Forest Land Use Planning in Nam Pui National Biodiversity Conservation Area, Lao P.D.R.

Silavanh Sawathvong

Arbetsrapport 80 2000
Working Paper 80 2000

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Thesis for Master of Science in Forestry
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Silavanh Sawathvong
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Abstract

The abundant natural resources of Lao.PDR, especially land, water, and forests, provide a strong foundation for national development. While much of the forests in the region have already been seriously degraded or destroyed, about 47 percents of the total land area in Lao.PDR is still under forest cover. It provides critical habitats and important refuges for many threatened and endangered species and also provides a vital source of subsistence and cash income for an impoverished rural population.

In an effort to tackle the issue in a holistic manner, a protected areas system was established in 1993. In the Lao context it is called "National Biodiversity Conservation Areas"(NBCA). Under this strategy, protection efforts in the field are linked to land use planning (LUP), land allocation (LA), and livelihood improvement with communities residing adjacent to or within the protected areas. In general a procedure for LUP and LA at the village level has been developed and adopted by the government. It involves the delineation of village management areas and forest-land use zones for which management rules are prepared with the community.

The need to develop appropriate LUP and LA procedures and methods for NBCA management has therefore increased in importance. The main objective of this research is to identify and test feasible approaches for implementation of NBCA program that could balance the objectives of the government, local villagers and other stakeholders.

The case study was undertaken in Nam Pui NBCA which is located in the northern part of Lao.PDR. Two villages were studies e.g. Ban Vangphamone, 6379 ha with 236 inhabitants situated inside and Ban Phongsack, 4914 ha with 594 inhabitants situated adjacent to the NBCA.

In order to obtain holistic and accurate data and information, different types of techniques we are applied such as Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA), local knowledge, point sampling, village dialogue. Finally, a simulation model called "Area Production Model"(APM) was used for historical and future period scenarios on future development and conservation .

The integrated approach for capturing data and information was flexible and the different techniques complementary to each other which brought the planner close to the reality. APM was found to be a suitable tool for land use planning as well as land use monitoring. The output was a base document to be used by villagers and other stakeholders in a dialogue to agree on NBCA management practices.

The finding of the study supported the idea that sustainable natural resource management must be economically viable, ecologically viable and socially acceptable. Thus, during all steps in the land use planning and land allocation process, care should be taken to use approaches and methods which involve the people in decision-making. The village agreements and conservation rules developed must therefore contain management activities which the people understand and can manage as well as activities which support government policy and objectives.

Table of contents Pages

REFERENCES

APPENDICES

I. INTRODUCTION

In the UN conference on Environment and Development held in Rio de Janeiro in 1992, issues concerning natural phenomena such climate, forests and biology were discussed. The convention on Biological Diversity is one of the issues of future political action along with climate and forestry. The convention aims at the conservation of biological diversity, sustainable use of biological resources and fair and equitable sharing of the benefits arising from the utilisation of genetic resources. It may be said that biological issues such as conservation and utilisation of bio -resources have become the targets of social policy

Southeast – Asia is an extremely diverse region, not only in the richness of its bio-diversity and landforms, but also culturally, politically. During the past two decades the dominant challenge for conservation has been to protect this biological and cultural heritage during dramatic change on population growth, economic development and commercialisation of natural resources. As part of these responses, all governments in the region have established protected areas and coverage has increased dramatically, in five out of ten countries in the region covering more than 10% of their land area. (Lao. P.D.R has its formally protected areas covering 12.8% of total land area)

Against this long-term trend, the years of 1997 and 1998 have been exceptional and may prove highly influential. First, weather patterns through region were affected by a severe El Nino event. Many protected areas have been shown to be vulnerable to drought and forest fires, which has important management implication at the site level. Then came the regional financial crisis and an ensuring period of economic recession and political upheaval. This will present some intensified challenges for conservation agencies and protected area managers, including reduced government budgets and greater pressures to meet the subsistence needs of surrounding communities.

The large-scale loss of natural forest threatens the loss of animal and plant species as habitats disappear. As rural populations continue to rely on forests for food, fibber, construction material and income, a balance has to be found between the need to use forest resources to maintain the livelihood of the rural poor and the need to maintain protected forest to conserve bio-diversity.

New concepts in forest management are emerging. I n response to the continuing decline of forest resources wide range programs have been introduced that involves communities in the protection and management of forest resources and provides incentives and benefits for sustainable forest utilisation.

An emerging issue in many protected areas through out the region is reconciling the conservation of bio-diversity with the needs and rights of local communities living in or near these areas. It is increasingly recognised that the key to successfully management of protected areas involves the active participation of local communities and other stakeholders.

II. NATURE CONSERVATION IN LAO.P.D.R

The Lao.P.D.R ranks as one of the biologically richest countries in the region, not particularly because of any high rate of taxonomic diversity or endemism (in many fields these are largely unstudied), but because a significant part of the country is covered by a relatively intact and contiguous original forest. In total some 47% of the country are classified a forest, though not all of this is primary forest. This forest cover provides substantial areas of a variety of natural habitats, which often lost or severely reduce in neighbouring countries (Manivong, K. and Sandewall, M 1992).

The importance of the forests in the Lao.P.D.R is reflected in the conservation status of the wildlife of 1,250 species: 37 % of the mammals, 19% of the birds, 22% of the reptiles, 55% of the amphibians, and 5% of the fish were regionally or internationally significant (Duckworth, J.W, Salter, R.E. and Khounboline, K.1999)

To the bio-diversity significance of the country's natural resources must be added their economic importance. This is particularly true of aquatic products and non-timber forest products (N.T.F.P). Outside of the towns, fish and other organisms provide a major source of protein for much of the population (Claridge, G, 1996). Where there are no significant wetlands, forest animal protein takes the place of aquatic organism both as a food and as a source of cash to buffer periodic rice shortages. N.T.F.P's play a crucial role in rural economies, providing food, construction materials, medicines, fuelwoods, and income from the collection, trade and processing of these products. Taken together, N.T.F.P s is among the most important economic commodities in the country (De Beer et al., 1994) The country's natural environments also play a highly valuable role as watersheds, protecting water supplies for hydropower generation, irrigation and domestic and industrial supplies. (Science, Technology and Environment Agency, 1993).

The protected areas system in the Lao.P.D.R comprises 20 National Bio-diversity Conservation Areas (N.B.C.As) and unknown number of province and district protected areas with a range of designations including Conservation forest and Protection forest.
The N.B.C.As cover 30,568 square kilometres, or about 12.8% of the country. (Department of Forestry, 1999). The protected areas are also the home of a significant human population which generally derives its (mostly subsistence) livelihood from agriculture and the use of the forest and wetland products.

The task of managing this very large and important conservation estate is accounting. It entails responsibility for more than one-eight of the country which under protection status, ensuring sustainable use of natural resources throughout the remainder of the country, and control of trade in national resources across the country'' border.

The movement of the natural resources, particularly wildlife, across national concern because of the high demand for wildlife products in neighbouring countries.
Conservation management at the field level must be done both inside and outside protected areas. Bio-diversity values, wildlife, important ecosystems and land scrapes, etc. are not confined within the boundaries of protected areas.

III. POLICIES AND LEGAL FRAME WORK

3.1 General

The basic direction for the forestry sector development was set in the first National Forestry Congress in May 1989 and the adoption of Tropical Forestry Action Plan in September 1991. Later, in 1994; it became the " National Forestry Action Plan ". During these events it was concluded that a new system of sustainable forest management needs to be established along with the promotion of people's participation in conservation and management as well as natural environment protection.

At the same time, government of Lao gives high priority to stabilise shifting cultivation through Land use planning and a Forestland allocation program. The Protected Areas system was established with the aim of conserving a good natural forest. The Village forestry strategy was formulated as guide lines for participatory management of natural resource as well as a plantation strategy.

Since late 1989, a number of decrees have been issued which concern forestry and land use planning. The most relevant ones are the decree on land, the decree on the management and use of forest and forestland, the decree regarding the allocation of land and forestland for tree plantations and the decree on conservation.

These decrees elaborate how all types of land would be owned how forest lands of various categories and uses would be used, managed and protected and how forest and agricultural lands will be allocated. They guided recent forest management program until the end of 1996.

The latest step in the development of a legal framework has been the preparation and enactment of the following Laws: Land; Forestry; Water and water resource Laws. The Forestry Law became effective on 2nd November 1996, the Water and water resource Law on 3rd March 1997 and the Land Law on 12th April 1997.

Collectively these Laws support good land use planning and management practices and also provide a basis for the surveying and mapping of forest and agriculture resources needs, for allocation of land according to needs and labour capabilities of the users and for preceding the issuance of titles to lands managed to improve productivity under flexible guidelines.

3.2 Forest Law No. 125/PO

The Forest Law was issued on 2 November 1996 to substitute Decree 169 on the Management of Forest and forestland and Decree 186 on the Allocation of Land and Forest Land for Tree Plantation and Forest Protection (issued 12 October 1994).

Article 1 states the function of the Forest Law as defining basic principles, regulations, and measures on the management, conservation and utilisation of forest resource and forestland. The Forestry Law is aimed to promote forest generation and plantation in Lao PDR in order to improve people's livelihoods as well as to sustain the natural environment and maintain equilibrium of the ecosystem.

According to this new Forest Law, forest is divided into five categories, namely: (i) protection forest; (ii) conservation forest; (iii) production forest; (iv) regeneration forest; and, (iv) degraded forest or bare land (Article 16). Article 18 defines conservation forest as forest and forest land classified with the objective to reserve the historical, cultural, tourist, environmental, educational and research values of wildlife and plant species and the ecosystems of which they are part.

The tenure rights to forest and forest land can be obtained by: (i) transfer, (ii) allocation, and, (iii) inheritance (Article 48). However, customary rights to use of forest and forest land are recognised. Customary use includes the collection of non-prohibited wood for fences and fuel, the collection of forest products, hunting and fishing of non-prohibited species for household consumption and other uses following custom (Article 30).

Village authorities are accorded significant rights and duties to organise and develop local regulations to practice the use and allocation of forest and forest land to individuals for management, protection and conservation of forests, watersheds, wildlife and natural environment appropriate to the actual conditions of the village (Article 63).

Practically, the new forestry law has not yet been developed into by-laws or regulations for detailed enforcement. The old decree 169, the Management of Forest and Forest Land Decree (3 November 1993) aimed to provide guidelines for Districts and villages to demarcate forest resources for management, protection and conservation purposes (forest zoning), in some circumstances, is still valid and to be used as the guideline for legal enforcement, for example in land allocation and land use zoning at the village level. Some detailed guidelines on forest demarcation were mentioned in this decree. In principle, therefore, it is supportive of community-based natural resource management.

3.3 Land tenure and Management

All land is the property of "the national community" The state has the responsibility for managing land and allocating it for use to individuals, families and organisations (Constitution, Article 15 and Land law, Article 3)

Natural forests are also the property of the national community, and the State has the same responsibilities for them as for land (Forestry law, Article 5)

The State protects the legal interests of the holders of land use rights (LL, Art. 5), specifically ensuring the rights of protection, use, usufruct, transfer and inherence (details in LL, Art. 53-58 and FL, Art. 51-55)

The State assigns land management responsibilities, including land allocation, to relevant line ministries, including the Ministry of Agriculture and Forestry (MAF) (LL, Art. 8-9)

The Land Title is the "main evidence for permanent land use right" It is issued after a 90 days period to verify that there are no outstanding competing claims for the land (LL, Art. 49)

Land Certificate attests the provisional use right for agriculture or forestland (LL, Art. 48) it is valid for three years (LL, Art. 18).

The State obligates holders of the land use rights (LL, Arts. 6 and 60, and FL, Arts. 8 and 57) to:

-Protect the land and the environment

-Not violate the rights and interests of other persons

-Accept valid servitude

-Paying taxes and fees relevant to land use

-Complying with other land and forest regulations

Consequences of non-compliance include loss of the land use right, although with (unspecified) compensation (Arts. 67-71)

3.4 Allocation of agriculture land

Individuals and families (may receive allocation of a limited amount of land for agriculture purposes (LL, Art. 17):

-Up to one hectare per full-time family labour unit for rice and fish farming

-Up to 3 ha. Per full-time family labour unit for commercial crops

-Up to 3 ha per full-time family labour unit for orchards

-Up to 15 ha per full-time family labour unit of deforested land or grasslands for pasture

-More of any category can be requested from the State on a leasehold basis.

An organisation may obtain an amount of land based on the " actual capacity " of the organisation (LL, Art. 17)

The District Administrative Authority is responsible for agricultural land allocation, and issues Land Use Certificates (LUCs) to land users. These LUCs are valid for three years, after which users may apply for long term use rights (LL, Art. 18)

3.5 Forest Land

Forestland is all land, which has been defined as such by the State (FL, Art. 4 and LL, Art. 19)

Forest are classified into five categories (FL, Arts. 16-21):

-Protection forests: The main objective of Protection Forest is the protection of watershed areas and the prevention of soil erosion.

-Conservation forests: The main objective of Conservation Forest is the protection and conservation of species, additional objectives include protection of historical, cultural, and education sites, and sites of research, or tourist value.

-Production forests: The main objective of Production Forest is the production of timber for national economic and social development and people's livelihood, provided harvesting is carried out on a sustainable basis.

-Rehabilitated forest: The area, which can support the natural regeneration process.

-Degraded forests or defoliated land: The area is suitable for converting in to tree plantation.

Individuals and families have the right to receive allocations of degraded forestland of up to 3 ha but may apply for more on a leasehold basis (LL, Art. 21)

The District Administrative Authority is responsible for forest allocation, and issues Land Use certificates to land users under the same conditions as for agriculture land (LL, Art. 22)

3.6 Protected Areas

The concept" Protected Areas" does not figure in the Forestry Law. The category that comes closest to this concept is instead " Conservation forests " Article 18 of Forestry Law defines this category of forest as " forest and forest land classified for the purpose of protecting and conserving animal species, plant species, nature and various other things which have historical, cultural, tourism, environmental, educational and scientific research value"

Such Conservation forests (FF, Art. 42) are to be divide into Total Protection Zones, Controlled Use Zones, and Corridor Zones. Regarding " Controlled Use Zones", which is the most interesting category for the purpose of discussion, they consist of " …areas of forest or forest land, bordering or close to Total Protection Zones, which people allowed to used with certain restrictions on logging, the utilisation of forest products and hunting"

As with any other categories of forests, allocation of such usefructory rights rests ultimately with the district which can then pass these to villages which assume responsibility. Customary rights are recognised in this process although it is not specified how these should be defined, only that " customary use" must be accordance with village regulations which the village authority has determined provided that these are consistent with FF, Art. 63, which specifies in detail the rights and duties of the village authority in this context.

3.7 Land-Forest allocation in Protected Areas

The major land use policy issue regarding land-forest allocation in protected areas relates to the declaration of those areas as NBCAs, a form of Conservation Forest. The making of the decision to set these areas aside for the primary purpose of biodiversity conservation, within the context of a national system of such areas, is clearly a high level land use policy decision.

In effect, the Government of Lao has decided through a process of macro-land use planning that overriding land use in the designated areas will be biodiversity conservation, and this has some national level priority

The majority of these areas were declared jointly under Decree 164/PM and this decree itself provides some fundamental policy guidance in relation to land use within NBCAs. For example:

The objectives of NBCAs as set out in article 3:

- conservation of forest resources, wildlife species and watersheds,
- preservation of natural ecosystems, and
- Preservation of the values inherent in scenic beauty for tourism and values for education and research.

The rules and regulations set out in article 4:

-Prohibition on cutting any trees except for scientific purposes after receiving special permission from the government'

-Prohibition on collection of the non-timber forest products, hunting or fishing within designated core areas except with permission issued on a case-by-case basis,

-Prohibition on carrying out surveys for mineral exploration, hydropower development, road construction, or agro-business other than with special permission from the government;

-Prohibition on staking land claims, founding new settlements or expanding areas of crop land;

-Prohibition on digging for historic articrafts and antiques;

-Prohibition on carrying and using explosives or chemical poisons, or discarding waste which would pollute water bodies or otherwise have a deleterious effect on wildlife or habitat; and

-Prohibition on lighting fires and clearing for pinning shifting cultivation

While full implementation of all of these rules and regulations is not necessarily feasible in the Lao context, their inclusion in the decree establishing the majority of the existing national-level protected areas provides a clear indication of the intended policy on land use within those protected areas.

3.8 Law and Practice

Lao.P.D.R is a country where most people have to struggle for their every day physical survival. Superimposing a new legal system on such a society is a difficult task, especially if the new system is not compatible with these traditional rules and practices. The prescribed behaviour and the actual behaviour might differ considerably.

In remote villages and in villages that have sustained their traditions and resisted the legal influences from the state, all conflicts (even serious crimes) might be solved within the village administration. The political strength of the village may often determine how successful it and its habitants can be in asserting their rights against authorities and other outsiders. The legal relation between the village and outsiders is also very unclear and will differ from case to case.

To elaborate a web of coercive laws that gives the people detailed " Does " and " Don't " regarding the forests, will therefore be difficult in rural areas. It stands the risk of lacking the criteria of a law that actually makes it capable of changing people's behaviour. The people must have the capacity to follow the law, the village regulation must make it possible to follow the law and the village regulation must be communicated to the people.

There must be incentives for the people to follow the law. The incentives could include direct benefits, but also to avoid the threatened pain and penalties of the law itself. However, the risks of getting prosecuted and convicted on the basis of the forest legislation in LaoPDR are microscopic.

Any process through which coercive, top down rules are made stands a risk of excluding those who are addressed by the law from the decision-making. Only the act of changing the decision-making process to include rural people is likely to ensure that the legal order meets their needs. A participatory process is also required to find subjective factors. Naturally, it is important to know the reason for behaviour to be able to change it by a law.

In case of NBCA, local people will be involved by the development of incentives and understanding. However, the tenure policy regarding land inside NBCA is more dismal than for other forestland. It is said that stringent regulation of the use of resources in and around NBCA implying stiff penalties is not appropriate.

In Lao PDR where the government has limited resources to enforce such regulations, the success of the management of the NBCA is said to ultimately depend on co-operation and support of local communities in resource management through granting of long term, legally enforceable use and access rights to forest land areas.

In exchange, the community should adopt resource management principles and make the commitment not to expand use of lands beyond jointly agreed upon borders. This collective right to forestland should not include the right to transfer and the land is only supposed to be used for subsistence purpose and hence not commercially. This right could comprise any kind of forest (virgin, degraded, etc.) even though the state will give certain condition for certain forest types according to the purposes of the management (e.g. conservation of bio-diversity, protection of watershed areas and production). This policy is implemented through the land allocation process.

The promotion of permanent individual use was introduced to degraded forestland for agricultural, livestock or forestry purposes. This land is usually referred to as upland fields and the right to such land is formally given to families through the land allocation process, where each family is given individuals right to the land. First, they receive temporary rights and then, after three years of appropriate use, the right of permanent use.

IV. OBJECTIVE OF THE RESEARCH

With reference to the efforts of the Government of Lao.PDR in establishing National Biodiversity Conservation Areas (NBCAs), the objectives of this study has been:

Identify and test feasible approaches for implementation of the NBCA program

a) that could balance the objectives of the GOL, local villagers and other stake-holders

b) that fully considers the life situation, livelihood and preference of the people living in and around the NBCAs

The main research questions could be formulated as follows:

How could village land-use planning be integrated with conservation zoning for NBCA management? How could the villagers be actively involved in biodiversity conservation under the concept that man and forests could live inharmony?

V.RESEARCH METHODOLOGY

5.1General Approach

The Lao government is giving a focal role to the villagers in the definition of land use zoning. To have a truly participatory discussion on future land use and zoning it is important to first reach consensus about the current situation and the consequences of alternative measures and regulations.

As forestry is seen as one of many forms of land management, an integral research approach is applied in the study (table 1).

Table1: The approach applied in the study

Stage	Activity
1. Reconnaissance Survey	• Official policies and programmes review • Selection of pilot villages • Visit to the study site
2. Village inventory	• Village interviews • Systematic point sampling • Line transects survey for agriculture land • Estimation of land use changes
3. Co-analysis and consolidation of data and information	• Data analysis • Stakeholder dialogue
4. Scenarios on future development perspectives	• Using the Area Production Model(APM) • Stakeholder discussion
5. Approach for implementation	• Suggestion a suitable approach on programme implementation

5.2 Reconnaissance Survey

In order to have a good understanding of the current situation before starting a research project; a reconnaissance survey should come as first priority. It could contain officials policies and programmes review, meeting with concerned stakeholders to introduce the main objective of the research, discussion on criteria for field study, preliminary visit to the study area to know better the site and people. The reconnaissance survey was undertaken during January 1999.

5.2.1 Review of official policies and programmes

Policy development and preparation of a legal framework for the management and utilisation of forest-land resources has contributed much in recent years to the creation of an enabling environment for the devolution of forest-land management to the local level in the Lao PDR.

A series of decrees and decisions commencing in 1992 reflect the government intention to forest management decentralisation. These relate to:

- forest and land allocation to villagers
- the management and use of forest resource at village level
- Promoting the establishment of forest plantations in village management areas.

The principal legislation dealing with the devolution of rights, management and use of forestland resources to the village level are the Forestry Law of 1996, the Land Law of 1997, the Agriculture Law of 1998 and the Environmental Law of 1998. These laws illustrate the intention to decentralise natural resources management and to conduct the program in a participatory manner.

The Forestry Law provides for the delegation of responsibility for managing sections of NBCAs to villages in exchange for compensatory benefits such as trees and non-timber forest products. Guardian villages are authorised to prepare management plans for the forest under their custody with the protected area authority.

Instructions and directives on forest and land allocation were issued by the government in 1996 which provides the operational framework in which the local rules and regulations are prepared in NBCA villages.

The government policy enables village committees to formulate specific village forest resource regulations, recognises the right to harvest forest products for household needs and the right to hunt non-protected animals and to fish by legal means. Rights for villagers to use degraded forestland or barren land in approved land use management areas has been recognised and the village and people are actively involved in LUP and LA.

5.2.2 Selection of pilot village

A stakeholder meeting was organised to introduce the main objective of the research and discuss the relevant issue of Nam Pui NBCA. The term "stakeholder" means any group of people, organised or unorganised, who share a common interest or stake in particular issue or system; they can be at any level or position in society, from global, national and regional concerns down to the level of household or intra household and be groups of any size or aggregation (Robin,G & Kate, W 1997)

In the Nam Pui case many stakeholders were identified such as Provincial Authority, District Authority, technical staffs from Provincial and District Agriculture and Forestry sector, Army group, Project developers, teacher group, villagers group (in and around NBCA), religious group (Buddhist Monks) and Students group .

The criteria for selection of pilot villages was formulated as follows:

- old settlement , at least 30 years
- village with mixed ethnic groups (the Lao Lum, the Lao Theung and the Lao Soung group)
- land allocation already implemented
- average populated village (not more than 100 households)
- Good co-operation with the NBCA management

Two villages were selected as pilot villages for the research study e.i. Ban Vangpamone as enclave village and Ban Phongsack as outside village. One important reason behind the selection of these two villages was that the Province Authority had recently made a request to the government on the extension of the eastern boundary of NBCA that covered this area and they were to study the impact on NBCA management.

5.2.3 Visit to the study site

After two pilot villages were selected, a study site visit was organised. A multi-disciplinary research team was formed with 3 foresters, 1 lady agronomist and 1 sociologist. The checklist for Rapid Rural Appraisal (RRA) was prepared to interview village authority and some key informants about the village situation. RRA teams of researchers gathered, represented and analysed the information. Villagers generated data and discussed the research finding.

The investigation of the village boundary was carried out with the assistance of a key informant (senior villager) and delineated on the topographic map 1:50000. A detail map study was undertaken to identify the relevant reference points such as road, tracts, foot paths, river or streams, permanent agriculture areas, forest areas, village settlement etc. It was to be used for planning of the village inventory.

5.3 Village inventory

A common assumption in natural resource planning is that environmental conservation is good for society and what is in the common good must at heart be good for the resource-poor people who are directly involved in using these resource. This assumption needs to be questioned and the position of those most directly affected needs closer analysis.

In Lao.PDR, village is considered as an administration unit of the government at the grass root level. It has its own leadership e.g. village council, who can consolidate villagers opinions and who makes decisions on issues concerning the entire village such as land

distribution, natural resource use etc. This research will concentrate on the two pilot villages.

The village inventory took place during February to March 1999.

5.3.1 Village interviews

Participatory Rural Appraisal (PRA) was used in data capturing at village and household levels. PRA make use of a rich menu of method such as visualisation, interviewing and group work, of which visualisation has proven particularly innovative within agricultural development. Rather than answering a stream of questions directed by the values of the researcher, villagers represent their ideas in a form that they can discuss, modify and extend. Seasonal calendars help to understand the dynamics of rural livelihoods. Historical profiles and trend analyses can help to access village development process.

The following PRA methods were used in this research :

Visualised analyses including participatory mapping, aerial photograph analyses, seasonal calendars, historical profiles and trend analyses.

Interviews including semi-structured interviewing transect and group walk, key informant interviews.

Group and teams dynamic include buzz session and review, rapid report writing, village and share presentation, self-corrected notes and diaries.

Household interviews

The selection of households was based on a ranking by the village council in to three socio-economic strata: well off, moderate and marginal households. Then 10 percent of each stratum were randomly selected for interviews. The content included family back ground, economic condition, current and future land use, use of forest products, wildlife information, family planning, family development plan etc in combination with field visit.

5.3.2 Systematic point sampling

Systematic point sampling is a systematic net of sample points. The main objectives were to understand the past and current situation on land use distribution in the village and to get better information on biodiversity (forest condition, wildlife species and its habitats, agro-ecosystem etc.)

Based on the natural condition such as topography, access road, river etc, the village area was divided into 3 blocks with about 20 sample points for a working day. With a density

Figure 1. Ban Vangphamone Map. Distribution of sampling points.

