(3))/12 | % | 100-66 | 66-33 | 33-0 | - |
| Total 4.1.1 | % | 100-66 | 66-33 | 33-0 | - |
| **4.2 Water conservation** | | | | | |
| **4.2.1 Construction of small-scale check dam/weir, Removal sediments in check dams/weir, Dredging of natural water body** | | | | | |
| (1) Area adjacent to Zone-C | | It is recommendable to all the areas adjacent to Zone-C (+++). | | | |
| (2) Existing of stream network | Km/ 1000 rai | >3.0 | 3-2 | 2-0.1 | 0 |
| (3) Area with land slope (0-5%) | % | <60 | 60-90 | 90-100 | 100 |

| Component/Expected activities/Indicators | Unit | Priority recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| Total ((1)+(2))*(3) | % | 100-66 | 66-33 | 33-0 | - |
| Total 4.2.1 | % | 100-66 | 66-33 | 33-0 | - |

Based on the above criteria, priority recommendation among the M/P code areas was made by activity and component. To clarify the processes, the indicators by the M/P code areas in Phayao are shown as examples.

## Table 5.4.5 Indicators Measurement Processes (Natural Resources Management, Phayao)

| Program | Component | Expected Activities | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Main Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Forest produce utilization | 1.1 Food utilization | Foods harvesting (herbs and bamboo shoot, etc.) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | + | +++ | +++ | ++ | +++ | +++ | |
| | | (1) Building awareness on sustainable use of forest resources | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for awareness on sustainable use |
| | | (2) Creation of learning center for the communities | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for food harvesting control |
| | | (3) Existing of community (villages) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas where community (village) exist. |
| | | (4) Community forest area (rai) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | - | +++ | +++ | ++ | +++ | +++ | Community forest area (rai) |
| | | (5) Farmland utilization (forest area/LRAs) | ++ | ++ | - | + | + | ++ | + | ++ | - | + | + | - | ++ | + | Rate of forest area in land use (1/1.00) |
| | 1.2 Non-food utilization | Medical plants, Making wood vinegar, Tree cutting | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | + | +++ | +++ | ++ | +++ | +++ | |
| | | (1) Building awareness on sustainable use of forest resources | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for awareness on sustainable use |
| | | (2) Creation of learning center for the communities | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for food harvesting control |
| | | (3) Existing of community (villages) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas where community (village) exist. |
| | | (4) Community forest area (rai) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | - | +++ | +++ | ++ | +++ | +++ | Community forest area (rai) |
| | | (5) Farmland utilization (forest area/LRAs) | ++ | ++ | - | + | + | ++ | ++ | ++ | - | + | + | - | ++ | + | Rate of forest area in land use (1/1.00) |
| 2 Forest area management | 2.1 Community forest | Community forest registration, Organizing community forest committee | +++ | +++ | + | ++ | ++ | +++ | ++ | +++ | + | ++ | ++ | + | +++ | ++ | |
| | | (1) Building awareness on sustainable use of forest resources | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for awareness on sustainable use |
| | | (2) Existing of community (villages) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas where community (village) exist. |
| | | (3) Farmland utilization (forest area/LRAs) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | - | +++ | +++ | +++ | +++ | +++ | Rate of forest area in land use (1/1.00) |
| | 2.2 Community forest | Strengthening community forest committee, making regulation | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | + | +++ | +++ | ++ | +++ | +++ | |
| | | (1) Building awareness on sustainable use of forest resources | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for awareness on sustainable use |
| | | (2) Capacity building of local communities in resources management | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for capacity building |
| | | (3) Community forest area (rai) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | - | +++ | +++ | ++ | +++ | +++ | Community forest area (rai) |
| | | (4) Villages access to community forest | ++ | ++ | ++ | +++ | ++ | +++ | + | +++ | - | ++ | ++ | + | ++ | ++ | Number of villages access to community forest |
| 3 Forest rehabilitation | 3.1 Forest valuations | Identify valuable species/natural resources, Knowledge dissemination, Eco-tourism | +++ | +++ | + | ++ | ++ | +++ | ++ | +++ | + | ++ | ++ | + | +++ | ++ | |
| | | (1) Building awareness on sustainable use of forest resources | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for awareness on sustainable use |
| | | (2) Creation of learning center for the communities | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for food harvesting control |
| | | (3) Existing of community (villages) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas where community (village) exist. |
| | | (4) Farmland utilization (forest area/LRAs) | ++ | ++ | - | + | + | ++ | + | ++ | - | + | + | - | ++ | + | Rate of forest area in land use (1/1.00) |
| | | (5) Community forest area (rai) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | - | +++ | +++ | ++ | +++ | +++ | Community forest area (rai) |
| | | (6) Access to center of Amphoe | +++ | +++ | +++ | +++ | +++ | +++ | ++ | +++ | +++ | +++ | ++ | ++ | ++ | +++ | Distance to Amphoe (km) |
| | | (7) Road condition | + | +++ | - | + | +++ | - | - | ++ | + | + | + | ++ | + | +++ | Good village road condition through year (%) |
| | 3.2 Forest rehabilitation | Reforestation activities | +++ | +++ | + | ++ | ++ | +++ | ++ | +++ | - | ++ | ++ | + | ++ | ++ | |
| | | (1) Building awareness on sustainable use of forest resources | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for awareness on sustainable use |
| | | (2) Farmland utilization (forest area/LRAs) | ++ | ++ | - | + | + | ++ | + | ++ | - | + | + | - | ++ | + | Rate of forest area in land use (1/1.00) |
| | | (3) Rate of area (rai) /community forest | +++ | +++ | +++ | ++ | + | ++ | + | +++ | - | + | ++ | + | + | ++ | Community forest area (rai)/ LRAs(rai) (rate) |
| | | Making firebreak | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | |
| | | Area adjacent to the Zone-C | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas adjacent to Zone-C |
| | | Community forest guard activities | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | - | +++ | +++ | ++ | +++ | +++ | |
| | | Community forest area (rai) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | - | +++ | +++ | ++ | +++ | +++ | Community forest area (rai) |
| | 3.3 Reserved forest area | Puting boundary markers | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to the areas where A, E and C zones exist. |
| 4 Soil and water conservation | 4.1 Soil conservation | Farm land soil conservation, Soil improvement | +++ | +++ | ++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | |
| | | (1) Existing of community (villages) | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas where community (village) exist. |
| | | (2) Farmland use (agricultural land use) | +++ | +++ | ++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | Agricultural land use (%) |
| | 4.2 Water conservation | Construction of small-scale check dams/weirs, Removal sediments in check dams/weirs, | +++ | ++ | +++ | +++ | ++ | +++ | ++ | ++ | ++ | ++ | +++ | ++ | ++ | ++ | |
| | | (1) Area adjacent to the Zone-C | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas adjacent to Zone-C |
| | | (2) Existing of stream network | ++ | ++ | +++ | ++ | ++ | +++ | ++ | + | + | ++ | ++ | + | ++ | ++ | Existing of stream network based on stream |
| | | (3) Area with land slope (0-5%) | +++ | ++ | +++ | +++ | ++ | +++ | ++ | ++ | ++ | ++ | +++ | ++ | ++ | ++ | Rate of area with land slope (0-5%) |

+++ : Highly recommendable ++ : Moderately recommendable + : Recommendable - : Not Recommendable

## Table 5.4.6 Quantitative Indicators for Prioritization (Natural Resources Management, Phayao)

| Program | Component | Expected Activities | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Main Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Forest produce utilization | 1.1 Food utilization | Foods harvesting (herbs and bamboo shoot, etc.) | | | | | | | | | | | | | | | |
| | | (1) Building awareness on sustainable use of forest resources | | | | | | | | | | | | | | | |
| | | (2) Creation of learning center for the communities | | | | | | | | | | | | | | | |
| | | (3) Existing of community (villages) | | | | | | | | | | | | | | | |
| | | (4) Community forest area (rai) | 467.0 | 2,378.0 | 770.0 | 1,509.0 | 72.0 | 3,024.0 | 184.0 | 7,601.0 | 0.0 | 76.0 | 2,330.0 | 45.0 | 222.0 | 806.5 | Community forest area (rai) |
| | | (5) Farmland utilization (forest area/LRAs) | 0.111 | 0.124 | 0.001 | 0.071 | 0.019 | 0.106 | 0.040 | 0.176 | 0.000 | 0.038 | 0.045 | 0.002 | 0.179 | 0.052 | Rate of forest area in land use (1/100) |
| | 1.2 Non-food utilization | Medical plants, Making wood vinegar, Tree cutting | | | | | | | | | | | | | | | |
| | | (1) Building awareness on sustainable use of forest resources | | | | | | | | | | | | | | | |
| | | (2) Creation of learning center for the communities | | | | | | | | | | | | | | | |
| | | (3) Existing of community (villages) | | | | | | | | | | | | | | | |
| | | (4) Community forest area (rai) | 467.0 | 2,378.0 | 770.0 | 1,509.0 | 72.0 | 3,024.0 | 184.0 | 7,601.0 | 0.0 | 76.0 | 2,330.0 | 45.0 | 222.0 | 806.5 | Community forest area (rai) |
| | | (5) Farmland utilization (forest area/LRAs) | 0.111 | 0.124 | 0.001 | 0.071 | 0.019 | 0.106 | 0.040 | 0.176 | 0.000 | 0.038 | 0.045 | 0.002 | 0.179 | 0.052 | Rate of forest area in land use (1/100) |
| 2 Forest area management | 2.1 Community forest | Community forest registration, Organizing community forest committee | | | | | | | | | | | | | | | |
| | | (1) Building awareness on sustainable use of forest resources | | | | | | | | | | | | | | | |
| | | (2) Existing of community (villages) | | | | | | | | | | | | | | | |
| | | (3) Farmland utilization (forest area/LRAs) | 0.111 | 0.124 | 0.001 | 0.071 | 0.019 | 0.106 | 0.040 | 0.176 | 0.000 | 0.038 | 0.045 | 0.002 | 0.179 | 0.052 | Rate of forest area in land use (1/100) |
| | 2.2 Community forest | Strengthening community forest committee, making regulation | | | | | | | | | | | | | | | |
| | | (1) Building awareness on sustainable use of forest resources | | | | | | | | | | | | | | | |
| | | (2) Capacity building of local communities in resources management | | | | | | | | | | | | | | | |
| | | (3) Community forest area (rai) | 467.0 | 2,378.0 | 770.0 | 1,509.0 | 72.0 | 3,024.0 | 184.0 | 7,601.0 | 0.0 | 76.0 | 2,330.0 | 45.0 | 222.0 | 806.5 | Community forest area (rai) |
| | | (4) Villages access to community forest | 4 | 4 | 2 | 7 | 2 | 16 | 1 | 17 | 0 | 3 | 2 | 1 | 3 | 2 | Number of villages access to community forest |
| 3 Forest rehabilitation | 3.1 Forest valuations | Identify valuable species/natural resources, Knowledge dissemination, Eco-tourism promotion | | | | | | | | | | | | | | | |
| | | (1) Building awareness on sustainable use of forest resources | | | | | | | | | | | | | | | |
| | | (2) Creation of learning center for the communities | | | | | | | | | | | | | | | |
| | | (3) Existing of community (villages) | | | | | | | | | | | | | | | |
| | | (4) Farmland utilization (forest area/LRAs) | 0.111 | 0.124 | 0.001 | 0.071 | 0.019 | 0.106 | 0.040 | 0.176 | 0.000 | 0.038 | 0.045 | 0.002 | 0.179 | 0.052 | Rate of forest area in land use (1/100) |
| | | (5) Community forest area (rai) | 467.0 | 2378.0 | 770.0 | 1509.0 | 72.0 | 3024.0 | 184.0 | 7601.0 | 0.0 | 76.0 | 2330.0 | 45.0 | 222.0 | 806.5 | Community forest area (rai) |
| | | (6) Access to center of Amphoe | 9.45 | 10.88 | 23.63 | 14.34 | 13.80 | 8.10 | 16.52 | 6.31 | 9.83 | 6.71 | 16.21 | 17.92 | 17.11 | 11.67 | Distance to Amphoe (km) |
| | | (7) Road condition | 0.35 | 0.88 | 0.25 | 0.28 | 0.80 | 0.20 | 0.24 | 0.62 | 0.50 | 0.36 | 0.45 | 0.62 | 0.32 | 0.78 | Good village road condition through year (%) |
| | 3.2 Forest rehabilitation | Reforestation activities | | | | | | | | | | | | | | | |
| | | (1) Building awareness on sustainable use of forest resources | | | | | | | | | | | | | | | |
| | | (2) Farmland utilization (forest area/LRAs) | 0.111 | 0.124 | 0.001 | 0.071 | 0.019 | 0.106 | 0.040 | 0.176 | 0.000 | 0.038 | 0.045 | 0.002 | 0.179 | 0.052 | Rate of forest area in land use (1/100) |
| | | (3) Rate of area (rai) (community forest | 0.021 | 0.180 | 0.682 | 0.057 | 0.003 | 0.066 | 0.006 | 0.677 | 0.000 | 0.004 | 0.031 | 0.002 | 0.010 | 0.029 | Community forest area (rai)/ LRAs(rai) (rate) |
| | | Making firebreak | | | | | | | | | | | | | | | |
| | | Area adjacent to the Zone-C | | | | | | | | | | | | | | | |
| | | Community forest guard activities | | | | | | | | | | | | | | | |
| | 3.3 Reserved forest area delineation | Community forest area (rai) | 467.0 | 2,378.0 | 770.0 | 1,509.0 | 72.0 | 3,024.0 | 184.0 | 7,601.0 | 0.0 | 76.0 | 2,330.0 | 45.0 | 222.0 | 806.5 | Community forest area (rai) |
| | | Putting boundary markers | | | | | | | | | | | | | | | |
| 4 Soil and water conservation | 4.1 Soil conservation | Farm land soil conservation, Soil improvement | | | | | | | | | | | | | | | |
| | | (1) Existing of community (villages) | | | | | | | | | | | | | | | |
| | | (2) Farmland use (anricultural land use) | 0.877 | 0.866 | 0.584 | 0.906 | 0.979 | 0.885 | 0.948 | 0.724 | 0.883 | 0.942 | 0.942 | 0.995 | 0.821 | 0.935 | Agricultural land use (%) |
| | 4.2 Water conservation | Construction of small-scale check dams/weirs, Removal sediments in check dams/weirs, Dredging | | | | | | | | | | | | | | | |
| | | (1) Area adjacent to the Zone-C | | | | | | | | | | | | | | | |
| | | (2) Existing of stream network | 2.880 | 2.619 | 4.750 | 2.983 | 2.757 | 3.074 | 2.633 | 1.317 | 1.337 | 2.650 | 2.702 | 1.382 | 2.387 | 2.898 | Existing of stream network based on stream density and map |
| | | (3) Area with land slope (0-5%) | 0.499 | 0.701 | 0.655 | 0.529 | 0.766 | 0.786 | 0.816 | 0.700 | 0.841 | 0.662 | 0.444 | 0.807 | 0.778 | 0.811 | Rate of area with land slope (0-5%) |

(4) Livelihood Improvement Sector

Livelihood improvement sector is composed of 4 programs and 8 components, and each component contains several expected activities, as shown below.

**Table 5.4.7 Expected Activities in Livelihood Improvement Sector**

| Program | Component | Expected Activities |
|---|---|---|
| 1. Livelihood improvement | 1.1 Non-agricultural income generation | 1.1.1 Paper flower making from fiber plant |
| | | 1.1.2 Weaving |
| | | 1.1.3 Mat making from bamboo strips |
| | | 1.1.4 Lamp making from coconut shell |
| | | 1.1.5 Making daily Thai dessert |
| | 1.2 Expenditure reduction | 1.2.1 Making daily commodities (soap, shampoo, detergent, etc.) |
| | | 1.2.2 Utilization of physic nut oil (making fuel) |
| | 1.3 Energy saving | 1.3.1 Making highly efficient cooking stove |
| 2. Fund development | 2.1 Locally accessible capital / fund development | 2.1.1 Organizing community bank / village fund |
| | | 2.1.2 Organizing welfare fund |
| | | 2.1.3 Organizing bamboo fund |
| 3. Health and welfare improvement | 3.1 Health improvement | 3.1.1 Thai massage |
| | | 3.1.2 Local doctor |
| | | 3.1.3 Traditional meditation |
| | | 3.1.4 Chemical Residual effect on Health |
| | 3.2 Culture dissemination | 3.2.1 Establishment of community information center |
| | | 3.2.2 Learning local knowledge / traditions |
| | | 3.2.3 Capacity building for leader |
| | | 3.2.4 Forest conservation camp |
| 4. Infrastructure development | 4.1 Social infrastructure | 4.1.1 Installation of village water supply |
| | | 4.1.2 Expansion of village water supply |
| | | 4.1.3 Village electrification |
| | | 4.1.4 Expansion of electricity service |
| | | 4.1.5 Village road improvement |
| | 4.2 Living conditions improvement | 4.2.1 Garbage disposal improvement |
| | | 4.2.2 Wastewater treatment |

The selected items for prioritization are shown as follows.

**Table 5.4.8 Selected Items for Prioritization**

| Component | Quantitative Data | Indicators Used |
|---|---|---|
| 1.1 Non-agricultural income generation | X | Agricultural household income (baht/year) |
| | X | Total household income (baht/year) |
| | X | Household have cottage industry/ handicrafts |
| 1.2 Expenditure reduction | X | Percentage of expenditure on paddy against agriculture-income |
| 1.3 Energy saving | X | Percentage of charcoal and wood as fuel sources |
| 2.1 Locally accessible capital / fund development | X | No. of households which use saving group for production |
| | X | No. of households which use cooperatives |
| | X | No. of households which use BAAC |
| | X | No. of households which use commercial bank or saving bank |
| | X | No. of households which use financial institute for industry |

| Component | Quantitative Data | Indicators Used |
|---|---|---|
| 2.1 Locally accessible capital / fund development | X | No. of households which use capitalist |
| | X | No. of households which use revolving fund of government |
| 3.1 Health improvement | X | No. of villages which have hospital |
| 3.2 Culture dissemination | - | No data applicable |
| 4.1 Social infrastructure | X | Household equipped with village water supply |
| | X | Household income |
| | X | Villages equipped with village water supply |
| | X | Coverage rate of village water supply in service area |
| | X | Village electrification |
| | X | Coverage rate of electrification |
| | X | Main road density |
| | X | Road inconvenient through the year (extremely poor) |
| | X | Road inconvenient in wet season (poor) |
| | X | Road good only in dry season (fair) |
| | X | Road fair through the year (compromised good) |
| 4.2 Living conditions improvement | X | Villages with garbage problems (untreated) |
| | X | Village with wastewater problem (untreated) |
| | X | Water quality of water source (poor) |
| | X | Water quality of water source (fair) |

Criteria by the indicators are shown in the Table 5.4.9. To measure the above indicators for priority recommendation, the criteria were set so as to become the average of all the M/P code areas as "++" and to distribute the M/P code areas proportionally into the three priorities, "recommendable: +", "moderately recommendable: ++" and "highly recommendable: +++". The not recommendable (-) was not applied in this sector since most of the proposed components are related with human activities and should be considered recommendable.

For example, annual household income is used as an indicator for the "1.1 Non-agricultural income generation" and the higher priorities were given to the lower income level. In case of the "1.3 Energy saving", the indicator, "Percentage of charcoal and wood as fuel sources", was used. Higher priorities were given to the areas with higher rates since the utilization of charcoal and wood should be reduced and/or changed in consideration of forest conservation. If the rate is zero, priority recommendation was set as "not recommendable".

**Table 5.4.9 Priority Criteria by Indicator**

| Parameters | Unit | Priority Recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| **1.1 Non-agricultural income generation** | | | | | |
| (1) Agricultural household income | 1,000 baht/year | < 25 | 25-35 | 35 < | N/A |
| (2) Total household income | 1,000 baht/year | < 30 | 30-40 | 40 < | N/A |
| (3) Household, which has cottage industry/ handicrafts | % | < 5 | 5-20 | 20 < | N/A |
| Total ((1)~(3)) / 9*100 | % | 100- 66 | 66-33 | 33-0 | N/A |

| Parameters | Unit | Priority Recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| **1.2 Expenditure reduction** | | | | | |
| Percentage of expenditure on paddy against agriculture-income | % | > 20 | 20-10 | 10 > | N/A |
| **1.3 Energy saving** | | | | | |
| Percentage of charcoal and wood as fuel sources | % | 100- 60 | 60-40 | 40-0 | 0 |
| **2.1 Locally accessible capital / fund development** | | | | | |
| (1) No. of households which use saving group for production | % | > 40 | 40-20 | 20 > | N/A |
| (2) No. of households which use cooperatives | % | > 30 | 30-10 | 10 > | N/A |
| (3) No. of households which use BAAC | % | > 50 | 50-30 | 30 > | N/A |
| (4) No. of households which use commercial bank or saving bank | % | > 4 | 4-2 | 2 > | N/A |
| (5) No. of households which use financial institute for industry | % | N/A | > 0 | 0 | N/A |
| (6) No. of households which use capitalist | % | > 3 | 3-1 | 1 > | N/A |
| (7) No. of households which use revolving fund of government | % | > 80 | 80-60 | 60 > | N/A |
| Total ((1)~(7))/ 21*100 | % | 100-66 | 66-33 | 33-0 | N/A |
| **3.1 Health improvement** | | | | | |
| No. of villages which have hospital | % | 0 | 0-10 | 10 < | N/A |
| **3.2 Culture dissemination** | | It is recommendable to all the areas where community (village) exists (+). | | | |
| **4.1 Social infrastructure** | | | | | |
| Installation of village water supply | | | | | |
| (1) Rate of household equipped with village water supply | % | <51 | 51-71 | 71-91 | 91-100 |
| (2) Household income | B/yr | >50,500 | 50,500 - 37,000 | 37,000 - 23,500 | <23,500 |
| (3) Villages equipped with village water supply | % | <65 | 65-81 | 81-99 | 99-100 |
| Total ((1)+(2))*(3)/18 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| Expansion of village water supply | | | | | |
| (1) Rate of household equipped with village water supply | % | <51 | 51-71 | 71-91 | 91-100 |
| (2) Household income | B/yr | >50,500 | 50,500 - 37,000 | 37,000 - 23,500 | <23,500 |
| (3) Coverage rate of village water supply in service area | % | <72 | 72-86 | 86-99 | 99-100 |
| Total ((1)+(2))*(3)/18 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| Village electrification | | (+++) PYO06 (Wang Khon Daeng), PRE04 (Pha Mu) | | | |
| Expansion of electricity service | | | | | |
| (1) Household income | B/yr | >50,500 | 50,500 - 37,000 | 37,000 - 23,500 | <23,500 |
| (2) Coverage rate of electrification | % | <95 | 95-98 | 98-99.9 | 100 |
| Total ((1)*(2))/9 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| Village road improvement | | | | | |
| (1) Main road density | Km/ 1000 rai | <0.01 | 0.01-0.35 | 0.35-0.75 | >0.75 |

| Parameters | Unit | Priority Recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| (2) Road inconvenient through the year (extremely poor) | % | >16 | 16-7 | 7-0 | 0 |
| (3) Road inconvenient in wet season (poor) | % | >9 | 9-3 | 3-0 | 0 |
| (4) Road good only in dry season (fair) | % | >13 | 5 | 5-0 | 0 |
| (5) Road fair through the year (compromised good) | % | >49 | 49-28 | 28-7 | 7-0 |
| Total ((1)+(2)*1.0+(3)*0.75+(4)*0.5+(5)*0.25)/10.5 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| **4.2 Living conditions improvement** | | | | | |
| Garbage disposal improvement | | | | | |
| (1) Villages with garbage problems (untreated) | % | >38 | 38-20 | 20-2 | 2-0 |
| Wastewater treatment | | | | | |
| (1) Villages with wastewater problems (untreated) | % | >11 | 11-5 | 5-0 | 0 |
| (2) Water quality of water source (poor) | % | >24 | 24-7 | 7-0 | 0 |
| (3) Water quality of water source (fair) | % | >63 | 63-39 | 39-15 | 15-0 |
| Total (1)+(2)+(3)*0.5 | % | 100-75 | 75-50 | 50-25 | 25-0 |

N/A: Not applied

Based on the above criteria, priority recommendation among the M/P code areas was made by activity and component. To clarify the processes, the indicators by the M/P code areas in Phrae are shown as examples.

## Table 5.4.10 Indicators Measurement Processes (Livelihood Improvement, Phayao)

| Program | Component | Indicator | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 | Main Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Livelihood improvement | 1.1 Income generation | | ++ | + | + | ++ | + | ++ | ++ | + | ++ | ++ | ++ | ++ | ++ | ++ | |
| | | (1) Agricultural household income | ++ | ++ | + | ++ | + | ++ | +++ | ++ | ++ | ++ | +++ | ++ | ++ | +++ | Agricultural household income (baht/year) |
| | | (2) Total household income | ++ | + | + | +++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | Total household income (baht/year) |
| | | (3) Opportunity to earn non agricultural income | +++ | ++ | ++ | +++ | +++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | + | + | Household, which have cottage industry/ handicrafts (%) |
| | 1.2 Expenditure reduction | | ++ | +++ | ++ | ++ | ++ | ++ | ++ | ++ | +++ | ++ | +++ | +++ | ++ | ++ | |
| | | Level of expenditure (paddy) | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | Percentage of expenditure on paddy against agri-income |
| | 1.3 Energy saving | | + | - | + | ++ | +++ | + | +++ | ++ | + | + | - | ++ | +++ | + | |
| | | Use of charcoal and wood as fuel | + | - | + | ++ | +++ | + | +++ | ++ | + | + | - | ++ | ++ | + | Use of charcoal and wood as fuel sources (%) |
| 2 Fund development | 2.1 Locally accessible capital / fund development | | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | |
| | | (1) Needs for fund (saving group for production) | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | + | ++ | + | ++ | ++ | Households using saving group for production (%) |
| | | (2) Needs for fund (cooperatives) | ++ | +++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | Households which use cooperatives (%) |
| | | (3) Needs for fund (BAAC) | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | Households which use BAAC (%) |
| | | (4) Needs for fund (commercial bank or saving bank) | ++ | +++ | ++ | ++ | ++ | ++ | ++ | + | ++ | + | ++ | +++ | ++ | + | Households which use commercial bank or saving bank (%) |
| | | (5) Needs for fund (financial institute for industry) | ++ | ++ | ++ | + | + | + | + | + | + | + | + | + | ++ | + | Households which use financial institute for industry (%) |
| | | (6) Needs for fund (capitalist) | + | + | ++ | ++ | + | ++ | + | ++ | + | + | + | + | ++ | + | Households which use capitalist (%) |
| | | (7) Needs for fund (revolving fund of government) | ++ | ++ | ++ | ++ | +++ | ++ | ++ | ++ | ++ | ++ | +++ | ++ | ++ | ++ | Households which use revolving fund of government (%) |
| 3 Health and welfare improvement | 3.1 Health improvement | | + | ++ | ++ | + | ++ | + | + | + | ++ | ++ | + | ++ | ++ | + | |
| | | Existence of hospital | + | ++ | ++ | + | ++ | ++ | + | + | ++ | ++ | + | +++ | ++ | + | Villages which have hospital (%) |
| | 3.2 Culture dissemination | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | "+" is applied to all the MP code area. |
| 4 Infrastructure development | 4.1 Social infrastructure | | + | + | + | + | - | + | - | - | - | - | - | - | - | - | |
| | | Installation of village water supply | + | + | + | + | - | + | - | + | - | - | - | - | - | - | |
| | | (1) Households equipped with village water supply | ++ | ++ | ++ | ++ | - | ++ | - | ++ | + | - | ++ | +++ | + | - | Rate of households equipped with village water supply (1/1000 |
| | | (2) Household income (Baht/yr) | + | ++ | +++ | + | ++ | + | + | + | + | + | + | - | - | + | Household income (Byr) |
| | | (3) Villages equipped with village water supply | ++ | ++ | + | ++ | - | ++ | - | ++ | + | + | - | - | ++ | - | Rate of villages equipped with village water supply |
| | | Expansion of village water supply | + | + | + | + | - | - | - | - | - | - | - | - | - | - | |
| | | (1) Villages equipped with village water supply | ++ | + | + | ++ | - | ++ | - | ++ | + | - | - | - | ++ | - | Rate of villages equipped with village water supply |
| | | (2) Household income (Baht/yr) | + | ++ | ++ | + | ++ | + | + | + | + | + | - | - | - | + | Household income (Baht/yr) |
| | | (3) Coverage rate of village water supplu in service area | ++ | ++ | ++ | ++ | + | + | + | - | + | + | +++ | ++ | - | + | Coverage rate of village water supplu in service area |
| | | Village electrification | - | - | - | +++ | - | - | - | - | - | - | - | - | - | - | |
| | | | - | - | - | + | - | - | - | - | - | - | - | - | - | - | |
| | | Expansion of electricity service | - | - | + | - | + | - | - | - | - | - | - | - | - | - | |
| | | (1) Household income (Byr) | + | ++ | ++ | + | ++ | + | + | + | + | + | - | - | - | + | Household income (Byr) |
| | | (2) Coverage rate of electrification | + | + | + | ++ | ++ | - | + | + | + | - | - | + | ++ | - | Coverage rate of electrification |
| | | Village road improvement | + | ++ | ++ | - | - | + | - | + | + | + | + | + | + | + | |
| | | (1) Main road density | +++ | +++ | ++ | ++ | ++ | +++ | ++ | +++ | +++ | ++ | +++ | +++ | +++ | +++ | Main road density |
| | | (2) Road inconvenient through the year (extremely poor) | - | +++ | ++ | - | - | - | - | - | ++ | - | - | - | - | - | Road inconvenient through the year (extremely poor) |
| | | (3) Road inconvenient in wet season (poor) | - | - | - | - | - | - | - | + | - | - | - | - | - | - | Road inconvenient in wet season (poor) |
| | | (4) Road good only in dry season (fair) | - | - | - | - | - | - | - | + | - | - | +++ | - | - | - | Road good only in dry season (fair) |
| | | (5) Road fair through the year (compromised good) | ++ | ++ | ++ | + | + | + | ++ | ++ | + | - | ++ | +++ | ++ | + | Road fair through the year (compromised good) |
| | 4.2 Living conditions improvement | | + | + | - | + | ++ | + | + | + | ++ | - | + | - | - | - | |
| | | Garbage disposal improvement | + | - | + | ++ | + | + | + | ++ | +++ | - | ++ | - | + | - | |
| | | Villages with garbage problems (untreated) | + | - | + | ++ | + | + | + | + | +++ | - | ++ | - | + | - | Villages with garbage problems (untreated) |
| | | Wastewater treatment | + | ++ | - | - | - | ++ | ++ | + | - | - | - | - | - | + | |
| | | (1) Village with wastewater problems (untreated) | +++ | - | - | - | - | +++ | ++ | + | - | - | - | - | - | - | Rate of village with wastewater problems (untreated) |
| | | (2) Water quality of water source (poor) | - | ++ | - | - | - | ++ | + | + | - | - | - | - | - | +++ | Rate of water quality of water source (poor) |
| | | (3) Water quality of water source (fair) | + | ++ | - | - | +++ | ++ | ++ | ++ | + | - | +++ | ++ | + | + | Rate of water quality of water source (fair) |

+++: Highly recommendable ++: Moderately recommendable +: Recommendable -: Not Recommendable

