

Participatory Land Management Planning in Biodiversity Conservation Areas of Lao PDR

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Doctoral thesis

Swedish University of Agricultural Sciences

Umeå 2003

Acta Universitatis Agriculturae Sueciae
Silvestria 267

ISSN 1401-6230
ISBN 91-576-6501-X
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Printed by: SLU, Grafiska Enheten, Umeå, Sweden, 2003

Abstract

Sawathvong, S. 2003. Participatory Land Management Planning in Biodiversity Conservation Areas of Lao PDR. Doctoral dissertation. ISSN 1401-6230, ISBN 91-576-6501-X

The importance of integrating forest conservation and rural development objectives is much better understood today than in the past. Despite an increased understanding such integration in many countries remains poorly supported in terms of co-ordination between government agencies and stakeholders. Environmental degradation and loss of biodiversity conservation areas to competing alternative uses is widespread throughout the world and Lao PDR is no exception.

The forest policy in Lao PDR has developed under the framework of international conventions. The protected area system has been established with the aim of conserving healthy and diverse forests. Rehabilitation and reforestation policies are important complements. The former "rules by decree" approach has been replaced by a set of laws and regulations.

This thesis presents and discusses a management approach for biodiversity conservation areas in Lao PDR. As part of that, it highlights the significance of appropriate policies and legislation as a base for sustainable management, discusses various interdisciplinary and interactive planning methods tested in case studies, and analyses the utilisation of non-timber forest products as part of a strategy for sustainable management of biodiversity conservation areas.

The integration of techniques from social sciences and natural sciences is emphasised to encourage local participation in managing the conservation areas. Participatory Rural Appraisal, simple sampling methods, and remote sensing were used in the studies. A simple simulation model (the Area Production Model) strengthened the inter-action process. The integrated and cross-sectoral approach turned out to be simple, flexible and dynamic.

The recognition of non-timber forest products (NTFPs) plays an important role in the conservation and development of protected area management. A literature review was made to gain insight into the research trend in Southeast Asia in terms of tenure rights of NTFPs and the way people utilise them. Quantitative resource assessment is an important part in sustainable management. In a case study, a participatory two-phase sampling approach for cardamom assessment was developed and tested with a promising result.

Key words: biodiversity, cardamom, Lao PDR, participatory, planning, sampling, simulation model.

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**Commemorated to 650th anniversary of
King Chao Fa Ngoum Maharaj, the founder of
Lane Xang kingdom
(The land of a million elephants, the first state of the Lao nation)
&
Dedicated to my father Sawathvong who was a well-known
Lao Art Master of Luang Prabang Province.**

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Appendix

Papers I-V

The thesis is based on the following papers, which will be referred to by their Roman numerals:

I: Ohlsson, B. & Sawathvong, S. 2003. Forest policy development in the Lao PDR in the context of globalisation. (Manuscript).

II: Sawathvong, S. 2003. Experiences from developing an integrated land use planning approach for protected areas in the Lao PDR. *Forest Policy and Economics*. In press.

III: Sandewall, M., Ohlsson, B. & Sawathvong, S. 2001. Assessment of historical land use changes for purposes of strategic planning - a case study in Laos. *Ambio* 30: 55-61.

IV: Sawathvong, S. 2002. The challenge of non-timber forest product research in Southeast Asia. (Submitted Manuscript).

V: Sawathvong, S., Sandewall, M. & Ståhl, G. 2003. A two- phase sampling method for cardamom assessment based on local people's participation. (Submitted Manuscript).

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Introduction

Much of the recent global attention on biological diversity emanates from the United Nations Conference on Environment and Development (UNCED), held in 1992, and the resulting Convention on Biological Diversity (CBD), which entered into force in 1993. Biodiversity, according to the commonly accepted definition in the CBD, encompasses “ the variability of all organisms from all sources...and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems” (UNEP, 1992).

The use of the term “biodiversity” has expanded to cover a wide range of different aspects, at different scales and in different fields and activities, including natural and human sciences (Kaennel, 1998). As an example, MacKinnon (2000) includes also the life forms shaped by human breeding, and even genetic engineering, in the term.

Staying with “natural” organisms, the protection of biodiversity ensures that the linkages between species and ecosystems are maintained, and that the quality of the environment and our vast natural resources may be enjoyed also by future generations (Novacek, 2000).

Biodiversity at the global level

Without question, the earth’s biological diversity is an invaluable ecological, genetic, social, economic, scientific, educational, cultural, recreational, and aesthetic resource. However, over the past century, a variety of human activities have significantly reduced biological diversity worldwide. The share of bird, mammal, and fish species that are now in danger of extinction is in double digits – 11 percent of all bird species, 25 percent of mammals, and 34 percent of fish (Worldwatch institute, 2000).

Loss of biodiversity results in serious reductions in the goods (such as food, medicines and building materials) and the services (such as clean water and nutrient cycling) that the earth’s ecosystems can provide and that make economic prosperity and human survival possible. Ten Kate & Laird (1999) indicated that genetic resources alone contribute to USD 500-800 billion per year to national economics. As another example, the total value of medication extracted from plants is estimated at USD 43 billion a year (Rijoort, 2000).

Tropical forests are known to have high biodiversity values. They are reservoirs of huge numbers of species of *e.g.*, birds, mammals and reptiles, with species numbers well exceeding those found in temperate climatic zones. They have always been a key element in the lives of people in most developing countries and continue to be of fundamental environmental, social and economic importance in both national and regional development (Kanashiro *et al.*, 2002).

FAO's latest Forest Resource Assessment (FRA 2000) indicates that the net global reduction in forest area between 1990 and 2000 was 9.4 million hectares per year. Although most of the disappearing tropical forests belong to those of the developing world, the consequences of these actions threaten the future of both developed and developing nations (FAO, 2001). It is the essential prominence of tropical forest to all communities and an increasing awareness that degradation and losses of forests are occurring at an increasing rate, that provide the impetus for new international initiatives for tropical forest conservation and management.

The World Conservation Strategy (IUCN, UNEP, & WWF, 1980) defined conservation as "the management of human use of the biosphere so that it may yield the greatest sustainable benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations". This was the first modern attempt to recognise that conservation of renewable resources, including biological diversity, involves wise dynamic use and not just static preservation or protection.

Biodiversity and Protected Areas in Southeast Asia

Southeast Asia is one of the wealthiest parts of the world when it comes to biodiversity, *e.g.*, the area has large numbers of endemic species (Table 1). The various books of PROSEA (Plant resources of Southeast Asia) list 15,000 plant species that are useful to people.

Table 1: Endemic species in Southeast Asia

Country	Mammals	Birds	Plants
Brunei	9	14	2
Cambodia	23	18	0
Indonesia	128	104	184
Lao PDR	30	27	1
Malaysia	42	34	371
Myanmar	31	44	6
Philippines	49	86	320
Singapore	6	9	2
Thailand	34	45	355
Vietnam	38	47	297

Source: The ASEAN Regional Centre for Biodiversity Conservation (2001).

While biodiversity is extremely important, it is also being lost at a rapid pace, considering the deforestation rates in Southeast Asia (Table 2). There are many

reasons for this loss. Largely, it is a question of pressure on land resources with an increasing human population, but poor planning, weak protection and law enforcement, corruption, and lack of clear information also play major roles (MacKinnon, 2001).

The region is one of the most populated in the world, with over 507 million people who consistently obtain food, clothing, shelter, medicine, recreation, and livelihood from the biological resource (Faylon, 2001).

Non-timber forest products (NTFPs) have been vitally important to forest-dwellers and rural communities in the region for centuries (De Beer & McDermott, 1989). Until recently, however, the use of NTFPs has largely been confined to meeting subsistence needs. The situation is now changing rapidly, as increasing attention is being directed toward the economic potential of NTFPs as an important tool for participatory protected area management (Valkenburg, 2000).

Country	Land area 1000ha	Forest area 2000					Area change 1990-2000 (Total Forest)	
		Natural Forest 1000ha	Forest planta. 1000ha	Total Forest			1000ha/ year	%
				1000ha	%	Ha per capita		
Brunei	527	439	3	442	83.9	1.4	-1	-0.2
Cambodia	17,652	9,245	90	9,335	52.9	0.9	-56	-0.5
East Timor *	1,479	507	-	507	34.3	0.6	-3	-0.6
Indonesia	181,157	95,116	9,671	104,986	58.0	0.5	-1,312	-1.2
Lao PDR	23,080	12,507	54	12,561	54.4	2.4	-53	-0.4
Malaysia	32,855	17,543	1,750	19,202	58.7	0.9	-237	-1.2
Myanmar	65,755	33,598	821	34,419	52.3	0.8	-517	-1.4
Philippines	29,817	5,036	753	5,789	19.4	0.1	-89	-1.4
Singapore	61	2	-	2	3.3	n.s	n.s	n.s
Thailand	51,089	9,842	4,920	14,762	28.9	0.2	-112	-0.7
Vietnam	32,550	8,108	1,711	9,819	30.2	0.1	52	0.5
Total S.E Asia	436,022	191,947	19,972	211,914	48.6	0.4	-2,326	-1
Total Asia	3,084,746	431,946	115,847	54,793	17.8	0.2	-364	-0.1
Total World	13,063,900	3,682,722	186,733	3,869,455	29.6	0.6	-9,391	-0.2

Table 2: Forest resources and deforestation in Southeast Asia

Source: Adapted from Forest Resource Assessment 2000 (FAO, 2001).

