

Analysis of biodiversity conservation-based poverty-alleviation initiatives in Thailand

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Abstract

The link between poverty and biodiversity conservation reveals a multi-dimensional phenomenon. The uncertainties and complexities involved in defining poverty, as well as the dilemmas inherent in designing programs, and the practical obstacles to implementing the simultaneous reduction of poverty and conservation of biodiversity are some of the key factors in this phenomenon.

Despite such complexity, it is interesting to record that poverty alleviation and biodiversity conservation are among the main guiding principles, fundamental goals, and a substantial part of policy agenda particularly in developing countries.

This project aims to improve our understanding of such complex linkages by analyzing the policy scenarios and field level interventions targeted to achieve the twin objectives of biodiversity conservation and poverty alleviation in Thailand, which has taken important initiatives in this direction in the recent past.

The project raises the following key questions: a) What place does biodiversity conservation have in poverty reduction programs? b) Are the mainstream poverty reduction approaches adequately sensitive to conservation in Thailand? c) To what extent is it possible to craft policies and interventions that can secure the joint objectives of poverty reduction and biodiversity conservation in India?

1. Introduction

Although poverty is often measured and defined in absolute terms (people falling below a specified level of income, commonly US\$2 per day) (World Bank 2001), it is now widely accepted that causes of poverty are multidimensional (Sanderson 2005). The World Bank (2001) refers to three dimensions of poverty: lack of assets,

powerlessness and vulnerability. Thus, poverty can be thought of as a state of reduced or limited livelihood opportunities. In other words, addressing multidimensional characteristics of poverty may help achieving livelihoods security. In view of the complimentary characteristics of poverty and livelihoods, the terms are used interchangeably in this article. Conservation in this context is used in its broadest sense, including management of natural resources sustainably as well as their protection and restoration, rather than in a narrow sense of maintaining an original state or preservation (Fisher et al 2005). The links between poverty and biodiversity conservation are interpreted by scholars and practitioners in many different ways. For example, Roe and Elliott (2004) state that dependence of rural poor on forest resources is a significant underlying threat to conservation; Adams et al. (2004) view poverty reduction and biodiversity conservation as simultaneous developmental goals. Agrawal and Redford (2006) on the other hand term this link as ‘complex’, mainly because of the inherent dilemma in designing programs that may beset the achievement of twin objectives.

This research in Thailand focused on understanding different dimensions of biodiversity (forest) conservation and household poverty links. The selection of Thailand for the research is justified by the fact that after witnessing large scale deforestation during logging concession era, prior to 1980s, last few decades have reported a number of forest conservation initiatives in different parts of the country by various stakeholders. Such initiatives, therefore, provided an opportunity to understand the approaches being adopted, especially from the point of view of poverty reduction among the forest dependent communities, and response of the related policies in the respective sectors. Accordingly, this research in Thailand is a case study based, revolving around following broad objectives:

- Understanding the community forestry and protected area conservation models and their poverty alleviation benefits
- Reviewing and synthesizing policies from the point of view of complementarity of such initiatives in the context of poverty alleviation and livelihoods security of forest dependent communities.

2. Methodology

2.1 Field study locations

Based on a literature review, preliminary discussions with subject experts and researchers, a reconnaissance survey was conducted to select five villages across four case study locations for the field research (Figure 1). Selected locations varied in terms of type of forest ecosystem, socio-cultural setup, resource user groups and management regimes. The objective of selecting representative study locations was to better understand the different dimensions of conservation and poverty links. Accordingly, each case study looked into different research themes, revolving around broad objectives of research, as listed below:

- Forest-agriculture interface and its livelihoods implications in Doi Mae Salong
- Livelihoods benefits of forest restoration in Doi Suthep-pui National Park
- Livelihood links of Joint Management of Protected Area in Phutoei National Park; and
- Poverty alleviation benefits of community conservation of mangroves in Pred Nai

2.2 Research tools and sample size

Preliminary reconnaissance helped in designing survey protocols and methodological frameworks for primary data collection in each study location. Participatory research tools, such as focused group discussions (FGD), key informant interviews, participatory resource appraisals (PRA), time line exercise, participant observations and household questionnaire surveys were used for field data collection. On an average at each study location 5-6 days were spent with the local communities to collect primary field data, focusing on general demographic patterns, forest based livelihoods of the local communities, and other associated aspects, such as awareness on conservation and management of forest resources, institutional mechanisms, benefit sharing etc. Formal and informal discussions with the management authorities were also conducted to understand the policy perspective of conservation and livelihood linkages. Using stratified random sampling method I sampled 10% to 25%, averaging 16% of the total 485 households of the study villages (Table 1). Land ownership was considered an important criterion for sample selection, and therefore, sampled households represented land owners as well as landless families. After preliminary data analysis, wherever needed, second visit was also made to the study

villages in order to fill the information gaps.