**Table 5.4.11 Quantitative Indicators for Prioritization (Livelihood Improvement, Phrae)**

| Program | Component | Indicator | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 | Parameter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Livelihood improvement | 1.1 Income generation | (1) Agricultural household income | 29,536 | 32,551 | 45,160 | 25,208 | 38,987 | 23,620 | 20,925 | 27,920 | 25,032 | 17,231 | 9,756 | 4,248 | 14,093 | 24,861 | Baht/household |
| | | (2) Total household income | 36,637 | 42,277 | 53,311 | 28,039 | 39,154 | 31,214 | 27,238 | 36,173 | 27,883 | 26,896 | 16,336 | 11,438 | 18,887 | 30,828 | Baht/household |
| | | (3) Household have cottage industry/ handicrafts | 3.9 | 0.2 | 1.3 | 1.0 | 0.0 | 9.6 | 19.2 | 19.3 | 5.5 | 0.0 | 2.3 | 0.0 | 26.8 | 21.5 | Percentage against the total households |
| | 1.2 Expenditure reduction | | | | | | | | | | | | | | | | |
| | | Percentage of expenditure on paddy against agri-income | 11.28 | 21.24 | 7.00 | 6.95 | 7.37 | 10.93 | 10.69 | 6.56 | 22.23 | 13.84 | 135.23 | 52.96 | 13.21 | 5.09 | Percentage |
| | 1.3 Energy saving | | | | | | | | | | | | | | | | |
| | | Percentage of charcoal and wood as fuel sources | 11.11 | 0.00 | 27.27 | 51.72 | 100.00 | 6.25 | 77.78 | 50.00 | 11.11 | 0.00 | 57.14 | 100.00 | 58.33 | 7.69 | Percentage |
| 2 Fund development | 2.1 Locally accessible capital / fund development | | | | | | | | | | | | | | | | |
| | | (1) Households using saving group for production | 18.7 | 13.5 | 12.2 | 9.9 | 0.0 | 16.5 | 9.4 | 12.2 | 21.7 | 0.0 | 23.7 | 0.0 | 9.5 | 0.5 | Rate against the total number of households |
| | | (2) Households which use cooperatives | 25.6 | 36.5 | 34.7 | 15.2 | 2.0 | 29.8 | 10.6 | 18.1 | 7.3 | 19.3 | 15.9 | 6.5 | 13.3 | 9.6 | Rate against the total number of households |
| | | (3) Households which use BAAC | 45.5 | 57.9 | 34.3 | 19.3 | 68.3 | 53.6 | 25.5 | 25.8 | 49.3 | 19.3 | 18.4 | 32.7 | 45.2 | 11.6 | Rate against the total number of households |
| | | (4) Households which use commercial bank or saving bank | 0.4 | 24.0 | 2.5 | 0.6 | 0.0 | 5.5 | 0.6 | 0.0 | 1.3 | 0.0 | 0.7 | 19.6 | 0.1 | 0.0 | Rate against the total number of households |
| | | (5) Households which use financial institute for industry | 0.9 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | Rate against the total number of households |
| | | (6) Households which use capitalist | 0.0 | 0.0 | 2.2 | 0.2 | 0.0 | 1.2 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | Rate against the total number of households |
| | | (7) Households which use revolving fund of government | 72.4 | 61.9 | 61.6 | 69.4 | 94.6 | 73.4 | 76.6 | 65.7 | 51.6 | 38.6 | 83.8 | 78.4 | 56.1 | 44.8 | Rate against the total number of households |
| 3 Health and welfare improvement | 3.1 Health improvement | | | | | | | | | | | | | | | | |
| | | Villages which have hospital | 88.89 | 0.00 | 0.00 | 27.59 | 0.00 | 6.25 | 38.89 | 15.38 | 0.00 | 0.00 | 14.29 | 0.00 | 8.33 | 30.77 | Percentage |
| | 3.2 Culture dissemination | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | No data is applicable |
| 4 Infrastructure development | 4.1 Social infrastructure | | | | | | | | | | | | | | | | |
| | | Installation of village water supply | | | | | | | | | | | | | | | |
| | | (1) Households equipped with village water supply | 31% | 58% | 70% | 59% | 91% | 65% | 94% | 62% | 79% | 97% | 64% | 33% | 77% | 94% | Household equipped with village water supply (%) |
| | | (2) Household income (Baht/yr) | 36,637 | 42,277 | 53,311 | 28,039 | 39,154 | 31,214 | 27,238 | 36,173 | 27,883 | 26,896 | 16,336 | 11,438 | 18,887 | 30,828 | Household income (Bt/yr) |
| | | (3) Villages equipped with village water supply | 67% | 67% | 82% | 72% | 100% | 75% | 100% | 65% | 89% | 100% | 100% | 100% | 75% | 100% | Villages equipped with village water supply (%) |
| | | Expansion of village water supply | | | | | | | | | | | | | | | |
| | | (1) Villages equipped with village water supply | 67% | 67% | 82% | 72% | 100% | 75% | 100% | 65% | 89% | 100% | 100% | 100% | 75% | 100% | Villages equipped with village water supply (%) |
| | | (2) Household income (Baht/yr) | 36,637 | 42,277 | 53,311 | 28,039 | 39,154 | 31,214 | 27,238 | 36,173 | 27,883 | 26,896 | 16,336 | 11,438 | 18,887 | 30,828 | Household income (Bt/yr) |
| | | (3) Coverage rate of village water supplu in service area | 54% | 78% | 83% | 79% | 91% | 96% | 94% | 100% | 86% | 97% | 64% | 33% | 99% | 94% | Coverage rate of village water supplu in service area |
| | | Village electrification | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | |
| | | Expansion of electricity service | | | | | | | | | | | | | | | |
| | | (1) Household income (Bt/yr) | 36,637 | 42,277 | 53,311 | 28,039 | 39,154 | 31,214 | 27,238 | 36,173 | 27,883 | 26,896 | 16,336 | 11,438 | 18,887 | 30,828 | Household income (Bt/yr) |
| | | (2) Coverage rate of electrification | 99% | 99% | 99% | 97% | 98% | 100% | 99% | 99% | 100% | 100% | 99% | 97% | 99% | 100% | Coverage rate of electrification |
| | | Village road improvement | | | | | | | | | | | | | | | |
| | | (1) Main road density | 0.00 | 0.00 | 0.00 | 0.19 | 0.04 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Main road density |
| | | (2) Road inconvenient through the year (extremely poor) | 0.0% | 33.3% | 18.2% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 11.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | Road inconvenient through the year (extremely poor) |
| | | (3) Road inconvenient in wet season (poor) | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | Road inconvenient in wet season (poor) |
| | | (4) Road good only in dry season (fair) | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.8% | 0.0% | 0.0% | 14.3% | 0.0% | 0.0% | 0.0% | Road good only in dry season (fair) |
| | | (5) Road fair through the year (compromised good) | 44.4% | 33.3% | 36.4% | 27.6% | 25.0% | 18.8% | 33.3% | 34.6% | 22.2% | 0.0% | 28.6% | 100.0% | 33.3% | 7.7% | Road fair through the year (compromised good) |
| | 4.2 Living conditions improvement | | | | | | | | | | | | | | | | |
| | | Garbage disposal improvement | | | | | | | | | | | | | | | |
| | | Villages with garbage problems (untreated) | 11.1% | 0.0% | 18.2% | 37.9% | 12.5% | 12.5% | 16.7% | 3.8% | 77.8% | 0.0% | 28.6% | 0.0% | 16.7% | 0.0% | Rate of villages with garbage problems (untreated) |
| | | Wastewater treatment | | | | | | | | | | | | | | | |
| | | (1) Village with wastewater problems (untreated) | 11.1% | 0.0% | 0.0% | 0.0% | 0.0% | 12.5% | 5.6% | 3.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | Rate of village with wastewater problems (untreated) (1/1100) |
| | | (2) Water quality of water source (poor) | 0.0% | 44.4% | 0.0% | 0.0% | 0.0% | 8.0% | 2.9% | 2.1% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 43.5% | Rate of water quality of water source (poor) (1/100) |
| | | (3) Water quality of water source (fair) | 21.4% | 44.4% | 0.0% | 13.2% | 100.0% | 52.0% | 40.0% | 45.8% | 17.6% | 0.0% | 75.0% | 50.0% | 38.5% | 26.1% | Rate of water quality of water source (fair) (1/100) |

(5) Sustainble Agriculture Development Sector

Sustainable agriculture development sector is composed of 5 programs and 11 components, and each component contains several expected activities, as shown below.

**Table 5.4.12 Expected Activities in Sustainable Agriculture Development Sector**

| Program | Component | Expected Activities |
|---|---|---|
| 1. Agriculture production | 1.1 Crop production | 1.1.1 Promotion of crop cultivation (38 crops) |
| | | 1.1.2 Planting local and common crops after harvesting paddy |
| | | 1.1.3 Planting vegetables around house (kitchen garden) |
| | | 1.1.4 Diversification of crops |
| | 1.2 Farming technology improvement | 1.2.1 Introduction of integrated farming |
| | | 1.2.2 Introduction of soil and water conservation farming technologies |
| | | 1.2.3 Crop production by organic farming |
| | | 1.2.4 Knowledge improvement for breeding seeds |
| 2. Livestock development | 2.1 Livestock raising | 2.1.1 Promotion of chicken raising |
| | | 2.1.2 Promotion of swine raising |
| | | 2.1.3 Promotion of cattle raising |
| | | 2.1.4 Promotion of buffalo raising |
| | | 2.1.5 Promotion of fish raising |
| | | 2.1.6 Promotion of frog raising |
| | 2.2 Feed production | 2.2.1 Plant pasture seeds suitable for local conditions |
| | | 2.2.2 Improvement of equipments to prepare feed in dry season |
| | | 2.2.3 Improvement of equipments to make mix concentrated feed |
| 3. Farm produce processing | 3.1 Plant material processing | 3.1.1 Rice processing and its by-product utilization (straw, husks) |
| | | 3.1.2 Fruits processing (juice, wine, etc) |
| | | 3.1.3 Vegetables processing |
| | | 3.1.4 Utilization of by-product from processing factories |
| | 3.2 Animal material processing | 3.2.1 Chicken meat processing |
| | | 3.2.2 Swine meat processing |
| | | 3.2.3 Cattle meat processing |
| | | 3.2.4 Frog meat processing |
| 4. Marketing | 4.1 Enhancement of local circulation of farm produce | 4.1.1 Community market development |
| | | 4.1.2 Development of marketing network |
| | 4.2 Marketing improvement of local specialties | 4.2.1 Farm produce marketing improvement |
| | | 4.2.2 Livestock produce marketing improvement |
| 5. Infrastructure development | 5.1 Water resources development | 5.1.1 Existing irrigation facilities improvement |
| | | 5.1.2 Individual farm pond development |
| | | 5.1.3 Groundwater development |
| | | 5.1.4 Existing reservoir improvement |
| | | 5.1.5 Perennial stream development |
| | | 5.1.6 Small scale reservoir development |
| | 5.2 On-farm facilities | 5.2.1 On-farm road improvement and development |
| | | 5.2.2 Farmland soil conservation |
| | | 5.2.3 Flood mitigation |

The selected items for prioritization are shown as follows.

**Table 5.4.13 Selected Items for Prioritization**

| Expected Activities | Quantitative data | Indicators used |
|---|---|---|
| 1.1.1 Promotion of crop cultivation (38 crops) | X | Suitable soil area distribution |
| 1.1.2 Planting local and common crops after harvesting paddy | X | Popularity of paddy cultivation in the area |
| 1.1.3 Planting vegetables around house (kitchen garden) | - | No quantitative data applicable. |
| 1.1.4 Diversification of crops | X | Number of main crops cultivated |
| 1.2.1 Introduction of integrated farming | - | No quantitative data applicable. |
| 1.2.2 Introduction of soil and water conservation farming technologies | X | Distribution of sloped land area |
| 1.2.3 Crop production by organic farming | - | No quantitative data applicable. |
| 1.2.4 Knowledge improvement for breeding seeds | - | No quantitative data applicable. |
| 2.1.1 Promotion of chicken raising | X | Popularity of chicken raising in the area |
| 2.1.2 Promotion of swine raising | X | Popularity of swine raising in the area |
| 2.1.3 Promotion of cattle raising | X | Popularity of cattle raising in the area |
| 2.1.4 Promotion of buffalo raising | X | Popularity of buffalo raising in the area |
| 2.1.5 Promotion of fish raising | - | No quantitative data applicable. |
| 2.1.6 Promotion of frog raising | - | No quantitative data applicable. |
| 2.2.1 Plant pasture seeds suitable for local conditions | - | No quantitative data applicable. |
| 2.2.2 Improvement of equipments to prepare feed in dry season | - | No quantitative data applicable. |
| 2.2.3 Improvement of equipments to make mix concentrated feed | - | No quantitative data applicable. |
| 3.1.1 Rice processing and its by-product utilization (straw, husks) | X | Popularity of paddy cultivation in the area |
| 3.1.2 Fruits processing (juice, wine, etc) | X | Popularity of fruits cultivation in the area |
| 3.1.3 Vegetables processing | X | Popularity of vegetables cultivation in the area |
| 3.1.4 Utilization of by-product from processing factories | - | No quantitative data applicable. |
| 3.2.1 Chicken meat processing | - | No quantitative data applicable. |
| 3.2.2 Swine meat processing | - | No quantitative data applicable. |
| 3.2.3 Cattle meat processing | - | No quantitative data applicable. |
| 3.2.4 Frog meat processing | - | No quantitative data applicable. |
| 4.1.1 Community market development | - | No quantitative data applicable. |
| 4.1.2 Development of marketing network | - | No quantitative data applicable. |
| 4.2.1 Farm produce marketing improvement | - | No quantitative data applicable. |
| 4.2.2 Livestock produce marketing improvement | - | No quantitative data applicable |
| 5.1.1 Existing irrigation facilities improvement | X | Village of water shortage for cropping |
| | X | Farmland ratio of land use |
| | X | Perennial stream density |
| | X | Water availability by source (total) |
| | X | Water availability by source (perennial source) |
| 5.1.2 Individual farm pond development | X | Land holding size of SPK 4-01 farmers |
| 5.1.3 Groundwater development | X | Village of water shortage for cropping |
| | X | Farmland ratio of land use |
| | X | Ground water potential (yield) |
| 5.1.4 Existing reservoir improvement | X | Village of water shortage for cropping |

| Expected Activities | Quantitative data | Indicators used |
|---|---|---|
| | X | Farmland ratio of land use |
| | X | Perennial stream density |
| | X | Water availability by source (total) |
| | X | Water availability by source (existing reservoir and lake |
| 5.1.5 Perennial stream development | X | Village of water shortage for cropping |
| | X | Farmland ratio of land use |
| | X | Water availability by source (perennial stream) |
| | X | Perennial stream density |
| 5.1.6 Small scale reservoir development | X | Village of water shortage for cropping |
| | X | Farmland ratio of land use |
| | X | Water availability by source (manmade reservoir) |
| | X | Perennial stream density |
| 5.2.1 On-farm road improvement and development | X | Farmland ratio of land use |
| | X | Ratio of upland field in farmland utilization |
| | X | Slope of topography |
| | X | Erosion of plain land |
| | X | Ratio of agricultural households |
| | X | Density of on-farm road |
| | X | Agricultural households having farming automobiles (number/household) |
| 5.2.2 Farmland soil conservation | X | Slope of topography |
| | X | Erosion of plain land |
| | X | Ratio of villages having erosion problem |
| 5.2.3 Flood mitigation | X | Ration of villages having flood problem |

For those activities without quantitative indicators, they were assumed to be applicable in all the areas and the same priority was given to all the areas considering the importance of the activities. In addition, for those M/P code areas which have specific production features (e.g. Fruit production is dominant in PYO09. Chili cultivation is dominant in PRE01. Soybean cultivation is dominant in PRE06, PRE09, PRE10 and ANN17. ), the related activities were prioritized. Following table shows the criteria of the selected indicators.

**Table 5.4.14 Priority Criteria by Indicator**

| Component/Expected activities/Parameters | Unit | Priority recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| **1.1 Crop production** | | | | | |
| 1.1.1 Promotion of crop cultivation | | | | | |
| Suitable soil area/ Total M/P code area (38 crops) | % | 100-75 | 75-50 | 50-25 | 25-0 |
| Total 38 crops/38*3 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| 1.1.2 Planting local and common crops after harvesting paddy | | | | | |
| % of farmers who do paddy cultivation | % | 100-75 | 75-50 | 50-0 | - |
| 1.1.3 Planting vegetables around house (kitchen garden) | - | It is recommendable to all the areas for the promotion of self-reliance. (+++) | | | |
| 1.1.4 Diversification of crops | | | | | |
| Number of main crops cultivated | No. of Crops | 1 | 2 | 3 | 4 |
| Total 1.1.1~1.1.4 | % | 100-75 | 75-50 | 50-25 | 25-0 |

| Component/Expected activities/Parameters | Unit | Priority recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| **1.2 Farming technology improvement** | | | | | |
| 1.2.1 Introduction of integrated farming | - | It is recommendable to all the areas after learning the technologies concerned. (++) | | | |
| 1.2.2 Introduction of soil and water conservation farming technologies | | | | | |
| Distribution of sloped land area | % | 100-20 | 20-10 | 10-0 | - |
| 1.2.3 Crop production by organic farming | - | It is possible to all the areas after learning the technologies concerned. (++) | | | |
| 1.2.4 Knowledge improvement for breeding seeds | - | It is possible to all the areas after learning the technologies concerned. (++) | | | |
| Total 1.2.1~1.2.4 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| **2.1 Livestock raising** | | | | | |
| 2.1.1 Promotion of chicken raising | | | | | |
| % of farmers who do chicken raising | % | 0-10 | 10-20 | 20-30 | 30-100 |
| 2.1.2 Promotion of swine raising | | | | | |
| % of farmers who do swine raising | % | 0-10 | 10-20 | 20-30 | 30-100 |
| 2.1.3 Promotion of cattle raising | | | | | |
| % of farmers who do cattle raising | % | 0-10 | 10-20 | 20-30 | 30-100 |
| 2.1.4 Promotion of buffalo raising | | | | | |
| % of farmers who do buffalo raising | % | 0-10 | 10-20 | 20-30 | 30-100 |
| 2.1.5 Promotion of fish raising | - | It is possible to all the areas after learning the technologies concerned. (++) | | | |
| 2.1.6 Promotion of frog raising | - | It is possible to all the areas after learning the technologies concerned. (+) | | | |
| Total 2.1.1~2.1.6 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| **2.2 Breeding improvement** | | | | | |
| 2.2.1 Plant pasture seeds suitable for local conditions | - | It is recommendable to the areas where cattle raising is practiced. (+) | | | |
| 2.2.2 Improvement of equipments to prepare feed in dry season | - | It is recommendable to the areas where cattle is widely raised. (+) | | | |
| 2.2.3 Improvement of equipments to make mix concentrated feed | - | It is recommendable to the areas where cattle is widely raised. (+) | | | |
| Total 2.2.1~2.3.3 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| **3.1 Plant material processing** | | | | | |
| 3.1.1 Rice processing and its by-product utilization (straw, husks**)** | | | | | |
| % of farmers who do paddy cultivation | % | 100-75 | 75-50 | 50-25 | 25-0 |
| 3.1.2 Fruits processing (juice, wine, etc) | | | | | |
| % of farmers who do fruit cultivation | % | 100-60 | 60-40 | 40-20 | 20-0 |
| 3.1.3 Vegetables processing | | | | | |
| % of farmers who do vegetables cultivation | % | 100-30 | 30-20 | 20-10 | 10-0 |
| 3.1.4 Utilization of by-product from processing factories | - | With a processing factory of farm produce, it is possible to utilize its by-product for farming or animal feed. (+) | | | |
| Total 3.1.1~3.1.4 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| **3.2 Animal material processing** | | | | | |
| 3.2.1 Chicken meat processing | | Although this is more difficult than plant processing, It is possible to all the areas after learning the technologies concerned. (+) | | | |
| 3.2.2 Swine meat processing | | -ditto- | | | |
| 3.2.3 Cattle meat processing | | -ditto- | | | |
| 3.2.4 Frog meat processing | | -ditto | | | |
| Total 3.2.1~3.2.4 | % | 100-75 | 75-50 | 50-25 | 25-0 |

| Component/Expected activities/Parameters | Unit | Priority recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| **4.1 Enhancement of local circulation of farm produce** | | | | | |
| 4.1.1 Community market development | - | It is recommendable to the areas where villagers purchase various things from the outside. (++) | | | |
| 4.1.2 Development of marketing network | - | It is recommendable to the areas where community markets are developed. (+) | | | |
| Total 4.1.1~4.1.2 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| **4.2 Marketing improvement of local specialties** | | | | | |
| 4.2.1 Farm produce marketing improvement | - | It is recommendable to the areas where special farm produce is cultivated. (++) | | | |
| 4.2.2 Livestock produce marketing improvement | - | It is recommendable to the areas where special livestock produce is cultivated. (+) | | | |
| Total 4.1.1~4.1.2 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| **5.1 Water resources development** | | | | | |
| 5.1.1 Existing irrigation facilities improvement | | | | | |
| (1) Village of water shortage for cropping | % | 100-28 | 28-14 | 14-1 | 1-0 |
| (2) Farmland ratio of land use | % | 100-95 | 95-70 | 70-40 | 40-0 |
| (3) Perennial stream density | km/1000rai | >1.4 | 1.4 - 0.7 | 0.7 - 0.1 | <0.1 |
| (4) Water availability by sources (total) | places/ villages | >2.4 | 2.4 - 1.9 | 1.9 - 1.4 | <1.4 |
| (5) Water availability (perennial sources) | places/ villages | >1.2 | 1.2 - 0.8 | 0.8 - 0.4 | <0.4 |
| Total ((1)+(2)+(3)+(4)+(5))/15 | % | 100-66 | 66-33 | 33-0 | |
| 5.1.2 Individual farm pond development | | | | | |
| Land holding size of SPK 4-01 farmers | rai | >12 | 12 - 9 | 9 - 5 | <5 |
| 5.1.3 Groundwater development | | | | | |
| (1) Village of water shortage for cropping | % | 100-28 | 28-14 | 14-1 | 1-0 |
| (2) Farmland ratio of land use | % | 100-95 | 95-70 | 70-40 | 40-0 |
| (3) Ground water potential (yield) | m3/hr | >7 | 7 - 4 | 4 - 1 | <1 |
| Total (((1)+(2))*(3))/18 | % | 100-66 | 66-33 | 33-0 | |
| 5.1.4 Existing reservoir improvement | | | | | |
| (1) Village of water shortage for cropping | % | 100-28 | 28-14 | 14-1 | 1-0 |
| (2) Farmland ratio of land use | % | 100-95 | 95-70 | 70-40 | 40-0 |
| (3) Perennial stream density | km/1000rai | >1.4 | 1.4 - 0.7 | 0.7 - 0.1 | <0.1 |
| (4) Water availability by sources (total); | places/ villages | >2.4 | 2.4 - 1.9 | 1.9 - 1.4 | <1.4 |
| (5) Water availability by sources; existing reservoir and lake | places/ villages | >0.7 | 0.7 - 0.3 | 0.3- 0.01 | <0.01 |
| Total (((1)+(2)+(3)+(4))*(5))/36 | % | 100-66 | 66-33 | 33-0 | |
| 5.1.5 Perennial stream development | | | | | |
| (1) Village of water shortage for cropping | % | 100-28 | 28-14 | 14-1 | 1-0 |
| (2) Farmland ratio of land use | % | 100-95 | 95-70 | 70-40 | 40-0 |
| (3) Water availability by sources (perennial sources) | places/ villages | >0.5 | 0.5 -0.3 | 0.3 - 0.1 | <0.1 |
| (4) Perennial stream density | km/1000rai | >1.4 | 1.4 - 0.7 | 0.7 - 0.1 | <0.1 |
| Total ((1)+(2)-(3))*(4))/9 | % | 100-66 | 66-33 | 33-0 | |
| 5.1.6 Small scale reservoir development | | | | | |
| (1) Village of water shortage for cropping | % | 100-28 | 28-14 | 14-1 | 1-0 |
| (2) Farmland ratio of land use | % | 100-95 | 95-70 | 70-40 | 40-0 |
| (3) Water availability by sources (manmade reservoir) | places/ villages | >0.4 | 0.4 -0.2 | 0.2 - 0.1 | <0.1 |

| Component/Expected activities/Parameters | Unit | Priority recommendation | | | |
|---|---|---|---|---|---|
| | | +++ | ++ | + | - |
| (4) Perennial stream density | km/1000rai | >1.4 | 1.4 - 0.7 | 0.7 - 0.1 | <0.1 |
| Total ((1)+(2)-(3))*(4))/9 | % | 100-66 | 66-33 | 33-0 | |
| Total 5.1.1~5.1.6 | % | 100-66 | 66-33 | 33-0 | |
| **5.2 On-farm facilities** | | | | | |
| 5.2.1 On-farm road improvement and development | | | | | |
| (1) Farmland ratio of land use | % | 100-95 | 95-70 | 70-40 | 40-0 |
| (2) Ratio of upland fields in farmland utilization | % | 100-86 | 86-60 | 60-34 | 34-0 |
| (3) Slope of topography | % | <4 | 4 - 6.5 | 6.5 - 9.0 | >9.0 |
| (4) Erosion of plain land | mm/year | <0.5 | 0.5 -1.75 | 1.75-3.0 | >3.0 |
| (5) Ratio of agricultural households | % | 100-93 | 93-76 | 76-59 | 59-0 |
| (6) Density of on-farm road | km/1000rai | <0.5 | 0.5 -2.4 | 2.4 - 4.75 | >4.75 |
| (7) Agricultural households having farming automobiles | Number/ household | >0.34 | 0.34-0.24 | 0.24-0.14 | <0.14 |
| Total ((1) - (7)) /21 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| 5.2.2 Farmland soil conservation | | | | | |
| (1) Slope of topography | % | <4 | 4 - 6.5 | 6.5 - 9.0 | >9.0 |
| (2) Erosion of plain land | mm/year | <0.5 | 0.5- 1.75 | 1.75- 3.0 | >3.0 |
| (3) Ratio of villages having erosion problem | % | 100-76 | 76-46 | 46-16 | 16-0 |
| Total ((6-(1)-(2))+(3))/9 | % | 100-75 | 75-50 | 50-25 | 25-0 |
| 5.2.3 Flood mitigation | | | | | |
| Ration of villages having flood problem | % | 100-25 | 25-12 | 12-0.1 | 0.1-0 |
| Total 5.2.1~5.2.3 | % | 100-75 | 75-50 | 50-25 | 25-0 |

For instance, if number of main crops cultivated, which is considered to indicate the degree of diversification of crops, is very few in some areas, priority of the activity related to crop diversification becomes higher for stability of farming activities. For the prioritization of those components consisting of several activities, priority of each activity were integrated and/or averaged. In case of "2.1 Livestock raising component" which consists of 4 quantitative indicators (percentage of farmers who do animal raising for 4 kinds) and 2 other non-quantitative indicators (promotion of fish raising (++) and promotion of from raising (+) for all the areas), all the data were integrated and prioritized.

**Table 5.4.15 Example of Livestock Raising Component in Phrae**

| M/P Code area | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Data (%) | | | | | | | | | | | | | | |
| Chicken raising | 0.1 | 0.0 | 0.1 | 2.6 | 0.0 | 10.5 | 17.7 | 22.4 | 1.5 | 0.0 | 3.2 | 0.0 | 2.6 | 31.3 |
| Swine raising | 5.5 | 6.7 | 1.4 | 3.0 | 23.0 | 8.8 | 5.6 | 6.3 | 1.0 | 0.0 | 0.8 | 3.3 | 10.6 | 11.7 |
| Cattle raising | 2.1 | 1.0 | 4.4 | 4.9 | 10.2 | 4.9 | 5.0 | 4.8 | 0.2 | 0.0 | 0.5 | 2.0 | 6.2 | 2.3 |
| Buffalo raising | 0.0 | 0.1 | 1.6 | 0.3 | 0.0 | 0.0 | 0.8 | 0.8 | 0.2 | 0.0 | 0.0 | 0.0 | 5.2 | 0.0 |
| Fish raising | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frog raising | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Priority | | | | | | | | | | | | | | |
| Chicken raising | +++ | +++ | +++ | +++ | +++ | ++ | ++ | + | +++ | +++ | +++ | +++ | +++ | - |
| Swine raising | +++ | +++ | +++ | +++ | + | +++ | +++ | +++ | +++ | +++ | +++ | +++ | ++ | ++ |

| M/P Code area | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cattle raising | +++ | +++ | +++ | +++ | ++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ |
| Buffalo raising | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ |
| Fish raising | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ |
| Frog raising | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| Priority of Component | +++ | +++ | +++ | +++ | ++ | +++ | +++ | ++ | +++ | +++ | +++ | +++ | +++ | ++ |

Based on the above criteria, priority recommendation among the M/P code areas was made by activity and component. To clarify the processes, the indicators by the M/P code areas in Phayao are shown as examples.

## Table 5.4.16 Indicators Measurement Processes (Agriculture Development, Phayao)

| Program | Component | Indicator | | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Main Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Agricultural production | 1.1 Crop production | | | ++ | +++ | +++ | ++ | +++ | +++ | +++ | +++ | +++ | ++ | +++ | +++ | ++ | ++ | |
| | | Paddy | | - | - | ++ | - | - | - | ++ | + | - | + | - | - | - | - | Soil suitability for cropping |
| | | Field crops | Upland rice | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - ditto - |
| | | | Wheat & barley | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | | Corn & maize | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | | Sorghum | + | - | - | + | ++ | - | + | ++ | ++ | ++ | ++ | ++ | - | +++ | - ditto - |
| | | | Cassava | + | - | - | + | ++ | + | + | ++ | ++ | ++ | ++ | ++ | + | +++ | - ditto - |
| | | | Sugarcane | + | + | ++ | + | ++ | ++ | ++ | +++ | ++ | ++ | ++ | +++ | ++ | +++ | - ditto - |
| | | | Sesame | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | | Castor oil | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | | Cotton | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | | Tobacco | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | Beans | Soybean, peanut, mungbean | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | Vegetables | Garlic, onion, tomato | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | | Mixed vegetables | - | - | ++ | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | | Red onion | - | - | - | - | - | - | - | - | + | + | - | + | - | - | - ditto - |
| | | | Baby corn | - | - | - | - | - | - | - | - | + | + | - | + | - | - | - ditto - |
| | | | Chili | - | - | - | - | - | - | - | - | + | + | - | + | - | - | - ditto - |
| | | | Cabbage & potato | - | - | - | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | Tree crops | Lychee | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Longan | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Arabica coffee | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Tea | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Mango | - | + | - | - | ++ | + | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Subtropical fruit | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Pineapple | + | - | - | + | ++ | ++ | + | ++ | ++ | ++ | ++ | ++ | ++ | +++ | - ditto - |
| | | | Tamarind | + | - | ++ | + | ++ | ++ | + | ++ | ++ | ++ | ++ | ++ | + | +++ | - ditto - |
| | | | Coconut | - | - | ++ | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Banana | - | - | ++ | - | ++ | + | - | - | ++ | ++ | + | + | + | - | - ditto - |
| | | | Cashewnut | - | - | - | - | ++ | + | - | - | ++ | ++ | + | + | + | - | - ditto - |
| | | | Citrus | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Pomelo, tangerine, mandarin | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Jackfruit | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Kapok | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Avocado | - | - | - | - | ++ | - | - | - | ++ | ++ | + | + | - | - | - ditto - |
| | | | Mulberry | - | - | - | - | ++ | + | - | - | ++ | + | + | + | + | - | - ditto - |
| | | Flowers | | - | - | ++ | - | ++ | - | - | - | ++ | + | + | + | - | - | - ditto - |
| | | Bamboo | | ++ | ++ | ++ | ++ | +++ | ++ | + | ++ | ++ | ++ | ++ | +++ | +++ | +++ | - ditto - |
| | | Pasture | | ++ | ++ | ++ | ++ | +++ | ++ | + | ++ | ++ | ++ | ++ | +++ | +++ | +++ | - ditto - |
| | | Planting local and common crops after harvesting paddy | | +++ | +++ | +++ | ++ | ++ | +++ | +++ | +++ | + | ++ | ++ | ++ | +++ | +++ | % of farmers who do paddy cultivation |
| | | Planting vegetables around house (kitchen garden) | | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | It is recommendable to all the areas for the promotion of self-reliance. |
| | | Diversification of crops | | ++ | +++ | +++ | ++ | +++ | +++ | +++ | +++ | +++ | ++ | +++ | +++ | ++ | ++ | Present situation of crop diversification |
| | 1.2 Farming technology improvement | Introduction of integrated farming | | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | It is recommendable to all the areas after learning the technologies concerned. |
| | | Introduction of soil and water conservation farming technologies | | ++ | + | + | ++ | + | + | + | + | + | + | +++ | + | + | + | Distribution of sloped land area |
| | | Crop production by organic farming | | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | It is possible to all the areas after learning the technologies concerned. |
| | | Knowledge improvement for breeding seeds | | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | It is possible to all the areas after learning the technologies concerned. |
| 2 Livestock development | 2.1 Livestock raising | Promotion of animal raising | | +++ | +++ | +++ | +++ | +++ | +++ | +++ | ++ | +++ | +++ | +++ | +++ | +++ | +++ | |
| | | Chicken raising | | +++ | ++ | ++ | +++ | ++ | ++ | +++ | - | +++ | +++ | +++ | +++ | +++ | +++ | % of farmers who do chicken raising |
| | | Swine raising | | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | % of farmers who do swine raising |
| | | Cattle raising | | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | ++ | ++ | +++ | +++ | ++ | % of farmers who do cattle raising |
| | | Buffalo raising | | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | +++ | % of farmers who do buffalo raising |
| | | Fish raising | | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | It is possible to all the areas after learning the technologies concerned. |
| | | Frog raising | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | - ditto - |
| | 2.2 Breeding improvement | Selection of breeders suitable for local conditions | | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | It is recommendable to the areas where animal raising is practiced. |
| | | Artificial insemination (cattle) | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | It is recommendable to the areas where assistance of DOL is available. |
| | 2.3 Feed production | Plant pasture seeds suitable for local conditions | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | It is recommendable to the areas where cattle raising is practiced. |
| | | Improvement of equipments to prepare feed in dry season | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | It is recommendable to the areas where cattle is widely raised. |
| | | Improvement of equipments to make mix concentrated feed | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | - ditto - |
| 3 Farm produce processing | 3.1 Plant material processing | Rice processing and its by-product utilization (straw, husks) | | +++ | +++ | +++ | ++ | ++ | +++ | +++ | +++ | + | ++ | ++ | ++ | +++ | +++ | % of farmers who do paddy cultivation (People need to learn the technologies concerned.) |
| | | Fruits processing (juice, wine, etc) | | - | - | + | + | + | - | - | - | - | ++ | - | - | - | + | % of farmers who do fruits cultivation (People need to learn the technologies concerned.) |
| | | Vegetables processing | | +++ | - | - | + | - | - | - | - | - | - | + | + | - | - | % of farmers who do vegetables cultivation (People need to learn the technologies concerned.) |
| | | Utilization of by-product from processing factories | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | With a processing factory of farm produce, it is possible to utilize its by-product for farming or animal feed. |
| | 3.2 Animal material processing | Chicken meat processing | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | Although this is more difficult than plant processing, It is possible to all the areas after learning the technologies concerned. |
| | | Swine meat processing | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | - ditto - |
| | | Cattle meat processing | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | - ditto - |
| | | Frog meat processing | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | - ditto - |
| | | Making fish sauce | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | - ditto - |
| 4 Marketing | 4.1 Enhancement of local circulation of farm produce | Community market development | | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | ++ | It is recommendable to the areas where villagers purchase various things from the outside. |
| | | Development of marketing network | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | |
| | 4.2 Marketing improvement of local specialties | Farm produce marketing improvem | | ++ | + | + | + | + | + | + | + | + | + | + | + | + | + | It is recommendable to the areas where special farm produce is cultivated. |
| | | Livestock produce marketing improvement | | + | + | + | + | + | + | + | + | + | + | + | + | + | + | It is recommendable to the areas where special livestock produce is cultivated. |