Scale 1:75 000

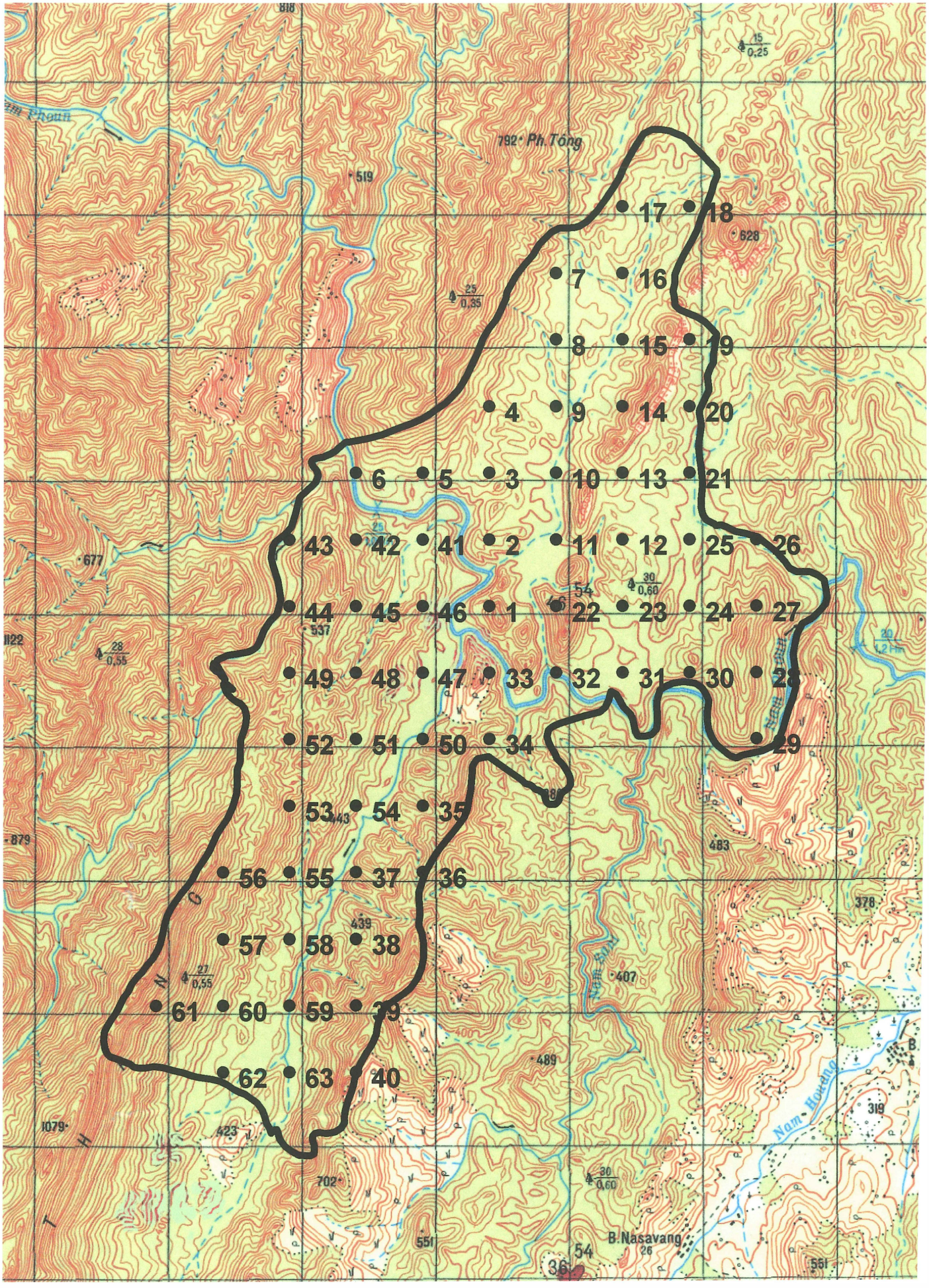
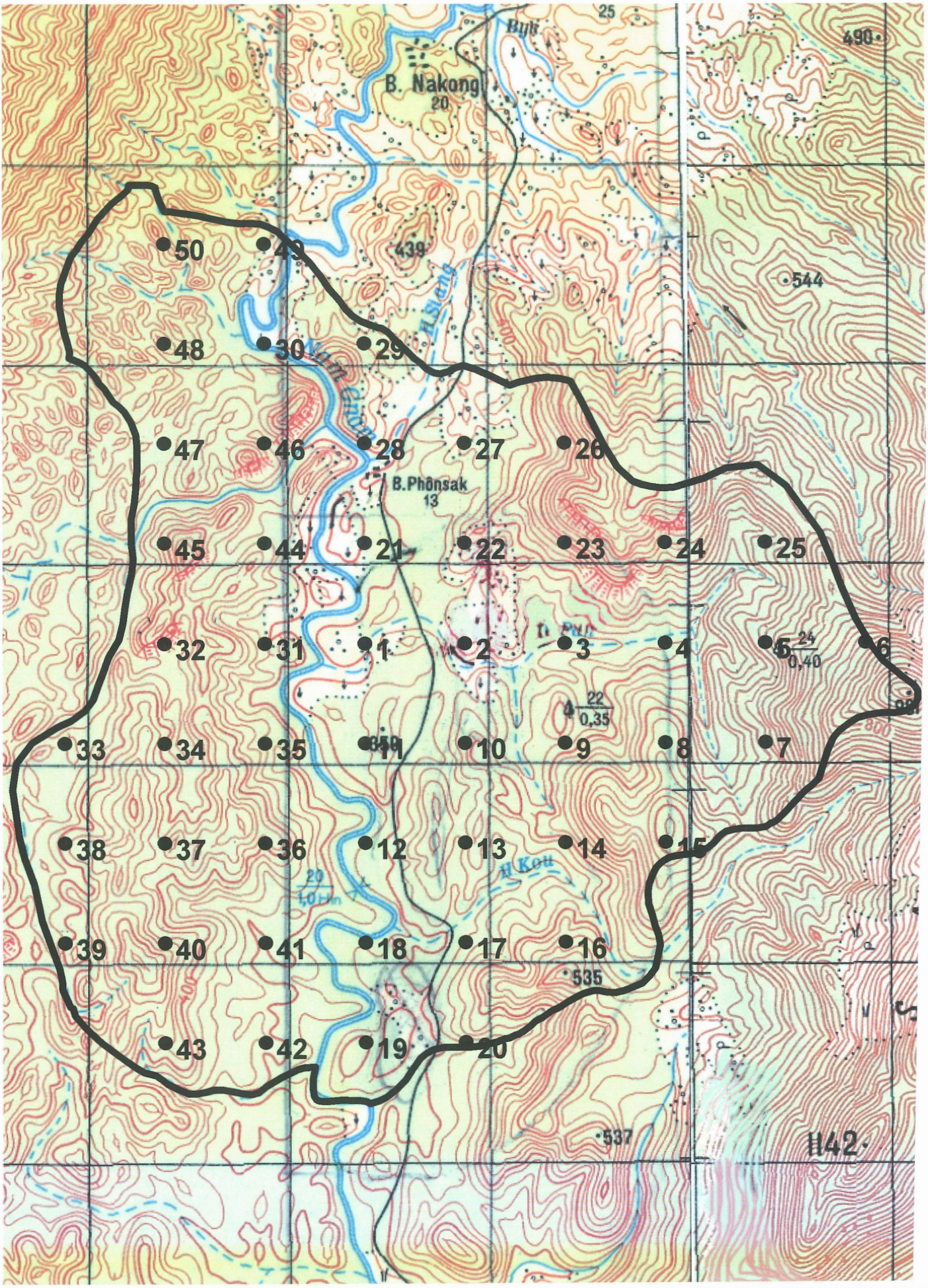


Figure 2. Ban Phongsack Map. Distribution of sampling points.

Scale 1:100 000



of one point per 100 ha it gave 63 sample points in Ban Vangphamone and 50 sample points in Ban Phongsack.

The research teams included some key informants who well knew the area and had a good knowledge on vegetation and wildlife. The team visited every sample point. They observed and recorded the important variables useful for conservation management e.g. forest types, tree species, non-timber forest products, wildlife species, salt lick mineral, watering points, streams or rivers, access roads or foot paths and agriculture land (including fallow land).

Sometimes the aerial photos were used, especially with the area suspected to have changed land use and the discussion with the key informants was very helpful to understand the past and current land use. The systematic point sampling gave a good information and data for biodiversity conservation planning. It also provided a method of controlling and monitoring the current land use.

5.3.3. Line transects survey for agriculture land.

The line transects survey is a simple technique survey in the philosophy " walk, talk, and touch". The main objectives are to gain more information on land tenure, land ownership and to better understand the village farming system.

The pilot villages had practised their agriculture production along the flat and gently sloping land of the riverside. The research team including some key informants walked within a parallel line of 100-m intervals. They observed, discussed and recorded the variables e.g. number of fields used, type of crops, and soil condition. They also investigated the past land use, crop including yield per ha, pest and disease or other problems and land ownership (who owns the plot?).

When comparing the village interviews information and transect information. There was a big difference between actual land use, land ownership and the official statistic figures. One reason was that villagers had hidden their plots to avoid tax collection. The line transects survey provided a good land use monitoring.

5.3.4 Estimation of land use changes

In the previous plan, different sets of air photos in different periods were used to analyse forestland use change but due to the location of the study area situated near to the international Lao-Thai border. There were no old air photos available. So, the study is based upon the available materials such as aerial photo 1: 30000 produced 1981, Spot satellite images 1: 50000 produced 1989, and data from the field sampling 1999.

For the reason of simplicity, village forest land-use was classified into 4 groups i.e. closed forest, opened forest, unstocked forest, and agricultural land. The aerial photos and the satellite images were interpreted visually. The data from point sampling contributed to create the current land use map. With the help of Arc/Info software, all the above data were computed. The village land use area was estimated and compared in different period's e.g. 1981, 1989, and 1999. This study was combined with field observation, soil condition, and other indicators like grass species.

5.4 Co-analysis data and information

The inventory data and information gained during the village inventory was analysed to assess to the current situation of the people to be affected by the program, their livelihood, dependency on land and environment resources etc. Then the different perspectives and consequences of future changes were discussed in participatory stakeholder meetings in order to consolidate the data. This was undertaken during April to July 1999.

5.5 Future conservation and development scenarios

Finally, a simulation tool, the Area Production Model (APM), was used for a scenario on future conservation and development perspectives. Then the researchers come back to the village with their findings and result for a final discussion with the villagers and authorities concerned. This was undertaken during January 2000.

Based on gained knowledge of the actual situation in the area, the position of different stakeholders and government objectives, the researchers could elaborated on a suitable approach to implement the NBCA program in the area.

VI. ROLE OF STAKEHOLDERS

6.1 Institutional structure

Under the Lao government system, conservation management involves three distinct levels of responsibility and administration – national, provincial and district. Central government responsibility for wildlife protection and protected areas lies principally in the Centre for Protected Areas and Watershed Management (CPAWM) in the Department of Forestry (DOF) of the Ministry of Agriculture and Forestry (MAF).

Responsibility for other aspects of conservation management (NTFPs, aquatic products, agricultural practices, etc…) is located among DOF, Department of Agriculture and Department of Livestock and Fisheries. In the provinces and districts responsibility lies with Provincial Agriculture and Forestry Office (PAFOs) and their subsidiary bodies

such as Provincial Forestry Offices (PFOs) and the District Agriculture and Forestry Offices (DAFOs)

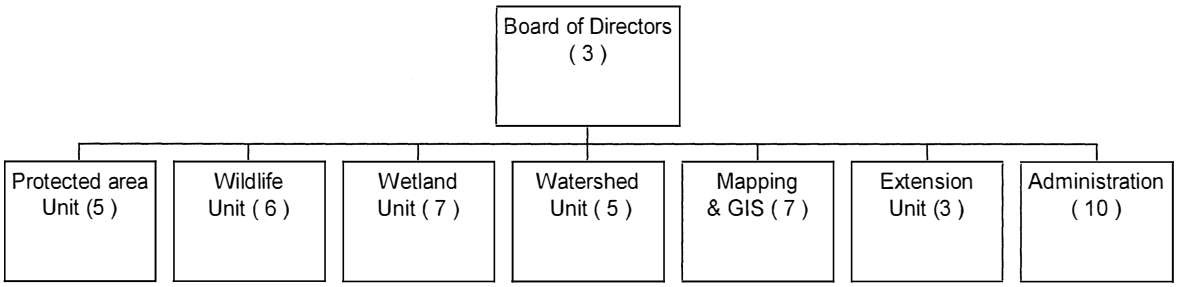
The process of establishing and guiding land-forest allocation is occurring under the national Land Management and Land-forest Allocation Committee, established by Decree 137/PM in 1996. This is an inter-ministry committee charged with studying policies, plans and regulations and co-ordinating, monitoring and controlling land-forest allocation. Its members in different departments (Prime Minister's, Forestry, Agriculture, Land) take responsibility for different aspects of implementation.

The Committee has a permanent head, located in the Prime Minister's Department. The national level committee is paralleled by committee structures at the province and district level, and when land-forest allocation occurs at the village level a similar committee is established.

6.1.1 Centre for Protected Areas and Watershed Management (CPAWM)

CPAWM was established in 1994 as a technical sub-division within DOF responsible for management and monitoring with respect to the protection and conservation of watershed resources, protected areas, wetland and wildlife. CPAWM currently consists of a board of directors and 7 units with a total staff of 46 persons.

Figure 3. Organizational Chart of CPAWM



An important factor to bear in mind when assessing the institutional performance and capacity of CPAWM is that the conservation sector has now grown to become probably the biggest single sector within DOF. For instance, out of 43 donor-funded projects listed by DOF in 1997 about half were either co-ordinated directly by CPAWM or closely affiliated with this division. To this should be added the 20 NBCAs that have been created so far throughout the country for which the Protected Areas Unit within CPAWM has the overall co-ordinating responsibility.

6.1.2 Nam Pui NBCA's organisation

A Protected Area Unit has been established by the PAFO of Sayabouli to be especially responsible for the Nam Pui NBCA. In 1999 this unit has 11 staffs – 9males and 2

females – based at the NBCA headquarters and field office at Ban Nakhayang, Paklay District. This unit is currently organised into the following sub-units;

1) Administration and planning unit
2) Patrolling and survey unit
3) Land use planning and participatory management planning unit
4) Extension unit

Currently, the Lao-Swedish forestry program supports most of the infrastructure and operating costs. However, the NBCA Unit lacks transport, probably essential to the effective implementation and co-ordination of NBCA management, and has no mobile communications equipment.

6.1.3 District Agriculture and Forestry Office (DAFO) participation

Concerned DAFO staff participate in some NBCA activities such patrolling, land use planning and extension activities, but stronger links and more initiative on the part of the NBCA is required. Piang District has recently relocated its Government office to Ban Nam Pui and the new DAFO office are now located into Navene area, very close to the NBCA. The Thong Mixai DAFO is also very close to the NBCA and the veranda of the new staff house presents good views into forested hills.

6.2 Village participation

The concept of partnership ensures that the social functions of the forest are truly considered in the planning process by the affected partners themselves. It should be noted, however, that participatory planning does not automatically make forestry socially sustainable because some of the local or traditional ways to use the forest may be unsustainable.

Partnership can be identified by the respective rights and responsibilities of the stakeholders, which may depend on various factors e.g. the stakeholders location, the nature and history of their interest in the NBCA, their use of, or dependence on resource in the NBCA, their administrative, customary or professional duties and rights as recognised or directed by the Government.

6.2.1 Villages

The role of the village as a local government authority has been strengthened during the last decade. From being traditionally a very important informal administrative unit, it has now also gained formal recognition through the constitution and its function and authority are regulated in the prime ministerial decree no 102 PM issued in 1993.

A village, as an administrative unit, may be established for an area containing not less than 20 houses or 100 inhabitants. Each village has a leader and two deputies, who are

elected by villagers from a list of candidates approved, by the district. The government pays them for their official duties. Representatives from the elders association, the youth organisation and the Lao women's union are also part of the formal village council.

The village leadership consolidates village's opinions and makes decisions on issues concerning the entire village. The village leader also acts as the formal representative vis-à-vis district officials when placing proposals and requests concerning village development issues. He is also in charge of organising construction and repair of village infrastructure, such as village path and school buildings. Expected total labour contribution of a household is between 10 to 30 person days a year.

In some large villages, households are divided into several sections according to the location of their houses. Each section is headed by a leader, and the village leader assigns responsibility for village duties through section leaders, who in turn mobilise the households in their sections.

Apart from the official elected leaders, village have traditional leaders who are usually elder respected by the whole community. Their influence in the village community is strong, especially for such issues as land distribution, and it is common that the official village head consults with traditional leaders for important decisions.

Type of stakeholder villages

An important criteria which could be used to determine a villages role in Participatory Protected Areas Management is the location of the village- and more specifically the village boundaries- in relation to the NBCA and the NBCA boundaries.
In this respect, it can be useful to define four (4) general types of villages, as follows:

- Type 1: village located totally within the NBCA.

These are often termed 'enclave' villages, and the nature of their location suggests that they will have a major impact upon, and a major role in the NBCA and its management.

- Type 2: villages whose 'boundaries' overlap those of the NBCA.

This is a common village type, where the actual dwellings are usually located outside the NBCA, but some village forests and even agricultural lands are located partly within the NBCA boundaries.

- Type 3: villages adjacent to the NBCA.

In the case the village and the NBCA share a common boundary, often because a significant geographical feature such as a mountain ridge or river defines both boundaries. It can also occur because the village authority (mistakenly) thought that the

village boundaries could not go into or overlap the NBCA, and thus they 'claimed' village boundaries up to the edge of the NBCA.

- Type 4: villages distant from, but 'using' the NBCA.

These villages types do not overlap or share a common border with the NBCA, and may be some distance from it. However, villagers regularly enter the NBCA to either pass through it, or collect natural resources in the NBCA. They thus have a stake in NBCA management.

Table 2 Some salient data on the villages in and around the Nam Pui NBCA (1999,Sayabouli conservation unit)

		Number by village type							
District	**Number of villages**	**I**	**II**	**III**	**IV**	**Persons**	**Families**	**bovines**	**Domestic elephant**
Piang	17	4	5	5	3	9233	1495	959	08
Paklay	18	1	6	9	2	10202	1768	3326	68
Thongmixay	10	0	7	1	2	5121	812	2320	85
	45	**5**	**18**	**15**	**7**	**24556**	**4075**	**6605**	**161**

Note: 'village type' describes the physical relationship of the village boundary to the NBCA. (See 6,2,1) The above assumes the proposed NBCA eastern extension is approved.

This guidelines for classifying villages stakeholder is described in a document titled "Participatory Protected Area Management (PPAM) in Nam PUI and Phou Xang He protected areas" Volume 1,C.A.Flint, August 1998. And it will soon be used officially to all NBCAs in Lao.PDR.

6.2.2 Security and the role of the Military

Much of the conservation value of Nam Pui- and its long-term prospects as a conservation area- stems from its strategic location adjacent to a sealed, though no longer hostile, border. Some 25 military camps are scattered in and around the NBCA. Parts of the reserve are unsafe due to land mines and village settlement has been discouraged. In all, about 70% of the NBCA have no village claimants and are designated as a 'Totally Protected Zone'. This is an unusual situation in Lao.PDR, where co-management with villagers normally covers most or all of an NBCA.

While the military presence in Nam Pui helps to protect the area, particularly from cross-border intrusions, it poses significant threats to biodiversity, from the subsistence activities of troops in the field. However, co-operative activities with the Army (for

patrolling) and the Constabulary (for gun retrieval, apprehension of offenders and check point operation) have begun, and there is commitment to strengthen these ties into a feature of NBCA management. The military role in Nam Pui must be recognised and incorporated into any management planning.

6.2.3 Other relevant Agencies and Projects

Sayabouli is a target Province of the UNDPs "area development" program, and as such its integrated development activities may have important impacts on Nam Pui NBCA. UNDP funded the recent improvements to the Sayabouli-Paklay road, and the upgrading of the Nam Tan irrigation scheme immediately north of the NBCA (due to focus more on participatory watershed management in its next phase). The UNDP/ ILO IRAP project is assisting the further planning of communication links, while the aquaculture program has begun work with villagers in Navene and other villages around the NBCA.

The Forest Conservation and Livelihood Improvement project, implemented by CARE and the Paklay DAFO (with Netherlands funding) has begun in pilot villages, most of which are close to the NBCA. Close co-ordination with this project will probably continue, as it will actually assist the NBCA Unit in tasks, which it is currently not capable of undertaking. CIRAD has started a research and farming systems development program in southern Sayabouli, including Thong Mixai District.

The Sayabouli Rural Development Committee, a unit of the Provincial Government, focus's activities on development zones, and one of these was the Navene area. This agency will continue to play an important role in development of the area.

VII. NAM PUI N.B.C.A

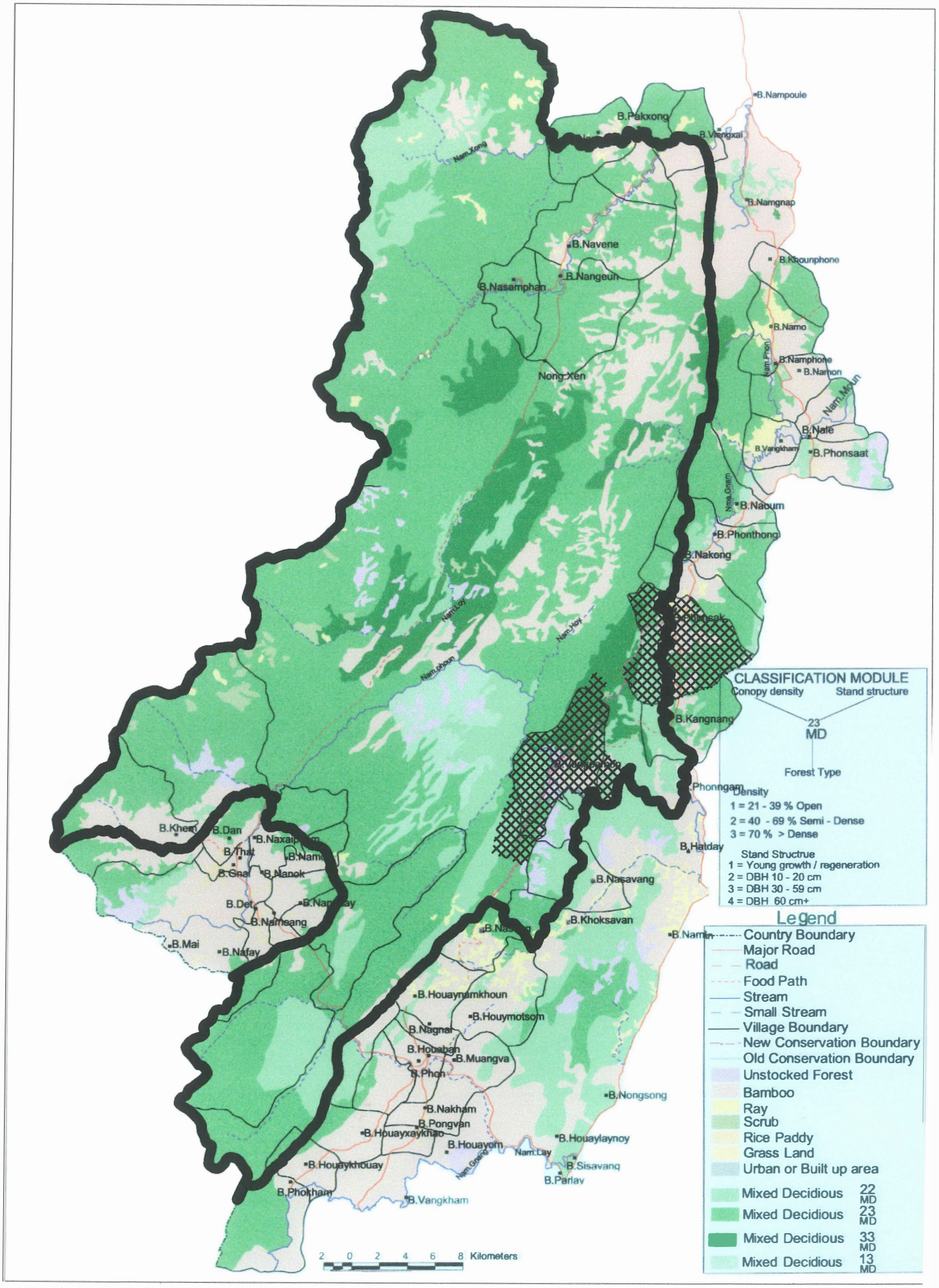
7.1 Location and boundaries

Nam Pui NBCA is located in Sayabouli Province, and is part of Piang, Paklay and Thong Mixai Districts. Its total area is 191,200 hectares.

The Western boundary of the NBCA runs along a major watershed divide and forms the international border with Thailand, contiguous with Nan and Uttaradit Provinces of that country. Thus, this boundary is both officially and geographically well defined. The boundary integrity is the responsibility of the military, which are in the process of erecting border cairns. The extent of Thai citizen's entry into the NBCA for NTFP collection and hunting is unknown.

The Eastern boundary runs (generally) parallel to the Sayabouli- Paklay road and is defined by ridge tops, along rivers or sometimes neither- in which case it is difficult to delineate. There is a valid proposal to enlarge this eastern boundary to the Nam Yam River. This more 'natural' boundary is easily and well recognised by locals, will encompass good forest and habitat, and has been informally requested by community leaders. Due to its accessibility and proximity to the NBCA headquarters, it will give the

Figure 4. Nam Pui - NBCA Map
(National Biodiversity Conservation Area).



NBCA and conservation in general excellent exposure to the community in general and nature tourists in particular.

The Northern boundary has several versions, the most common and currently accepted one taking the Nam Song river and its tributary, the Nam Lu as the border (see map)

Part of the Southern boundary almost completely encloses Thong Mixay District. Again, the exact delineation of this southern boundary does not always follow easily recognisable natural features, except in some areas where it forms the border with Thailand.

Participatory exercises with the villages have revealed that the delineation of the NBCA boundary is indeed often unclear. Villagers and staff understanding are often at variance with the few maps available. About 30-40% of the NBCA area is claimed by, or lies within village boundaries (sees maps). Continued participatory management planning and mapping is required to more clearly define village and acceptable NBCA boundaries.

7.2 Stakeholder villages over view

Generally, village boundaries have been gleaned from maps developed during the PAFO/ DAFO land allocation exercises between 1994 to 1998. Some of these boundaries require participatory review. Most data comes from earlier land allocation exercises, and requires improvement, verification and updating.

Ethnically, the majority of the villagers are Lao Lum. There are three recent villages with Lao Sung peoples, two being Hmong and one Yao village. One of the new villages in Ban Navene Zone is a recent Khamu immigrant (from Luang Prabang). Rather unique, are the Malabri or Thong Leung people, nomadic forest dwellers who live in the forest here, and in related forests in Thailand. Members of this tribe sometimes come to barter in Ban Phongsak and Ban Naom along the eastern boundary of the NBCA. The current status of this group is unknown or unrecorded.

7.3 Roads and communication links

The north south road from Sayabouli to Paklay road runs parallel to the NBCA eastern border and is in good condition (recently upgraded with UNDP support). It now provides easy access to many of the villages and forests in this eastern section facilitates resource extraction and improves marketing links.

The northern road from Ban Nam Pui running westwards to Ban Navene is quite good, although a little difficult in the wet season. There is a proposal to extend this road all the way west to the Thai border, and upgrade it into a major road with an international border crossing. Without strict controls, this would effectively destroy the integrity of the northern section of the NBCA.

The road-running west from Paklay to Thong Mixay goes directly through the bottom section of the NBCA, and as such provides good access to this controlled used zone area. It is a strategically important road – being the only road link between Thong Mixay and the rest of Lao.PDR. It has recently been repaired but is not compacted well and in places destroyed by logging trucks extracting the logs to pay for road construction.

Construction of the Thong Mixay to Ban Navene north-south security road –running directly through the center of NBCA was – commenced in 1994, but halted in 1996 due to lack of funds and problems with land mines. It now continues to be constructed/upgraded, and if access to and use of this road is not strictly controlled, it will certainly be a threat to the integrity of the NBCA.

7.4 Topography and water courses.

Much of the NBCA is composed of rather steep hills and mountains, up to 1,700 m on the Thai border and 1,300 m in the central area. There are only a few valleys of any width, including the Nam Pui valley. The topography results in moist, steep valleys, but hillsides and ridges tend to be dryer and prone to wildfire.

The Nam Pui NBCA is effectively (as are most NBCAs) an important watershed for many small rivers including the Nam Phoun, Nam Lai, Nam Pui, and Nam Song. The Nam Yam is an accessible and important stream on its eastern boundary. Rivers generally run from west to east, and join the Mekong River. These rivers and their tributaries flow all year, important for village water supply, fisheries and potential nature tourism.

7.5 Vegetation, habitat types and wildlife

While the biodiversity value of Nam Pui NBCA has yet to be adequately surveyed, it ranks as one of the highest priority sites in the country (Berkmuller et al. 1995). The habitat is predominantly mixed deciduous forest, much of it disturbed by fire, with pockets of evergreen forest persisting on the mountains bordering Thailand and along the Nam Phoun River.

Just outside the current reserve- and proposed for inclusion within it – is the only known locality of an evergreen formation dominated by the plant families *Annonaceae, Meliceae and Sapindaceae* (Vidal, J. 1960). One specie, *Chukrasia tabulalis (Meliaceae*), has recently become the subject of an international selection program as a plantation timber species. The area also contains some of the only natural teak forests in Lao.PDR. These examples illustrate the importance of Nam Pui NBCA and adjacent lands as a plant genebank.

The outstanding wildlife value of Nam Pui NBCA lies in its estimated population of some 350 elephants- possibly the largest contiguous population in Lao.PDR. At least 50 mineral licks are known and apparently influence seasonal ranging patterns through the reserve. A further 696 tamed elephants were register in Sayabouli in 1997 – the largest number in any province. Most of these animals are used for logging and transport of

goods in the three adjacent districts and seasonally released in to the NBCA; others are hired out to work in other parts of the country. Management of these animals is a matter of international concern.

Other threatened large mammals occurring in Nam Pui include gaur, tiger, leopard, Asian wild dog and two species of bears. Until the 1980'the area contained Sumatra rhino, but there have been no recent reports. Lying west of the Mekong, Nam Pui is also the only NBCA in Lao.PDR protecting of the Thai fauna, such as lar gibbons and Phayre's langur. A recent record of silvered langur lies well beyond the species known range and merits further study. Birds, reptiles, amphibians and fish have yet to be studied in detail.

VIII. VILLAGE PROFILE

8.1Data source

The information presented in this chapter is based upon data obtained during the village inventory. The most significant features of the villages in and around Nam Pui NBCA is that they have all undergone a land use planning and forest-land allocation (starting 1994), in case Ban Vangphamone in 1998 and Ban Phongsack in 1997.

Although this land use planning and forestland allocation was not conducted very well e.g. maps and records are not well kept or organised, and to date no follow up on allocated land areas has been done. But it was good that some participatory approach was introduced. The important issue gave official recognition to village boundaries in combination with the negotiation on the NBCA's boundary and the conservation management zoning.

In order to avoid the land use conflict in NBCA, Ban Vangphamone and Ban Phongsack were selected for research study by introducing APM as land use planning tool.

8.2 Ban Vangphamone – a profile

8.2.1 Historical and demographic changes.

Ban Vangphamone is an enclave village in Nam Pui NBCA that is included in Paklay District. It can only be accessed by the old logging road constructed in1990. This road is very poor, sometimes being unusable in the wet season, even by a 4-wheel driver car. The length of this road is about 12 km from the starting point of Ban Nakha-ngang where the main road Sayabouli-Paklay is crossing.

