

Agricultural Land Use of Highland Communities in Doi Phu Kha National Park Area, Thailand: Cases of Huai Win, Pang Yang and Maneepluek 1

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Abstract

This study analyzed agricultural land use patterns of highland communities in protected areas of Northern Thailand, where three hill tribe communities were compared: Huai Win (Lua), Pang Yang (Lua) and Maneepluek 1 (Hmong). The article explained land use changes both in traditional and recent periods of agricultural land use. The traditional land use patterns of the hill tribes consisted of nature-based subsistence agriculture such as long-fallow cultivation with household labor and low cost investment. Nowadays, the land use patterns are modernized, being characterized by commercial intensive land use such as short-fallow cultivation or annual cropping, due to the support of both governmental and non-governmental organizations, high growth rate of population, the introduction of commercial agriculture, and more convenient transportation.

The demarcation of special use zones is one of the land use planning processes in the Joint Management of Protected Area Project (JoMPA). The objective of the project was to conserve biodiversity and ecosystem functions of protected areas with responsibilities and outcomes of sustainable management shared among all stakeholders. The level of success in implementing such a process was reflected in land use pattern as shown in the three representative communities. Huai Win, representative of a subsistence cultivation community, is characterized by simple land use pattern with minimal land use regulations. The demarcation process implemented for this community, therefore, has been most efficient. Pang Yang, a semi-commercial cultivation community, faced some difficulties during the demarcation process, as complex land use regulations limited the efficiency of the process. Maneepluek 1, a commercial cultivation community, had the most intensive agricultural system and the most complex land use regulations. Hence, the demarcation process of this community was least efficient among the three cases.

Keywords: agricultural land use, highland community, protected area, land use planning

I. Introduction

The northern region of Thailand is a mountainous area and the habitation of various hill tribes. The traditions, cultures and agricultural land use patterns of hill tribes, called slash-and-burn agriculture (Joseph, 1995) are different from those of Thai local people. Kunstadter, P. *et al.* (1978) classified forest

farming in northern Thailand into 3 types of swidden cultivation: 1) Short-cultivation=short-fallow is practiced by Northern Thai people; only supplementary to irrigated wet-rice cultivation in transitional zones between valley and hill lands at elevations between 300–600 meters, 2) Short-cultivation=long-fallow is practiced by Karen, Lua and Khmu people; rotational swiddening on sloping land in addition to wet-rice cultivation on terraced

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fields at elevations of 700–1,600 meters, and 3) Long-cultivation=very-long-fallow is practiced by Hmong, Yao, Lisu, Lahu and Akha people; pioneer swiddening on steep slopes and opium cultivation as a cash crop at elevations between 800–1,200 meters.

Therefore, the hill tribes of Thailand are separated into 2 groups according to the tradition and culture of their agricultural patterns. One is the opium cultivating ethnic groups and the other is non-opium cultivating ethnic groups. The opium cultivation ethnic groups consist of Hmong, Yao, Lisu, Lahu and Akha. The agricultural land use pattern of this group is called “shifting cultivation” because cultivation takes the form of cutting, stubbing and burning of the trees in primary forest. Moreover, they cultivate in primary forest for a long period, approximately 5–10 years. Consequently, the quality of soil in those areas would deteriorate. Then, they would abandon that area, and search for a new area for their traditional cultivation, moving their residences as well as with their agricultural area.

The non-opium cultivation ethnic groups consist of Karen, Lua and Khmu. The agricultural land use pattern of this group is called “rotating cultivation”, and takes the form of cutting, stubbing and burning of trees in secondary forest. They cultivate in secondary forest for a period of approximately 1–4 years, and abandon the cultivated land to allow the revival of soil quality for 4–10 years. Thereafter, they return to cultivate their revived land as part of the cycle (Sutti, 1996; Kunstadter, 1978; Keen, 1970).

Doi Phu Kha National Park, a Protected Area (PA) by government, is located at Nan Province in the east of northern Thailand. This area was inhabited by the Lua realm approximately 200 years ago. Rotating cultivation of this ethnic group was extended in the area by the Lua hill tribe, while the Hmong immigrated to the area from other places about 50 years ago. Between the 1960s and 1980s, these areas were termed ‘Red areas’, referring to communist areas where the government policy of national security was enforced. Therefore, there are several hill tribe communities which were made to move from their

original places to new areas due to national security.

In the recent situation, the pressure of such protected areas has become more complex due to high growth rates among hill tribe communities, the introduction of commercial agriculture, the preservation policy of government, and more convenient infrastructure. These factors have brought about changes in agriculture pattern of hill tribe communities from the past to the present.

In the past, the traditional land use of the hill tribe agrarian systems were nature-based subsistence agriculture, with long-fallow cultivation, the use of household labor and low cost investment. At present, modernized land use emphasizes commercial, intensive land use, short-fallow cultivation or annual cropping, because of the support of organizations, both government and non-government, and more convenient transportation.

In this changing situation, the conservation policy of the national park is difficult to implement due to the extension of the agricultural area of hill tribe communities. These reflect critical social problems relating to land-use conflicts between neighboring hill tribe communities and between farmers and forestry agencies. Understanding the agricultural land use patterns and changes of hill tribe communities in PA is important in managing the land-use conflicts from the stage of negotiation, which has led to conservation of biodiversity and ecosystem functions of protected areas in a move to sustainable management shared among authorities, local stakeholders and the general public.

II. Study Areas

Doi Phu Kha National Park, covering 1,065,000 rai or 170,400 ha, is the fourth largest protected area in Thailand, and was declared as such by the Thai government in 1999. It is a typical remote mountainous area, with altitudes ranging from 200 to 2,080 meters, and an important region as the upper reach of the Nan River, one of main four rivers of northern Thailand (Fig. 1).

