

Economic Value of Non-Timber Forest Products Used by the Largest Hmong Community in Thailand

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ABSTRACT

The Khek Noi Hmong village, the largest Hmong community in Thailand, settled in Phetchabun province, the lower part of northern Thailand. The villagers living in this area closest to Thung Salaeng Luang National Park were chosen as samples. Questionnaires and interviews were used to collect data on the economic valuation of Non-Timber Forest Products (NTFPs) between October 2012 and September 2014. Of all 3,034 households in 12 villages, 353 households were selected by random sampling. The NTFPs samples were 118 items, and were classified into 6 categories including socio-economic background of samples surveyed. Based on the market price method, the economic average net value of the NTFPs was 34,487.22 Thai Baht (THB) per household per year or 104,634,225.48 THB per community per year. The analysis revealed that 6 categories of NTFPs were woods, herbs and spices, wild crops and wild fruits, mushrooms, wild animals and insects, and ornamental plants. The top 3 categories of all NTFPs items, having the most utilization, were bamboo trees (*Bambusa* sp.), wild pigs (*Sus scrofa*), and eucalyptus (*Eucalyptus globulus* Labill.) with a net value per year equal to 31,251.60, 974.40, and 396.70 THB, respectively. Moreover, the seasonal calendar of each type of the NTFPs was created to understand a relationship between the forest dynamics and the human needs. The NTFPs in lower northern Thailand are therefore the most important coping strategies, including informal safety nets for the local people living close to the park.

Key words: NTFPs, biodiversity, local value, hill tribe people, northern Thailand

INTRODUCTION

Most rural people in many areas of the world, if not all, live in and along the periphery of forests and a large number of these people rely upon Non-Timber Forest Products (NTFPs) for their subsistence and partly for cash income (Olmos, 1999). The NTFPs include wood fuel, charcoal, honey, resin, spices, and raw materials for handicrafts from rattan, vines, bamboo, grasses, and wildlife products such as bones and skins for natural and ornamental purposes (Narendran *et al.*,

2001). These products may be collected by virtually anyone in the community, and are free of charge. People who are heavily dependent on forests for their livelihood primarily on a subsistence basis were often indigenous people or people from ethnic minorities. They are, thus, usually outside both the political and economic mainstream (Fisher *et al.*, 1997).

Since the 19th century, the Royal Thai Government blamed the hill tribe people for the destruction of forests in northern Thailand. They believed that education is the most important measure to restrain hill tribe people from destroying the natural's forests (Vithoon, 1989; Delang, 2005). At present, the hill tribe people in this area are helping to conserve the threatened forests but the quality of the forests is reduced, leading to a decrease in the biodiversity. While doing so, it was apparent that the NTFPs sector was an important source of their subsistence and income of people in the community. There has been much debate on the sustainability of this extraction for the long-term ecological integrity of forests. A number of researchers maintained that NTFPs can contribute to the economic well-being of the rural people and that the villagers should be involved in the conservation of biodiversity (Shankar *et al.*, 1996; Mesquita, 2000; Vodouhe *et al.*, 2009; Nahayo *et al.*, 2013). Sustainable harvest of renewable natural resources such as NTFPs could also be defined as the level of harvest that does not damage the ability of the harvested population to replace itself (Hall & Bawa, 1993).

Although several standard techniques can be used to provide the valuation of NTFPs e.g. travel cost, hedonic pricing, and contingent valuation methods (Svarrer and Olsen, 2005; Turner *et al.*, 2010; Vaughan *et al.* 2013), the market price method is a typical valuation technique for measuring the economic benefits from the NTFPs. Moreover, it is relatively easy to give a monetary value and to obtain for established markets (Kahn, 1998).

The mountainous highlands in the lower part of northern Thailand are the home of the Karen, Hmong, and other hill tribes. This research focused on the Hmong community at Khek Noi village in Phetchabun province. This area is the largest Hmong community and is also the 2nd largest hill tribe group in Thailand. This community consisted of 12 villages with a population of approximately 3,034 households or 13,246 people living in the community (Community Development Plan, 2011). It is possibly the largest number of Hmong people outside China and the United States (Yang, 2008). The Khek Noi Hmong village is situated close to the Thung Salaeng Luang National Park (Figure 1) which is one of the biodiversity-rich natural forests in the lower part of northern Thailand (DNP, 2010). However, there is little information on the NTFPs in this area. Thus, the purposes of this study were to identify the biodiversity of NTFPs appropriated by the Hmong households and to estimate the economic values of NTFPs by using the market price method.