+++ : Highly recommendable ++ : Moderately recommendable + : Recommendable - : Not Recommendable

## Table 5.4.17 Quantitative Indicators for Prioritization (Agriculture Development, Phayao)

| Program | Component | Indicator | | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Parameter |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Agricultural production | 1.1 Crop production | | | 7.89 | 5.26 | 15.79 | 7.89 | 59.65 | 13.16 | 8.77 | 14.04 | 60.53 | 50.88 | 35.09 | 40.35 | 13.16 | 18.42 | |
| | | Paddy | | 9.57 | 22.79 | 68.48 | 2.24 | 19.04 | 16.39 | 54.22 | 25.04 | 11.47 | 30.05 | 7.64 | 14.53 | 14.18 | 15.81 | Suitable soil distribution |
| | | Field crops | Upland rice | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | Suitable soil distribution |
| | | | Wheat & barley | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Corn & maize | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Sorghum | 49.91 | 20.50 | 0.00 | 36.74 | 61.54 | 22.86 | 26.52 | 52.78 | 53.69 | 53.32 | 56.38 | 50.03 | 15.44 | 76.31 | Suitable soil distribution |
| | | | Cassava | 49.91 | 20.50 | 0.00 | 36.74 | 69.24 | 48.59 | 26.52 | 60.48 | 59.73 | 53.32 | 56.38 | 56.63 | 32.64 | 76.31 | Suitable soil distribution |
| | | | Sugarcane | 49.91 | 46.75 | 56.82 | 38.45 | 69.24 | 66.15 | 54.10 | 79.53 | 69.44 | 65.30 | 63.56 | 85.13 | 61.61 | 89.09 | Suitable soil distribution |
| | | | Sesame | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Castor oil | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Cotton | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Tobacco | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | Beans | Soybean, peanut, mungbean | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | Vegetables | Garlic, onion, tomato | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Mixed vegetables | 8.95 | 1.63 | 56.82 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 52.28 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Red onion | 8.35 | 1.63 | 0.00 | 6.46 | 8.52 | 16.28 | 20.99 | 7.95 | 41.79 | 42.20 | 20.14 | 29.18 | 11.92 | 23.34 | Suitable soil distribution |
| | | | Baby corn | 8.35 | 1.63 | 0.00 | 6.46 | 8.52 | 16.28 | 20.99 | 7.95 | 41.79 | 42.20 | 20.14 | 29.18 | 11.92 | 23.34 | Suitable soil distribution |
| | | | Chili | 8.35 | 1.63 | 0.00 | 6.46 | 8.52 | 16.28 | 20.99 | 7.95 | 41.79 | 42.20 | 20.14 | 29.18 | 11.92 | 23.34 | Suitable soil distribution |
| | | | Cabbage & potato | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | Tree crops | Lychee | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.63 | 35.06 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Longan | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.63 | 34.83 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Arabica coffee | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.86 | 35.53 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Tea | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.86 | 35.53 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Mango | 8.95 | 36.85 | 0.00 | 21.13 | 54.51 | 27.94 | 20.99 | 8.83 | 55.28 | 58.17 | 37.14 | 43.94 | 16.96 | 23.34 | Suitable soil distribution |
| | | | Subtropical fruit | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.63 | 35.06 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Pineapple | 49.91 | 20.50 | 0.00 | 36.74 | 69.24 | 62.86 | 35.33 | 60.48 | 59.73 | 53.32 | 56.95 | 61.48 | 57.48 | 76.31 | Suitable soil distribution |
| | | | Tamarind | 49.91 | 20.50 | 67.50 | 36.74 | 69.37 | 54.21 | 26.53 | 60.48 | 60.21 | 59.98 | 57.56 | 56.63 | 32.64 | 76.31 | Suitable soil distribution |
| | | | Coconut | 8.95 | 1.63 | 56.82 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 52.28 | 56.97 | 37.14 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Banana | 8.95 | 1.63 | 67.50 | 21.13 | 61.19 | 47.64 | 21.00 | 15.64 | 58.33 | 53.64 | 35.18 | 37.58 | 32.60 | 23.34 | Suitable soil distribution |
| | | | Cashewnut | 8.95 | 1.63 | 10.67 | 21.13 | 61.19 | 47.64 | 21.00 | 15.64 | 57.85 | 53.64 | 35.18 | 37.58 | 32.60 | 23.34 | Suitable soil distribution |
| | | | Citrus | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.86 | 35.17 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Pomelo, tangerine, mandarin | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.86 | 35.17 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Jackfruit | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.86 | 35.17 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Kapok | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.86 | 35.40 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Avocado | 8.95 | 1.63 | 0.00 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 51.80 | 51.86 | 35.40 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | | Mulberry | 8.95 | 1.63 | 0.00 | 21.13 | 61.06 | 42.01 | 20.99 | 15.64 | 57.85 | 46.98 | 34.01 | 37.58 | 32.60 | 23.34 | Suitable soil distribution |
| | | Flowers | | 8.95 | 1.63 | 56.82 | 21.13 | 53.36 | 16.28 | 20.99 | 7.95 | 52.28 | 46.98 | 34.01 | 30.98 | 15.40 | 23.34 | Suitable soil distribution |
| | | Bamboo | | 60.56 | 66.76 | 67.90 | 52.74 | 77.50 | 70.01 | 39.49 | 70.79 | 70.31 | 66.29 | 65.09 | 82.60 | 81.46 | 76.31 | Suitable soil distribution |
| | | Pasture | | 60.91 | 66.76 | 68.10 | 52.74 | 77.50 | 71.96 | 39.49 | 70.79 | 70.31 | 66.29 | 65.09 | 82.60 | 82.77 | 76.31 | Suitable soil distribution |
| | | Planting local and common crops after harvesting paddy | | 77.89 | 87.43 | 90.19 | 61.51 | 71.74 | 83.87 | 84.07 | 89.49 | 29.99 | 73.76 | 73.12 | 68.28 | 94.02 | 85.00 | % of farmers who do paddy cultivation |
| | | Planting vegetables around house (kitchen garden) | | | | | | | | | | | | | | | | |
| | | Diversification of crops | | 2.0 | 1.0 | 1.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 0.0 | 2.0 | 1.0 | 1.0 | 2.0 | 2.0 | How many crops with over 50% of HH engaged in |
| | 1.2 Farming technology improvement | Introduction of integrated farming | | | | | | | | | | | | | | | | |
| | | Introduction of soil and water conservation farming technologies | | 12.25 | 5.39 | 6.85 | 15.30 | 1.57 | 3.16 | 1.52 | 2.11 | 6.42 | 1.19 | 21.91 | 0.31 | 2.42 | 1.36 | Area distribution (over 20%) |
| | | Crop production by organic farming | | | | | | | | | | | | | | | | |
| | | Knowledge improvement for breeding seeds | | | | | | | | | | | | | | | | |
| 2 Livestock development | 2.1 Livestock raising | Promotion of animal raising | | | | | | | | | | | | | | | | |
| | | | Chicken raising | 1.23 | 10.47 | 12.37 | 6.97 | 16.64 | 19.80 | 8.36 | 30.37 | 0.44 | 0.35 | 2.49 | 0.87 | 0.48 | 1.30 | % of farmers who do chicken raising |
| | | | Swine raising | 5.25 | 8.65 | 6.27 | 7.56 | 6.75 | 1.49 | 1.59 | 4.38 | 0.22 | 1.53 | 1.46 | 0.76 | 0.38 | 9.08 | % of farmers who do swine raising |
| | | | Cattle raising | 9.55 | 5.92 | 2.64 | 4.64 | 6.67 | 2.16 | 1.94 | 7.71 | 1.43 | 13.33 | 10.68 | 3.56 | 0.93 | 10.71 | % of farmers who do cattle raising |
| | | | Buffalo raising | 1.28 | 1.00 | 0.33 | 0.20 | 0.80 | 0.12 | 0.57 | 0.12 | 0.00 | 0.21 | 0.51 | 0.23 | 0.10 | 0.49 | % of farmers who do buffalo raising |
| | | | Fish raising | | | | | | | | | | | | | | | |
| | | | Frog raising | | | | | | | | | | | | | | | |
| | 2.2 Breeding improvement | Selection of breeders suitable for local conditions | | | | | | | | | | | | | | | | |
| | | Artificial insemination (cattle) | | | | | | | | | | | | | | | | |
| | 2.3 Feed production | Plant pasture seeds suitable for local conditions | | | | | | | | | | | | | | | | |
| | | Improvement of equipments to prepare feed in dry season | | | | | | | | | | | | | | | | |
| | | Improvement of equipments to make mix concentrated feed | | | | | | | | | | | | | | | | |
| 3 Farm produce processing | 3.1 Plant material processing | Rice processing and its by-product utilization (straw, husks) | | 77.89 | 87.43 | 90.19 | 61.51 | 71.74 | 83.87 | 84.07 | 89.49 | 29.99 | 73.76 | 73.12 | 68.28 | 94.02 | 85.00 | % of farmers who do rice cultivation |
| | | Fruits processing (juice, wine, etc) | | 17.54 | 14.48 | 22.42 | 23.55 | 31.43 | 18.14 | 6.87 | 6.54 | 1.10 | 55.33 | 9.07 | 6.47 | 3.49 | 20.28 | % of farmers who do fruits cultivation |
| | | Vegetables processing | | 32.71 | 7.83 | 2.64 | 10.65 | 1.41 | 6.73 | 1.78 | 0.18 | 0.00 | 9.89 | 11.27 | 19.30 | 9.59 | 8.11 | % of farmers who do vegetable |
| | | Utilization of by-product from processing factories | | | | | | | | | | | | | | | | |
| | 3.2 Animal material processing | Chicken meat processing | | | | | | | | | | | | | | | | |
| | | Swine meat processing | | | | | | | | | | | | | | | | |
| | | Cattle meat processing | | | | | | | | | | | | | | | | |
| | | Frog meat processing | | | | | | | | | | | | | | | | |
| | | Making fish sauce | | | | | | | | | | | | | | | | |
| 4 Marketing | 4.1 Enhancement of local circulation of farm produce | Community market development | | | | | | | | | | | | | | | | |
| | | Development of marketing network | | | | | | | | | | | | | | | | |
| | 4.2 Marketing improvement of local specialties | Farm produce marketing | | | | | | | | | | | | | | | | |
| | | Livestock produce marketing improvement | | | | | | | | | | | | | | | | |

(6) Consultation on Prioritization Results with PLROs

Discussions were held with PLROs to reflect situations and development strategies of each province on the prioritization of programs and components. Their opinion on priority recommendation of programs and components derived through discussions are indicated in the following sections.

(7) Cost Estimation of Infrastructure Development

1) Basic Approach

Several programs and components in two sectors (Livelihood Improvement and Sustainable Agriculture Development) include infrastructure development, and the related activities are shown below.

**Table 5.4.18 Infrastructure Development in the Master Program**

| Sector/Program | Component | Expected activities |
|---|---|---|
| **2. Livelihood improvement** | | |
| 2.4 Infrastructure development | 2.4.1 Social infrastructure | (1) Installation of village water supply<br>(2) Expansion of village water supply<br>(3) Village electrification<br>(4) Expansion of electricity service<br>(5) Village road improvement |
| | 2.4.2 Living conditions improvement | (1) Garbage disposal improvement<br>(2) Wastewater treatment |
| **3. Agriculture development** | | |
| 3.5 Infrastructure development | 3.5.1 Water resources development | (1) Existing irrigation facilities improvement<br>(2) Individual farm pond development<br>(3) Groundwater development<br>(4) Existing reservoir improvement<br>(5) Perennial stream development<br>(6) Small scale reservoir development |
| | 3.5.2 On-farm facilities | (1) On-farm road improvement and development<br>(2) Farmland soil conservation<br>(3) Flood mitigation |

Detailed facilities to be constructed and improved are planned as follows.

**Table 5.4.19 Targeted Facilities for Construction and Improvement**

| Component/Expected activities | Targeted Facilities |
|---|---|
| **2.4.1 Social infrastructure** | |
| (1) Installation of village water supply | Deep well, pump, standpipe, pipelines, etc. |
| (2) Expansion of village water supply | Distribution pipe from pipeline to house |
| (3) Village electrification | Electrification to villages |
| (4) Expansion of electricity service | Electricity service for individual household and villages |
| (5) Village road improvement | Road of 6.0 m wide with laterite pavement |
| **2.4.2 Living conditions improvement** | |
| (1) Garbage disposal improvement | Not designed. Learning its necessity. |
| (2) Wastewater treatment | Not designed. Learning its necessity. |

| Component/Expected activities | Targeted Facilities |
|---|---|
| **3.5.1 Water resources development** | |
| (1) Existing irrigation facilities improvement | Repair of weir, canals, check structures |
| (2) Individual farm pond development | Farm pond (1,269 cu.m), Micro irrigation system |
| (3) Groundwater development | Shallow and/or deep well with micro irrigation system |
| (4) Existing reservoir improvement | Dredging and/or expansion of existing reservoir |
| (5) Perennial stream development | Construction of intake facility and irrigation supply canal |
| (6) Small scale reservoir development | Reservoir with intake facility, feeder canals |
| **3.5.2 On-farm facilities** | |
| (1) On-farm road improvement/ development | Road of 4.0 m wide with laterite pavement |
| (2) Farmland soil conservation | Contour bund with vegetation (vetiver grass) |
| (3) Flood mitigation | Catch drains, drainage system. Depend on local conditions. |

Infrastructure development cost is estimated by expected activity in each M/P code area.

2) Unit Cost for Cost Estimate

The cost estimate is composed of three items; survey cost, construction/improvement cost, and administration cost. The two items, survey and construction/improvement costs, are estimated by expected activity based on the unit cost and the targeted quantities in the M/P code area concerned. The administration cost covers the necessary costs for operation and management during implementation period. It is assumed that the amount is equivalent to 30% of the survey and construction/improvement costs. Infrastructure development cost of the component is the sum of the expected activities costs.

The unit cost of the expected activities is estimated based on the related cost estimate criteria used by ALRO, considering the construction/improvement level of the facilities. It is also quoted from a list of unit costs, “Office of Budget, 2005”, the on-going JBIC project and the data from PEA. The unit cost by each expected activity is shown below.

**Table 5.4.20 Unit Cost of Expected Activity**

| Component/Expected activities | Unit cost | | |
|---|---|---|---|
| | Unit | Survey | Construction |
| **2.4.1 Social infrastructure** | | | |
| (1) Installation of village water supply | Set | 25,000 | 208,100 |
| (2) Expansion of village water supply | Household | 56 | 302 |
| (3) Village electrification | Village | 187,000 | 4,675,000 |
| (4) Expansion of electricity service | Household | 50 | 700 |
| (5) Village road improvement | km | 650 | 95,000 |
| **2.4.2 Living conditions improvement** | | | |
| (1) Garbage disposal improvement | Not estimated since scale of facility cannot be designed. | | |
| (2) Wastewater treatment | Not estimated since scale of facility cannot be designed. | | |
| **3.5.1 Water resources development** | | | |
| (1) Existing irrigation facilities improvement | rai | 127 | 11,836 |
| (2) Individual farm pond development | site | 250 | 47,000 |
| (3) Groundwater development | site | 1,200 | 47,000 |
| (4) Existing reservoir improvement | place | 127,000 | 1,353,500 |
| (5) Perennial stream development | km | 11,200 | 132,740 |
| (6) Small scale reservoir development | site | 25,400 | 4,246,620 |

| Component/Expected activities | Unit cost | | |
|---|---|---|---|
| | Unit | Survey | Construction |
| **3.5.2 On-farm facilities** | | | |
| (1) On-farm road improvement/ development | km | 1,785 | 89,600 |
| (2) Farmland soil conservation (High land) | rai | 127 | 1,705 |
| Farmland soil conservation (Plain land) | rai | 127 | 1,023 |
| (3) Flood mitigation | Not designed. Further study is required in the target site. | | |

The activities for appropriate garbage disposal and wastewater treatment are important in terms of environmental conservation. However, in general, the related tambons and villages have little knowledge and technique for the matters. Facility requirement level of construction and improvement cannot be anticipated at the moment. Tambons and villages may need further development through any appropriate learning processes such as study tours to advanced villages. The cost, therefore, was not estimated here. For the flood mitigation facilities, more detailed site information is necessary to plan the scale of facilities for cost estimation. Hence the cost was not estimated here.

3) Cost Estimate Procedures

Quantities such as size of area, number of villages/households and number of site, are estimated based on the priority recommendation of the M/P code area (See the next section for details.) and possible data derived from the NRD2C and GIS which may indicate development potentials and constraints. In the course of the quantity estimate, the priority recommendation is applied as follows.

1. "+++": Feasibility of facility development is relatively high. This assumes that 90 % of the estimated quantity of the expected activities will be implemented, while the remaining 10 % will not be executed due to some reasons (e.g. physical condition of the site, intention of tambons and villages, shortage of budget of farmers, etc.)
2. "++": Feasibility of facility development is moderate. This assumes that 65 % of the estimated quantity of the expected activities will be implemented, while the remaining 35 % will not be executed due to the same reasons above.
3. "+": Feasibility of facility development is low. This assumes that 35 % of the estimated quantity will be carried out, while the remaining 65 % will not be executed due to the same reasons above.
4. "-": Feasibility of facility development is the least and not recommendable. This assumes that villagers have no interest and/or willingness to execute the activities. The estimated quantity, therefore, is assumed at zero (0) %.

Quantity estimate processes of expected activities are shown with an example of the M/P code area (PYO01), as follows.

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**Example: Component 2.4.1 Social infrastructure**

Expected activity: (1) Installation of village water supply

Categorization of the M/P code areas for village water supply

| Categorization of M/P code areas | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| Villages equipped with village water supply (NRD2C) | <=65% | 65-81% | 81-99% | 100% |
| Villages equipped with village water supply (assumed) | 32.5% | 73% | 90% | 100% |
| Villages to be provided (assumed) | 67.5% | 27% | 10% | 0% |

M/P code area: PYO01

| Estimation | Quantity | Calculated |
|---|---|---|
| Area (rai) | 22,098 | |
| Number of village | 24 | |
| Categorization class | 1 | |
| Quantity calculation | | |
| Number of villages to be provided (assumed from categorization) | 16 | 24*0.675 |
| Priority recommendation | +++ | |
| Ratio to be provided (from priority) | 90% | |
| Number of villages to be provided (set) | 14 | 16*0.9 |

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### 5.4.2 Phayao Province

(1) Characteristics of Natural Resources and the LRAs

Characteristics of natural resources and LRAs are summarized in accordance with sectors as follows.

**Table 5.4.21 Characteristics of Natural Resources and LRAs in Phayao**

| | |
|---|---|
| Area | 3,959,413 (rai) |
| Population | 501,509 (2002) |
| Natural resources | About two thirds of the provincial area is in the mountainous areas. Forest area is 51% of the provincial area. Designated reserve forest is about 2.6 million rai (about two thirds of the provincial area) and is larger than the forest area, which is currently reducing.<br>There are two large swamps and three major rivers of Yom, Ing and Lao, which originate from mountain range of this province.<br>Irrigated area covers only 9% of the provincial land, 34 % of the provincial farmland.<br>Protected area is nearly 600,000 rai, 25% of the total forest area.<br>Community forest, total 25,420 rai, is scattered over the 94 sites. |
| Agricultural Land Reform Areas (LRAs) | |
| Target group | Number of LRAs (M/P code areas); 14<br>Total area; 378,166.2 rai<br>Number of tambon concerned; 51<br>Number of village concerned; 280<br>Beneficiaries (LRA declared); 160,656 persons<br>Potential beneficiaries; 479,646 persons (based on tambon) |
| Natural resources | The M/P code areas with low slope less that 5% is around 60% of total M/P code areas.<br>Density of the perennial stream is small compared to that of all categories of stream. Surface water use is limited.<br>Soils suitable for pasture and fruit tree represent a large portion.<br>Rapid change of land cover from forest to agricultural land has been occurred. M/P code areas with high soil erosion rate are widely distributed.<br>All of M/P code areas are adjacent to reserved forest.<br>The M/P code areas have community forest except for PYO09. |

| | |
|---|---|
| Socio-economy | SPK4-01farmers comprise 25% of total provincial population.<br>Share of the agricultural households in the M/P code areas is higher than that of the provincial average.<br>Household income; 33,003Baht (NRD2C). As for household expenditures, share of “food” and “finance” is relatively large, and most households have debts.<br>Road and water supply system have been provided in most of M/P code areas. One village in PYO07 has no electric service.<br>In 46 % of villages, people use charcoal and wood for fuel source for cooking. |
| Agriculture | Average land holding size of SPK4-01 farmers is smaller than that of provincial average.<br>Paddy field is dominant in half of the M/P code areas. Field crops are dominant in the six M/P code areas.<br>In general, livestock activities are relatively inactive.<br>Farm machines are more widely extended compared to Phrae and Nan.<br>In most M/P code areas, farmers use both chemical and natural fertilizer.<br>Technology Transfer Centers do not function well to extend useful knowledge.<br>4.4 % of villages in the M/P code areas have irrigation facilities. 19% of villages suffer from water shortage. |

(2) Prioritization of Programs and Components by the M/P Code Areas

In accordance with the method explained in the previous section (5.4), programs and components were prioritized by each M/P code area, and the results are shown below.

**Table 5.4.22 Priority Recommendation of Components (Natural Resources Management, PYO)**

| M/P Code area | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Food produce utilization: Average 2.79 | | | | | | | | | | | | | | | |
| 1.1 Food utilization | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 2.79 |
| 1.2 Non-food utilization | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 2.79 |
| 2. Forest area management: Average 2.36 | | | | | | | | | | | | | | | |
| 2.1 Community forest establishment | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 2 | 2 | 1 | 3 | 2 | 2.14 |
| 2.2 Community forest management | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 2.79 |
| 2.3 Forest valuations | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 3 | 1 | 2 | 2 | 1 | 3 | 2 | 2.14 |
| 3. Forest rehabilitation: Average 2.90 | | | | | | | | | | | | | | | |
| 3.1 Forest rehabilitation | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 2 | 3 | 3 | 2.79 |
| 3.2 Reserved forest area delineation | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3.00 |
| 4. Soil and water conservation: Average 2.65 | | | | | | | | | | | | | | | |
| 4.1 Soil conservation | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2.93 |
| 4.2 Water conservation | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2.36 |

Remark: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

**Table 5.4.23 Priority Recommendation of Components (Livelihood Improvement, PYO)**

| M/P Code area | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Livelihood improvement: Average 2.33 | | | | | | | | | | | | | | | |
| 1.1 Non-agriculture income generation | 2 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2.57 |
| 1.2 Expenditure reduction | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 2.57 |
| 1.3 Energy saving | 2 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 0 | 3 | 1 | 1 | 1 | 2 | 1.86 |
| 2. Fund development: Average 2.33 | | | | | | | | | | | | | | | |
| 2.1 Locally accessible capital / fund development | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2.43 |
| 3. Health and welfare improvement: Average 1.71 | | | | | | | | | | | | | | | |
| 3.1 Health improvement | 3 | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 1 | 2 | 2 | 3 | 3 | 1 | 2.43 |

| M/P Code area | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.2 Culture dissemination | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 4. Infrastructure development: Average 1.04 | | | | | | | | | | | | | | | |
| 4.1 Social infrastructure | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 2 | 1 | 1 | 1 | 0 | 0.64 |
| 4.2 Living conditions improvement | 2 | 1 | 0 | 0 | 1 | 2 | 2 | 0 | 2 | 2 | 3 | 3 | 2 | 0 | 1.43 |

Note: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

**Table 5.4.24 Priority Recommendation of Components (Sustaianble Agri. Dev't, PYO)**

| M/P Code area | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Agriculture Production: Average 2.36 | | | | | | | | | | | | | | | |
| 1.1 Crop production | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 2.64 |
| 1.2 Farming technology improvement | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2.07 |
| 2. Livestock development: Average 1.97 | | | | | | | | | | | | | | | |
| 2.1 Livestock raising | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2.93 |
| 2.2 Feed production | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 3. Farm produce processing: Average 1.04 | | | | | | | | | | | | | | | |
| 3.1 Plant material processing | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.07 |
| 3.2 Animal material processing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 4. Marketing: Average 1.50 | | | | | | | | | | | | | | | |
| 4.1 Enhancement of local circulation of farm produce | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2.00 |
| 4.2 Marketing improvement of local specialties | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 5. Infrastructure development 1.64 | | | | | | | | | | | | | | | |
| 5.1 Water resources development | 2 | 2 | 1 | 2 | 3 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1.80 |
| 5.2 On-farm facilities | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 0 | 1 | 1 | 2 | 1 | 1 | 1 | 1.43 |

Note: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

(3) Prioritization of Programs and Components

The average scores of the M/P code areas are used to prioritize the programs and components in each province, and the results are shown below. The priorities in parenthesis are opinions derived through discussions with the PLRO.

**Table 5.4.25 Priority Recommendation of Programs and Components in Phayao**

| Program and Component | SCORE | PRIORITY |
|---|---|---|
| Natural Resources Management | | |
| 1 Food produce utilization | 2.79 | +++(++) |
| 1.1 Food utilization | 2.79 | +++(++) |
| 1.2 Non-food utilization | 2.79 | +++(++) |
| 2. Forest area management | 2.36 | +++ |
| 2.1 Community forest establishment | 2.14 | ++(+++) |
| 2.2 Community forest management | 2.79 | +++(++) |
| 2.3 Forest valuations | 2.14 | ++ |
| 3. Forest rehabilitation | 2.90 | +++ |
| 3.1 Forest rehabilitation | 2.79 | +++ |
| 3.2 Reserved forest area delineation | 3.00 | +++ |

| Program and Component | SCORE | PRIORITY |
|---|---|---|
| 4. Soil and water conservation | 2.65 | +++ |
| 4.1 Soil conservation | 2.93 | +++ |
| 4.2 Water conservation | 2.36 | ++(+++) |
| Livelihood Improvement | | |
| 1. Livelihood improvement | 2.33 | +++ |
| 1.1 Non-agricultural income generation | 2.57 | +++ |
| 1.2 Expenditure reduction | 2.57 | +++ |
| 1.3 Energy saving | 1.86 | +(++) |
| 2. Fund development | 2.43 | +++(++) |
| 2.1 Locally accessible capital / fund development | 2.43 | ++ |
| 3. Health and welfare improvement | 1.71 | ++(+) |
| 3.1 Health improvement | 2.43 | ++(+) |
| 3.2 Culture dissemination | 1.00 | + |
| 4. Infrastructure development | 1.04 | + |
| 4.1 Social infrastructure | 0.64 | + |
| 4.2 Living conditions improvement | 1.43 | + |
| Sustainable Agriculture Development | | |
| 1. Agriculture Production | 2.36 | +++(++) |
| 1.1 Crop production | 2.64 | +++ |
| 1.2 Farming technology improvement | 2.07 | ++ |
| 2. Livestock development | 1.97 | ++(+++) |
| 2.1 Livestock raising | 2.93 | +++ |
| 2.2 Feed production | 1.00 | +(++) |
| 3. Farm produce processing | 1.04 | + |
| 3.1 Plant material processing | 1.07 | +(++) |
| 3.2 Animal material processing | 1.00 | + |
| 4. Marketing | 1.50 | ++(+) |
| 4.1 Enhancement of local circulation of farm produce | 2.00 | ++ |
| 4.2 Marketing improvement of local specialties | 1.00 | + |
| 5. Infrastructure development | 1.64 | ++ |
| 5.1 Water resources development | 1.86 | + |
| 5.2 On-farm facilities | 1.43 | + |

Note:

Scores are derived from the previous tables (Calculation based on the figure 3 (+++), 2 (++), 1 (+) and 0 (-)).
For programs, “+++” is given to the scores with more than 2.0, “++” to the scores between 2.0 and 1.5, and “+” to the scores less than 1.5.
For components, “+++” is given to the scores with more than 2.5, “++” to the scores between 2.0 and 2.5, and “+” to the scores less than 2.0.

### (4) Infrastructure Development

In accordance with the procedures of cost estimate described in the previous section, the infrastructure development cost in Phayao is estimated as shown in Table 5.4.26.

## Table 5.4.26 Summary of Infrastructure Development Cost (Phayao)

(unit : 1,000 Baht)

| Items | PYO01 | PYO02 | PYO03 | PYO04 | PYO05 | PYO06 | PYO07 | PYO08 | PYO09 | PYO10 | PYO11 | PYO12 | PYO13 | PYO14 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.5 Infrastructure Development under 3. Agricultural Development | | | | | | | | | | | | | | | |
| 3.5.1 (1) Existing Irrigation Facility Improvement | 29,393 | 6,361 | 280 | 37,185 | 23,888 | 48,522 | 12,504 | 0 | 0 | 11,882 | 12,037 | 3,717 | 2,924 | 6,314 | 195,007 |
| 3.5.1 (2) Individual Farm Pond Development (1,260 | 35,995 | 46,192 | 6,265 | 35,995 | 33,231 | 51,290 | 28,194 | 30,283 | 49,017 | 20,700 | 50,676 | 87,346 | 94,902 | 15,725 | 585,811 |
| 3.5.1 (3) Groundwater Development w/ Micro Irrigation System | 10,590 | 2,569 | 125 | 6,767 | 9,023 | 3,948 | 689 | 376 | 2,256 | 12,908 | 35,215 | 4,574 | 1,880 | 3,634 | 94,554 |
| 3.5.1 (4) Existing Reservoir Improvement | 1,925 | 3,849 | 1,925 | 5,774 | 5,774 | 3,849 | 1,925 | 0 | 0 | 1,925 | 3,849 | 1,925 | 1,925 | 0 | 34,645 |
| 3.5.1 (5) Perennial Stream Development | 393 | 337 | 0 | 1,441 | 1,740 | 1,441 | 2,264 | 0 | 674 | 1,516 | 2,826 | 823 | 2,077 | 1,534 | 17,066 |
| 3.5.1 (6) Smal Scale Reservoir Developemnt | 5,554 | 22,215 | 0 | 116,626 | 138,841 | 0 | 5,554 | 0 | 0 | 0 | 0 | 0 | 5,554 | 0 | 294,344 |
| Sub-Total | 83,850 | 81,523 | 8,595 | 203,788 | 212,497 | 109,050 | 51,130 | 30,659 | 51,947 | 48,931 | 104,603 | 98,385 | 109,262 | 27,207 | 1,221,427 |
| 3.5.2 (1) On-Farm Road Improvement and Development | 2,388 | 451 | 48 | 1,212 | 1,734 | 3,944 | 3,564 | 416 | 1,342 | 2,352 | 1,509 | 1,366 | 2,020 | 1,746 | 24,093 |
| 3.5.2 (2) Farm Land Soil Conservation | 17,610 | 2,045 | 225 | 21,780 | 5,664 | 17,804 | 0 | 0 | 11,273 | 0 | 20,681 | 0 | 9,125 | 7,880 | 114,087 |
| Sub-Total | 19,998 | 2,496 | 273 | 22,992 | 7,398 | 21,748 | 3,564 | 416 | 12,615 | 2,352 | 22,190 | 1,366 | 11,145 | 9,626 | 138,180 |
| Total of 3.5 | 103,848 | 84,019 | 8,868 | 226,780 | 219,895 | 130,798 | 54,694 | 31,075 | 64,562 | 51,283 | 126,793 | 99,751 | 120,407 | 36,833 | 1,359,607 |
| 2.4 Infrastructure Development under 2. Livelihood Improvement Plan | | | | | | | | | | | | | | | |
| 2.4.1 (1) Installation of Village Water Supply | 4,242 | 0 | 0 | 909 | 2,727 | 0 | 0 | 0 | 0 | 3,939 | 6,667 | 909 | 909 | 0 | 20,303 |
| 2.4.1 (2) Expansion of Village Water Supply | 423 | 104 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,328 | 1,409 | 0 | 0 | 0 | 3,264 |
| 2.4.1 (3) Village Electrification | 0 | 0 | 0 | 0 | 0 | 0 | 82,168 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 82,168 |
| 2.4.1 (4) Expansion of Electricity Service | 18 | 0 | 0 | 0 | 0 | 0 | 1,113 | 0 | 0 | 51 | 0 | 0 | 28 | 0 | 1,210 |
| 2.4.1 (5) Village Road Improvement | 398 | 0 | 25 | 522 | 75 | 485 | 597 | 0 | 249 | 261 | 522 | 87 | 286 | 99 | 3,606 |
| Sub-Total | 5,081 | 104 | 25 | 1,431 | 2,802 | 485 | 83,878 | 0 | 249 | 5,579 | 8,598 | 996 | 1,223 | 99 | 110,551 |
| 2.4.2 (1) Garbage Disposal Improvement | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.4.2 (2) Waste Water Treatment | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of 2.4 | 5,081 | 104 | 25 | 1,431 | 2,802 | 485 | 83,878 | 0 | 249 | 5,579 | 8,598 | 996 | 1,223 | 99 | 110,551 |
| G. Total | 108,929 | 84,123 | 8,893 | 228,211 | 222,697 | 131,283 | 138,572 | 31,075 | 64,811 | 56,862 | 135,391 | 100,747 | 121,630 | 36,932 | 1,470,158 |

### 5.4.3 Phrae Province

(1) Characteristics of Natural Resources and the LRAs

Characteristics of natural resources and LRAs are summarized in accordance with sectors as follows.