Note: *East Timor is a new country, which separate from Indonesia.

Protection of areas is a major strategy for many conservation efforts, especially for preserving biodiversity. Protected areas usually have been seen primarily in biological or ecological terms, but recent studies indicate also the economic importance of land managed for conservation objectives (McNeely, 1999). The protected areas systems in Southeast Asia are designed according to the conservation requirements of each country, but often follow the categories set by the International Union for the Conservation of Nature (IUCN) (Table 3).

Table 3: IUCN Protected Area Categories

Category	Name	Main Management objectives
I	(a) Strict Nature Reserve (b) Wilderness Area	Science or wilderness protection
II	National Park	Ecosystem protection and recreation
III	Natural Monument	Conservation of specific natural features
IV	Habitat/ Species Management Area	Conservation through management intervention
V	Protected Landscape / Seascape	Landscape / seascape conservation and recreation
VI	Managed Resource Protected Area	Sustainable use of natural ecosystems

Source: IUCN, 1994.

The proportion of protected areas is increasing as more land and sea territory is brought under protected area management (Table 4). However, many of these protected areas are protected in name only and are characterised as “paper parks”, *i.e.* areas that appear as protected areas in the government books but in reality are dedicated to other uses.

Table 4: Protected Areas in Southeast Asia

Country	Land area 1000ha	Protected Areas (PAs)		
		Number PAs	Area 1000ha	% of total land area
Brunei	527	31	121	21
Cambodia	17,652	23	3,267	18
Indonesia	181,157	1069	34,512	18
Lao PDR	23,080	20	3,000	13
Malaysia	32,855	149	1,527	4.6
Myanmar	65,755	3	173.5	0.3
Philippine	29,817	19	1,454	4.8
Singapore	61	5	2.9	4.7
Thailand	51,089	204	10,954	21

Source: The ASEAN Regional Centre for Biodiversity Conservation (2001).

A recent study found that the majority of protected areas in this region are reasonably successful at stopping land clearing, and, to a lesser degree, effective at mitigating logging, mining, hunting, fire, and grazing (Bruner *et al.*, 2001). New approaches to protected areas based on recognition of local community rights and on co-management are jeopardised by old-style conservation thinking that

continues to see protected areas in terms of fortresses. Such thinking continues to be powerful and influences the activities of governments (Stevens, 1997).

Biodiversity and Protected Areas in the Lao PDR

The Lao PDR still maintains a rich endowment of forest resources and biodiversity (Manivong & Sandewall, 1992). Its wildlife fauna includes some 1,250 species in which 37 % of the mammals, 19% of the birds, 22% of the reptiles, 17% of the amphibians, and 5% of the fish were considered internationally significant (Duckworth *et al.* 1999). Unfortunately, no formal plant survey has been carried out.

The Lao PDR is situated in between Cambodia, Myanmar, Thailand, Vietnam and Yunnan (China), each having 2 - 10 times the population number of the Lao PDR (Robichaud *et al.*, 2001). The current population in the Lao PDR is about 5.2 million people at a density of 22 persons per km², growing at about 2.4% per year (UNFPA, 2002).

In 1998, Lao PDR ranked 140th of 174 countries on the UN Human Development Index, which combines per capita income, literacy, and life expectancy (UNDP, 1998). With low economic diversification, Lao PDR has to depend on its natural capital, especially timber, hydropower, and NTFPs to support national development and the livelihood of its people. This reliance is accentuated by the demands of the nation's natural resource-demanding neighbours; together they create a significant and heavy pressure on the forest resource, and biodiversity, in the Lao PDR (ADB, 2000).

Since the early 1990s, government policy has emphasised participatory action with villagers to develop sustainable livelihood and conservation strategies (Pravongviengkham, 1998). In 1993, the Lao protected area system was developed with 20 National Biodiversity Conservation Areas (NBCAs) that cover about 12.8% of the country (Figure 1). The establishment of this protected area system was merely the start of a long-term process of developing a management system capable of protecting, enhancing and managing the valuable natural resource on a sustainable basis, for the benefits of the entire nation (Anon, 1999).

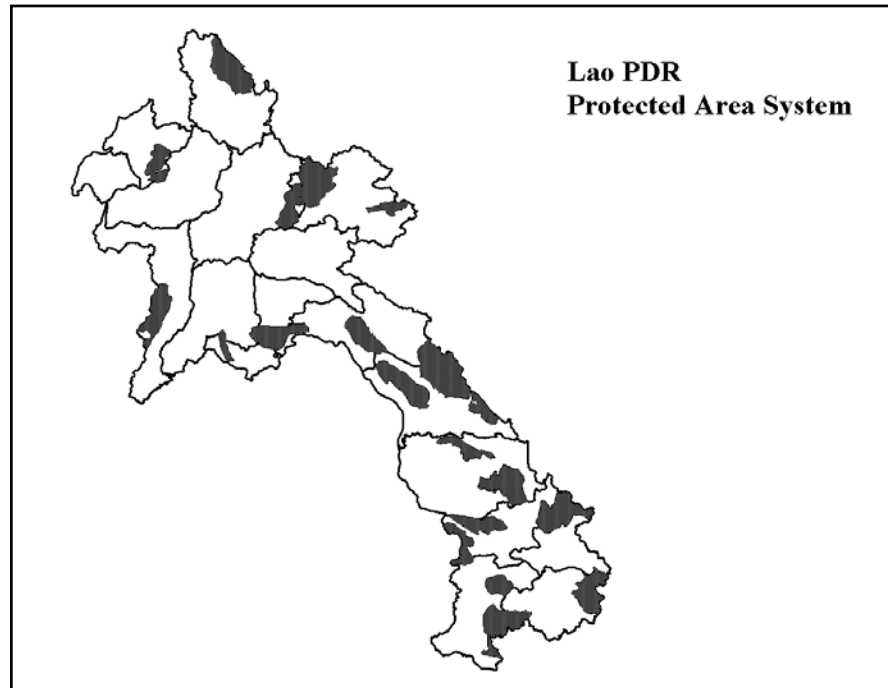


Figure 1. Map showing the National Biodiversity Conservation Areas in the Lao PDR

Lao's protected areas and surrounding lands are among the most remote and agriculturally marginal in the country. Their remoteness has contributed to their protection, since they have been inaccessible and viewed as economically unproductive. Human use of these once remote areas is increasing as a result of increased population growth in traditional communities, migration, and settlement, often being the result of problems and policies in other parts of the country (Chape, 2001). Both protected areas and the land around them face increasing degradation as a result of large-scale development projects, expanding agricultural frontiers, illegal hunting, logging, and uncontrolled burning.

According to 1998 data from the Conservation Monitoring Centre, threatened species comprise 220 plants and 151 animals, including 60 mammals, 72 birds, 10 reptiles and 9 fishes, in addition to the recently discovered Saola (*Pseudorx nghetinhensis*) and Giant Muntjac (*Megamuntiacus vuquangensis*) (Galt *et al.*, 2000).

Lao PDR is now decentralising the planning and management of protected areas to local stakeholders, based on the finding that local "ownership" of the protected area planning process and local responsibility for protected area management outcomes engenders a sense of caring and wiser use of the available resource base. Ensuring positive linkages between conservation and development is essential in the Lao PDR as 10% of the total number of villages in the country are located inside or closely outside the protected areas (Chape, 2001). The participatory

management policy is a foundation of great promise for biodiversity conservation in the country. The challenge ahead is to move promise to realisation.

Recent reviews of the protected area system in the Lao PDR

Despite mounting investment, protected areas in the Southeast Asia region continue to degrade, often so rapidly that they have ceased to be of importance for biodiversity conservation or economic uses. Many international organisations, donors, non-government organisations (NGOs), and national institutions have reviewed the protected area management systems. Some relevant reviews related to Lao PDR are discussed below.

MacKinnon (1997) made an assessment of protected areas in the Indo-Malay realm. He identified the status of, and major threats to, each protected area in the four countries (Cambodia, Lao PDR, Thailand, and Vietnam), and provided recommendations for strengthening, and in some cases extending, the protected area network.