Doi Phu Kha National Park, located in Pur

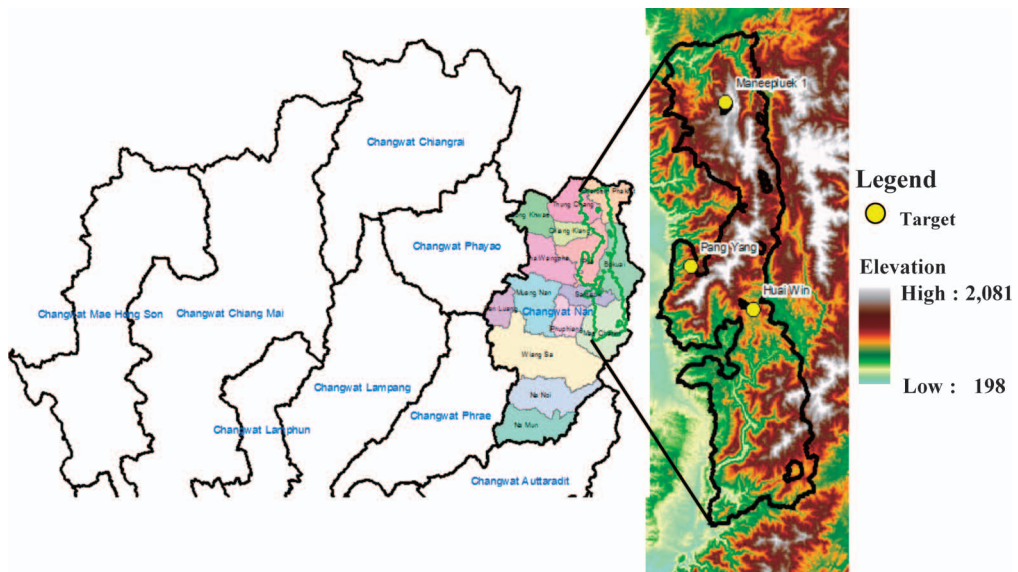


Fig. 1. The boundary of Doi Phu Kha National Park and 3 target communities

Table 1. The study sites

	Village name	Sub-district	District	Number of households	Ethnic group	Elevation (meters)	Map Coordinates (UTM Zone 47Q)	
							Eastings	Northing
1	Huai Win	Bo Kluea Tai	Pua	25	Lue	800	723075	2107735
2	Pang Yang	Phu Kha	Pua	47	Lue	900	710078	2167290
3	Maneepluek 1	Ngob	Tung Chang	120	Hmong	1,300	717275	2150624

District, Nan Province in the northern Thailand and bordering Laos, covers 8 districts of Nan Province, namely 1) Chaloeam Phra Kiat, 2) Thung Chang, 3) Chiang Klang, 4) Pua, 5) Bo Kluea, 6) Tha Wang Pha, 7) Santi Suk and 8) Mae Charim. The area is inhabited by a population of hill tribes of 11,203 people comprising 2,457 household in 48 villages (The Project of Joint Management of Protected Area, 2010). The population is composed of 2 main ethnic groups, Lua and Hmong.

Huai Win, Pang Yang, and Maneepluek 1 were selected to represent all hill tribe communities in Doi Phu Kha national park. In the past, agricultural patterns of each hill tribe community were different as they were rooted in the tradition and culture of each ethnic group. However, several factors have contributed to bring about changes in agricultural patterns: high growth rates in hill tribe communi-

ties, introduction of commercial agriculture, preserved policy of government, and convenient infrastructure.

Huai Win

Huai Win is a small community, consisting of 25 households and all 124 people are of the Lua hill tribe. The community was established as a settlement 29 years ago in 1983 when the settlers migrated from a nearby community, and the new settlement was located at Bo Kluea Tai Sub-district, Bo Kluea District, Nan Province which is the central area of the national park. They inhabit an area approximately 800 meters in altitude, which is difficult to access from outside because roads to this village have not been developed. Consequently, the village did not receive development aid from the government.

Pang Yang

This community consists of 47 households and 263 people. Almost all households are Lua hill tribe, but there are 2 households which are northern Thais. They settled at Phu Kha Sub-district, Pua District, Nan Province, in the west of national park, and inhabited an area of approximately 900 meters in altitude. The village is convenient to access because it is near the thriving city of Pua and hence, well connected to main roads.

Manepluek 1

Manepluek 1 is a large community with two satellite communities, Manepluek 2 and Manepluek 3. Manepluek 1 consists of 120 households and 1,169 people, and all households are Hmong hill tribe. It was established as a settlement 16 years ago in 1996 at Ngob Sub-district, Thung Chang District, Nan Province, in the north of national park. The area is approximately 1,300 meters in altitude and is convenient for transportation. Because Hmong prefer to cultivate cash crops, the roads in this area were developed for economic reasons, since good transportation is important for transfer of products from farmland to market

III. Traditional Agricultural Land Use Patterns

As Hemwan, P. (2004) noted, in the traditional agrarian system of the Hmong and

Karen hill tribes, social factors and farmer characteristics have the most important influence on household consumption, traditional cultivation and farming skill. Traditions, cultures, and beliefs of each ethnic group are the factors that have influenced agricultural land use patterns. The agrarian systems were nature-based subsistence agriculture. These patterns are classified into 2 types as follows.

1. Land Use Patterns of Lua Farmers

This pattern is representative of short-cultivation=long-fallow pattern. The Lua are the original pioneers in these areas, and do not cultivate opium. Usually, they inhabit areas ranging in altitude from 700 to 1,200 meters. Their agricultural pattern is classified as rotating cultivation. When seasonal cultivation begins annually, every household in the village will select the land for annual cultivation from the common land of village. The preparation of cultivated land consists of cutting, stubbing and burning of the trees, especially small-sized trees, on the land. They cultivate the selected land for approximately 1–2 years, and then abandon the land for the revival of soil quality for 2–10 years, and return to cultivate their revived lands as part of the cycle every 8–10 years. These fields are called “Rotated Field (*Rai Lao*)” (Fig. 2).

The Lua cultivated only for subsistence, so upland rice was the main crop cultivated in Rai Lao. Some vegetables were secondary subsis-

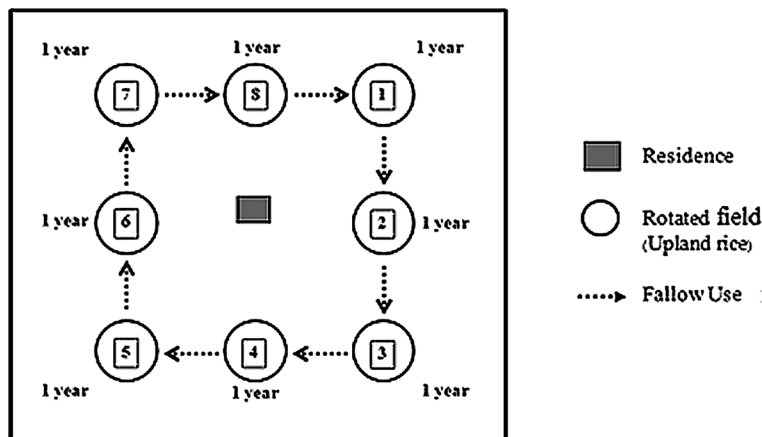


Fig. 2. Lua's agricultural land use patterns

tence crops for Lua households in addition to the rice field. Because rice does not grow in cold weather, they inhabited an area lower than 1,200 meters. In the traditional land use of Lue, they have community land which is the common property right of all households in the village, such as conservation forest, useful forest and cemetery. These areas were distinguished by boundaries that all members in the village perceived and accepted.