**Table 5.4.27 Characteristics of Natural Resources and LRAs in Phrae**

| | |
|---|---|
| Area | 4,086,624 (rai) |
| Population | 482,232 (2002) |
| Natural resources | The majority of land is mountainous covered by forest. Flat areas are found in the middle and southern parts of the province.<br>Reserve forests (around 3.0 million rai) are distributed over 27 sites. Forest area covers 1.5 million rai, which represents 37% of the total provincial area, and it is deteriorating.<br>Irrigated area occupies 70% of the provincial farmland, but most irrigation systems are small scale.<br>There are 8 river basins. The largest one is the middle basin of Yom where 8 M/P code areas are located.<br>There are 6 sites of protected areas. PRE05 and 08 are in the proximity to these areas.<br>Community forests (46,629 rai) are distributed over 134 sites. |
| Agricultural Land Reform Areas (LRAs) | |
| Target group | Number of LRAs (M/P code areas); 14<br>Total area; 496,048.2 rai<br>Number of tambon concerned; 42<br>Number of village concerned; 184<br>Beneficiaries (LRA declared); 175,865<br>Potential beneficiaries; 229,966 persons (based on tambon population) |
| Natural resources | Steep terrain (over 6.5%) occupy more than one third of the total M/P code areas. Average slope of the four M/P code areas (PRE02, 07, 09 and 13) is more than 10%.<br>Because the density of perennial stream is relatively small, utilization of surface water is limited. Ground water development potential is also low.<br>Soils suitable for pasture and fruit tree occupy a large portion. Soils unsuited and rather unsuited for farming are widely distributed.<br>Rapid change of land cover from forest to agricultural land has been occurred.<br>All of the M/P code areas are adjacent to reserve forests.<br>Most M/P code areas have community forest except for PRE05, 12 and 13. |
| Socio-economy | SPK4-01farmers comprise 13% of the provincial population.<br>Share of the agricultural households in the M/P code areas is higher than that of the provincial average.<br>Household income; 32,139 Baht (NRD2C) (Based on the participatory survey, it is around 60% of the provincial average）.<br>As for household expenditures, share of “food” and “finance” is relatively large, and most households have debts.<br>Road and water supply system have been provided in most of the M/P code areas. One village in PRE04 has no electric service.<br>In 42 % of villages, people use charcoal and wood for fuel source for cooking. |
| Agriculture | Average land holding size of SPK4-01 farmers is 9.1 rai, smaller than the provincial average.<br>Paddy field is dominant in many M/P code areas, however, fruits cultivation is also widespread in the south.<br>In general, livestock activities are relatively inactive.<br>Farm machine utilization is not common as compared with Phayao and Phitsanulok.<br>In most of the M/P code areas, farmers use both chemical and natural fertilizer.<br>Technology Transfer Centers do not function well to extend useful knowledge.<br>1.8 % of villages in the M/P code areas have irrigation facilities. 10% of villages suffer from water shortage. |

(2) Prioritization of Programs and Components by the M/P Code Areas

In accordance with the method explained in the previous section (5.4), programs and components were prioritized by each M/P code area, and the results are shown below.

**Table 5.4.28 Priority Recommendation of Components (Natural Resources Management, PRE)**

| M/P Code area | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Food produce utilization: Average 2.57 | | | | | | | | | | | | | | | |
| 1.1 Food utilization | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 2.57 |
| 1.2 Non-food utilization | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 2.57 |
| 2. Forest area management: Average 2.50 | | | | | | | | | | | | | | | |
| 2.1 Community forest establishment | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 2 | 3 | 2.50 |
| 2.2 Community forest management | 3 | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 2.57 |
| 2.3 Forest valuations | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 1 | 2 | 1 | 3 | 2 | 3 | 2.43 |
| 3. Forest rehabilitation: Average 2.86 | | | | | | | | | | | | | | | |
| 3.1 Forest rehabilitation | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 1 | 3 | 2.71 |
| 3.2 Reserved forest area delineation | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3.00 |
| 4. Soil and water conservation: Average 2.65 | | | | | | | | | | | | | | | |
| 4.1 Soil conservation | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 2.79 |
| 4.2 Water conservation | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 2.50 |

Remark: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

**Table 5.4.29 Priority Recommendation of Components (Livelihood Improvement, PRE)**

| M/P Code area | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Livelihood improvement: Average 2.17 | | | | | | | | | | | | | | | |
| 1.1 Non-agriculture income generation | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2.64 |
| 1.2 Expenditure reduction | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2.29 |
| 1.3 Energy saving | 1 | 0 | 1 | 2 | 3 | 1 | 3 | 2 | 1 | 0 | 2 | 3 | 2 | 1 | 1.57 |
| 2. Fund development: Average 2.21 | | | | | | | | | | | | | | | |
| 2.1 Locally accessible capital / fund development | 2 | 3 | 3 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2.21 |
| 3. Health and welfare improvement: Average 1.50 | | | | | | | | | | | | | | | |
| 3.1 Health improvement | 1 | 3 | 3 | 1 | 3 | 2 | 1 | 1 | 3 | 3 | 1 | 3 | 2 | 1 | 2.00 |
| 3.2 Culture dissemination | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 4. Infrastructure development: Average 0.54 | | | | | | | | | | | | | | | |
| 4.1 Social infrastructure | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.29 |
| 4.2 Living conditions improvement | 1 | 1 | 0 | 1 | 1 | 2 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 0 | 0.79 |

Note: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

**Table 5.4.30 Priority Recommendation of Components (Sustainable Agri. Dev't, PRE)**

| M/P Code area | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Agriculture Production: Average 2.32 | | | | | | | | | | | | | | | |
| 1.1 Crop production | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2.36 |
| 1.2 Farming technology improvement | 2 | 3 | 2 | 2 | 2 | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 2 | 2.29 |
| 2. Livestock development: Average 1.90 | | | | | | | | | | | | | | | |
| 2.1 Livestock raising | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 2.79 |
| 2.2 Feed production | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |

| M/P Code area | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3. Farm produce processing: Average 1.04 | | | | | | | | | | | | | | | |
| 3.1 Plant material processing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1.07 |
| 3.2 Animal material processing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 4. Marketing: Average 1.50 | | | | | | | | | | | | | | | |
| 4.1 Enhancement of local circulation of farm produce | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2.00 |
| 4.2 Marketing improvement of local specialties | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 5. Infrastructure development 1.25 | | | | | | | | | | | | | | | |
| 5.1 Water resources development | 1 | 1 | 1 | 2 | 2 | 0 | 1 | 2 | 2 | 0 | 1 | 0 | 2 | 1 | 1.14 |
| 5.2 On-farm facilities | 1 | 3 | 1 | 2 | 1 | 2 | 1 | 2 | 2 | 0 | 0 | 1 | 1 | 2 | 1.36 |

Note: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

(3) Prioritization of Programs and Components

The average scores of the M/P code areas are used to prioritize the programs and components in each province, and the results are shown below. The priorities in parenthesis are opinions derived through discussions with the PLRO.

**Table 5.4.31 Priority Recommendation of Programs and Components in Phrae**

| Program and Component | SCORE | PRIORITY |
|---|---|---|
| Natural Resources Management | | |
| 1 Food produce utilization | 2.57 | +++(++) |
| 1.1 Food utilization | 2.57 | +++(++) |
| 1.2 Non-food utilization | 2.57 | +++(++) |
| 2. Forest area management | 2.50 | +++ |
| 2.1 Community forest establishment | 2.50 | ++(+++) |
| 2.2 Community forest management | 2.57 | +++ |
| 2.3 Forest valuations | 2.43 | ++ |
| 3. Forest rehabilitation | 2.86 | +++ |
| 3.1 Forest rehabilitation | 2.71 | +++ |
| 3.2 Reserved forest area delineation | 3.00 | +++ |
| 4. Soil and water conservation | 2.65 | +++ |
| 4.1 Soil conservation | 2.79 | +++ |
| 4.2 Water conservation | 2.50 | ++(+++) |
| Livelihood Improvement | | |
| 1. Livelihood improvement | 2.17 | +++ |
| 1.1 Non-agricultural income generation | 2.64 | +++ |
| 1.2 Expenditure reduction | 2.29 | ++(+++) |
| 1.3 Energy saving | 1.57 | +(++) |
| 2. Fund development | 2.21 | +++(++) |
| 2.1 Locally accessible capital / fund development | 2.21 | ++ |
| 3. Health and welfare improvement | 1.50 | ++(+) |
| 3.1 Health improvement | 2.00 | ++(+) |
| 3.2 Culture dissemination | 1.00 | +(++) |
| 4. Infrastructure development | 0.54 | + |
| 4.1 Social infrastructure | 0.29 | + |
| 4.2 Living conditions improvement | 0.79 | + |
| Sustainable Agriculture Development | | |

| Program and Component | SCORE | PRIORITY |
|---|---|---|
| 1. Agriculture Production | 2.32 | +++ |
| 1.1 Crop production | 2.36 | ++ |
| 1.2 Farming technology improvement | 2.29 | ++(+++) |
| 2. Livestock development | 1.90 | ++ |
| 2.1 Livestock raising | 2.79 | +++ |
| 2.2 Feed production | 1.00 | + |
| 3. Farm produce processing | 1.04 | + |
| 3.1 Plant material processing | 1.07 | +(++) |
| 3.2 Animal material processing | 1.00 | + |
| 4. Marketing | 1.50 | ++ |
| 4.1 Enhancement of local circulation of farm produce | 2.00 | ++ |
| 4.2 Marketing improvement of local specialties | 1.00 | + (++) |
| 5. Infrastructure development | 1.25 | + |
| 5.1 Water resources development | 1.14 | +(++) |
| 5.2 On-farm facilities | 1.36 | + |

Note:

Scores are derived from the previous tables (Calculation based on the figure 3 (+++), 2 (++), 1 (+) and 0 (-)).
For programs, “+++” is given to the scores with more than 2.0, “++” to the scores between 2.0 and 1.5, and “+” to the scores less than 1.5.
For components, “+++” is given to the scores with more than 2.5, “++” to the scores between 2.0 and 2.5, and “+” to the scores less than 2.0.

(4) Infrastructure Development

In accordance with the procedures of cost estimate described in the previous section (0), the infrastructure development cost in Phrae is estimated as shown in Table 5.4.32.

**Table 5.4.32 Summary of Infrastructure Development Cost (Phrae)**

(unit : 1,000 Baht)

| Items | PRE01 | PRE02 | PRE03 | PRE04 | PRE05 | PRE06 | PRE07 | PRE08 | PRE09 | PRE10 | PRE11 | PRE12 | PRE13 | PRE14 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.5 Infrastructure Development under 3. Agricultural Development | | | | | | | | | | | | | | | |
| 3.5.1 (1) Existing Irrigation Facility Improvement | 451 | 358 | 0 | 3,235 | 0 | 513 | 358 | 42,115 | 3,686 | 0 | 622 | 0 | 2,084 | 0 | 53,422 |
| 3.5.1 (2) Individual Farm Pond Development (1,260 | 737 | 2,887 | 15,233 | 22,973 | 41,953 | 0 | 36,179 | 159,214 | 6,020 | 0 | 12,654 | 983 | 6,450 | 63,821 | 369,104 |
| 3.5.1 (3) Groundwater Development w/ Micro Irrigation System | 376 | 1,065 | 752 | 2,506 | 1,379 | 2,381 | 1,128 | 11,341 | 0 | 0 | 564 | 0 | 877 | 0 | 22,370 |
| 3.5.1 (4) Existing Reservoir Improvement | 0 | 1,925 | 0 | 0 | 0 | 1,925 | 0 | 3,849 | 0 | 0 | 1,925 | 0 | 1,925 | 0 | 11,548 |
| 3.5.1 (5) Perennial Stream Development | 0 | 0 | 0 | 1,160 | 2,638 | 0 | 0 | 1,722 | 243 | 0 | 0 | 0 | 1,591 | 3,125 | 10,479 |
| 3.5.1 (6) Smal Scale Reservoir Developemnt | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 77,751 | 0 | 0 | 0 | 0 | 0 | 0 | 77,751 |
| Sub-Total | 1,564 | 6,235 | 15,985 | 29,874 | 45,970 | 4,819 | 37,665 | 295,992 | 9,949 | 0 | 15,765 | 983 | 12,927 | 66,946 | 544,674 |
| 3.5.2 (1) On-Farm Road Improvement and Development | 48 | 59 | 249 | 1,342 | 249 | 119 | 166 | 2,507 | 59 | 24 | 166 | 12 | 297 | 1,544 | 6,843 |
| 3.5.2 (2) Farm Land Soil Conservation | 901 | 751 | 3,468 | 21,815 | 3,084 | 1,616 | 2,299 | 30,633 | 1,426 | 0 | 0 | 181 | 3,532 | 11,581 | 81,285 |
| Sub-Total | 949 | 810 | 3,717 | 23,157 | 3,333 | 1,735 | 2,465 | 33,140 | 1,485 | 24 | 166 | 193 | 3,829 | 13,125 | 88,128 |
| Total of 3.5 | 2,513 | 7,045 | 19,702 | 53,031 | 49,303 | 6,554 | 40,130 | 329,132 | 11,434 | 24 | 15,931 | 1,176 | 16,756 | 80,071 | 632,802 |
| 2.4 Infrastructure Development under 2. Livelihood Improvement Plan | | | | | | | | | | | | | | | |
| 2.4.1 (1) Installation of Village Water Supply | 303 | 303 | 303 | 909 | 0 | 303 | 0 | 909 | 0 | 0 | 0 | 0 | 0 | 0 | 3,030 |
| 2.4.1 (2) Expansion of Village Water Supply | 29 | 80 | 54 | 188 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 350 |
| 2.4.1 (3) Village Electrification | 0 | 0 | 0 | 94,809 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 94,809 |
| 2.4.1 (4) Expansion of Electricity Service | 0 | 0 | 4 | 0 | 149 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 153 |
| 2.4.1 (5) Village Road Improvement | 0 | 12 | 12 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| Sub-Total | 332 | 395 | 373 | 95,906 | 149 | 303 | 0 | 934 | 0 | 0 | 0 | 0 | 0 | 0 | 98,392 |
| 2.4.2 (1) Garbage Disposal Improvement | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.4.2 (2) Waste Water Treatment | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of 2.4 | 332 | 395 | 373 | 95,906 | 149 | 303 | 0 | 934 | 0 | 0 | 0 | 0 | 0 | 0 | 98,392 |
| G. Total | 2,845 | 7,440 | 20,075 | 148,937 | 49,452 | 6,857 | 40,130 | 330,066 | 11,434 | 24 | 15,931 | 1,176 | 16,756 | 80,071 | 731,194 |

### 5.4.4 Nan Province

(1) Characteristics of Natural Resources and the LRAs

Characteristics of natural resources and LRAs are summarized in accordance with sectors as follows.

**Table 5.4.33 Characteristics of Natural Resources and LRAs in Nan**

| | |
|---|---|
| Area | 7,141,919 (rai) |
| Population | 482,181 (2002) |
| Natural resources | The majority of land is high mountainous area with steep slope (over 30%) and unsuitable for agriculture. Provincial land is the watershed of the Nan River originated in the northern part of this province.<br>Reserve forests cover 6.5 million rai, which occupy 90% of the province, but around 40% of them are regarded as deteriorated forest. Forest area accounts for 42% of the provincial area, 3.0 million rai.<br>Irrigated farmland covers only 5% of the total provincial area.<br>Total 8 sites of protected area exist.<br>Community forests are distributed over 122 sites, with total area of 54,187 rai. |
| Agricultural Land Reform Areas (LRAs) | |
| Target group | Number of LRAs (M/P code areas) ; 20<br>Total area; 565,366.1 rai<br>Number of tambon concerned; 76<br>Number of village concerned; 416<br>Beneficiaries (LRA declared); 214,874<br>Potential beneficiaries; 255,757 persons (based on the tambon population) |
| Natural resources | Steep sloped land over 6.5% occupies more than one third of the total M/P code area.<br>Perennial stream density is larger than that of Phayao and Phrae, but utilization of surface water is limited. Ground water development potential is low.<br>Soils suitable for pasture and fruit tree represent a large portion. Soils unsuited and rather unsuited for farming are widely distributed.<br>Soil erosion rate, 4.4 mm/year, is the highest among the four provinces.<br>Twelve (12) M/P code areas have community forest of 39,190 rai, the largest among the four provinces. |
| Socio-economy | SPK4-01 farmers represent 51% of provincial population, the largest among the four provinces.<br>Share of the agricultural households in the M/P code areas is higher than that of the provincial average.<br>Household income; 43,175 Baht (NRD2C)<br>As for household expenditures, in general, expenses for “food” and “finance” are relatively high. In addition, most households have debts.<br>Road and water supply system have been provided in most of the M/P code areas.<br>In 76 % of villages, people use charcoal and wood for fuel source for cooking, the highest among the four provinces. |
| Agriculture | Average land holding size of SPK4-01 farmers (8.8 rai) is smaller than the provincial average.<br>Field crops are dominant in the M/P code areas. There are only 4 M/P code areas where paddy is prevalent.<br>Livestock activities are more active than other three provinces.<br>In most of the M/P code areas, farmers use both chemical and natural fertilizer.<br>Technology Transfer Centers do not function well to extend useful knowledge.<br>10.9 % of villages in the M/P code areas have irrigation facilities. 17% of villages suffer from water shortage. |

(2) Prioritization of Programs and Components by the M/P Code Areas

In accordance with the method explained in the previous section (5.4), programs and components were prioritized by each M/P code area, and the results are shown below.

**Table 5.4.34 Priority Recommendation of Components (Natural Resources Management, ANN)**

| M/P Code area | ANN01 | ANN02 | ANN03 | ANN04 | ANN05 | ANN06 | ANN07 | ANN08 | ANN09 | ANN10 | ANN11 | ANN12 | ANN13 | ANN14 | ANN15 | ANN16 | ANN17 | ANN18 | ANN19 | ANN20 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Food produce utilization: Average 2.15 | | | | | | | | | | | | | | | | | | | | | |
| 1.1 Food utilization | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 3 | 1 | 3 | 1 | 1 | 3 | 3 | 1 | 2.15 |
| 1.2 Non-food utilization | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 3 | 1 | 3 | 1 | 1 | 3 | 3 | 1 | 2.15 |
| 2. Forest area management: Average 2.62 | | | | | | | | | | | | | | | | | | | | | |
| 2.1 Community forest establishment | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2.90 |
| 2.2 Community forest management | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 1 | 2 | 3 | 1 | 3 | 1 | 3 | 1 | 1 | 3 | 3 | 1 | 2.15 |
| 2.3 Forest valuations | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 | 2.80 |
| 3. Forest rehabilitation: Average 2.78 | | | | | | | | | | | | | | | | | | | | | |
| 3.1 Forest rehabilitation | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 1 | 2.75 |
| 3.2 Reserved forest area delineation | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3.00 |
| 4. Soil and water conservation: Average 2.78. | | | | | | | | | | | | | | | | | | | | | |
| 4.1 Soil conservation | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 | 3 | 1 | 2.75 |
| 4.2 Water conservation | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2.80 |

Remark: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

**Table 5.4.35 Priority Recommendation of Components (Livelihood Improvement, ANN)**

| M/P Code area | ANN01 | ANN02 | ANN03 | ANN04 | ANN05 | ANN06 | ANN07 | ANN08 | ANN09 | ANN10 | ANN11 | ANN12 | ANN13 | ANN14 | ANN15 | ANN16 | ANN17 | ANN18 | ANN19 | ANN20 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Livelihood improvement: Average 2.22 | | | | | | | | | | | | | | | | | | | | | |
| 1.1 Non-agriculture income generation | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 2 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 2.20 |
| 1.2 Expenditure reduction | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1.90 |
| 1.3 Energy saving | 3 | 3 | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 0 | 0 | 2.55 |
| 2. Fund development: Average 2.55 | | | | | | | | | | | | | | | | | | | | | |
| 2.1 Locally accessible capital / fund development | 2 | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 3 | 2 | 2.55 |
| 3. Health and welfare improvement: Average 1.60 | | | | | | | | | | | | | | | | | | | | | |
| 3.1 Health improvement | 2 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 2 | 2 | 2 | 1 | 3 | 1 | 3 | 3 | 3 | 3 | 2.20 |
| 3.2 Culture dissemination | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 4. Infrastructure development: Average 0.83 | | | | | | | | | | | | | | | | | | | | | |
| 4.1 Social infrastructure | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0.50 |
| 4.2 Living conditions improvement | 2 | 0 | 1 | 1 | 2 | 1 | 1 | 2 | 0 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 0 | 2 | 1 | 0 | 1.15 |

Note: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

**Table 5.4.36 Priority Recommendation of Components (Sustainable Agri. Dev't, ANN)**

| M/P Code area | ANN01 | ANN02 | ANN03 | ANN04 | ANN05 | ANN06 | ANN07 | ANN08 | ANN09 | ANN10 | ANN11 | ANN12 | ANN13 | ANN14 | ANN15 | ANN16 | ANN17 | ANN18 | ANN19 | ANN20 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Agriculture Production: Average 2.00 | | | | | | | | | | | | | | | | | | | | | |
| 1.1 Crop production | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2.00 |
| 1.2 Farming technology improvement | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2.00 |
| 2. Livestock development: Average 1.83 | | | | | | | | | | | | | | | | | | | | | |
| 2.1 Livestock raising | 3 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2.65 |
| 2.2 Feed production | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 3. Farm produce processing: Average 1.05 | | | | | | | | | | | | | | | | | | | | | |
| 3.1 Plant material processing | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1.10 |
| 3.2 Animal material processing | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1.00 |
| 4. Marketing: Average 1.50 | | | | | | | | | | | | | | | | | | | | | |
| 4.1 Enhancement of local circulation of farm produce | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2.00 |
| 4.2 Marketing improvement of local specialties | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5. Infrastructure development 1.43 | | | | | | | | | | | | | | | | | | | | | |
| 5.1 Water resources development | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 0 | 1.40 |
| 5.2 On-farm facilities | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 0 | 1 | 2 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 1 | 1 | 1.45 |

Note: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

(3) Prioritization of Programs and Components

The average scores of the M/P code areas are used to prioritize the programs and components in each province, and the results are shown below. The priorities in parenthesis are opinions derived through discussions with the PLRO.

**Table 5.4.37 Priority Recommendation of Programs and Components in Nan**

| Program and Component | SCORE | PRIORITY |
|---|---|---|
| Natural Resources Management | | |
| 1 Food produce utilization | 2.15 | +++(++) |
| 1.1 Food utilization | 2.15 | ++ |
| 1.2 Non-food utilization | 2.15 | ++ |
| 2. Forest area management | 2.62 | +++ |
| 2.1 Community forest establishment | 2.90 | +++ |
| 2.2 Community forest management | 2.15 | ++ |
| 2.3 Forest valuations | 2.80 | +++(++) |
| 3. Forest rehabilitation | 2.88 | +++ |
| 3.1 Forest rehabilitation | 2.75 | +++ |
| 3.2 Reserved forest area delineation | 3.00 | +++ |
| 4. Soil and water conservation | 2.78 | +++ |
| 4.1 Soil conservation | 2.75 | +++ |
| 4.2 Water conservation | 2.80 | +++ |

| Program and Component | SCORE | PRIORITY |
|---|---|---|
| Livelihood Improvement | | |
| 1. Livelihood improvement | 2.22 | +++ |
| 1.1 Non-agricultural income generation | 2.20 | ++(+++) |
| 1.2 Expenditure reduction | 1.90 | +(+++) |
| 1.3 Energy saving | 2.55 | +++ |
| 2. Fund development | 2.55 | +++(++) |
| 2.1 Locally accessible capital / fund development | 2.55 | +++(++) |
| 3. Health and welfare improvement | 1.60 | ++(+) |
| 3.1 Health improvement | 2.20 | ++ |
| 3.2 Culture dissemination | 1.00 | +(++) |
| 4. Infrastructure development | 0.83 | + |
| 4.1 Social infrastructure | 0.50 | + |
| 4.2 Living conditions improvement | 1.15 | +(++) |
| Sustainable Agriculture Development | | |
| 1. Agriculture Production | 2.00 | +++ |
| 1.1 Crop production | 2.00 | ++ |
| 1.2 Farming technology improvement | 2.00 | ++(+++) |
| 2. Livestock development | 1.83 | ++ |
| 2.1 Livestock raising | 2.65 | +++(++) |
| 2.2 Feed production | 1.00 | + |
| 3. Farm produce processing | 1.05 | + |
| 3.1 Plant material processing | 1.10 | +(++) |
| 3.2 Animal material processing | 1.00 | + |
| 4. Marketing | 1.50 | ++ |
| 4.1 Enhancement of local circulation of farm produce | 2.00 | ++ |
| 4.2 Marketing improvement of local specialties | 1.00 | +(++) |
| 5. Infrastructure development | 1.43 | + |
| 5.1 Water resources development | 1.40 | +(+++) |
| 5.2 On-farm facilities | 1.46 | + |

Note:

Scores are derived from the previous tables (Calculation based on the figure 3 (+++), 2 (++), 1 (+) and 0 (-)).

For programs, “+++” is given to the scores with more than 2.0, “++” to the scores between 2.0 and 1.5, and “+” to the scores less than 1.5.

For components, “+++” is given to the scores with more than 2.5, “++” to the scores between 2.0 and 2.5, and “+” to the scores less than 2.0.

### (4) Infrastructure Development

In accordance with the procedures of cost estimate described in the previous section (0), the infrastructure development cost in Nan is estimated as shown in Table 5.4.38.

## Table 5.4.38 Summary of Infrastructure Development Cost (Nan)

(unit : 1,000 Baht)

| Items | ANN01 | ANN02 | ANN03 | ANN04 | ANN05 | ANN06 | ANN07 | ANN08 | ANN09 | ANN10 | ANN11 | ANN12 | ANN13 | ANN14 | ANN15 | ANN16 | ANN17 | ANN18 | ANN19 | ANN20 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.5 Infrastructure Development under 3. Agricultural Development | | | | | | | | | | | | | | | | | | | | | |
| 3.5.1 (1) Existing Irrigation Facility Improvement | 6,376 | 0 | 2,877 | 0 | 2,706 | 23,639 | 3,701 | 0 | 0 | 8,180 | 82,270 | 11,026 | 33,188 | 1,897 | 66,920 | 6,361 | 0 | 67,993 | 0 | 0 | 317,194 |
| 3.5.1 (2) Individual Farm Pond Development (1,260 | 115,356 | 99,570 | 115,356 | 46,437 | 99,570 | 95,577 | 95,577 | 2,150 | 95,577 | 614 | 58,907 | 63,513 | 30,774 | 5,160 | 17,322 | 47,359 | 47,359 | 24,570 | 860 | 0 | 1,061,608 |
| 3.5.1 (3) Groundwater Development wi Micro Irrigation System | 1,065 | 0 | 2,444 | 0 | 3,885 | 9,336 | 3,760 | 0 | 0 | 877 | 16,480 | 1,942 | 4,574 | 3,008 | 1,665 | 3,133 | 0 | 3,634 | 313 | 0 | 55,517 |
| 3.5.1 (4) Existing Reservoir Improvement | 3,849 | 0 | 1,925 | 0 | 1,925 | 3,849 | 0 | 0 | 0 | 11,548 | 7,699 | 1,925 | 5,774 | 1,925 | 9,623 | 3,849 | 0 | 5,774 | 0 | 0 | 59,694 |
| 3.5.1 (5) Perennial Stream Development | 3,770 | 136 | 421 | 1,150 | 538 | 6,540 | 3,540 | 0 | 593 | 7,433 | 486 | 1,541 | 2,235 | 34 | 0 | 95 | 278 | 2,650 | 2,382 | 0 | 33,822 |
| 3.5.1 (6) Smal Scale Reservoir Developemnt | 66 | 0 | 0 | 0 | 66 | 0 | 66 | 0 | 0 | 0 | 0 | 66 | 10,104 | 0 | 0 | 0 | 0 | 1,949 | 0 | 0 | 12,217 |
| Sub-Total | 130,492 | 99,706 | 123,023 | 47,587 | 108,690 | 138,941 | 106,644 | 2,150 | 96,170 | 28,652 | 165,842 | 80,013 | 86,849 | 12,024 | 94,930 | 60,797 | 47,637 | 106,470 | 3,555 | 0 | 1,539,982 |
| 3.5.2 (1) On-Farm Road Improvement and Development | 1,105 | 36 | 1,639 | 606 | 927 | 1,984 | 6,388 | 202 | 285 | 356 | 6,706 | 6,220 | 2,055 | 1,628 | 2,875 | 5,465 | 249 | 3,671 | 2,447 | 0 | 44,954 |
| 3.5.2 (2) Farm Land Soil Conservation | 6,891 | 377 | 0 | 0 | 5,503 | 21,878 | 49,294 | 1,487 | 1,043 | 5,306 | 26,497 | 23,391 | 22,533 | 5,931 | 22,540 | 39,195 | 924 | 30,990 | 14,502 | 0 | 272,239 |
| Sub-Total | 7,996 | 413 | 1,639 | 606 | 6,430 | 23,862 | 49,632 | 1,689 | 1,328 | 5,662 | 33,233 | 29,711 | 24,588 | 7,559 | 25,415 | 44,660 | 1,173 | 34,661 | 16,949 | 0 | 317,193 |
| Total of 3.5 | 138,478 | 100,119 | 124,662 | 48,193 | 115,120 | 162,803 | 156,276 | 3,839 | 97,498 | 34,314 | 199,075 | 109,724 | 111,437 | 19,583 | 120,345 | 105,457 | 48,810 | 141,131 | 20,504 | 0 | 1,857,175 |
| 2.4 Infrastructure Development under 2. Livelihood Improvement Plan | | | | | | | | | | | | | | | | | | | | | |
| 2.4.1 (1) Installation of Village Water Supply | 0 | 0 | 3,636 | 6,970 | 0 | 1,818 | 606 | 0 | 0 | 0 | 1,515 | 0 | 606 | 7,273 | 0 | 1,212 | 0 | 606 | 0 | 0 | 24,242 |
| 2.4.1 (2) Expansion of Village Water Supply | 0 | 0 | 334 | 1,492 | 289 | 1,286 | 280 | 0 | 0 | 65 | 0 | 0 | 338 | 224 | 79 | 0 | 0 | 0 | 0 | 0 | 4,328 |
| 2.4.1 (3) Village Electrification | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.4.1 (4) Expansion of Electricity Service | 434 | 0 | 0 | 0 | 0 | 126 | 22 | 101 | 0 | 24 | 0 | 0 | 0 | 12 | 29 | 42 | 0 | 0 | 0 | 0 | 791 |
| 2.4.1 (5) Village-Road Improvement | 0 | 0 | 0 | 3,121 | 249 | 4,675 | 1,119 | 124 | 0 | 1,243 | 2,562 | 1,442 | 0 | 373 | 1,604 | 808 | 124 | 2,723 | 0 | 12 | 20,181 |
| Sub-Total | 434 | 0 | 3,970 | 11,583 | 538 | 7,905 | 2,027 | 225 | 0 | 1,332 | 4,077 | 1,442 | 944 | 7,882 | 1,712 | 2,062 | 124 | 3,329 | 0 | 12 | 49,542 |
| 2.4.2 (1) Garbage Disposal Improvement | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2.4.2 (2) Waste Water Treatment | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sub-Total | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of 2.4 | 434 | 0 | 3,970 | 11,583 | 538 | 7,905 | 2,027 | 225 | 0 | 1,332 | 4,077 | 1,442 | 944 | 7,882 | 1,712 | 2,062 | 124 | 3,329 | 0 | 12 | 49,542 |
| G. Total | 138,912 | 100,119 | 128,632 | 59,716 | 115,658 | 170,708 | 158,303 | 4,064 | 97,498 | 35,646 | 203,152 | 111,166 | 112,381 | 27,465 | 122,057 | 107,519 | 48,934 | 144,460 | 20,504 | 12 | 1,906,697 |

### 5.4.5 Phitsanulok Province

(1) Characteristics of Natural Resources and the LRAs

Characteristics of natural resources and LRAs are summarized in accordance with sectors as follows.