Based upon a combination method (using total numbers of plant, bird and mammal species, weighted for endemism and land area), he ranked Lao PDR as moderately rich in species, but important for biodiversity conservation due to lower population compared to neighbouring countries. However, Lao forest biodiversity remains very little studied.

In the Second Southeast Asia Regional Forum of the World Commission for Protected Areas, Lao Department of Forestry (1999) presented its national report on the current status of protected area management system and clearly pointed out the decentralisation process and the approach to collaborate with local villagers for protected area management. Land use planning and livelihood developments with communities residing adjacent to, or within, the protected areas were important keys for accomplishing a joint management effort.

Robichaud *et al.*, (2001) carried out an intensive review of the national protected area system of Lao PDR between 1999 and 2001. The review provides detailed information on a wide range of protected area issues in the Lao PDR, including their current status, biogeography, policy and legal framework, management models and pressures, as well as an analysis of future options for funding, design and management. The main conclusion was that each NBCA has its own problem and change over time. Further, the concept of adaptive management could probably be implemented to meet the needs of the NBCAs.

The ongoing critical evaluation of protected areas and their role in the socio-economic development of the four countries of the lower Mekong River region (Cambodia, Lao PDR, Thailand, and Vietnam) is a joint undertaking by the major stakeholders (*e.g.* International organisation, donors, NGOs, and national partners). The review work ran from July 2001 to August 2002, and a regional delegation will present the results at the World Parks Congress in September 2003,

in Durban, South Africa. It is seeking to better define the benefits of protected areas for development and to have those benefits reflected in economical decisions.

Objectives

The main objective of this study was to develop approaches that could support a sustainable management of natural resources and biodiversity in forest conservation areas, with special emphasis on conditions in the NBCAs of the Lao PDR.

The specific objectives were (with reference to the papers of this thesis where they are addressed):

- To analyse the forest policy development process in Lao PDR in the context of globalisation. (Paper I)
- To develop a management approach for protected areas that integrates objectives of environmental protection and other socio-economic development. (Paper II and III)
- To review and structure research related to utilisation of non-timber forest products, with emphasis on Southeast Asia. (Paper IV)
- To propose and evaluate a methodology for quantitative assessment of cardamom. (Paper V)

The key question was how to integrate local tradition and experience with new knowledge and management models in participatory land management in Biodiversity Conservation Areas.

Materials and Methods

The study areas

The main study site was Nam Pui NBCA of the Sayabouli province. Some of the ideas and methods applied were developed in another study area, the Upper Nam Nane watershed of the Luang-Prabang province (Figure 2).



Figure 2. Study areas within the Lao PDR

The Nam Pui NBCA is about 190,000 hectares and is situated along the international border to Thailand. The vegetation is a dense mixed deciduous forest with pockets of evergreen forest, where natural teak (*Tectona grandis* (Linn) F.) stands are found. The area provides the only indigenous teak genetic source in the country, and it has been reported as the last home of endangered mammal species e.g. the Asian elephant (*Elephas maximus* Linnaeus) (Robichaud *et al.* 2001).

The human system comprises 45 stakeholder villages with a total population of about 24,500 persons, a varying number of military groups for international border security with Thailand, and an unknown number of nomadic forest dwellers (Malabri or Thong Lueang) (Flint & Chanthavong, 1998).

Two separate villages: an enclave village (Ban Vangphamone) and an external village (Ban Phongsack), were selected as the main study sites for developing and testing participatory land management approaches for biodiversity conservation areas.

The study area of the Upper Nam Nane Watershed covers about 9200 ha. It includes seven villages and is located within the Nane district, Luang Prabang province. About 57% of the total area is currently considered as reserves, protection forest or regeneration forest land. Some 7% of the area is forestland without forest cover, which has previously been used for shifting cultivation.

The population is about 2,600 persons, comprising three main ethnic groups, Lao, Hmong and Khamu. Six of the villages have been settled in the area for 50 – 120

years. Over the last 70 years, the population has increased ten-fold and people have developed their agriculture practice from pioneering shifting cultivation into a more stable rotational swidden-based agriculture system. In recent years they have been exposed to a number of government strategies, new infrastructure and development projects (Sandewall *et al.*, 1998).

Problem analysis

The objective of the study was to develop approaches that could support a sustainable management in biodiversity conservation areas. The objective includes several issues. Those issues and how they were addressed in the study are summarised in Table 5 and further elaborated in the following sections (see also Figure 3)

Table 5: Major issues addressed in the study

Issue	How it was addressed in the study
1 Who are the stakeholders?	In the study, there were local stakeholders, mainly the villagers living within and around the study area, and external stakeholders, mainly the government.
2 How do the different stakeholders influence the management in the area?	The government defines policies, laws and regulations. The villagers manage and use the resources based on their own situation, e.g. livelihood and tenure rights.
3 What policies, external and internal rules, and other forces influence the area?	Policies, legislation and effects of globalisation were analysed based on official documents and literature (Paper I). In addition an overview and summary of NTFP research in Southeast Asia was conducted (Paper IV)
4 How to establish a common platform among stakeholders to agree on the management?	In the study, various participatory methods and tools for assessment of the current situation, analysis of future alternatives, and consensus building were elaborated and tested (Papers II, III and V). The methods and tools were based on stakeholder interaction.
5 How to define the current situation in the area, such as land use, nature resources, and people's needs, including historical developments?	A number of techniques for data collection and assessment were tested and evaluated (Papers II, III and V).
6 How to analyse and discuss the situation and the various options for management and future development?	In the study, scenario techniques in combination with stakeholder discussions were tested and evaluated (Papers II and III).

Overview of the study

The study process began with an analysis of Lao forest policy in order to identify the priority study fields (Paper I). The current policy aims at conserving remaining forests for biodiversity protection and at restoring degraded forestland for local use as well as for producing export commodities for the international market. Local people's participation is a cornerstone in all these activities.

Integrated land use planning was developed and tested in the selected stakeholder villages of Nam Pui NBCA (Paper II) and Upper Nam Nane watershed (Paper III). It included a variety of participatory techniques and simple sampling methods for capturing village data and information, and determining and analysing the historical and current situation. The Area Production Model (APM) was used for developing land use scenarios (Grylle, 1997).

A review of NTFP research in the Southeast Asia region was carried out to highlight relevant research activities and development trends (Paper IV). Fulfilment of conservation objectives depends on consensus among stakeholders on how to share resources for income generation. In Paper V, a method for quantitative assessment of important NTFP resources, such as cardamom, was tested and evaluated. The method is designed so that local people can participate and thereby influence the resource sharing arrangements within and around the protected areas.

A multi-disciplinary research team of four persons with different backgrounds (a forester, a conservationist, a sociologist, and an agronomist), was formed to work in collaboration with local key informants (paper II, III, V). The integration of techniques from social science and natural science was emphasised to encourage local participation. Participatory processes were applied in the study, since they provide means to collect data and information, and analyse them (Buchy & Hoverman, 2000). Participation also contributes to increase trust and co-operation, and develops a sense of ownership by involving local people in the decision-making (Furze *et al.* 1996).

In the following sections, the main methods used in the study will be described.

Forest policy analysis

The analysis of the forest policy development in the Lao PDR, as set in an international perspective, was based on a review of official documents, international study reports, donors' critical reports and other literature. The study (Paper I) basically covered the period after decolonialisation, from 1954 and onwards. By necessity, the study includes many documents, which have not been peer-reviewed or internationally published.

The initial policy analysis revealed many contact points between international policy developments and the developments in Lao PDR. To further analyse the

impact of globalisation on Lao forest policy development, an analytical framework (Held *et al.*, 2000) was used (Paper I). The framework comprises spatio-temporal and organisational dimensions as given below.

The spatio-temporal dimension comprises:

- the extensity of global networks;
- the intensity of global interconnectedness;
- the velocity of global flows, and
- the impact propensity of global interconnectedness.

The organisational dimension comprises:

- the infrastructure of globalisation;
- the institutionalisation of global networks and the exercise of power;
- the pattern of global stratification and
- the dominant mode of global interaction.

Important goals of using the framework are to illustrate the processes of policy development and to provide evidence illustrations of policy implementation at local level.

For practical purposes, the study was concentrated on the development in one sector only, the forest plantation sector. However, the framework is seen as a tool that would also be applicable for analysing globalisation in relation to forest protection and conservation.

Participatory techniques and tools for capture and analysis of data and information

Participatory techniques cover a wide variety of tools and methods that can be used in collaboration with local people to gather information about local conditions. Some participatory techniques are used for gathering information; others are mainly designed to promote people's participation (Kanji and Greenwood, 2001). Two main participatory techniques used in the studies (Paper II, III, V) were Rapid Rural Appraisal (RRA) and Participatory Rural Appraisal (PRA). In addition, sampling, remote sensing and scenario techniques (APM), all based on stakeholder interaction were tested as resource management tools.

