Field Study: Lao PDR

Nam Et and Phou Loei National Biodiversity Conservation Areas

Section 1

Introduction

This field study investigates the economic benefits provided by two adjoining National Biodiversity Conservation Areas (NBCAs): Nam Et and Phou Loei (NEPL). These NBCAs were selected by the Department of Forest Resource Conservation for the field study for the following reasons:

- they comprise a single protected area complex;
- they form an upland area typical of northern Lao PDR, containing a mix of montane forest and shifting cultivation;
- they contain biodiversity of national, regional and global importance;
- they include natural resources of critical importance to local, provincial and national development; and
- there is an existing support project for management of the protected areas.

The study investigated the contribution of these two protected areas to economic activities in surrounding provinces, districts and villages. To define the scope and content of the study, the various economic benefits of NEPL were described and assessed. Selected benefits were chosen for detailed analysis, according to the following criteria:

- diverse, representative and generally relevant and generated for different groups and at different levels of scale;
- issues regarded by political, economic and protected area planners as being of critical significance to development goals; and
- practicable and achievable data collection, methodology and analysis needs within the limited time frame, resources and capacity of the field study.

In line with these criteria, the following economic relationships were selected as detailed case studies:

- the household value of forest products from the NBCAs in Vienthong District;
- the downstream value of forest watershed catchment protection to energy and agriculture sectors in Houaphan Province;
- the economic potential of future options for developing and using NBCA goods and services; and
- the value of forest carbon sequestration and climate services.

Section 2

Background to the NBCAs

2.1 The Protected Areas

Nam Et and Phou Loei NBCAs are located in the northeastern part of Lao PDR (Figure 1). Since they form a contiguous area and share a common boundary along a 30-km stretch, they can be treated as a single ecological and management unit. The Vietnam border bounds Nam Et NBCA on the north side; Route 1, the main highway in northern Lao PDR, bisects the upper part of Phou Loei NBCA. Originally gazetted to cover an area of just over 4,200 sq. km, the NBCAs are being extended to 5,500 sq. km.

Most of the land in NEPL is hilly or mountainous (over 60 per cent of the combined area is over 1,000 metres ASL). Nam Et contains a mosaic of secondary mixed deciduous forest, with areas of bamboo and shrubland indicating extensive slash and burn agricultural practices in the past (MAF and IUCN 1998). Phou Loei has significant old growth mixed deciduous forest, with montane evergreen forest dominating the higher altitudes.

Figure 1. Location of Nam Et and Phou Loei NBCAs

NEPL has a high conservation value, with some of the highest faunal biodiversity of any protected area in northern Lao PDR (MAF and IUCN 1998, WCS 1998). It supports a tiger population of international importance, as well as at least 17 other key large mammal species of conservation concern. There are sizeable numbers of Gaur *(Bos gaurus)*, Banteng *(Bos javanicus)*, the goat-like black muntjac (a species new to science), various medium-size cats such as Golden cat *(Catopuma temmincki)* and Clouded Leopard *(Neofelis nebulosa)*, two species of bears including Asiatic black bear *(Ursus thibetanus)*, at least six species of primate, including the White-cheeked gibbon *(Hylobates leucogenys)*, at least three bat species previously unrecorded in Lao PDR and one species of bat unrecorded anywhere else. Nearly 300 bird species have been recorded, 35 of which are key species of conservation concern.

2.2 Socio-economic conditions in surrounding provinces

Almost two thirds of the land area of NEPL is situated within Viengthong District of Houaphan Province (Table 1). The NBCA also includes smaller parts of Houamueang, Xam Neua and Et districts of Houaphan Province, Viengkham and Phonsai districts of Luang Prabang Province, and Phukoodt District of Xieng Khouang District.

Table 1. Provincial and district boundaries in NEPL NBCAs

Province	District	area (km^2)	% of total NBCA area
Houaphan	Vienthong	2,800	66.2
	Xam Neua	609	14.4
	Et	193	4.5
	Houameuang	118	2.8
Luang Prabang	Vienkham and Phonsai	424	10.0
Xieng Khouang	Phukoodt	86	2.0
Total		4,230	100.00

From MAF and IUCN 2001a, b

In 2000, the combined population of the three provinces surrounding Nam Et and Phou Loei NBCAs (Houaphan, Luang Prabang and Xieng Khouang) was some 924,000 people (Table 2). This represents just less than one fifth of the total population of the country. With a predominantly rural demographic, population densities in Houaphan and Xieng Khouang provinces are well below the national average, at 14–17 persons per sq. km. The population density in Luang Prabang is more than 1.5 times higher than that.

Table 2. Population in Houaphan, Luang Prabang and Xieng Khouang provinces

Province	area (km^2)	districts	villages	households	no. people	pop. density (per km^2)	% rural*
Houaphan	16,500	8	854	36,000	282,214	17	94
Luang Prabang	16,875	11	1,162	64,000	420,847	25	89
Xieng Khouang	15,880	7	507	37,000	231,422	15	93
Lao PDR	236,800	141	11,251	800,000	5,277,073	22	83

**From MAF 2000; all others from UNDP 2002*

Farming is the major rural land use and livelihood in all three provinces; agricultural landholdings account for approximately 177,000 ha (Table 3). Farmland comprises a relatively small proportion of the total land area (two per cent of Houaphan and Xieng Khouang and six per cent of Luang Prabang). From 90–95 per cent of agricultural land is used for rice and other arable crops. Most land is cultivated under rainfed production techniques. Irrigated fields account for a very small proportion: five per cent in Houaphan and Xieng Khouang, and 11 per cent in Luang Prabang, far lower than the national average of 22 per cent.