Settlement history and demography of this village has frequently changed over time. Different groups of people living in the vicinity often moved in and out. The following history has been told by key informants in the neighbouring villages and confirmed by some district staffs. It could be summarised as following:

- 1952 the first settlement was a group of people from Ban Naxeng, Ban Palai, Ban Lat, and Ban Pongvane. Total population was 40 households with a total of about 200 persons including 115females. They were totally forest dependent and subsisting on gathering, hunting and fishing. No agriculture was practised.

- 1961 Severe drought followed by forest fires, the villagers could not get enough food for survival. So, they decided to return to their home village.

- 1966 A new group of people from Ban Bouabane, Ban Houay Leuak and Ban Vangpa had only 8 households of about 40 persons including 25 females. Their main objective was development of wet rice field by starting with shifting cultivation practice and then gradually converting it in to permanent agriculture i.e. rice field, perennial crop and also combined with hunting, gathering, fishing as subsistence basis.

- 1969 after only 3 years an accident occurred among some night hunters shooting each other's. It was an unlucky period in their life. So they decided to move back to their home village because they thought if they still stayed, some bad thing might happen.

- In 1990 during the border disputes between Thailand and Lao.PDR, Paklay District Authority officially established Ban Vangphamone for security purpose by grouping all voluntary villagers from different villages in the District. It was around 75 households with a total population of 375 persons including 210 females. The district survey team had surveyed the Houay-Sanee agriculture production area for establishment of 200 ha irrigation scheme. From this scheme people could have got access to fertile land suitable for rice field, around 3ha per household. But this dream did not come true due to the changed situation.

- In 1993,Government declared the establishment of 18 NBCAs. Nam Pui NBCA was included among those. Ban Vangphamone became NBCA village.

- 1995 Many discussions on how to manage the NBCA and whether villages in NBCA should stay or move out. Villagers did not feel secure, many households decided to move out. Out of the population of Ban Vangphamone only 48 households with 245 persons including 127 females remained.

- 1994-95 a joint team (Department of Forestry and Provincial Forestry section) surveyed the area for demarcation of NBCA boundaries

- 1996 Nam Pui team re-surveyed the boundaries with the villagers, it was found that the eastern part was still good dense evergreen forest, so it was proposed to extend the NBCA up to Nam Yam River. Ban Vangphamone became an enclave village of Nam Pui NBCA.

- 1997 Provincial meeting on NBCA management adopted a new concept, Participatory Protected Areas Management implying that people can live within the NBCA and the villagers are the main actors in sustainable conservation of natural resource.

- 1998 Land use planning and forestland allocation was carried out in Ban Vangphamone. A clear identification of forest land and agriculture land was done. Forestland was classified into 3 main categories e.g. village conservation forest, village protection forest, village use forest. Agriculture land was allotted on household basis. Contract on the use of agriculture land and care of nature conservation had been made between District and Village Authority.

- The period 1993-1998 was considered as a period of migration due to unsecured policy on NBCA management.40 households about 200 persons moved out and 9 households about 50 persons moved in. In 1998,Ban Vangphamone had 44 households about 236 persons including 113 females and 129 persons including 89 female labours were considered as labour force.

- In February/1999 a group of new immigrants including 15 households with about 119 persons from Viengkham District of Luang-Prabang province came to settle in Ban Vangphamone. The local authorities were stricter, and did not allow them to stay but they were exhausted. They were proposed to stay during the cropping season then next year seek other alternatives. But some of them, who had another alternative, moved out to other place.

- January/2000 the research team re-visited the village, it was found that the problem was solved. Those immigrants had moved out since last March/1999.

8.2.2 Socio-economic situation

Ban Vangphamone was considered as unpermanent settlement until the year 1990. It was observed that no single house was made by good timber as it was in normal Lao Lum village. In general bamboo houses with imperata grasses roofs were found but sufficient of construction timber were availed for build a new house in every households. The reason behind that it was unsecured policy on NBCA management.

Now Ban Vangphamone has a total population of 44 households consist of 236 persons including 113 females with 129 labours including 89 female labours. All villagers belong to the Lao Lum ethnic category and they are Buddhists but no temple founded. Next year they plan to build a temple and they will invite some senior monk to teach Buddhism.

All children, both girls and boys above 6-year age, go to primary school in the village. The villagers built this full grade primary school by themselves. It consists of 5 rooms with timber walls, good tin roofs but no cement floor. Only 3 teachers teach 71 students including 25 female students with very poor facility teaching materials. After completion of primary school, the students must continue their study in the secondary school at Ban

Nam Phoun about 25 km far away from Ban Vangphamone. That is the main reason why most of the students leave the school at that times especially the student girls.

The socio-economic status of this village is basically subsistence. They are mostly sufficient in food, only 6 households are deficient in food in short period 2-3 months a year. The collection of non-timber forest products is an addition at source of income besides food products.

Fish is an important protein source as well as small livestock like pigs and poultry (chicken, ducks etc.). The "bush meat" is limited since the district has collected all guns, so that they can only use the traditional method such as snare lines for small game. From field observations, the villagers do not suffer serious malnutrition. The local daily diet mainly consists of rice, fish and vegetables.

The village does not have a drinking water supply system and the villagers rely on Nam Phoun River, which still has clean water. They usually boil water before drinking. Common diseases are malaria and diarrhoea. The district has supported one dispensary with a nurse. A revolving fund for patent medicine is well established. In addition the female traditional nurse takes care of the newly born child. The natural growth is about 3% per year. It is higher than national growth rate (2.6%). The family planning is implemented by 2 injections per year for ladies because the male's villagers refuse to use the condoms.

8.2.3 Natural Resource

Ban Vangphamone is rich in natural resources with good dense forest suitable for wildlife and abundance of water. Nam Phoun is the main river, which supports the daily life of the villagers. Apart from their daily use, they collect fish and other species (crabs, prawns) for consumption. As fish is important to them, the villagers have established the fish conservation zone with the accepted rules. After they have seen their fish stocks increasing, it has made them understand clearly their role in fish conservation. People can spend less time to catch fish, but get more fish than they can uses to in the past.

Land is still fertile because agriculture has not been practised more than 10 years. Villages can enjoy a good yield if they have changed the technology and new variety, the yield augmented automatically. The flat land is quite large with more than 300 ha in both Houay-Sanee and Houay Khone sites which can support population growth in the future.

Mixed deciduous forests usually include bamboo brake and some portion of dry evergreen forest. The flora composes *Pterocarpus macrocarpus, Afzelia xylocarpa, Chukrasia tabularis, Largestromia spp, Hopea odorata, Shorea spp*, *Bamboo spp* and many kinds of non-timber forest products such as bamboo shoots, mushrooms, wild vegetables, grasses for thatch, gums, cardamoms, broom grasses and fuel wood.

Figure 5. Ban Vangphamone Land Use Map 1981.

Scale 1:75 000

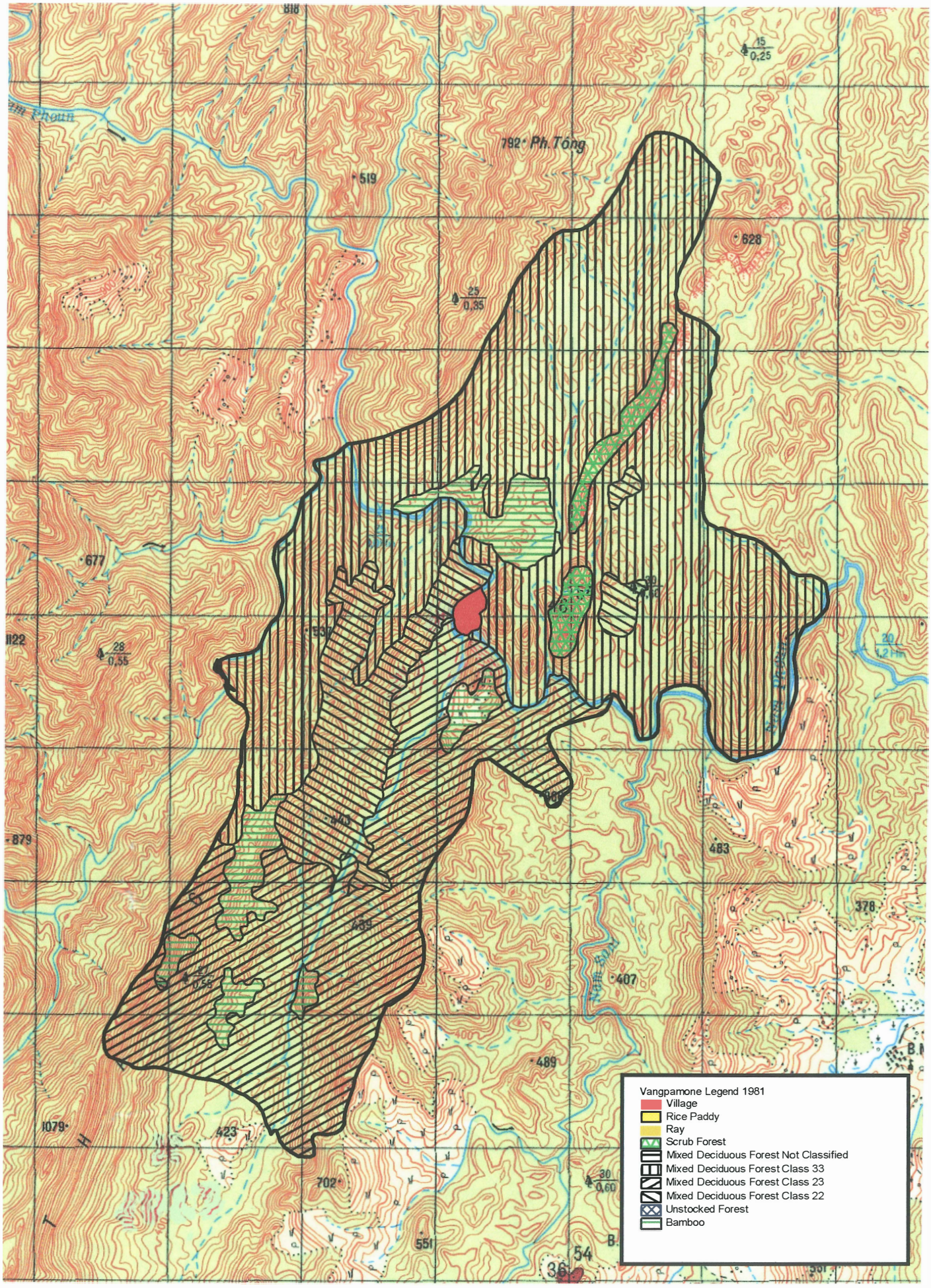


Figure 6. Ban Vangphamone Land Use Map 1989.

Scale 1:75 000

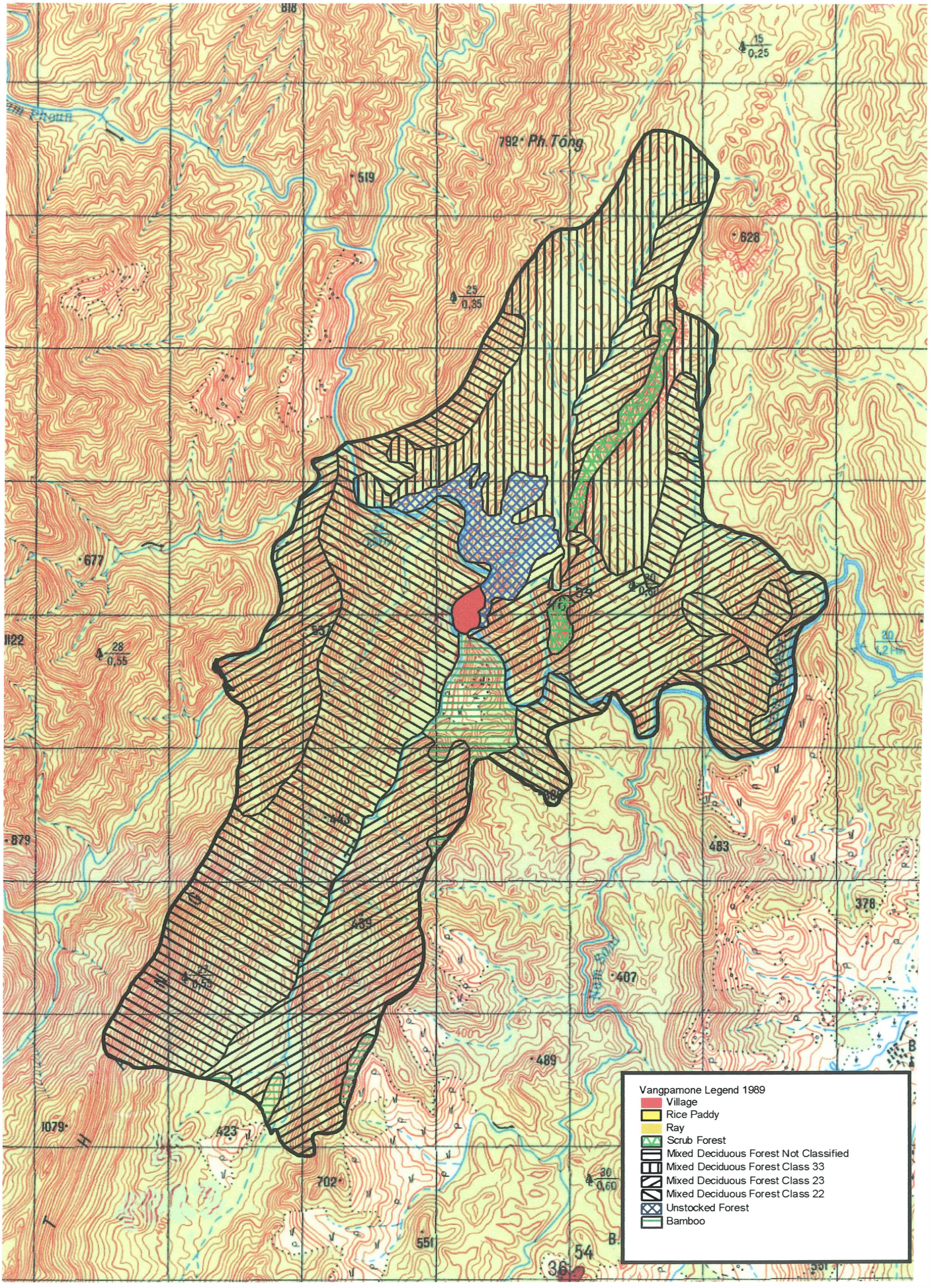
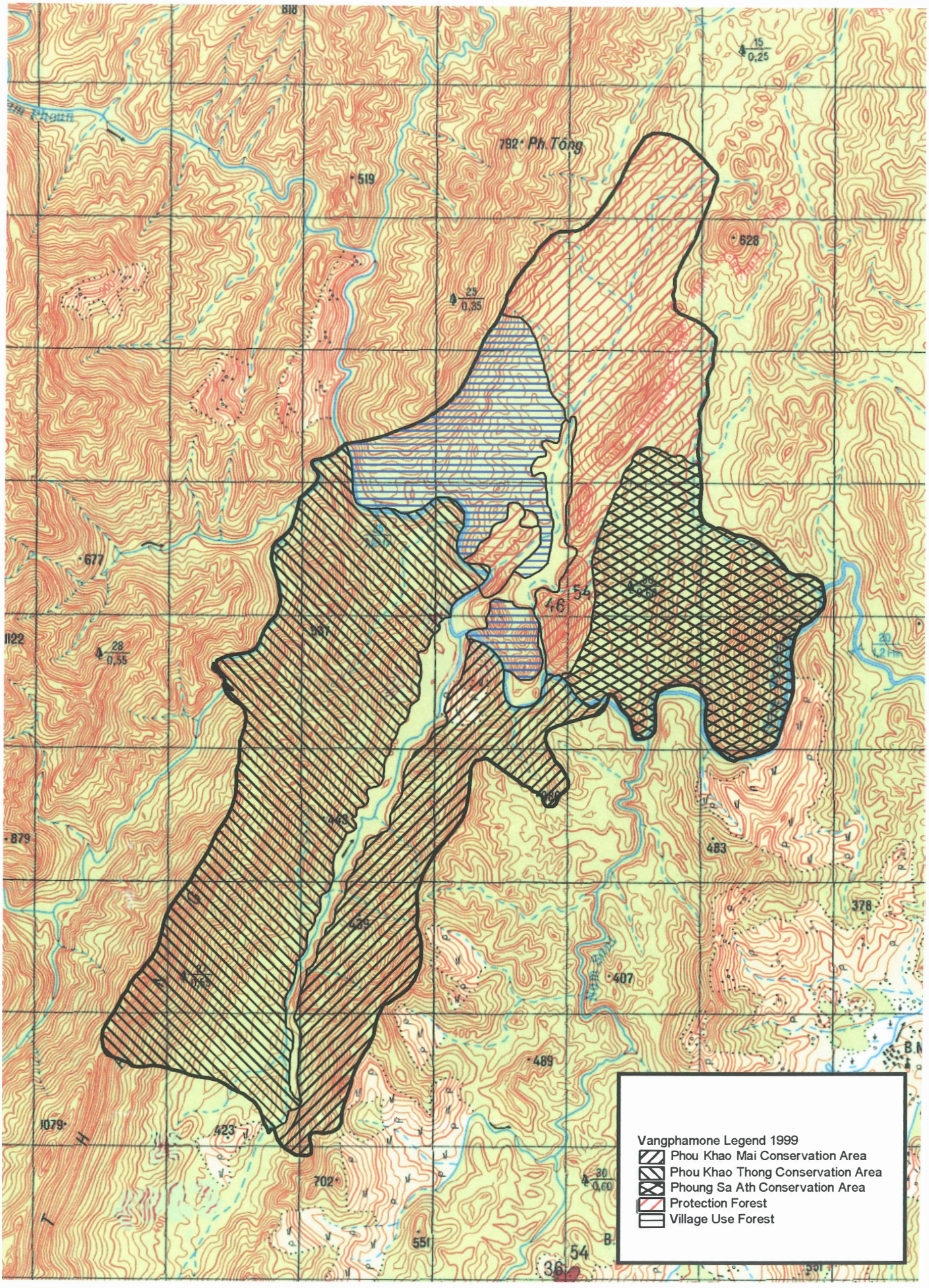


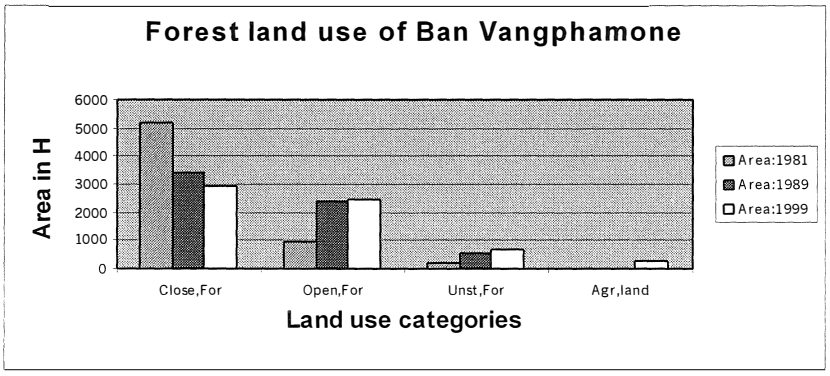
Figure 7. Ban Vangphamone Land Use Map 1999.

Scale 1:75 000



The presence of animal salt licks, watering points, migration routes are good for wildlife. Different wildlife species occur such as wild elephant, deer, monkey, tiger, boteng, wild boar and various birds.

Fig.8 Forest land use change in Ban Vangphamone:



In order to assess the change of forest cover, a simple study was made by a comparison of the interpreted of aerial photo 1:30000 scale, dated 1981, Spot satellite images scale 1:50000 dated1989 and land use map from the field inventory in the year 1999. It was observed that in 1981 the close forest area cover 90% of the village area, only 10% is open forest with some small patch of unstocked forest (fig.8). No agricultural land occurs. Referring to the settlement history of the village, during that period, villagers had moved out, since 1966, and not yet come back.

In 1989 the open forest developed fast and covered nearly half of the former close forest area. The main reason was that the government had established the state forest enterprise (joint venture with the former Chzeco-Slovaquia) and that area was considered as Production Forest. Access road to the village started side by side with the selective cutting adopted. Unstocked forest increased but no agricultural land developed because village is still vacuum.

In 1999, the current forest land use situation is almost the same as the year 1989. Close forest has slightly declined, Open forest increased very little. Unstocked forest gradually developed along with agricultural land because villagers returned back 1990. Rotational shifting cultivation was adopted in the first stage then gradually developed in to permanent agriculture e.g. wet rice field along the main river of the village. The kapok trees and paper mulberry trees have been introduced as cash crop. Forest along the road and along the river is converted into these cash crop plantations. The close mixed deciduous forest remained only in the mountain ridge.

In 1998 there was a wild fire taken during at least 3 months. Many species died and now form a scrub or stunt forest in many areas. The pioneering species regenerated well in bamboo brake areas. Natural bamboo stands close to the village seems over exploited (sometimes all canes in the clump have been cut), so their productive capacities have been seriously impaired. On the other hand, stands far from village is under exploited and the resultant overcrowding of the canes in the clumps have stifled growth and likewise impaired productivity.

When compared with the settlement history of the village, from 1952 to 1989 no agricultural practice has been found even the traditional shifting cultivation. This is true, during that time villagers relied upon on gathering and hunting on a subsistence basis.

8.2.4 Land use and farming system

Ban Vangphamone completed the land use planning and forestland allocation in1998. All households got about 1.5 ha of agriculture land. Based on household sampling, it was found that the better off households got 5 plots of about 5 ha, average household with 3-4 plots of about 3-4 ha and the poor households received 2 plots or about 1-1.5 ha. Forests are classified into three main categories, such as village conservation forest, village protection forest and village use forest.

Table 3: Estimated total land area, according to point sampling and allocated land area in Ban Vangphamone on different land use types

S/n	Land use categories	Point sampling(ha)	Land allocation(ha)
01	Village conservation forest	4086	340
02	Village protection forest	1222	325
03	Village use forest	673	400
04	Agriculture land	375	107
05	Settlement area	23	23
06	Area not classify	0	3423
	Total	6379	4618

Conclusion of the analysis and discussions with key informants of the village

- During land use planning and forest-land allocation exercise, the district team had the idea that Ban Vangphamone village had reduced its population by half since the establishment of the village, so they decided to cut some portion with dense forest to NBCA. During discussion with the villagers, they want to keep their traditional boundary. It made village area bigger than previous land allocation program.

- The district team does not have enough time to walk or survey in the forest. Only small area nearby the village has been identified. The research team carried out point sampling survey covering almost the important points such as forest types, wildlife habitats, watering points, salt minerals, migration routes, or corridor etc. All village land was classified according to the criteria of land use categories e.g. village conservation forest, village protection forest, village use forest, agriculture land, settlement area etc.

- The allotted agriculture land was limited to only 3 plots with not more than 2 ha per households, but actually the village used more than 4 plots for shifting cultivation.

- Point sampling survey can founded 50 plots in the gross area of paddy and shifting cultivation. Villagers adopted 5 years rotation cycle. The district team considered shifting cultivation area within the net area, so that the agriculture land in land allocation program was smaller than the point sampling survey

- The result of the household sampling showed that the better off household has 5plots with 5 ha, the average household with 3-4 plots about 3-4 ha, the poor household with 2 plots about 1-1.5 ha. Villagers were accepted points sampling figures but they have remarked that they do not want to pay the land tax for the fallow land.

- As land use planning in NBCA is a government priority, it is essential that the district team should become conversant with various conservation requirements for the management of conservation zones of NBCA. Without this knowledge, the district team will not be properly equipped to conduct activities such as appropriate village forest management and agricultural land management agreements. The District team also needs to develop abilities to collect data specific to NBCA including wildlife, hunting, fishing and NTFPs surveys.

Table 4: Standard error percentage of land use categories Ban Vangphamone

S/n	Land use categories	Area, ha	Percentage of total area	Number of sample points	Standard error percentage
01	V. conservation forest	4086	63.9%	40	7%
02	V. protection forest	1222	19.1%	12	10%
03	V. use forest	673	10.1%	6	13%
04	Agriculture land	375	5.9%	5	10%
05	Settlement	23	0.4%		

Formula: $\mathbf{ept}=\sqrt{pt.(1-pt)/(n-1)}$

Farming systems:

Ban Vangphamone are practising both paddy rice production and shifting cultivation in the low land area along the two-stream line called Houay sanee and Houay khone. There have been villagers staying in their present location on and off since 1952 but started in Agriculture practice in 1990. Depending on owner of paddy land, households are in different stages of transition from the traditional shifting cultivation through rotational shifting cultivation to a mixed agriculture production system i.e. paddy rice and paper mulberry plantation.

As an average, a household of 3 labours can build up to 0.25 ha of rice field in one year. It needs 4-5 years to develop 1 ha of rice field. Shifting cultivation practice needs at least 1 ha to get enough rice for annual consumption. Paper mulberry trees *(Broussonetia Papyrefera)* occurs naturally. The slash and burn system can encourage the good regeneration of this specie because they are root suckers. One just needs to transplant new sprouts in proper spacing and the trees grow well. Only one-year bark can be harvest for fiber. 1 ha can yield at least 400kg to 500kg. 1kg of dry bark costs 30 cents; villagers obtain cash income and use wood as firewood. Most of the villagers have at least 1ha – 3ha of paper mulberry.

Agriculture land is still fertile. The yield per ha for rice field is about 2500 kg and the recently developed rice field is about 2000 kg without any fertiliser input. For the shifting cultivation, the yield is about 1500 kg.

Local chicken and ducks are commonly raised in all households. Chickens are kept primary for home consumption and second only for sale. They are important sources of

cash for a villager when he goes to market to buy small amounts of supplies for farm and home. Ducks are kept for home consumption and for eggs of which some are sold.

All poultry are free ranging and gather most of their food by scavenging. They are fed at times with rice bran, broken rice, paddy, vegetable waste and termites. So far they do not use any vaccination, mortality is low due to their remoteness of the area. Even though, last year the NBCA staff opened the veterinary training course to the villagers.

Pigs are part of the scene in the village, either free ranging or in pens. Most of the households have at least one pig. They are kept for sale, home consumption and ceremonial purpose.
Both buffalo and cattle are important to the villagers due to high market demand and attractive prices. To quote the village headman " If a family with a rice deficit of six months can sell a buffalo bull, it can survive until the next harvest and sometime it can be used for exchange to all needs of the household e.g. cost of household construction, hand-tractor etc…. They generally graze freely around a village, in fallow areas, and in forested land.

The big part of the income comes from the sale of those animals. Side by side the non-timber forest products play a very important role to villagers especially to the poor families.

A wide range of forest products for home consumption are part of the family diet e.g. bamboo shoots, mushrooms, wild vegetables, some for building materials e.g. bamboo, rattan, grass for thatch, some for income generation e.g. Cardamom, broomgrass, Gum and Palm fruits (Mak Tao).

Problem of Agriculture production:

1. The production systems both wet rice field and shifting cultivation is based upon natural condition without irrigation support. Some year, when drought occurs, it gives poor yield and the village suffers from rice deficit.

2. Pest and insects frequently spread over rice field e.g. stem borer, grasshoppers.

3. Wild life is commonly reported as crop pests and predators of livestock in the village. Wild pigs and rodents are the major crop pests, although a number of others including deer and various birds are involved. The villagers estimated that about 30 % of total harvested yield are lost to wildlife.

4. The villagers still use local rice varieties, which gives low yield, and takes a long period to mature. By experience, some farmers use a short rice variety. It seems to be successful (good yield) and can escape from the disturbance of wild life.

5. Both wild elephants and domestics elephants frequently destroy the crop and even the farmer's huts and rice stores.

6. Wild dogs are reported as the major predators on livestock species such a poultry.

7. Until now, no new technology has been applied in the agriculture production system and no kind of chemical fertilisers has been used.

8. Shortage of labour with limit of funds makes it a slow process to develop land into Paddy field. So shifting cultivation practice is still dominant.

9. The District irrigation scheme for Houay Sanee can not be implement due to shortage of budget.

10. Limited of marketing opportunities, bad access road, only few local trade man come to collect non timber forest products such as rattan, broomgrass, cardamom, paper mulberry bark and kapok .The village had only one small hand tractor.

8.3 Ban Phongsack – a profile

8.3.1. Historical and demographic changes

Ban Phongsack belong to Piang District. The village boundary overlaps with the boundary of Nampui NBCA where it is easy to identify by taking NamYam River as a common border. It has significant forest resources. The Sayabouly-Paklay road is crossing Ban Phongsack. It ensures access to the market e.g. district and province market and the International (Thai) border.

Ban Phongsack is multi ethnic and the three main ethnic categories of the country are represented. They are called Lao Lum, Lao Theung, and Lao Soung. These terms, which indicate different elevations, associated with their dominant habitation patterns (low land, mild land and high land) are officially used to distinguish ethnic groups in the country.