MATERIALS AND METHODS

Populations and samples

Local people aged 15 and over living with their families from 12 villages of Khek Noi community were the respondents of the questionnaire-interview survey.

One member of each family directly involved in forest product collection, was selected for representing their family. The sample collection was 353 of 3,034 households by using Taro Yamane formula at 95% confident level (Yamane, 1993).

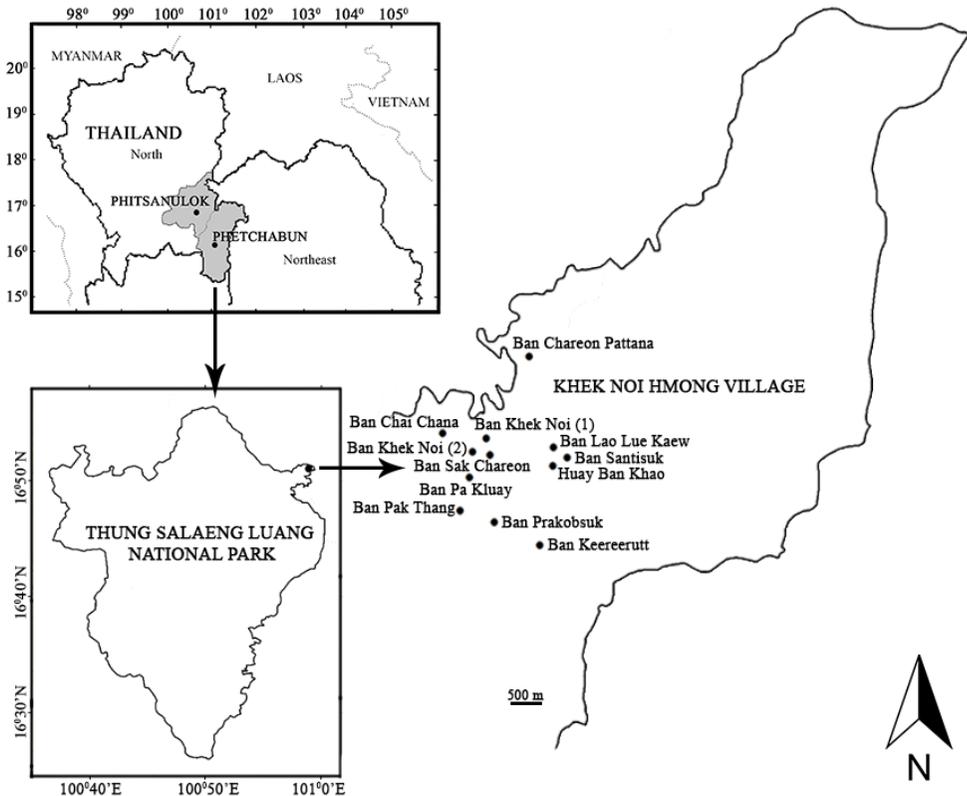


Figure 1 Represents a map of Khek Noi Mhong Community situated in Thung Salaeng Luang National Park, lower northern Thailand.

Data collection

The data collection was divided into 3 phases. The main data collection method was questionnaire and interview, which gathered information on the family size, education, occupation, marriage status, and income, were distributed during October 2012 to September 2014. In the first phase, questionnaires were carried out to assess the socio-economic status of the households. The detailed examinations on the extraction of NTFPs were carried out in the second phase. In the last phase, the information on the use of a biodiversity based on local knowledge of the sampled households was gathered. Moreover, all specimens of NTFPs collected from all local markets and a representative of the family members were identified. During these surveys, collection of NTFPs took place round the year under the guidance of the sampled households.

Data analysis

Most specimens were identified by experienced park staffs and taxonomy of literature reviews in the field (Monkolprasit *et al.*, 1997; Nabhitabhata *et al.*, 2000; Pauwels *et al.*, 2003; Nabhitabhata and Chan-ard, 2005; Jongjitvimol, 2008; Duengkae, 2011). Animal specimens were confirmed by comparing them with specimens at Naresuan University museum. All voucher specimens of animals were collected and deposited in Zoology Laboratory, Pibulsongkram Rajabhat University. Plant specimens and mushrooms were identified at Kasetsart University, Kam Phaeng Saen Campus (KU, KPS) and were confirmed by comparing them with specimens at Chiang Mai University Herbarium, Forest Herbarium, and Chulalongkorn University Herbarium. All voucher herbarium specimens were deposited in the botany laboratory at KU, KPS.