Table 3. Land use in Houaphan, Luang Prabang and Xieng Khouang provinces

	No. agricultural landholdings	landholdings (000 ha)	Arable land (000 ha)	Irrigated area (ha)	Planted rice area (000 ha per season)
Houaphan	36,900	40.2	38.0	1,800	12.5
Luang Prabang	55,700	98.1	87.5	9,320	11.5
Xieng Khouang	28,100	38.7	34.9	1,270	14.5
Lao PDR	668,000	1,048.0	877.0	197,200	500.0

From UNDP 2002

Between 90 and 98 per cent of households have access to agricultural land (Table 4). The average landholding size is smallest in Houaphan (1.09 ha per household), slightly larger in Xieng Khouang (1.38 ha) and larger again in Luang Prabang Province (1.76 ha per household). This notwithstanding, a higher proportion (over half) of households in Houaphan and Xieng Khouang have access to irrigated land, and own cattle and buffalo. The incidence of slash and burn agriculture is significantly higher than the national average in Houaphan (76 per cent of villages) and Luang Prabang (89 per cent of villages).

Table 4. Agricultural assets and land-use practices

	access to farmland (% hh)	average landholding (ha)	access to irrigated land (% hh)	own large livestock (% hh)	villages using slash and burn (%)
Houaphan	98	1.09	59	80	76
Luang Prabang	90	1.76	25	48	89
Xieng Khouang	94	1.38	62	79	46
Lao PDR	86	1.57	25	61	45

From UNDP 2002

Poverty, measured in terms of household access to the basic food and non food items deemed necessary for a minimum standard of living, is widespread throughout Houaphan, Luang Prabang and Xieng Khouang provinces. The Northern Region is the poorest part of Lao PDR (UNDP 2002); poverty is highest in Houaphan Province, where three quarters of the population were classified as poor in 1998, and where there has been little reduction in poverty over recent years (Table 5). Per capita GDP is below the national mean in all three provinces, and is only just

over half of the average for Lao PDR in Houaphan. Other socio-economic indicators — such as infant mortality rate and access to safe water and medical facilities — underline the lack of basic services and infrastructure.

Table 5. Poverty indicators in Houaphan, Luang Prabang and Xieng Khouang provinces

	GDP per capita index*	% poor 1998*	decline in poverty rate 1992–98**	infant mortality rate*	access to safe water (% hh)*	hospital more than 8 hrs away (% hh)**
Houaphan	56	74.6	1.0	125	1.8	36
Luang Prabang	79	49.4	4.8	132	10.4	3
Xieng Khouang	92	34.9	9.9	121	1.8	8
Lao PDR	100	38.6	3.1	104	15.1	8

**From GOL 2000; **from UNDP 2002*

Government expenditures are also low in Houaphan, Luang Prabang and Xieng Khouang provinces (Table 6), as little as 79,000 Kip per capita per year in Luang Prabang Province, and 220,000–240,000 Kip per capita in Xieng Khouang and Houaphan provinces (less than half the national average). With foreign aid as well as national public expenditures included, Houaphan and Luang Prabang province show low per capita expenditures of only 300,000–350,000 Kip per capita per year, compared to a national average of more than 837,000 Kip.

Table 6. Government and donor expenditures in Houaphan, Luang Prabang and Xieng Khouang

	National expenditure (Kmill)	% national expenditures	Per capita nat'l expenditure (K000)	Per capita nat'l expen. (K000) incl. foreign aid
Houaphan	65.53	8	240.94	302.4
Luang Prabang	31.93	4	78.65	349.9
Xieng Khouang	49.10	6	220.18	1,231.4
Lao PDR	*848,530.00	*31	545.73	837.7

*From UNDP 2002; *regions only*

2.3 Land and resource use in the NBCAs

At least 160 villages are located in or beside NEPL, more than 100 of which are partially or wholly inside the NBCA boundaries (Table 7). Viengthong District has the largest proportion of NBCA land area as well as the majority of the NCBA population (an estimated 70 per cent of NBCA resident and boundary villages, and up to 78 per cent of NBCA adjacent villages).

Table 7. Villages inside and adjacent to NEPL NBCAs

Province	District	villages inside or on boundary of NBCA	villages adjacent to NBCA
Houaphan	Vienthong	* 52	* 29
	Xam Neua	* 8	* 6
	Et	> 8	not known
	Houameuang	5	7
Luang Prabang	Vienkham and Phonsai	* 27	* 12
Xieng Khouang	Phukoodt	4	not known
Total		> 104	> 54

*From MAF and IUCN 2001b; *updated from Viengthong District survey data 2001*

More than 80 per cent of the residents of NBCA villages farm as their primary occupation. While farming is dominated by upland subsistence cropping under slash-and-burn practices (MAF and IUCN 2001b), some communities also cultivate paddy. An average of 0.54 ha of land per family is given over to rice production, with more than half of farmers cultivating only upland rice, a third combining paddy and upland rice, and just 13 per cent of families cultivating paddy only.

Although cash-crop farming is limited, due to low-quality produce, poor access to markets and small profit margins, this is gradually changing as extension services advance and infrastructure improves. Non-rice crops are grown in 60 per cent of NBCA villages, with an average cumulative cropped area of 0.64 ha per household. This is mostly given over to maize but also includes peanuts, soybeans, sesame and vegetables. Just under half of villages cultivate tree crops and fruits, including mango, tamarind, plums and bananas. Livestock is an important source of cash income and wealth in 80 per cent of villages. All villages with livestock keep poultry and pigs, 94 per cent keep buffalo and half keep cattle. Average annual cash income is 3.5 million Kip per family, half of which is contributed by sales of crop and livestock produce. Almost all households earn money from forest products, including NTFP and wildlife; they contribute between a fifth and a quarter of annual cash income.