No one can tell the exact history of the village. Based upon the discussion with the neighbour village i.e. Ban Nakhong it was found that people believe the latter is the mother village, because Ban Phongsack village authority is not the original of this area. Most of them migrated from other place or sometime they are descendants of Ban Nakong

The historical record could be summarised as follows:

- 1942. 5 households with about 40 persons from Ban Nakhong village came to settle with the objective to open the land for shifting cultivation and they gradually developed it into wet rice field.

- 1962 Villagers agreed to follow the Buddhism. They constructed a temple and invited one senior Monk and five Junior Monks to teach Buddhism,

- 1968 The Households had increased into 24 households with about 192 persons after seeing the success of the first groups. Both of them are Lao Loum from Ban Nakhong. At that time, all administration part was carried out jointly with Ban Nakhong.

- 1972 Newcomers from Ban Phong Gnam, Ban PongKok and Ban Vangthom made the population increase to 34 households with about 272 persons including some Lao Theung households.

- Late 1975 after a new regime, the District officially declared Ban Phongsack to be an independent village.

- 1976 the number of children has increased. The villagers decided to build a primary school with 4 rooms, timber wall and imperata roof.

- 1977 a Lao Soung group (Yao) of 10 households with about 80 persons settled in the western part of the village. They mainly practised the pioneering type of shifting cultivation.

- 1979 The Lao Soung group (Yao) moved out to another place because the land degraded and agriculture production decreased. The remaining population was 30 households with about 240 persons.

- 1993 The Government had declared the establishment of Nampui NBCA. According to the old boundary Ban Phongsack is a village that could share the boundary with the NBCA. But when considering the extension of the Eastern part of Nampui NBCA, it makes Ban Phongsack boundary overlap the NBCA boundary. In the same year the village renovated a full grade primary school

of five rooms with tiled roof. The population was double size compared to 1979 population, 70 households about 433 persons including 202 females.

- 1994 The land use planning and Forest land allocation programs was implemented. Total population was 85 households with about 533 persons including 257 females. It included Lao Lum 509 persons, Lao Theung 21 persons, and Lao Soung 3 persons.

- 1997 Lao-Swedish Forestry Program introduced the concept of Participatory land use planning as a review process.

- 1999 the total population is 94 households with about 594 persons including 244 females. The labour force consists of 253 persons. There are 90 households of Lao Lum, 3 households of Lao Theung and 3 households of Lao Soung.

8.3.2 Socio-economic situation :

Ban Phongsack is located along the road Sayabouli- Paklay with a good facility to Khenethao District, Lao-Thai International border point about 150km and to Sayabouli province about 200km. Now the total population is 94 Households about 594 persons including 224 females, 253 labour forces.

The mixed ethnicity consists of LaoLum 96 %, Lao Theung 3% and Lao Soung 1%. Lao Lum is Buddhist. Lao Theung and Lao Soung are animist and ancestors beliefs. They are well co-ordinated together. The Buddhist temple with one senior Monk and five Junior Monks is settled in the middle of the village. During all Buddhism days young and old people (both men and women) gather to listen to the Buddhism sutra.

In the past Ban Phongsack was situated along the NamYam River. Now they decided to move out along the road, households enjoyed better accessibility and greater opportunities to receive social services. However, they are faced with difficult access to the use of water resource because they relied upon NamYam River both for drinking and daily use.

Ban Phongsack does not have a health centre like Ban Vangphamone .The nearest health centre is located in Ban Phongsa- ad situated 30 km away from Ban Phongsack. The common diseases are malaria and diarrhoea. In case of severe sickness, the villagers use to go to the provincial hospital. The annual growth rates since 1986 is 2% because the family planning and aid programs have been strengthened.

The full grade school consists of 5 timber classrooms, cement floor, teak roof but old tables and bank. The total number of students is 140 persons including 30 females with 4 teachers (one female).

The secondary school is available in Ban Phongsa-ad only but there is no dormitory facility. So it is difficult for the students who have completed primary school, they can rarely continue their study, especially the females.

Women and child have a heavy workload such as all housework, fetching water, collecting fire wood, hand milling rice, cooking, cleaning, child care and at night time some women are also engaged in handicraft production (weaving and embroidery)

The social status of each household can be identified easily when seeing the house. The better of households have good timber house with fiber roof. The average households have timber house with tin roof. The poor households have bamboo houses with roof of imperata grasses or bamboo.

Based upon on the criteria of self-sufficiency in food consumption, the better off households' represent 6% of the population, the average households' 86 %, the poor households 8%.

As a central point between Sayabouli and Paklay, some better off households have started small-scale business on petroleum service and agriculture input materials such as vegetable seeds, pesticides and fertilisers. The average agriculture revenue per capita is only US$ 81.

8.3.3Natural resource:

Ban Phongsack consist mixed deciduous forest, small patch pure teak stand and some bamboo brake. The major tree species are *Pterocarpus macrocarpus, Afzelia xylocarpa, Dipterocarpus alatus, Chukrasia tabularis, Shorea spp, Mangifera indica, Tectona grandis* etc

In general the forest resource of Ban Phongsack can be divided into two parts. The Eastern part of NamYam, it is covered by the closed mixed deciduous forest with some disturbance along the NamYam River for their subsistence agriculture. In the western part of Nam Yam consists of open Mixed deciduous with some small portion of pure teak stands. It was considered as a former logging area of the province. A large area forms pure bamboo forests.

Figure 9. Ban Phongsak Land Use Map 1981.

Scale 1:50 000

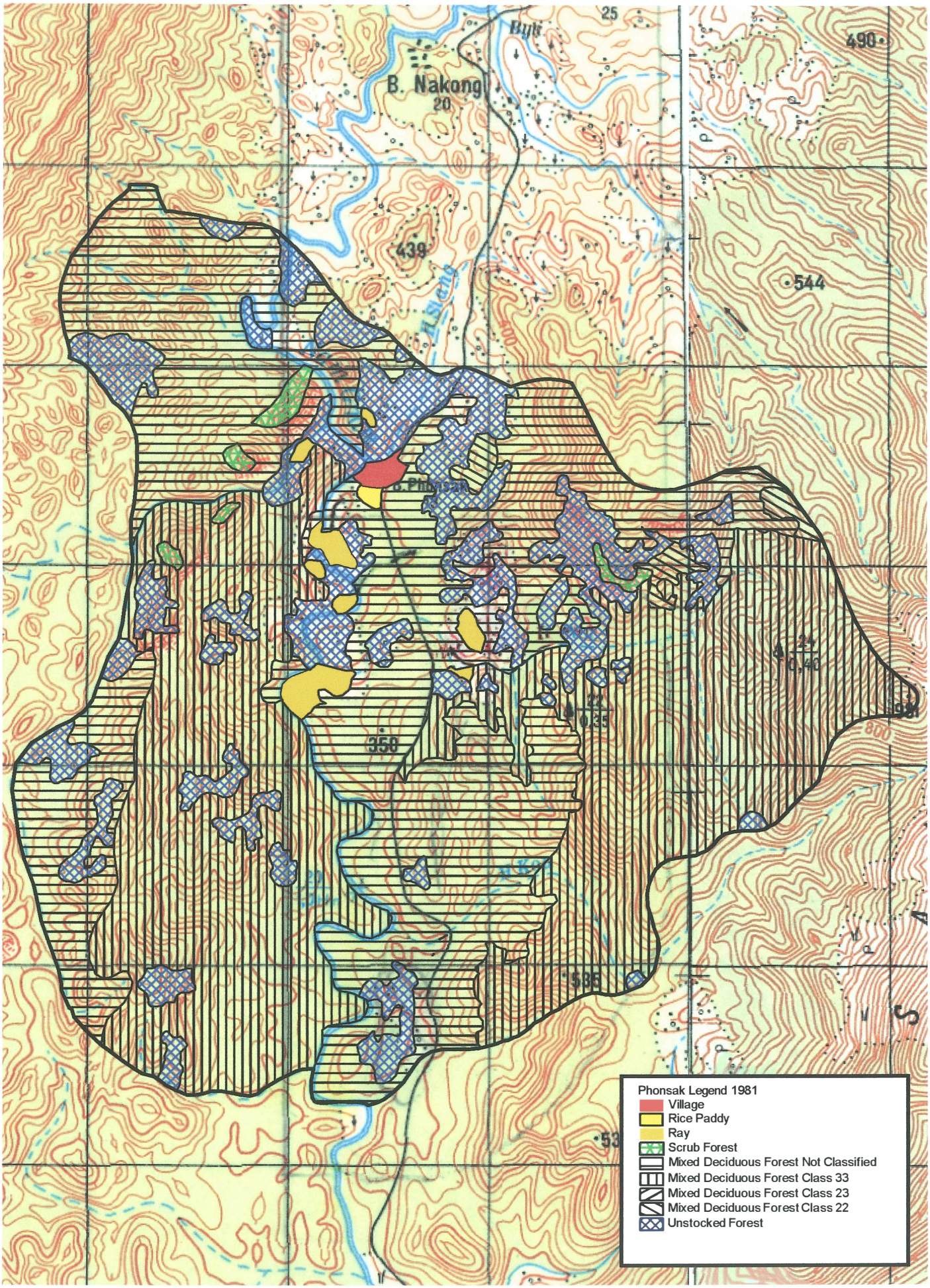


Figure 10. Ban Phongsack Land Use Map 1989.

Scale 1:50 000

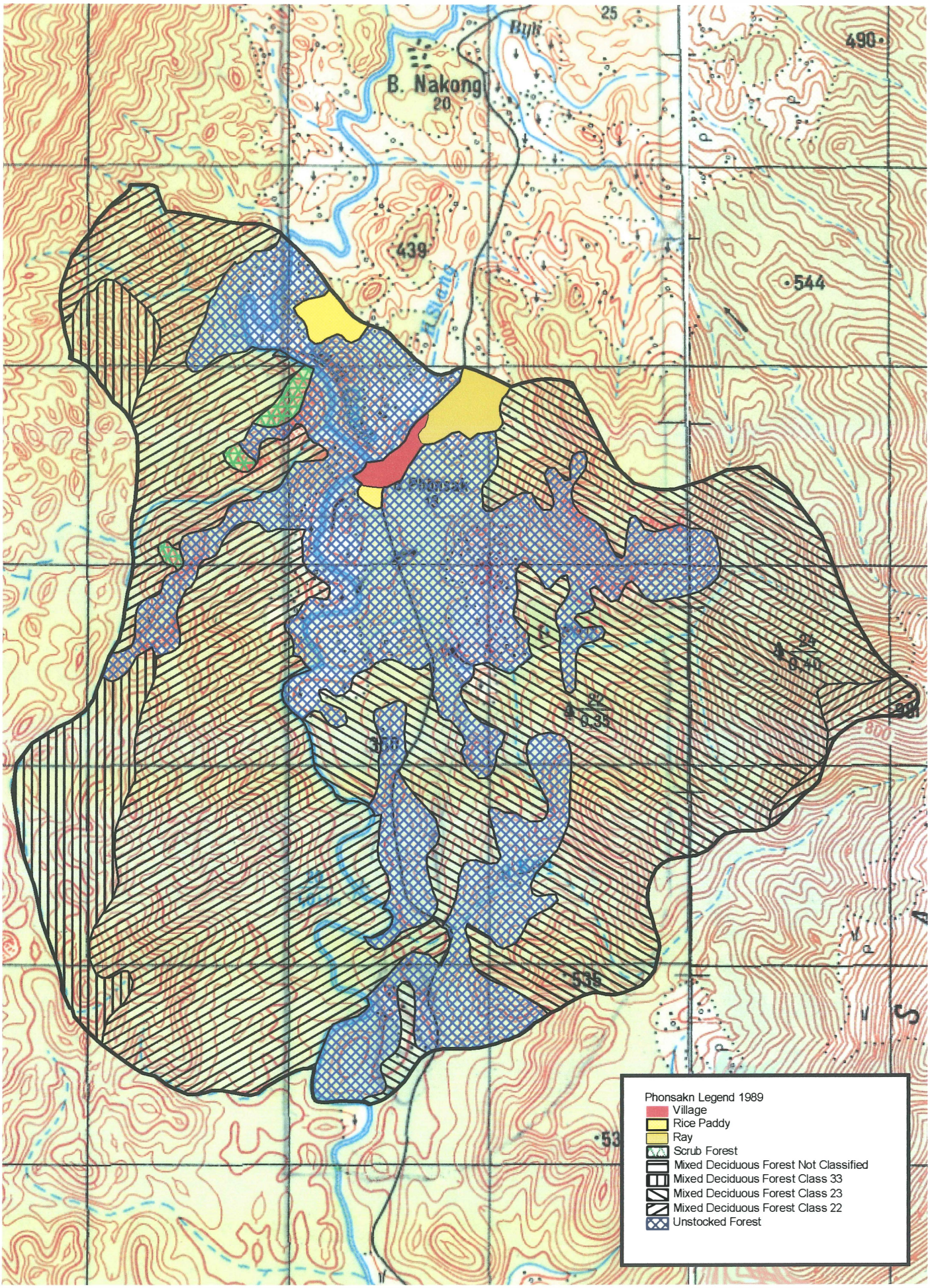
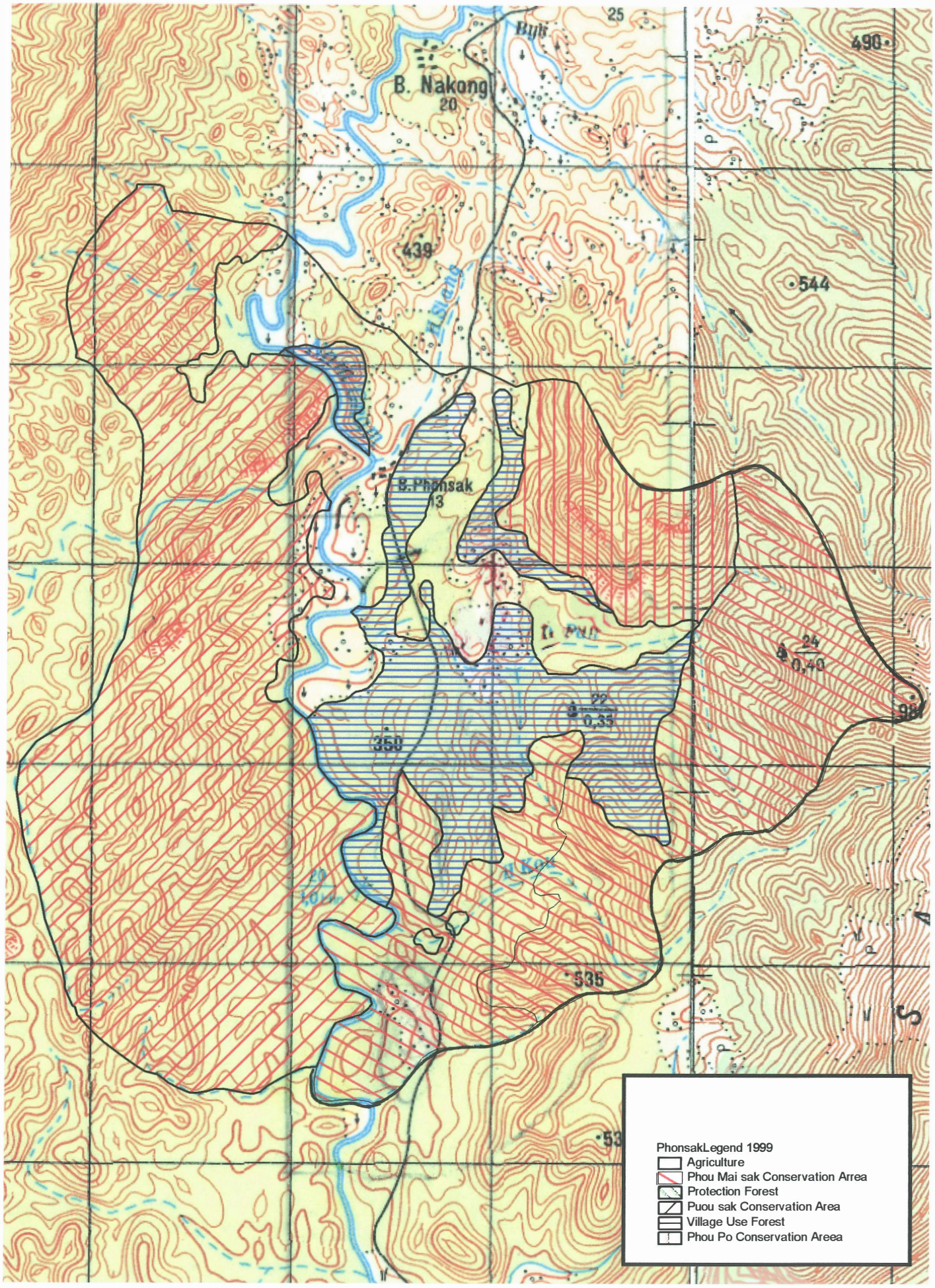


Figure 11. Ban Phongsack Land Use Map 1999.

Scale 1:50 000



Nam Yam is the main river of Phongsack village but it is not rich in fish and other aquatic animals because of shallow water and a lot of waterweeds.

The tall grasslands comprise mainly *Imperata cylindrica, Cymbopogon spp, Saccharum spp*, and thorny species such as wild raspberry. There are occasional areas of short grass (mainly *Axonpus affinis, Paspalum conjucatum*) interspersed among the tall species. All those species indicate soil of very low fertility.

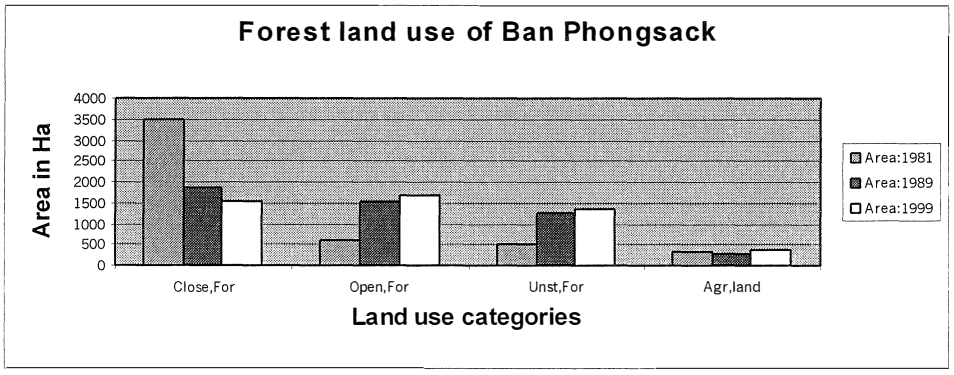
The villagers confirmed that such areas were used for shifting cultivation over at least five cycles of 10 years period. However, an observation of these areas suggests that soil type have badly a powerful influence on the evolution of the grasslands.

As compared with Ban Vangphamone, land is not fertile possibly because of the heavy use and other reasons. The yield per hectare is lower, for wet rice field 2000 kg, for new converted rice field 1500 kg, Shifting cultivation 1000 kg.

Still the forest resource of Ban Phongsack supports a good habitat for wild life such as monkeys, gibbons, deer, wild boars and different kind of birds. The gun confiscation scheme has been completed in this village. Some small game is still found, local techniques are use to capture some squirrels, lizards, birds for supplement their diet.

Cardamom, canes and bamboo are the main non-timber forest products. In addition there are two kinds of fruit palm called Mak Ko and Mak Tao which generate good cash income.

Figure 12 Forest land use change in Ban Phongsack:



The land use change study showed that in 1981 closed forest covered 70% of the village area. Opened forest and unstocked forest cover about 10% each. The reason behind this is during 1977-1979 Lao Suong (Yao) settled in the western part of the village and they are mainly practicing pioneering shifting cultivation.

In 1989 the closed forest decline 50% and the opened forest and unstocked forest develop two folds because of the reason that Ban Phongsack also include in the production forest of the state forest enterprise. Due to its accessibility heavy logging is taken by using the heavy machine like the skidder, close forest is severe damage.

In 1999, the closed forest area has decreased even more and many big trees removed. Besides forest degradation, large areas have become unproductive, as imperata grasslands have to expand. Some agriculture land has been developed into more permanent farm; e.g. the area of wet rice fields has doubled in the last decade. Also the area of cash crops, mainly paper mulberry trees, has increased. The remaining closed mixed deciduous forest is only found on the eastern part of Nam Yam River when there is no road.

8.3.4Land use and Agriculture system:

Ban Phongsack completed land use planning and forestland allocation in1997. Every household got their own land for agriculture practice. The result by the household sampling showed that the better off households got 5-7 plots with an area of 4-5 ha, the average household got 3-4 plots with an area of 2-3 ha and the poor household got 3-4 plots with an area of 1-2 ha. The forest is classified into three main categories namely Village conservation Forest, Village Protection forest and Village use forest.

Table 5: Estimated total land area, point sampling 1999 and officially allocated area 1997 in Ban Phongsack on different land use categories

S/N	Land Use categories	Sampling(ha)	Land allocation(ha)
01	V. conservation Forest	3139	1684
02	V. Protection Forest	733	2430
03	V. Use Forest	322	150
04	Agriculture	698	154
05	Settlement	22	20
	Total	4914	4438

The difference between the point sampling estimates of the current situation and the area figures from the land allocation were analysed and discussed with the villagers. The following conclusions are drawn:

1. The total village area is about 10% higher according to the sampling estimate due to the adjustment of the boundary with Ban Nakhong, possible sampling errors and measurement errors.

2. The village conservation forest area is bigger than the area figures from the land allocation because the point sampling considered that wild life habitat, salt minerals, and watering and special species like Teak as important for conservation purpose, then two more village conservation forests identified.

3. Village Protection Forest area is smaller than the area figures from the land allocation because it gives the priority to river bank protection.

4. Agriculture land according to the point sampling is 4 times bigger than the agriculture land of the previous land allocation program. An important reason is that the figure from point sampling including fallow lands and grasses land.

5. The previous land allocation did not provide the villagers with good opportunities to consider conservation aspects as a base for land use classification. During the sampling exercise they had better opportunities to get information in e.g. natural resources including wildlife habitats, non-timber forest products and important trees species. Therefore the classification could be adapted to a more realistic situation and the area of different categories could be revised.

Table 6: Standard error percentage of land use categories of Ban Phongsack

S/n	Land use categories	Area, ha	Percentage of total area	Number of sample points	Standard error percentage
01	V. Conservation forest	3139	63.9%	30	8%
02	V. Protection forest	733	14.9%	7	14%
03	V. Use forest	322	6.6%	8	8%
04	Agriculture land	698	14.2%	5	17%
05	Settlement	22	0.4%		

Formula: ept: $\sqrt{pt.(1 - pt) / (n - 1)}$

Farming system:

Different farming systems were adopted by the various ethnic categories in Ban Phongsack. In the case the Lao Soung (Yao) came to settle in western part of the village in 1977 and move to another place in 1979.

They commonly used pioneering shifting cultivation. First they selected a good forest area, mostly in upper watershed. Then they clear-cut and burn the forest to get high potassium concentration in the soil and cultivate rice for several seasons until the soil is depleted. It will take long time before forests can naturally be established again or soil can be regenerated. In many instances only Imperata grass will generate in these areas.

They return to previously cultivated fields that seek out either primary forest or the relatively old second growth forest for the next cycle. From this practice the term of pioneering is derived. These systems are not sustainable under population pressure and require that its people constantly move to new-forested areas in a semi- nomadic fashion.

The Lao Theung group was experience with rotating shifting cultivation, which usually infers that families live in a permanent place based on a fallow period. They cultivated in a suitable location from one to four ha of upland rice, corn, cassava, sweet potatoes, and various other fields and vegetable crops.

Rotational shifting cultivation with a proper fallow length, e.g. ten to twenty years, is probably a relatively sustainable agriculture system. But with the increased population pressure and local land and forest allocation mandates, fallow periods have drastically declined.

This inadequate rejuvenation of biomass and soils has resulted in improper forest regeneration. With inadequate time for forest regeneration there is increased weed infestation, which is one of the major causes of reduced rice yields. In the case of Ban Phongsack, the fallow cycle has been reduced to about five years.

Lao Loum traditionally convert the land area in to wet rice field but some of them have practice swidden agriculture which is upland rice based with complementary vegetable, field crop, and fruit tree production along with livestock rearing.

All villagers have also been dependent upon the forest for their wood needs, such as building materials, tools, fences and firewood, in addition to the gathering of non timber forest products for their consumption and income generation.

An interactive process of trial and error has refined their indigenous knowledge and skills, which have been passed down over the generations and is demonstrated by their ancestor's survival for centuries due to their livelihood practices. Teak plantation and paper mulberry plantation is common found.

The numbers of cattle and buffaloes have been increasing in recent years along with market demand and attractive prices. They generally graze freely around a village, in fallow areas and in forested land. Some farmers are now using buffaloes and cattle as follower in their shifting cultivation systems to control weed growth by trampling and for fertility maintenance.

Rearing of small animals is important to households. Ban Phongsack, however is the centre point between Sayabouli and Paklay, so it is sensitive to disease.

Traditional "miang" (tea) gardens commonly occur. The villagers have cultivated in some small portion of evergreen hill forest near by the village, it is considered as an indigenous agro-forestry system. Both men and women as a social custom consume Miang for chewing. Miang (tea) leaves are used for medicinal purposes and as a beverage more than 2,000 years.

A Miang variety (*Camellia sinensis var. assamica*) or Assam tea is planted with irregular spacing under forest trees without application of chemical fertiliser. Some small trees are cut down and used for firewood. Villagers select and thin forest trees once every 3-5 years for giving some sunlight to miang trees that are kept approximately 5m high.

Miang (tea) leaves are harvested four times a year; the second harvesting gives the largest production. Villagers produce miang for chewing purposes by steaming its leaves and then storing them anaerobically, such as in pits or sealed baskets for a period of time.

These miang gardens prevent shifting cultivation from spreading into natural forest because farmers have to conserve the forest trees for shading the tea trees. Villagers also prevent forest fire that would otherwise damage their crops and the surrounding forest. It is quite possible that miang gardens have acted as a bufferzone between shifting cultivation and the natural forest.

Agriculture Production problems:

The farmers of Ban Phongsack mentioned a number of problems linked to their agriculture as follows:

1. The land degradation affects soil fertility and the crop yield has decreased.

2. Under severe circumstance nuisance grasses such as Imperata, Chromalaena and Angeratum, become established over large areas and deter reforestation.

3. No intensive cropping system has been adopted, but only traditional cropping.

4. Long drought periods have encouraged forest fires that affected agricultural crop and forest biodiversity.

5. The stock of poultry has suddenly wiped out because of epidemic diseases. No veterinary service has been available on these occasions.

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6. Lack of funds for establishment of irrigation system.

IX. AREA PRODUCTION MODEL (APM) APPLICATION

9.1. Area Production Model Concept:

Professor Nils-Erik Nilsson, Swedish University of Agriculture sciences (SUAS), developed the Area Production Model in the early 1980s(Nilsson,N-E,1984.) .It was one of the first computerised models for production and consumption studies. Technically, It is a computer program for developing scenarios on future land use, fuel wood balance, plantation development etc but the idea is that is to be use for broader purposes and as a help to understand and analysis changes, identify data requirements and strategies options.

The computer program has been further developed into Windows by Magnus Grylle, FAO, and used in a number of places such as South East Asia and South-America. (FAO/FRA 1990, final draft users guide to the APM, version 2.0).

In Lao P.D.R., it has been used since 1997 in five- (5) research and pilot studies initiated by SUAS. In1999, the training Workshop " Inter- active and dynamic approaches on forest and land use planning " in Vientiane and Lao P.D.R. in the mid April, was carried out with the objectives to promote new ideas out and approaches on how to improve forest land use and the related planning process. It was practically orient and gave a deep understanding on the APM concept (Sandewall, M 1999, working paper No 6o).

The APM approach concerns methods for determining and analysing the historical and current situation and techniques for analysing future options and strategies using scenario techniques. Important tools for determining the current situation and changes are sampling methods and interview techniques. One of the tools used for the developing scenarios is the Area Production Model.

The research study presented in this paper has selected two pilot villages in and around the Nam Pui NBCA. Ban Vangphamone considered as a village inside NBCA and Ban Phongsack as village outside NBCA.

9.2 Ban Vangphamone resolution :

Scenario 1:

Based on the current situation and assuming that the population growth rate in Ban Vangphamone is reduced to 1% within 20 years can the village sustainably survive in the NBCA?

Data input (see also enclosed tables)

Based on the socio-economic and land use data of the village, Total population is 236 persons with the natural growth rate of 3% then reduce 0.5% in each period until it reached 1% and remains on that level by a good family planning.

The Agriculture revenue per capita start at US$110 and the growth rate is 1%. It gradually increases by 0.5% each period until it reaches 3%.