2. Land Use Patterns of Hmong Farmers

This pattern is representative of long-cultivation=very-long-fallow pattern. The Hmong have moved into these areas in order to cultivate newly occupied land. Their agricultural pattern is classified as shifting cultivation. They selected cultivated land near the village for easy transportation of agricultural products from field to residence. Preparation of land consists of cutting, stubbing and burning of trees, and these areas are cultivated for periods ranging from 5–10 years. When the quality of soil deteriorates, they leave it for more than 10–40 years, find a new area in primary forest for their traditional cultivation, and do not come back to use formerly cultivated areas which are called “Abandoned Field (*Rai Rang*)”. Consequently, only grass only remains growing there (Fig. 3).

Usually, they inhabit an area more than 1,200 meters in altitude because they prefer to cultivate opium which can grow in cool weather. Opium, which is a commercial crop, is the main crop for Hmong. They do not emphasize upland rice because they can purchase it using

the income from opium. The fields for opium cultivation are selected for best suitability of both weather and quality of soil, and cultivated every year for a long period of 5–10 years, until the quality of the field deteriorates, when they move to a new area.

IV. Recent Change of Agricultural Land Use Patterns

Several factors have influenced agricultural patterns of the hill tribes, for instance high population growth rates in hill tribe communities, introduction of commercial agriculture, nature-conservation policy of the government, and more convenient infrastructure. Hemwan (2004) noted that economic reasons, including more income, stable market, cost savings and good production price, are the most important factors that influence the hill tribe cultivating decisions. Social factors and farmer characteristics are also important in attaining stable income and improving cultivation skills. The agrarian systems have been modernized to emphasize commercial, intensive land use, short-fallow cultivation or annual cropping. These patterns are classified into 3 types as follows.

1. Case of Huai Win

Huai Win community, classified as a non-opium cultivation group in the past, is a representative of subsistence cultivation. Some of the communities inside the national park are also relatively isolated from the existing roads, but accessible by dirt roads or trails. Huai Win is one of the communities which it is difficult

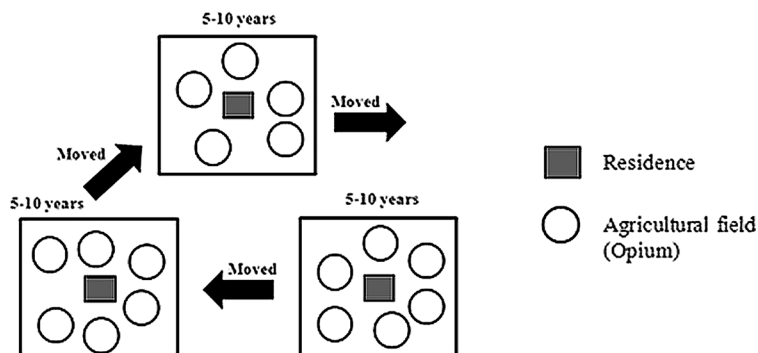


Fig. 3. Hmong's agricultural land use patterns

Table 2. Comparison of land use classification of 3 communities

Land use types Rai	Huai Win			Pang Yang			Maneepluek 1		
	Hectare	%		Rai	Hectare	%	Rai	Hectare	%
1. Residence	73.00	11.68	1.07	36.83	5.89	0.81	174.40	27.90	0.39
2. Agricultural Area	3,258.49	521.36	47.79	3,320.37	531.26	72.94	8,340.35	1,334.46	18.81
2.1 Permanent Area	46.58	7.45	0.69	693.09	110.89	15.30	308.19	49.31	0.69
— Terrace paddy field	3.25	0.52	0.05	37.68	6.03	0.83	—	—	—
— Orchard (Fruit tree)	43.33	6.93	0.64	103.24	16.52	2.28	308.19	49.31	0.69
— Upland rice	—	—	—	—	—	—	1,701.82	272.29	3.84
— Corn	—	—	—	552.17	88.35	12.19	633.86	101.42	1.43
— Cabbage	—	—	—	—	—	—	1,315.35	210.46	2.97
— Ginger	—	—	—	—	—	—	323.46	51.75	0.73
2.2 Rotated Area (Rai Lao)	3,211.91	513.91	47.10	2,627.28	420.36	57.64	—	—	—
1) Recent rotated area	—	—	—	965.30	154.45	21.30	—	—	—
— Upland rice	775.42	124.07	11.37	518.85	83.02	11.45	—	—	—
— Corn	—	—	—	446.45	71.43	9.85	—	—	—
2) Rotated area	2,436.49	389.84	35.73	1,661.98	265.92	36.34	—	—	—
— Left for 1 years	308.08	49.29	4.52	282.43	45.19	6.23	—	—	—
— Left for 2 years	734.98	117.60	10.78	702.16	112.35	15.15	—	—	—
— Left for 3 years	286.30	45.81	4.20	246.27	39.40	5.44	—	—	—
— Left for 4 years	141.24	22.60	2.07	431.12	68.98	9.52	—	—	—
— Left for 5 years	675.19	108.03	9.90	—	—	—	—	—	—
— Left for 6 years	290.70	46.51	4.26	—	—	—	—	—	—
2.3 Abandoned Area (Rai Rang) abandoned 1–7 years	—	—	—	—	—	—	4,057.67	649.23	9.15
3. Forest area	3,486.72	557.88	51.14	1,173.56	187.77	26.25	35,841.18	5,734.59	80.80
3.1 Ceremonial forest or Cemetery	13.86	2.22	0.20	36.31	5.81	0.80	726.74	116.28	1.64
3.2 Conservation forest	961.88	153.90	14.11	401.53	64.24	8.86	6,256.73	1,001.08	14.11
— Revival by community	399.94	63.99	—	—	—	—	—	—	—
3.3 Multipurpose forest	2,510.98	401.76	36.83	735.72	117.71	16.59	28,857.71	4,617.23	65.05
— Revival by community	933.46	149.35	—	73.57	11.77	—	—	—	—
Total	6,818.21	1,090.91	100.00	4,530.76	724.92	100.00	44,355.93	7,096.95	100.00

Source: Author's calculation from GIS database, surveyed by fieldwork in 2008 (1 rai=0.16 ha).

to access in the rainy season. Therefore, they have no convenient contact outside the community, and few commercial crops have been produced in this area. For these reasons, they are considered less developed from the perspective of government or organization. Consequently, the original tradition and culture of the ethnic group still influences their agri-

cultural pattern.