Rural appraisals

RRA enables outsiders to understand rural conditions quickly; it combines methods from various disciplines to yield relevant data (Messerschmidt, 1995). Researchers make no attempt to know all the questions ahead of time but allow for program changes as learning accumulates. They always use triangulation, i.e. crosschecking data by multiple methods, to quickly validate or reject findings;

commonly knowledge from many different disciplines and informants are brought together (Paper II, III, V).

The PRA was developed in the 1980s in the search for practical research and planning approaches that could support decentralised planning and democratic decision-making, value social diversity, and enhance community participation and empowerment (Chambers & Guijt, 1995).

The PRA used in this study was based on a series of work sessions with local people or groups of local stakeholders that led to the establishment of many activities such as historical profile assessment, key informant interviews, household interviews, village dialogue (Paper II, III), local knowledge assessment, participatory mapping, field observation *etc.* (Paper V). It reflected the vision on the village situation and encouraged the dialogue with researchers.

Systematic point sampling with local key informants

To gather data about current land use, a systematic point sampling inventory design was used. The survey covered the entire area studied by a systematic grid of sampling points. The distance between the points was set to achieve a certain level of precision (*cf.* Thompson, 1992). Sampling points were allocated by use of different techniques depending on the local situation and available tools. Aerial photos (Paper III) or topographic maps (Paper II) were used as a base for the inventory. The research team, together with local key informants, visited every sample point. They observed and recorded variables useful for land use planning and conservation objectives. The general idea was to combine objective measurements and observations in the field with local information from persons with good knowledge of the past and present land use in the area. The discussion between local key informants and researchers generated information on historical, present and intended future land use and related issues (*cf.* Sandewall, 2001).

Remote sensing

In the Upper Nam Nane Catchment Area, remote sensing was applied as a complementary technique to point sampling (Paper III). The purpose was to confirm the information on historical land use given by local informants. A cluster of sampling points per photograph was allocated in the central part of each image to form a grid of 74 sample points in the catchment area. Those points were identified on panchromatic aerial photos from 1982, a Landsat TM satellite image from 1967, and panchromatic aerial photos from 1953. Land use was assessed in the images (*cf.* Sandewall, 2001).

In the Nam Pui NBCA study (Paper II), panchromatic aerial photos from 1982 were used to trace the historical land use development. This information was useful in the discussions (Sawathvong, 2000).

Two-phase sampling for cardamom assessment

Two-phase sampling is a design in which initially a sample of units is selected for obtaining auxiliary information only. Then, a sub-sample is selected in which the variable of interest is observed in addition to the auxiliary information (*cf.* Thompson, 1992). The purpose of two-phase sampling is to obtain better estimates by using the relationship between auxiliary variables and the variable of interest (Paper V).

This methodology was used for developing participatory NTFP (*e.g.* cardamom) assessment methods. Participatory mapping of cardamom resources generates auxiliary information such as cardamom distribution, and site productivity. It provides a good base for selection of sampling units for the phase two field sampling. Two inventory techniques, plot sampling and strip surveying, were tested and evaluated from the point of view of applicability for villagers.

Scenario analysis

The APM is a simulation model, originally designed by Nilsson (1982) as a tool for strategic planning of land use and forestry. Since then, it has been upgraded in various versions and tested in case studies, workshops and some large-scale applications in a number of countries worldwide, including Lao PDR.

Technically, the APM is a computer program for developing scenarios on future demography, land use, fuel wood balance, plantation development, *etc.* In general terms, it describes the development over time of production and consumption in agriculture and forestry within a defined geographical area under different assumptions on management, land use, and socio-economic and micro-economic changes (Sandewall & Nilsson, 2001).

The APM is aimed to be used for various purposes, such as helping users to understand and analyse land use changes, identifying data requirements, and outlining strategic development options (Grylle, 1997).

An APM scenario can be run for any defined geographical area. In this study it was used on village level (Paper II) and for a watershed (Paper III). The required input data is multi-disciplinary to describe the current situation and the rate of current and expected future changes. Some of the most important input variables when using the APM are listed below:

- Total area divided on different land use types
- Population and population growth (subdivided on urban and rural population)
- Economic growth per capita
- Land productivity in agriculture, and change in productivity over time
- Production of different agriculture and forest crops
- Demand and supply of timber and fuel wood

Results and Discussion

A major finding of the study was that the current forest policy, important strategies and legislation, supported local people's participation in land use planning. It clarifies the roles of the various stakeholders in the collaborative management process and recognises the customary rights and practices of local people as the starting point for natural resource management. The study also suggested that in order to develop a sustainable resource management in protected (and other) forest areas one should use and integrate local and scientific knowledge to establish a common and accurate understanding of the current situation among stakeholders. The approach tested and evaluated in the study, comprising a set of tools, techniques and procedures, exemplifies how the work could be done (Figure 3).

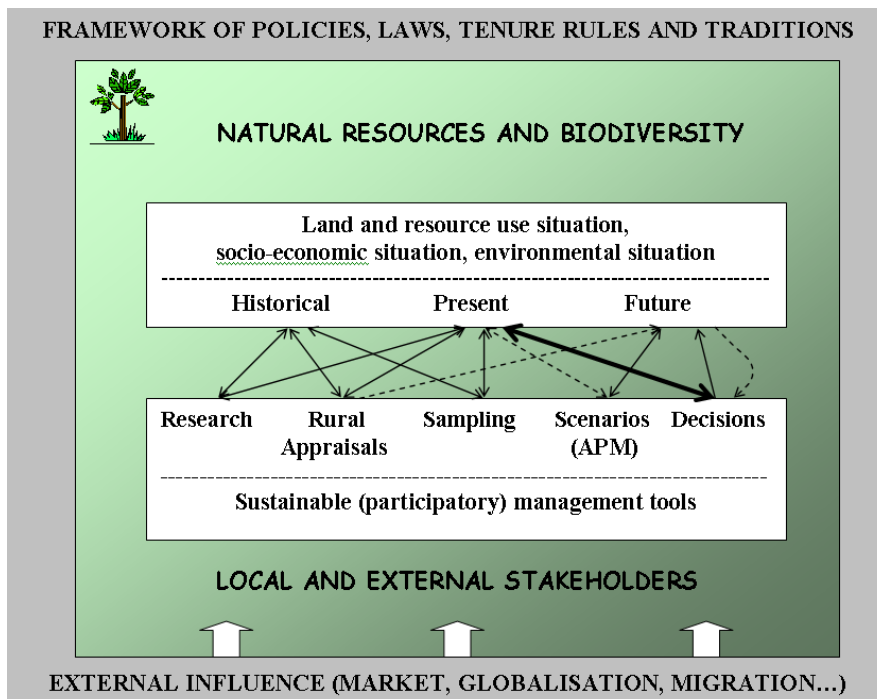


Figure 3. The outlined concept for participatory land management in biodiversity conservation areas.

Forest policy framework in Lao PDR

Today the global problem of forest degradation and deforestation is still on the top of the agenda of various state and non-state institutions and organisations (Eigen, 2000). Since the late 1980s, various initiatives at the local, national and international level have been implemented with little success in solving the problems of deforestation on their own (UN, 2000). Therefore, developing consensual knowledge on how to address the global challenge of deforestation and forest degradation is a relevant issue.

As indicated in Paper I, many developments in the forest policy of Lao PDR have coincided with international processes, *e.g.* the TFAP process and in the aftermath of the UNCED meeting.

Although TFAP is no longer functioning as an international initiative, the principles of a programmatic approach achieving a country-led forest programme is still being maintained (Liss, 1998). The establishment of a country-specific process on the formulation and implementation of a national forest programme serves the public interest in sustainable management of the remaining forest resources. This was led to a more generic concept of a national forest programme capturing the various national approaches to forestry development and being a complement to the recent policy of the United Nations Forum on Forests (UNFF).

The case studies (*e.g.* Paper III) gave historical evidence that local development, demography and resource management have been significantly influenced by national policies, especially when those policies have coincided with local people's needs to improve their own situation, *e.g.* improved infrastructure, access to markets and new technologies, while more prohibitive policies have been less successful.

By use of the framework of Held *et al.* (2000), it was shown that Lao PDR has not only become part of global policy processes, but also managed to contribute to them with the development of its own indigenous system in an interactive process.

Management planning for the protected areas in Lao PDR has been guided by a clear policy to involve local stakeholders. Further, the forestry law and current regulations on wildlife and protected areas support local management (Anon, 1999). In that respect, Lao PDR may have a different policy compared to *e.g.* Thailand, where many efforts have been made to involve local communities in managing the natural resource, but these communities have not yet been granted legal rights.

In plantation forestry, Lao PDR has taken a different stand than other countries in the region by focusing on individual rather than community based operations and by setting up socio-economic and environmental criteria to avoid large scale industrial plantation. This practice creates a mosaic of plantations along with green natural forest patches, which promotes biodiversity preservation (ADB, 1999). In

a globalisation context, the operation is part of a global net work having foreign companies, such as IKEA, as clients. An increasing export of processed products for house-ware from plantations is foreseen.