Subsistence food production per ha is calculated by subtraction with 30% for compensation of crop damage. It starts with 1287kg/ha with the growth 1-% then increase in each period until it reach 2.5% and give as constant. Subsistence food production consists of rice in Paddy fields and shifting cultivation with the gross area of 296 ha (4 years cycle basis)

Marketable food production consists of sesame, corn, cotton and tamarind. The yield per ha is 216kg/ha with the growth of 1% then gradually increase 0.5% in each period until it reaches 2.5% as constant. Its area is only 7 ha.

The cash crop production comprises only Paper Mulberry bark and kapok. The yield per ha is 266kg/ha with the growth 1% then gradually increase up to 2.5 % as constant. The area is 27 ha.

Other land includes agricultural potential land 46ha, potential forest 20ha, and unproductive land 3ha.

Forest was classified as follows:

Village conservation forest 4086ha; village protection forest 1222 ha and village use forest 673 ha. MAI of environmental forest is considered 1 m3/year/ha with the limitation of the fuel wood collection. MAI for village use forest is used 4m3/year/ha based upon the data from permanent sample plots (Forest Management and Conservation Project / World Bank/ FINNIDA/ Lao.PDR). The APM scenarios cover a 50 years period.

Out put (see also enclosed tables)

During 50 years, population increase to double size, from 236 persons to 496 persons. Agriculture revenue per capital augment 3 times, from USD 110 to USD 378. Agriculture development is well balance between subsistence food production and cash crop production.

The subsistence food production area expand to its maximum in 2014, then it gradually reduce in parallel to its increased yield per ha. During the first 15 years potential agriculture and potential forest land is being converted to land for food production. From 2015 the trend is reversed when agriculture productivity increases faster than population.

The market food production area does not develop due to limit of market opportunity. But the cash crop production area expand 2.5 times during 50 years, from 27 ha to 66 ha because of easy establishment of paper mulberry plantation with its low cost profile and attractive price and in response to the economic growth in the region.

No other land will be affected, all forestlands are kept for conservation and protection purpose. The supply and demand of fuel wood can balance even in the situation of double size population.

With the control of the growth factors, land is still available for the agriculture purpose. The living standard of the villages is gradually up graded. So, it can conclude that Ban Vangphamone can survive with this circumstance, without any negative effect to the NBCA management program.

Scenario 2

Can also the new immigrants stay in Ban Vangphamone as enclave village of NBCA, if there is strict control of future immigration?

Data input (see also enclosed tables)

During field research study in Ban Vangphamone, date 15 February 1999, the immigrants from Viengkham District, Luang Prabang province 119 persons unofficially settled. The district officer did not allowed them to stay but they did not have any alternative to come back to their home village because their financial resource was exhausted. They had requested the Official's authority to stay for this seasonal cropping, then next year they promised to move out to another place.

So it was a good opportunity to use APM as tool for analysing the changes if assuming that they were accepted to stay in Ban Vangphamone. The numbering of population would be increased from 236 persons to 355 persons by adding the number of the immigrants. We assume the yield per ha with different production system and the growth rates will be the same as for the settled population in Ban Vangphamone.

When the calculation of the subsistence food production area is based on the rate 0.31 ha per head and the gross area of 4 years cycle is used for shifting cultivation practice. The subsistence food production area is estimated 440 ha that will be need for the village. By taking the subsistence food production area as the base, it was assumed that the marketable food production and the cash crop production were 10% and 30% respectively. Other input data were the same figure as in the first scenario.

Out put (see also enclosed tables)

As compare to the first scenario, the agriculture revenue per capita have the same level but the population number is bigger about 250 persons in the year 2049. In fact it needs to expand the subsistence food production area in the first decade. The available of potential

agriculture and forestland has totally used within the first and the second year respectively. The third year, the natural forest e.g. village use forest has been gradually reduced up to 129 ha in the year 2014.

The market food production is not much developed but the cash crop production has increased quite well as a result of increased agriculture revenue. The main cause is that the villagers have improved their technology and more invested in agriculture inputs giving the high yield. At the same time the population growth had slowed down. So the subsistence food production area is reduced and the villagers give priority to the cash crop production to gain more cash generation.

The initial surplus of wood energy gradually decreased as the increased demand caused by growing population and was not compensated by established energy production. It shows the negative status in the year 2033.

In conclusion, from the above result the immigrants from Luang-Prabang province should not be allow to settle in the Nam Pui NBCA. If they stay, it will make a lot trouble to biodiversity conservation. The natural forest wills definitely loss 129 ha within 15 years. There will be a great disturbance of wildlife habitat. In addition Ban Vangphamone consider as a new enclave village, it is better have less human activities.

This scenario is only the showcase. The reason is that during the last visit of the village in January 2000, those immigrants were moved out to another place.

Scenario 3

New challenge with market economic opportunity, assuming in a decade, subsistence food production can meet the basic need food. The marketable food and cash crop become high priority for the villagers to generate cash income for accounting other basic needs. Can this contribute to the effectiveness of NBCA management?

Input data (see also enclosed tables)

The model reflects that people produce their basic food needs in their own fields and produce additional incomes (marketable food and cash crops) to raise their standard of living. But in the study area people will have to be able to buy part of their basic needs of food. In the third scenario, some of the required subsistence food production area (after 10 years) has been exchanged to marketable food and cash crop production areas.

Based on the result from the first scenario on the year 2009, the estimated area for subsistence food, marketable food and cash crop are 283 ha, 34 ha and 68 ha with their assuming per ha is 2000kg, 300kg and 500kg respectively. The growth rate of subsistence food production is used the same level as it was in the first scenario i.e. up to 2.5%. For the growth rate of the marketable food and cash crop production is upgraded to its maximum level at 3%. Other input data were used the same data from the first scenario. The analysis will cover 50 years period (2009-2059).

Out put (see also enclosed tables)

No any change on the population and agriculture revenue per capita from the first scenario. By the year 2059 the figure of agriculture revenue per capita (GDP/capita) can reach the government target USD 500 per capita in the year 2000. This could be a good example for the planner and decision-makers that is not easy for a successful socio-economic development.

In the first 5 years, the potential agriculture land has been totally used with 7ha of potential forestland. Then the exchange process between subsistence food area and cash crop production area is taken place smoothly. In 50 years, the subsistence food area reduce nearly half size from 283ha to 149 ha and the cash crop production area increase nearly two times from 68ha to 120ha.

The forested area is well preserved and gives a good support to energy balance status. But there will be a negative trend after this scenario period. So some tree plantation program could take action with indigenous species in mind.

In conclusion, this scenario gives almost positive result. But in the real field if the irrigation scheme is not put in to action, no financial support for rural credit and no strong agriculture extension service. It is hard to be a success story.

9.3 Ban Phongsack resolution

Scenario 1

Many development take initiative in Ban Phongsack such as good family planning, access to market (both local and international), application of agriculture production technology (mechanisation, hybrid seeds, chemical fertiliser etc.), double cropping in rice production, more investment (rural credits).

Can villagers enjoy those facilities for uplifting their living standard without any affects to their involvement in NBCA management?

Input data (see also enclosed tables)

With an initial total population of 594 persons, the growth rate is reduced stepwise from 2% to 1%. Agriculture revenue per capita start with a low level as USD 81 and assuming the growth rate gradually increase 0.5% every 5 years till it reaches 5% as its stable stage.

The subsistence food production keeps their growth rate of 2%. The marketable food production gradually increase their growth rate in every 10 years with 0.5% till it reach its saturate point at 3%. The cash crop production follows the same growth rate of their agriculture revenue per capita.

In addition with the internal usage of biomass energy, the villagers sell the firewood to the town as one sort of cash income. As some forest of Ban Phongsack is over exploitation during the time it was under state production forest. The rehabilitation strategy becomes a key issue. So the potential forestland is put as first priority for land use transfer. This scenario covers 50 years period (1999-2049)

Out put (see also enclosed tables)

During 50 years period the population doubles from 594 persons to 1052 persons. With the applied growth rates, the agriculture revenue per capita augments nearly 5 times from USD 81 to USD 390.

In the first 10 years the subsistence food grow up to its peak at 420 ha by using the potential forestland and some 21 ha of potential agriculture land. There after the potential forestland recover up to 94 ha. The cash crop production area increase nearly 2 times from 67 ha to 119 ha. Within 15 years the energy balance figure shows a negative status but the forested area can remain instead.

In conclusion Ban Phongsack is well located not only for market access but the overlapping part to the NBCA has a clear field demarcation by the Nam Yam River. The eastern part of Nam Yam can be kept for village conservation forest within the NBCA controlled used zone. Luckily, on that part no road exists, it makes it convenient to supervise.

On the western part of Nam Yam, there is enough land for agriculture development eventhough the soil is poor, but if villagers could invest in agriculture inputs, soil will be improved and give the high yield productivity.

To solve the problem of unbalance biomass energy, enrichment planting could take place in the new potential forest land with indigenous species or family based tree planting scheme could be encouraged.

If not, forest encroachment could become a severe problem in the future and it will be difficult to control the use of the natural resource in NBCA. Ban Phongsack could enjoyed a better quality of life along with a close collaboration in NBCA management.

Scenario 2

In a decade the agro-business is well developed in the area. The cash crop becomes a main source of foreign currency exchange. GDP growth meets with the national level. There will be electricity power service to the village. The villagers enjoy the modern life.

Could these developments complement to the biodiversity conservation?

Input data (see also enclosed tables)

The population growth rate keeps constant at 1%. The agriculture revenue per capita (GDP) start with 3% and gradually increase 1% in each 5 years until it reach its stable point at 6%.

The subsistence food keeps the stable growth rate at 2%. The market food growth rate start with 2.5% and increase in every 10 years with 0.5% till it meet the peak at 4%. The cash crop growth rate follows the same tract of the GDP/ capita.

The rural biomass energy demand reduces nearly half but the supply fuel wood to the urban remains the same level. This scenario covers 50 years (2009-2059).

Out put (see also enclosed tables)

As compare to the first scenario the total population is almost the same level. With the applied growth rate, the agriculture revenue per capita (GDP/capita) is highly jumped from USD 92 to USD 1273 in 50 years.

The subsistence food area reduces 148 ha from 381 ha to 233 ha because the yield per ha increases more than 2 times. The market food area increases 67 ha from 42 ha to 109 ha. The cash crop area increases only 54 ha from 84 ha to 138 ha because a high yield variety is introduced.

The potential forestland develops to its peak at 48 ha in 2045. The potential agriculture land remains the same level at 191 ha. The unbalance of biomass energy occurs in 2044. But there do not have any change in forested area.

In conclusion, the better life and good agro-business management could contribute to participatory protected area management. I t could be interpreted that development and conservation are mutually benefit to the nature.

X.COMMENTS TO APM

Advantages

- The APM is an aid to strategic planning of land use and forestry. It is a simulation model making it possible to adapt every APM run to available data and existing situation in an interactive process. The government of Lao PDR has shown its interest to APM application because it suited well to their policy on land use planning and forestland allocation which the main objective was sustainable use of natural resource (land, water, forest and wildlife etc.).

- The APM deals with land use changes and their consequences. It includes socio-economic data as well as agriculture and forest data. It seems that APM is flexible in application with different cases e.g. the research and pilot study in Lao PDR (village level, watershed, district, protected area etc.)

- The APM was considered as the first computerised models for production and consumption studies. Several data sets can be stored and re-used.

- The APM result was a basis for having a good dialogue with people concerned and could play with many scenarios accepted by all parties.

- The research and field study was necessary for the APM development process. By experience, it could give a good feedback and facilitate APM adaptation to the local situation.

Disadvantages

- APM does not consider the crop damage, which may frequently occur with the village close to forest. By experience in Ban Vangphamone, our pilot village, villagers have been reported that crop damage covered 30% of total harvesting. Crop damage may consist of disturbance by wild animals such as birds, deer, elephants, wild boar, rodents, severe drought followed by pest.

- Difficulty to take animal husbandry into cash crop production because rural villages were most adopted the free grazing or rearing and the overlapping land use part is not available in the model. But the livestock production (mainly buffalo, cattle, pigs and poultry) is commonly generating the main cash income or being used instead of cash by rural households.

- As APM could be adapted to different localities e.g. village, watershed, district etc. The term GDP does not suit to all conditions and the suitable term should be "Agricultural revenue per capita"

- The forest classification in APM is different from those in the Lao forestry Law which consist 5 main forest land use categories(protection forest, conservation forest, production forest, rehabilitation forest and forest plantation)

- Villagers have long benefited from collecting a wide range of non-timber forest products such as bamboo shoots, tubers, mushrooms, wild fruits and wild vegetables for food; and resins, gums, bamboo clumps, rattan canes, broom grass and cardamoms for cash income as much as 25% of the income generation of households. But the model not yet considered.

- APM concentrated on land use changes but it not yet connected with a map. So it could not be seen where the land was changed.

- The land use transfer is based upon the priorities giving in the model but in the reality the land use transfer could be possible in any convenient land categories.

Some constraint on APM application

- It is difficult to have accurate input data because there are no detailed data. Many data were obtained from the memory of key informants.

- No data were available on the growth of natural forest such as MAI or CAI or even the plantation information.

- It really needs experienced staff and a good knowledge of the location.

- The user should have background on the Windows system and some English language, which is limited among Lao staffs. Even though the manual has been translated in to Lao version.

- No new air photo has been taken in the pilot area. Remote sensing can help to identify or study the historical land use change.

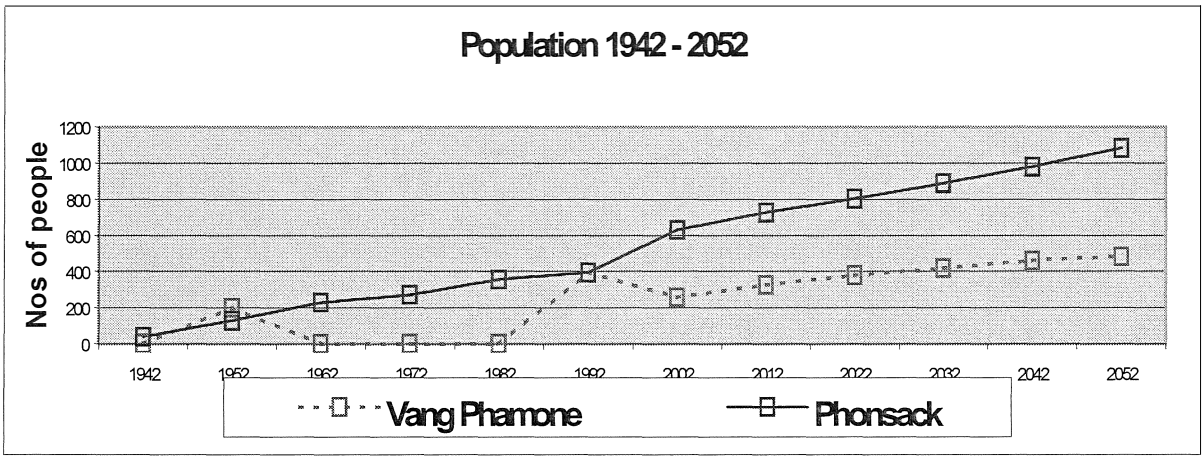
XI. FINDING AND DISCUSSION

- Map rectification

Different source of maps and photos were used i.e. 1:50000 American topographic map dated 1967, 1:30000 Russian aerial photos dated 1981, 1:50000 spot satellite image map dated 1989. It was very difficult to rectify them into the same map due to problems to identify the original map projection.

- Population Study

Figure 13 Population change in the pilot villages



The population growth rate is a very crucial issue; it can directly affect the land use management of NBCA, From the history of Ban Vangphamone it was not stable until 1996. During 1952-1990 new groups of people moved in and moved out due to many kinds of accidents as listed in the history part.

During 1990-1995 people still worried on the protected area policy, some people still move out. From1996 people feel secure and stable to stay but the natural growth rate of 3% is seem to be higher than the national growth rate level of 2.4%(1999, Asian Development Bank).

When assuming to slow down the growth rate at 1% as constant, still the figure show in double size. In the case of Ban Phongsack, the population grows gradually at average 2% per year since 1962 and by assuming the future growth rate at 1% per year as constant.

In the next 5 decades, the population will increase 1.5 times. Population growth is higher in rural areas due to high fertility rates. So, for future land use management of NBCA, both villages need very strong family planning for birth control.

- The main cause of forest land use change in the study area is not directly related to the issue of the population increase but due to the external factor e.g. the state forest enterprise.

- The forest types definition used by National Office for Forest Inventory and Planning (NOFIP) is very broad, only mixed deciduous forest was identified in Nam Pui NBCA but in the field research we can found some portion of moist deciduous forest and dry evergreen forest by its significant of floristic composition.

- The combination of all sort data collection technique such as RRA, PRA, Sampling and local knowledge make sense to create reliable and consolidated data, close to the reality and give accuracy for the precise decision. But it is difficult to get in to the reality because villagers always hide their own information from tax collection. Field sampling is helpful to verify the village land use patterns and to identify village forest land use categories for NBCA management.

- The APM concept is found as a suitable tool for strategic planning and monitoring of land use change and it could produce a good base material for discussion and negotiation with all stakeholders especially the historical and future period scenarios on future development in National Biodiversity Conservation Areas.

- In NBCA the first priority is to delineate the village boundaries and the forest land use zones for all villages within and around the NBCA so that the co-management agreements can be developed with the villages for management of the totalled protected zones and the controlled use zones.

- Boundaries between villages should be realistic, acceptable to communities and to the greatest extent possible relevant to the resources being managed. Traditional boundaries or village security boundaries generally provide locally recognised and acceptable boundaries for forestland allocation purposes.

- The village level forest categories should give effect to biodivresity conservation zoning through co-ordination of village forest categories across village area boundaries and negotiation of appropriate controls and restrictions with all communities.

XII.RECOMMENDATION

In order to follow the government intention of completing land use planning and land allocation in National Bio-diversity Conservation Areas fairly rapidly a modified approach should be adopted to focus on the essential elements first, i.e. boundaries delineation, forest-land use zoning and preparation of village agreements.

Land use planning and land allocation should not be considered as a "on-off exercise" but as a "continuous process" in which the accepted procedures can be undertaken in harmony with the establishment of NBCA management practices.

A "village boundary first" approach has the advantages of introducing villagers and staffs to the first stage in inter-village planning and net working and setting up the framework in which the remaining steps in the process can be completed.

A good, but not necessarily a detailed understanding of biodiversity values and issues for the whole of the NBCA is required before forest-land use zoning and allocation are undertaken. It is also essential to first classify villages based on their proximity to the boundary of the NBCA and their likely impact on resources in the NBCA.

Need to integrate APM application to land use planning and land allocation process even the APM still has many technical inconsistencies as computer model, which require further development work but the user should use his brain to adjust to the real situation. The training and field experience must be strengthened.

Land use planning teams and conservation staff must work together in NBCA villages to ensure that the knowledge and skills of both groups complement each other during land use planning and land allocation exercise and conservation management activity.

Working in clusters of villages simultaneously instead of single villages enhances inter-village understanding and co-operation, facilitates boundary delineation, and resolves boundary disputes and enables more accurate forest-land use zoning. It can also strengthen the capacity of the village residents to repel undesirable exploitation from outside.

The completion of interim village agreements, within and between villages, is important activity early in the process as it consolidates the effectiveness of networking initiated during boundary delineation and forest-land use zoning.

Other programs need to be conducted in combination with land use planning and land allocation process if it is succeed in controlling forest encroachment in NBCA. These include well-established controls and enforcement on the settlement of residents in the NBCA especially new immigrants should not permitted and strong implemented the family planning program.

XIII.CONCLUSION

Land use planning and land allocation with people's participation is an essential tool for planning and implementing NBCA management programs and activities. Therefore identifying village management areas. Forest-land use zones and removing forest-land use conflicts are pre-requisites for successful conservation management.

Sustainable natural resource management must be economically viable, ecologically viable and socially acceptable. Hence it is imperative that the populations while assisting the government in managing natural resources, attain economic benefits for their efforts. The government must also be prepared to accept responsibility for initiating and supporting sustainable development activities with the NBCA populations.

Basic improvement in forest-land use can not be achieved unless there is a process of consensus building involving the rural population. Thus during all steps in the land use planning and allocation process care should be taken to use approaches and methods which involve the people in decision-making.

People play important role in sustainable natural resource management and development. The village agreements and conservation rules developed therefore must contain management activities which the people understand and can manage as well as activities which support government policy and objectives.

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Annexes

Appendix 1

LIST OF TABLES AND FIGURES IN THE REPORT

TABLES

FIGURES

Appendix 1

LIST OF TABLES AND FIGURES IN THE REPORT

TABLES

FIGURES

Appendix 2

CLASSIFICATION OF PROTECTED AREAS IN LAO.PDR.

Protected area categories and designations

Pursuant to the categories and purposes of Conservation Forest and Protection Forest stated in the Forestry Law(1996), protected areas are herewith further divided into five categories:

(i) National Park
(ii) Provincial Conservation Forest
(iii) District Conservation Forest
(iv) Provincial Protection Forest
(v) District Protection Forest

The designations "National", "Provincial", and "District" refer to the level of Government authority that may approve the establishment of such areas. Ultimate responsibility for management of each category of protected area lies with the designating authority although day-to-day management may be delegated to lower levels of authority.

The term "National Park" is considered synonymous with the term "National Reserved Forest", as used in PM Decree 164, or "National Biodiversity Conservation Area" and constitutes the designation at national level of Conservation Forest. Other categories of Protected Areas may be designated at either Provincial or District level.

National Park

A National park is an area, normally at least 100,000 ha in size, which is deemed to be of outstanding biodiversity, scenic, or other conservation value at the national or international level.

The primary objectives of its management are the protection of biodiversity, maintenance of ecological services and the regulation of the biophysical environment.

Secondary objectives include the protection of historic sites and cultural values, and provision of opportunities for research, education, recreation, and nature tourism.

While some extractive activities may also be accommodated within National Parks, subject to local regulation and zoning, such utilization is not a primary objective of their management.

Provincial Conservation Forest

A Provincial Conservation Forest is an area, normally at least 10,000 ha in size and overlapping more than one district, which is deemed to have biodiversity, scenic or other values that are significant at the provincial level.

The primary objectives of its management are the protection of biodiversity and maintenance of ecological services.

Secondary objectives include the sustainable extraction of non timber forest products, regulated through systems of zonation and delegated community responsibility.

District Conservation Forest

A District Conservation Forest is an area, normally at least 1,000 ha in size and overlapping more than one village boundary, which is deemed to have conservation values that are significant at the district level.

The primary objectives of its management include maintenance of forest cover and sustainable extraction of non timber forest products, regulated through systems of zonation and delegated community responsibility.

Provincial Protection Forest

A Provincial Protection Forest is an area, normally at least 10,000 ha in size and overlapping more than one district, which is deemed vital at the provincial level for the protection of the biophysical environment particular water and soil resources, or alternatively, for reasons of national security.

The primary objectives of its management are the maintenance of forest cover and protection against farming encroachment or other activities that may increase soil erosion. Biodiversity conservation is usually a lower priority .

Areas appropriate for designation as Provincial Protection Forest include forest lands critical to the supply of the water for irrigation, hydroelectric or other infrastructure projects, or forested areas adjoining an international border.

District Protection Forest

A District Protection Forest is an area, normally at least 1,000 ha in size and over – lapping more than one village that is deemed important at the District level for the protection of the biophysical environment, particular water and soil resources.

The primary objectives of its management are the maintenance of forest cover and protection against farming encroachment or other activities that may increase soil erosion. Biodiversity conservation is a lower priority.

Areas appropriate for designation as District Protection Forest include forested lands critical to the supply of water for small irrigation, hydroelectric or other infrastructure projects.

International equivalence of Lao Protected Areas

Based on the management objectives and criteria set forth above, three categories of protected areas in Lao.PDR are deemed equivalent to the following global categories recognized by IUCN- The World Conservation Union:

(i) National Parks…..IUCN Class II (National Parks)
(ii) Provincial Conservation Forest…IUCN Class VI (management Resource Area)

(iii) Provincial Protection Forest…IUCN Class VI (Management Resource Area)

In addition, protected areas in Lao.PDR either singly or in combination, may suitable for nomination as " World Heritage Areas" under the UN World Heritage Convention, or "Biosphere Reserves" under UNESCO's "Man and Biosphere" Programme. If approved by the Government of Lao.PDR, such international designations may carry supplementary management and reporting obligations to those specified in the regulations.

Appendix: 3

DEFINITION OF THE LAND USE CLASSES AND VEGETATION TYPES IN LAO.PDR

The Land Use Classes:

1. **Areas of Current Forest**

   Areas of Current Forest are defined as areas being suitable for forest production and having a tree cover with a crown density of at least 20% (forest plantation are excepted from the rule of a minimum crown density)

2. **Areas of Potential Forest**

   Areas of Potential Forest are defined as areas suitable for forest production having a crown density less than 20% and not permanently being used for other purposes (i.e housing, agriculture etc..)

3. **Other Wooded Areas**

   Other Wooded Areas are defined as areas with a certain cover of trees or shrubs but being unsuitable (too poor) for forest production. The tree cover is less than 20% (if it would be more it should be considered as Current Forest)

4. **Areas of Permanent Agriculture**

   Permanent Agriculture include areas for production of crops, fruit trees etc. and areas permanently being used for grazing.

5. **Areas with other Land Use**

   Areas with other Land Use include land that for various reasons is "non-productive" and areas being used for other purposes than Agriculture and Forestry

6. **Water**

   The group Water includes natural or artificially made areas of water.

The Vegetation types:

Evergreen Forest

The Evergreen Forest type is a multi storey forest consisting of more than 80% trees of evergreen species. Most of the trees have long and cylindrical boles, many of them with a buttress. Usually, the height of the trees of the upper storey is more than 30 m. The dense second storey prevents most of the light from reaching the ground floor. Another typical characteristic of this forest type are climbers and lichen on the tree stems. Bamboo is usually not found except when the canopy has been opened.

Evergreen Forest located at an altitude above 200 m is classified as **Upper Evergreen Forest**. Areas below that altitude are classified as **Lower Evergreen Forest**.

Dry Evergreen Forest

The Dry Evergreen Forest type has a lower proportion of evergreen trees than the Evergreen type, 50%-80%. Except for in disturbed stands there is very little bamboo. Soil is usually deep. The forest consists of a considerable number of species of which 2 to 3 species tend to be predominant.

a) Upper Dry Evergreen Forest (UDE)

Dry Evergreen Forest located at an altitude above 200 m. Some characteristic species of this type are Mai Khen (Hopea spp), Mai Dou (Pterocarpus pelatus), Mai Nhang (Dipterocarpus alatus), Mai Peua (Largerstromia spp), and Mai Bak (Anisoptera spp). The light of upper and second storey is usually less than in LDE.

b) Lower Dry Evergreen Forest(LDE)

Dry Evergreen Forest located at an altitude below 200 m. The second storey is usually dense and the height, varying from 10-30 m, is usually quite even within the stand.

Mixed Deciduous Forest

In the Mixed Deciduous Forest type, the deciduous tree species represent more than 50% of the stand. The forest storeys are not as dense as those evergreen types and most of the seedlings and saplings are deciduous trees. Most often bamboo occurs in this type of forest.

a) Upper Mixed Deciduous Forest(UMD)

Mixed Deciduous Forest located at an altitude above 200 m. In moist areas there might be a lot of climbers, and it could be difficult to distinguish this forest type from the Dry Evergreen type. In dry regions the difference can be clearly seen. The type appears quite open with a considerable amount of bamboo and undergrowth.

b) Lower Mixed Deciduous Forest(LMD)

Mixed Deciduous Forest located at an altitude below 200 m.

Dry Dipterocarp Forest(DD)

The Dry Dipterocarp Forest occurs in open stands. The tree diameter is comparably small and the height of the stand varies from 8 to 25 m. The crowns do not spread out widely.

This type of forest is normally found in places with shallow soil, where the hard pan emerges aboves the ground, and on laterized soil. On the most poor and shallow soils the trees are crooked and do not exceed 10 m in height. If the crown cover is less than 20% and the stand is undisturbed the vegetation type should be classified as Savannah Many species being characteristically for the Dry Dipterocarp Forests are fire resistant and have a thick bark. Mai Sabeng(Dipterocarpus intricatus), Mai Chick(Shorea obtusa), Mai Sat(Dipterocarpus obtusifolius), Mai Suak(Terminalia tomentosa), and Mai Hang(Shorea siamensis) are such species.

Gallery Forest(GE)

The Gallery Forest is not characterized by tree species composition but could be i.e either deciduous or evergreen. Clues used for identification of this forest type are the occurrence of some other land use types in its vicinity such as streams and villages. In areas where streams are likely to overflow seriously, the forest is often left along the low bank of the streams(both persistent and intermittent ones) forming a long band of forest with the stream bed on one side and, for example, paddy fields on the other. The with of the Gallery Forest will not be more than 100 m.