From Table 2, we can see that the current land use of Huai Win amounts to 1,091 ha, of which 48% is used for agriculture: upland rice, fruit tree, rotated area, and 51% is forest used for cemetery, conservation forest and multipurpose forest. It is noteworthy that this community revived the forest by themselves and re-

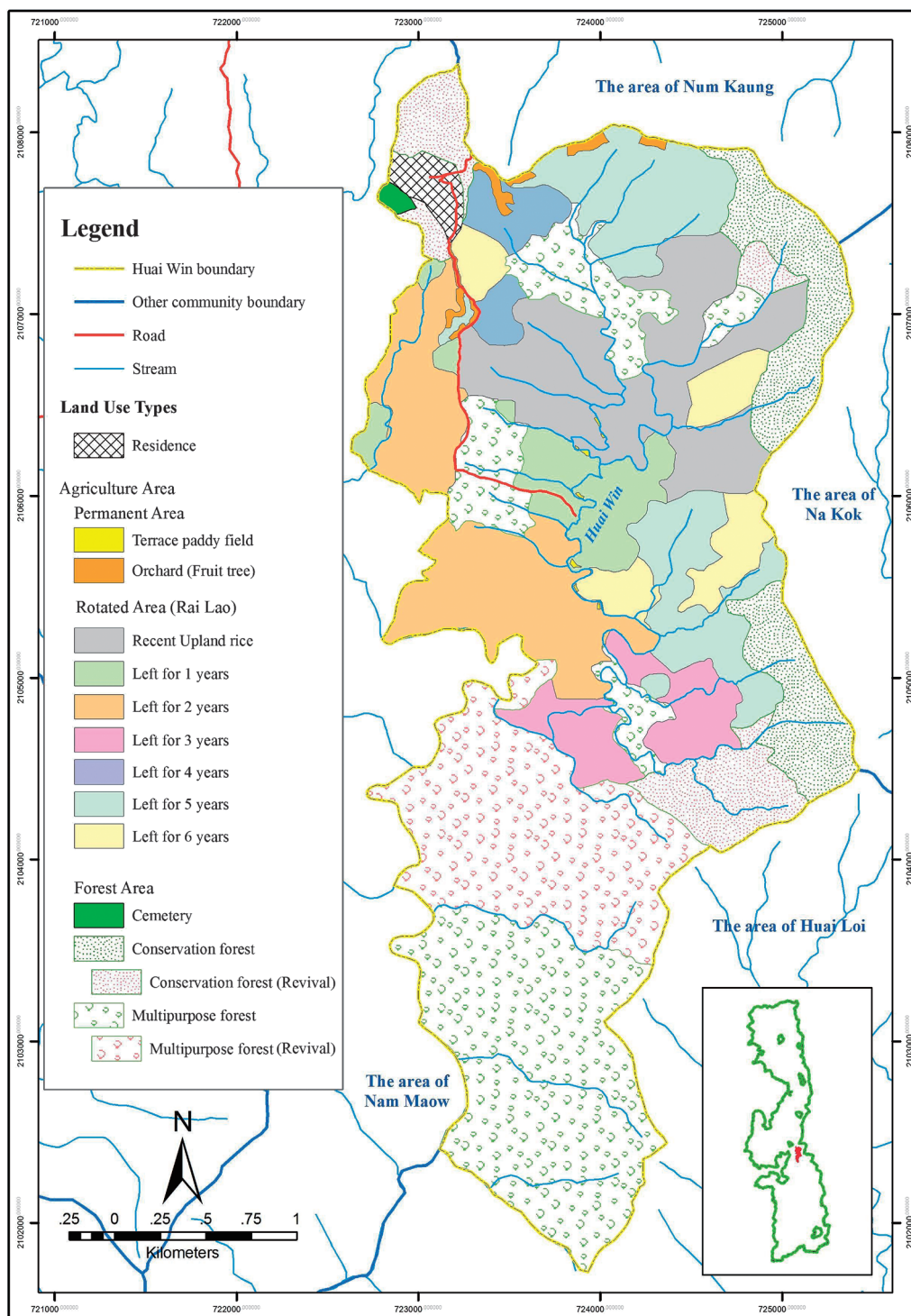


Fig. 4. Land use map of Huai Win

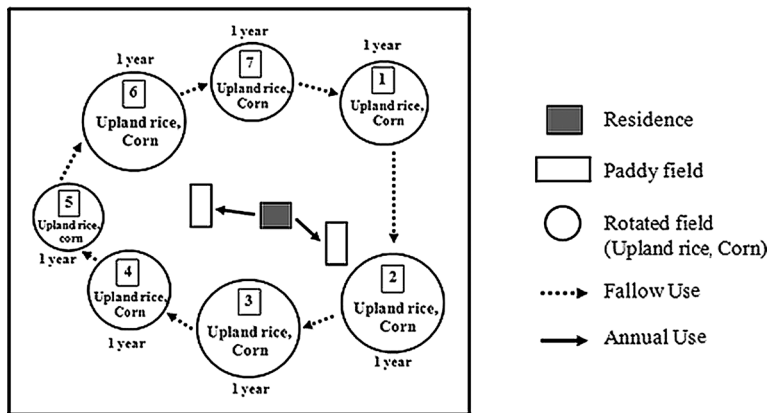


Fig. 5. Agricultural land use pattern of subsistence cultivation community

stored from *Rai Lao* to use both conservation forest of 64 ha and multipurpose forest of 149 ha (Fig. 4). This pattern shows that this community tends to conserve their pattern of land use.