The NTFP survey provided information on the different NTFPs extracted, the time or period of gathering these products, the quantities extracted as well as the quantities consumed at home and those that were marketed. Estimates of the quantities and value of NTFPs extracted per year, per household were carried out by using the market price method, as follows:

$\text{Economic value of each NTFP} = \text{Average price} \times \text{Used per year per household}$

RESULTS

The data of the utilization of biological diversity on the basis of the local wisdom of Hmong villages in Khek Noi community was collected by interview and questionnaire methods from a sample of 353 out of 3,034 households. The results showed that the majority of the sample population were female (59.21%), younger than 30 years old (27.76%), and uneducated (48.15%). Moreover, livelihoods were based on agriculture, trading and employment. Agriculture was the major livelihood activity (75.35 %). Most of the sample populations were married (81.30%), with 3-6 family members per each household (32.01%) and earned less than 3,000.00 Thai Baht (THB) per month (33.99%). The income from agriculture and livestock sales is the other main source of income, apart from the NTFPs.

Villagers can easily enumerate large numbers of products collected from the forest. So far we have recorded 118 items of NTFP's mentioned and extracted by villagers. There are a variety of fruits, greens, mushrooms, and wild animals and insects. The dependence on wood fuel is high; most people extracted wood from the forest. The analysis revealed that 6 categories of NTFPs are: woods (20 items, 16.95%), herbs and spices (25 items, 21.19%), wild crops and wild fruits (35 items, 29.66%), mushrooms (7 items, 5.93%), wild animals and insects (30 items, 25.42%), and ornamental plants (only 1 item, orchids, 0.85%). About 107 items or 90.68% of NTFPs were harvested for household consumption. Only 11 items (9.32%) including 2 items of herbs and spices, 4 items of wild crops, 3 items of mushrooms and 2 items of wild animals can be traded on the market in Khek Noi community between October 2012 and September 2014. The NTFPs that have frequently been used (over 200 kg) included 14 items, namely amaranth (*Amaranthus* sp.), finger root (*Globba laeta*), black ginger (*Kaempferia parviflora*), Thai galangal (*Zingiber* sp.),

Javanese turmeric (*Curcuma zanthorrhiza*), edible fern (*Diplazium esculentum*), lasia (*Lasia spinosa*), bamboo shoot (*Bambusa* sp.), banana blossom (*Musa* sp.), termite mushroom (*Termitomyces fuliginosus*), barking deer (*Muntiacus* sp.), Thai silver barb (*Barbonymus* sp.), wild pig (*Sus scrofa*), and bamboo worm (*Omphisa fuscidentalis*) (Table 1).

Table 1 shows the annual per capita household income from NTFPs varies across the different categories of NTFPs. A few dominant NTFPs contributed to a large portion of the annual household income from NTFPs. The categories of woods (20 items) have the highest economic value although there were less item than categories of wild crops and wild fruits (35 items), wild animals and insects (30 items), and herbs and spices (25 items). *Bambusa* sp., the highest total used per year product, contributed to 96.51% and 90.45% of the average household income from NTFPs in the woods categories and in all forest products, respectively.

With the exclusion of wood, the highest levels of NTFPs extraction come from the categories of wild crops, wild fruits and wild animals and insects. Two commonly and widely gathered products were wild pig (2,867 kg) and bamboo shoot (2,097 kg) as wild animals and wild crops became an important NTFPs of Khek Noi Hmong village.

The maximum numbers of days of employment in NTFPs extraction depended on the categories of woods, herbs and spices, wild crops and wild fruits generated. Most of NTFPs (87 items, 73.73%) can be gathered and extracted throughout the year. The products like all of wood fuel, herbs and spices, and ornamental plant, except pak-wan (*Melientha suavis*) and bamboo shoot, were extracted as when the market demand arises throughout the year. Most of wild fruits were gathered between February and November, whereas fruit of black sugar palm (*Arenga pinnata*) and *Musa* can be gathered all year round. Mushrooms are important in the rainy season. They were collected only between May and August. There are 13 wildlife items which were gathered throughout the year while Chinese edible frog (*Hoplobatrachus rugulosus*) was gathered in June and July. Some products like subterranean ants (*Carebara* sp.) and eggs of red ants (*Oecophylla smaragdina*) were gathered from March to May; cicada (*Meimuna opalifera*) was gathered in September; bamboo worm and rhinoceros beetle (*Xylotrupes gideon*) were gathered from June to October (Table 1).