2.3 Analytical framework

Participatory tools and methodological frameworks were designed and adopted to assess qualitative and quantitative impacts of community conservation of forests on biodiversity and livelihood strategies by local communities. While the qualitative field data collection recorded ranking based perception of the respondents on various indicators of biodiversity and socio-economic values, wherever possible quantitative data was collected on the total household income sources of income, and contribution by the forest resources. For biodiversity values, key indicators such as availability and abundance of faunal and floral species, management aspects such as resource harvesting, illegal logging, hunting and forest fire etc. were used. For socio-economic assessment changes in forest based livelihood benefits, income patterns, environmental services, and management and governance aspects such as, awareness level, institutional capabilities and conflict were recorded. Information were also collected on other associated aspects such as access to basic infrastructure such as drinking water, health, education, market etc. The results of the field data analysis for each case study are discussed in the section below, followed by an integrated synthesis and discussion.

3. Results

3.1 Forest agriculture interface and its livelihoods implications in Doi Mae

Salong

3.1.1 *Land use transition*

The case study in Doi Mae Salong (DMSL) region of Chiang Rai province in north Thailand focused on understanding the process of forest and agriculture land use transition and associated conservation practices and livelihoods strategies of ethnic minorities in Pana Sawan and Lawyo villages. The DMSL is one of the prominent regions in northern Thailand that has witnessed the process evolution of ethnic and cultural diversity and land use transition (Silori 2009). While various aspects of the process have been documented in the past, attempts to understand the impacts at the grassroots level have been rare (Forsyth 1995, Rerkasem 1996), and almost none with respect to the livelihoods implications for the forest dependent communities. A review of the existing literature indicates that State policies contributed significantly to direct

the process of land use transition in the region. While until mid 1980s logging concessions alongside slash and burn practices caused heavy deforestation, the follow up restoration programs recovered degraded forest lands to some extent (Thiusta 1999). The Royal Project for Development of Highlanders initiated in 1969 is hailed as landmark intervention in this direction. However, in view of the major focus of the programme on land based interventions, large land cultivators were the key beneficiaries. In case of the study villages, Chinese households, on an average cultivating large chunk of hill slopes were major beneficiaries of such programme. In for Pana Sawan land holding for Chinese households was averaged more than 90 rai (6.25 rai = 1 ha). Comparatively better economic status of such households was a key factor which prompted them to adopt relatively high inputs commercial crops such as tea, coffee and tropical fruits. The marginal and small landholders (having <30 rai in the study villages), could not afford such high input crops, and therefore continued with traditional crops such as upland rice, corn and few vegetables. Sample survey results from Pana Sawan substantiated such patterns, where only 7% of the total cultivated land was under rice and corn, mainly cultivated by marginal households of Akha and Lahu, while coffee and tea covered more than 56%, and the rest 37% was under fruit orchards, mainly owned by Chinese households. The socio-economic impacts of such land use changes were obvious. Expansion of tea and coffee plantations and fruit orchards provided employment opportunities and poor households of Akha and Lahu from nearby countries, Myanmar and Lao PDR kept migrating to fulfill the growing demand for manual labour. In the process, many of such households settled in the region and started cultivating smaller land areas in order to supplement their basic needs. In Lawyo village, for example, 14 rai was average land holding, and under upland rice and corn were dominant crops. Together these crops covered more than 40% of the cultivated area, while merely 2% was under tea and coffee plantations. Of the rest nearly 41% was under fruit crops, which is a recent introduction. The changes in agriculture landscape had an impact on surrounding forest lands. Introduction of perennial crops and promotion of agroforestry on one hand helped in substantially reducing the tilling frequency on hill slopes, on the other hand, they contributed to stabilize hill slopes and reduced soil erosion. Some of such changes were reported by the respondents during perception study, mainly including enriched biodiversity, improved soil moisture regime and recharging of streams and rivulets.