Huai Win, which is a small Lua community classified as a non-opium cultivation group, represents the subsistence cultivation community with an agricultural pattern of short-cultivation=long-fallow. Its agricultural system is not so complex. Figure 5 shows that the agricultural pattern of this community emphasizes subsistence cultivation as in the past. Upland rice is still a main crop for annual cultivation, while some corn is planted as a commercial crop in some parts of the rice fields. They still have *Rai Lao* for 7-year-rotated cultivation of upland rice, and some terraced paddy fields in suitable areas near the main stream of their community. The commercial crop of corn has increased little in this area because of inconvenient access, and commercial cultivation is not important to the agricultural system in this community.

Consequently, this community is still in poverty because they do not have economic alternatives to contribute to higher household incomes. From socio-economic data of this community, more than 36% of household have an income of 10,000–30,000 baht per year and 24% an income less than 10,000 baht per year. This shows that the community still emphasizes subsistence cultivation.

2. Case of Pang Yang

Pang Yang community, classified as a non-opium cultivation group in the past, is representative of semi-commercial cultivation. Therefore, its traditional agricultural pattern is short-cultivation=long-fallow. This community can be accessed conveniently by existing roads because it is located near a thriving city. Consequently, it can easily receive technology and innovation from outside. The village is developed, and the villagers can adapt themselves more easily than the Huai Win village. The agricultural produce systems are more complex than the subsistence cultivation community.

Figure 6 shows that the current total land use of Pang Yang amounts to 731 ha, of which 73% are used for agriculture: upland rice, corn, fruit tree, rotated area, and 26% are forest: cemetery, conservation forest, multipurpose forest and the land which has been returned to forest (Table 2). This community has revived the forest, restored from *Rai Lao*, to be conservation forests of 12 ha, as did the Huai Win.

In Fig. 7, it is shown that Pang Yang is classified as a community with an agricultural pattern of semi-commercial cultivation. They still have *Rai Lao*, but the rotation period was reduced to 5 years. Corn, which has become a popular cash crop is emphasized by farmers because it generates income. Lychee is also emphasized. This reflects an agrarian system with more intensive land use. Cultivated land for cash crops was selected in suitable areas,

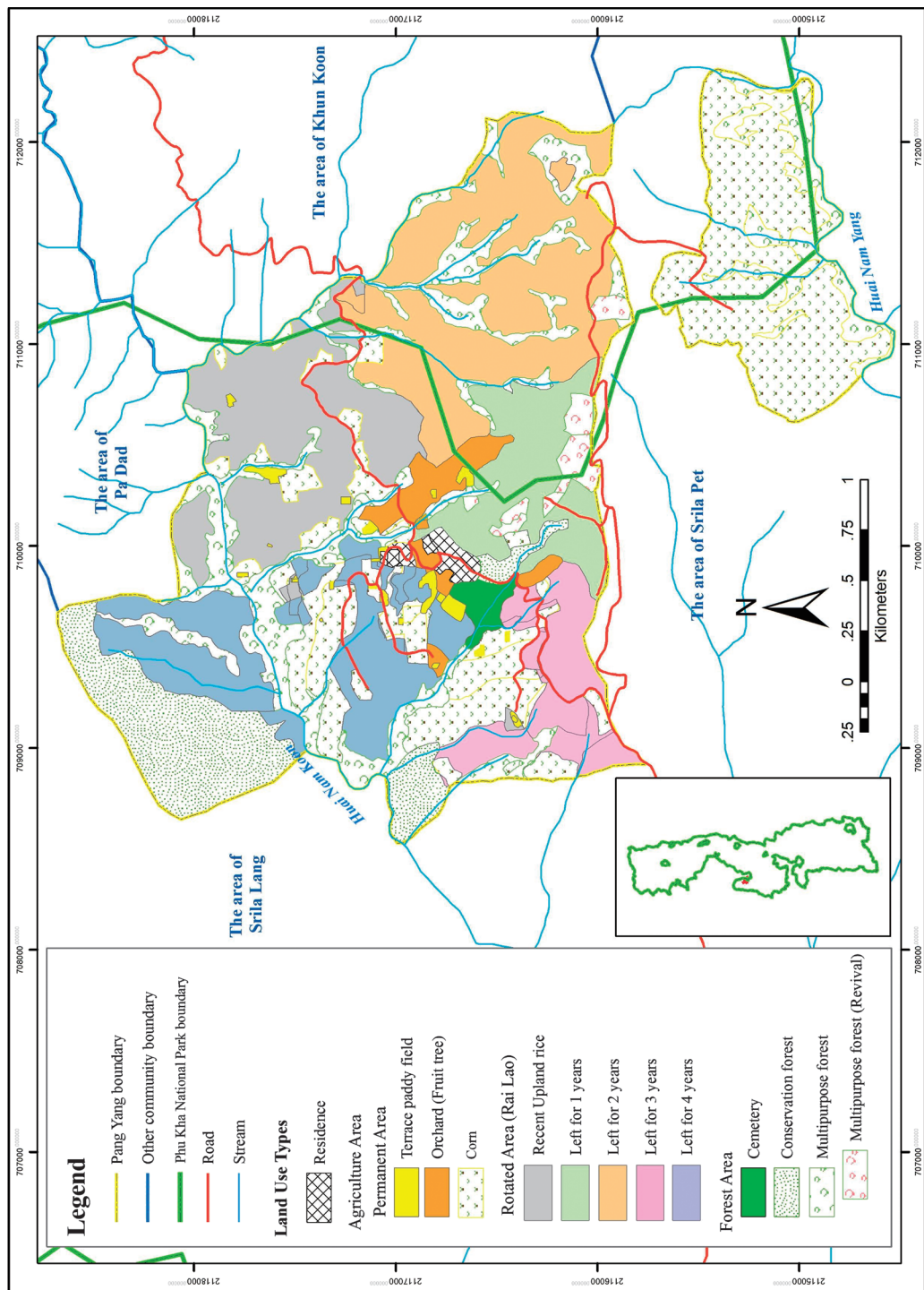


Fig. 6. Land use map of Pang Yang

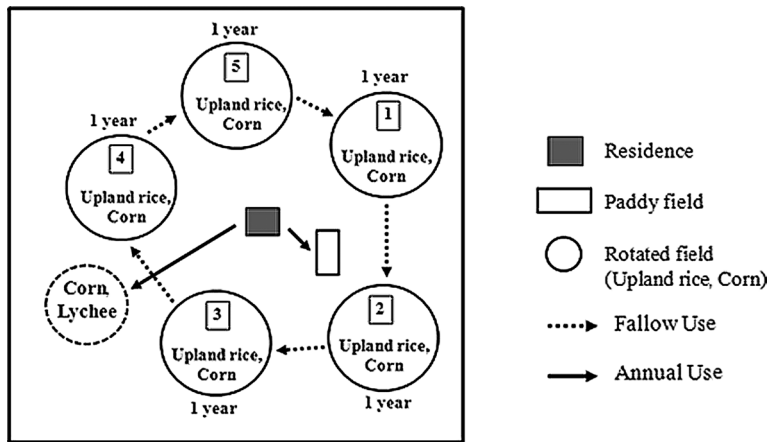


Fig. 7. Agricultural land use pattern of semi-commercial cultivation community

and not rotated, and they invested in corn production. While upland rice is traditionally cultivated, it tends to be reduced because of low yield. More terraced paddy fields were built up depending on whether they received enough budget from the government.