**Table 5.4.39 Characteristics of Natural Resources and LRAs in Phitsanulok**

| | |
|---|---|
| Area | 6,759,909 (rai) |
| Population | 867,356 (2002) |
| Natural resources | More than half of the province is in the low land situated in the Yom and Nan Rivers basin. In the eastern and northeastern parts of the province, mountainous areas and flat plateau are found between the valleys. PIK01 and 02 are located in the Kwai Noi River Basin.<br>Reserve forest represents around 3.0 million rai. Forest area covers around 2.5 million rai, 36% of the total provincial area.<br>There are 11 sites of protected area in the province.<br>Community forests are scattered over 67 sites, total area of 17,506 rai. |
| Agricultural Land Reform Areas (LRAs) | |
| Target group | Number of LRAs (M/P code area); 4<br>Total area; 237,242.5 rai<br>Number of tambon concerned; 17<br>Number of village concerned; 79<br>Beneficiaries (LRA declared); 39,858<br>Potential beneficiaries; 539,923 persons (based on the tambon population) |
| Natural resources | The M/P code areas are largely located in the northeastern part of the province.<br>Average land slope of the M/P code area is 5.3%, more gentle than that of other three provinces.<br>Although perennial stream density is higher than that of Phayao and Phrae, surface water use is limited. Groundwater development potential is high in PIK03 and 04 (both area sizes are small).<br>Soils suitable for pasture and fruit tree represent a large portion.<br>Soil erosion seems to be prominent in PIK01 and 02 (estimated at 2.79mm/year).<br>Three M/P code areas are adjacent to community forest (10,910 rai) except for PIK03.<br>Five reserve forest areas out of 13 are in close proximity to the PIK01 and 02. |
| Socio-economy | SPK4-01farmers comprise 3% of the provincial population, the least among the four provinces.<br>Share of the agricultural households in the M/P code areas is higher than that of the provincial average.<br>Household income; 41,673 Baht (NRD2C). As for household expenditures, share of “food” and “finance” is relatively large, and most households have debts.<br>Road and water supply system have been provided in most of the M/P code areas.<br>In 59 % of villages, people use charcoal and wood for fuel source for cooking. |
| Agriculture | Land holding size of SPK4-01 farmers is, on average, 19.9 rai, the largest in the four provinces.<br>Field crops are generally dominant, and corn and cassava are prevailing in PIK01 and 02.<br>Livestock activities are inactive.<br>Farm machines are more common compared to Phrae and Nan.<br>In most of the M/P code areas, farmers use both chemical and natural fertilizer.<br>Technology Transfer Centers do not function well to extend useful knowledge.<br>9.3 % of villages in the M/P code areas have irrigation facilities. 43% of SPK4-01 farmers have farm pond. 19% of villages suffer from water shortage. |

(2) Prioritization of Programs and Components by the M/P Code Areas

In accordance with the method explained in the previous section (5.4), programs and components were prioritized by each M/P code area, and the results are shown below.

**Table 5.4.40 Priority Recommendation of Components (Natural Resources Management, PIK)**

| M/P Code area | PIK01 | PIK02 | PIK03 | PIK04 | Average |
|---|---|---|---|---|---|
| 1 Food produce utilization: Average 2.25 | | | | | |
| 1.1 Food utilization | 3 | 3 | 0 | 3 | 2.25 |
| 1.2 Non-food utilization | 3 | 3 | 0 | 3 | 2.25 |
| 2. Forest area management: Average 1.75 | | | | | |
| 2.1 Community forest establishment | 2 | 3 | 0 | 0 | 1.25 |
| 2.2 Community forest management | 3 | 3 | 0 | 3 | 2.25 |
| 2.3 Forest valuations | 2 | 3 | 1 | 1 | 1.75 |
| 3. Forest rehabilitation: Average 2.25 | | | | | |
| 3.1 Forest rehabilitation | 3 | 3 | 0 | 3 | 2.25 |
| 3.2 Reserved forest area delineation | 3 | 3 | 0 | 3 | 2.25 |
| 4. Soil and water conservation: Average 2.13. | | | | | |
| 4.1 Soil conservation | 3 | 3 | 3 | 2 | 2.75 |
| 4.2 Water conservation | 2 | 2 | 1 | 1 | 1.50 |

Remark: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

**Table 5.4.41 Priority Recommendation of Components (Livelihood Improvement, PIK)**

| M/P Code area | PIK01 | PIK02 | PIK03 | PIK04 | Average |
|---|---|---|---|---|---|
| 1 Livelihood improvement: Average 2.25 | | | | | |
| 1.1 Non-agriculture income generation | 2 | 2 | 3 | 3 | 2.50 |
| 1.2 Expenditure reduction | 2 | 3 | 3 | 3 | 2.75 |
| 1.3 Energy saving | 3 | 2 | 0 | 1 | 1.50 |
| 2. Fund development: Average 2.25 | | | | | |
| 2.1 Locally accessible capital / fund development | 2 | 2 | 3 | 2 | 2.25 |
| 3. Health and welfare improvement: Average 1.75 | | | | | |
| 3.1 Health improvement | 1 | 3 | 3 | 3 | 2.50 |
| 3.2 Culture dissemination | 1 | 1 | 1 | 1 | 1.00 |
| 4. Infrastructure development: Average 0.88 | | | | | |
| 4.1 Social infrastructure | 1 | 1 | 0 | 1 | 0.75 |
| 4.2 Living conditions improvement | 2 | 1 | 0 | 1 | 1.00 |

Note: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

**Table 5.4.42 Priority Recommendation of Components (Sustainable Agri. Dev', PIK)**

| M/P Code area | PIK01 | PIK02 | PIK03 | PIK04 | Average |
|---|---|---|---|---|---|
| 1 Agriculture Production: Average 2.38 | | | | | |
| 1.1 Crop production | 3 | 3 | 2 | 2 | 2.50 |
| 1.2 Farming technology improvement | 2 | 3 | 2 | 2 | 2.25 |
| 2. Livestock development: Average 2.00 | | | | | |
| 2.1 Livestock raising | 3 | 3 | 3 | 3 | 3.00 |
| 2.2 Feed production | 1 | 1 | 1 | 1 | 1.00 |
| 3. Farm produce processing: Average 1.00 | | | | | |
| 3.1 Plant material processing | 1 | 1 | 1 | 1 | 1.00 |
| 3.2 Animal material processing | 1 | 1 | 1 | 1 | 1.00 |
| 4. Marketing: Average 1.50 | | | | | |
| 4.1 Enhancement of local circulation of farm produce | 2 | 2 | 2 | 2 | 2.00 |
| 4.2 Marketing improvement of local specialties | 1 | 1 | 1 | 1 | 1.00 |
| 5. Infrastructure development 1.88 | | | | | |
| 5.1 Water resources development | 3 | 2 | 2 | 2 | 2.25 |
| 5.2 On-farm facilities | 2 | 2 | 0 | 2 | 1.50 |

Note: Averages are calculated in accordance with the data of the M/P code areas: 3 (+++), 2 (++), 1 (+) and 0 (-).

(3) Prioritization of Programs and Components

The average scores of the M/P code areas are used to prioritize the programs and components in each province, and the results are shown below. The priorities in parenthesis are opinions derived through discussions with the PLRO.

**Table 5.4.43 Priority Recommendation of Programs and Components in Phitsanulok**

| Program and Component | SCORE | PRIORITY |
|---|---|---|
| Natural Resources Management | | |
| 1 Food produce utilization | 2.25 | +++(++) |
| 1.1 Food utilization | 2.25 | ++ |
| 1.2 Non-food utilization | 2.25 | ++ |
| 2. Forest area management | 1.75 | ++(+++) |
| 2.1 Community forest establishment | 1.25 | +(+++) |
| 2.2 Community forest management | 2.25 | ++ |
| 2.3 Forest valuations | 1.75 | ++ |
| 3. Forest rehabilitation | 2.25 | +++ |
| 3.1 Forest rehabilitation | 2.25 | ++ |
| 3.2 Reserved forest area delineation | 2.25 | ++(+++) |
| 4. Soil and water conservation | 2.13 | +++ |
| 4.1 Soil conservation | 2.75 | +++(++) |
| 4.2 Water conservation | 1.50 | +(+++) |
| Livelihood Improvement | | |
| 1. Livelihood improvement | 2.25 | +++ |
| 1.1 Non-agricultural income generation | 2.50 | +++ |
| 1.2 Expenditure reduction | 2.75 | +++ |
| 1.3 Energy saving | 1.50 | +(++) |
| 2. Fund development | 2.25 | +++(++) |
| 2.1 Locally accessible capital / fund development | 2.25 | ++ |
| 3. Health and welfare improvement | 1.75 | ++(+) |
| 3.1 Health improvement | 2.50 | ++ |
| 3.2 Culture dissemination | 1.00 | +(++) |
| 4. Infrastructure development | 0.88 | + |
| 4.1 Social infrastructure | 0.75 | + |
| 4.2 Living conditions improvement | 1.00 | +(++) |
| Sustainable Agriculture Development | | |
| 1. Agriculture Production | 2.38 | +++(++) |
| 1.1 Crop production | 2.50 | +++(++) |
| 1.2 Farming technology improvement | 2.25 | ++ |
| 2. Livestock development | 2.00 | +++ |
| 2.1 Livestock raising | 3.00 | +++ |
| 2.2 Feed production | 1.00 | +(++) |
| 3. Farm produce processing | 1.00 | + |
| 3.1 Plant material processing | 1.00 | + |
| 3.2 Animal material processing | 1.00 | + |
| 4. Marketing | 1.50 | ++(+) |
| 4.1 Enhancement of local circulation of farm produce | 2.00 | ++ |
| 4.2 Marketing improvement of local specialties | 1.00 | + |
| 5. Infrastructure development | 1.88 | ++ |
| 5.1 Water resources development | 2.25 | ++(+++) |
| 5.2 On-farm facilities | 1.50 | + |

Note: Scores are derived from the previous tables (Calculation based on the figure 3 (+++), 2 (++), 1 (+) and 0 (-)). For programs, "+++" is given to the scores with more than 2.0, "++" to the scores between 2.0 and 1.5, and "+" to the scores less than 1.5. For components, "+++" is given to the scores with more than 2.5, "++" to the scores between 2.0 and 2.5, and "+" to the scores less than 2.0.

(4) Infrastructure Development

In accordance with the procedures of cost estimate described in the previous section (0), the infrastructure development cost in Phitsanulok is estimated as shown in Table 5.4.44.

**Table 5.4.44 Summary of Infrastructure Development Cost (Phitsanulok)**

(unit : 1,000 Baht)

| Items | PIK01 | PIK02 | PIK03 | PIK04 | Total |
|---|---|---|---|---|---|
| 3.5 Infrastructure Development under 3. Agricultural Development | | | | | |
| 3.5.1 (1) Existing Irrigation Facility Improvement | 212,190 | 126,344 | 0 | 202 | 338,736 |
| 3.5.1 (2) Individual Farm Pond Development (1,260 cu.m) | 167,506 | 60,749 | 0 | 2,703 | 230,958 |
| 3.5.1 (3) Groundwater Development w/ Micro Irrigation | 6,329 | 3,509 | 0 | 1,754 | 11,592 |
| 3.5.1 (4) Existing Reservoir Improvement | 3,849 | 1,925 | 0 | 1,925 | 7,699 |
| 3.5.1 (5) Perennial Stream Development | 17,964 | 1,403 | 748 | 4,004 | 24,120 |
| 3.5.1 (6) Smal Scale Reservoir Developemnt | 22,215 | 16,661 | 0 | 5,554 | 44,430 |
| Sub-Total | 430,053 | 210,591 | 748 | 16,142 | 657,535 |
| 3.5.2 (1) On-Farm Road Improvement and Development | 15,123 | 6,427 | 214 | 12 | 21,776 |
| 3.5.2 (2) Farm Land Soil Conservation | 103,143 | 41,707 | 0 | 0 | 144,850 |
| Sub-Total | 118,266 | 48,134 | 214 | 12 | 166,626 |
| Total of 3.5 | 548,319 | 258,725 | 962 | 16,154 | 824,161 |
| 2.4 Infrastructure Development under 2. Livelihood Improvement Plan | | | | | |
| 2.4.1 (1) Installation of Village Water Supply | 1,212 | 909 | 0 | 303 | 2,424 |
| 2.4.1 (2) Expansion of Village Water Supply | 0 | 260 | 0 | 69 | 329 |
| 2.4.1 (3) Village Electrification | 0 | 0 | 0 | 0 | 0 |
| 2.4.1 (4) Expansion of Electricity Service | 2,391 | 1,329 | 0 | 353 | 4,073 |
| Improvement | 846 | 584 | 0 | 112 | 1,542 |
| Sub-Total | 4,449 | 3,082 | 0 | 837 | 8,368 |
| 2.4.2 (1) Garbage Disposal Improvement | 0 | 0 | 0 | 0 | 0 |
| Treatment | 0 | 0 | 0 | 0 | 0 |
| Sub-Total | 0 | 0 | 0 | 0 | 0 |
| Total of 2.4 | 4,449 | 3,082 | 0 | 837 | 8,368 |
| G. Total | 552,768 | 261,807 | 962 | 16,991 | 832,529 |

# CHAPTER 6 MASTER PROGRAM IMPLEMENTATION PLAN

## 6.1 RESULTS IN PILOT PROJECT

Pilot projects were conducted at seven Tambons in four provinces from May 2006 to March 2007, in order to verify the element of the M/P and reflect lessons learned from the implementation on the M/P.

Through the pilot projects, effectiveness of learning/trials/practice processes under the supports from government organization, related organization and local human resource, and validities of programs/ components/ activities which are formulated in order to achieve the goals of "Natural resources in and around LRAs are conserved" and "Local people become self-reliant", was examined. A brief summary of the results is shown in Table 6.1.1.

**Table 6.1.1 Validities of the M/P Based on the Results of Pilot Project and Lessons Learned**

| Verification Items | Result of verification | Lessons learned |
|---|---|---|
| Implementation processes of Learning /trails / practice taken by LRAs people | - A flexible learning opportunity based on the local conditions of project sites and people's needs, can make local peoples' activities more efficient.<br>- The flexible learning opportunity encourages local people to grow awareness and learn knowledge/skills. The activities become sustainable.<br>- Ownership sense and capacity development of local people can be built in the flexible implementation processes from planning to monitoring/ evaluating of activities. Through these processes, local people become self-reliant. | - It is required to provide learning opportunities based on the conditions of project sites and people's development sense.<br>- Supports by local human resource are effective in providing flexible learning opportunity.<br>- In natural resources management, participatory survey and learning process is necessary to encourage local people to grow awareness and guide to joint/ required activities. |
| Cooperation system with implementation organizations of government organizations, related organizations and local human resources | - The project implementation was not conducted in one Tambon, although activity plan was provided.<br>- There were some implementation constraints with budget use, coordination with related organization, and monitoring system.<br>-ATSAP needs to cooperate with M/P implementation sites and learning centers established under the concept 'sufficient economy' in order to promote sustainable agriculture.<br>- TAO and MONRE can build a cooperation system in the joint activity of the natural resources management plan. | In order to implement M/P which is expected to be larger scale than the pilot project,<br>- Consensus building among Tambons and villagers is required.<br>- It is required to build an implementation organization with full-time staffs from ALRO, ATSAP and PLRO.<br>- It is required to develop capacity of the full-time staffs and facilitators who are the cores of the implementation.<br>- Networking by activity groups can help local people support sustainability of the activities. |
| Validity of programs components/ activities based on their achievements | All the components and activities in the natural resources management plan (comprising of four programs and ten components) were implemented. There was a difference in achievement in the short period of the pilot project implementation. Programs such as 'forest resources management' and 'forest rehabilitation' showed a certain degree of achievements. However, promoting in the 'soil conservation', especially 'soil erosion prevention farming' had some problems. The 'community forest management' is expected continuously to develop with being anchored by people. Continuing these components/ activities, it is | - With confirming effectiveness of natural resource in forest, it encourages local people to grow 'awareness' for natural resources management and conservation, and 'motivation' for joint activities and required activities.<br>- There are required activities that villagers work together to achieve goals for management/conservation.<br>- It is required that related government organizations such as LDD and DOAE |

| Verification Items | Result of verification | Lessons learned |
|---|---|---|
| | possible to achieve targets. As the results, it is verified that the programs/ components/ activities are effective. | provide some actions (e.g., incentives and appropriate learning opportunities), to promote 'soil erosion prevention farming' in the LRAs |
| | Five components of the livelihood improvement plan (M/P is comprised of four programs and eight components) were implemented. Achievements there from directly connected to livelihood improvement. However, Verification of effectiveness of components/activities such as 'non-agricultural income generation' and 'locally accessible capital/fund development' was limited, because they are required to step in creating a new income resource, investment, and circulation in the long term. Several components/ activities were not implemented because they are required to continue in a long period in order to achieve an effect. As the results, there is a difference in the verification of effectiveness. However, all the programs and components were verified to help people's self-reliance with continuous activities and supports from stakeholders. | -'Expenditure reduction' is a realistic way for livelihood improvement, since it is the activity with instant effects, which are linked with daily expenditure like 'making daily commodities'.<br>- It is important for livelihood improvement that people feel 'happiness' and participate in the activity as joint undertaking. Such joint activities connect to succession and promotion of the activity. - Activity group with 'happiness' can act as resource person to expand and promote the activity. |
| | Seven components/activities of the sustainable agriculture development plan (M/P comprising of five programs/ten components) are implemented. The contents of the implemented components / activities are mostly to improve the existing manner of practice for farming activities. Therefore, decree of achievements of the activities was not shown in detail due to implementation time limitation of short period. However, it was demonstrated that it was possible to improve quality of products and increase the quantity with limiting inputs from outside and using resource available within the community/ area. It was confirmed that these activities were being promoted.<br>Some components such as 'marketing' and 'infrastructure development' were not implemented due to time and fund limitation. Although these components are effective to achieve goals, they are needed to continue for a long period of time. A long period is needed to examine effectiveness of the components/ activities. However, it was verified that these components would be effective, if they would be continued under supports of stakeholders. | - It is required to make use of advanced farmers/ sites as 'learning centers' when villagers expect to learn new knowledge and skills during the processes of learning/ trials/ practices.<br>-As an entry activity, activity of organic agriculture is effective. However, several seasons may be needed to practice it until it become effective.<br>- To achieve goals of 'integrated farming' and 'community market development', appropriate learning opportunities at advanced communities/ sites and continuous supports from outside are required. |

Through this verification, the effectiveness of the M/P was examined. Lessons learned from there were reflected in "M/P implementation plan" of this chapter.

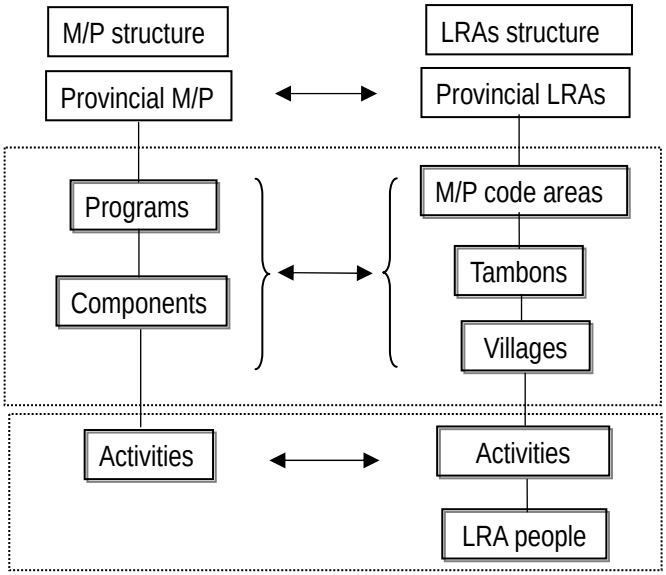
## 6.2 M/P IMPLEMENTATION METHOD

### 6.2.1 Basic Concept

**(1) Structure of M/P and LRAs**

Structure of M/P is briefed in relation with administrative classification of LRAs.

- LRAs are composed of several M/P code areas which are grouped based on the boundary of Amphoe administration and watershed (referred 4.2.).
- M/P code areas consist of several Tambons and villages.
- Programs and components are planned by the M/P code area. （Priority of programs and components is put on each M/P code area. It does not mean its priority on the specified Tambons and villages.）
- Components consist of several expected activities.




- Activities groups are organized by LRAs people.
- Activities are taken by the groups.

The number of the M/P code areas, Tambons, and communities as the targets for M/P implementation is shown as follows.

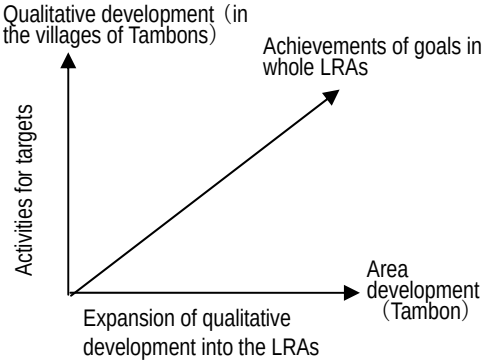
**Table 6.2.1 Target Number of M/P code areas, Tambons and Villages for M/P Implementation**

| Item | Phayao | Phrae | Nan | Phitsanulok |
|---|---|---|---|---|
| M/P code areas | 14 | 14 | 20 | 4 |
| Tambons | 51 | 42 | 76 | 17 |
| Villages | 280 | 184 | 416 | 79 |

The implementation of M/P is to materialize programs/components in the targeted sites as shown in the Table 6.2.1. The implementation is conducted in a Tambon basis, considering the lessons learned from the participatory survey conducted in this study, the discussion with C/P organizations, and the pilot project implementation.

**(2) Materialization of the programs/components in the LRAs**

The two goals of “Natural resources in and around LRAs are conserved.” and “LRAs people become self-reliant” can be achieved through implementing activities that materialize the programs and



components in Tambons and villages in M/P code areas. In order to achieve the targets, it is required to repeat the ‘qualitative development’ and ‘area development’ in the Tambons.

Vertical (Qualitative) development ;

This approach is to undertake necessary activities to realize the programs and components in the targeted Tambon and villages. Various activities in line with the programs and components are initiated by LRAs people (villagers). In this process, LRAs people prepare CDP under the support from facilitator. Necessary supports from government and related organizations and local resources, are incorporated in the CDP. Based on the CDP, various activities are learned, tried and practiced in their own community and lands. Those activities are deepened qualitatively, by repeating finding problems and solutions. The activities are progressed for the two targets along the development approaches. Each activity is continued until its objective is achieved. Activities undertaken can be integrated to two goals in the Tambon and villages. The qualitative development process can be undertaken in several villages together in the Tambon.

Horizontal (Area expansion) development ;

This approach is to expand qualitative development into other targeted Tambons. Outcomes of the activities achieved in qualitative development are disseminated among the Tambons. In this approach, target Tambon is selected first. Then, qualitative development process is conducted in the selected Tambon.

The two goals are achieved by accumulating outcomes through repeating vertical ‘qualitative development’ and horizontal ‘area expansion development’.

### 6.2.2 Vertical Qualitative Development Process

Qualitative development is a process which villagers take necessary actions to achieve the development goals in their own villages and farmlands. Concept of the M/P emphasizes that capacity development with learning process is required in order to realize programs and components. Then, in the M/P implementation, villagers are considered to be an implementation body. In the qualitative development process, therefore, it is encouraged villagers to participate in learning process to learn components/ activities and realize them on their own initiatives. In order to operate such qualitative development, a villagers’ participatory operation is required. The participatory operation enables villagers to make consensus to take collective actions and turn their activity steps forward for the goals. Actions planned by villagers should be continued until outcomes from their actions become established in their villages or lands. Then, villagers are required to participate in the various development stages from planning to implementation. Especially, in the natural resources management and conservation plan, it is important to understand that in order to realize the programs/ components and get benefits from their activities, it is necessary to take collective actions in a long term.

Although villagers should drive qualitative development process on their own initiatives, they do not have sufficient capacity. Any support from outside is necessary. Then, outside resources such as

governmental organizations, related institutions and local human resources such as NGOs are expected to support them technically and financially.

**(1) Villagers Driven Operation**

Villagers are expected to drive qualitative development process with the outside resources. In the process, they make action plans with CDP to materialize programs and components. First, they conduct survey and analyze their community/ village and LRAs, and make action plans. After making the plans, they initiate to act along them. The activity process taken by villagers is expected as follows.

Survey, analysis and planning stage (learning)

1) To analyze present situations of natural resources, socio-economy and agriculture in and around the LRAs.
2) To review priorities of programs and components.
3) To find development needs and local resources available in the LRAs.
4) To prepare action plans along programs and components.

Implementation stage (learning, trial and practice)

5) To design ways of operation of action plans including necessary supports from outside.

Monitoring and evaluation stage

6) To implement the action plans as designed, monitor the progress, and evaluate the outcomes.
7) To revise the action plans based on the evaluation, if necessary.

Follow-up and expansion

8) To continue the implementation until it can be established in the areas.

Through participating in the above processes, villagers can create development sense and motivation to participate in the M/P implementation. They can learn real needs, constraints and available local resources for development as well as related rules and regulations. Through such learning, they can build up their capacity to step in for attaining the goals and to organize themselves to deal in the above development stages. Thus, the villagers driven operation is expected to contribute to the sustainability of the M/P.

**(2) Supports from governmental organizations, related institutions and local resources**

Qualitative development may be stepped forward gradually by repeating activities such as learning, trial and practice in their lands. In this working process, it needs technical and financial supports from outside as mentioned above.

Technical supports are given to villagers through learning opportunities provided by government organizations, related institutions and local resources such as advanced farmers, existing learning center, universities and NGOs. Villagers can get necessary knowledge and technology from such outside resources on local needs.

Financial supports should be provided by government organizations such as ALRO, PLRO and TAO when villagers drive qualitative development in their land.

Both supports should be continued until their activities become established in their villages and land,

since planned activities aim to improve their life style and farming system with natural resources conservation/ management concept. The supports should be provided at the right time as necessary. The supports can help villagers, to vitalize their activities and make qualitative development more easily.

**Table 6.2.2 Implementation Process of Qualitative development**

| Development stage | Year-1 | Year-2 | Year-3 | ・・・ | Year-N |
|---|---|---|---|---|---|
| Input/ Support from outside resources | Although supporting activities are continued until activities established in the areas, they are gradually decreased there. | | | | |
| 1. Analysis | | | | | |
| 2. Planning | | | | | |
| 3. Implementation | | | | | |
| 4. Monitoring and evaluation | | | | | |
| 5. Follow-up and extension | | | | | |

（Each activity is planned and implemented depending on the each area and activity group）

**(3) Supports from Facilitator**

A facilitator helps villagers drive qualitative development of villagers, is to stay in the village as needed, and acts as an interface or connector between villagers and outside resources such as government organizations, to arrange necessary learning opportunity. Supports from facilitator are to encourage villagers to organize themselves into activity groups and prepare learning opportunity as required.

**(4) Key Issues in the Process from Planning Stage to Expansion of Components/ Activities**

Qualitative development processes taken by villagers may differ among the LRAs/ villages, depending on local conditions such as natural resources conditions of their lands and community forest, development awareness and planning capability of villagers. Although such different processes may be taken, following issues that were learned through the pilot project implementation should be incorporated as key issues in the operation.

**1) Supports from outside should be planned flexibly for local needs**

Development activities would be customized for local needs. The timing and contents of outside supports should be designed on the real requirement arisen in the qualitative development process. Then, it is important to make technical supports flexibly on locality of the LRAs. (In the pilot project, by making planning steps more flexible, participants could develop their ownership. This would contribute to the sustainable M/P implementation.)

**2) Providing learning opportunity of ‘awareness’ for villagers**

In the natural resources management plan, for conservation ‘awareness’ of natural resources might be developed among participants through learning process when programs/ components/ activities are initiated. In the process, villagers can learn their daily life/ farming practices linked with natural resources in the forest. Through the learning process, ‘awareness’ and ‘motivation’ of activities can be

developed among participants. Activities are created with developing the awareness. The key issue is to find activities through learning that may bring the awareness. Facilitator provides such learning opportunity together with outside human resources and related organization, as follows.

1) Participatory joint survey on forest resources such as medical herb, mushroom, bamboo shoot
2) Linkage livelihood with harvesting of natural resources
3) Change of runoff water from forest area into pond and canals
4) Quantitative and qualitative change of forest such as tree and vegetation in the past
5) Decrease of wild animal in the forest, and occurrence of forest fire

**Box.1 Experience from the pilot project**

In the pilot project, participatory survey on forest valuation was conducted. Through this survey, participants have learned about mutual influence with forest produce harvesting (medical herb, mushroom, bamboo shoot) and livelihood, dry season water flow and watershed conservation, devastation of forest and decrease of wild animal and plants. Through the learning, 'awareness' of activities such as construction of water conservation weir, community forest management and setting of forest area boundary were grown among participants. Awareness can be grown among local people through study tours in advanced areas/ communities where the same activities were planned, tried and practiced.

Such awareness can be expanded into local people through learning at the areas/ communities where activities are practicing.

**3) Required collective activities can be provided through awareness**

Some collective activities are required in order to achieve the development goal in the natural resources management plan. These are the components/ activities in the forest area management program and forest rehabilitation program (community forest management/ strengthening of community forest committee, reserved forest area delineation/ putting of forest boundary marker, forest rehabilitation/ setting of fire-break line). Those components/ activities are considered to be collective activities which local people can cope with together to enjoy the benefits in future. It is essential in the qualitative development process to guide from awareness to such required collective activities.

**4) Motivation should be given to LRAs people when components/ activities are planned**

Motivation to LRAs people should be considered when components/ activities are initiated. Especially, activities for natural resource management plan may bring public benefit in community and Tambon level, it is different from livelihood improvement plan and sustainable agriculture development plan that are in the household level. Initiating activities may depend on villagers' willingness and opinions with motivation (beneficial or not for them) whether the activity is initiated and continued. Thus, when an activity is planed, motivations of the villagers must be considered.

It is obvious from the cases at the pilot projects that understanding that villagers conserve and manage their land and community forest may lead to their benefit, is needed.

The activity 'soil erosion protection farming' was not developed as mentioned above, because

motivations of the villagers were unclear. Thus, related organizations such as LDD, DOAE and universities are required to guide the following activities to motivate villagers.

**Box.2 Experience from the pilot project**

In the pilot project, villagers became aware of necessity of the natural resources management through participatory survey on forest valuation and discussion on forest among participants. As a result, the activities 'construction of small scale water conservation weir', 'making fire break line' are included in the natural resources management plan. These activities are motivated by villagers, because they understood that the activities led to augmentation of water in the dry season, quantitative change of wild animal and tree and vegetation, and forest resource conservation in a long period of time. However, soil conservation components/ 'soil erosion prevention' were not promoted among LRAs people since motivation or benefits from soil conservation farming to be applied in their farmlands, was not clear. In the sustainable agriculture development plan, 'integrated farming' in the farming technology improvement component was not proceeded to trial and practice processes, since LRAs people could not catch the entire picture of the integrated farming in place of present farming style.

- Growing awareness of soil erosion prevention farming in steep sloped lands through showing examples: soil eroded lands where soil fertility is deteriorated may cause decrease of crop production in a long term. Then, encourage LRAs people to initiate any soil erosion prevention farming activities.
- Clearly indicate benefits and/or advantages of applying soil erosion prevention farming such as anti-erosion grasses (e.g., vetiver grass and lemon grass), covering with them, and mixing with crops.
- Provide study tours and learning opportunities to show both of eroded lands and soil erosion prevention farms.
- Support LRAs peoples' soil erosion prevention farming activities; the incentives to apply such farming are the key issues. (Currently, motivations (benefits) are still unclear in farmland level. Therefore, technical and financial supports from the government are necessary for the incentives of LRAs peoples, when they may determine to apply any soil erosion prevention farming. (e.g., funding and applying activity, compensation of earnings based on the actual prevention effects.)

As for the 'integrated farming', ALRO/ATSAP and PLRO are required to motivate farmers to change their way of current farming to integrated farming style. The following activities are expected.

- Advanced farmers who are practicing 'integrated farming' exist in north region, although its scale is various. Those farmers are listed as 'learning center' or 'model farm' to make integrated farming network. LRAs farmers who are interested in the integrated farming and any advanced farming can learn concrete way of farming through such network. Learning opportunity through study tours is provided under technical and financial supports.
- Integrate farming workshops/ seminars are to be held regularly to share information of progresses. LRAs farmers are encouraged to participate in these opportunities.
- 'Learning center' under the support of government are currently being set up in north region in order to realize concept of "sufficiency economy" which is targeted in the National Development Plan. The 'learning center' can be utilized as the learning sites for sustainable agriculture and livelihood improvement.

**5) Entry activities for easy sharing and expansion of awareness**

It is important to share awareness and development steps among people in order to achieve the goals. To do so, it is required to find any entry activities that can be easily tried and practiced by LRA people.

**6) It is important that people feel 'Happiness' in the activities in order to continue/ promote/ expand components/ activities**

In order to expand the component/ activity in the livelihood improvement plan and sustainable agriculture development plan, it is the key that actors are aware of 'Happiness' from the activity.

**Box.3 Experience from the pilot project**

In the pilot project, expenditure reduction component/ 'making daily commodities' and farming technology improvement component/ 'organic farming' were considered to be the entry activities in the livelihood improvement plan and sustainable agriculture development plan. Those activities are expanded easily into other communities and areas. Also, activities such as 'making daily commodities' and `plant vegetables around house' were promoted and expanded to the other villagers more easily, because actors felt 'Happiness' in their activities.

**(5) Key issues for sustainability of components/ activities**

Components/ activities, which are planned and practiced by LRAs people are gradually progressed while being affected by each. In the implementation, sustainability of components/ activities should be concerned in the progresses. In order to keep sustainability, the following issues that have been learned from the pilot projects, should be put on the implementation progresses.