All of the villages in the area influence the NBCAs in some way, mainly through crop farming and forest products collection. Large areas of bamboo land indicate that slash and burn techniques were used for crop cultivation in Nam Et in the past. Phou Loei NBCA appears to be less affected by swidden agriculture.

There is not enough data to gauge the impacts of local use of forest products, although it is known that some harvesting practices are destructive (orchid collection, for example, often involves felling whole trees), and that certain products (i.e. eaglewood, rattan, *Dioscera spp.* and orchids) are collected at unsustainable levels. Hunting, both for subsistence and to supply the wildlife trade, has been identified as a major threat to biodiversity (MAF and IUCN 2001b). There is a high commercial demand for wildlife (including bears, tigers, otters, deer, golden cats, pangolins and turtles) and wildlife parts. There is little evidence of large-scale logging, and roads and other infrastructure have had only a minor impact on the NBCA (WCS 1998).

Section 3

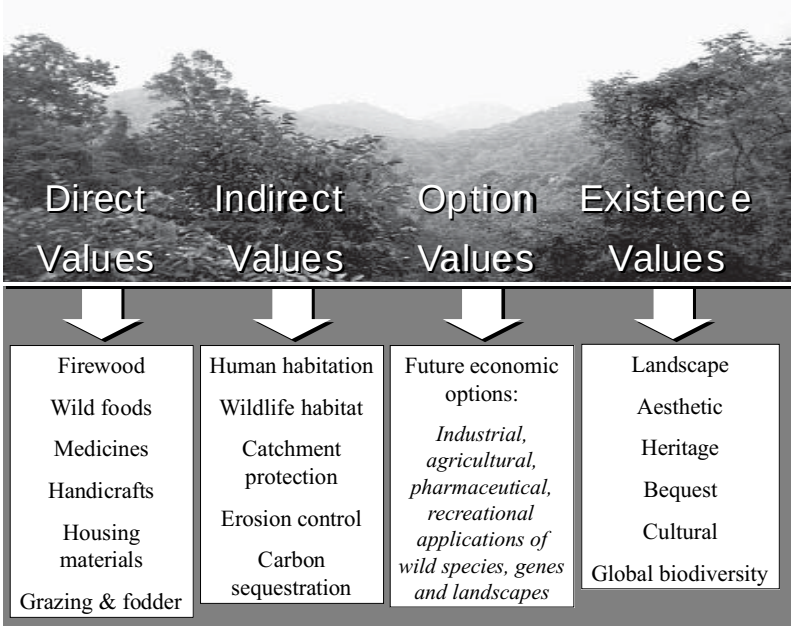
Economic and development connections

3.1 NBCA economic values

Unlike many other forest areas in Lao PDR, NEPL does not support a wide range of industrial and commercial sectors such as large-scale hydro-electric generation, logging or tourism. Its main value lies in subsistence-level forest product harvesting, non-marketed ecological services, potential for support future economic activities, uses and markets, and intrinsic or non-use economic values. NEPL also yields a wide range of economic values (Figure 2). These encompass more than cash income, and include the following:

- physical goods that can be consumed directly (direct values);
- environmental and ecological services that support life (indirect values);
- resources and landscapes that allow for future economic uses and services (option values); and
- intrinsic economic significance, regardless of use (existence values).

Figure 2. NEPL's economic values



Direct values

Plant-based forest products are widely used for household subsistence and income by NBCA villages, and are also part of district, provincial, national and cross-border trade and commerce. Almost 200 different forest products are harvested by NBCA villagers; they are used for construction, handicraft production, wild foods, medicines, fodder, forage and domestic energy (MAF and IUCN 2001b). Some of the most commercially important forest products are orchid stems, paper mulberry, eaglewood, rattan, *Dioscera spp.*, bamboo shoots and cardamom.

Wildlife is consumed by families living in and around the NBCA, including birds, snakes, frogs, porcupine, barking deer and wild pig. Various wildlife products collected in NEPL are also traded illegally, including tiger bone, gaur parts, bears, pangolins and reptiles. Although data are limited, it appears that fish provide an important source of protein to villagers (WCS 1998).

Fuelwood is used for cooking and heating by all the families living in and around the NBCA, and is also used in the preparation of animal feed and distilling alcohol. Handicrafts, including musical instruments, weapons, baskets, mats and hats, incorporate raw materials from NBCA plants and animals.

Grazing, forage and fodder resources from NEPL are used by almost all the villages in and around the NBCA for buffalo, cattle, goats and pigs. Construction materials, including timber, poles and roofing materials, are used by almost all families living inside and around the NBCA. Commercial logging did occur in the past, and there are several small privately-owned sawmills located around NEPL.

Indirect values

Rivers rising in NEPL, including the Nam Et (which flows into Et and Sop Bao districts), the Am Xeng (which flows into Viengkham District), the Nam Neun (which flows into Vietnam) and the Nam Khan and Nam Xuang (which flow into Luang Prabang) provide supplementary dry season water for Xam Neua, Luang Prabang and other towns.

Hydro-electric facilities utilise water from streams that rise in the NBCA. These facilities supply villages in and around the NBCA as well as downstream urban settlements. A 60-kW scheme on the Nam Et near Xon Neua supplies nine villages, and a 250-kW dam on the Nam Sat supplies Viengthong District centre and ten villages (MAF and IUCN 1998). A medium-scale hydro-electric scheme on the Nam Peun has an installed capacity of 36 kW. At least 1,000 households villages in Houaphan Province rely on more than 850 micro-hydro units which utilise watercourses originating in Nam Et and Phou Loei.