Pang Yang has changed its agricultural pattern from subsistence to more commercial cultivation. Similarly to Maneapluek 1, which represents the commercial cultivation community as described later, the community's agricultural system is more complex than that of Huai Win. The case of Pang Yang reflects the adaptation of farmers to recent changes. Convenient transportation is an important factor in the change of agricultural systems, and since this community is easily accessible, it has adopted technology and innovation into its agricultural system. Recently, commercial crops such as corn and lychee have been introduced and have become the main household income of this community, while subsistence crops such as rice are still cultivated for traditional reasons.

Consequently, Pang Yang farmers have adopted secondary jobs which help to increase their income. More than 55% of all households have an income of 10,000–30,000 baht per year, and 23% of households have incomes of 30,000–50,000 baht per year. The main household incomes are from the sale of commercial agricultural products, which shows that Pang Yang has adapted continuously, changing from

subsistence cultivation to more commercial-oriented cultivation.

3. Case of Maneapluek 1

Maneapluek 1 community, which was classified as an opium cultivation group in the past, represents a commercial cultivation pattern, with an agricultural pattern of long-cultivation=very-long-fallow. Transportation in this community is very convenient. In the past, Hmong preferred to cultivate opium, a cash crop, but opium has recently been replaced by short-term cultivation of vegetables (corn, cabbage, ginger, potato) and fruit trees (lychee, peach, pear, persimmon, coffee). This reflects an agrarian systems with the most intensive land use among the three types.

Figure 8 shows that the total land use of Maneapluek 1 amounts to 44,356 ha, of which 19% are used for agriculture: upland rice, corn, fruit tree, abandoned area, and 81% are forest: ceremonial forest, conservation forest, multi-purpose forest (Table 2). *Rai Rang*, abandoned land, occupies 9% of the community area, which shows that the territory of the community is relatively very large compared to other communities.

Rai Rang, which is abandoned land of low quality, is found in this community. Figure 9 shows that *Rai Rang* occupies approximately 3–4 plots per household. In the occupied land of each household, villagers have the freedom to select the cash crop to cultivate according to

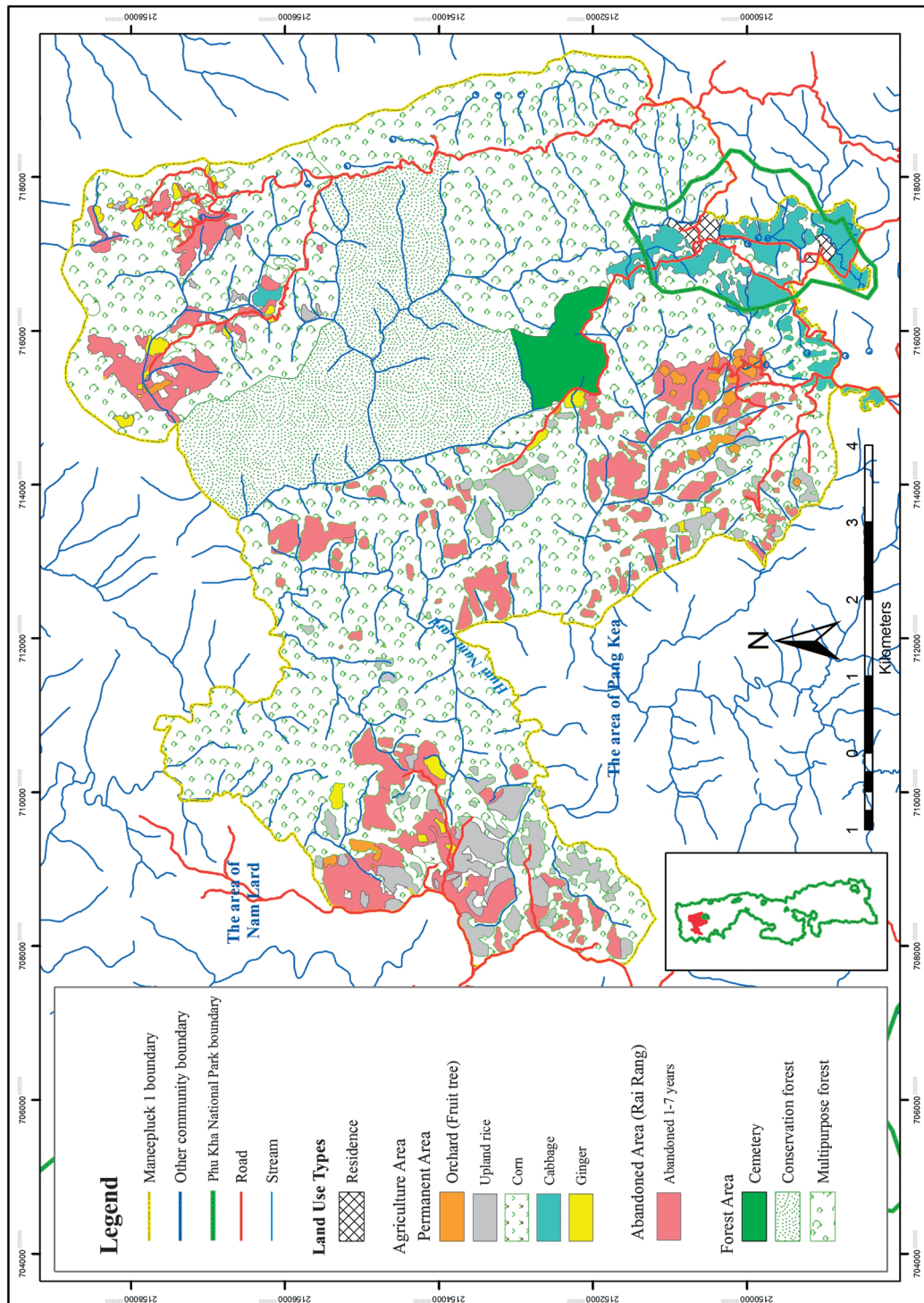


Fig. 8. Land use map of Manepluek 1

the suitability of weather, soil quality, physical conditions, and distance from water source and roads in each area. Because most cash crops, such as cabbage and ginger, are short-term vegetables of approximately 4 months per cropping, farmers cultivate their land from 1 to 3 or 4 times per year. For cash crops, they did not cultivate the same plot repeatedly due to insect problems. On the other hand, in the rice field, the low quality upland is usually cultivated only once a year because villagers do not emphasize the cultivation of subsistence crops. They are sure that if they receive money from cash crop cultivation, they can buy rice in order to feed their household.