Globalisation may have considerable consequences for the distribution of power and resources between and within countries. The Lao PDR is currently subject to increased globalisation, changing the nature of natural resource management (ADB, 2000). New interventions such as protected area systems and plantation forestry as applied in the Lao PDR have impacts on traditional social structures in the country.

A Lao PDR farmer in a village without roads along the Mekong Basin could be used as one example. He is currently being engaged in plantation forestry, based upon credit and the wood market, which is connected to the global entity through a network of institutions, norms, values and forces beyond his or her control. Likewise, a farmer living in a remote area, designated a protected area, is now part of a global concern about nature conservation and is also part of a global economy of marketable products and services.

Research on land use history

A basic assumption of the Nam Nane catchment study (Paper III) was that one can learn from the past when trying to understand the present situation and elaborating strategies for the future development. The approach was to trace and describe the historical development and analyse that information in combination with data on demographic, socio-economic, agricultural, environmental and political conditions in different years. In this way one can better understand how government policies and other factors have (directly or indirectly) influenced land-use, life and decisions of the people (*cf.* Sandewall et al. 1998).

In a case such as the Nam Nane Catchment Area, an area with stable population, long historical settlements, good access to communication and market, it was relatively easy to analyse the historical situation and subsequently discuss future management strategies (with or without scenarios). The Nam Pui NBCA provided a quite different case with an unstable population, new settlement villages and limited market access due to its remote location. Analysing the history was more complex in this case, but it was still a feasible way of approaching management issues in collaboration with the stakeholders.

The conclusion of the Nam Nane catchment study was that when combining various scientific methods and local knowledge, it initially resulted in data of varying quality and meaning, but the research process eventually led to consensus on how to interpret those data. It also encouraged the villagers to present information and issues that were new for the researchers. The historical perspective provided an important background to the analysis and discussion about current and future development.

Rural appraisals

Based upon the field experience during the study (Paper II, III), there was a number of problems associated with both the RRA and the PRA. The team generally lacked the possibilities to verify the information in an objective way. Sometimes, the villagers were biased and had a substantial number of issues they wanted to pursue, all of which did not necessarily contribute to a correct description of their reality. Land areas sometimes had to be estimated based upon either anecdotal or old information. This also was the case in a study by Sandewall *et al.* (1998). Villagers often provided normative statements and the process easily became politicised. In addition, there were incentives for giving biased information, for example due to tax issues (*cf.* Sawathvong, 2000). Also it was difficult and time consuming to ascertain that, for instance, all strata and interest groups of the village were represented (Paper II, III).

The quality of the PRA exercises was found to vary with the PRA team, the experience gained and the attitude of the villagers. However, in general the PRA practice encouraged the development of good attitudes among village people (*cf.* Pratt, 2001). A multidisciplinary research team was found to be required to fill all gaps and worked well in the study (Paper II, III).

Papers II and III showed that the PRA results were sensitive to the selection of key informants. To compensate for bias and misunderstanding caused by less suitable key informants, controlled household sampling turned out to be an effective tool, especially when it included field observations and not only interviews. One example was the issue of permanent land tenure. According to the key informants, each household had three plots of land (plot size of 1 hectare) for cultivation, but the interviews and visits to sampled households verified that the households had at least five plots that they used on a rotational basis.

Local skills need to be developed, *e.g.*, in communicating information in a form understandable to researchers with access to resources for development (*cf.* Chambers & Guijt, 1995). In Paper II, PRA revealed how the availability of useful species was not simply a function of their abundance per area, but also of factors that limited access to resources, such as tenure rights, seasonal availability or proximity to roads and paths.

As pointed out by Chambers (1994), the use of participatory techniques does not guarantee participation and empowerment. PRA tools are useful for appraisal but not for in-depth analysis. However, when integrated with other data capture tools, such as sampling, remote sensing and, scenario techniques, a deeper and more accurate description and understanding of the situation was achieved (Paper II, III).

Systematic point sampling

The systematic point sampling served to provide accurate and statistically reliable data about past and present land use (Paper II, III). The different approaches, such as use of local knowledge and systematic point sampling, were mutually supportive. They offered a powerful tool for rapid assessment of the current land use, its changes, trends and underlying causes (*cf.* Sandewall, 2001). Village key informants who know well the current and previous land use practices that accompanied the field team and told about the use of land 5, 10, 15, and 20 years ago, at the points visited. This gave a good picture of the stability or the dynamics of the land use and provided input data for modelling historical land use developments as a mean for formulating scenarios for the development of future land use.

The use of local knowledge from key informants covered broad subjects such as land use types, land tenure system, wildlife habitat, corridors, biodiversity species identification and ecological zones. As shown by Sawathvong (2000), it can be applied with or without such tools as air photos and satellite images, but a good topographic map and some basic understanding of sampling is required. The fieldwork (Paper II, III) showed, as many times before, that there might be big differences between actual land use and land use according to official statistics. The systematic point sampling method was developed as a tool for land use planning (Sandewall, 2001) but was also found useful for controlling and monitoring the current land use of protected areas.

The integrated method for capturing data and information tested in this study was flexible and its various techniques complementary and brought the researchers and planners close to reality. The compilation of data based on local knowledge and systematic observations produced valuable data for the land use zoning of forestland in the villages as well as input data for analysis and scenarios.

Participatory inventory methodology

The strategy for the development of a method for quantitative assessment of certain NTFPs, such as cardamom, was to integrate social science techniques with quantitative plant inventory methods. As Peters (1996) points out, the collection of local knowledge is often the quickest and cheapest means of obtaining basic information about a resource in an area. Two-phase- sampling (Thompson, 1992) was found suitable for this purpose because with this method it is possible to combine knowledge of subjective kind with objectively collected data from a sample-based survey (Paper V).

There is a debate whether or not participatory inventories can or should be biometrically rigorous (Wong, 2000). The formal inventory science is often understood in a narrow sense of analysing resources isolated from human perceptions, knowledge and action. This means that an emphasis is put on assessing the resource situation from an outsider's perspective, ignoring the way

local people understand and respond to the issues (Carter, 1996). Paper V showed that the involvement of local people in the inventory work had a great advantage, since local people's ideas and judgement could be incorporated into the sampling design and the implementation. It also helped to develop a sense of responsibility for sustainable natural resource management and understanding of biodiversity conservation.

Ojha (2002) points out that in Nepal, the current participatory forest inventory policy is a result of widespread concern for sustainability of community forest management. However, there is a need of extra efforts, knowledge, and skills on the part of both villagers and foresters to implement the policy.

An ideal participatory inventory design is one which is simple, but can be developed into a more complex form of assessment when, and if, local expertise and demands for accuracy increase. It can be expected that the greater the level of local people's participation, the greater the needs will be for a comprehensive training programme.

APM for land use planning

Models that describe land use developments and changes in forest cover are fairly common. However, many models are designed by and for researchers and are not used in practice in forest and land management. There is also a bias towards large scale models, e.g. deforestation models, based on regression and similar techniques while simulation models for local use are less common (Kaimowitz & Angelsen, 1998).

The model used in the study, APM, was applied on local level as an interactive (participatory) management tool. It was used as a frame for data collection, as an interactive tool for analysing and discussing quality and relevance of data, including historical developments, and as a strategic instrument for discussing and negotiating future development options and strategies among villagers and other parties concerned (Paper II, III).

The study (Paper II) gave a good example that APM scenarios could be used as the base for discussions with the villagers of how to maintain and protect the forest area.

Population growth could directly affect the land use management of protected areas. APM scenarios illustrating historical population growth and projections over the next 50 years were very useful for initiating discussions on family planning (Figure 4).

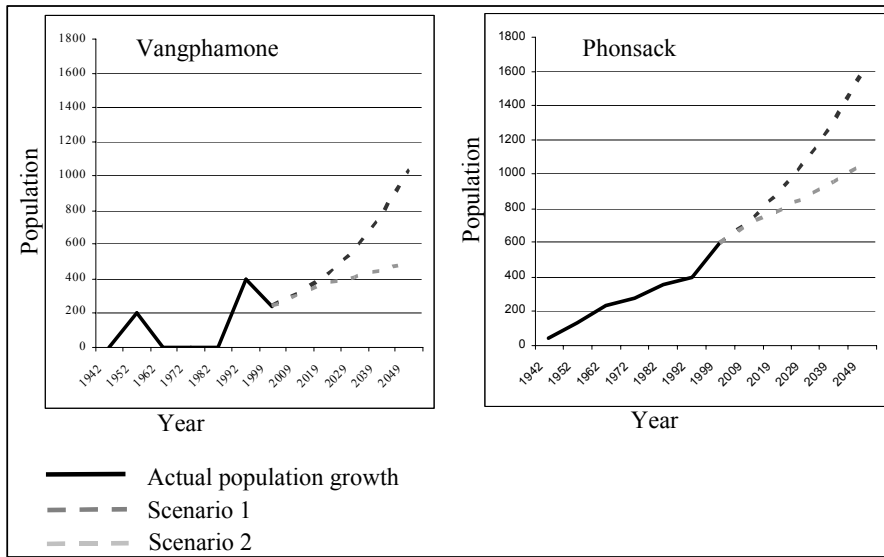


Figure 4. Example of APM scenarios on population growth in the two main study villages (Actual growth 1942-1999 and simulated growth under different assumption 1999-2049)

Population growth has increased the demand for resources such as land for subsistence and market food production, and sometime also for cash crop production. The consumption of fuelwood and other forest products also has increased, which has led to land use conflict and encroachment into the protected area.