Irrigation projects utilise water resources rising in the NBCA, both for individual households and for smallholder schemes in areas downstream of the NBCAs. The development on the Nam Et near Xon Neua can irrigate 180 ha (MAF and IUCN 1998); a weir on the Nam Khan near Meuang Hiam can irrigate 45 ha; and a weir at Muang Peu irrigates 30 ha (MAF and IUCN 1998). Various other small weirs and irrigation systems were built by the Lao-America Crop Control and Development Project and various other donors. Approximately 1,000 ha of irrigated paddy in Houaphan Province, including two large-scale schemes, rely on rivers originating in NEPL.

Water mills that utilise water resources rising in the NBCA are commonly used to grind rice and animal feed. River travel takes place along watercourses rising from the NBCA, especially the Nam Et, Nam Khan, Nam Xeuang, Nam Xeng and Nam Neun.

Forests and grasslands in the NBCA provide atmospheric regulation services, including carbon sequestration, oxygen release and microclimate stabilisation.

NBCA land supports more than 100 villages. It also provides habitat for a wide range of birds, mammals and reptiles, many of which are threatened or have conservation significance.

Option values

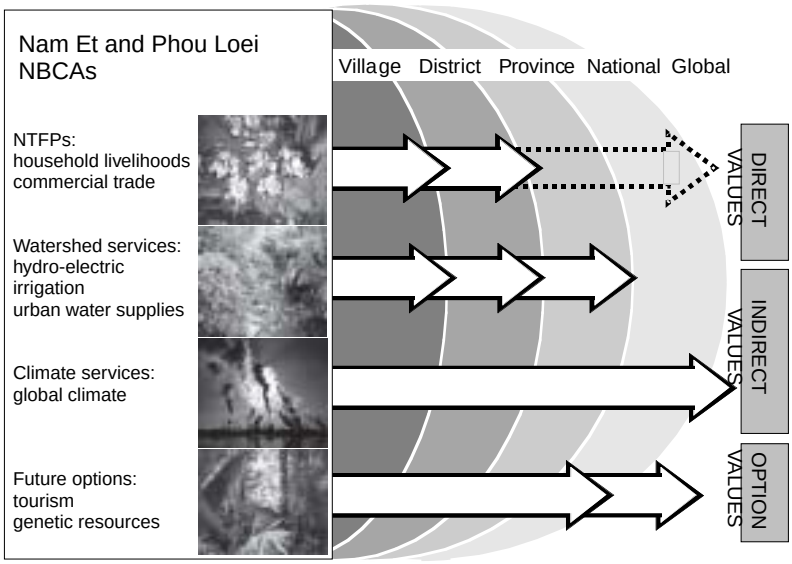
The NBCA supports future options for economic activities, such as the development of tourist and recreational activities, water resources development and the use of wild species and genetic resources for village and commercial-level domestication and improvement as well as pharmaceutical and industrial uses.

3.2 Protected areas and development

The goods and services described in section 3.1 underpin economic activities at the village, district, provincial and even national level. They are closely linked to local, regional and national development processes, providing raw materials, services and other products which support economic production and consumption. They can be grouped into four major levels, according to the types of values they generate, and the different groups, sectors and levels they benefit (Figure 3):

- NBCA forest land and resources contribute raw materials to household subsistence and income for communities living in and around the NBCAs;
- NBCA watershed catchment protection services ensure clean and regular water supplies for economic consumption and production for local and downstream human populations, and support both small-scale and commercial production in the agricultural, energy and industrial sectors;
- NBCA option values help ensure local, regional, national and international economic growth and prosperity in the future, through such aspects as tourism development, commercial applications of wild species and gene pools, and water resources development.
- the value of forest carbon sequestration and climate services. NBCA atmospheric regulation services generate benefits that accrue at the global level to the international community, primarily through mitigating the effects of global warming.

Figure 3. NEPL and the surrounding economy



Section 4

Economic benefits to villages and districts

Two thirds of the land area of NEPL (2,800 sq. km), and up to three quarters of NBCA villages are situated in Vienthong District. The district is located in Houaphan Province, in the Northern Region of Lao PDR. The Northern Region is the poorest part of Lao PDR; poor households comprise more than half the population (Figure 4). Houaphan Province has the highest incidence of poverty (75 per cent) in the Northern Region and in the country as a whole (UNDP 2002).

The villages in and around NEPL in Viengthong District contain some of the province's most vulnerable and remote households. The vast majority of people have insufficient access to the basic food and non-food items deemed necessary for a minimum standard of living and little cash income. They also suffer high infant mortality rates and a lack of medical care, education, social services and other essential infrastructure. As described in the recent *Participatory Poverty Assessment* (NSC and ADB 2001), they live in upland forested areas, practising slash and burn agriculture to produce upland rice and other crops for domestic consumption, and relying on forest products collection for home use and sale in order to compensate for rice shortages.

Figure 4. Poverty and Viengthong District NBCA villages

In this context of limited and insecure livelihoods, and of widespread rural poverty, the natural resources of NEPL provide essential economic support to household subsistence and income for the villages of Viengthong District.

4.1 Population and livelihoods

Almost all of the 80 or so villages in Viengthong District are in or near NEPL (Table 8), with a resident or semi-resident population of almost 14,000 persons (58 per cent of the total district population). According to Schlemmer (2001), the major ethnic groups in the NBCA population are Hmong and Yao/Mien (29 per cent), Khm'u (27 per cent) Phu Tai (22 per cent) and Tai Lao (10 per cent).