3.1.2 Forest livelihood interface

Household survey reported annual average income of 75346 baht/household in Pana Sawan and 35537 baht/households in Lawyo. Chinese household from Pana Sawan reported maximum average income of 172167 baht/household, distantly followed by 56964 baht/household for Akha and 21416 baht/household for Lahu. Patterns of income contribution by different sources revealed that in general agriculture was major source, contributing 66% in Pana Sawan and nearly 48% in Lawyo. Second major contributors were remittance income in Lawyo (44%) and daily wage labour (26%) in Pana Sawan. Survey results on the contribution of forest resources to livelihoods reported that 85% households from Pana Sawan and 88% from Lawyo depend on them for edible plants as diet supplement; medicinal plants for health care; fuel wood for cooking energy; and timber for house construction. In terms of monetary contribution, in Lawyo village of the total forest dependent households, 71% reported earning cash income that contributed 0.5% to 36% to the household income, averaging at 7.5%, as against none in Pana Sawan village. This is an important contribution for the low income (35537 baht/annum) households of Lawyo village, when compared with more than double income earning households of Pana Sawan (75346 baht/household/annum). However, while improved forest quality and employment opportunities in agriculture sector are reported as important incentives for poor households of Akha and Lahu to cross the border, fact of the matter is that ethnic minority and hill tribe status of such migrants is a major factor that to some extent determines the poverty situation in the area. Citizenship is a major issue for such migrants, which limits their movement for alternate employment opportunities in nearby cities and towns. On top of this, the official harassment and extortion generate a sense of inequality and exclusion among them, persistently keeping them under impoverished situation. Contrary to this, Chinese households enjoy a distinct advantage, due to a relatively 'soft policy' of the State, owing to their role in policing the border against communist attack in earlier days. Comparatively large average land area under their cultivation and higher income levels, as reported from the case study are indications of such indifferent policies.

3.2 Livelihoods benefits of forest restoration in Doi Suthep-Pui National Park

3.2.1 Brief overview

Ban Mae Sa Mai (BMSM) village is located within Doi Suthep-Pui National Park (DSNP) in Mae Rim district of Chiang Mai province in northern Thailand. It is one of the largest settlements of Hmong hill tribe in northern Thailand. Published literature has reported Hmong tribes as the main agents of converting forested areas into agriculture cultivations. Specifically, in DSNP the large scale deforestation in the upper Mae Sa valley resulted into loss of about 17% of the Park area (Thailand Development Research Foundation 1997), causing drying up of the major streams that supplied water for drinking and agriculture purposes. Such a situation left the villagers with a strong sense of the link between deforestation and loss of livelihoods sources. Faced with acute water shortage, the villagers moved down from 1300 m to its present location at 1000 m elevation about 40 years back. In order to reverse the negative impacts of forest destruction on their livelihoods, the villagers initiated community efforts to restore the degraded areas, which were later supported by the technical inputs from the Forest Restoration Research Unit of Chiang Mai University (FORRU-CMU) (Elliott and Kuaraksa 2008). Thus, the case study of BMSM focused on to analyze the resultant impacts of forest restoration on the livelihoods of the villagers, especially in the context of PA management.

3.2.2 Conservation and livelihoods link

The historical account traced through time line exercise, starting from as early as mid 1960s, reported many stages of transitions in the forest quality and associated livelihoods strategies of the Hmong tribe. Forest quality that was rated '3' on a scale of 1 to 3 (poor to good) until mid 1970s, reduced to '1' by late 1980s. This was due to continued destruction of forests by new settlers, first for opium cultivation on upper slopes, and once it was banned in 1982; forests were clear felled for rice, corn, cabbage and lychee cultivation. The negative impacts of forest destruction, such as shortage of water, high rates of soil erosion, silting of water courses, frequent flash floods, deteriorating quality of drinking water and reduced availability of NTFPs, were reaffirmed by the respondents during the field study. Livelihood was all the more uncertain, as the villagers had to pay for the products, which they used to formally collect from the forest without paying any price. Notification of the DSNP only added to the difficult situation as the access to the forest resource was further

restricted and agriculture expansion to new areas was strictly banned. Moreover, the local inhabitants not only feared eviction after notification of the DNSP, but also got into frequent conflict with the Park authorities over use of resources, including lands for cultivation. The only way out from such a situation, as perceived by the villagers was to win the confidence of the Park authorities to secure their claim to remain inside the DSNP. The villagers adopted community forestry to proactively reforest the degraded areas on the upper watershed forests, complimented by the institutional setup and bylaws and rules and regulations to harvest and protect the afforested areas. Consequently, these efforts yielded positive results and forest quality and status of other environmental services were progressively rated as '2' by the late 1990s, and '3' at the time of this study (2009). Agriculture sector also seems to have benefited from the improved forest conditions on the upper watershed areas. Of the total respondents, 27% rated low, 60% moderate and 13% high improvement in agriculture productivity. This had direct impact on the household income level, since agriculture contributed maximum (62%) to the average household income of 186584 baht/year. Although quantification of the reported improved productivity was not possible due to short study period, very few of the respondents indicated productivity increase between 10% and 30% for the dominant crop lychee. Improved quality of forests also helped in supplying various forest products for day to day needs of the local households. More than 75% on the interviewed households reported their dependence on NTFPs for various needs such as food, energy and house construction, but direct and indirect cash income from forest sector was marginal. Only one, out of 14 forest dependent households, reported earning cash income from sale of NTFPs, while other five reported income from limited ecotourism activities. From socio-cultural point of view, change in the image from forest destroyer to forest conservator and winning the trust of Park authorities was listed as major achievement by almost all the respondents. Such an image transformation of the villagers persuaded local government to provide financial support for developing basic infrastructure in the village, such as school, health and drinking water facilities, and road connectivity. These are seen as important contribution to livelihood security of the villagers, since road connectivity helped them to sell their agriculture produce and also engage in other business activities in nearby town, Chiang Mai. At the same time, younger is able to reach out to institutions and colleges for higher studies.