Manepluek 1 represents the commercial cultivation community, and the most complex agricultural system compared to other communities. This agrarian system emphasizes commercial intensive land use with short-fallow cultivation or annual cropping because of the support of organizations, both governmental and non-governmental, and more convenient transportation. Consequently, they have alternatives which help to increase income, similar to the case of Pang Yang. More than 80% of the households have an income of more than 50,000 baht per year. The main household incomes are from the sale of cash crop products, which shows that Manepluek 1 has emphasized commercial cultivation and more intensive farming.

V. National Park Conservation and Land Use Patterns

1. Management of Protected Area

A Protected Area (PA) of the state is declared for preservation and conservation of national resources and environment. These areas are declared protected without participation of local communities who have lived there for a very long time. Nowadays, such areas are managed by the state, which has the right for prohibition and arrest. The rules of protection in these areas are used for law enforcement to resolve conflicts between local communities and forestry agencies.

The communities were settled in these areas long before the establishment of National Park. At the time there was no clear information on land use patterns of local communities. Consequently, conflicts arose between the communities and the park authority. On the other hand, local communities' land use activities in the upper reaches affected people living in the lowlands. The encroachment into the communities was found in many areas of the park due to various reasons such as abandoned farmland, shifting cultivation, or illegal logging with backing from investors or influential people.

The project of Joint Management of Protected Areas (JoMPAs) was a development project which was begun in Doi Phu Kha National Park in 2006–2009. The objective of the project was to preserve biodiversity and

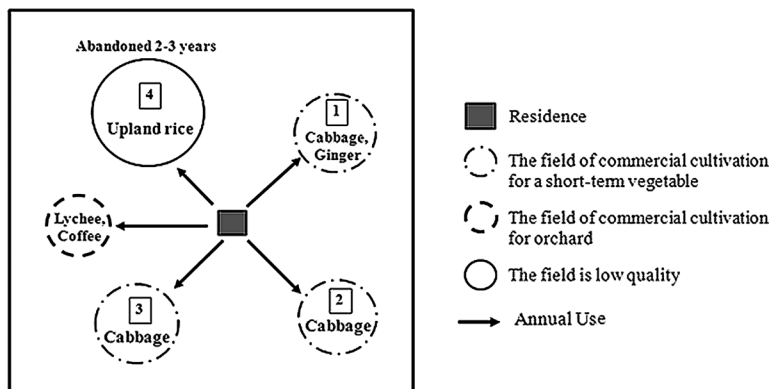


Fig. 9. Agricultural land use pattern of commercial cultivation community

ecosystem functions of the protected areas. In order to solve land use problems, the demarcation process of the special use zone was set. This important process contributed to a negotiation platform for several stakeholders, including members of the target village, members of neighboring villages, local authorities, forestry agencies, park authorities, local government officials and all local stakeholders.

The important point of the special use zone demarcation process was information. Data collection on social and cultural conditions, economic conditions, and community attitudes and actions showed that some of the communities were better prepared to accept the project. One important factor was geographic information, which explains physical and land use conditions of hill tribe communities, using Geographical Information System (GIS), Remote Sensing, and Global Positioning System (GPS). This information was crucial for implementation of the project. The process provided the geographic data, helping villagers and park staff to understand the information as maps and 3D-models, and helping the villagers, park staff and all stakeholders to reach agreement on the land uses of specific areas. The maps and other geographic information were important parts of the joint management agreements between the villages and the park.

As a result of this process, villager could clearly understand the boundary of their land use area, for instance recent cultivated field, rotated field, conservation forest, multipurpose forest and cemetery, and clearly the rules of the village concerning the limitations of usage in their land use area. They were more willing to change their activities and land use patterns and more willing to work with the park officials in joint management of the resources, if given greater opportunities for livelihood.

The alternative income generation opportunities helped them to reduce their need to use as much park land as before. For example, more efficient practices in agricultural lands near their communities might convince them to reduce or stop using lands farther away. This has been negotiated in the first of the target communities, where terraced farming has been shown to require less labor while giving higher yields, and where the introduction of new crops gives higher income and a greater variety of income sources, allowing farmers to reduce the area they need to use.

2. Case of Huai Win

The community boundary was identified clearly from the agreement of neighboring communities and local stakeholders. On the north is the conservation forest of Na Kang community; on the south is conservation forest of Huai Loy, while to the east is the conservation forest of Na Kok community, and to the west the agriculture land of Num Maow community. In addition, they have produced land use regulations for communal resource management (Box 1).

Consequently, there is efficient land use demarcation, and regulations for the management of their land use have been created and are strictly followed by the members of the community, who know the land use boundary, as well as its roles. In 2009, there was a case of conservation forest encroachment by a member of the community, in which the community committee managed the problem, resulting in restrictions and a fine to the violator.

3. Case of Pang Yang

The community boundary was identified clearly from the agreement of neighboring communities and local stakeholders. The north

Box 1. Huai Win regulations on land use

• Conservation forest

1. Do not cut trees in these areas (violators will be fined 1,500–5,000 baht per tree).
2. Cutting trees for common use which has to have approval from the community committee.

• Multipurpose forest

1. Any person who wants to cut trees in these areas has to have to approval from the community committee (fine 1,500–5,000 baht per tree).

Box 2. Pang Yang regulations on land use

• **Conservation forest**

1. Trees in these areas must not be cut (fine 1,500–5,000 baht per tree depending on the size).
2. It is forbidden to start a fire in these areas (fine 1,000–3,000 baht).
3. Dirty watershed is not allowed (fine 500 baht).