Table 8. NBCA population, Viengthong District

	villages	households	persons	% district pop.
Type I Enclave villages (entirely inside NBCA boundary)	18	745	6,025	25
Type II Straddle villages (on boundaries, with land inside NBCA)	33	1,255	7,926	33
Type III Adjacent villages (bordering NBCA)	11	659	4,207	17
Type IV External villages (outside, but affecting, NBCA)	18	1,032	6,209	25
Viengthong District	81	3,691	24,367	
Houaphan Province	847	39,357	267,152	

NBCA village type definitions from Southammakhot 2000. From MAF and IUCN 2001b;
**updated from Viengthong District survey data 2001.*

Most households in Viengthong District have a similar livelihood strategy that combines farming, keeping livestock, hunting and NTFP collection, although there are clear differences in access to productive assets and income. Villages located in and on the border of the NBCA have less access to productive assets and income-earning opportunities than those in other parts of the district (Table 9).

While there is little variation in cropped area and area planted with rice, households living outside the NBCA engage in a greater range of rice farming activities. The majority of NBCA residents rely on upland rice only; villages outside the NBCA combine upland rice with rainfed and irrigated paddy production. Villagers living inside the NBCA tend to have more livestock, but also have markedly lower rice yields and per capita rice production. Noticeably fewer NBCA villages cultivate other cash and tree crops. While the majority of families in the district farm as their primary occupation, households living outside the NBCA also engage in other occupations, such as trade and paid employment. The average household, agricultural and non-farm cash income is also significantly lower for NBCA resident villages.

Table 9. Socio-economic characteristics of Viengthong District NBCA villages

	Viengthong District	Inside NBCA (Type I)	NBCA bound. (Type II)	NBCA Adjacent (Types III + IV)
Agriculture				
Cumulative cropped area (ha/hh)*	0.64	0.69	0.68	0.57
Rice area (ha/hh)	0.58	0.59	0.61	0.54
Upland rice yield (kg/ha)	2,600	2,400	2,600	2,700
Rice production (kg/capita)	249	177	290	247
% planting wet season/rainfed paddy	70	44	74	83
% planting dry season/irrigated paddy	14	0	6	31
% planting upland rice	98	94	97	100
% planting cash crops	67	56	62	67
% planting tree crops	44	33	44	52
Livestock ownership (TLU/household)	2.22	3.37	2.27	1.46
Primary occupation				
% farming	93	99	98	85
% trade	3	0	0	6
% employed	3	0	1	6
% none/other	2	1	1	3
Cash income				
Total income (Kip mill/hh/yr)	4.41	3.49	4.44	4.95
Agricultural income (Kip mill/hh/yr)*	2.04	1.84	2.20	1.97
Non-farm income (Kip mill/hh/yr)	2.37	1.64	2.24	2.98

**Excludes opium. Calculated from Viengthong District survey data 2001;*
TLU: Tropical Livestock Unit (1 TLU = 250 kg live body weight)

Opium cultivation has a long history in Viengthong District, and the district was thought to have one of the country's highest rates of opium production during the 1980s. Opium production, which requires a cold climate, high altitude and limited sunlight, is particularly widespread in northern parts of the district. Production reportedly declined during the implementation of the Lao-American Project in the late 1980s and early 1990s, but has risen with the completion of the project (Schlemmer 2001). It is difficult to gauge the overall contribution of opium to local economies in Viengthong District, although it clearly provides an extremely important income source in some areas. Data from selected NBCA villages show a great variation in the extent and economic importance of opium in different villages around NEPL (Table 10).

Table 10. Opium production and income in selected NBCA villages, Viengthong District

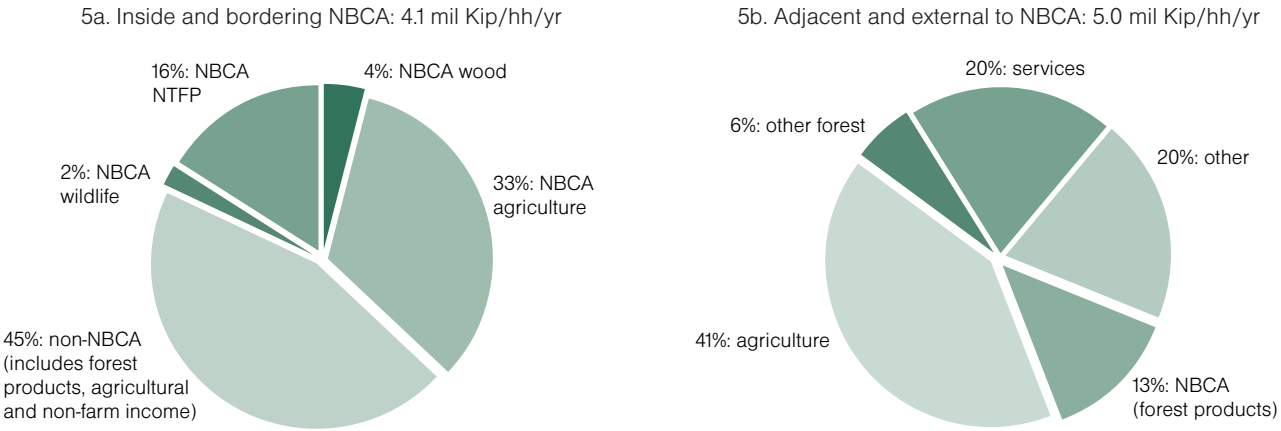
Village	% of total farmers	Harvest (kg/yr)	Value (Kip mill/yr)	Cash income (Kip mill/yr)	% of village agric. income
Buamphat (inside NBCA)	98	21.5	34.62	27.29	22.6
Ponexong (inside NBCA)	9	0.4	0.62	0.31	0.3
Long Ngua Pa (inside NBCA)	100	51.0	82.07	70.04	33.9
Nam Neun (inside NBCA)	100	28.4	45.71	40.03	36.7
Xay (NBCA boundary)	52	2.1	3.35	0.74	0.5