3.3 Livelihoods link of Joint Management of Protected Area in Phutoei National Park

3.3.1 *Brief overview*

Joint Management of Protected Areas (JOMPA) is a recent concept of PA management in Thailand that aims to bring together different levels of actors, including the Department of National Parks (DNP), local communities, and NGOs to address the key problems of continued loss of biodiversity, degradation of the ecosystem, loss of livelihood opportunities for the rural poor, and lack of democratic involvement of a broad range of stakeholders in the PA management (Chalerplap 2008). JOMPA is under implementation in 11 PAs, including Phutoei National Park (PNP), situated in Suphanburi province in western Thailand. The PNP is surrounded by a total of 22 villages; 7 of them located within 2 km from the park boundary. Huai Hin Dam, located on the south-western fringe of the Park, is one of the few villages being developed as a model village to promote the concept of JOMPA, and therefore selected as a case study village to understand links between conservation initiatives under JOMPA, and livelihoods benefits, besides analyzing related policy aspects.

3.3.2 *Conservation and livelihoods links*

Similar to many other regions of the country, forest quality in the study location also reported many ups and downs during past few decades, owing to slash and burn agricultural practices and logging concessions until mid 1980s. A ban on these practices in late 1980s was supplemented by regeneration and conservation efforts. However, regeneration efforts were largely dominated monoculture plantations, and therefore did little to contribute to the biodiversity values. Relocation of cultivated lands from such areas earmarked for forest regeneration, caused livelihood insecurity among the forest dependent groups. Huai Hin Dam village, inhabited by Karen community, faced with similar situation, decided to conserve the forest for their survival and formed a community forestry group in 1994 (ThCCP RECOFTC, Undated). However, the community conservation efforts received a setback, when Phutoei National Park was notified in late 1998. The notification of Park caused confusion and insecurity among the villagers and access to the Park forest including the cultivated lands, which were now inside the notified area, was restricted. While Karen people continued their resilience against imposed ban on the resource use from Park area, JOMPA was introduced as a potential tool to promote participatory concept

of PNP management. Past conservation efforts by Karen provided a formidable ground to experiment JOMPA in PNP. Under this scheme, the community forest area was reclassified into three major land uses, conservation forest, utilization forest and controlled area. Controlled area included rotational agriculture lands, cultivated under a common ownership of the village, just outside PNP boundary. Conservation forest was meant for preserving biodiversity and therefore logging and wildlife hunting were prohibited. Utilization forest was meant to meet the NTFP and timber needs of the villagers, which was regulated by rules and regulation framed by community forestry management committee of the village.

Results of ranking (on a scale of 1 to 4: poor, average, good and very good), to assess the changes in forest quality indicators are presented in (Figure 2). Forest regeneration reported noticeable improvement during last 10 years, while hunting of wild animals and birds reportedly declined, resulting into improved biodiversity inside the park. Similarly availability of useful plants and their products including bamboo shoots, edible herbs (8 species) and medicinal herbs (15 species) reported increase. The improvement in the availability of forest products helped earning additional income to the villagers. On an average it was reported that of the total average household income of 134000 baht/year, nearly 13% is contributed directly and indirectly from the forest products. This includes 2% contribution from the sale of bamboo shoots and remaining 11% from other plant species (>15 species) and their products, used for making natural dye for handicraft items (Table 2). While bamboo shoots are collected by almost all the households of the village, natural dye based handicraft item was reported an important occupation for 8 (63%) out of 13 sampled households. The data obtained from the records of saving group of 20 women for 4 years (2004-2007) who are involved in this occupation, reported constant increase in the sale of natural dye based handicraft items and income from them (Figure 3). Annual sale of handicraft items increased from 48973 baht in 2004 to 121332 baht in 2007, yielding a substantial increase in average annual income, from 2249 baht to 6067 baht for each member.