Coniferous Forest(S)

The Coniferous Forest is usually single storied and open but the young growth may sometimes form a dense second storey. This forest type occurs in higher elevations with a cool climate. The characteristic species of this type are pines(Pinus kesiya or Pinus merkusii) but other coniferous trees such as Cunninghammia spp may also be predominant.

Mixed Broadleaved and Coniferous Forest(MS)

The Mixed Coniferous Forest is a transition type between the coniferous and the broaleaved forest types. The coniferous trees could be mixed with either deciduous or evergreen trees. It is also found in higher elevations.

Forest Plantation(P)

In Forest Plantations, the planted trees could still be identified(i.e by even height, even spacing or by species typical for plantations) although they may be mixed up with other non-cultivated plants. All sustainable plantations(including young ones with a crown density less than 20%) should be classified as Forest Plantations.
Rubber plantations are also classified as Forest Plantations. Shade trees that provide shade for coffee, tea as well as fruit orchard are not classified as Forest Plantations.

Bamboo(B)

If an area is covered with bamboo and the overstorey has a crown cover less than 5% it should be classified as Bamboo.

Abandoned ray is often recovered by bamboo. Some species of bamboo may last for many years. Bamboo brakes may vary in height from 2 m to 25 m depending on their species. If bamboo represents less than 80% of the total vegetation cover of the understorey, the vegetation type should not be classified as bamboo.

Unstocked Forest Areas(T)

Unstocked Forest Areas are previously forested areas in which the crown density has been reduced to less than 20% because of logging, shifting cultivation or other heavy disturbance. If the area is left to grow undisturbed, it becomes forest again.

Abandoned ray and disturbed stands wth crown density less than 20% should be classified as Unstocked Forest Areas. Old ray in which seedlings, saplings and trees cover more than 20% of the area should be classified as some type of Current Forest.

Savannah(SH)

The Savannah is an area where the soil conditions are unsuitable for tree growth as well as agriculture production. The tree cover in the Savannah should be at least 1% but not more than 20%. The trees are drought resistant and mostly short with graminaceous and herbaceous plants forming an understorey.

Savannah should not be mixed up with those grass covered areas that sometimes occur after shifting cultivation. Normally, the Savannah does not occur on steep slopes but in plain areas.

Heath, Stunted and Scrub Forest(SR)

This is an area covered with scrub and stunted trees. The soil is shallow and rocky.

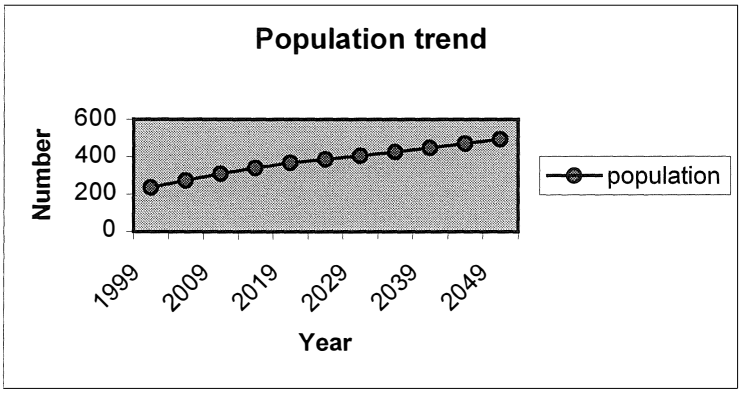
Appendix: 4

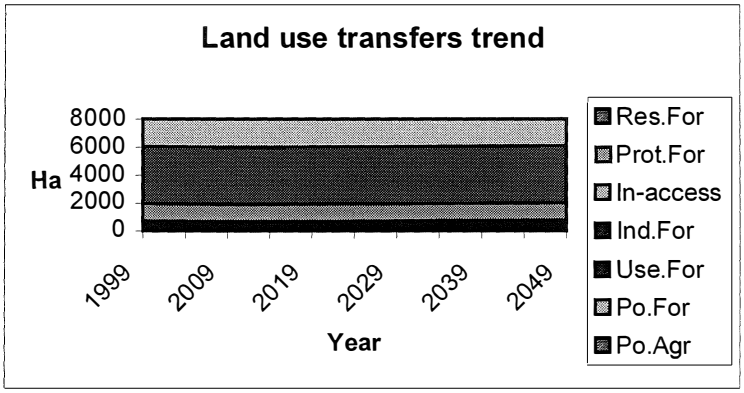
THE STAGES OF LAND USE PLANNING AND FOREST ALLOCATION IN LAO. P D R

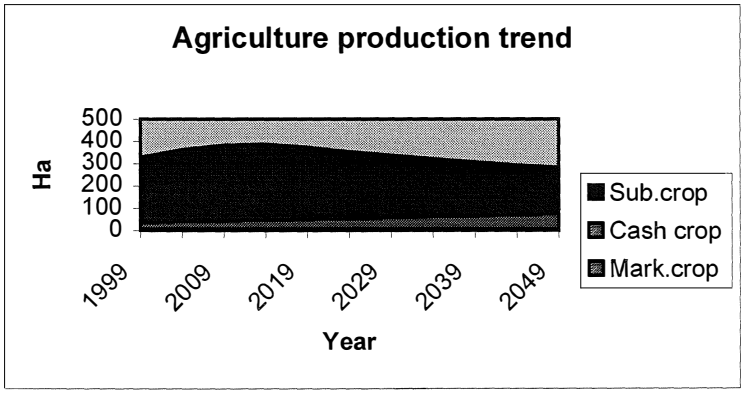
Group A	Stage 1:	Preparation for Implementing Land Use Planning and Land-Forest Allocation Activities: a) staff training and preparation; b) villager consultation and preparation. • includes the identification of persons to be on the village forest and agricultural land management committee, and the administrative steps necessary to establish this committee.
Group B	Stage 2:	Village Boundary Survey, Land Use Zoning, Forest Surveys and Land Use Mapping • senior representatives of neighbouring villages attend, particularly to be involved in identification of village boundaries as well as land uses in which their community may participate.
Group C	Stage 3:	Data Collection and Analysis directed to: • understanding the current situation and how it came about; • identifying land users/owners; • identifying trends in demand for agricultural land and forest products so as to ensure that areas set aside are adequate for future needs; • land use allocation is based a combination of current use, land suitability and demand trends.
	Stage 4:	Land Use Planning and Land Allocation • explanation and negotiation of the results of stages 2 and 3, leading to consensus.
	Stage 5:	Agricultural Field Measurement • identifies areas, locations, uses of agricultural land.
	Stage 6:	Preparation of Forest and Agricultural Agreements and Transferring Rights to Villagers • issuing temporary land certificates for agricultural and housing land. • negotiate appropriate forest and agricultural land management rules for each of the land use zones and formulate as village agreements. which are then endorsed and signed by the village head, the land use planning and land allocation committee and the District Governor.

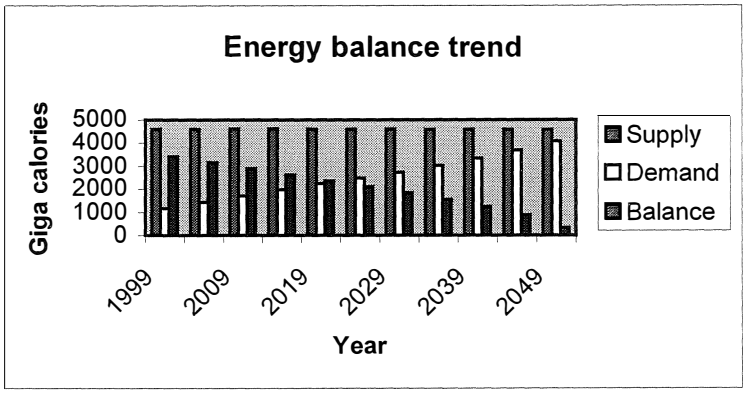
Group D	Stage 7:	Land Use Management Extension • assistance over time with production, organisation, marketing, business opportunities, etc.; • demonstration of appropriate farming methodologies.
	Stage 8:	Monitoring and Evaluation • develop monitoring criteria for ecological and socio-economic impacts of land uses; • carrying out of monitoring of the results of land-forest allocation..

Future Development Scenario 1 of Ban Vangphamone (1999-2049)









Data set

Description: BAN VANGPHAMONE

District	PAKLAY	
Country	LAO,PDR	
Land area	6379	
Years	1999	2049

1 ton agriculture residue to Giga Calories (GCal)	2,5
1 cubic meter solid wood to Giga Calories (GCal)	1,5
1 cubic meter solid wood to 1 forest cubic meter	1,0

Land use transfer priorities

Other land, potential agriculture land	1
Farm forest land, natural forests	3
Other land, potential forest land	2
Industrial forest land, natural forests	4
Nat. environmental forest, in-accessible	5
Nat. environmental forest, protection areas	6
Nat. environmental forest, rerserves and NP	7

Growth factors, start value and period growth in %.

Total population	236	3,00	2,50	2,00	1,50	1,00	1,00	1,00	1,00	1,00	1,00
Rural population	236	3,00	2,50	2,00	1,50	1,00	1,00	1,00	1,00	1,00	1,00
Gross Domestic Product	110	1,00	1,50	2,00	2,50	3,00	3,00	3,00	3,00	3,00	3,00
Production subsistence food	1 287	1,00	1,50	2,00	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Production marketed food	216	1,00	1,50	2,00	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Production cash crop	266	1,00	1,50	2,00	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Rur. biomass energy demand	5	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Urb. biomass energy demand		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Agriculture data

Agriculture land	Area (hectares)	Volume wood per hectare	Autoproduction of wood m^3/ hectare and year	Yield of residues kg per hectare	Amount of residues used as fuelwood (%
Subsistence food	296	10	0,02	200	100
Marketed food	7	10	0,03	300	100
Cash Crop	27	10	0,01	100	100
Other land					
Potential agricultural	46	10	0,2		
Potential forest	20	10	0,2		
Unproductive	3	2	0,1		

Forest data

I Unavailable for production	Area (hectares)	MAI m^3	Ann fuel wood removal m^3	Ann. Logging m^3/ hectare	Total volume in m^3 per ha	Total volume in m^3 altogether	Commercial volume in m^3 per ha	Commercial volume in m^3 altogether
NP and reserves	4 086	1	0,3					
Protection	1 222	1	0,3					
Inaccessible areas								
Existing plantations	0							
II Available for production								
Industrial								
Existing plantations								
Farm forest	673	4	2		20	20		
Existing plantations								

Population & GDP

Year	Population			Gross Domestic Product	
	Rural	Urban	Total	Total (in millions)	Per capita
1999	236		236	0	110
2000	243		243	0	111
2001	250		250	0	112
2002	258		258	0	113
2003	266		266	0	114
2004	274		274	0	116
2005	280		280	0	117
2006	287		287	0	119
2007	295		295	0	121
2008	302		302	0	123
2009	310		310	0	125
2010	316		316	0	127
2011	322		322	0	130
2012	328		328	0	132
2013	335		335	0	135
2014	342		342	0	138
2015	347		347	0	141
2016	352		352	0	144
2017	357		357	0	148
2018	363		363	0	152
2019	368		368	0	156
2020	372		372	0	160
2021	376		376	0	165
2022	379		379	0	170
2023	383		383	0	175
2024	387		387	0	180
2025	391		391	0	186
2026	395		395	0	191
2027	399		399	0	197
2028	403		403	0	203
2029	407		407	0	209
2030	411		411	0	215
2031	415		415	0	222
2032	419		419	0	228
2033	423		423	0	235
2034	427		427	0	242
2035	432		432	0	250
2036	436		436	0	257
2037	440		440	0	265
2038	445		445	0	273
2039	449		449	0	281
2040	454		454	0	289
2041	458		458	0	298
2042	463		463	0	307
2043	467		467	0	316
2044	472		472	0	326
2045	477		477	0	336
2046	482		482	0	346
2047	486		486	0	356
2048	491		491	0	367
2049	496		496	0	378

Agriculture development

Year	Subsistence food		Marketed Food		Cash Crop		Accumulated
	Area	Production/Ha	Area	Production/Ha	Area	Production/Ha	transfer
1999	296	1 287	7	216	27	266	0
2000	302	1 300	7	218	28	269	7
2001	308	1 313	7	220	29	271	14
2002	314	1 326	7	223	30	274	21
2003	320	1 339	7	225	30	277	27
2004	326	1 353	7	227	31	280	34
2005	330	1 373	7	230	32	284	39
2006	333	1 394	7	234	33	288	43
2007	336	1 414	7	237	34	292	47
2008	340	1 436	7	241	35	297	52
2009	343	1 457	7	245	35	301	55
2010	343	1 486	7	249	36	307	56
2011	343	1 516	7	254	37	313	57
2012	343	1 546	7	260	38	320	58
2013	343	1 577	7	265	38	326	58
2014	343	1 609	7	270	39	333	59
2015	340	1 649	7	277	40	341	57
2016	336	1 690	7	284	40	349	53
2017	333	1 733	7	291	41	358	51
2018	330	1 776	7	298	41	367	48
2019	326	1 820	7	305	42	376	45
2020	322	1 866	7	313	43	386	42
2021	317	1 912	7	321	43	395	37
2022	312	1 960	7	329	44	405	33
2023	308	2 009	7	337	45	415	30
2024	303	2 059	7	346	45	426	25
2025	299	2 111	7	354	46	436	22
2026	294	2 164	7	363	47	447	18
2027	290	2 218	7	372	47	458	14
2028	286	2 273	7	382	48	470	11
2029	282	2 330	7	391	49	482	8
2030	278	2 388	7	401	50	494	5
2031	274	2 448	7	411	50	506	1
2032	270	2 509	7	421	51	519	-2
2033	266	2 572	7	432	52	532	-5
2034	262	2 636	8	442	53	545	-7
2035	258	2 702	8	454	53	558	-11
2036	254	2 770	8	465	54	572	-14
2037	250	2 839	8	476	55	587	-17
2038	247	2 910	8	488	56	601	-19
2039	243	2 983	8	501	57	616	-22
2040	240	3 057	8	513	57	632	-25
2041	236	3 134	8	526	58	648	-28
2042	233	3 212	8	539	59	664	-30
2043	229	3 292	8	553	60	680	-33
2044	226	3 375	8	566	61	697	-35
2045	223	3 459	8	581	62	715	-37
2046	219	3 546	8	595	63	733	-40
2047	216	3 634	8	610	64	751	-42
2048	213	3 725	8	625	65	770	-44
2049	210	3 818	8	641	66	789	-46

Land use transfers

1 = Other land, potential agriculture land
2 = Other land, potential forest land
3 = Farm forest land, natural forests
4 = Industrial forest land, natural forests
5 = Nat. environmental forest, in-accessible
6 = Nat. environmental forest, protection areas
7 = Nat. environmental forest, rerserves and NP

Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
1999	0	46	20	673	0	0	1 222	4 086
2000	7	39	20	673	0	0	1 222	4 086
2001	14	32	20	673	0	0	1 222	4 086
2002	21	25	20	673	0	0	1 222	4 086
2003	27	19	20	673	0	0	1 222	4 086
2004	34	12	20	673	0	0	1 222	4 086
2005	39	7	20	673	0	0	1 222	4 086
2006	43	3	20	673	0	0	1 222	4 086
2007	47	0	19	673	0	0	1 222	4 086
2008	52	0	14	673	0	0	1 222	4 086
2009	55	0	11	673	0	0	1 222	4 086
2010	56	0	10	673	0	0	1 222	4 086
2011	57	0	9	673	0	0	1 222	4 086
2012	58	0	8	673	0	0	1 222	4 086
2013	58	0	8	673	0	0	1 222	4 086
2014	59	0	7	673	0	0	1 222	4 086
2015	57	2	7	673	0	0	1 222	4 086
2016	53	6	7	673	0	0	1 222	4 086
2017	51	8	7	673	0	0	1 222	4 086
2018	48	11	7	673	0	0	1 222	4 086
2019	45	14	7	673	0	0	1 222	4 086
2020	42	17	7	673	0	0	1 222	4 086
2021	37	22	7	673	0	0	1 222	4 086
2022	33	26	7	673	0	0	1 222	4 086
2023	30	29	7	673	0	0	1 222	4 086
2024	25	34	7	673	0	0	1 222	4 086
2025	22	37	7	673	0	0	1 222	4 086
2026	18	41	7	673	0	0	1 222	4 086
2027	14	45	7	673	0	0	1 222	4 086
2028	11	48	7	673	0	0	1 222	4 086
2029	8	51	7	673	0	0	1 222	4 086
2030	5	54	7	673	0	0	1 222	4 086
2031	1	58	7	673	0	0	1 222	4 086
2032	-2	61	7	673	0	0	1 222	4 086
2033	-5	64	7	673	0	0	1 222	4 086
2034	-7	66	7	673	0	0	1 222	4 086
2035	-11	70	7	673	0	0	1 222	4 086
2036	-14	73	7	673	0	0	1 222	4 086
2037	-17	76	7	673	0	0	1 222	4 086
2038	-19	78	7	673	0	0	1 222	4 086
2039	-22	81	7	673	0	0	1 222	4 086
2040	-25	84	7	673	0	0	1 222	4 086
2041	-28	87	7	673	0	0	1 222	4 086
2042	-30	89	7	673	0	0	1 222	4 086
2043	-33	92	7	673	0	0	1 222	4 086
2044	-35	94	7	673	0	0	1 222	4 086

1 = Other land, potential agriculture land
2 = Other land, potential forest land
3 = Farm forest land, natural forests
4 = Industrial forest land, natural forests
5 = Nat. environmental forest, in-accessible
6 = Nat. environmental forest, protection areas
7 = Nat. environmental forest, rerserves and NP

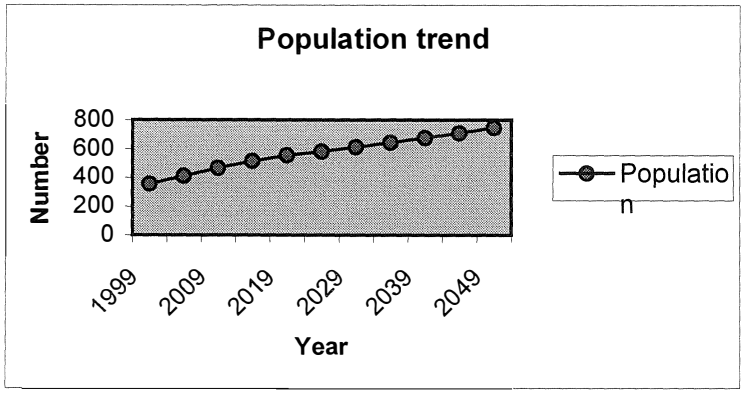
Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
2045	-37	96	7	673	0	0	1 222	4 086
2046	-40	99	7	673	0	0	1 222	4 086
2047	-42	101	7	673	0	0	1 222	4 086
2048	-44	103	7	673	0	0	1 222	4 086
2049	-46	105	7	673	0	0	1 222	4 086

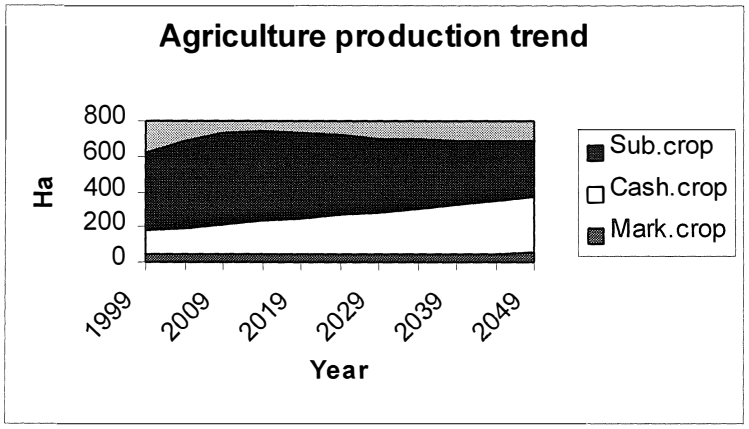
Energy balance

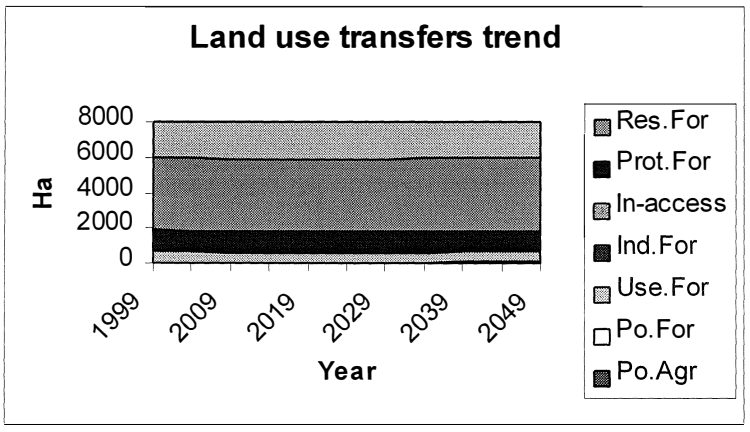
Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
1999	4 597	1 180	3 417	2 278
2000	4 599	1 228	3 371	2 247
2001	4 600	1 277	3 323	2 215
2002	4 601	1 328	3 273	2 182
2003	4 603	1 382	3 221	2 147
2004	4 604	1 438	3 166	2 111
2005	4 605	1 488	3 117	2 078
2006	4 606	1 541	3 065	2 043
2007	4 606	1 595	3 011	2 007
2008	4 607	1 651	2 956	1 971
2009	4 608	1 710	2 898	1 932
2010	4 608	1 761	2 847	1 898
2011	4 608	1 814	2 793	1 862
2012	4 608	1 869	2 739	1 826
2013	4 608	1 926	2 682	1 788
2014	4 608	1 984	2 624	1 749
2015	4 607	2 034	2 573	1 716
2016	4 606	2 085	2 521	1 681
2017	4 605	2 137	2 468	1 645
2018	4 605	2 191	2 414	1 609
2019	4 604	2 246	2 358	1 572
2020	4 603	2 291	2 312	1 541
2021	4 602	2 337	2 264	1 510
2022	4 601	2 384	2 216	1 477
2023	4 600	2 432	2 167	1 445
2024	4 598	2 481	2 117	1 411
2025	4 597	2 531	2 066	1 378
2026	4 596	2 582	2 014	1 343
2027	4 595	2 634	1 962	1 308
2028	4 594	2 687	1 908	1 272
2029	4 593	2 741	1 853	1 235
2030	4 593	2 796	1 797	1 198
2031	4 592	2 852	1 740	1 160
2032	4 591	2 909	1 681	1 121
2033	4 590	2 968	1 622	1 081
2034	4 589	3 028	1 562	1 041
2035	4 588	3 088	1 500	1 000
2036	4 587	3 150	1 437	958
2037	4 586	3 214	1 373	915
2038	4 586	3 278	1 307	872
2039	4 585	3 344	1 240	827
2040	4 584	3 411	1 173	782
2041	4 583	3 480	1 103	735
2042	4 582	3 550	1 032	688
2043	4 581	3 621	960	640
2044	4 581	3 694	887	591

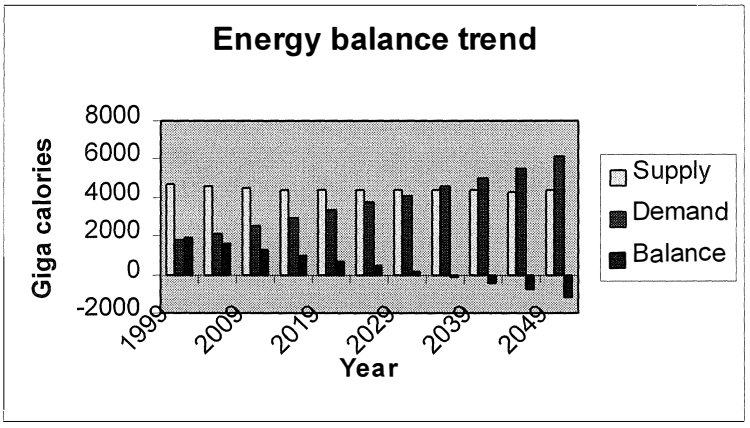
Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
2045	4 580	3 768	812	541
2046	4 579	3 844	735	490
2047	4 578	3 921	657	438
2048	4 578	4 000	577	385
2049	4 577	4 081	496	331

Future Development Scenario 2 Ban Vangphamone
(1999-2049)









Data set

Description: BAN VANGPHAMONE 2

District	PAKLAY	
Country	LAO.PDR	
Land area	6379	
Years	1999	2049

1 ton agriculture residue to Giga Calories (GCal)	2,5
1 cubic meter solid wood to Giga Calories (GCal)	1,5
1 cubic meter solid wood to 1 forest cubic meter	1,0

Land use transfer priorities

Other land, potential agriculture land	1
Farm forest land, natural forests	3
Other land, potential forest land	2
Industrial forest land, natural forests	4
Nat. environmental forest, in-accessible	5
Nat. environmental forest, protection areas	6
Nat. environmental forest, rerserves and NP	7

Growth factors, start value and period growth in %.