**Table 6.2.3 Issues for Sustainability of Components/ Activities**

| Program | Component | Issues for sustainability |
|---|---|---|
| **Natural resources management** | | |
| 1. Forest produce utilization | 1.1 Forest produce utilization | To sustain utilization of forest resources in the community forest, rules and monitoring of the activities should be made by the community forest management committee. |
| | 1.2 Non-food utilization | |
| 2. Forest area management | 2.1 Community forest establishment | Targets should be determined from establishment of community forest to strengthen it, networking with another community forest and capacity building of community forest management. |
| | 2.2 Community forest management | |
| | 2.3 Forest valuation | Conservation awareness of forest resources should be promoted among LRAs people through sharing of knowledge of forest resources and awareness of sustainable use of forest produce. |
| 3. Forest rehabilitation | 3.1 Forest rehabilitation | Frame of reforestation activities where valuable trees can be planted by people, should be established. "Making firebreak line" should be put on the Tambon's annual plan. |
| | 3.2 Reserved forest area delineation | "Reserved forest delineation" should be conducted by MONRE, on the other hand, "Community forest boundary" should be conducted by ALRO. |
| 4. Forest conservation | 4.1 Soil conservation | To promote soil erosion prevention activity, motivation and awareness should be given to LRAs people through study tours |

| Program | Component | Issues for sustainability |
|---|---|---|
| | 4.2 Water conservation | To promote construction of water conservation weir in the conserved forest, the regulation of RFD should be improved so that people can enter in the conservation forest. |
| **Livelihood improvement** | | |
| 1. Livelihood improvement | 1.1 Non-agricultural income generation | Market development should be incorporated in non-agricultural income generation activities. Then, present on-going activities should be qualitatively strengthened rather than generating new activities. |
| | 1.2 Expenditure reduction | Making household account book should be promoted. "Making daily commodity" should be linked with community market activity. Expenditure reduction is useful to make household account stable. But, increase in household income should be achieved to pay back debt. |
| | 1.3 Energy saving | |
| 2. Fund development | 2.1 Locally accessible capital/ fund development | Since present funding system exists, a long-term time span is necessary to establish a community fund initiated by community members. |
| 3. Health and welfare improvement | 3.1 Health improvement | It is important to cooperate with traditional doctors (medical herb) and local health centers. Tambons should support health improvement activities. |
| | 3.2 Culture dissemination | Forest sprit ceremony and knowledge from traditional doctors and seniors are effective to develop conservation awareness of natural resources. |
| 4. Infra. development | 4.1 Social infrastructure | All of components/ activities may be incorporated into Tambon development plan and other related organizations' plan. |
| | 4.2 Living conditions improvement | |
| **Sustainable agriculture development** | | |
| 1. Agricultural production | 1.1 Crop production | It is important to provide learning opportunity in actual practicing sites, existing learning centers, which are practicing integrated farming and organic farming, considering technical level of LRAs farmers. Through learning, they can recognize that these farming practices are helpful for expenditure reduction and food security. It is important to support the activities from "compost making" and "plant vegetables around house" to the activities "organic farming" and "integrated farming". It is useful that farm products from these farming are brought to the community market. |
| | 1.2 Farming technology improvement | |
| 2. Livestock development | 2.1 Livestock raising | It is useful to learn at actual practicing farmers. Technical supports in the trial and practice processes to link the activities such as fish raising, pig raising and chicken raising with the integrated farming should be provided for trial farmers. |
| | 2.2 Feed production | |
| 3. Farm produce processing | 3.1 Plant material processing | Farm processing products should be put on community market activities, since it is hard to develop a long-distance market channel. |
| | 3.2 Animal material processing | |
| 4. Marketing | 4.1 Enhancement of local circulation of farm produce | To realize both components, a learning opportunity in the actual practicing sites/ community should be provided for farmers. A long-term follow up activities after learning is also important to establish the components in their lands. The community market is the place where farm products from integrated farming are brought in. |
| | 4.2 Marketing improvement of local specialties | |

| Program | Component | Issues for sustainability |
|---|---|---|
| 5.Infra. development | 5.1 Water resource development | As well as the infrastructures in livelihood improvement, some of components/ activities may be incorporated into the Tambon plan and related organizations' plan. |
| | 5.2 On-farm facilities | |

### 6.2.3 Horizontal (Area Expansion) Method

#### (1) Basic Concept

Since the area expansion is implemented in a Tambon basis as mentioned in the section 6.1, M/P implementation will be started from a selection of target Tambon where qualitative development is planned. The numbers of Tambons targeted are in Phayao (51) Phrae (42), Nan (76), and Phitsanulok (17). The targeted Tambons may be selected in the course of M/P implementation in which the selection is repeated for area development and qualitative development.

The way of selection of targeted Tambons should be based on the lessons learned from the pilot project implementation as follows.

- First of all, a priority river basin is selected in the province, considering that components/ activities in natural resources management and conservation plan should be promoted and expanded in the watershed basis. (For example, it is easy to make community forest management network in a same basin or forest area.)
- Next, several Tambons located in the same river basin are preliminarily selected.
- Discussion with such Tambons is conducted to make consensus of M/P implementation.
- In the discussion with Tambons, representatives of villagers are also required to participate to discuss concept and frame of the M/P implementation including the followings.
    - Objectives of the M/P implementation
    - Framework of three sector plans (natural resource management plan, livelihood improvement, and sustainable agriculture development) with participatory approach
    - Implementation mechanism including villagers driven qualitative development process with learning process and supports from outsiders
    - Engagement of stakeholders in the implementation process
- During making consensus, study tours into the pilot project sites may be conducted as necessary to learn its experience and outcomes.
- Tambons adjacent to the Tambons where implementation consensus was made, should be involved in the discussion.

At the discussion with C/P organizations, it was concluded that it was difficult to select target Tambons and put all of them on the long-term time schedule of M/P implementation. Thus, it is planned that the Tambon selection is done in the course of the M/P implementation, monitoring the progresses of the activities in the selected Tambons and consensus making process in candidate

Tambon. Thus, the M/P implementation is progressed with repeating alternately the qualitative development and the area expansion development.

The above Tambon selection process should be managed by each PLRO in the four provinces. ALRO should monitor the progresses.

**(2) Supports from local resources and local network with activity groups**

In the area development, it makes easy to transfer similar activities into other related people and areas with showing the implementation processes of activities developed in the qualitative development. Moreover, The area development is supported by networking activities by activity groups with local human resources.

The network is needed to make communication and mutual help among them more smoothly.

**Box.4 Experience from the pilot project**

In the pilot project, activity groups of 'making daily commodity', 'kitchen garden' were organized and contributed to expansion of the activities through promotion in the stakeholder meeting/ workshop. In Phitsanulok, a community forest management network was established with neighboring communities in the process. It supported to build capacity of the community forest management committee members through discussion and sharing experiences.

Knowledge and skills learned from the experience in the qualitative development should be brought to the other areas, which can support activities at the other areas.

In addition, if any on-going villages and communities can be incorporated in the network as a 'learning center', they can function as a kind of technology transfer center and expand similar experiences into surrounding areas/ villages.

**Box.5 Experience from the pilot project**

In the pilot project, a farmer that implemented the activity 'bio-gas production' utilizing feces and urine of pigs, became a 'learning center' whose objective is to show the implementation process to surrounding people and promote/expand the activity. People who are interested in this activity learned knowledge and skills at the 'learning center' and considered applying it for their farms/ houses. As mentioned above, the 'learning centers' became the bases of learning for local people in the neighborhood. Thus, the 'learning center' contributed to promotions of the same activities with showing people achievements and technical know-how. Activity promotion becomes easier, if areas/ people/ groups who are challenging same activity, make network and 'learning centers' and mutually learn. Likewise, it is in the natural resources management plan. For example, local people and community forest management committee who face similar problems such as way of community forest management and forest utilization and seek solutions, can make networks. The network can help each other. If they can mutually learn and discuss about activities such as 'making regulation' of community forest' and 'forest rehabilitation', promotion and expansion of the activity becomes easier.

Through experience of the pilot project, advanced farmers/ farmlands easily become 'learning centers' in the agriculture development plan and livelihood improvement plan (e.g., farmers/farm-lands such as

livestock raising farmers, bio-gas producing farms, kitchen garden farmers and making daily commodity groups). In the natural resources management plan, advanced villages/ communities where community forest management and conservation activities are being undertaken, can be 'learning centers' (e.g., communities in Nan and Phitsanulok).

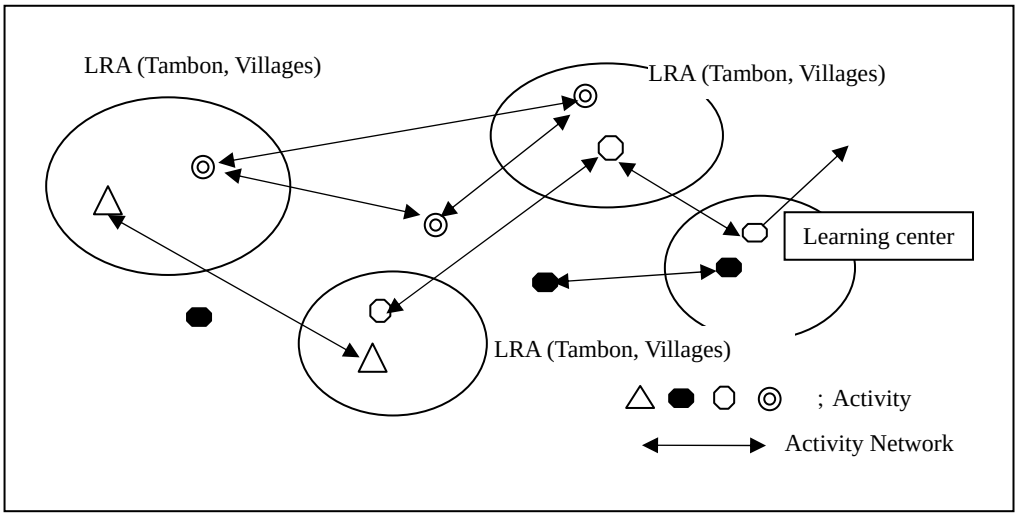



**Figure 6.2.1 Supports for Area Development with Network**

Networks are organized and enlarged when areas/communities/groups conduct study tours of mutual visits and exchange information in stakeholder meeting, workshops and seminars (ALRO is currently making list of local human resources to build networks.)

### 6.2.4 Operation and Management Method of M/P Implementation

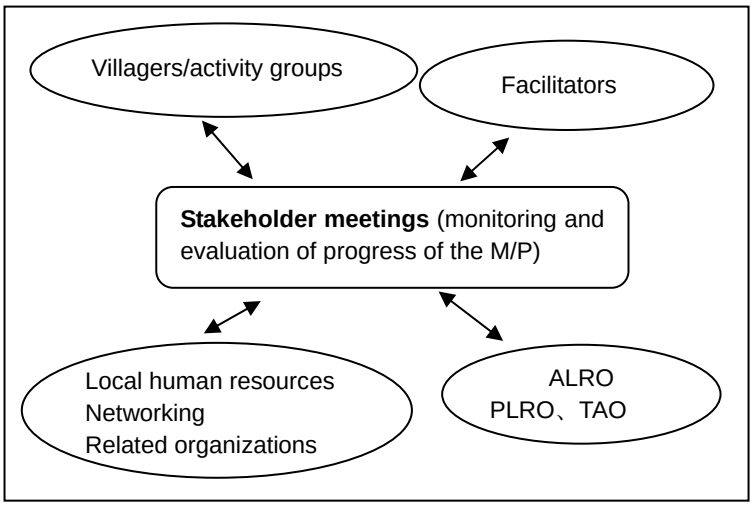
The implementation process of the M/P is operated and managed in each level of central (ALRO), province (PLRO), Tambon administration (TAO), NGOs and village and activity groups. Each organization manages and monitors implementation progress based on the M/P structure. Since qualitative development is implemented in several villages together within a Tambon, it is monitored and evaluated by Tambon, villages and activity group. ALRO and PLRO support financially and technically its operation. Area development is monitored by PLRO under supports of ALRO. ALRO manages implementation progress of the M/P in the four provinces comprehensively.

**Table 6.2.4 Major Functions for M/P Operation and Management in Each Government Level**

| Implementation Organization | Major function in M/P operation process |
|---|---|
| Central level（ALRO） | Comprehensively manage implementation progress of the M/P in four provinces.<br>- Monitoring and evaluation of the implementation progress of the MP at each province<br>- Supports for qualitative development at Tambons |
| Province level (PLRO) | Manage progress of area development. Support qualitative development at Tambons.<br>- Selection of Tambons<br>- Monitoring and evaluating of qualitative and area development at Tambons |

| | |
|---|---|
| Tambon level (TAO) | Manage progress of qualitative development at Tambons<br>- Monitoring and evaluation of promotion and expansion of the activity at target villages |
| Village level | Manage progress of qualitative development at villages<br>- Organizing activity groups.<br>- Monitoring and evaluation of processes of leaning/trial/practice among activity groups |
| Activity group level | Manage progress of the activity<br>- Monitoring and evaluation of process of activity of learning/trial/practice. |

The implementation of the M/P proceeds in each level under the concept of project cycle management of monitoring and evaluation at each level (see Figure 6.1.2). Monitoring and evaluation of the activities in qualitative development process are conducted based on the monitoring guideline.




Achievements of programs/ components and adjustments of implementation progress among each level are shared in stakeholder meetings.

The objective of the stakeholder meeting is to monitor and evaluate the progress of the M/P and provide feedbacks of the problems and solutions arisen in the implementation processes. Participants are expected to be the stakeholder such as ALRO, PLRO, TAO, related organizations, facilitators, representatives of activity groups and villages.

**Box.6 Experience from the pilot project**

In the pilot project, outcomes and implementation progress were shared among participants through stakeholder meetings and/or workshops such as monthly meeting and quarterly joint meeting. The meetings and workshops were useful to promote and expand the activities among participants through exchanging knowledge and information. It also contributed to networking and capacity building of participants.

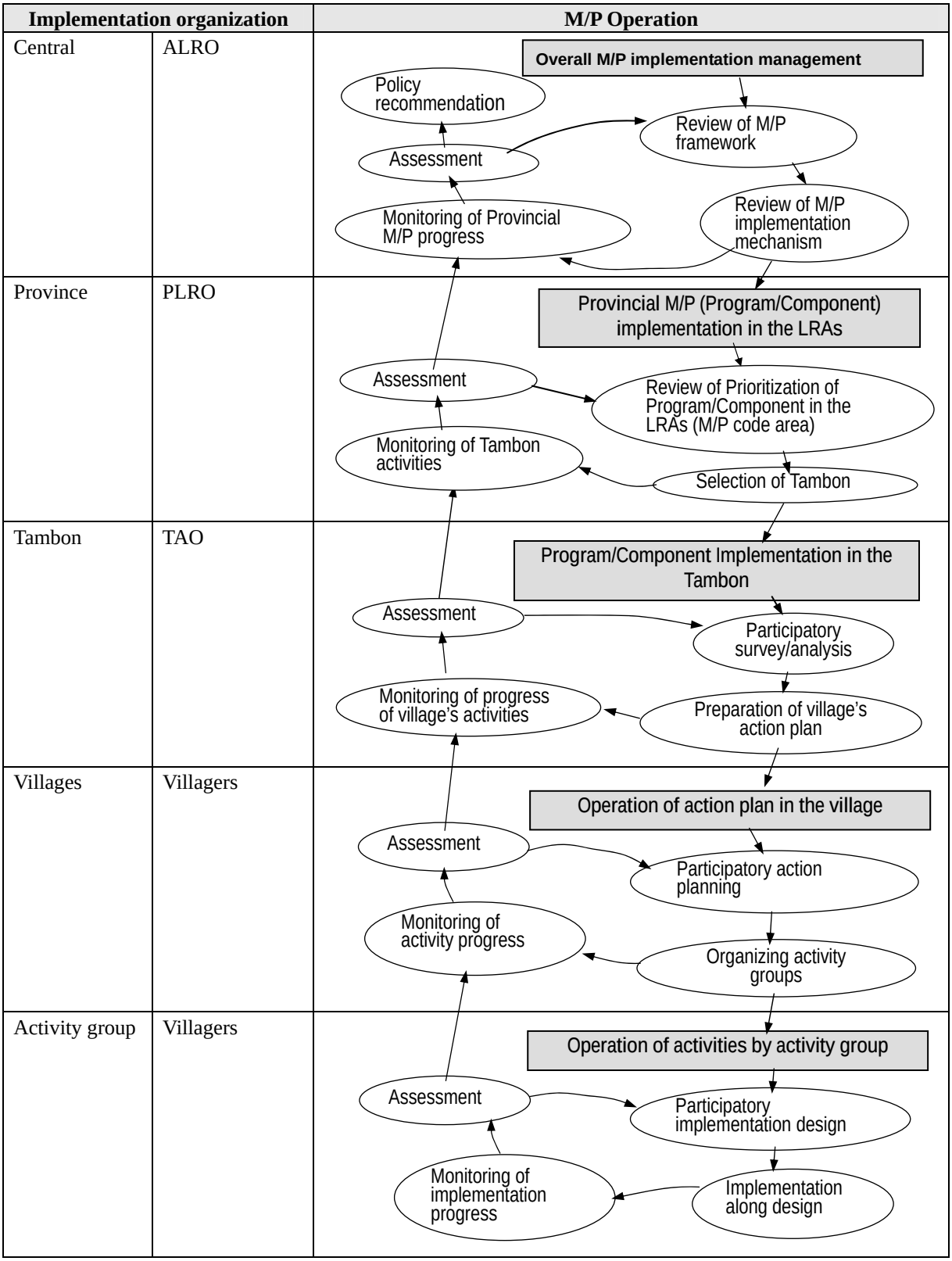
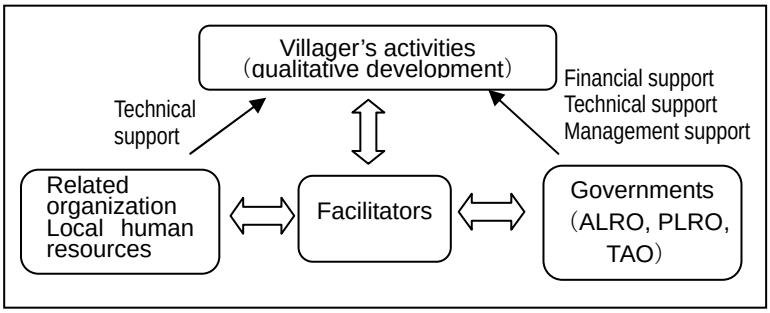



**Figure 6.2.2 Management of Project Implementation in Each Office/Villages/Activity group**

## 6.3 ROLES OF STAKEHOLDER FOR M/P IMPLEMENTATION

### 6.3.1 M/P Implementation and Stakeholders

The M/P is implemented under cooperation of governments, related organizations, local human resources, and facilitators. Their basic roles are following.




- Government organizations such as ALRO, PLRO, TAO, help the implementation of qualitative development and area development financially, technically and operationally, providing administrative conditions for participating in M/P implementation processes. Major role of the government organizations is to show the implementation frame of the M/P (three sector plans and programs/ components) and provide financial supports.
- Related organizations and local human resources provide technical support of qualitative development of villagers.
- Facilitators support qualitative development of villagers in cooperation with governments, related organizations and local human resources.

The roles of the stakeholders are described as follows.

### 6.3.2 Roles of ALRO, Gorverment Organization, Villagers, and Facilitators

ALRO, PLRO and Tambons should manage the implementation progresses of the M/P as mentioned in 6.2.4. They support qualitative development of villagers in cooperation with facilitators. The roles of stakeholders are as followings (see Table 6.3.1).

**(1) ALRO**

Responsibility of central government organizations of ALRO is to operate and manage overall implementation of the M/P at the four provinces. It includes provision of administration environment and public relation to the related organizations in order to realize M/P implementation. Especially for natural resources management plan, prior consultation with MONRE to establish a cooperation system is a major role. In the pilot project, a cooperation system with MONRE could be established in the provinces in the course of promotion of conservation activities in the targeted community forest. In the implementation of M/P, such cooperation system should be established. To do so, significance of the M/P should be disseminated to MONRE prior to the implementation. If the cooperation system can be established in advance, it enables local people to make conservation and management activities more easily in their forest areas. Public relations for related organizations such as LDD and DOAE are also important tasks of central government organizations.

**(2) ATSAP**

ATSAP examines suggestions about development plans and policies arisen from the monitoring/ evaluation processes of the activities to reflect them in the development strategies and policies of MOAC.

**(3) PLRO**

The major role of PLRO is to operate and manage the provincial M/P implementation. It includes selection of targeted Tambons for area expansion and overall monitoring and evaluation of implementation progress of the M/P. PLRO should establish cooperation system with related provincial organizations in the course of the implementation (for example, forest rehabilitation program such as “making firebreak line” can be materialized in cooperation with TAO.). PLRO also should provide technical and financial supports required in the qualitative development processes for local people with facilitators. In the area expansion process, PLRO should support networking process with local human resources and provide learning opportunities to strengthen capacity for them.

**(4) Tambon（TAO）**

Tambon supports local people in operating qualitative development. In natural resources management and conservation plan, Tambons play a leading role to incorporate the activities such as ‘putting boundary markers’, ‘making firebreak’, ‘construction of small-scale check dams/weirs’ into Tambon development plan. They financially and technically support such activities. It is the major role to support joint activities in the natural resources management plan.

**(5) Villagers and facilitators**

Villagers should implement activities as main actors. They have to participate in various processes of learning/ trials/ practices. Facilitators should support villager’s driven qualitative development cooperating with PLRO and Tambons.

**Table 6.3.1 Major roles of government/facilitator and local people at the M/P implementation**

| Organization | Expected Roles |
|---|---|
| Central（ALRO） | - Arrangement of administration conditions (budget and institution) for the M/P implementation<br>- Dissemination of the M/P concepts and related information to related organization<br>- Coordination of the M/P implementation with the other organizations<br>- Comprehensive management of the M/P at the four provinces<br>- Budgeting the M/P implementation and its allocation<br>- Formulation of an implementation organization structure (PMU) for the M/P implementation<br>- Education of personnel such as PMU for the M/P implementation<br>- Employment of facilitators and education to them<br>- Participation in stakeholder meetings/ workshops<br>- Recommendation of policy based on monitoring and evaluation of the M/P implementation<br>- Formulation of expansion and promotion strategy of M/P concepts to north region |

| Organization | Expected Roles |
|---|---|
| Central (ATSAP) | - Providing development policies based upon monitoring/evaluation<br>- Arrangement with related organizations for promotion activities for sustainable agriculture development |
| Province (PLRO) | - Selection of targeted Tambons for the M/P implementation<br>- Preliminarily making consensus among Tambons for the M/P implementation<br>- Adjustment and cooperation of the M/P implementation with related organizations<br>- Set up of the provincial PMU<br>- Education and training to PMU staff<br>- Budgeting and allocation for M/P implementation<br>- Supports for management of qualitative development at Tambons<br>- Arrangement with on-going plans/policies of the related organization<br>- Consultation about technical supports with related organizations for the M/P implementation and adjustments<br>- Building networks for the activity and promotion of making networks<br>- Adjustments for learning process of villagers (e.g., study tours)<br>- Operational support of participatory monitoring and evaluation<br>- Holding stakeholder meetings<br>- Suggestions of policies to central administration organizations based on an evaluation of implementation progress of the M/P |
| Tambon (TAO) | - Consultation and coordination of the M/P implementation with PLRO<br>- Prior consultation about M/P implementation at related villages/ communities<br>- Support for preparation of CDP<br>- Reviews of programs/components and support for establishments of activity plans<br>- Budgeting for the activity (e.g., construction of small-scale check dams/weirs, making fire breaks, putting boundary markers)<br>- Arrangements of activity plan with the Tambon development plan<br>- Support for provision of a learning opportunity for villagers/ communities<br>- Participation in monitoring and evaluation of the M/P operation<br>- Support for networking with local human resource<br>- Participation in stakeholder meetings<br>- Suggestions of policies to PLRO based on an evaluation of implementation progress of the M/P |
| Villagers | - Prepare CDP and action plans<br>- Participation in qualitative development<br>- Organizing villagers for qualitative development based on the action plan<br>- Monitoring and evaluation of the activity by activity groups<br>- Monitoring of the activities based on the monitoring guideline<br>- Reviews and revises of the action plans based on an evaluation of the activity<br>- Recommendations for activity plans to Tambon development plan<br>- Participation in learning opportunities and trials /practices<br>- Participation in joint activities and required activities (e.g., community forest establishment and making fire breaks)<br>- Participation in monitoring and evaluation of activities |
| Facilitator | - Supports for processes of plan/design/practice/evaluation by villagers<br>- Facilitation of CDP preparation and qualitative development process<br>- Support of participatory monitoring process by local people<br>- Facilitation of qualitative development process<br>- Coordination of learning opportunities and clarification of necessary technical supports at qualitative development<br>- Consultation and coordination of learning opportunity with provinces, Tambons, related organizations and networks |

| Organization | Expected Roles |
|---|---|
| | - Participation in stakeholder meetings<br>- Supports of organizing activity groups of villagers |

### 6.3.3 Roles of Related Organizations and Local Human Resources

**(1) Establishment of flexible supporting system**

Based on the pilot project implementation, it is proposed that technical supports from outside such as provision of learning opportunities and technical information from related organizations and local resources, have to be planned and implemented flexibly, depending on local needs of villagers and physical conditions of the areas. In the M/P implementation, therefore, involvements of provincial government organizations in provision of technical supports are flexibly established. Considering lessons learned from the pilot projects, the way of technical supports should be flexibly made in the frame of present administrative system. It should be planned depending on villager's technical levels. The support is flexibly provided at the time when villagers require in the qualitative development process.

**Box.7 Experience from the pilot project**

It is not easy to establish cooperation system among related government organizations in Thailand. In the pilot project, then, contents and timing of support were not planned in advance. When any supports were required from villagers, a most appropriate organization was found in the present organization system. Then, contents and timing of the support were discussed with the organization. The support was flexibly conducted through arrangement in the implementation progress. For example, in natural resources conservation and management plan in the pilot projects, through discussions, significance of the activities such as 'construction of check dam/ weirs' was understood by MONRE and necessary supports were provided.

**(2) Roles of government organizations, related organizations and local human resources for technical supports**

Technical supports are to provide knowledge and skills required in learning, trial, and practice processes. The supports should be supplied depending on the technical levels of villagers and conditions of the target areas. Contents of the supports and roles of the stakeholders of each component are summarized in Table 6.3.2. (The cooperation system among related organizations and the way of supports are not fixed as mentioned above. Support and cooperation may be realized in the discussion among stakeholders. Although supports and main stakeholders are presented in the table, they may be actually decided depending on the local needs and capacity of the organizations.)

In the pilot projects, technical supports from LDD, MONRE, learning centers of MONRE, advanced areas/ community, provincial related organizations and local human resources were effective for promotion of the activities in the natural resource management plan. Meanwhile, for promotion of activities in the livelihood improvement plan and the sustainable agriculture development plan, technical supports from local human resource such as advanced livestock farmers, organic farming

farmers and the university were practical. Those supports are more effective than those from the governmental organizations. The supports by these organizations and local human resources should be continued until the skills and technology would be established in their farmlands.

**Table 6.3.2 Technical Supports from Related Organizations and Local Human Resources**

| Program/Component | Related stakeholders | Roles of stakeholders |
|---|---|---|
| ***Natural Resources Management*** | | |
| **1. Forest produce utilization** | | |
| 1.1 Food utilization | Related organizations of MONRE (learning centers of forest resource), local intellectuals | Identification of edible forest products (e.g., bamboo shots, mushrooms, and herbs), in northern Thai areas. Provision of knowledge and skills for management of these resources and sustainable collection. |
| 1.2 Non-food utilization | Local human resources, MONRE, advanced communities | Provision of knowledge and skills for effective utilization of non-food products (e.g., dead trees, bamboos, charcoals, wood vinegar). |
| **2. Forest resources management** | | |
| 2.1 Community forest establishment | MONRE, advanced community forest management committee | Introduction of regulation of forest resource management, registration of community forest to RFD, lessons for community forest establishment, supports for a set of procedures. |
| 2.2 Community forest management | MONRE, advanced community forest management committee | Enhancement of community forest management committee, making regulations and their actual improvement, learning/trial/practice about making rules for a beneficial utilization, and a sustainable utilization of forest. |
| 2.3 Forest Valuations | MONRE, related organizations, local intellectuals, Buddhist monks, local human resources, NGOs | Identification of useful animal and plant resources at forest, implementation of a joint field survey, learning for connections of natural resources to livelihood and farming, development of awareness of conservation, learning at areas where identification of forest resources is implemented and communities where are practicing management of animal and plant conservation. |
| **3. Forest rehabilitation** | | |
| 3.1 Forest rehabilitation | MONRE, PLRO, TAO, and advanced community forest areas | Introduction of knowledge and skills about supply of young plants, making firebreak, setup in the field, organizing observers for community forest, coordination of adjacent forest, provision of learning opportunities about management and conservation, and utilization of degraded forest land. |
| 3.2 Reserved forest area delineation | MONRE, TAO | Presence in the boundary setting of community forest and reserved forest area, joint survey of villagers. |
| **4. Natural resource conservation** | | |
| 4.1 Soil conservation | LDD, DOAE, MONRE, universities, advanced practice farms, local human resources | Introduction of making organic fertilizer for soil improvements, soil conservation farming method at steep sloping land (mixed crop, plant cover, anti-erosion plant), introduction of successful case examples and offer of learning opportunities, study tours for eroded areas, supports for making policies and application thereof. |
| 4.2 Water conservation | TAO, MONRE, LDD, advanced forest community areas, PWO, RID | Conservations of water sources (e.g., forestation, forest rehabilitation), construction of check dams and channels, learning/practice of managing and maintenance. |

| Program/Component | Related stakeholders | Roles of stakeholders |
|---|---|---|
| ***Livelihood improvement plan*** | | |
| **1. Livelihood improvement** | | |
| 1.1 Non-agricultural income generation | Local human resources, NGOs, TAO, CDP | Supports for creation of opportunities for non-agricultural income generation using local resources (textile weaving, artificial flowers, and making wood works) and subsidization. |
| 1.2 Expenditure reduction | Local human resource | Necessary activities for expenditure reduction to improve livelihood (utilization of local resource and making daily commodity for themselves). |
| 1.3 Energy saving | Local human resource | Strategies of saving fuel to decrease expenditure, survey for local resources, plant of physic nuts, high-efficiency stoves, utilization of bio-diesel. |
| **2. Fund development** | | |
| 2.1 Locally accessible capital/fund development | TAO, local human resources | Funding development of saving, welfare, and farming. |
| **3. Health and welfare improvement** | | |
| 3.1 Health improvement | TAO, health administration clinics | Activity to improve villager's health/welfare cooperating with local traditional doctors. |
| 3.2 Culture dissemination | TAO, Local intellectuals | Succession of traditional culture, local knowledge and sprit ceremony of forest |
| **4. Infrastructure development** | | |
| 4.1 Social infrastructure | TAO, related organizations to infrastructure development | Survey and supports for social infrastructure (e.g., electricity and water service) and living infrastructure (drinking water/sewerage system). |
| 4.2 Living condition improvement | | |
| ***Agriculture development plan*** | | |
| **1. Agriculture production** | | |
| 1.1 Crop production | LDD, DOAE | Learning/ practicing of knowledge about crops which suited to soil series, introduction of crops for home consumption and post rice paddy, and introduction of knowledge/skills of crop production utilizing local resources. |
| 1.2 Farming technology improvement | Local human resources universities, DOAE, DOA | Introduction of a farming method with reduction of production cost, organic farming, integrated farming, provision of learning opportunity, an appropriate breed variety and a cropping method for soil and climate. |
| **2. Livestock development** | | |
| 2.1 Livestock raising | Local human resources, DOL, DOF, LDD, DOAE | Introduction of fund development in case of rebuilding small-scale livestock/fish farming (fish culture, chickens, pigs, cattle, frogs), introduction of appropriate skills locally adopted, introduction of case examples, provision of learning opportunities, supports for trial/practice, introduction of knowledge of artificial insemination, a sustainable utilization of land, feed production in the dry season. |
| 2.2 Feed production | | |
| **3. Farm produce processing** | | |
| 3.1 Plant material processing | Local human resources, DOAE、DOA, TAO | Introduction of applicable skills to process local product (rice, chili, cassava). Provision of knowledge/skills (brown rice, local alcoholic beverage, making juice, utilization of rice straws and husk). |
| 3.2 Animal material processing | Local human resources, DOL, TAO | Introduction of appropriate knowledge/skills about processing of animal products (fish sauce and meat processing). |

| Program/Component | Related stakeholders | Roles of stakeholders |
|---|---|---|
| **4. Marketing** | | |
| 4.1 Enhancement of local circulation of farm produce | Local human resources, advanced areas, CDP | Provision of learning opportunities for market development (community market) and technical supports of market development activities. |
| 4.2 Marketing improvement of local specialties | | |
| **5. Infrastructure development** | | |
| 5.1 Water resources development | TAO, RID | Supports for request process to related organizations for construction of water resources facilities such as farm ponds and canals. |
| 5.2 On-farm facilities | TAO, PLRO | Supports for request process to related organizations for construction of on-farm facilities such as farm road. |

Note: Department of Agricultural Extension (DOAE), Department of Livestock (DOL), Department of Fishery (DOF), Land Development Department (LDD), Community Development Plan (CDP), Royal Irrigation Department (RID)

### 6.3.4 Roles of Stakeholders in Promotion for Natural Resources Management Plan

There are required programs/ components/ activities in the natural resources management plan. These should be implemented in cooperation with various stakeholders such as RFD, TAO, farmer leaders in the areas/ communities and villagers. In order to realize these activities, responsibility and roles of stakeholder are especially important, as follows.