3.4 Poverty alleviation benefits of community conservation of mangroves

4.5.1 Brief overview

The Pred Nai village is located in Trat Province on the eastern seaboard of Thailand. The mangroves of Pred Nai, one of the last surviving mangrove forests in Thailand's eastern seaboard, were placed under a logging concession in 1941. Uncontrolled logging and intensive shrimp farming caused heavy destruction. As a result, an area of nearly 48,000 ha of mangroves was reduced to 1920 ha by the early 1980s (Senyk 2005). Government concessions favored corporations and restricted the villagers from harvesting crabs, shellfish, and other mangrove resources. Some local people converted degraded mangrove areas into shrimp ponds and built gates to block seawater, causing further damage to the remaining mangroves. Availability of marine products, such as crabs, fishes and shellfish decreased substantially. Threatened for their livelihoods, the local villagers resisted against the corporate destruction of the mangroves. A protest led by a group of 5-10 villagers soon gained momentum and support from the rest of the village turned into mass protest, forcing government to impose a ban on commercial logging in 1987. Vindicated by their stand, villagers institutionalized their struggle and formed Pred Nai Community Forestry Group. The continued efforts of the villagers to protect the remaining mangroves and plant new areas got support from many quarters including religious leaders, local and provincial governments, donor agencies and technical experts and organizations. Technical support from RECOFTC helped villagers to formulate a long term participatory mangrove restoration and management plan and framing rules and regulatory practices for marine resource harvesting, particularly, the grapsoid and mud crabs, the important cash earning species (Somying 2006). Having reviewed the background of community conservation of mangroves, this case study in Pred Nai focused on understanding direct and indirect benefits from the mangrove forests in the context of poverty alleviation.

4.5.2 Conservation and poverty links

Household survey data reported that average annual income ranged from 65,000 baht for landless households to slightly above one million baht for a large land holder, averaging about 435,000 baht per annum. Fish and shrimp farming contributed up to 63% to the average annual income, followed by agriculture (26%) and collection of marine animals (9%), mainly grapsoid crab from mangrove forests. The remainder

was contributed by other sources such as sale of wild honey and ecotourism. Thus, nearly 74% of the total average household income can be directly or indirectly attributed to mangrove forests. While analyzing income patterns across different socio-economic groups, it was reported that for landless households, more than 71% income is directly derived from the sale of grapsoid crab (69%) and honey (2%) collected from mangrove forest (Figure 4). For small to large land holders, although the share of direct cash income from crab collection from the mangroves ranged from <2% to 19%, they linked their income from fish and shrimp farming (56%, 59% and 72% for small, medium and large landholders, respectively) to the improved conditions of mangrove forests, that supply nutrient to the coastal water, which floods their fish ponds periodically and thus provides ideal habitat for fish and shrimps. The contribution of marine products from mangrove forests to the household income was also reflected from the data collected from local crab traders. It was estimated that annual harvest (2008-09) volumes of crab trade from Pred Nai was nearly 95 tons with a market value of 4.68 million baht, with a continuous upward trends over the past few years (Figure 5). Increased quantity of harvest also provided employment opportunities to villagers, whose number increased from 6-7 persons per day about a decade back to nearly 70 at present. On top of this, every day about 30 more people from surrounding villages visit Pred Nai mangrove forest for crab collection. Despite continues increase in the number of visitors for crab collection, average quantity of collection remained constant at around 7-8 kg for each collector for last 10-15 years. However, the time spent for catching crabs has declined significantly to an average of 4-5 hours per night, as compared to almost a whole night about ten years ago. Such a pattern indicates the improve condition of mangrove forests and sustainable resource harvesting practices by the villagers.

4 Discussion and Conclusion

The results of the field research done in Thailand sufficiently indicate that the community action to restore and conserve the degraded forests was fundamentally driven by their livelihoods needs. The synthesis of case studies, therefore, supports the fact that biodiversity conservation can potentially contribute to livelihoods security of forest dependent households, including poor and marginal ones (Fisher and Hirsh 2008). Case study results from Huai Hin Dam and Pred Nai (Silori et al 2009) are particularly worth mentioning in this regard. At a micro level however, interplay of

few other factors may determine the synergy and relationship between conservation and livelihoods. Lack of land tenure, citizenship status, and ambiguous policies are few such factors those emerged from case studies. The lack of land tenure is more critical in PA system, as reported from DSNP and PNP. Although villagers reported improved relationships with the Park authorities, tenurial issue of cultivated lands inside the parks was perceived as an important factor that may add uncertainty to their livelihoods. The 'hill tribe' identity and selective approaches of the State authorities towards ethnic minorities, in upland of northern Thailand restrict their movement for alternate employment opportunities, making them further vulnerable to poverty. Such a situation not only creates a sense of exclusion and powerlessness, but also prohibits an individual to live a life and make choices that they strive for and value, and thus forces them to remain poor (Sen 1992). Lack of explicit policies to mainstream poverty reduction strategies in conservation agenda further adds to the complexity (UNDP-UNEP 2009), as revealed from the review of relevant conservation policies in the country. For example national biodiversity strategy and action plan (2008-2012) of Thailand although describes sustainable use of tropical biodiversity, the explicit mention of the poverty reduction strategies or livelihoods security of the resource dependent populations is an obvious omission from its policy statement. Further, the prevailing ambiguity over community forestry bill (started in 1994) (Roonwong and Onprom 2000) in the country only creates a situation of uncertainty with respect to the ongoing *de facto* community forestry initiatives and thus contributes least to poverty alleviation among the forest dependent communities. The case studies conducted in Thailand have not only highlighted the important role being played by the forests for livelihoods security and poverty alleviation, but also sufficiently indicates the capacities and potential of community action to address the twin objectives. It is therefore highly desirable that national policies recognize this potential and reframe the policies to create a scope of mainstreaming poverty alleviation agenda in the conservation planning. Lingering uncertainty over the policy decisions such as CF bill will only add to further confusion and uncertainty, which might frustrate rural communities, and detach them from the conservation traditions, especially the younger generation.