Data on opium production from Schlemmer 2001, data on other agricultural income calculated from Viengthong District survey data 2001

4.2 Contribution of NBCA resources to household income

In all villages in the district, forest resources (mainly NTFP and wildlife products) provide a major source of household cash income: 57 per cent of household cash income for villages located inside and on the boundary of the NBCA, and 19 per cent for NBCA adjacent households (Figures 5a and 5b, Table 18).

Figures 5a and 5b. Contribution of NBCA resources to household cash income



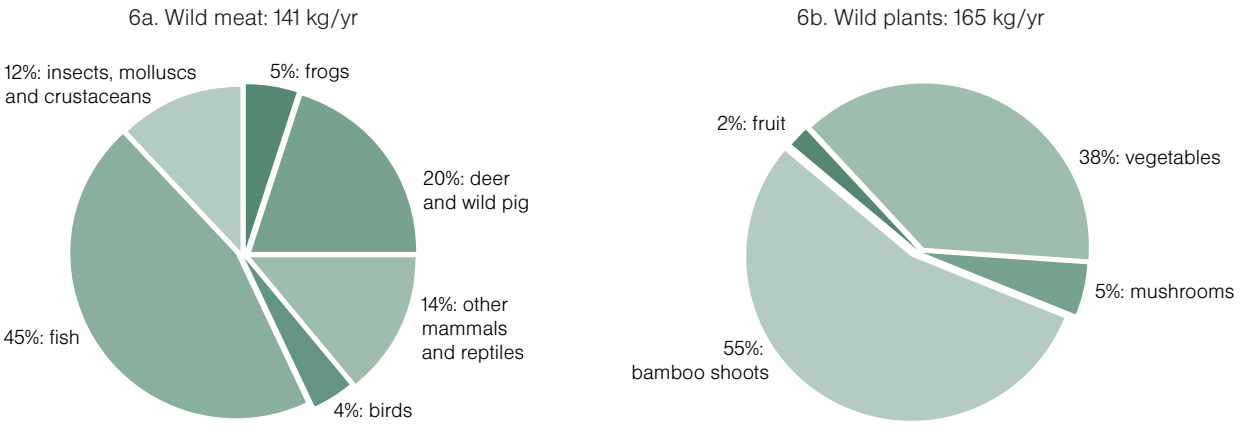
Calculated from Viengthong District survey data 2001.

The cash income contribution of NBCA resources is high for all households, averaging 38 per cent of total income or 1.7 million Kip/hh/yr across the district. It ranges between 56 per cent of household income (2.28 million Kip) for villages inside or bordering the NCBA to 13 per cent of household income (0.66 million Kip) for NBCA-adjacent villages.

4.3 Contribution of NBCA resources to subsistence

NBCA resources also meet a range of household subsistence needs, including forest land for crop cultivation, food, medicine, fodder, and construction and handicraft materials. More than 40 species of trees, 15 bamboos, 34 wild vegetables, 6 palms, 7 grasses, 4 vines, 12 wild fruits, 56 medicinal plants and 13 mushrooms (many harvested from the NBCA) are used by villagers in the district (MAF and IUCN 2001b). NBCA households consume an average of 165 kg of wild plant products and 141 kg of wild meat (Figures 6a and 6b).

Figures 6a and 6b. Annual household consumption of forest products by weight



Calculated from Schlemmer 2001

Valuing these home-consumed items at local market prices results in a total subsistence value of NBCA resources for Vienthong District households from between 1.9 million Kip (for NBCA-adjacent villages) and 4.6 million (for villages inside the NBCA), with an average household value of 3.1 million a year in the district (Table 11).

Table 11. Value of NBCA resources for home consumption

	Value (Kip 000 per household per year)			
	Viengthong District	Inside NBCA (Type I)	NBCA boundary (Type II)	Adjacent to NBCA (Types III + IV)
Housing materials	159	183	165	138
Firewood	707	992	680	560
Bamboo shoots	64	74	66	55
Wild vegetables	32	37	33	28
Mushrooms	26	30	27	23
Wild fruits	3	3	3	2
Deer and wild pigs	304	350	315	263
Other mammals and reptiles	174	200	180	150
Birds	99	114	103	86
Fish	575	662	596	497
Insects and molluscs	72	83	75	62
Frogs	92	107	96	80
Agricultural home consumption	789	1,794	935	–
Total home consumption	3,096	4,628	3,274	1,942

4.4 Total value of NBCA resources for Viengthong District households

The local use of forest land and resources from NBCA and non-NBCA areas in and around NEPL is worth more than 16.5 billion Kip a year for households in the district (Table 12). Annual NBCA values are 2.7 million Kip for households outside the NBCA, 5.4 million Kip for those bordering the NBCA, and almost 7.3 million Kip for villages in the NBCA. Subsistence use of NBCA resources comprises the bulk of annual value for all households, although NBCA-based income is highest within the protected areas.