The utilization based on local wisdom plays more significant role in the traditional medicine than the commercial value. Hmong have expertise in the extraction of wild honey and herbs, and other products for quality of villager's life. They also pass their skills to the next generation within families.

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Table 1 Categories item, seasonal calendar and economic value of NTFPs in the study area.

Category of NTFPs	Scientific name (item)	Seasonal calendar	Total used/year	Used/year /household	Count units	Average price (THB/1 count unit)	Economic value (THB/year)
1. Woods	1.1 <i>Azzeria xylocarpa</i> (Kurz) Craib	whole year	2.00	0.006	m ³	600.00	3.60
	1.2 <i>Artocarpus heterophyllus</i> Lam.	whole year	1.00	0.003	m ³	500.00	1.50
	1.3 <i>Azadirachta indica</i> A.Juss.	whole year	2.00	0.006	m ³	300.00	1.80
	1.4 <i>Bambusa</i> sp.	whole year	12,811.00	36.270	m ³	860.00	31,192.20
	1.5 <i>Bombax anceps</i> Pierre	whole year	2.00	0.006	m ³	1000.00	6.00
	1.6 <i>Dimocarpus longan</i> Lour.	whole year	17.00	0.050	m ³	400.00	20.00
	1.7 <i>Dipterocarpus alatus</i> Roxb. ex G.Don	whole year	10.00	0.030	m ³	360.00	10.80
	1.8 <i>Eucalyptus globulus</i> Labill.	whole year	216.00	0.610	m ³	650.00	396.50
	1.9 <i>Flacourtia indica</i> (Burm. f.) Merr.	whole year	183.00	0.520	m ³	400.00	208.00
	1.10 <i>Hopea odorata</i> Roxb.	whole year	13.00	0.040	m ³	1000.00	40.00
	1.11 <i>Leucaena leucocephala</i> (Lam.) de Wit.	whole year	11.00	0.030	m ³	250.00	7.50
	1.12 <i>Litchi chinensis</i> Sonn.	whole year	100.00	0.280	m ³	350.00	98.00
	1.13 <i>Livistona speciosa</i> Kurz	whole year	1.00	0.003	m ³	200.00	0.60
	1.14 <i>Mangifera indica</i> L.	whole year	51.00	0.140	m ³	500.00	70.00
	1.15 <i>Pinus merkusii</i> Jungh. & de Vriese	whole year	1.00	0.120	m ³	440.00	52.80
	1.16 <i>Psidium guajava</i> L.	whole year	3.00	0.008	m ³	600.00	4.80
	1.17 <i>Sandoricum koetjape</i> (Burm.f.) Merr.	whole year	1.00	0.003	m ³	300.00	0.90
	1.18 <i>Tamarindus indica</i> L.	whole year	63.00	0.180	m ³	700.00	126.00
	1.19 <i>Xylia xylocarpa</i> (Roxb.) Taub.	whole year	4.00	0.010	m ³	800.00	8.00
	1.20 Unknown (Firewood)	whole year	43.00	0.120	m ³	600.00	72.00
Total			13,535.00	38.435	m³	10,810.00	32,321.00
2. Herbs and spices	2.1 <i>Aloe vera</i> (L.) Burm.f..	whole year	9.00	0.030	kg	60.00	1.80
	2.2 <i>Alpinia galanga</i> (L.) Willd.	whole year	45.00	0.130	kg	25.00	3.25
	2.3 <i>Alstonia scholaris</i> (L.) R. Br.	whole year	6.00	0.020	kg	15.00	0.30
	2.4 <i>Andrographis paniculata</i> (Burm. f.) Nees	whole year	2.00	0.006	kg	50.00	0.30
	2.5 <i>Boesenbergia</i> sp.1	whole year	1.00	0.003	kg	60.00	0.18

Table 1 Categories item, seasonal calendar and economic value of NTFPs in the study area (Cont.).