• **Multipurpose forest**

1. Cutting trees for sale is not allowed.
2. Any person who wants to cut trees in these areas has to have approval from the owner of the neighboring field.

Box 3. Maneepluek 1 regulations on land use

• **Conservation forest**

1. Do not cut trees in these areas (violators will be fined 5,000–10,000 baht per tree, depending on the size).
2. It is forbidden to start a fire in these areas (fine 2,000–5,000 baht).
3. Hunting in these areas is not allowed.
 - Fine 2,500–5,000 baht for big size.
 - Fine 100–1,000 baht for small size.

• **Multipurpose forest**

1. Cutting trees for construction or repair housing must be approved by community committee (fine 500–1,000 baht per time).
2. Cutting trees for commercial sale to outsiders is not allowed (fine 10,000–20,000 baht per time).
3. Cutting trees for commercial sale is not allowed (fine 2,000–10,000 baht per time).
4. It is forbidden to destroy trees (fine 5,000–10,000 baht per time).
5. Hunting in these areas is not allowed
 - Fine 2,500–5,000 baht for big size.
 - Fine 100–1,000 baht for small size.
6. Collecting firewood is only for household demand.

abuts the agricultural area of Pa Dad community; the south abuts conservation forest of Silapet community, the east borders the agricultural area of Khun Khon community and to the west is the conservation forest of Silalang community. They too have produced land use regulations for communal resource management (Box 2). These regulations are more complex than Huai Win Community due to greater complexity of the agricultural pattern of this community.

4. Case of Maneepluek 1

The community boundary of Maneepluek 1 is different from the other communities. Although it was identified from the agreement of neighboring communities and local stakeholders, it is unclear in some place because of the extent of the community's territory (about 6 times that of Huai Win and Pang Yang). To the north and east are the conservation forests of Khun Nan community; to the south the agricul-

tural area of Pa Kae community, and to the west the agricultural area of Nam lard community.

They too have produced land use regulations for communal resource management as shown in Box 3. These regulations reflect the greater complexity of the community which is much larger than both Huai Win and Pang Yang. This is also shown by the buffer area for the community, which was declared a national park from 1999 to the present and greatly extended, from 400 ha to 7,097 ha, due to the large population (about 6 times that of Huai Win and 3 times that of Pang Yang).

Hmong people are typical immigrants from several different areas and presently constitute a hill tribe community. Consequently, the community is composed of various groups of relatives, indicated by surnames or "Sae." Hmong give high importance to faith in their social structure, which explains the complex relationships in the community.

Consequently, the regulations for the management of their land use of Maneepluek 1 are less efficient than either Huai Win or Pang Yang, and more complex than Huai Win community due to the greater complexity of agricultural patterns and social relations. This is reflected in regulations which focus in more detail on controlling the various members of the community. This is illustrated by the case of Doi Phu Kha National Park, which encroached into the communal forest in Maneepluek 1's boundary. There were 5 cases of violations in 2009 (Doi Phu Kha National Park, 2011).

VI. Concluding Remarks

The successful implementation of the process of the special use zone demarcation is reflected by success at several levels for the three representative communities, based on their agricultural land use patterns: High level—Huai Win, Middle level—Pang Yang, Low level—Maneepluek 1.

Huai Win represents the land use pattern of subsistence cultivation groups. This is a simple system because they still emphasize cultivation of upland rice in *Rai Lao* of this community. Upland rice, which is the main subsistence crop, is cultivated only once a year. Therefore, the patterns of this system are of long-fallow cultivation, the use of household labor and low cost investment. Hence, there remain 7 plots of *Rai Lao* for rotating cultivation as in the past (Fig. 4). *Rai Lao* is a common property system which is managed by all members of the village. On the other hand, commercial crop is not important in this village because of inconvenient transportation, social factors and farmer characteristics (Hemwan, 2004). This agricultural pattern emphasizes subsistence cultivation in this community. Consequently, there is an efficient demarcation processes, shown by clear boundaries of land use and regulations, which are strictly followed by all members of the community (see Box 1).

Pang Yang represents the semi-commercial cultivation groups that have changed their agricultural patterns from subsistence cultivation to more commercial-oriented cultivation. This

community reflects the recent adaptation of farmers in introducing commercial crops, including technology and innovation which have resulted in the changed cultivation patterns of this community. They have reduced *Rai Lao* from 7–8 plots in the past to 5 plots at present, and so some households at present have no cultivated land in *Rai Lao* which was formerly cultivated upland rice because they have converted to commercial crops. The situation of this community is representative of the many communities in Phu Kha National Park, which have changed to more complex agricultural patterns for economic reasons. The regulations on land use for communal resource management have been clearly created, but it is not possible to implement them in some areas where there is an overlap of the land between subsistence and commercial crops. Consequently, the regulations on land use of this community are more detailed than Huai Win due to the more complex usage.

Maneepluek 1 is representative of the commercial cultivation groups. Because they prefer to cultivate cash crops, short-term vegetable are the main crops in this community, and economic factors are the most important influence on their cultivating decisions, which has led them to become a wealthy community. The cultivation pattern is more intensive than that of Huai Win and Pang Yang. Cash crops are cultivated on land which has suitable weather, soil quality, and physical conditions and is not far from permanent stream and road. For the rice fields, they select less fertile land because they do not emphasize the cultivation of subsistence crops. Otherwise, some occupied areas of low quality were *Rai Rang* abandoned for approximately 1–7 years. *Rai Rang* was one of ownership patterns of Hmong household, in that they occupied land and would use it again in the long term. This agricultural pattern shows that this community emphasizes commercial cultivation. Consequently, the demarcation processes on the land use of this village are less efficient, as reflected by the fact that both the boundary of land use and the regulations on land use are not clearly created. Because of the economic incentive from cash crops and the variety of social relations of

members in the community, the regulations on land use management are the most detailed. It is difficult to implement the regulation in this community and there are cases of violation every year.

The observations of this study reflect several issues. The communities which are more efficient in land use management are still in poverty. On the other hand, communities which are less efficient in land use management have higher income since they adopt a new agricultural system. These community groups tend to affect biodiversity and the ecosystem through their agricultural system. The question is how best to encourage communities which are conducting more commercial-oriented cultivation to have more efficient land use management as well. On the other hand, the subsistence cultivation communities which have efficient land use management should at the same time support the sustainability of their livelihood.

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