The analysis and discussions of causes of changes in agricultural land areas and their consequences for the use of the forest (Table 6) and related socio-economic issues were intensive and constructive.

Table 6. Example of an APM scenario on land use transfer in Vangphamone village 1999-2049

Year	Land used for crop production	Remaining areas (hectare) after land transfer, classes as listed below.							Total area
		1	2	3	4	5	6	7	
1999	330	46	20	673	0	0	1,222	4,086	6,377
2004	364	12	20	673	0	0	1,222	4,086	6,377
2009	385	0	11	673	0	0	1,222	4,086	6,377
2014	389	0	7	673	0	0	1,222	4,086	6,377
2019	375	14	7	673	0	0	1,222	4,086	6,377
2024	355	34	7	673	0	0	1,222	4,086	6,377
2029	338	51	7	673	0	0	1,222	4,086	6,377
2034	323	66	7	673	0	0	1,222	4,086	6,377
2039	308	81	7	673	0	0	1,222	4,086	6,377
2044	295	94	7	673	0	0	1,222	4,086	6,377
2049	284	105	7	673	0	0	1,222	4,086	6,377

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= natural environmental forest, in-accessible

6= natural environmental forest, protection areas

7= natural environmental forest, reserve forests

The generalised example from Phongsack village (Figure 5) illustrated an imbalance between production and consumption of fuelwood as a result of increased population and fuelwood selling business.

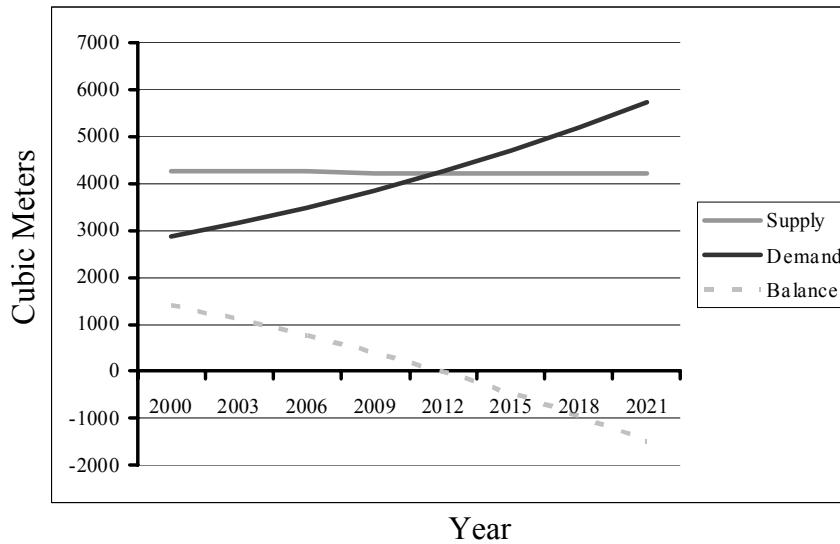


Figure 5. APM scenario on energy balance during 2000-2020 in Phongsack village in the study area

Using the APM as an interactive management tool required that the data needed by APM coincided with the data used in local management, and also that the development reflected by the model was so realistic and transparent that people can draw the needed conclusions from their data and the scenarios developed.

APM scenarios on population, agricultural production and fuelwood consumption were helpful for interactive discussion between researchers and local villagers in order to have a common understanding for sustainable utilisation of natural resources in the protected area. However, several technical shortcomings of the model were identified in the study (table 7). Some of them suggest that the model need to be improved or developed while others highlight important research fields or issues where the planning procedures might be reconsidered.

Table 7. Some shortcomings in the current APM version encountered in the study

Issue	Shortcomings	Comments and suggestions
Overlapping land use	The area approach of the APM does not reflect the overlapping land use in such integrated agriculture, agro-forestry and sylvo-pastoral systems that are common in the study areas.	As a consequence (a) it is hard to separate subsistence crops from marketed ones (b) grazing and animal husbandry is poorly reflected in the model.
Aggregation of crops with different yield	All agriculture crops can be aggregated in three classes only, based on the use of the crop.	Therefore, crops with much different yield (in kg per ha) must be aggregated, and means become rough. Additional classes should be considered.
Crop damage	Insect and wildlife damage seriously influence crop yield and life quality in the forest villages. The uneven crop yield from year to year is only reflected in the APM as an average reduction in yield over five years.	A general reduction of 20-30 % of "normal yield" were adopted in the study in Nam Pui NBCA (paper II).
Shifting cultivation	Public statistics and official planning often use cultivated "net area" for estimating areas used in shifting cultivation, while fallow land is usually not considered. The model is designed to consider all areas used over a fallow cycle.	To provide realistic scenarios, one might use "gross area" (i.a. all areas allocated for permanent and shifting cultivation) as agriculture land. Alternatively, "fallow length" and "net area" could be integrated as input variables in a modified version.
Transparency of land use changes	The scenarios illustrate trends for development but are not linked to maps, which are often needed in local management discussions.	Introduction of a simple GIS component in the APM would be a useful complement for local use of the model.
Land use transfer	Transfer of land use is strictly linked to initially defined priorities, which generates less realistic scenarios.	A more dynamic system for land transfer to be developed.
Classification of land use	The predefined FAO classification is not adapted to local standards.	A version of the model allowing local users to define classes.
Non Timber Forest Products	NTFPs represent a very important cash income in forest villages.	Development of an NTFP component in the APM.

The findings of the study confirmed and complemented some other experiences made recently in Asia and Africa (Anon, 2002). Based on referred experiences, Nilsson (2002) recently introduced a prototype for an Excel version, which is more transparent in the sense that users can follow how all the calculations are made. For a user in a tropical country with technical background and interest, this opens up for local adaptation and development work. However, for extension staff concerned with planning and resource management, the primary need might often be to find solutions, which are illustrative and can be read in the local language and stimulate visionary thinking.

The role of NTFP research

Research and development of NTFPs is a challenging field, because it involves a change from conventional timber management towards an approach to ecological, socio-cultural, technological, trade and institutional issues associated with multiple use of forest and conservation objectives.

In recent years several driving forces have emerged, which promote NTFPs as tools for rural livelihood development and biodiversity conservation (Angelsen, pers. comm.):

- The international debate highlighting the need for such sustainable solutions, which can promote both local income growth and forest conservation.
- A rising awareness among forestry professionals that “forest is more than timber”.
- A gradual change in attitude by governments, which previously tended to neglect NTFPs in favour of timber, towards an increased focus on local resource use and poverty issues.

As a result (Paper IV) the interest in NTFP research has increased due to the recognition of the contribution of such products to household economies and food security, and to environment objectives such as the conservation of biological diversity (*e.g.* Rijsoort, 2000). The NTFPs can serve as a stimulus for forest conservation by adding economic value to the forest and generating incomes (*e.g.* Fisher, 2000).

There is an ongoing international debate on the potential for commercialising NTFPs involving, *e.g.*, researchers and NGOs. Some studies indicate that NTFPs commercialisation does not necessarily provide opportunities for development of the rural poor in or adjacent to forested areas (*e.g.* Arnold & Ruiz Pérez, 2001). Instead, it is suggested that the idea of promoting conservation through NTFPs commercialisation needs to be revised because the selective nature of market demand and the uneven distribution of non-timber forest resources could make the resources altered and degraded. Nevertheless, subsistence use of NTFPs generally remains large and very important to rural livelihoods.

For most rural communities in Southeast Asia, management of NTFP resources is only a part-time activity that is combined with other land-use activities (De Beer & McDermott, 1989). This study (Paper II, III) has also shown that the utilisation of NTFPs is integrated within the total livelihood system of local people. Therefore, research should not focus primarily on the role of NTFP production in combination with forest conservation, but on the role of NTFP production within integrated land-use systems.