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Fig. 1: Location of study villages in Thailand

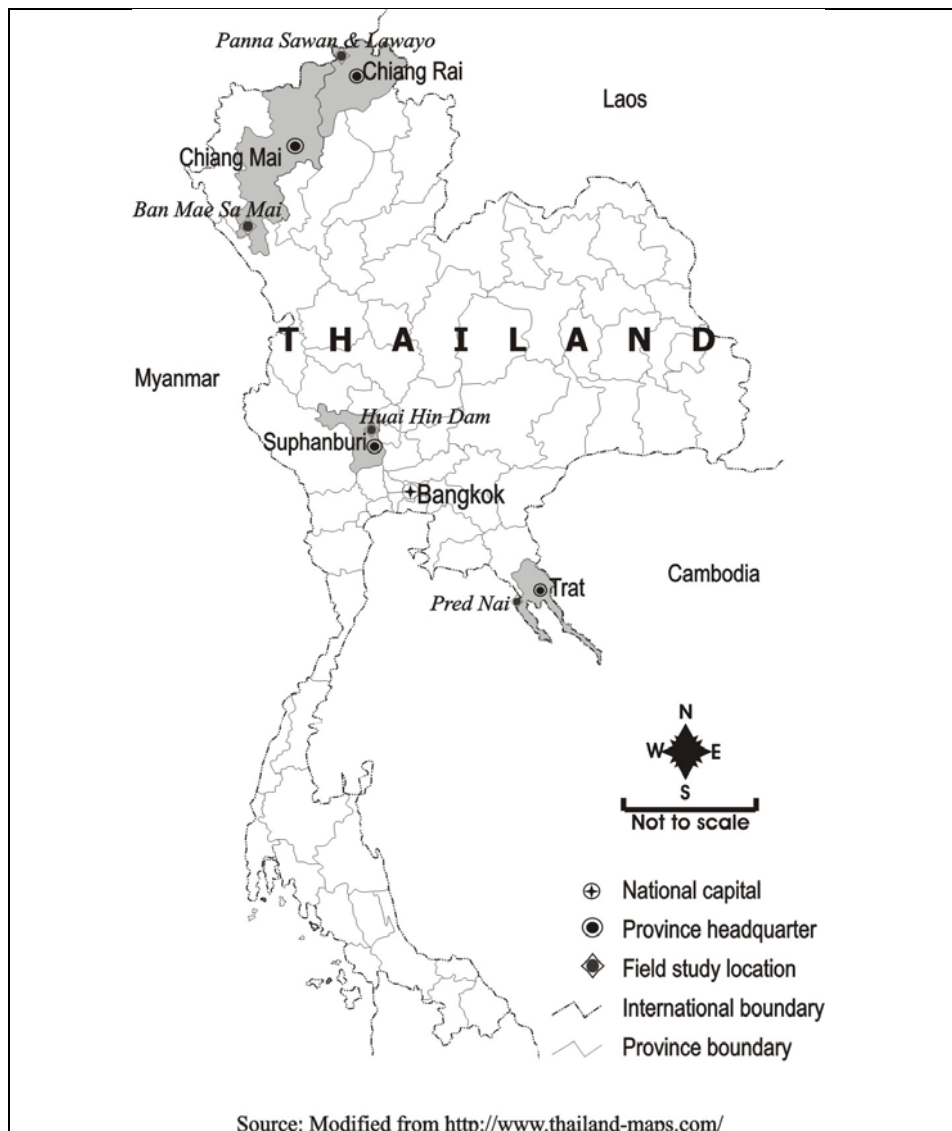


Table 1: Study village and sample size

Village name	Province name	Forest type	Socio-cultural/ethnic groups	No. of total households	Total sampled households	% of total households
Panna Sawan	Chiang Rai	Moist hill evergreen forest	Chinese, Lahu and Akha	116	13	11
Lawyo	Chiang Rai	-do-	Akha	56	8	14
Ban Mae Sa Mai	Chiang Mai	Mixed evergreen deciduous forest	Hmong	130	17	13
Huay Hin Dam	Suphanburi	Dry deciduous forest	Karen	56	13	25
Pred Nai	Trat	Mangrove forest	Thai	130	27	21