- PLRO and MONRE should organize study tours (e.g., 'learning center' on natural resources at Chiang Mai) and provide learning opportunity for local people/ villagers, in order to encourage them to grow 'awareness' for realization of required programs/components.
- MONRE should provide technical information and supports in the presence of components/ activities such as 'putting boundary markers', 'food utilization', 'forest valuation', 'construction of small-scale check dam/weir' under the water conservation component. Moreover, MONRE, PLRO and related organizations should introduce advanced areas/ communities of these activities as appropriate study tours to show future picture after completion of these activities. MONRE should cooperate with PLRO to materialize the 'reforestation activities' such as provision of seedlings.
- For promotion and expansion of 'soil erosion prevention farming', responsible organizations such as LDD, DOAE, and universities should provide appropriate study tours and any learning opportunities in which LRAs people can learn its practical way and motivation. The organizations should support LRAs people technically and financially to apply soil erosion prevention farming on their farm lands.
- Related Tambons should incorporate the required activities such as 'construction of check dams/ weirs' and 'making fire break line' into the Tambon development plan with financial supports as regular annual activities.
- Official and/or unofficial leaders in villages and communities should encourage villagers to participate in joint and required activities and facilitate such activities in the fields.
- RID should conduct feasibility study for water resource development and construction of

soil/water conservation facilities in and around LRAs by request from PLRO and TAO.

## 6.4 PROJECT IMPLEMENTATION PLAN OF THE M/P

### 6.4.1 Scenarios of Project Implementation Plan

Scenarios of project implementation plans of the M/P are supposed based on funding sources.

Objectives of the M/P are achieved with accumulation of achievements of qualitative and area development. The progress is largely depending on amount of fund for the M/P implementation. Scale of the M/P implementation is also affected by available fund. Considering present implementation capacity of ALRO who is considered to be the core of project implementation organization, following three scenarios are described depending on funding for project implementation.

Scenario-1 ; Funding is not provided.

PLRO may utilize the M/P as a guideline for development. The pilot project sites are functioned as model areas or learning centers, and ALRO may promote development at the LRAs in the province within its regular budget. Due to the limited regular budget, the number of Tambons where are able to implement activities may be uncertain. Therefore, qualitative development is limited into some individual components/ activities depending on farmers' self-fund and limited budget of TAO. Progress of area development may be extremely slow and achievement of the objectives may be uncertain with extremely low speed.

Scenario-2 ; M/P is incorporated into on-going programs of ALRO.

Concepts of the M/P are incorporated into on-going programs of ALRO such as 'Sufficiently Economy Settlement', 'Learning Center for Sufficiency Economy Community', and 'Local Intellectual Network'. It is possible that livelihood improvement/sustainable agriculture development plan is reflected into these programs. However, it is required that natural resources management plan is reflected. In addition to the implementation of 'Sufficiently Economy Community', a 'learning center' for the natural resources management plan is established based on the M/P code areas and river basins. Qualitative development at a site (Tambon) is possible with implementation of 'Sufficiency Economy Settlement', but area development is limited as a site (Tambon)/ year in that program. Employment of facilitators is needed to reflect concepts of the M/P into the program. Achievements/ impacts are limited within Tambon level implemented.

Scenario-3 ; Special fund is provided for M/P implementation with setting of target year

M/P implementation is attempted to achieve objectives with a target year. It is implemented as a special project of which implementation process is more effective than the scenario-1 and 2. For example, if the implementation period may be set in ten years, area development may be planned at from four to five Tambons per year in each province. Since scale of the projects is larger than the pilot projects, ALRO may not implement within the ordinary task with budget. Special fund is necessary. Considering anticipated scale of the project and implementation capacity of ALRO, a project implementation organization should be established independently of the existing ordinary organization.

Implementation organizations, outcome/impact/achievement and risks in each scenario anticipated as follows

| Scenario | Implementation Organization | Outcomes/Impacts/ Achievement | Risk |
|---|---|---|---|
| 1 | Existing organizations of PLRO | Low | Discontinuation of the implementation in connection with the pilot project because of regular PLRO staff personnel changes. |
| 2 | Existing organizations of ALRO/ PLRO and facilitators | Moderate | Reduction of available budget and/or suspension of the program because of administrative and social changes. |
| 3 | An independent organization of existing organizations such as PMU and facilitators. | High | Funding arrangement is unsecured due to government budget limitation. |

The achievement of objectives in the scenario-1 is unsecured since the M/P implementation may be limited into individual components /activities under budget limitation. In the scenario-2, the achievements are also unstable since its implementation which are to be incorporated in the on-going programs, may be arranged each other. Considering the outcomes, impacts and achievement of three scenarios, in order to ensure the achievements, the scenario-3 is necessary.

However, administration environment to stand up the M/P project should be arranged. Meanwhile, considering present budget constraints for realization of the project, it may take time to obtain its budget. If the time is anticipated to be long, the M/P implementation may be initiated with the scenario-2. It is recommended to arrange the administration environment including funding for the scenario-3 in the course of the implementation of the scenario-2. After the project preparation, the scenario-3 can be conducted.

In any case, considering the alternatives as mentioned above, it is proposed that the project is implemented with the scenario-3.

Thus, M/P implementation project plans are designed based on the scenario-3 in this study.

### 6.4.2 Basic Concept for M/P Project Implementation Plans

**(1) Phasing project**

A long term for the M/P implementation (e.g., ten years) is required, if all the Tambons are targeted for the M/P project implementation. In north region, it can be said that political, social and economic conditions that are related to the realization of the project, are unstable. In addition, it is designed to incorporate progress of networking and supports from local human resources, which cannot be planned beforehand, in the course of the project implementation. As mentioned in the framework of the M/P implementation, operation of the M/P implementation has to be flexibly planned. Considering those, a design for operation of the M/P implementation is approached as follows.

- M/P project implementation consists of two implementation phases.
- Target year for the project implementation is set at ten-years. Implementation period of each phase is planned at five-years. Phase-II should be planned based on the review of phase-I.
- Targeted Tambons may be selected based on the boundary of river basin and M/P code area.

- Five Tambons are selected as the core of the provincial M/P implementation.
- The five Tambons and their neighboring Tambons are the target in the Phase-I. The other remainder are targeted for phase-II.
- A project implementation plan of phase-II may be formulated in the course of the implementation of Phase-I, reflecting outcomes of the phase-I including progress of making networks.
- The way of the M/P implementation are flexibly changed in the course of the implementation such as Tambon selection and provision of supports depending on monitoring and evaluating the progress in each implementation level.

**(2) Project implementation agency**

The project implementation agencies are the Agricultural Land Reform Office (ALRO) in Central level, and the Provincial Land Reform Office (PLRO) in provincial level

**(3) Project implementation Organization**

**1) Establishment of Project Management Unit (PMU)**

PMU (Project Management Unit) should be established for smooth implementation of the M/P project. It is an independent organization of existing organizations. The PMU is established in the ALRO and PLRO. PMU should engage in the project implementation and function as an implementation body of administration side.

To examine organizing the PMU, function and capacity of present organization of ALRO/ATSAP, PLRO, and TAO are reviewed as follows.

**Table 6.4.1 Function and Capacity of Existing Organizations for Organizing PMU**

| Organization | Functions of existing organizations and analysis for organizing PMU |
|---|---|
| ALRO | The main duty is distribution of land use title in the LRAs. Although it has experience of similar project implementation, the number of staff who is well versed in participatory development is not many. It is hard to employ a new full-time project staff. Organization capacity is sufficient to manage overall M/P implementation. |
| ATSAP | Main responsibility is to study and formulate policies and prospective development plans for sustainable agriculture. It has no regional and provincial offices. In the office, there are staffs who have knowledge and experience of participatory approach. |
| PLRO | It is the implementing agency of distribution of land titles and development in provincial level. It has experience of similar project implementation. Considering the present organization capacity, the number of staff who can manage the M/P implementation with ordinary works, is limited at two or three. It is hard to employ new full-time project officers. |
| TAO | In general, there are three full-time staffs. The number of staff who has knowledge of participatory development is small. There is no staff who can work for only the M/P implementation full-time. Organization capacity is not enough to manage full-scale project implementation. It is hard to employ a new officer as well. |

It is appropriate that PMU is organized with staffs of ALRO, ATSAP and PLRO as core of implementation body, considering experience in the pilot project (ALRO, ATSAP and PLRO were the core and flexible cooperation system with other organizations (e.g., MONRE, LDD, DOAE) has been established.)

PMU consists of full-time project staffs. Considering their capacity and the mechanism of project implementation, a project manager and three project management officers are allocated from ALRO and two coordinators from ATSAP are allocated in central level. PMU is placed in the ALRO. In addition, two management staffs are allocated in PLRO in provincial level. It is required that allocated staffs are well versed in participatory approach and three sector programs of the M/P.

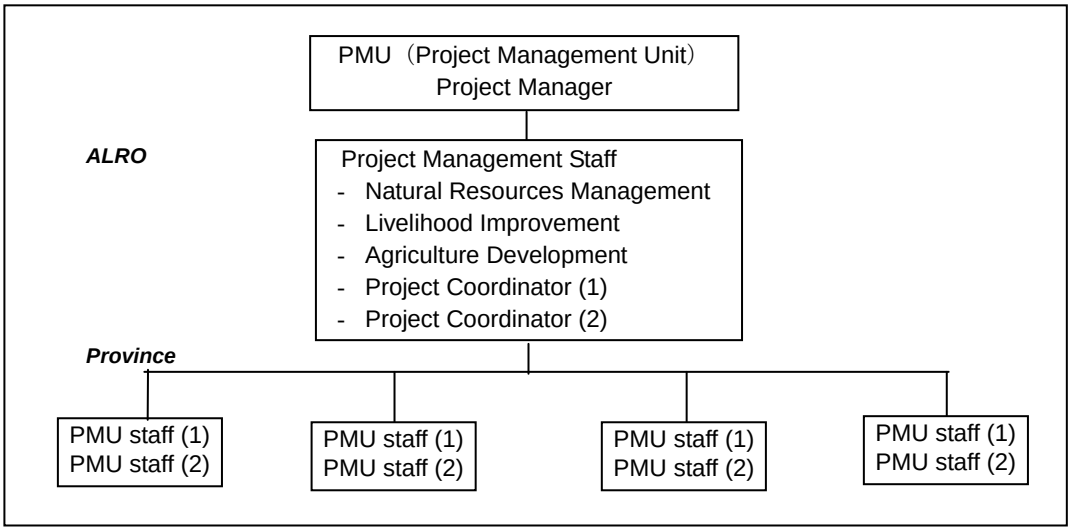



**Figure 6.4.1 PMU Organization**

Training for the PMU staff

ALRO has to conduct appropriate training for the PMU staff which aims to develop capacity of M/P project implementation including understanding of concepts of the M/P, and operation/ management methods and contents of each sector. The training can be conducted using experiences and outputs from the pilot projects and on-going similar projects.

- C/P staff who participated in the pilot projects and other staff who are engaging in similar projects
- Human resources and intellectuals of NGOs and universities that participated in the pilot projects.
- Activity records and visits for the pilot project sites.

**2) Employment of facilitators**

The necessity of facilitators was verified through the pilot project implementation. The facilitators should be incorporated in the project implementation. Capacity of government organization for allocation of facilitators is reviewed as follows.

**Table 6.4.2 Capacity of Governmental Organizations for Allocation of Facilitators**

| Government organizations | Capacity for allocation of facilitators |
|---|---|
| Tambon | Although human resources who have knowledge of participatory development are existed, they do not have sufficient capacity to operate qualitative development process. It is hard to employ new officers. However, some of them can be leaders for the activities. |
| PLRO | Although there are some staffs who have knowledge and experience of participatory development, it is hard for them to stay in the villages for daily operation of project in order to facilitate local people's activities. However, they can support the activity cooperating with |

| Government organizations | Capacity for allocation of facilitators |
|---|---|
| | facilitators. If the staffs function as facilitators, it may be required to improve the current system and conduct appropriate training and education as facilitator. There is no system to employ new staff as facilitator. |
| ALRO/ATSAP | There are human resources who have knowledge and experience of participatory survey, there are few people who can facilitate qualitative development process as facilitators, the same as in the province. There is no system to employ new staff as facilitators |

As mentioned in the above table, it is difficult to allocate facilitators from governmental organizations, considering allocation capacity of each governmental organization, necessity of training of staffs to be facilitators. On the other hand, there exist NGOs, who are familiar with participatory approach and have experiences, skill and knowledge as facilitator, in north region. It is the most realistic idea to utilize NGOs as facilitators. (It is also possible to utilize the NGOs that have engaged in the pilot project.)

Allocation of field workers who help facilitator facilitate people's qualitative development, lead and promote activities is planned in the project implementation. The field workers are allocated in the Tambon basis.

Training of facilitators

Facilitators need facilitation skills when qualitative development is implemented in the villages/ communities. Moreover, they need to understand basic concept and implementation mechanism/ method of the M/P before the project starts. Prior to the project implementation, therefore, ALRO/ATSAP together with PMU should conduct appropriate training program which aim to educate facilitators about the M/P and develop their ability and skills for facilitation. Training programs can be realized by inviting the facilitators who engaged in the pilot project. Training subjects are listed as follows.

- Concepts of the M/P (objectives of the M/P, implementation of the three sector programs/components in an integrated manner, participatory approach with learning processes, utilization of local human resources, and networking)
- Roles of facilitators for the M/P implementation
- Introduction of case examples of the pilot project by facilitators

### 3) Roles of the project implementation organizations

The project implementation organization is illustrated as follows.

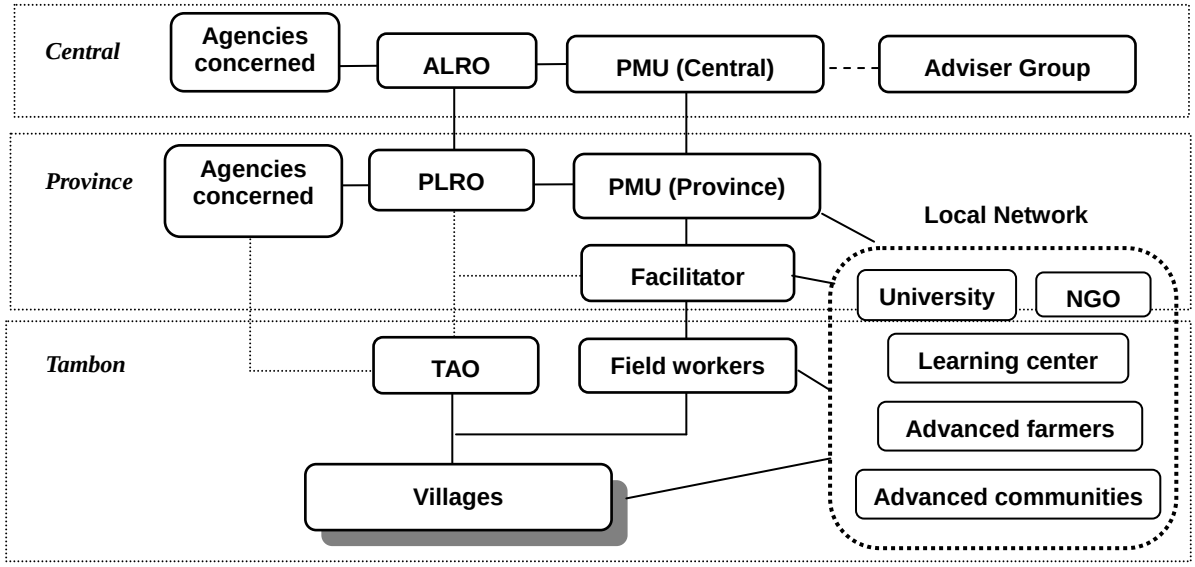



**Figure 6.4.2 M/P Implementation Organization**

PMU is responsible for the project implementation under ALRO. Major roles of the PMU which is overlapped with those of government organizations such as ALRO and PLRO, is listed as follows. Major responsibility of the PMU is to operate and manage the proposed project as the executing agency, in coordination with the related organizations. Those roles may be revised and added on the PMU, monitoring and evaluating the working progress.

**Table 6.4.3 Roles of the M/P implementation organizations**

| PMU | Expected roles |
|---|---|
| PMU (Central) | - Coordination among ALRO, ATSAP and related originations<br>- Comprehensive progress management of the provincial M/P<br>- Public relation of the M/P for related organizations<br>- Preparation of work design for provincial PMU and facilitators<br>- Set up of provincial PMU<br>- Arrangement with components/ activities and on-going plans/ policies of related organizations<br>- Design and enforcement of budget planning and its progress report to ALRO<br>- Education and training for PMU staff<br>- Implementation of training for facilitators/ fieldworkers<br>- Operational support of stakeholder meeting<br>- Participation in participatory monitoring and evaluation and its operational support<br>- Policy recommendation to ALRO/ ATSAP based on the monitoring and evaluation of the implementation progress<br>- Preparation of development strategy for expansion of M/P concepts to 13 provinces<br>Coordination among ALRO and other related departments |
| PMU (Province) | - Coordination with PLRO for project implementation<br>- Selection of targeted Tambons for the M/P implementation<br>- Prior consultation for making consensus of the M/P implementation with Tambons, and establishment of cooperation system with the Tambon.<br>- Cooperation and coordination with provincial related organizations for the M/P implementation |

| PMU | Expected roles |
|---|---|
| | - Distribution of activity fund for qualitative development into the Tambons<br>- Establishment and arrangement with provincial related organizations for M/P implementation<br>- Arrangement of technical supports for the M/P implementation with related organizations and local human resources<br>- Training for fieldworkers with facilitators<br>- Networking for the activity<br>- Arrangement of the learning processes for villagers (learning opportunity, study tour)<br>- Holding stakeholder meetings/ workshops/ seminars<br>- Suggestion and recommendation on development policies to central government based on an progress evaluation of the M/P<br>- Suggestion and recommendation on the expansion and promotion method of M/P based on the evaluation of project implementation |
| Facilitator | - Technical supports of planning/ implementation and evaluation of the activities by villagers<br>- Guidance of participatory development<br>- Facilitation of CDP preparation and qualitative development<br>- Training for fieldworkers<br>- Coordination of learning opportunities and clarification of necessary technical supports in the course of qualitative development<br>- Consultation and arrangement of learning opportunities among provinces, related organizations, Tambons, local resources and networks<br>- Support for organizing activity group and supporting activities<br>- Holding stakeholder meetings/ and operational support<br>- Support for networking<br>- Operational support for participatory monitoring and evaluation<br>- Suggestion and recommendation of policy and plans to provincial PMU |
| Fieldworkers | - Assistance of the facilitator<br>- Organizing activity groups<br>- Supports of the activities |

Note: Expected roles are overlapped with those of government organizations shown in Table 6.3.1.

### 6.4.3 M/P Project Implementation Plan (Phase-I )

#### (1) Target Tambons for the phase-I

Considering the basic concept of the project implementation, for the phase-I, target Tambons are selected based on the M/P code areas and river basins, as follows.

**Table 6.4.4 The Number of Target Tambons and M/P Code Areas for Phase-I**

| Province | The number of target Tambons and areas (Phase I) | |
|---|---|---|
| | M/P code area | Tambon |
| Phayao | 7 | 15 |
| Phrea | 5 | 9 |
| Nan | 7 | 10 |
| Phitsanulok | 2 | 5 |

The number of targeted Tambons is different from four provinces. Since the implementation in each Tambon may be flexibly progressed, coordination among Tambons such as joint study tours and mutual visits, should be the key for smooth and effective implementation. Related with the selected Tambons, core Tambons are listed as follows.

**Table 6.4.5 Core Tambons and M/P Code Areas for Phase-I**

| Phayao | | Phrea | | Nan | | Phisanulok | |
|---|---|---|---|---|---|---|---|
| Tambon | PYO | Tambon | PRE | Tambon | ANN | Tambon | PIK |
| Ban Tun | 11 | Wiang Ta | 05 | Yap Hua Na | 13 | Suan Miang | 01 |
| Tha Jam Pee | 10 | Pak Kang | 08 | Ai Na Lai | 15 | Tha Sakae | 01 |
| Mae Suk | 11 | Phai Thon | 04 | Mae Sakhon | 15 | Pa Daeng | 01 |
| Nong Lom | 12 | Thung Sri | 04 | Lai Nan | 18 | Khan Chong | 02 |
| Pong Jen | 07 | Mae Sai | 03 | Tan Chum | 18 | Hin Lat | 02 |

### (2) Project implementation period

The project implementation period is targeted at five years. Therefore, area development is launched in from four to five Tambons in a year. Implementation period of qualitative development in each Tambon is preliminarily set at three-years (Three times of the cycle of planning/ implementation/ feedback are practiced in the period. Enhancing the ability of villagers and networking are attained during the period, in order to secure sustainability of components/ activities).

### (3) Approximate project implementation cost

The project implementation cost of the Phase-I consists of; 1) cost for learning / trials / practice (for learning opportunities such as study tours and meeting/ workshops, and people's activities in trials /practice processes), 2) construction of infrastructure, 3) employment of facilitators and fieldworkers, 4) operation and maintenance of the project

**Table 6.4.6 Estimation of Approximate Project Cost (Phase-I)**

| Item | Unit | Cost (1,000 Bahts) | Remarks |
|---|---|---|---|
| *Central level* | | | |
| Project supervision | Set | 26,000 | Monitoring and evaluation, Project office OM |
| Sub-total | | 26,000 | |
| *Provincial level* | | | 4 provinces |
| Infrastructure | Set | 1,340,800 | Civil works |
| Equipment/ machinery | Set | 24,000 | Vehicle, Office equipment, etc |
| Learning/ Trial/ Practice | Set | 147,000 | Learning process |
| Consulting services | Set | 146,500 | Facilitators, Field workers |
| Project supervision | Set | 36,000 | Project offices, O/M of the offices |
| Sub-total | | 1,694,300 | |
| Grand total | | 1,720,300 | |

Project cost is estimated based on the following conditions.

- Project supervision cost in central office is estimated as follows.

| Items | Cost（1,000baht） | Remark |
|---|---|---|
| Employment of office worker | 9,000 | Five office workers |
| Monitoring and evaluation | 12,000 | Meetings/ workshops (four per a year) |
| O/M of the office | 5,000 | Computer, office machine and others |
| Total | 26,000 | |

- Cost for learning/trials/practice were estimated at 1,000,000 baht/year/Tambon based on the pilot projects.
- Cost for construction of infrastructure was estimated from those of components of livelihood improvement plan and sustainable agriculture development plan. Related components are 'social infrastructure' and 'living condition improvement' in the livelihood improvement plan, and 'water resources development' and

'on-farm facilities' in the sustainable agriculture development plan. In those components, activities of 'individual farm pond development', 'groundwater development (with micro-irrigation system), and 'on-farm road improvement/development' were picked as the infrastructure which ALRO/ PLRO can construct with their responsibility in the LRAs (unit cost is referred in 5.4).

**Quantity of infrastructure provision**

| Province | M/P code area | Area (rai) | No. of farm pond | No. of well (with micro-irrigation) | On-farm road (km) |
|---|---|---|---|---|---|
| Phayao | PYO-07 | 30,458 | 459 | 11 | 30.0 |
| | PYO-08 | 11,222 | 493 | 6 | 3.5 |
| | PYO-09 | 35,123 | 798 | 36 | 11.3 |
| | PYO-10 | 20,634 | 337 | 206 | 19.8 |
| | PYO-11 | 75,233 | 825 | 562 | 12.7 |
| | PYO-12 | 25,973 | 1,422 | 73 | 11.5 |
| | PYO-13 | 22,504 | 1.545 | 30 | 17.0 |
| | *Total* | *221,147* | *5,879* | *924* | *105.8* |
| Phrae | PRE-03 | 9,377 | 248 | 12 | 2.1 |
| | PRE-04 | 25,383 | 374 | 40 | 11.3 |
| | PRE-05 | 130,263 | 683 | 22 | 2.1 |
| | PRE-07 | 88,959 | 589 | 18 | 1.4 |
| | PRE-08 | 132,241 | 2,592 | 181 | 21.1 |
| | *Total* | *386,223* | *4,486* | *279* | *38.0* |
| Nan | ANN-05 | 37,119 | 1,621 | 62 | 7.8 |
| | ANN-11 | 55,358 | 959 | 263 | 56.7 |
| | ANN-12 | 59,951 | 1,034 | 31 | 53.2 |
| | ANN-13 | 71,058 | 501 | 73 | 17.3 |
| | ANN-15 | 35,976 | 1,732 | 17 | 24.2 |
| | ANN-18 | 31,622 | 400 | 58 | 30.9 |
| | ANN-19 | 28,229 | 14 | 5 | 20.6 |
| | *Total* | *319,313* | *6,261* | *509* | *210.7* |
| Phitsanulok | PIK-01 | 148,238 | 2,727 | 101 | 127.3 |
| | PIK-02 | 74,308 | 989 | 56 | 54.1 |
| | *Total* | *222,546* | *3,716* | *157* | *181.4* |

- Improvement and construction cost of infrastructure is estimated as follows based on the quantity in the above table.

**Improvement and construction cost of infrastructure (unit; baht)**

| Infrastructure | Phayao | Phrae | Nan | Phitsanulok |
|---|---|---|---|---|
| Farm pond | 361,117,575 | 275,552,550 | 295,515,675 | 228,255,300 |
| Well (with micro-irrigation) | 57,897,840 | 17,106,180 | 31,893,940 | 9,837,620 |
| On-farm road | 12,569,095 | 4,514,420 | 25,031,266 | 21,550,411 |
| Total | 431,584,510 | 297,173,150 | 352,440,881 | 259,643,331 |

- Allocation of facilitator and field worker is planned two facilitators per province and two field workers per Tambon.
- Equipment and machinery of PMU provincial office is estimated at 6.0 million baht per province.
- Project supervision such as O/M cost of the provincial PMU office is estimated at 9.0 million baht per province, based on the employment of two office workers and O/M cost of the office.
- Based on the above conditions, project cost of each province is approximately estimated as follows.

**Approximate project cost of each province (unit; 1,000 baht)**

| Items | Phayao | Phrae | Nan | Phitsanulok | Total |
|---|---|---|---|---|---|
| Infrastructure | 431,584 | 297,173 | 352,441 | 259,643 | 1,340,841 |
| Equipment/ machinery | 6,000 | 6,000 | 6,000 | 6,000 | 24,000 |
| Learning/ Trial/ Practice | 45,000 | 42,000 | 45,000 | 15,000 | 147,000 |
| Consulting services; Facilitators | 6,000 | 6,000 | 6,000 | 6,000 | 24,000 |
| Consulting services; Field workers | 37,500 | 35,000 | 37,500 | 12,500 | 122,500 |
| Project supervision | 9,000 | 9,000 | 9,000 | 9,000 | 36,000 |

The project cost is estimated at 1,720 million Bahts. About 78% is shared by construction of infrastructure.

In principle, infrastructure should be provided by related organizations by villager and community's request through community development plan. In the M/P implementation, those infrastructures are picked to be the infrastructure facilities such as small ponds in the LRAs, farm road, small-scale irrigation and drainage canals which ALRO and PLRO can deal in their tasks. Those infrastructures may be incorporated into the development plans of Tambon and related organizations. Requested infrastructure may not relate directly to the activity process of learning/ trials/ practice. Considering these conditions, infrastructure may not always be provided in the project. The infrastructure may be constructed and improved independently of the M/P implementation depending on budget availability.

## 6.5 FORMULATION OF DEVELOPMENT STRATEGY FOR SUPER GOAL

### 6.5.1 Overall Development Strategy

The pilot project in the selected Tambons is the first step in order to achieve the super goal. Based on the performance and experiences form the pilot project implementation, effectiveness of the M/P was examined, and lessons learned through its implementation were reflected on the M/P. After the implementation of the pilot projects, the M/P will be continuously implemented in the four provinces. In the course of the M/P implementation, expansion strategy of the M/P concept should be formulated for other 13 provinces in north region, based on the evaluation of outcomes and experiences accumulated through the M/P project implementation. According to the expansion strategy, the concepts of the M/P will be expanded in the 13 provinces. The super goal can be achieved through these approaches. Overall development strategy for the goal is illustrated in the following figure.

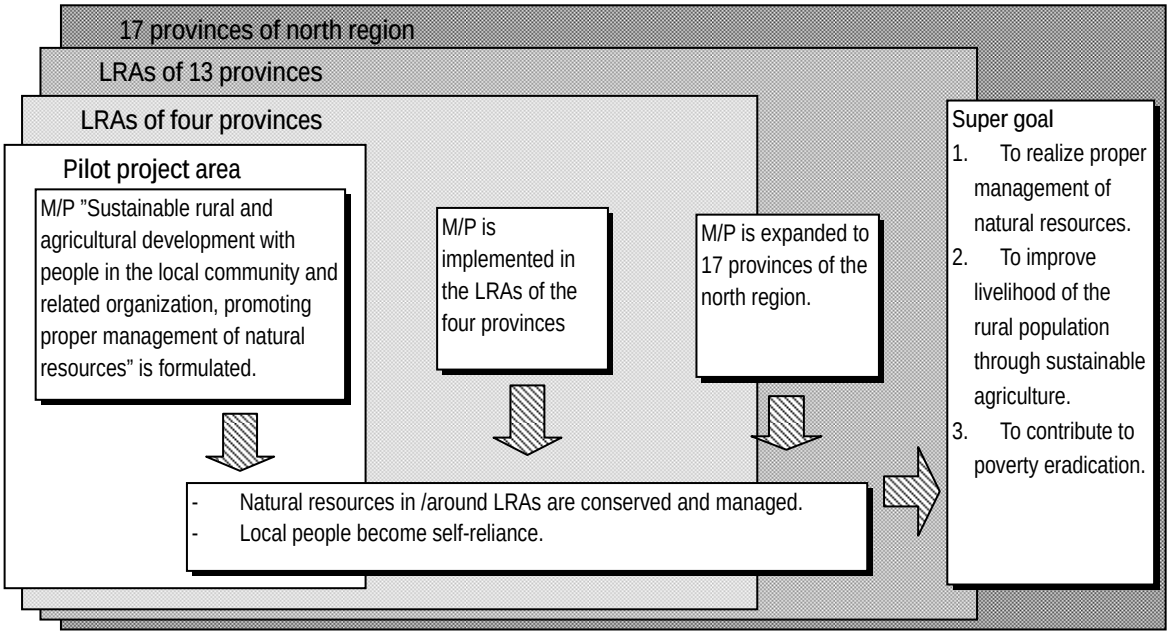



**Figure 6.5.1 Overall Development Strategy for Super Goal**

### 6.5.2 Formulation of Road Map

The M/P should be implemented in the long-term timeframe. However, political environment to support long-term implementation to achieve the super goal is not very stable. In addition, socio-economic conditions in the north region are changing rapidly. It is rather difficult to make consensus among Tambons and prepare implementation schedule in advance. Considering these situations, it is difficult to discuss the development strategy on the long-term timetable. However, to direct toward the super goal, at least, the following milestones should be set on the timetable as a road map.

- Pilot project implementation is continued.
- Administration environment to launch the M/P project is provided.
- The M/P project is implemented in the four provinces (Phase I and Phase II)
- The M/P project implementation is overall evaluated.
- Expansion strategy of the M/P concept is formulated for the 13 provinces.
- Project with M/P concept is implemented in the 13 provinces.

These are summarized in the timeframe as a short term (one to five years), a midterm (6-10 years), and a long term (11-20 years) as follows.

| Milestones | Pre. | Short term (1 -5 years) | Midterm (6-10 years) | Long term (11-20 years) |
|---|---|---|---|---|
| 1. Continuation of the pilot projects | → | | | |
| 2. Provision of administration environment for realization of the M/P project | → | | | |
| 3. M/P project implementation (Phase-I) | | ——— | | |
| M/P project implementation (Phase-II) | | | ——— | |
| 4. Overall evaluation of the M/P project implementation | | | - - - → | |
| 5. Formulation of expansion strategy of the M/P concept for 13 provinces | | | → | |
| 6. Project implementation with M/P concept in the 13 provinces. | | | | → |

**Figure 6.5.2 Road Map for Super Goal**

#### (1) Continuation of the pilot projects

The pilot project sites/ communities should be functioned as model sites or learning centers for next M/P project. Performance including people's activity process and supports from outsiders are shown for neighboring local people/ communities and Tambons. Considering the significance of the pilot projects, on-going activities should be continuously followed and supported. The activities should be monitored and evaluated until they become established in the sites/ communities.

#### (2) Provision of administration environment for realization of the M/P project

During the continuation of the pilot project, administration conditions for the M/P project implementation should be arranged based on the scenario-3. ALRO should deal in the followings.

- Making consensus among related organizations (Basic concepts of the M/P, mechanism and

method of project implementation, establishment of cooperation system with related organizations)

- Project funding for M/P implementation (Phase I)
- Establishment of PMU and training of the PMU staffs
- Employment of facilitators
- Orientation for facilitators prior to the M/P implementation

**(3) M/P project implementation in the four provinces**

Based on the basic concept as mentioned above, the project is implemented as a special project with project fund. Pilot project sites are utilized as model sites or learning centers for effective implementation. Projects are implemented in the two phases-I and II. The number of targeted Tambons of each Phase is preliminary planned as follows.