Category of NTFPs	Scientific name (item)	Seasonal calendar	Total used/year	Used/year /household	Count units	Average price (THB/1 count unit)	Economic value (THB/year)
	2.6 <i>Boesenbergia</i> sp.2	whole year	64.00	0.810	kg	40.00	32.40
	2.7 <i>Cereus</i> sp.	whole year	1.00	0.030	kg	15.00	0.45
	2.8 <i>Chromolaena odorata</i> (L.) R.M.King & H.Rob.	whole year	144.00	0.410	kg	15.00	6.15
	2.9 <i>Curcuma aeruginosa</i> Roxb.	whole year	5.00	0.010	kg	50.00	0.50
	2.10 <i>Curcuma aromatica</i> Salisb.	whole year	3.00	0.008	kg	50.00	0.40
	2.11 <i>Curcuma</i> sp.	whole year	98.00	0.280	kg	20.00	5.60
	2.12 <i>Curcuma zanthorrhiza</i> Roxb.*	whole year	458.00	1.290	kg	30.00	38.70
	2.13 <i>Eucalyptus globulus</i> Labill.	whole year	5.00	0.010	kg	20.00	0.20
	2.14 <i>Globba laeta</i> K.Larsen	whole year	376.00	1.070	kg	50.00	53.50
	2.15 <i>Justicia fragilis</i> Dennst.	whole year	6.00	0.020	kg	15.00	0.30
	2.16 <i>Kaempferia parviflora</i> Wall. ex Baker	whole year	605.00	1.970	kg	80.00	157.60
	2.17 <i>Morus alba</i> L.	whole year	6.00	0.020	kg	40.00	0.80
	2.18 <i>Orthosiphon aristatus</i> (Blume) Miq.	whole year	3.00	0.008	kg	5.00	0.04
	2.19 <i>Prunus cerasoides</i> Buch.-Ham. ex D.Don	whole year	2.00	0.006	kg	60.00	0.36
	2.20 <i>Talinum paniculatum</i> (Jacq.) Gaertn.	whole year	2.00	0.006	kg	120.00	0.72
	2.21 <i>Thunbergia laurifolia</i> Lindl.	whole year	2.00	0.006	kg	30.00	0.18
	2.22 <i>Tinospora crispa</i> (L.) Hook. f. & Thomson	whole year	6.00	0.020	kg	30.00	0.60
	2.23 <i>Tradescantia spathacea</i> Sw.	whole year	10.00	0.030	kg	30.00	0.90
	2.24 <i>Zingiber</i> sp.*	whole year	248.00	0.700	kg	60.00	42.00
	2.25 <i>Zingiber montanum</i> (J.König) Link ex A.Dietr.	whole year	54.00	0.150	kg	50.00	7.50
	Total		2,161.00	7.043	kg	1,020.00	354.73
3. Wild crops and wild fruits	3.1 <i>Amaranthus</i> sp.*	whole year	492.00	1.390	kg	16.00	22.24
	3.2 <i>Arenga pinnata</i> (Wurmb) Merr.	whole year	3.00	0.008	kg	15.00	0.12
	3.3 <i>Averrhoa carambola</i> L.	Jun. - Jul.	3.00	0.008	kg	10.00	0.08
	3.4 <i>Baccaurea ramiflora</i> Lour.	May	132.00	0.370	kg	20.00	7.40
	3.5 <i>Bambosa</i> sp.*	May - Aug.	2,097.00	5.940	kg	10.00	59.40

Table 1 Categories item, seasonal calendar and economic value of NTFPs in the study area (Cont.).