Table 2: List of plants used for making natural dye by Karen people of Huai Hin Dam

No.	Local name	Common name	Scientific name	Family	Plant part	Colour
1	Fhang	Sappan	<i>Caesalpinia sappan</i> L.	Caesalpinioideae	Bark	Red
2	Padauk	Burma Padauk	<i>Pterocarpus macrocarpus</i> Kurz.	Leguminosae	Bark	Brown
3	Taowanlek		<i>Ventilago calyculata</i> Tul	Rhamnaceae	Leaf	Yellow Green
4	Hom		<i>Strobilanthes cusia</i> (Nees) Kuntze.	Acanthaceae	Leaf	Blue
5	Taklum	Garuga	<i>Garuga pinnata</i> Roxb.	Burseraceae	Bark	Brown
6	Kratin	Wild Tamarind	<i>Leucaena leucocephala</i> (Lamk.) de Wit.	Mimosoideae	Bark	Brown
7	Plao	Croton plant	<i>Croton roxburghii</i> N.P. Balakr.	Euphorbiaceae	Bark	Brown
8	Hookwang	Indian almond	<i>Terminalia catappa</i> Linn.	Combretaceae	Leaf	Yellow
9	Mamuang	Mango	<i>Mangifera indica</i> Linn.	Anacardiaceae	Leaf	Green
10	Peka		<i>Oroxylum indicum</i> (L.) Kurz	Bignoniaceae	Leaf	Green
11	Konta		<i>Harrisonia perforata</i> Merr.	Simaroubaceae	Fruit	Black
12	Mapraw	Coconut	<i>Cocos nucifera</i> L.	Palmae	Bark	Brown
13	Sak	Teak	<i>Tectona grandis</i> L.f.	Labiatae	Bark	Brown
14	Yapa		<i>Morinda coreia</i> Ham.	Rubiaceae	Leaf	Green

No.	Local name	Common name	Scientific name	Family	Plant part	Colour
15	Unchun	Blue pea	<i>Clitoria ternatea</i> L.	Leguminosae	Flower	Blue
16	Daokajay	Cosmos; Tickseed	<i>Cosmos sulphureus</i> Cav.	Compositae	Flower	Yellow

Figure 2: Perception on the change on the forest quality indicators in Huai Hin Dam village

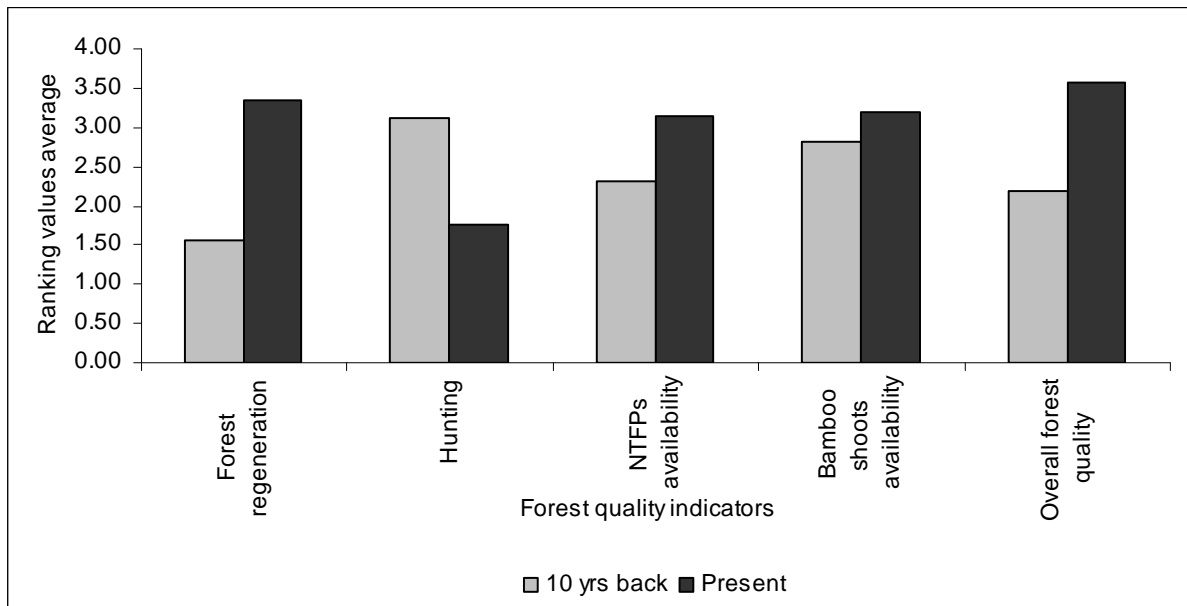


Figure 3: Production of plant dye based handicraft items and income in Huai Hin Dam village