Table 12. Total value of NBCA resources for Viengthong District households

	Kip million/household/year			Kip billion/year
	Inside	Boundary	Adjacent	District
Home consumption				
wood products	1.18	0.85	0.70	3.12
wild plants	0.14	0.13	0.11	0.45
wild meat and fish	1.52	1.36	1.14	4.76
agriculture	1.79	0.94	—	2.51
total home consumption	4.63	3.27	1.94	10.84
% home consumption	64.00	61.00	73.00	65.00
cash income				
NTFP	0.55	0.69	0.51	2.13
wood products	0.16	0.20	0.14	0.61
wildlife	0.08	0.10	0.07	0.30
agriculture	1.84	1.10	—	2.75
Total cash income	2.64	2.09	0.72	5.80
% cash income	36.00	39.00	27.00	35.00
Total NBCA value	7.27	5.36	2.67	16.64

Calculated from Viengthong District survey data 2001 and Schlemmer 2001.

These estimates — which average around US$300 per household per year for forest foods, firewood and NTFPs — are broadly comparable with data collected in other parts of the country (Table 13).

Table 13. Comparison of forest value: NEPL and other areas of Lao PDR

Note: data exclude some Nam Et and Phou Loei values, such as income from crops and livestock in NBCA areas. No data are available for medicinal plants, bamboo and rattan ("other NTFPs" include housing materials).

	NEPL (US$/household/year)*	Other areas of Lao PDR (US$/household/year)**
Forest foods	168	200
Firewood	61	40
Other NTFPs	14	40
Subtotal	243	280
NTFP cash income	51	39
Total	294	319

**Based on all forest products, calculated for average household, figure adjusted to family of five persons (average NEPL family size 6.7) to be comparable with data from other areas of Lao PDR. **From various sources, cited in Foppes and Ketphanh 2000; includes income from wood products and from crops grown/livestock grazed in NBCA, averaged across NBCA resident, border, adjacent and external households.*

Table 14. Difference in NBCA forest product value according to agricultural assets

	NBCA forest product value (Kip mill/hhold/year)	NBCA forest products as % of agricultural value
Viengthong District	3.16	82
NBCA resident villages	3.43	88
NBCA adjacent villages	2.67	73
Per capita rice production		
Rice surplus households (>350 kg)	3.64	69
Rice balanced households (250-350 kg)	3.02	70
Rice deficit households (150-250 kg)	2.94	80
Severe rice deficit households (< 150 kg)	3.43	136
Cumulative cropped area		
Highest cropped area (>1 ha)	4.77	72
High cropped area (0.75-1.0 ha)	3.06	71
Average cropped area (0.5-1.0 ha)	3.06	73
Lower cropped area (0.25-0.5 ha)	2.77	95
Lowest cropped area (< 0.25 ha)	3.35	193
Livestock		
Most livestock (> 3 TLU)	3.99	74
Least livestock (1.5-3 TLU)	3.02	76
Average livestock (0.5-1.5 TLU)	2.71	91
Little or no livestock (< 0.5 TLU)	3.72	131

Forest value includes wood and NTFPs; total agricultural value includes production for subsistence and income from both NBCA and non-NBCA land. Calculated from Viengthong District survey data 2001.

The economic importance of NEPL resources varies for different types of households in the district. NBCA forest resource values are highest in cash terms for families with either the most or the fewest agricultural assets, measured in terms of per capita rice production, cumulative cropped area and livestock ownership (Table 14). These indicators reflect those emphasised in the 2001 *Poverty Reduction Strategy Paper* (GOL 2001), which sees degree of rice self-sufficiency as the primary determinant of poverty, lack of arable land as a secondary condition of poverty, and livestock ownership as the primary indicator of wealth.

Richer households generate the highest overall income from NBCA forest products, possibly due to higher-value commodities. For the poorest households, high levels of such income likely reflect their reliance on sales of wildlife and NTFP due to the absence of alternative sources of income. These households also rely heavily on NBCA forest products, reflected in the very high value of such products relative to agricultural income. For the households with the fewest agricultural assets, the annual value of forest consumption is consistently higher than the value of agricultural production.

Both cash income and total value, measured in total and agricultural income obtained from NEPL, are higher for high-income households (Table 15). The contribution of NBCA resources to the household economy is, however, much higher for cash-poor households (contributing nearly half of cash income, and almost two thirds of subsistence)

Table 15. Difference in NBCA value according to household cash income

	Household cash income		Total household value	
	(Kip mill/year)	as % of total	(Kip mill/year)	as % of total
Viengthong District	1.69	38	4.81	54
NBCA resident villages	2.28	56	6.03	70
NBCA adjacent villages	0.66	13	2.67	29
Total household income				
Higher income (>5.0 mill Kip/year)	3.38	34	6.50	44
Average income (2.5-5.0 mill Kip/year)	1.61	43	4.82	59
Lower income (<2.5 mill Kip/year)	0.78	45	3.69	62

NBCA products include both forest and agricultural items from NBCAs; total household value includes farm, NBCA and non-farm items from within and outside of NBCAs. Calculated from Viengthong District survey data 2001.

Section 5

Provincial, national and global economic benefits

As well as making a direct contribution to household income and subsistence, NEPL generates many other economic benefits to the economies of the surrounding district and province, and at national and global levels. These benefits include the provision of ecological services that underpin production and consumption and those vital life-support functions that enable broader economic activities to occur. These benefits are for the most part non-marketed; they accrue indirectly.

5.1 Watershed catchment protection values for Houaphan Province

Numerous permanent and semi-permanent streams and rivers form an important watershed catchment area for both Lao PDR and Vietnam (Figure 8). NEPL cover a large part of the catchment for at least four major river systems: the Nam Et, Nam Khan, Nam Neun and Nam Xuang (Table 16).