Category of NTFPs	Scientific name (item)	Seasonal calendar	Total used/year	Used/year /household	Count units	Average price (THB/1 count unit)	Economic value (THB/year)
3.6	<i>Borassus flabellifer</i> L.	whole year	3.00	0.008	kg	25.00	0.20
3.7	<i>Calamus</i> sp.	whole year	37.00	0.100	kg	10.00	1.00
3.8	<i>Castanopsis purpurea</i> Barnett	Mar.	5.00	0.010	kg	30.00	0.30
3.9	<i>Centella asiatica</i> (L.) Urb.	whole year	13.00	0.040	kg	10.00	0.40
3.10	<i>Citrus</i> sp.	Oct. - Nov.	5.00	0.010	kg	15.00	0.15
3.11	<i>Coccinia grandis</i> (L.) Voigt	whole year	10.00	0.030	kg	12.00	0.36
3.12	<i>Colocasia esculenta</i> (L.) Schott	whole year	4.00	0.010	kg	10.00	0.10
3.13	<i>Dimocarpus longan</i> Lour.	May	13.00	0.040	kg	10.00	0.40
3.14	<i>Diplazium esculentum</i> (Retz.) Sw. *	whole year	632.20	1.790	kg	30.00	53.70
3.15	<i>Dolichandrone serrulata</i> (Wall. ex DC.) Seem.	whole year	2.00	0.006	kg	30.00	0.18
3.16	<i>Duchesnea indica</i> (Andr.) Focke	Jul. - Aug.	5.00	0.010	kg	10.00	0.10
3.17	<i>Ipomoea aquatica</i> Forssk.	whole year	10.00	0.030	kg	20.00	0.60
3.18	<i>Irvingia malayana</i> Oliv. ex A.W.Benn.	Oct. - Nov.	2.00	0.006	kg	30.00	0.18
3.19	<i>Lasia spinosa</i> (L.) Thwaites	whole year	226.30	0.640	kg	10.00	6.40
3.20	<i>Limnocharis flava</i> (L.) Buchenau	whole year	4.00	0.010	kg	4.00	0.04
3.21	<i>Livistona speciosa</i> Kurz	Mar. - Apr.	14.50	0.040	kg	10.00	0.40
3.22	<i>Mangifera</i> sp.	May	96.00	0.270	kg	20.00	5.40
3.23	<i>Manihot esculenta</i> Crantz	whole year	10.00	0.030	kg	5.00	0.15
3.24	<i>Marsilea crenulata</i> Desv.	whole year	4.00	0.010	kg	5.00	0.05
3.25	<i>Melientha suavis</i> Pierre	Apr. - May	28.00	0.080	kg	120.00	9.60
3.26	<i>Momordica charantia</i> L.	whole year	7.00	0.020	kg	15.00	0.30
3.27	<i>Musa</i> sp. *	whole year	285.00	0.810	kg	8.00	6.48
3.28	<i>Nephelium hypoleucum</i> Kurz	May	107.00	0.300	kg	15.00	4.50
3.29	<i>Nephelium maingayi</i> Hiern	May	12.00	0.030	kg	20.00	0.60
3.30	<i>Passiflora foetida</i> L.	Jul.	14.00	0.040	kg	10.00	0.40
3.31	<i>Phyllanthus emblica</i> L.	May	12.00	0.030	kg	15.00	0.45

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	3.32 <i>Sandoricum koetjape</i> (Burm.f.) Merr.	May - Jun.	26.00	0.070	kg	15.00	1.05
	3.33 <i>Spondias pinnata</i> (L.f.) Kurz	Apr.	13.00	0.040	kg	15.00	0.60
	3.34 <i>Syzygium aromaticum</i> (L.) Merr.& L.M.Perry	whole year	2.00	0.006	kg	5.00	0.03
	3.35 <i>Syzygium</i> sp.	Feb.	1.00	0.003	kg	10.00	0.03
	Total		4,330.00	12.235	kg	615.00	183.39
4. Mushrooms	4.1 <i>Amanita hemibapha</i> (Berk. et Br.) Sacc.*	May - Aug.	53.00	0.150	kg	150.00	22.50
	4.2 <i>Amanita princeps</i> Corner and Bas.	May - Jul.	44.00	0.120	kg	70.00	8.40
	4.3 <i>Astraeus hygrometricus</i> (Pers.) Morgan	May - Jul.	2.00	0.006	kg	300.00	1.80
	4.4 <i>Auricularia auricula-judae</i> (Bull. Fr.) Wettst.	May - Jul.	62.40	0.180	kg	60.00	10.80
	4.5 <i>Lentinus squarrosulus</i> (Mont.) Singer	May - Jul.	16.00	0.050	kg	60.00	3.00
	4.6 <i>Termitomyces fuliginosus</i> Heim*	May - Aug.	208.50	0.590	kg	100.00	59.00
	4.7 <i>Termitomyces straiatus</i> (Beeli Geim)*	May - Jul.	58.40	0.240	kg	40.00	9.60
	Total		444.30	1.340	kg	780.00	115.10
5. Wild animals	5.1 <i>Apis florea</i> (Fabricius, 1787)	whole year	41.60	0.120	kg	100.00	12.00
	5.2 <i>Arborophila</i> sp.	whole year	98.00	0.280	kg	60.00	16.80
	5.3 <i>Barbonymus</i> sp.	whole year	607.00	1.720	kg	70.00	120.40
	5.4 <i>Capricornis</i> sp.	whole year	100.00	0.280	kg	180.00	50.40
	5.5 <i>Carebara</i> sp.	May	1.00	0.003	kg	50.00	0.15
	5.6 <i>Cyrtacanthacris tatarica</i> (Linnaeus, 1758)	whole year	0.20	0.005	kg	80.00	0.40
	5.7 <i>Gallus gallus</i> (Linnaeus, 1758)	whole year	113.00	0.320	kg	120.00	38.40
	5.8 <i>Gryllus bimaculatus</i> De Geer, 1773	whole year	25.20	0.070	kg	60.00	4.20
	5.9 <i>Hoplobatrachus rugulosus</i> (Wiegmann, 1835)	Jun. - Jul.	53.00	0.150	kg	180.00	27.00
	5.10 <i>Lepus peguensis</i> (Blyth, 1855)	whole year	10.10	0.030	kg	70.00	2.10
	5.11 <i>Lophura</i> sp.	whole year	3.00	0.008	kg	40.00	0.32
	5.12 <i>Macrobrachium</i> sp.	whole year	0.40	0.001	kg	150.00	0.15