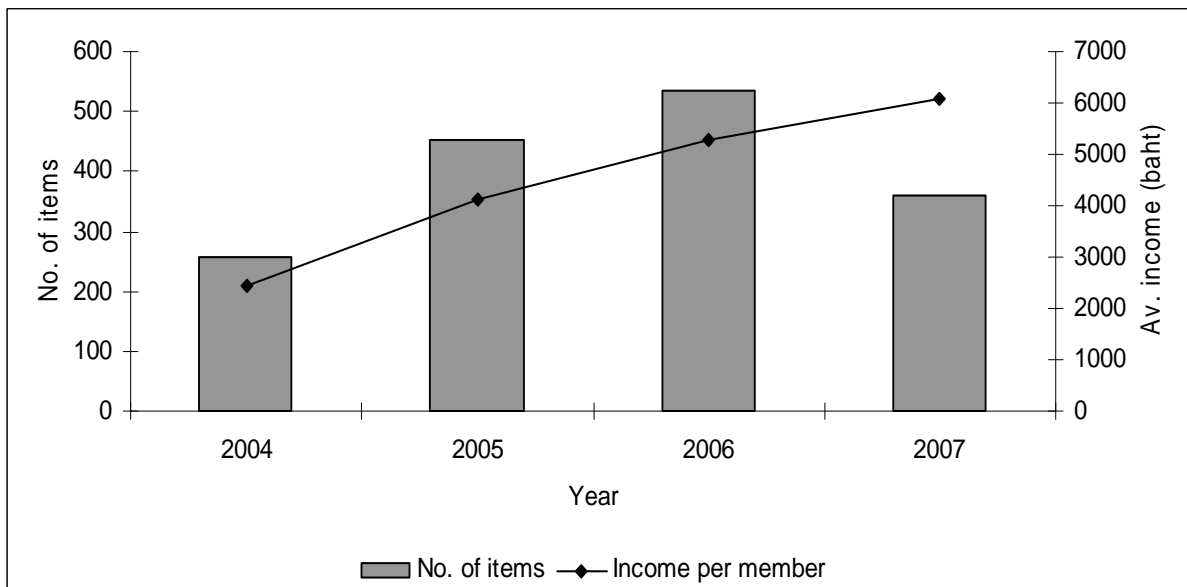


Figure 4: Income patterns across socio-economic groups in Pred Nai village

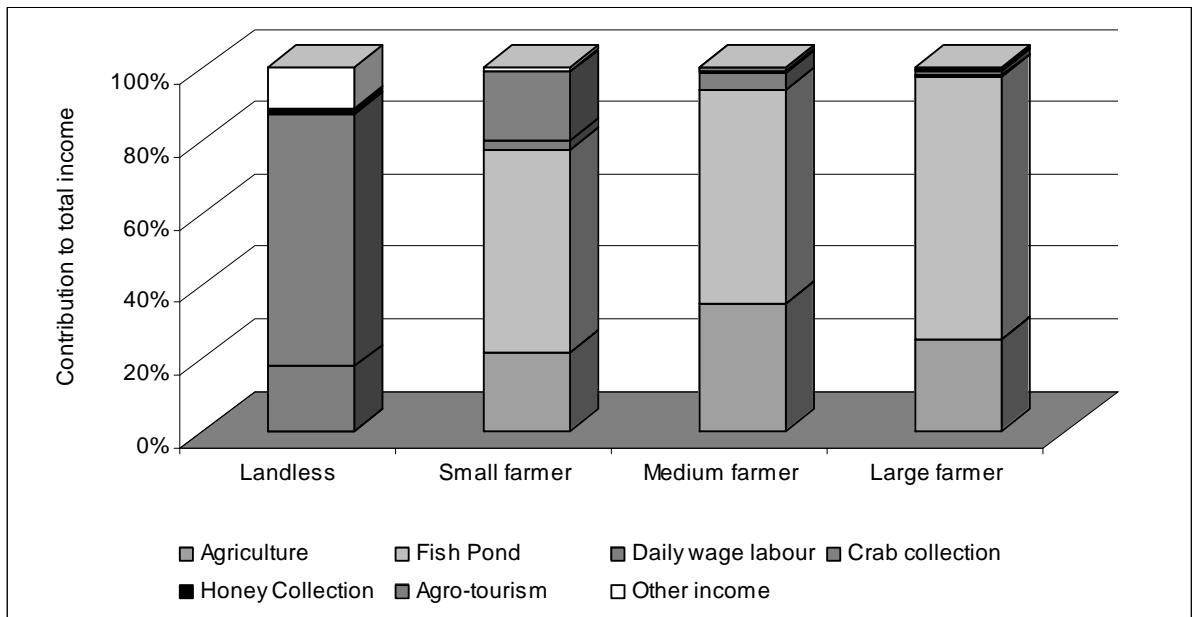


Figure 5: Economic valuation of crab collection in Pred Nai village