Total population	355	3,00	2,50	2,00	1,50	1,00	1,00	1,00	1,00	1,00	1,00
Rural population	355	3,00	2,50	2,00	1,50	1,00	1,00	1,00	1,00	1,00	1,00
Gross Domestic Product	110	1,00	1,50	2,00	2,50	3,00	3,00	3,00	3,00	3,00	3,00
Production subsistence food	1 287	1,00	1,50	2,00	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Production marketed food	216	1,00	1,50	2,00	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Production cash crop	266	1,00	1,50	2,00	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Rur. biomass energy demand	5	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Urb. biomass energy demand		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Agriculture data

Agriculture land	Area (hectares)	Volume wood per hectare	Autoproduction of wood m^3/ hectare and year	Yield of residues kg per hectare	Amount of residues used as fuelwood (%)
Subsistence food	440	10	0,02	200	100
Marketed food	44	10	0,03	300	100
Cash Crop	132	10	0,01	100	100
Other land					
Potential agricultural		10	0,2		
Potential forest	20	10	0,2		
Unproductive	3	2	0,1		

Forest data

I Unavailable for production	Area (hectares)	MAI m^3	Ann fuel wood removal m^3	Ann. Logging m^3/ hectare	Total volume in m^3 per ha	Total volume in m^3 altogether	Commercial volume in m^3 per ha	Commercial volume in m^3 altogether
NP and reserves	4 086	1	0,3					
Protection	1 222	1	0,3					
Inaccessible areas								
Existing plantations								
II Available for production								
Industrial								
Existing plantations								
Farm forest	673	4	2		20	20		
Existing plantations								

Population & GDP

Year	Population			Gross Domestic Product	
	Rural	Urban	Total	Total (in millions)	Per capita
1999	355		355	0	110
2000	366		366	0	111
2001	377		377	0	112
2002	388		388	0	113
2003	400		400	0	114
2004	412		412	0	116
2005	422		422	0	117
2006	432		432	0	119
2007	443		443	0	121
2008	454		454	0	123
2009	466		466	0	125
2010	475		475	0	127
2011	484		484	0	130
2012	494		494	0	132
2013	504		504	0	135
2014	514		514	0	138
2015	522		522	0	141
2016	530		530	0	144
2017	538		538	0	148
2018	546		546	0	152
2019	554		554	0	156
2020	559		559	0	160
2021	565		565	0	165
2022	571		571	0	170
2023	576		576	0	175
2024	582		582	0	180
2025	588		588	0	186
2026	594		594	0	191
2027	600		600	0	197
2028	606		606	0	203
2029	612		612	0	209
2030	618		618	0	215
2031	624		624	0	222
2032	630		630	0	228
2033	637		637	0	235
2034	643		643	0	242
2035	649		649	0	250
2036	656		656	0	257
2037	662		662	0	265
2038	669		669	0	273
2039	676		676	0	281
2040	683		683	0	289
2041	689		689	0	298
2042	696		696	0	307
2043	703		703	0	316
2044	710		710	0	326
2045	717		717	0	336
2046	725		725	0	346
2047	732		732	0	356
2048	739		739	0	367
2049	746		746	0	378

Agriculture development

Year	Subsistence food		Marketed Food		Cash Crop		Accumulated
	Area	Production/Ha	Area	Production/Ha	Area	Production/Ha	transfer
1999	440	1 287	44	216	132	266	0
2000	449	1 300	44	218	136	269	13
2001	458	1 313	44	220	140	271	26
2002	467	1 326	44	223	144	274	39
2003	476	1 339	44	225	149	277	53
2004	485	1 353	44	227	153	280	66
2005	490	1 373	44	230	157	284	75
2006	495	1 394	44	234	161	288	84
2007	500	1 414	44	237	165	292	93
2008	505	1 436	44	241	169	297	102
2009	510	1 457	44	245	173	301	111
2010	510	1 486	44	249	177	307	115
2011	510	1 516	44	254	180	313	118
2012	510	1 546	44	260	184	320	122
2013	510	1 577	44	265	187	326	125
2014	510	1 609	44	270	191	333	129
2015	505	1 649	44	277	194	341	127
2016	500	1 690	44	284	197	349	125
2017	495	1 733	44	291	200	358	123
2018	490	1 776	44	298	203	367	121
2019	485	1 820	44	305	206	376	119
2020	478	1 866	44	313	209	386	115
2021	471	1 912	44	321	212	395	111
2022	464	1 960	45	329	215	405	108
2023	458	2 009	45	337	218	415	105
2024	451	2 059	45	346	222	426	102
2025	444	2 111	45	354	225	436	98
2026	438	2 164	46	363	228	447	96
2027	431	2 218	46	372	232	458	93
2028	425	2 273	46	382	235	470	90
2029	419	2 330	46	391	239	482	88
2030	413	2 388	46	401	242	494	85
2031	407	2 448	47	411	246	506	84
2032	401	2 509	47	421	250	519	82
2033	395	2 572	47	432	253	532	79
2034	389	2 636	47	442	257	545	77
2035	383	2 702	48	454	261	558	76
2036	378	2 770	48	465	265	572	75
2037	372	2 839	48	476	269	587	73
2038	367	2 910	48	488	273	601	72
2039	361	2 983	48	501	277	616	70
2040	356	3 057	49	513	281	632	70
2041	351	3 134	49	526	285	648	69
2042	346	3 212	49	539	290	664	69
2043	341	3 292	49	553	294	680	68
2044	336	3 375	50	566	298	697	68
2045	331	3 459	50	581	303	715	68
2046	326	3 546	50	595	307	733	67
2047	321	3 634	50	610	312	751	67
2048	316	3 725	51	625	316	770	67
2049	312	3 818	51	641	321	789	68

Land use transfers

1 = Other land, potential agriculture land
2 = Other land, potential forest land
3 = Farm forest land, natural forests
4 = Industrial forest land, natural forests
5 = Nat. environmental forest, in-accessible
6 = Nat. environmental forest, protection areas
7 = Nat. environmental forest, rerserves and NP

Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
1999	0	0	20	673	0	0	1 222	4 086
2000	13	0	7	673	0	0	1 222	4 086
2001	26	0	0	667	0	0	1 222	4 086
2002	39	0	0	654	0	0	1 222	4 086
2003	53	0	0	640	0	0	1 222	4 086
2004	66	0	0	627	0	0	1 222	4 086
2005	75	0	0	618	0	0	1 222	4 086
2006	84	0	0	609	0	0	1 222	4 086
2007	93	0	0	600	0	0	1 222	4 086
2008	102	0	0	591	0	0	1 222	4 086
2009	111	0	0	582	0	0	1 222	4 086
2010	115	0	0	578	0	0	1 222	4 086
2011	118	0	0	575	0	0	1 222	4 086
2012	122	0	0	571	0	0	1 222	4 086
2013	125	0	0	568	0	0	1 222	4 086
2014	129	0	0	564	0	0	1 222	4 086
2015	127	2	0	564	0	0	1 222	4 086
2016	125	4	0	564	0	0	1 222	4 086
2017	123	6	0	564	0	0	1 222	4 086
2018	121	8	0	564	0	0	1 222	4 086
2019	119	10	0	564	0	0	1 222	4 086
2020	115	14	0	564	0	0	1 222	4 086
2021	111	18	0	564	0	0	1 222	4 086
2022	108	21	0	564	0	0	1 222	4 086
2023	105	24	0	564	0	0	1 222	4 086
2024	102	27	0	564	0	0	1 222	4 086
2025	98	31	0	564	0	0	1 222	4 086
2026	96	33	0	564	0	0	1 222	4 086
2027	93	36	0	564	0	0	1 222	4 086
2028	90	39	0	564	0	0	1 222	4 086
2029	88	41	0	564	0	0	1 222	4 086
2030	85	44	0	564	0	0	1 222	4 086
2031	84	45	0	564	0	0	1 222	4 086
2032	82	47	0	564	0	0	1 222	4 086
2033	79	50	0	564	0	0	1 222	4 086
2034	77	52	0	564	0	0	1 222	4 086
2035	76	53	0	564	0	0	1 222	4 086
2036	75	54	0	564	0	0	1 222	4 086
2037	73	56	0	564	0	0	1 222	4 086
2038	72	57	0	564	0	0	1 222	4 086
2039	70	59	0	564	0	0	1 222	4 086
2040	70	59	0	564	0	0	1 222	4 086
2041	69	60	0	564	0	0	1 222	4 086
2042	69	60	0	564	0	0	1 222	4 086
2043	68	61	0	564	0	0	1 222	4 086
2044	68	61	0	564	0	0	1 222	4 086

1 = Other land, potential agriculture land
2 = Other land, potential forest land
3 = Farm forest land, natural forests
4 = Industrial forest land, natural forests
5 = Nat. environmental forest, in-accessible
6 = Nat. environmental forest, protection areas
7 = Nat. environmental forest, rerserves and NP

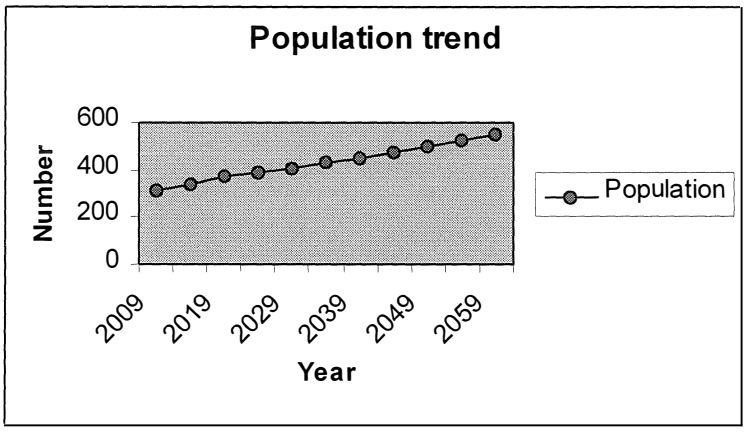
Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
2045	68	61	0	564	0	0	1 222	4 086
2046	67	62	0	564	0	0	1 222	4 086
2047	67	62	0	564	0	0	1 222	4 086
2048	67	62	0	564	0	0	1 222	4 086
2049	68	61	0	564	0	0	1 222	4 086

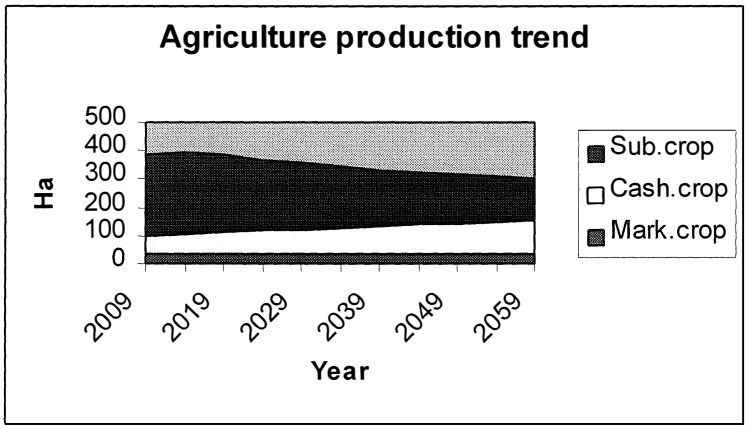
Energy balance

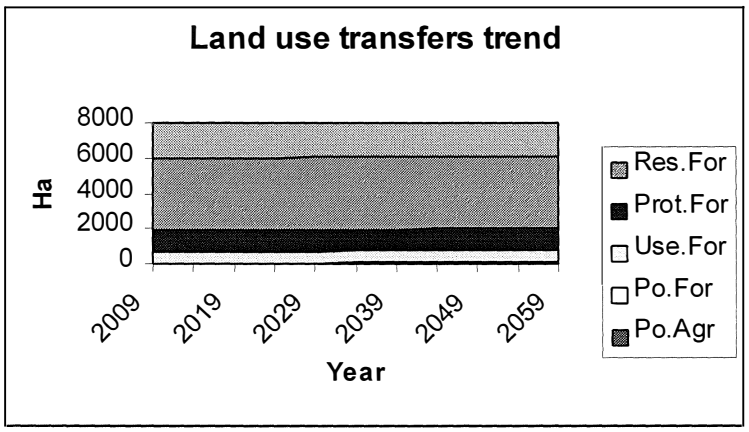
Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
1999	4 717	1 775	2 942	1 961
2000	4 719	1 847	2 873	1 915
2001	4 705	1 921	2 784	1 856
2002	4 672	1 998	2 673	1 782
2003	4 636	2 079	2 557	1 705
2004	4 603	2 163	2 440	1 627
2005	4 579	2 239	2 340	1 560
2006	4 556	2 318	2 238	1 492
2007	4 533	2 400	2 133	1 422
2008	4 509	2 484	2 025	1 350
2009	4 486	2 572	1 914	1 276
2010	4 475	2 649	1 826	1 217
2011	4 467	2 729	1 738	1 158
2012	4 456	2 812	1 644	1 096
2013	4 448	2 897	1 551	1 034
2014	4 437	2 984	1 453	969
2015	4 436	3 059	1 376	918
2016	4 434	3 136	1 298	866
2017	4 433	3 215	1 218	812
2018	4 432	3 296	1 136	757
2019	4 431	3 379	1 052	701
2020	4 429	3 447	982	655
2021	4 427	3 516	911	607
2022	4 426	3 587	839	560
2023	4 425	3 659	766	511
2024	4 423	3 732	690	460
2025	4 421	3 807	614	409
2026	4 420	3 884	536	357
2027	4 418	3 962	456	304
2028	4 417	4 042	375	250
2029	4 415	4 123	293	195
2030	4 414	4 206	208	139
2031	4 413	4 290	123	82
2032	4 411	4 376	35	23
2033	4 410	4 464	-55	-36
2034	4 408	4 554	-146	-97
2035	4 407	4 646	-238	-159
2036	4 406	4 739	-333	-222
2037	4 404	4 834	-430	-287
2038	4 403	4 931	-528	-352
2039	4 402	5 031	-629	-419
2040	4 401	5 132	-731	-487
2041	4 400	5 235	-835	-557
2042	4 398	5 340	-942	-628
2043	4 397	5 447	-1 050	-700
2044	4 396	5 557	-1 161	-774

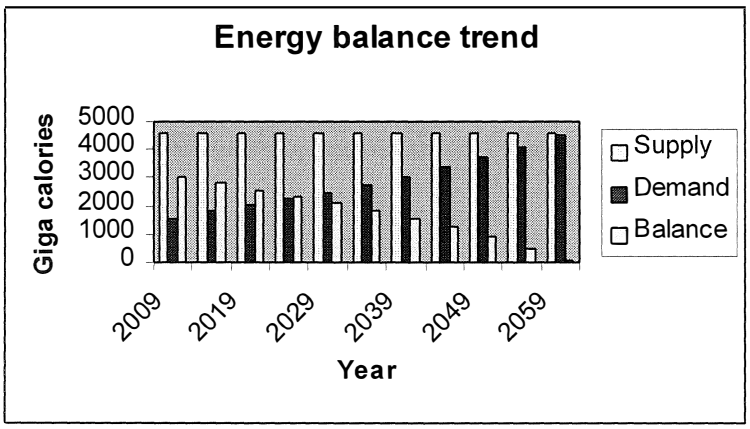
Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
2045	4 395	5 669	-1 274	-849
2046	4 394	5 783	-1 389	-926
2047	4 392	5 899	-1 507	-1 004
2048	4 391	6 017	-1 626	-1 084
2049	4 390	6 138	-1 748	-1 165

Future Development Scenario 3 Ban Vangphamone
(2009-2059)









Data set

Description: BAN VANGPHAMONE 3

District	PAKLAY	
Country	LAO.PDR	
Land area	6379	
Years	2009	2059

1 ton agriculture residue to Giga Calories (GCal)	2,5
1 cubic meter solid wood to Giga Calories (GCal)	1,5
1 cubic meter solid wood to 1 forest cubic meter	1,0

Land use transfer priorities

Other land, potential agriculture land	1
Farm forest land, natural forests	3
Other land, potential forest land	2
Industrial forest land, natural forests	4
Nat. environmental forest, in-accessible	5
Nat. environmental forest, protection areas	6
Nat. environmental forest, rerserves and NP	7

Growth factors, start value and period growth in %.

Total population	310	2,00	1,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Rural population	310	2,00	1,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Gross Domestic Product	125	2,00	2,50	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
Production subsistence food	2 000	2,00	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50	2,50
Production marketed food	300	2,00	2,50	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
Production cash crop	500	2,00	2,50	3,00	3,00	3,00	3,00	3,00	3,00	3,00	3,00
Rur. biomass energy demand	5	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Urb. biomass energy demand		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00

Agriculture data

Agriculture land	Area (hectares)	Volume wood per hectare	Autoproduction of wood m^3/ hectare and year	Yield of residues kg per hectare	Amount of residues used as fuelwood (%)
Subsistence food	283	10	0,02	200	100
Marketed food	34	10	0,02	300	100
Cash Crop	68	10	0,01	100	100
Other land					
Potential agricultural		10	0,2		
Potential forest	20	10	0,2		
Unproductive	3	2	0,1		

Forest data

I Unavailable for production	Area (hectares)	MAI m^3	Ann fuel wood removal m^3	Ann. Logging m^3/ hectare	Total volume in m^3 per ha	Total volume in m^3 altogether	Commercial volume in m^3 per ha	Commercial volume in m^3 altogether
NP and reserves	4 086	1	0,3					
Protection	1 222	1	0,3					
Inaccessible areas								
Existing plantations								
II Available for production								
Industrial								
Existing plantations								
Farm forest	673	4	2		20	20		
Existing plantations								

Population & GDP

Year	Population			Gross Domestic Product	
	Rural	Urban	Total	Total (in millions)	Per capita
2009	310		310	0	125
2010	316		316	0	128
2011	323		323	0	130
2012	329		329	0	133
2013	336		336	0	135
2014	342		342	0	138
2015	347		347	0	141
2016	353		353	0	145
2017	358		358	0	149
2018	363		363	0	152
2019	369		369	0	156
2020	372		372	0	161
2021	376		376	0	166
2022	380		380	0	171
2023	384		384	0	176
2024	388		388	0	181
2025	391		391	0	186
2026	395		395	0	192
2027	399		399	0	198
2028	403		403	0	204
2029	407		407	0	210
2030	411		411	0	216
2031	415		415	0	223
2032	420		420	0	229
2033	424		424	0	236
2034	428		428	0	243
2035	432		432	0	251
2036	437		437	0	258
2037	441		441	0	266
2038	445		445	0	274
2039	450		450	0	282
2040	454		454	0	290
2041	459		459	0	299
2042	464		464	0	308
2043	468		468	0	317
2044	473		473	0	327
2045	478		478	0	337
2046	482		482	0	347
2047	487		487	0	357
2048	492		492	0	368
2049	497		497	0	379
2050	502		502	0	390
2051	507		507	0	402
2052	512		512	0	414
2053	517		517	0	427
2054	522		522	0	439
2055	528		528	0	453
2056	533		533	0	466
2057	538		538	0	480
2058	544		544	0	495
2059	549		549	0	509

Agriculture development

Year	Subsistence food		Marketed Food		Cash Crop		Accumulated
	Area	Production/Ha	Area	Production/Ha	Area	Production/Ha	transfer
2009	283	2 000	34	300	68	500	0
2010	283	2 040	34	306	69	510	1
2011	283	2 081	34	312	71	520	3
2012	283	2 122	34	318	72	531	4
2013	283	2 165	34	325	74	541	6
2014	283	2 208	34	331	75	552	7
2015	280	2 263	34	340	76	566	5
2016	278	2 320	34	348	77	580	4
2017	275	2 378	34	357	79	594	3
2018	272	2 437	34	366	80	609	1
2019	269	2 498	34	375	81	625	-1
2020	266	2 561	34	386	82	643	-3
2021	262	2 625	34	398	83	663	-6
2022	258	2 690	34	409	83	682	-10
2023	254	2 758	34	422	84	703	-13
2024	250	2 827	34	434	85	724	-16
2025	247	2 897	34	447	86	746	-18
2026	243	2 970	34	461	87	768	-21
2027	239	3 044	34	475	88	791	-24
2028	236	3 120	34	489	88	815	-27
2029	233	3 198	34	504	89	839	-29
2030	229	3 278	34	519	90	865	-32
2031	226	3 360	34	534	91	891	-34
2032	222	3 444	34	550	92	917	-37
2033	219	3 530	34	567	93	945	-39
2034	216	3 618	34	584	94	973	-41
2035	213	3 709	34	601	95	1 002	-43
2036	210	3 802	34	619	96	1 032	-45
2037	207	3 897	34	638	97	1 063	-47
2038	204	3 994	34	657	98	1 095	-49
2039	201	4 094	34	677	99	1 128	-51
2040	198	4 196	34	697	100	1 162	-53
2041	195	4 301	34	718	101	1 197	-55
2042	192	4 409	34	740	102	1 233	-57
2043	189	4 519	34	762	103	1 270	-59
2044	186	4 632	34	785	104	1 308	-61
2045	184	4 748	34	808	105	1 347	-62
2046	181	4 866	34	832	106	1 387	-64
2047	178	4 988	34	857	107	1 429	-66
2048	176	5 113	34	883	108	1 472	-67
2049	173	5 240	34	910	109	1 516	-69
2050	171	5 371	34	937	110	1 562	-70
2051	168	5 506	34	965	111	1 608	-72
2052	166	5 643	34	994	112	1 657	-73
2053	163	5 784	34	1 024	113	1 706	-75
2054	161	5 929	34	1 054	115	1 757	-75
2055	158	6 077	34	1 086	116	1 810	-77
2056	156	6 229	34	1 119	117	1 865	-78
2057	154	6 385	34	1 152	118	1 920	-79
2058	152	6 545	34	1 187	119	1 978	-80
2059	149	6 708	34	1 222	120	2 037	-82

Land use transfers

1 = Other land, potential agriculture land
2 = Other land, potential forest land
3 = Farm forest land, natural forests
4 = Industrial forest land, natural forests
5 = Nat. environmental forest, in-accessible
6 = Nat. environmental forest, protection areas
7 = Nat. environmental forest, rerserves and NP

Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
2009	0	0	20	673	0	0	1 222	4 086
2010	1	0	19	673	0	0	1 222	4 086
2011	3	0	17	673	0	0	1 222	4 086
2012	4	0	16	673	0	0	1 222	4 086
2013	6	0	14	673	0	0	1 222	4 086
2014	7	0	13	673	0	0	1 222	4 086
2015	5	2	13	673	0	0	1 222	4 086
2016	4	3	13	673	0	0	1 222	4 086
2017	3	4	13	673	0	0	1 222	4 086
2018	1	6	13	673	0	0	1 222	4 086
2019	-1	8	13	673	0	0	1 222	4 086
2020	-3	10	13	673	0	0	1 222	4 086
2021	-6	13	13	673	0	0	1 222	4 086
2022	-10	17	13	673	0	0	1 222	4 086
2023	-13	20	13	673	0	0	1 222	4 086
2024	-16	23	13	673	0	0	1 222	4 086
2025	-18	25	13	673	0	0	1 222	4 086
2026	-21	28	13	673	0	0	1 222	4 086
2027	-24	31	13	673	0	0	1 222	4 086
2028	-27	34	13	673	0	0	1 222	4 086
2029	-29	36	13	673	0	0	1 222	4 086
2030	-32	39	13	673	0	0	1 222	4 086
2031	-34	41	13	673	0	0	1 222	4 086
2032	-37	44	13	673	0	0	1 222	4 086
2033	-39	46	13	673	0	0	1 222	4 086
2034	-41	48	13	673	0	0	1 222	4 086
2035	-43	50	13	673	0	0	1 222	4 086
2036	-45	52	13	673	0	0	1 222	4 086
2037	-47	54	13	673	0	0	1 222	4 086
2038	-49	56	13	673	0	0	1 222	4 086
2039	-51	58	13	673	0	0	1 222	4 086
2040	-53	60	13	673	0	0	1 222	4 086
2041	-55	62	13	673	0	0	1 222	4 086
2042	-57	64	13	673	0	0	1 222	4 086
2043	-59	66	13	673	0	0	1 222	4 086
2044	-61	68	13	673	0	0	1 222	4 086
2045	-62	69	13	673	0	0	1 222	4 086
2046	-64	71	13	673	0	0	1 222	4 086
2047	-66	73	13	673	0	0	1 222	4 086
2048	-67	74	13	673	0	0	1 222	4 086
2049	-69	76	13	673	0	0	1 222	4 086
2050	-70	77	13	673	0	0	1 222	4 086
2051	-72	79	13	673	0	0	1 222	4 086
2052	-73	80	13	673	0	0	1 222	4 086
2053	-75	82	13	673	0	0	1 222	4 086
2054	-75	82	13	673	0	0	1 222	4 086

1 = Other land, potential agriculture land
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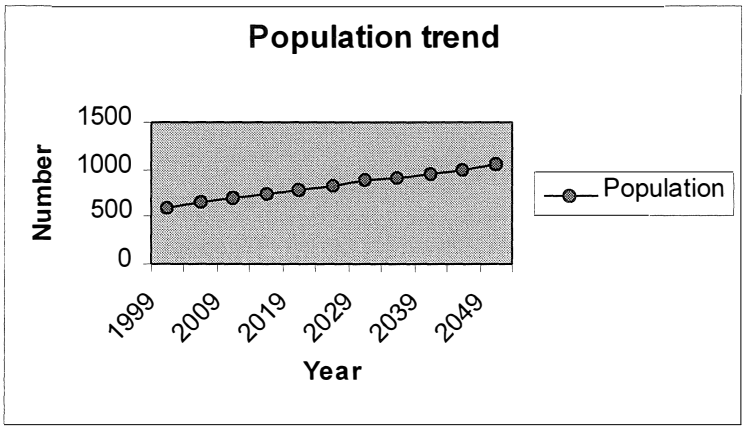
Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
2055	-77	84	13	673	0	0	1 222	4 086
2056	-78	85	13	673	0	0	1 222	4 086
2057	-79	86	13	673	0	0	1 222	4 086
2058	-80	87	13	673	0	0	1 222	4 086
2059	-82	89	13	673	0	0	1 222	4 086

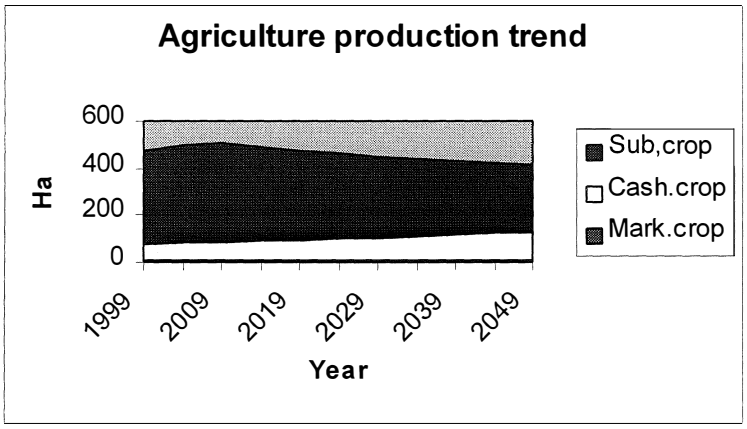
Energy balance

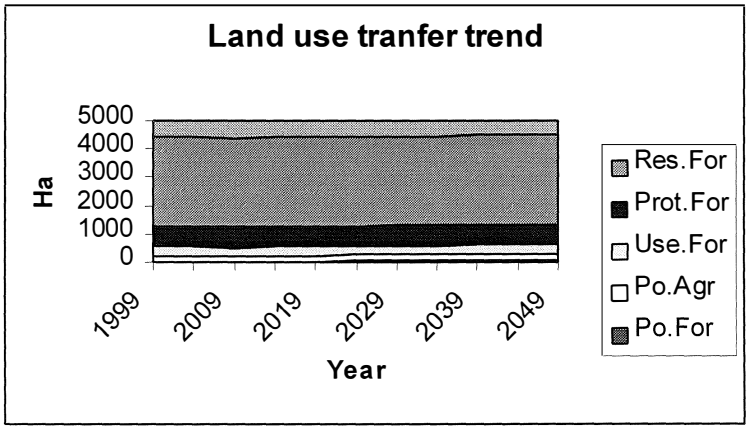
Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
2009	4 609	1 550	3 059	2 039
2010	4 609	1 597	3 012	2 008
2011	4 608	1 645	2 963	1 976
2012	4 608	1 695	2 914	1 942
2013	4 608	1 746	2 862	1 908
2014	4 608	1 799	2 810	1 873
2015	4 608	1 844	2 764	1 843
2016	4 607	1 890	2 717	1 811
2017	4 606	1 938	2 669	1 779
2018	4 606	1 987	2 619	1 746
2019	4 605	2 036	2 568	1 712
2020	4 604	2 077	2 527	1 685
2021	4 603	2 119	2 484	1 656
2022	4 602	2 162	2 441	1 627
2023	4 601	2 205	2 396	1 597
2024	4 600	2 250	2 351	1 567
2025	4 600	2 295	2 305	1 537
2026	4 599	2 341	2 258	1 505
2027	4 598	2 388	2 210	1 473
2028	4 597	2 436	2 161	1 441
2029	4 596	2 485	2 111	1 408
2030	4 595	2 535	2 061	1 374
2031	4 595	2 586	2 009	1 339
2032	4 594	2 638	1 956	1 304
2033	4 593	2 691	1 902	1 268
2034	4 592	2 745	1 847	1 232
2035	4 592	2 800	1 792	1 194
2036	4 591	2 856	1 735	1 156
2037	4 590	2 914	1 676	1 118
2038	4 589	2 972	1 617	1 078
2039	4 589	3 032	1 557	1 038
2040	4 588	3 093	1 495	997
2041	4 587	3 155	1 432	955
2042	4 586	3 219	1 368	912
2043	4 586	3 283	1 302	868
2044	4 585	3 349	1 236	824
2045	4 585	3 417	1 168	779
2046	4 584	3 485	1 099	732
2047	4 583	3 555	1 028	685
2048	4 583	3 627	956	637
2049	4 582	3 700	882	588
2050	4 581	3 774	807	538
2051	4 581	3 850	731	487
2052	4 580	3 927	653	435
2053	4 579	4 006	573	382
2054	4 579	4 087	492	328

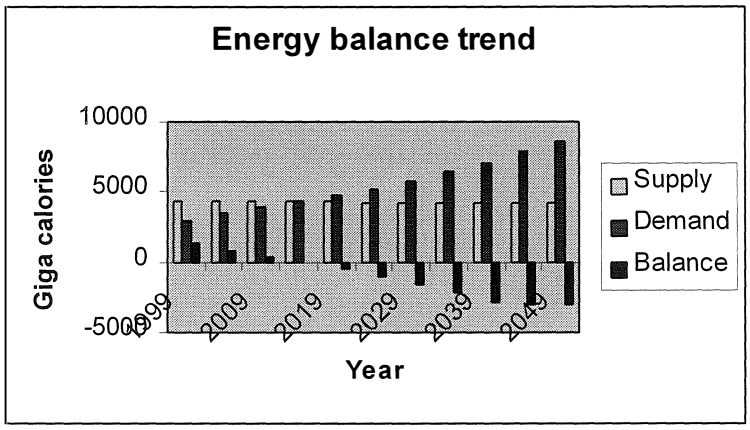
Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
2055	4 578	4 169	409	273
2056	4 578	4 253	325	217
2057	4 577	4 338	239	159
2058	4 577	4 425	151	101
2059	4 576	4 514	62	41

Future Development Scenario 1 Ban Phongsack
(1999-2049)









Data set

Description: BAN PHONGSACK

District	PIANG	
Country	LAO.PDR	
Land area	4914	
Years	1999	2049

1 ton agriculture residue to Giga Calories (GCal)	2,5
1 cubic meter solid wood to Giga Calories (GCal)	1,5
1 cubic meter solid wood to 1 forest cubic meter	1,0

Land use transfer priorities

Other land, potential agriculture land	2
Farm forest land, natural forests	3
Other land, potential forest land	1
Industrial forest land, natural forests	4
Nat. environmental forest, in-accessible	5
Nat. environmental forest, protection areas	6
Nat. environmental forest, rerserves and NP	7

Growth factors, start value and period growth in %.