While the subsistence use of NTFPs hardly affects the structure and composition of the forest, commercial NTFP exploitation often exceeds sustainable levels (*cf.* De Jong & Utamam, 1998). The challenge is to develop sustainable harvesting methods for products extracted from natural forests. In order to succeed with that, it is necessary to carry out quantitative resource assessment and sustainable management planning through a participatory approach. Paper V of this study was developed for this purpose.

Integrated land use planning in protected areas

The participatory land management planning approach to biodiversity conservation through reciprocal agreements was found to be an inclusive strategy for establishing and strengthening partnerships through which all of the relevant stakeholders were involved in a substantial way in planning and management activities (*cf.* Phillips, 2000). For Nam Pui NBCA, such planning is particularly relevant in situations where the active commitment and collaboration of stakeholders is necessary for managing the protected area, and where access to the protected area natural resources is essential for local livelihood security and cultural survival.

The core element in integrated land use planning is the dialogue amongst all stakeholders to reach decisions based on consensus (*cf.* Amler *et al.* 1999). In the study, a major task was to accompany and motivate all stakeholders in order to obtain a conciliation of interests concerning land resources, types and extent of land use. The process covered all steps from the collection of data and information by using multidisciplinary methods, to data processing, analysis, and negotiations for reaching consensus concerning the form of land use to be practised in the protected area (Paper II).

The awareness of the need to acknowledge and involve of stakeholders in land use planning and management emerged in the early 1970s and grew through the 1980s and 1990s (ODA, 1995). Today, the involvement of stakeholders is a prerequisite for good land resource management because it has the greatest likelihood of promoting long term sustainable land use as well as biodiversity conservation. However, in the case study (Paper II) the non-permanent settlers groups (*e.g.* the Malabri groups) were not included in the stakeholder process and the Military groups accepted the process but could not participate regularly due to their varying numbers and their administration system. In Nam Pui NBCA, the villages were the main stakeholder actors of the protected area management system.

The study considered that clusters of villages could be selected which introduces a “management area” approach to land use planning rather than a “village approach”. The management area is formed by a group of villages; this is important since large areas must be managed in a co-ordinated manner in order to ensure corridors for wildlife movements to be maintained (*cf.* Jones, 1999).

Other advantages of unifying villages in planning could be enhanced inter-village understanding and co-operation, facilitated boundary delineation, resolved boundary disputes, and better forestland use zoning. The stakeholder villages will have similar forest and agricultural land management regulations and agreements, which the people understand and can manage. It may also strengthen the capacity of the village residents to repel undesirable exploitation from outside (Sawathvong, 2000).

Paper II outlined how integrated land use planning for multipurpose zoning (Figure. 6) can defuse potentially confrontational situations and enable win-win arrangements in which local people are permitted to use resources in less sensitive ecological areas, cultivate valuable forest products on-farm, and participate actively in forest protection and regeneration. Such compromises can accomplish long term protection of core conservation zones.

The purpose of village land use zoning was mainly to establish a clear boundary between agricultural land and forested land. To meet with the conservation objective, the forested land was further divided into three sub-categories: 1. “Village protection forest” mainly protected a water source including watering points and salt lick points; 2. “Village conservation forest ” considered cultural forest, natural teak stands as a gene bank source, wildlife habitat and corridors; 3. “Village use forest” where local people could employ subsistence forestry for their livelihood.

To enable a more scientifically sensitive approach to protected area planning, greater detail is required regarding the location of rare and endangered species concentrations, breeding grounds, migration corridors, and in general, a more sensitive and detailed ecosystem typology. Mapping these characteristics enables improved understanding of areas where high intensity utilisation by local communities could compromise conservation objectives.

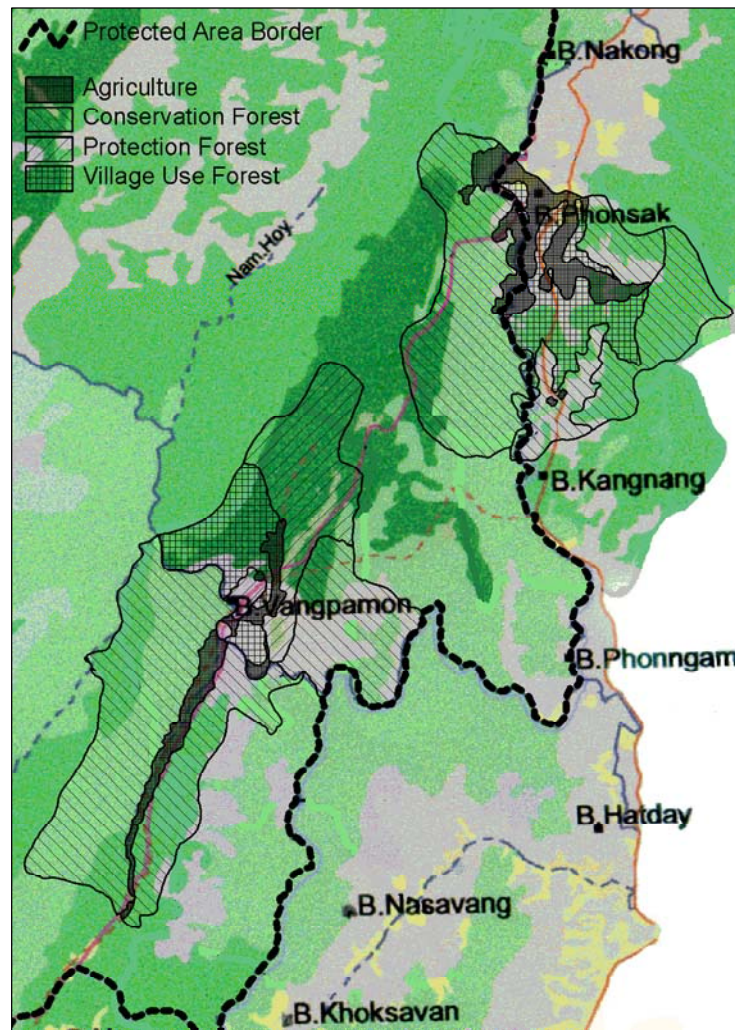


Figure 6. Land use zoning in the two study villages.

The experiences from this study showed that effective participation by local people depended on crucial issues like security of tenure, land rights, usufruct rights, and equity being squarely addressed and forming a part of the process of negotiating co-management agreements. Efforts to enforce associated rules provoked confrontations with local people, leading to a sense of injustice, and potentially, to even greater local disregard for conservation area policies and regulations.

Local villagers can be mobilised to help protecting conservation core zones from damage either by local people or outsiders. A sense of local ownership and co-

operation needs to be instilled with Military groups because along the international border to Thailand there is a restricted security zone (Figure 7). Drawing lines on maps to cordon off conservation areas from public use was insufficient as a demarcation strategy. Its application resulted in failure to capitalise on the potential for efficient use of some conservation area resources as a way of strengthening overall conservation objectives.

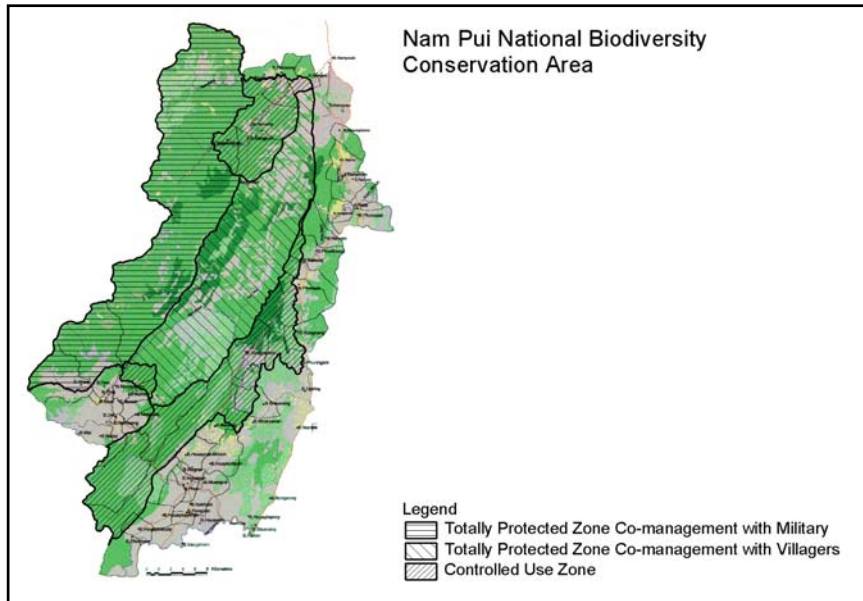


Figure 7. Nam Pui NBCA conservation zoning map

In the review by Robichaud *et al.* (2001) the issue of core zones or totally protected zones was discussed. The developer group suggested that core zones are inappropriate in the Lao context because protected area residents are heavily dependent on non-timber forest products and other forest resources, and in fact they may contribute to conservation through their indigenous management system. But in case of Nam Pui NBCA, a stronger focus on critical core zone protection would enable conservation area management, overall, to become more rigorous and effective. One core zone along the Thai international border was proposed to be co-managed with the military group and another core zone was proposed to be co-managed with stakeholder villages.