Table 1 Categories item, seasonal calendar and economic value of NTFPs in the study area (Cont.).

Category of NTFPs	Scientific name (item)	Seasonal calendar	Total used/year	Used/year /household	Count units	Average price (THB/1 count unit)	Economic value (THB/year)
	5.13 <i>Malayemys subtrijuga</i> (Schlegel and Muller, 1844)	whole year	1.00	0.030	kg	50.00	1.50
	5.14 <i>Meimuna opalifera</i> (Walker, 1850)	Sep.	0.50	0.001	kg	40.00	0.04
	5.15 <i>Muntiacus</i> sp.1*	whole year	250.00	0.710	kg	80.00	56.80
	5.16 <i>Muntiacus</i> sp.2	whole year	280.00	0.790	kg	100.00	79.00
	5.17 <i>Oecophylla smaragdina</i> (Fabricius, 1775)	Mar. - May	1.00	0.003	kg	80.00	0.24
	5.18 <i>Omphisa fuscidentalis</i> (Hampson, 1896)	Jun.- Oct.	230.00	0.650	kg	80.00	52.00
	5.19 <i>Paradoxurus</i> sp.	whole year	33.00	0.090	kg	200.00	18.00
	5.20 <i>Rattus argentiventer</i> (Robinson and Kloss, 1916)	whole year	52.00	0.150	kg	60.00	9.00
	5.21 <i>Ratufa</i> sp.	whole year	122.60	0.350	kg	60.00	21.00
	5.22 <i>Rhynchophorus ferrugineus</i> (Olivier, 1790)	whole year	5.00	0.010	kg	50.00	0.50
	5.23 <i>Suncus murinus</i> (Linnaeus, 1766)	whole year	7.00	0.020	kg	160.00	3.20
	5.24 <i>Suncus murinus</i> (Linnaeus, 1766)	whole year	9.00	0.030	kg	140.00	4.20
	5.25 <i>Sus scrofa</i> (Linnaeus, 1758)*	whole year	2,867.00	8.120	kg	120.00	974.40
	5.26 <i>Teleogryllus mitratus</i> (Burmeister, 1838)	whole year	25.20	0.070	kg	60.00	4.20
	5.27 <i>Tupaia glis</i> (Diard, 1820)	whole year	53.60	0.150	kg	60.00	9.00
	5.28 <i>Varanus bengalensis</i> (Daudin, 1802)	whole year	15.00	0.040	kg	60.00	2.40
	5.29 <i>Vespa affinis</i> (Linnaeus, 1764)	whole year	8.10	0.020	kg	60.00	1.20
	5.30 <i>Xylotrupes gideon</i> (Linnaeus, 1767)	Jun. - Oct.	13.00	0.040	kg	70.00	2.80
	Total		5,025.50	14.260	kg	2,690.00	1,511.80
6. Ornamental plants	6.1 <i>Dendrobium</i> sp.	whole year	6.40	0.02	kg	60.00	1.20
	Total		6.40	0.02	kg	60.00	1.20
	Net value			34,487.22 THB per household per year			104,634,225.48 THB per community per year

Note: * traded to the community market; 32 THB can be exchanged for approximately 1 US dollar

DISCUSSION AND CONCLUSION

The harvest of Non-Timber Forest Products (NTFPs) is an important source of income to millions of people world-wide (Ticktin, 2004). It plays a significant role in sustaining rural communities, particularly those living close to the forest areas. NTFPs also play different roles in the livelihoods of village households, depending on their income level. Therefore, these products open up new economic opportunities to poor women in some of the most remote areas of developing countries (IFAD, 2009).