Total population	594	2,00	1,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Rural population	594	2,00	1,50	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Gross Domestic Product	81	1,00	1,50	2,00	2,50	3,00	3,50	4,00	4,00	5,00	5,00
Production subsistence food	1 425	1,00	1,50	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00
Production marketed food	285	1,00	1,50	1,50	2,00	2,00	2,00	2,50	3,00	3,00	3,00
Production cash crop	447	1,00	1,50	2,00	2,50	3,00	3,50	4,00	4,50	5,00	5,00
Rur. biomass energy demand	5	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Urb. biomass energy demand	1	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00

Agriculture data

Agriculture land	Area (hectares)	Volume wood per hectare	Autoproduction of wood m^3/ hectare and year	Yield of residues kg per hectare	Amount of residues used as fuelwood (%)
Subsistence food	400	10	0,03	300	100
Marketed food	7	10	0,02	200	100
Cash Crop	67	10	0,01	100	100
Other land					
Potential agricultural	224	10	0,2		
Potential forest	12	10	0,2		
Unproductive	10	2	0,1		

Forest data

I Unavailable for production	Area (hectares)	MAI m^3	Ann fuel wood removal m^3	Ann. Logging m^3/ hectare	Total volume in m^3 per ha	altogether	Commercial volume in m^3 per ha	altogether
NP and reserves	3 139	1	0,5					
Protection	733	1	0,5					
Inaccessible areas								
Existing plantations								
II Available for production								
Industrial								
Existing plantations								
Farm forest	322	4	2	20				
Existing plantations								

Population & GDP

Year	Population			Gross Domestic Product	
	Rural	Urban	Total	Total (in millions)	Per capita
1999	594		594	0	81
2000	606		606	0	82
2001	618		618	0	83
2002	630		630	0	83
2003	643		643	0	84
2004	656		656	0	85
2005	666		666	0	86
2006	676		676	0	88
2007	686		686	0	89
2008	696		696	0	90
2009	707		707	0	92
2010	714		714	0	94
2011	721		721	0	95
2012	728		728	0	97
2013	735		735	0	99
2014	743		743	0	101
2015	750		750	0	104
2016	757		757	0	106
2017	765		765	0	109
2018	773		773	0	112
2019	780		780	0	115
2020	788		788	0	118
2021	796		796	0	122
2022	804		804	0	125
2023	812		812	0	129
2024	820		820	0	133
2025	828		828	0	137
2026	837		837	0	142
2027	845		845	0	147
2028	854		854	0	152
2029	862		862	0	158
2030	871		871	0	164
2031	879		879	0	171
2032	888		888	0	177
2033	897		897	0	185
2034	906		906	0	192
2035	915		915	0	201
2036	924		924	0	210
2037	934		934	0	219
2038	943		943	0	229
2039	952		952	0	239
2040	962		962	0	251
2041	971		971	0	264
2042	981		981	0	277
2043	991		991	0	291
2044	1 001		1 001	0	305
2045	1 011		1 011	0	320
2046	1 021		1 021	0	337
2047	1 031		1 031	0	353
2048	1 041		1 041	0	371
2049	1 052		1 052	0	390

Agriculture development

Year	Subsistence food		Marketed Food		Cash Crop		Accumulated
	Area	Production/Ha	Area	Production/Ha	Area	Production/Ha	transfer
1999	400	1 425	7	285	67	447	0
2000	404	1 439	7	288	68	451	5
2001	408	1 454	7	291	70	456	11
2002	412	1 468	7	294	71	461	16
2003	416	1 483	7	297	73	465	22
2004	420	1 498	7	300	74	470	27
2005	420	1 520	7	304	75	477	28
2006	420	1 543	7	309	76	484	29
2007	420	1 566	7	313	77	491	30
2008	420	1 590	7	318	79	499	32
2009	420	1 613	7	323	80	506	33
2010	416	1 646	7	328	80	516	29
2011	412	1 679	7	332	81	527	26
2012	408	1 712	7	337	82	537	23
2013	404	1 746	7	342	83	548	20
2014	400	1 781	7	348	84	559	17
2015	396	1 817	7	355	85	573	14
2016	392	1 853	7	362	85	587	10
2017	388	1 890	7	369	86	602	7
2018	385	1 928	7	376	87	617	5
2019	381	1 967	7	384	88	632	2
2020	377	2 006	7	391	89	651	-1
2021	373	2 046	7	399	90	671	-4
2022	370	2 087	8	407	91	691	-5
2023	366	2 129	8	415	92	712	-8
2024	362	2 171	8	424	93	733	-11
2025	359	2 215	8	434	93	759	-14
2026	355	2 259	8	445	94	785	-17
2027	352	2 304	8	456	95	813	-19
2028	348	2 350	8	468	96	841	-22
2029	345	2 397	8	479	97	870	-24
2030	342	2 445	8	491	98	905	-26
2031	338	2 494	8	504	99	941	-29
2032	335	2 544	8	516	100	979	-31
2033	332	2 595	9	529	101	1 018	-32
2034	328	2 647	9	542	102	1 059	-35
2035	325	2 700	9	559	103	1 107	-37
2036	322	2 754	9	575	104	1 157	-39
2037	319	2 809	9	593	105	1 209	-41
2038	316	2 865	9	611	106	1 263	-43
2039	313	2 923	9	629	107	1 320	-45
2040	310	2 981	10	648	108	1 386	-46
2041	307	3 041	10	667	110	1 455	-47
2042	304	3 101	10	687	111	1 528	-49
2043	301	3 163	10	708	112	1 604	-51
2044	298	3 227	10	729	113	1 684	-53
2045	295	3 291	11	751	114	1 769	-54
2046	292	3 357	11	773	115	1 857	-56
2047	289	3 424	11	797	116	1 950	-58
2048	286	3 493	11	820	117	2 047	-60
2049	283	3 563	11	845	119	2 150	-61

Land use transfers

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Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
1999	0	12	224	322	0	0	733	3 139
2000	5	7	224	322	0	0	733	3 139
2001	11	1	224	322	0	0	733	3 139
2002	16	0	220	322	0	0	733	3 139
2003	22	0	214	322	0	0	733	3 139
2004	27	0	209	322	0	0	733	3 139
2005	28	0	208	322	0	0	733	3 139
2006	29	0	207	322	0	0	733	3 139
2007	30	0	206	322	0	0	733	3 139
2008	32	0	204	322	0	0	733	3 139
2009	33	0	203	322	0	0	733	3 139
2010	29	4	203	322	0	0	733	3 139
2011	26	7	203	322	0	0	733	3 139
2012	23	10	203	322	0	0	733	3 139
2013	20	13	203	322	0	0	733	3 139
2014	17	16	203	322	0	0	733	3 139
2015	14	19	203	322	0	0	733	3 139
2016	10	23	203	322	0	0	733	3 139
2017	7	26	203	322	0	0	733	3 139
2018	5	28	203	322	0	0	733	3 139
2019	2	31	203	322	0	0	733	3 139
2020	-1	34	203	322	0	0	733	3 139
2021	-4	37	203	322	0	0	733	3 139
2022	-5	38	203	322	0	0	733	3 139
2023	-8	41	203	322	0	0	733	3 139
2024	-11	44	203	322	0	0	733	3 139
2025	-14	47	203	322	0	0	733	3 139
2026	-17	50	203	322	0	0	733	3 139
2027	-19	52	203	322	0	0	733	3 139
2028	-22	55	203	322	0	0	733	3 139
2029	-24	57	203	322	0	0	733	3 139
2030	-26	59	203	322	0	0	733	3 139
2031	-29	62	203	322	0	0	733	3 139
2032	-31	64	203	322	0	0	733	3 139
2033	-32	65	203	322	0	0	733	3 139
2034	-35	68	203	322	0	0	733	3 139
2035	-37	70	203	322	0	0	733	3 139
2036	-39	72	203	322	0	0	733	3 139
2037	-41	74	203	322	0	0	733	3 139
2038	-43	76	203	322	0	0	733	3 139
2039	-45	78	203	322	0	0	733	3 139
2040	-46	79	203	322	0	0	733	3 139
2041	-47	80	203	322	0	0	733	3 139
2042	-49	82	203	322	0	0	733	3 139
2043	-51	84	203	322	0	0	733	3 139
2044	-53	86	203	322	0	0	733	3 139

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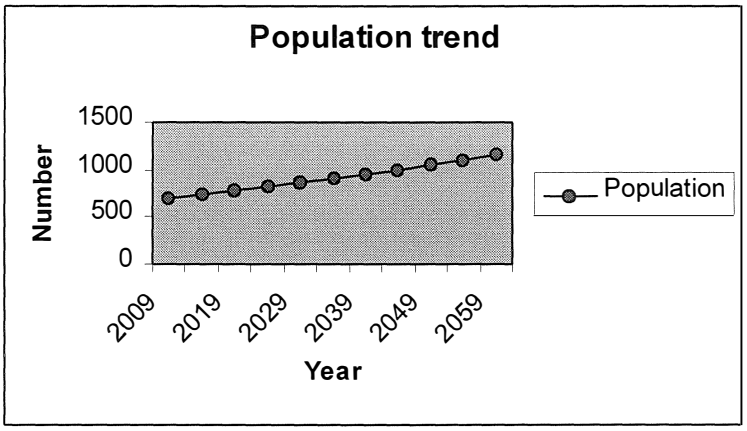
Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
2045	-54	87	203	322	0	0	733	3 139
2046	-56	89	203	322	0	0	733	3 139
2047	-58	91	203	322	0	0	733	3 139
2048	-60	93	203	322	0	0	733	3 139
2049	-61	94	203	322	0	0	733	3 139

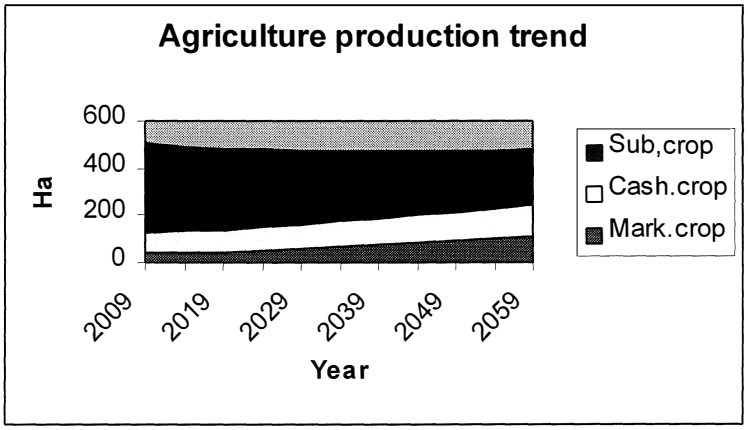
Energy balance

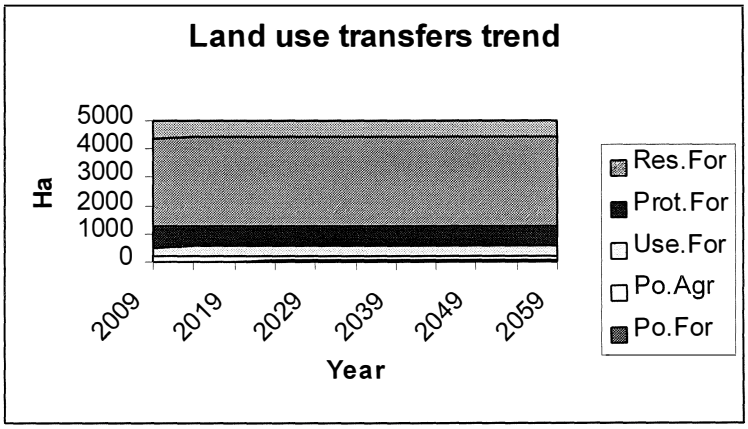
Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
1999	4 282	2 970	1 312	875
2000	4 284	3 060	1 224	816
2001	4 286	3 152	1 134	756
2002	4 288	3 247	1 040	694
2003	4 289	3 345	944	629
2004	4 291	3 446	845	563
2005	4 291	3 533	758	506
2006	4 291	3 622	669	446
2007	4 291	3 713	578	386
2008	4 291	3 806	485	323
2009	4 291	3 902	389	259
2010	4 289	3 981	309	206
2011	4 287	4 061	227	151
2012	4 285	4 142	143	95
2013	4 283	4 225	58	38
2014	4 281	4 310	-29	-19
2015	4 279	4 397	-118	-79
2016	4 277	4 485	-208	-139
2017	4 275	4 576	-300	-200
2018	4 274	4 668	-394	-263
2019	4 272	4 761	-490	-326
2020	4 270	4 857	-587	-392
2021	4 268	4 955	-687	-458
2022	4 266	5 054	-788	-525
2023	4 264	5 156	-892	-594
2024	4 262	5 259	-997	-665
2025	4 261	5 365	-1 104	-736
2026	4 259	5 473	-1 214	-810
2027	4 257	5 583	-1 326	-884
2028	4 255	5 695	-1 440	-960
2029	4 254	5 810	-1 556	-1 037
2030	4 252	5 927	-1 674	-1 116
2031	4 250	6 046	-1 795	-1 197
2032	4 249	6 167	-1 918	-1 279
2033	4 247	6 291	-2 044	-1 362
2034	4 245	6 418	-2 172	-1 448
2035	4 244	6 547	-2 303	-1 535
2036	4 242	6 678	-2 436	-1 624
2037	4 241	6 812	-2 572	-1 714
2038	4 239	6 949	-2 710	-1 807
2039	4 238	7 089	-2 851	-1 901
2040	4 236	7 231	-2 995	-1 997
2041	4 235	7 377	-3 142	-2 095
2042	4 233	7 525	-3 292	-2 194
2043	4 232	7 676	-3 444	-2 296
2044	4 230	7 831	-3 600	-2 400

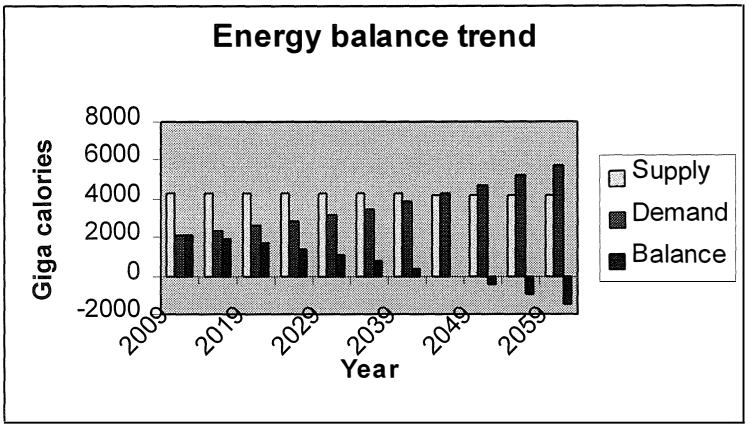
Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
2045	4 229	7 988	-3 759	-2 506
2046	4 228	8 149	-3 921	-2 614
2047	4 226	8 312	-4 086	-2 724
2048	4 225	8 479	-4 255	-2 837
2049	4 223	8 650	-4 427	-2 951

Future Development Scenario 2 Ban Phongsack
(2009-2059)









Data set

Description: BAN PHONGSACK 2

District	PIANG	
Country	LAO.PDR	
Land area	4914	
Years	2009	2059

1 ton agriculture residue to Giga Calories (GCal)	2,5
1 cubic meter solid wood to Giga Calories (GCal)	1,5
1 cubic meter solid wood to 1 forest cubic meter	1,0

Land use transfer priorities

Other land, potential agriculture land	2
Farm forest land, natural forests	3
Other land, potential forest land	1
Industrial forest land, natural forests	4
Nat. environmental forest, in-accessible	5
Nat. environmental forest, protection areas	6
Nat. environmental forest, rerserves and NP	7

Growth factors, start value and period growth in %.

Total population	707	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Rural population	707	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Gross Domestic Product	92	3,00	4,00	5,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00
Production subsistence food	2 000	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00	2,00
Production marketed food	300	2,50	2,50	3,00	3,00	3,50	3,50	4,00	4,00	4,00	4,00
Production cash crop	500	3,00	4,00	5,00	6,00	6,00	6,00	6,00	6,00	6,00	6,00
Rur. biomass energy demand	3	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Urb. biomass energy demand	1	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00

Agriculture data

Agriculture land	Area (hectares)	Volume wood per hectare	Autoproduction of wood m^3/ hectare and year	Yield of residues kg per hectare	Amount of residues used as fuelwood (%)
Subsistence food	381	10	0,03	300	100
Marketed food	42	10	0,02	200	100
Cash Crop	84	10	0,01	100	100
Other land					
Potential agricultural	191	10	0,2		
Potential forest	12	10	0,2		
Unproductive	10	2	0,1		

Forest data

I Unavailable for production	Area (hectares)	MAI m^3	Ann fuel wood removal m^3	Ann. Logging m^3/ hectare	Total volume in m^3 per ha	Total volume in m^3 altogether	Commercial volume in m^3 per ha	Commercial volume in m^3 altogether
NP and reserves	3 139	1	0,5					
Protection	733	1	0,5					
Inaccessible areas								
Existing plantations								
II Available for production								
Industrial								
Existing plantations								
Farm forest	322	4	2	20				
Existing plantations								

Population & GDP

Year	Population			Gross Domestic Product	
	Rural	Urban	Total	Total (in millions)	Per capita
2009	707		707	0	92
2010	714		714	0	95
2011	721		721	0	98
2012	728		728	0	101
2013	736		736	0	104
2014	743		743	0	107
2015	750		750	0	111
2016	758		758	0	115
2017	766		766	0	120
2018	773		773	0	125
2019	781		781	0	130
2020	789		789	0	136
2021	797		797	0	143
2022	805		805	0	150
2023	813		813	0	158
2024	821		821	0	166
2025	829		829	0	176
2026	837		837	0	186
2027	846		846	0	197
2028	854		854	0	209
2029	863		863	0	222
2030	871		871	0	235
2031	880		880	0	249
2032	889		889	0	264
2033	898		898	0	280
2034	907		907	0	297
2035	916		916	0	314
2036	925		925	0	333
2037	934		934	0	353
2038	943		943	0	374
2039	953		953	0	397
2040	962		962	0	421
2041	972		972	0	446
2042	982		982	0	473
2043	992		992	0	501
2044	1 002		1 002	1	531
2045	1 012		1 012	1	563
2046	1 022		1 022	1	597
2047	1 032		1 032	1	633
2048	1 042		1 042	1	671
2049	1 053		1 053	1	711
2050	1 063		1 063	1	753
2051	1 074		1 074	1	799
2052	1 085		1 085	1	847
2053	1 095		1 095	1	897
2054	1 106		1 106	1	951
2055	1 117		1 117	1	1 008
2056	1 129		1 129	1	1 069
2057	1 140		1 140	1	1 133
2058	1 151		1 151	1	1 201
2059	1 163		1 163	1	1 273

Agriculture development

Year	Subsistence food		Marketed Food		Cash Crop		Accumulated
	Area	Production/Ha	Area	Production/Ha	Area	Production/Ha	transfer
2009	381	2 000	42	300	84	500	0
2010	377	2 040	42	308	85	515	-3
2011	374	2 081	42	315	86	530	-5
2012	370	2 122	43	323	87	546	-7
2013	366	2 165	43	331	87	563	-11
2014	363	2 208	43	339	88	580	-13
2015	359	2 252	44	348	89	603	-15
2016	356	2 297	44	357	90	627	-17
2017	352	2 343	45	366	91	652	-19
2018	349	2 390	46	375	92	678	-20
2019	345	2 438	46	384	93	705	-23
2020	342	2 487	47	396	94	740	-24
2021	339	2 536	48	407	95	778	-25
2022	335	2 587	49	420	96	816	-27
2023	332	2 639	50	432	97	857	-28
2024	329	2 692	51	445	98	900	-29
2025	325	2 746	52	459	98	954	-32
2026	322	2 800	54	472	99	1 011	-32
2027	319	2 856	56	486	100	1 072	-32
2028	316	2 914	57	501	101	1 136	-33
2029	313	2 972	59	516	102	1 204	-33
2030	310	3 031	60	534	104	1 277	-33
2031	307	3 092	62	553	105	1 353	-33
2032	304	3 154	63	572	106	1 435	-34
2033	301	3 217	65	592	107	1 521	-34
2034	298	3 281	66	613	108	1 612	-35
2035	295	3 347	68	634	109	1 709	-35
2036	292	3 414	70	657	110	1 811	-35
2037	289	3 482	71	680	111	1 920	-36
2038	286	3 552	73	703	112	2 035	-36
2039	284	3 623	75	728	113	2 157	-35
2040	281	3 695	76	757	114	2 286	-36
2041	278	3 769	78	787	115	2 424	-36
2042	275	3 844	79	819	117	2 569	-36
2043	273	3 921	81	852	118	2 723	-35
2044	270	4 000	82	886	119	2 887	-36
2045	267	4 080	84	921	120	3 060	-36
2046	265	4 161	85	958	121	3 243	-36
2047	262	4 245	87	996	123	3 438	-35
2048	259	4 329	89	1 036	124	3 644	-35
2049	257	4 416	90	1 078	125	3 863	-35
2050	254	4 504	92	1 121	126	4 095	-35
2051	252	4 594	94	1 166	128	4 340	-33
2052	249	4 686	96	1 212	129	4 601	-33
2053	247	4 780	97	1 261	130	4 877	-33
2054	245	4 876	99	1 311	131	5 169	-32
2055	242	4 973	101	1 364	133	5 480	-31
2056	240	5 073	103	1 418	134	5 808	-30
2057	237	5 174	105	1 475	135	6 157	-30
2058	235	5 278	107	1 534	137	6 526	-28
2059	233	5 383	109	1 595	138	6 918	-27

Land use transfers

1 = Other land, potential forest land
2 = Other land, potential agriculture land
3 = Farm forest land, natural forests
4 = Industrial forest land, natural forests
5 = Nat. environmental forest, in-accessible
6 = Nat. environmental forest, protection areas
7 = Nat. environmental forest, rerserves and NP

Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
2009	0	12	191	322	0	0	733	3 139
2010	-3	15	191	322	0	0	733	3 139
2011	-5	17	191	322	0	0	733	3 139
2012	-7	19	191	322	0	0	733	3 139
2013	-11	23	191	322	0	0	733	3 139
2014	-13	25	191	322	0	0	733	3 139
2015	-15	27	191	322	0	0	733	3 139
2016	-17	29	191	322	0	0	733	3 139
2017	-19	31	191	322	0	0	733	3 139
2018	-20	32	191	322	0	0	733	3 139
2019	-23	35	191	322	0	0	733	3 139
2020	-24	36	191	322	0	0	733	3 139
2021	-25	37	191	322	0	0	733	3 139
2022	-27	39	191	322	0	0	733	3 139
2023	-28	40	191	322	0	0	733	3 139
2024	-29	41	191	322	0	0	733	3 139
2025	-32	44	191	322	0	0	733	3 139
2026	-32	44	191	322	0	0	733	3 139
2027	-32	44	191	322	0	0	733	3 139
2028	-33	45	191	322	0	0	733	3 139
2029	-33	45	191	322	0	0	733	3 139
2030	-33	45	191	322	0	0	733	3 139
2031	-33	45	191	322	0	0	733	3 139
2032	-34	46	191	322	0	0	733	3 139
2033	-34	46	191	322	0	0	733	3 139
2034	-35	47	191	322	0	0	733	3 139
2035	-35	47	191	322	0	0	733	3 139
2036	-35	47	191	322	0	0	733	3 139
2037	-36	48	191	322	0	0	733	3 139
2038	-36	48	191	322	0	0	733	3 139
2039	-35	47	191	322	0	0	733	3 139
2040	-36	48	191	322	0	0	733	3 139
2041	-36	48	191	322	0	0	733	3 139
2042	-36	48	191	322	0	0	733	3 139
2043	-35	47	191	322	0	0	733	3 139
2044	-36	48	191	322	0	0	733	3 139
2045	-36	48	191	322	0	0	733	3 139
2046	-36	48	191	322	0	0	733	3 139
2047	-35	47	191	322	0	0	733	3 139
2048	-35	47	191	322	0	0	733	3 139
2049	-35	47	191	322	0	0	733	3 139
2050	-35	47	191	322	0	0	733	3 139
2051	-33	45	191	322	0	0	733	3 139
2052	-33	45	191	322	0	0	733	3 139
2053	-33	45	191	322	0	0	733	3 139
2054	-32	44	191	322	0	0	733	3 139

1 = Other land, potential forest land
2 = Other land, potential agriculture land
3 = Farm forest land, natural forests
4 = Industrial forest land, natural forests
5 = Nat. environmental forest, in-accessible
6 = Nat. environmental forest, protection areas
7 = Nat. environmental forest, rerserves and NP

Year	Accumulated transfer	Remaining area after land transfer, classes as listed above. 1	2	3	4	5	6	7
2055	-31	43	191	322	0	0	733	3 139
2056	-30	42	191	322	0	0	733	3 139
2057	-30	42	191	322	0	0	733	3 139
2058	-28	40	191	322	0	0	733	3 139
2059	-27	39	191	322	0	0	733	3 139

Energy balance

Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
2009	4 280	2 121	2 159	1 439
2010	4 278	2 164	2 114	1 409
2011	4 276	2 207	2 069	1 379
2012	4 274	2 251	2 023	1 349
2013	4 273	2 297	1 976	1 317
2014	4 271	2 343	1 928	1 285
2015	4 269	2 390	1 879	1 253
2016	4 268	2 438	1 830	1 220
2017	4 266	2 487	1 779	1 186
2018	4 265	2 537	1 728	1 152
2019	4 263	2 588	1 675	1 116
2020	4 261	2 640	1 621	1 081
2021	4 260	2 693	1 567	1 045
2022	4 258	2 747	1 511	1 007
2023	4 257	2 802	1 454	970
2024	4 256	2 859	1 397	931
2025	4 254	2 916	1 338	892
2026	4 253	2 975	1 278	852
2027	4 252	3 035	1 217	811
2028	4 250	3 096	1 155	770
2029	4 249	3 158	1 092	728
2030	4 248	3 221	1 027	685
2031	4 247	3 286	961	641
2032	4 246	3 352	894	596
2033	4 245	3 420	825	550
2034	4 243	3 488	755	503
2035	4 242	3 558	684	456
2036	4 241	3 630	611	408
2037	4 240	3 703	537	358
2038	4 239	3 777	462	308
2039	4 238	3 853	385	257
2040	4 237	3 931	306	204
2041	4 236	4 010	226	151
2042	4 235	4 090	144	96
2043	4 234	4 172	62	41
2044	4 233	4 256	-24	-16
2045	4 232	4 342	-110	-73
2046	4 231	4 429	-198	-132
2047	4 230	4 518	-288	-192
2048	4 229	4 609	-380	-253
2049	4 228	4 702	-474	-316
2050	4 227	4 796	-569	-379
2051	4 226	4 893	-666	-444
2052	4 225	4 991	-766	-510
2053	4 225	5 091	-867	-578
2054	4 224	5 194	-970	-646

Year	Supply (giga calories)	Demand (giga calories)	Balance (giga calories)	Balance (cubic meters)
2055	4 223	5 298	-1 075	-717
2056	4 222	5 404	-1 182	-788
2057	4 221	5 513	-1 292	-861
2058	4 221	5 624	-1 403	-935
2059	4 220	5 737	-1 517	-1 011

Serien Arbetsrapporter utges i första hand för institutionens eget behov av viss dokumentation. Rapporterna är indelade i följande grupper: Riksskogstaxeringen, Planering och inventering, Biometri, Fjärranalys, Kompendier och undervisningsmaterial, Examensarbeten samt internationellt. Författarna svarar själva för rapporternas vetenskapliga innehåll.

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Riksskogstaxeringen: ***(The Swedish National Forest Inventory)***

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24 Fridman, J. & Walheim, M. Död ved i Sverige. - Statistik från Riksskogstaxeringen. ISRN SLU-SRG-AR--24--SE.

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1999 61 Broman, N & Christoffersson, J. Mätfel i provträdsvariabler och dess inverkan på precision och noggrannhet i volymskattningar. ISRN SLU-SRG-AR--61--SE.

2000 65 Hallsby, G m.fl. Metodik för skattning av lokala skogsbränsleresurser. ISRN SLU-SRG-AR--65--SE.

75 von Segebaden, G. Komplement till "RIKSTAXEN 75 ÅR". ISRN SLU-SREG-AR--75--SE.

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1995 3 Holmgren, P. & Thuresson, T. Skoglig planering på amerikanska västkusten - intryck från en studieresa till Oregon, Washington och British Columbia 1-14 augusti 1995. ISRN SLU-SRG-AR--3--SE.

4 Ståhl, G. The Transect Relascope - An Instrument for the Quantification of Coarse Woody Debris. ISRN SLU-SRG-AR--4--SE

1996 15 van Kerkvoorde, M. A sequential approach in mathematical programming to include spatial aspects of biodiversity in long range forest management planning. ISRN SLU-SRG-AR--15--SE.

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63 Fridman, J., Löfstrand, R. & Roos, S. Stickprovsvis landskapsövervakning - En förstudie. ISRN SLU-SRG-AR--63--SE.

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53 Reese, H. & Nilsson, M. Using Landsat TM and NFI data to estimate wood volume, tree biomass and stand age in Dalarna. ISRN SLU-SRG-AR--53--SE.

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69 Tingelöf, U & Nilsson, M.Kartering av hyggeskanter i pankromaötiska SPOT-bilder. ISRN SLU-SRG-AR--69--SE.

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