**Table 6.5.1 The Number of Targeted Tambons and M/P code area**

| Province | Number of target Tambon / MP code Area (Phase I + II) | | Number of target Tambon and M/P code area (Phase I) | | Number of target Tambon (Phase II) |
|---|---|---|---|---|---|
| | M/P code area | Tambon | M/P code area | Tambon | |
| Phayao | 14 | 51 | 7 | 15 | 36 |
| Phrea | 14 | 42 | 5 | 9 | 33 |
| Nan | 20 | 76 | 7 | 10 | 66 |
| Phitsanulok | 4 | 17 | 2 | 5 | 12 |

**1) Project implementation (Phase-I)**

Phase-I project is implemented based on the project implementation plan as mentioned in 6.4.3. Considering the way of next phase-II implementation, the following matters should be concerned in the phase-I implementation.

- Implementation progress is monitored and evaluated in each level. Especially, selection method of target Tambons and cooperation system among related organizations including local resources and network is flexibly evaluated. The results are immediately reflected in on-going implementation.
- Establishment of a mutual edifying opportunity for facilitators and PMU.
- Capacity development of fieldworkers should be promoted as the on-the-jog training in the qualitative development process. The fieldworkers should be educated and trained as being facilitators in that Tambon.
- Learning opportunity for ALRO/ PLRO staff and related organizations including TAOs, should be provided for capacity development for them for future project implementation.
- Adjacent Tambons are invited to the stakeholder meetings/ workshops and the learning/ trails/ practice processes of local people as necessary. Through the involvement in the implementation process, local people and related community can understand the concepts of M/P, which makes expansion of activities more effective.
- After completion of the phase-I project, a project implementation plan of the phase-II should be prepared. For the preparation, the following points should be considered.
    - Evaluation of the activity including an emergence of achievement and implementation process in the Tambon where programs/ components/ activities have been implemented.

- Cooperation among related organizations (particularly MONRE)
- Cooperation with Tambons in implementation of natural resources management plan
- Extent of promotion/ expansion of activity and networking of activity groups
- Effectiveness of implementation organizations, especially PMU, facilitators/ fieldworkers.

**2) Phase -II**

Project implementation period

The project implementation plan of phase-II is designed after evaluation and analysis of achievements of phase-I. After approval of its plan from related government organizations, the project is implemented as a special project in the same way as the phase-I. The project implementation period is targeted at five years, but it is planned with considering the evaluation and monitoring results of the implementation progress of the phase-I.

Targeted Tambons for phase-II

The target Tambons of the Phase-II is listed based on the phase-I. Temporally, the number is determined as Phayao (36), Phrae (33), Nan (66), and Phitsanulok (12).

Implementation organizations

PMU and facilitators are the core of the project implementation as it as in the phase-I. However, Implementation organization of the Phase II is established through evaluating and analyzing effectiveness of PMU (Central and Provincial) of the Phase I, actual situations of cooperation among local human resources and related organizations, effectiveness of networking, supports from outsiders and allocated facilitators/ field workers.

Estimation of project costs

Based on the results of the phase-I, cost estimation is reviewed. Based on the review, costs for employment of facilitators/ fieldworkers, learning/ trials/ practice processes, and infrastructure are estimated.

Implementation of phase-II project

The targeted number of Tambons for phase-II is larger than that of the Phase-I. Thus, the implementation needs to be more efficient than the Phase-I. Considering an efficient implementation method in this phase and future expansion manner into 13 provinces, the following points are emphasized in the Phase-II implementation.

- By utilizing networks and fieldworkers which have been established in the phase-I, mutual supporting systems are built including adjacent Tambons, in order to make promotion/ expansion of activities more easily.
- The Tambons implemented in the Phase-I are designated as ‘learning centers’. Tambons/ local people/ villagers in the Phase II are able to learn the processes of learning/ trials/ practice through study tours for the ‘learning centers’.
- Fieldworkers allocated at each Tambon are educated so that they can play as facilitators and

support qualitative development in neighboring Tambons.

- Officers at PLRO in neighboring provinces are invited to stakeholder meetings/ workshops and opportunities of people's activities so that they can understand the M/P concepts and implementation methods.

### (4) Overall evaluation of the M/P projects

When the phase-II is completed, the phase-I and II project implementation should be evaluated. Based on the evaluation, expansion strategies for the M/P concept in the 13 provinces are formulated. The followings are to be put in the evaluation.

- Evaluation of achievements and validity of the M/P implementation (emphasized on the natural resources management)
- Evaluation of promotion and expansion process with networking
- Effectiveness of implementation organizations (government organization, related organizations, PMU and facilitators/fieldworkers)

### (5) Formulation of expansion strategies of the M/P concept for 13 provinces

Based on the evaluation of the M/P projects, promotion and expansion strategy of the M/P concepts is formulated for 13 provinces.

#### 1) Selection of target provinces

Based on a development strategy in the 'Strategic Development of Cluster, Office of the Prime Minister, Nov.2003', five provinces of cluster of the upper north may be prioritized, since the natural resource management plan is put as an important issue in these provinces.

| Priority | Cluster | Province |
|---|---|---|
| 1 | Upper North | Chiang Rai, Lampang, Lampum, Chiang Mai, Mae Hong Son<br>(Phayao, Phrae, Nan will be implemented in the M/P process. ) |
| 2 | Lower North Group-1 | Tak, Sukhothai, Uttaradit, Phetchbum<br>(Phitsanulok will be implemented in the M/P process.) |
| 3 | Lower North Group-2 | Kampaeng Phet, Pitchit, Nakon Sawan, Uthai Thani |

In the provinces of priority-2 and 3, related Tambons and LRAs where are adjacent to the community forest and conservation zone are targeted.

#### 2) Basic concept for formulation of expansion strategy

Although for the four provinces, the project is planned as special project with funding and implementation organization with PMU and facilitators, expansion strategy for 13 provinces should be formulated based on the followings.

- Although the strategy is prepared based on the overall evaluation of the M/P implementation in the four provinces, it is the basic concept that the M/P concepts should be expanded and promoted in the ordinary tasks of PLRO, not in the special project with fund.
- PLROs should incorporate the M/P concepts such as local people's implementation body, implementation of the three-sector plan with learning processes into their ordinary tasks in the LRAs.
- In general, organization of the PLRO is composed of five working units. In these units, the 'Land reform management' unit may be the core for expansion.

- The employment of facilitators should be limited as far as possible, because expansion is done in the regular budget, by full-use of fieldworkers and experiences from the Tambons where the qualitative development have been conducted.
- In addition, it becomes possible to support activities of villagers with educating local leaders as field workers. They can play as facilitator in the villages/ communities in future.

**(6) Project implementation with the M/P concepts in the 13 provinces**

Based on the expansion strategy, the M/P concepts are gradually promoted/ expanded from prioritized five provinces of the upper north. LRAs development is conducted with incorporating the M/P concepts as the ordinary tasks of PLRO. Because of the limitation of the budget, people's activities and supports from outside may be limited in the course of the implementation. However, it is expected that the M/P concepts is expanded through widen networks and accumulated outcomes. Especially, the five provinces are adjacent to the M/P project implemented provinces. Thus, it is easy to learn from there.

Although expansion and promotion activities are considered to be the small-scale in grass root level, super goal can be achieved with accumulating these activities.

### 6.5.3 Roles and Capacity Development of Government Organizations

**(1) Providing administrative environment for project implementation**

Degradation of natural environment derive from overuse of natural resources has constrained agricultural and rural development in the north region. Considering those current situations, the M/P was formulated in order to implement sustainable agricultural and rural development with practicing an appropriate natural resources management in the four provinces. First, the M/P is to be implemented in the four provinces. Afterward, the project implementation with the M/P concepts will be promoted in the other 13 provinces according to the scenario as mentioned in the 6.5.2. Super goal can be achieved through promotion and expansion of the M/P concepts.

As a fundamental implementation policy of the M/P, it is confirmed that participation and cooperation of local people who are utilizing natural resources in their daily living and farming practices, should be indispensable. Thus, local people are the main actors of the program/component/activities in the M/P implementation. Under this concept, important roles of governments are to make a better administrative environment to make it possible to implement activities proposed by local people and rural communities for improvement of their farming lands and communities. Moreover, the other roles are to promote and expand such local people's activities in the related LRAs and Tambons as mentioned in the 6.2.3 area expansion.

**(2) Cooperation with related government organizations**

As mentioned above, important roles of ALRO/ PLROs are to materialize activities proposed by local people and rural communities in cooperation with local human resources and related organizations. As for realization of the collective activities led by them, especially those in the natural resources

management and conservation plan (e.g. making firebreak line, reforestation, putting forest boundary, soil conservation and water conservation in the forest and farmland), MONRE, LDD and related organizations have to cooperate with each other. ALRO/ PLRO should provide an environment conducive to realize such activities. As for cooperation with TAO, ALRO and PLRO should make approaches to TAO to participate in the project such as preparation of CDP and implementation of proposed activities, and to realize budget allocation for their activities proposed in the CDP. Related government organizations such as MONRE and LDD are implementing concrete activities such as reforestation, soil conservation and improvement in devastated forest and land, in accordance with their development plans/ policies. Meanwhile, TAO is strengthening its capacity development for self-reliance of community under the development strategies of the National Economic and Social Development Plan. ALRO and PLRO need to cooperate with these organizations to work with local people and rural communities to achieve the goals.

**(3) Capacity development for PMU**

ALRO should realize capacity development of the PMU to make project implementation more smooth and effective. Necessary subjects to improve the capacity are shown in the following tables, considering the capacity assessment of the stakeholder learned from the pilot project implementation.

Prior to project implementation, capacity development for them may be conducted by making use of human resources such as university and local intellectuals and experiences from on-going similar projects and implementing pilot projects. ALRO should provide appropriate learning opportunities for capacity development for them even in the course of the project implementation, monitoring the project implementation progress and workability of PMU, since upgrading their operation and management capacity is essential to make project implementation more effective.

**Table 6.5.2 Capacity Development for PMU**

| PMU | Major roles | Existing capacity based on the pilot project | Subjects for capacity development |
|---|---|---|---|
| PMU (Central) | - Coordination among ALRO, ATSAP and related organizations<br>- Comprehensive progress management of the provincial M/P<br>- Public relation of the M/P for related organizations<br>- Preparation of work design for provincial PMU and facilitators<br>- Set up of provincial PMU<br>- Arrangement with components/ activities and on-going plans/ policies of related organizations<br>- Design and enforcement of budget planning and its progress report to ALRO<br>- Education and training for PMU staff<br>- Implementation of training for facilitators/ fieldworkers<br>- Operational support of stakeholder meeting<br>- Participation in participatory monitoring and evaluation and its operational support<br>- Policy recommendation to ALRO/ ATSAP based on the monitoring and evaluation of the implementation progress<br>- Preparation of development strategy for expansion of M/P concepts to 13 provinces | ALRO/ATSAP<br>- Poor capacity for overall project operation and management (Overall project implementation schedule and schedule and cost management by each working unit)<br>- Lack of knowledge and understanding of participatory development with facilitator<br>- Poor operational support of participatory monitoring and evaluation (Set of indicators for monitoring, lack of reporting system and grasp of real implementation progress at the sites) | **<u>Individual level</u>**<br>- Understanding of Project Cycle Management and M/P implementation<br>- Preparation of training program for facilitators and provincial PMU<br>- Understanding of participatory approach with facilitator for M/P implementation<br>- Understanding of roles of stakeholder for participatory monitoring system in M/P implementation<br>**<u>Organization level (for set up of PMU organization for smooth implementation)</u>**<br>- Establishment of reporting system of implementation progress from provincial PMU<br>- Establishment of communication system on making decision for M/P implementation<br>- Preparation of overall implementation guideline of M/P<br>- Public relations for M/P implementation (to prepare newsletter and document on project activities performed) |
| PMU (Province) | - Coordination with PLRO for project implementation<br>- Selection of targeted Tambons for the M/P implementation<br>- Prior consultation for making consensus of the M/P implementation with Tambons, and establishment of cooperation system with the Tambon<br>- Cooperation and coordination with provincial related organizations for the M/P implementation | (Different among provinces)<br>- Lack of coordination and arrangement among NGO, TAOs and related organizations for activity support<br>- Lack of understanding of roles of PLRO<br>- Lack of communication system between facilitators and PLRO (frequent personnel changes of PLRO staff) | **<u>Individual level</u>**<br>- Understanding of M/P implementation with Project Cycle Management<br>- Understanding of significance of participatory development in project implementation<br>- Understanding of roles of stakeholders for project implementation with participatory approach |

| PMU | Major roles | Existing capacity based on the pilot project | Subjects for capacity development |
|---|---|---|---|
| | - Distribution of activity fund for qualitative development into the Tambons<br>- Establishment and arrangement with provincial related organizations for M/P implementation<br>- Arrangement of technical supports for the M/P implementation with related organizations and local human resources<br>- Training for fieldworkers with facilitators<br>- Networking for the activity<br>- Arrangement of the learning processes for villagers (learning opportunity, study tour)<br>- Holding stakeholder meetings/ workshops/ seminars<br>- Suggestion and recommendation on development policies to central government based on an progress evaluation of the M/P<br>- Suggestion and recommendation on the expansion and promotion method of M/P based on the evaluation of project implementation | - Lack of prior discussion on selection of target Tambons<br>- Insufficient support of participatory monitoring and evaluation | - Understanding of M/P concepts and its implementation mechanism<br>- Understanding of prior discussion on Tambon selection process<br>- Improvement of communication capacity for establishment of cooperation system with related organizations<br>- Understanding of significance of participatory monitoring system and its operational way<br>**Organization level**<br>- Establishment of provincial PMU prior to project implementation<br>- Understanding of roles of PMU and existing PLRO working unit<br>- Establishment of reporting system on implementation progress to central PMU<br>- Establishment of cooperation system with related organizations<br>- Systemization of learning process based on the pilot project implementation (documentation of lessons learned)<br>- Preparation of rules on facilitator training<br>- Understanding of participatory monitoring guideline and its application manner<br>- Preparation of database system on local human resources<br>- Continuation and budgeting for networking based on the database |
| Facilitator | - Technical supports of planning/ implementation and evaluation of the activities by villagers<br>- Guidance of participatory development<br>- Facilitation of CDP preparation and qualitative development<br>- Training for fieldworkers<br>- Coordination of learning opportunities and clarification of necessary technical supports in the course of qualitative development<br>- Consultation and arrangement of learning opportunities among provinces, related organizations, Tambons, | （Difference among provinces. Depending on activity）<br>- Lack of framework and basic concept of M/P<br>- Lack of communication of the M/P concept to village/ community leaders and lack of activity arrangement with them<br>- Difference in knowledge in three sector development fields among four provinces<br>- Difference in facilitation ability among four provinces<br>- Lack of knowledge and understanding of set up of indicators in | **Individual level**<br>- Understanding of M/P framework of three sectors, basic concept of implementation method, prior discussion with village/ community leaders<br>- Improvement of communication capacity<br>- Improvement of facilitation skill for project implementation with participatory approach<br>- Understanding of participatory monitoring and evaluation system and roles of facilitator for its smooth operation |

| PMU | Major roles | Existing capacity based on the pilot project | Subjects for capacity development |
|---|---|---|---|
| | local resources and networks<br>- Support for organizing activity group and supporting activities<br>- Holding stakeholder meetings/ and operational support<br>- Support for networking<br>- Operational support for participatory monitoring and evaluation<br>- Suggestion and recommendation of policy and plans to provincial PMU | participatory monitoring and evaluation activity<br><br>- Insufficient communication with PLRO<br>- Lack of reporting system on implementation progress (frequent personnel changes) | **Facilitator group level**<br>- Common understanding of roles of facilitator and provincial PMU<br>- Establishment of reporting system of implementation progress to provincial PMU<br>- Systemization of holding workshop for networking with local human resources<br>- Appropriate allocation of fieldworkers and preparation of training program for them |
| Field worker | - Assistance of the facilitator<br>- Organizing activity groups<br>- Supports of the activities | Not allocated in the pilot project | **Individual level**<br>- Understanding of project implementation mechanism including M/P framework of three sector development through study tours to the pilot project sites<br>- Learning of facilitation skill for promotion of activities<br>- Improvement of capacity/ skill for smooth communication with related Tambon and villagers |

### (4) Capacity development for government organizations

It is proposed that the fundamental direction to promote and expand the M/P concept in the northern 13 provinces is to incorporate local peoples' activity process with the M/P concept into the regular tasks of the existing organization unit of PLRO. The PLRO should operate expansion and promotion of the M/P concept as the routine work. To do so, it is required to improve ALRO/ PLRO institution (such as review of office regulations and regular budgeting so as to make M/P concept implementation as their routine work) in the course of the project implementation.

In order to expand and promote M/P concept in the north region as the routine works of ALRO and PLROs, it is also required to enhance capacity of related government organizations so as to make it possible to improve their capacity in both individual and organization levels. Related organizations and staffs are required to learn the M/P concept and its implementation mechanism such as cooperation with related organizations and utilization of local human resources and networks, and facilitation of implementation process. ALRO should push PMU to provide learning opportunity for PLROs of 13 provinces and related ALRO staff, so that they can learn implementation process and improve their capacity.

Intensity and sustainability of project implementation and expansion/ promotion of the project activities may be also affected by TAO's attitude such as participation in project activities, and provision of technical and financial support to local people/ communities. To secure sustainability, it is

required to invite related Tambons in the learning opportunity as well in ALRO/PLROs in order to learn M/P concept and its implementation mechanism and improve their capacity. Through mutual learning in the actual project sites, capacity development and cooperation system can be realized.

Problems for capacity development of related government organizations may be listed based on the existing capacity assessment learned from this study implementation including the pilot project. ALRO should provide learning opportunity for them in cooperation with PMU in the course of the project implementation.

**Table 6.5.3 Capacity Development for Related Government Organizations**

| Organization | Expected major roles | Existing capacity | Subjects for capacity development |
|---|---|---|---|
| Central (ALRO) | - Administrative arrangement (project preparation, budget and institution)<br>- Dissemination of the M/P concepts and related information to related organizations<br>- Coordination of the M/P implementation with the other organizations (MONRE and others)<br>- Comprehensive management of the M/P at the four provinces<br>- Budgeting the M/P implementation and its allocation<br>- Formulation of an implementation organization structure (PMU) for the M/P implementation<br>- Education of personnel of the organization (PMU)<br>- Employment of facilitators and education of them<br>- Participation in stakeholder meetings/ workshops<br>- Recommendation of policy based on monitoring and evaluation of the M/P implementation<br>- Formulation of expansion and promotion strategy of M/P concepts to north region | - No direct employment system of facilitator<br>- Lack of overall project management system<br>- Difficulty in cooperation system with related government organization<br>- Lack of proper cooperation and arrangement on project operation with PLROs<br>- Lack of reporting, monitoring and communication system on implementation progress between central and provinces | **Institution**<br>- Establishment of employment system of facilitator<br>- Establishment of duty regulations as ordinary works for implementation of M/P concept<br>- Budgeting system for ordinary works<br>- Regularizing training program for ALRO and PLRO staffs on implementation of M/P concept<br>**Organization**<br>- Establishment of project management system based on the Project Cycle Management<br>- Dissemination of M/P concepts and roles of government organizations<br>- Establishment of reporting system on monitoring and evaluation on project implementation progress<br>- Establishment of cooperation system with on-going plans/ policies of related government organizations<br>- Budgeting system for M/P concept activities as ordinary works<br>- Preparation of regular training program for ALRO, PLRO and Tambons, and representatives of villages<br>- Establishment of cooperation system with related organizations of MONRE<br>- Arrangement of policy and plan recommendation to MONRE<br>**Individual**<br>- Understanding of Project Cycle Management and improvement of project management<br>- Learning of three sector framework and participatory development with M/P concept<br>- Improvement of communication and cooperation capacity with organizations under MOAC<br>- Improvement of cooperation capacity |

| Organization | Expected major roles | Existing capacity | Subjects for capacity development |
|---|---|---|---|
| | | | with MONRE for policy and plan recommendation on natural resources<br>- Improvement of capacity on cooperation with related organizations<br>- Learning of participatory monitoring system and roles of stakeholder for its proper operation<br>- Understanding of roles of facilitators for participatory development |
| Central (ATSAP) | - Preparation of development policies and plans based on the monitoring and evaluation of the M/P implementation progress | - Difficulty in establishment of cooperation system with related government organizations and lack of making arrangement with them<br>- Lack of analysis of monitoring and evaluation results | **Institution**<br>- Participation in regular stakeholder meetings and workshop on participatory monitoring and evaluation in M/P implementation<br>- Participation in regular staff training programs on implementation of M/P concept<br>- Establishment of regular meetings with related organizations<br>- Establishment of political system to realize proposed plans/ policies<br>**Organization**<br>- Establishment of cooperation and communication system with related government organizations<br>- Arrangement with related organizayions of MOAC/MONRE on on-going policy and plan<br>**Individual**<br>- Learning of M/P concept, three sector framework and implementation mechanism<br>- Grasp of on-going plans/ policies of related organizations<br>- Improvement of analysis and planning capacity based on monitoring and evaluation results<br>- Communication capacity with related organizations to realize proposed plans/ policies |
| Province (PLRO) | - Selection of targeted Tambons for the M/P implementation<br>- Preliminarily making consensus among Tambons for the M/P implementation<br>- Adjustment and cooperation of the M/P implementation with related organizations<br>- Set up of the provincial PMU and training for them<br>- Budgeting and allocation | （Difference among provinces）<br>- Lack of prior discussion with target Tambons<br>- Insufficient cooperation system with the Tambon<br>- Difficulty in cooperation system with related provincial organizations | **Institution**<br>- Preparation of PLRO regulations for prior discussion with Tambon, establishment of cooperation system with related organizations, smooth implementation of the M/P concept<br>- Set up of regular meetings with provincial related organizations<br>- Establishment of regular budgeting system on implementation of the M/P concept<br>- Regularization of participation in staff |

| Organization | Expected major roles | Existing capacity | Subjects for capacity development |
|---|---|---|---|
| | for M/P implementation<br>- Supports for management of qualitative development at Tambons<br>- Consultation about technical supports with related organizations for the M/P implementation and adjustments<br>- Building networks for the activity<br>- Adjustments for learning process of villagers (e.g., study tours)<br>- Holding stakeholder meetings<br>- Suggestions of policies for central administration organizations based on an evaluation of progress of the M/P | - Insufficient communication system with ALRO due to frequent personnel changes<br>- Lack of personnel and budget for proper operation and management<br>- Lack of understanding of M/P concepts and roles of government organizations<br>- Lack of project management sense<br>- Lack of communication system with facilitator<br>- Insufficient establishment of participatory monitoring and evaluation system | training programs on M/P implementation<br>- Review of PLRO regulations of personnel changes<br>**Organization**<br>- Establishment of project management system based on the concept of Project Cycle Management<br>- Preparation of guideline for prior discussion with Tambons<br>- Preparation of dissemination documents/ papers for public relation<br>- Establishment of communication system among Tambons, villages and related organizations<br>- Establisment of cooperation and communication system with provincial MONRE office on plan/ policy recommendations<br>- Provision of organizations for participatory monitoring and evaluation system<br>- Provision of reporting system on policies recommendation to central level<br>- Preparation of database of local human resources and establishment of its utilization<br>**Individual**<br>- Learning of M/P concept, framework of three sectors and its implementation mechanism<br>- Improvement of capacity for adjustment of on-going plans/ policies with related organizations<br>- Improvement of cooperation capacity with provincial MONRE on plan and policy recommendation<br>- Learning on prior discussion subjects with Tambon for M/P implementation<br>- Improvement of communication skill with Tambons, villages and related organizations<br>- Learning of participatory development process with facilitator and field worker<br>- Learning of participatory monitoring and evaluation system, and operation and maintenance with supporting system from administration<br>- Learning for utilization of database of local human resources |
| Tambon (TAO) | - Consultation and coordination of the M/P | (Difference among Tambons) | **Institution**<br>- Regularization of participation in |

| Organization | Expected major roles | Existing capacity | Subjects for capacity development |
|---|---|---|---|
| | implementation with provincial level (PLRO)<br>- Prior consultation about M/P implementation at related villages/ communities<br>- Support for preparation of CDP<br>- Reviews of programs/components and support for establishments of activity plans<br>- Budgeting for the activity (e.g., construction of small-scale check dams/weirs, making fire breaks, putting boundary markers)<br>- Arrangements of activity plan with the Tambon development plan<br>- Support for provision of a learning opportunity for villagers/ communities<br>- Participation in monitoring and evaluation of the M/P operation<br>- Support for networking with local human resource<br>- Participation in stakeholder meetings<br>- Suggestions of policies to PLRO based on an evaluation of implementation progress of the M/P | Lack of understanding of M/P concept<br>- Lack of cooperation system with PLRO （Lack of TAO personnel）<br>- Insufficient arrangement with CDP and Tambon Development Plan (budget limitation in Tambon)<br>- Insufficient operational and technical supporting capacity of the M/P implementation | training programs prepared for M/P project implementation<br>- Regularization of communication system with PLRO, TAO personnel regulations, regular works and its budget arrangement<br>**Organization**<br>- Understanding of significance of the M/P project in line with National Development Plan<br>- Understanding of basic concept of Project Cycle Management and framework of the three sectors<br>- Understanding of M/P concept and implementation method with roles of Tambon<br>- Establishment of communication system with PLRO and representatives of villages<br>- Arrangement between CDP and Tambon Development Plan, and budgeting for proposed activities<br>**Individual**<br>- Learning of significance of the M/P concept<br>- Learning of M/P concept and basic working process with participatory development<br>- Learning of participatory monitoring system and roles of Tambons, and participation in stakeholder meetings/ workshops<br>- Improvement of communication skill with stakeholder<br>- Provision of related information for preparation of database on local human resources |

# CHAPTER 7 CONCLUSION AND RECOMMENDATIONS

## 7.1 CONCLUSION

The study team conducted the ‘‘Development Study on Planning and Capacity Building for Natural Resources Management and Sustainable Rural and Agricultural Development in the North Thailand’’ based on the Scope of Works (S/W) concluded between the Ministry of Agriculture and Cooperatives (MOAC), Thai Government and the Japan International Cooperation Agency (JICA) on March 31, 2004. In the study, based on the objectives of the study, a Master Program (M/P) which enables to implement sustainable rural and agricultural development mainly in Agricultural Land Reform Areas with people in the local community and related organizations, promoting proper management of natural resources was formulated in the selected four provinces in the northern seventeen provinces. Study results are presented in this report.

The M/P shows a framework of development to achieve the objectives with 13 programs and 28 components of 3 sectors (Natural Resources Management, Livelihood Improvement, Sustainable Agriculture Development Plan). The implementation means is that people have the initiative to conduct the activities, in cooperation with governmental and local human resources.

In the study, the pilot project was conducted to verify the M/P. Through the pilot project implementation, it was confirmed that these programs and components are fully effective to achieve objectives including implementation mechanism in which local people are the main implementation body in cooperation with government organizations, related organizations and local human resources. As the results, it was concluded that the M/P presented by this study should be conducted immediately in the Land Reform Areas of the four provinces.

## 7.2 RECOMMENDATIONS

### (1) Earlier implementation of the Master Program (M/P) and setting up the M/P implementation organization

The M/P was formulated under the joint works of all the related organizations such as ALRO/ ATSAP, Provincial Land Reform Office (PLRO), TAO, provincial related organizations, local human resources, NGOs, and local people/ villagers at Agricultural Land Reform Areas. Therefore, it is recommended that the MOAC initiates necessary works to implement at the earliest the M/P presented by this study. Moreover, it is suggested that parts of the M/P should be implemented under the present ALRO’s on-going programs until a sufficient budget for the M/P implementation is to be secured.

It is proposed to establish a project management unit (PMU) in the ALRO and PLRO for the M//P implementation. The PMU consists of full-time staffs who are well versed with participatory survey for the M/P implementation. In addition, facilitators should be allocated for smooth implementation of the M/P. Thinking of their roles, it is realistic that experienced NGOs in the north region are employed. ALRO is requested to take actions to secure experienced facilitators in the subject M/P

implementation.

**(2) Necessity of following up with pilot projects**

People's activities are continued in the pilot project sites, in order to achieve the development targets. It is required that the pilot project sites become learning centers or models for implementations of M/P. To that end, activities including supports from government organizations, related organization and local human resources shall be continued for the pilot project sites. ALRO/ATSAP and PLRO are required to continue supporting and monitoring the activities based on the concept of the M/P until their activities are established in the sites.

**(3) Public relation for the M/P implementation**

The M/P applies a development approach in which local people take the initiative in implementing activities in their communities/ areas, reassessing conventional development approaches. The basic concept is that local people are considered to be main actors, and related organizations and local human resources are supporters engaging their development processes. Concepts of this development means is prevailing among related organizations through the pilot project implementation, but that is still insufficient. Thus, it is suggested that ALRO/ATSAP and PLROs work to generalize the concepts of M/P to related government organizations and to make an administrative environment conducive for smooth implementations of the M/P.

**(4) Limitation of participatory approach and necessary incentives in the M/P implementation processes.**

Because the natural resources management and conservation in the forest areas is achieved through joint activities by local people who are living in and around, participatory approach are applied as the means in the M/P implementation to attain the objectives of M/P. As shown in the pilot project implementation, some activities with motivation and awareness could be implemented on their own initiatives as planned. However, the activities for which awareness and motivation are not grown up among local people, such as soil erosion prevention farming, could not be materialized in their lands. Considering such situation, it can be said that the participatory approach has some limitation in causing local people's initiatives in the natural resources management and conservation plan. In order to achieve the objectives of natural resources management and conservation plan, it is suggested that government and related organizations consider to take administrative approach such as provision of incentives to local people who practice proper measures of natural resources management and conservation in their lands so as to encourage them to participate in the management and conservation activities.

**(5) Need of further cooperation with the MONRE to achieve the natural resources management and conservation**

To achieve the target, 'Natural resources in and around the LRAs are conserved', cooperation with MONRE is absolutely necessary. In the M/P, in addition to 'community forest management', the activities such as 'making firebreaks', 'construction of small-scale check dams', and 'reforestation in the devastated areas', are incorporated. These activities are considered to be the fundamental and

collective activities of local people. The MONRE is required to understand that these activities lead to the natural resource management and conservation in the entire forests including conservation forests adjacent to LRAs. It is recommended that the MONRE provides a supporting system to materialize these activities in the whole forest areas, since the activities for natural resources management led by ALRO are limited only in the LRAs. Conservation and management activities in the conservation forests can be further promoted when the concept of community forest management and conservation manner could be applied to the conservation forests around LRAs through network made in the M/P implementation process. Comprehensive forest management and targeted conservation can be achieved only by accumulating such activities.

**(6) Roles of government organizations and need of capacity development**

**Provision of administrative environment to materialize activities by local people**

The project is to be implemented for sustainable rural and agricultural development with promoting an appropriate natural resources management in the four provinces. The super goals can be achieved by accumulating such participatory activities in the four provinces and promotion of the M/P concepts in the 13 provinces of the north region.

Participation and cooperation of local people who are living in the periphery of the forest and utilizing natural resources in their daily lives are essentially required in the project implementation process. Therefore, local people are considered to be the main actors for programs/ components/ activities of the M/P. Under these concepts, the important roles of government organizations are to make an environment conducive and/or enabling to materialize various activities by local people.

**Cooperation with related government organizations**

ALRO and PLRO should make enabling environment as mentioned above in which local people can realize proposed activities, as the core of government organizations, in cooperation with MONRE, LDD, TAO and other related organizations. In terms of activities of natural resources management, collective activities under local people's participation in cooperation with MONRE and TAO are required. Meanwhile, MONRE and LDD are developing concrete activities for natural resources conservation and management such as 'reforestation', 'soil and water conservation' and 'soil improvement', under the policy and strategy of each department. TAO is also developing capacity building under the national development strategy for strengthening local government and encouragement of self-reliance. It is recommended that ALRO and PLRO implement the project in harmony with the development direction of such related organizations.

**Capacity development of PMU**

ALRO should realize capacity development of the PMU to make project implementation more smooth and effective. PMU should be trained in the subjects such as 'learning of project cycle management', 'understanding of M/P concept', 'establishment of cooperation system with related organizations', and 'improvement of facilitation skill'. Prior to project implementation, such trainings may be conducted making use of human resources such as university and local intellectuals, and

using experiences and outputs from the pilot projects and on-going similar projects. ALRO should provide proper training programs for them even in the course of the project implementation, monitoring project implementation progress.

**Capacity development of related government organizations**

It is proposed that the fundamental direction to promote and expand the M/P concept in the northern 13 provinces is to incorporate development activities with the M/P concept into the regular tasks of the existing working unit of ALRO/ PLROs. They should operate expansion and promotion of the M/P concept as the routine work. To realize this situation, it is required to cope with institutional improvement such as establishment of budgeting system and improvement of work regulation so as to make such operation possible. In addition to this, it is also required to enhance implementation capacity of related government organizations in both individual and organization levels. Related organizations and their staffs are required to learn the M/P concept and its implementation mechanism such as cooperation manner with related organizations, utilization of local human resources and networks, and facilitation skill in implementation process. ALRO should encourage PMU to provide learning opportunity for PLROs of 13 provinces and related ALRO staff in the project sites of the four provinces, so that they can learn implementation process and improve their capacity.

Sustainability of project implementation may be also affected by TAO’s intention such as participation in project activities and technical and financial supports to activities by local people/ communities. To secure sustainability, it is required to encourage related Tambons to participate in the learning opportunity with ALRO/PLROs so that they can learn and understand the M/P concept and its implementation mechanism and improve their capacity, so as to make cooperation activities possible.