Environmental awareness raising and prohibitions on resource use have been insufficient at reforming local patterns of resource use. Economic dependency on products from within protected areas must either be made sustainable, or substituted with other economic alternatives (*cf.* Fisher, 2000). In the Nam Pui NBCA case, such alternatives include assistance with the collection of NTFPs *e.g.* resin, gum, and cardamom or the cultivation of NTFPs on farm *e.g.* paper mulberry. It was found that compromises are required, where villagers are

permitted to develop and implement sustainable management plans for products located within the protected area, in exchange for agreements to adhere to sustainable use commitments, and to join forces with the government to protect local areas from unsustainable use and incursion by outsiders.

In Philippine, Thailand and Vietnam, the recent developments of geographic information technologies have gained increasing attention. Participatory 3-D modelling have been introduced since attention has been paid to the relationships between the territory and its inhabitants (Rambaldi & Callosa, 2000). But a number of practical difficulties emerges once remote villagers are called upon to use topographic models and digitised maps without external support (*cf.* Puginier, 2002).

The author believes that success or failure of protected area management initiatives frequently boils down to whether or not a number of land use issues have been adequately addressed at the field level. The process of negotiating, observing and analysing indicators may be more crucial than the data gathered, and in particular can enhance benefit-sharing (*cf.* Lawrence, 2002).

Local villagers have complex relationships with their environment that need to be understood and taken into account in decision and policy making. The values that people attach to biodiversity will affect the ways in which biodiversity is assessed, and in turn the land use and natural management decisions that are based on these assessments (*cf.* McNeely *et al.*, 1990).

Many of the current challenges to improving the integration of effective protected area management with sustainable economic development now revolve around increasing capacity for the design of multiple use protected area zoning, conservation planning and management, and subsequently, enabling the application of leading edge social and scientific methods for effective integration of economic development with conservation objectives.

Conclusions

The cornerstone of this thesis is an approach for participatory land management planning, developed for biodiversity conservation areas in Lao PDR, so that these areas should be possible to maintain without sacrificing the livelihood conditions for people living in and around them. The management approach combines strict scientific methods and use of local peoples' knowledge and skills. Based on assessments of past and present living conditions and land use practices, scenarios are developed in order to illustrate the likely consequences of different management regimes. These scenarios form a basis for discussions of important decisions to be agreed upon by all stakeholders. Among other things, the decisions involve the appropriate land use zoning around villages in the biodiversity conservations areas.

Involvement of local people, and other stakeholders, in all parts of the planning process was found to increase the understanding and concern for land management issues. Moreover, by letting village people be partly responsible for the management of the conservation areas, former negative attitudes towards biodiversity conservation were shifted into positive concern and responsibility for the areas.

The novel part of the proposed management planning approach is that traditional PRA methods are combined with technically stricter methods, mainly remote sensing for assisting the assessment of historical land use, statistically based inventory methods to obtain reliable information on current land use, and use of a scenario modelling system in order to forecast the likely future conditions when managing the areas in different ways. The ambition was to develop the new components in such a way that they should be possible to use at local level, without major expert involvement. For example, a participatory inventory method aimed at cardamom assessment was developed; this method relies largely on local people's knowledge and skills.

The scenario system, *i.e.* the Area Production Model, was found to provide a good framework for the work. Particularly, the different scenarios worked out formed a very useful basis for the stakeholder discussions. However, several shortcomings of the system were found. Improvements of these would further improve the usefulness of the system in connection with solving land management problems of this kind.

As background studies, the thesis comprises an analysis of forest policy development in Lao PDR and a review of NTFP research in Southeast Asia. Among other things, these studies also point towards a need to develop participatory land management approaches, rather than basing land use policy on strict legislation and government decrees. Moreover, it is clear that NTFP collection can be used as an important means for villagers to benefit from protected forest areas without degrading forest conditions.

A general conclusion is that the development of land use management systems of this kind is a truly multi-disciplinary task. To be successful, social science techniques and natural science techniques need to be combined.

Throughout the thesis, the emphasis was put on the livelihood conditions of the village people and the likely development of these conditions. Assessment and forecasts of biodiversity in the areas were not addressed. The reason is that the overwhelming threat to biodiversity in the area is that villages expand their use of natural resources and that encroachment into the areas will further degrade the forests. Thus, once – hopefully – these problems are solved, it is an open arena for future research to develop methods for biodiversity assessment and forecasts within these areas.

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Acknowledgements

First of all I would like to express my deep sense of gratitude to Professor Ljusk Ola Eriksson, Head of Department of Forest Resource Management and Geomatics for giving me a challenge to continue my PhD research study.

My highness-respected priority is given to His Excellency Dr. Siene Saphangthong, Minister of Ministry of Agriculture and Forestry who authorised me to undertake this special opportunity. Special thanks to H.E. Dr. Ty Phommasack, Deputy Minister and Mr. Peung Insay, Director General of Personal Department who facilitated and simulated a smooth internal process. One that could not be forgotten is H.E. Phou Rasphone, Lao Ambassador to Sweden for his kindness encouragement.

My principal supervisor, Prof. Göran Ståhl, apart from his invaluable guidance throughout the whole process, has been very supportive, and my gratitude to him is both on a professional and personal level. I could not have written this thesis without your patient assistance.

I am thankful to Professor Nils-Erik Nilsson the originator of a relevant simulation model called “Area Production Model” (APM). He also encourage and share his valuable experience to my research study. I would like to acknowledge Dr. Tord Magnusson, Department of Forest Ecology, who spent his valuable time to make supportive recommendations in my pre-dissertation.

For creating a stimulation atmosphere and for good comradeship, I highly appreciated my assistant supervisor, Dr. Mats Sandewall and his family who took care of all kinds of matters concerned during my stay in Sweden. Special thanks to Kajsa Sandewall for her delicious and safe dishes (Osötat), and Mama Ingrid Sandewall who pray for my success.

I appreciated to work with Bo Ohlsson, a senior sociologist, since developing the Lao Tropical Forestry action Plan (1990) and until now we still share our experience on the development of forestry policy in Lao PDR. Thanks to Gun Ohlsson to facilitate our working condition. Constructive comments from national and international experts in Lao PDR were also greatly appreciated

My sincere thanks go also to Per Löfgren for his kind support in mapping and GIS work, to Mrs Anne-Maj Jonsson with her administration team for the excellent secretarial service, and to Anders Pålsson for his efficient practical arrangement. I enjoyed with Henrik Feychting who refreshed my French and Swedish discussion on the world daily news. The company of my African friends, Tarekegn Abebe (Ethiopian), Pare Souleymane (Burkinabe) and Miss Amani Kobbail (Sudanese) gave good insight on tropical forestry research in world developing countries.

I am grateful to all those who extended their co-operation and supported me for my research study especially to all my course governors and all staffs of Department of Forest Resource Management and Geomatics as well as Department of Rural Development Studies and Department of Agricultural Engineering within The Swedish University of Agricultural Sciences.

Many people have been involved in one or another with this research and the consequent preparation of this thesis, and thanks are extended to them. The research was very much a team effort, and the team members (Mr Soth Seun, Mr Bounleng, Mr Singkeao, Mr Phong, Mr Khongthong, and Ms Pheth) deserve sincere thanks. On many occasions, the fieldwork demanded input far beyond the call of duty. This extra effort was very much appreciated and was a major factor in the success of this research.

Since the thesis was compiled over a considerable period of time, many organisations in the Lao PDR have been contacted. I hereby thank all of them for their generous support to me: Forestry Research Centre, Agro- forestry Centre, Sayabouly Provincial Agriculture and Forestry Office, Nam Pui National Biodiversity Conservation Area Station.

The key to the success of the research lies with the stakeholder villagers of Nam Pui NBCA especially those in Ban Vangphamone and Ban Phongsack, and also seven villages of upper Nam Nane watershed, Luang Prabang. It is to these people that I extend my deepest thanks.

The financial and material support from Department of Forest Resource Management and Geomatics is gratefully acknowledged. Special thanks to the Northern Agriculture and Forestry college and Kengben Teak Improvement Research Centre in Luang Prabang, Lao PDR for providing a powerful pick-up car with a veteran driver during my field work.

Thanks also to my mother, relatives, neighbours, and friends who in different ways have been supported me and contributed to the completion of this work. In more ways than one, working to earn a Doctor's degree is a very egoistic thing to do.

Last, but most of all, my gratitude extends to Mrs Bouphany Sawathvong, my beloved wife who took care of all family business during my absence, and my two lovely sons for their constant love. You are enlightening my life.

Silavanh Sawathvong

UMEÅ, SWEDEN
March 2003