At Khek Noi Hmong village, 6 categories of NTFPs including, woods, herbs and spices, wild crops, wild fruits, mushrooms, wild animals and insects, and ornamental plants gave the economic average net value at 34,487.22 THB per household per year or 104,634,225.48 THB per community per year. Most of NTFPs, 107 items, were often used for household consumption. Trading of NTFPs is basically operated by primary collectors. It showed that collection of NTFPs of the household in this community did not come from a commercial harvest but from only subsistence harvest. This result corresponds to the research in other areas which found that people living around the forest and gathering forest products often do it for subsistence purposes. It is not considered a supplementary occupation to find extra income for the family in any way, due to the main occupation being agriculture (Svarrer and Olsen, 2005; Vaughan *et al.*, 2013). Thus, livelihood is supplemented with employment as off-farm income generation activities.

The market prices approach has been employed to assess “the margin” of NTFPs. At the operational level, the marginal benefits (demand) and the marginal cost (supply) equilibrium has been presented through the market prices approach from the value and quantity of NTFPs trade off by the local people. The average of direct benefits and economic values per household have been estimated. The economic values or prices and the flow or quantity in each item of NTFPs were measured by interviewing local villagers of each household from the target group as mentioned above. NTFPs values were calculated via market prices. At the strategic macro level valuation, an important factor is further indicators which should be developed to examine the scale of policy decision to serve local scale or gradual loss of an entire forest from time to time (Vodouhe *et al.*, 2009; Nahayo *et al.*, 2013).

Every community has its own living culture systems. For people at Khek Noi Hmong village, bamboo is an outstanding product of all NTFPs. They occurred in 2 categories as wood (bamboo stem) and wild crops (bamboo shoot). Bamboo and rattan shoots, cooked or eaten raw, are the most important side dishes on the daily menus. The bamboo stem continues to be an important raw material using in many ways such as equipment or furniture as well as to build a house including platform, walls, and roof of the house. Moreover, the bamboo is mostly used for construction of huts, barns and also as stakes on farms. Recently, it is being used for scaffolding instead of obeche (*Triplochiton scleroxylon*) planks. The bamboo is also combined with rattan to make furniture both for local market and export while both of mountain fan palms (*Livistona speciosa*) and sento (*Sandoricum koetjape*) are the lowest minimal value products in the wood category as they were only used as poles

of the houses. In accordance with the study of Wang *et al.* (2002) which found the several species of bamboos were used for building houses and food. Moreover, some species were a traditional source of raw materials in ethnic people's daily life in the Xishuangbanna area, Southwest China's Yunnan Province.

All identified herbs species have medicinal properties along with the other uses in traditional healing for primary health care. Most parts of them have medicinal properties, e.g. their whole plants, leave, roots, barks, and fruits. Medicine from these plant parts is prepared by older people in the family, usually in the form of juice, paste and powder. Elderly persons and traditional healers of the areas pose vast knowledge on ethnomedicinal practices along with various rituals. They also tried to pass this knowledge to next generation within the family. However, the knowledge transformation system is quite restricted. At the present, local people of Khek Noi Hmong village has adapted to western medicine for healing. It might be the key mechanisms resulting to a risk of gradually erosion, and they appear to be less salient of some skills and ethnomedical knowledge of younger age cohorts in the near future.

Food deficits were found to differ between the social groups and level of income per household. Although, livelihoods in Khek Noi Hmong village based on agriculture, wild edible plants were consumed in daily meals. Agricultural production is not enough to feed family members, especially in this remote community. In order to overcome food deficit, the diets are supplemented with wild edible plants. Unlike wildlife and fish which were insufficient sources of protein as livestock for people at Khek Noi Hmong village, wild pig (*Sus scrofa*) still is the most important NTFPs in the wild animal category because the most popular meat for Hmong is pork. This data is even more important as the number of wild animals in the natural park is decreasing due to hunting.

The results from information on the cognitive about forest showed that villagers were aware of conservation of NTFPs in their community forest and their interest were not oriented towards NTFPs plant species which have high demand in market because of their high price. It was found that the lengths of NTFPs gathering were related to seasons or natural phenomenon of forest. For example, some items were gathered whole year, while some were found only in the rain season. Activities of the people in the community are based on the capacity of forest by taking into account the potential of forests to produce resources up to replace those that were harvested out, thus causing a community having livelihoods that consistent with the utilization of forest resources (Yadav *et al.*, 2003). Forest conservation projects seeking to change the behavior of forest users need to understand the different livelihood strategies of the households in the vicinity of forests in order to offer appropriate NTFP models.

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