The Nam Et and Nam Neun rise in Nam Et NBCA, draining east to Vietnam and ultimately into the Tonkin Gulf. The Nam Khan and Nam Xuang rise in Phou Loei NBCA, flowing southwest and draining into the Mekong River near Luang Prabang.

Table 16. Catchments in NEPL NBCAs

Catchment	Location	area (km^2)	% of total area
Nam Et	Northern part of NBCA	2,194	52
Nam Khan	South and southeastern part of NBCA	797	19
Nam Nern	Eastern part of NBCA	780	18
Nam Xuang	Southwestern part of NBCA	465	11

From IUCN 2001b

The water sources originating in NEPL have a wide range of domestic, agricultural and industrial economic uses, including hydro-electric generation and irrigation. In Houaphan Province alone, NEPL rivers and their tributaries are known to support the following:

- at least three medium-scale hydro-electric schemes, with a combined capacity of more than 360kW and a total investment cost of more than US$2 million. An 80-kW scheme on the Nam Et supplies power to at least nine villages, a 250-kW scheme on the Nam Sat supplies power to Viengthong District Centre and at least ten villages, and a 36-kW scheme on the Nam Peun supplies power to at least five villages;
- more than 850 micro-hydro units, serving more than 1,000 households; and
- at least 1,000 ha of irrigated rice production, including two large-scale schemes that utilise weirs, gabions, pumps and wooden water wheels.

The combined gross value of those economic activities in Houaphan Province that depend on NEPL watersheds is almost 6 billion Kip a year (Table 17). The economic contribution of NEPL extends beyond the fact that the rivers upon which these activities depend rise there. The existence of the NBCA helps ensure the maintenance of forest cover and environmental quality in the rivers' upper catchments. This maintains the quality and supply of water supplies, regulates the seasonal flow and reduces the amount of downstream silt and sediment. If forest cover was not protected in these upper catchments, the next most likely land use — clearance for agriculture — would undoubtedly have negative effects on water flow and quality, reducing the economic output and value of downstream hydro-electric generation and irrigation.

Table 17. Value of production in Houaphan Province supported by NEPL watersheds

Economic activity	Direct beneficiary population	Gross value of output (Kip million/yr)	
Medium hydro	24 villages, one district centre	235	(traded value of electricity*)
Micro hydro	> 1,000 households	410	
Irrigated agriculture	1,000 ha of paddy rice	5,130	(gross returns to production)
Total		5,775	

**Although this power is currently provided without charge, or at minimal cost, electricity originating in other parts of the country is traded domestically and exported. Power is imported to the country from Thailand and Vietnam at a cost of three and six cents per kWh respectively. This traded value is used to determine the cost avoided of providing electricity from imported sources.*

5.2 Future economic options for NBCA goods and services

Very little of NEPL's potential economic value is realised in cash terms. The area is relatively remote, and almost no commercial or large-scale development of its resources has occurred. In conservation terms there is undoubtedly an advantage to this isolation, one which may account for the relatively high levels of biodiversity, forest cover and ecological integrity. There are, however, clear opportunities to increase the sustainable economic values captured from the NBCA if it continued to be managed as a conservation area. This could support socio-economic development in the future. Although some of these possible future uses and economic options cannot be known now, others are listed below.

Ecotourism options

Lao PDR opened its doors to international tourists in 1990. Since then the tourism industry has developed rapidly to become one of the country's largest earners of foreign currency; tourist arrivals increased from less than 7,000 in 1990 to more than 720,000 in 2000 (ADB 2001). Up to 70 per cent of the country's tourists express an interest in nature (Robichaud et al. 2001), and the government has established broad guidelines for ecotourism development (Yamauchi and Lee 1999).

The National Tourism Authority has already established several ecotourism projects in cooperation with international and regional partners. Dong Houa Sao, Nam Kan/Nam Nga, Nam Ha, Phou Hin Poun, Phou Khao Khoay, Phou Xang He and Xe Piane NBCAs are being developed as nature tourism or ecotourism destinations. Although these initiatives are in the early stage of development, they show that nature tourism can be an important source of revenues for both government and local communities, and it can have significant multiplier effects on provincial and national economies. In Nam Ha NBCA, for example, tourism in the first quarter of 2001 generated income of US$1,600 for local villages, more than US$3,000 for local food sellers, guides and transporters, almost US$400 for the NBCA authority and over US$300 for the provincial tourism office (calculated from data presented in Robichaud et al. 2001).

Tourism is virtually unknown in NEPL, although several sites exist in and around the NBCA with potential interest for tourists and recreational visitors, including hiking trails, cultural and historical sites, caves, waterfalls, hot springs, wildlife and birdwatching, dense tropical forest and local ethnic groups. NEPL could be incorporated into the Luang Prabang-Xieng Khouang tourism circuit, and may prove especially attractive once the nearby border crossing to Vietnam is opened.

Options for the downstream use of water resources

Lao PDR has an ambitious program to develop hydro-electric potential, which is envisaged as a means of generating export and foreign exchange earnings and serving the country's rapidly developing rural, urban and industrial sectors. At least three of the hydro-electric facilities proposed for future development depend on rivers rising in NEPL: Nam Khan 1 (planned installed capacity of 115 MW and annual generation of 582 GWh), Nam Khan 2 (145 MW/726 GWh) and Nam Khan 3 (95 MW/474 GWh).

These developments have the potential to contribute to the costs of NBCA conservation, and to provide those economic benefits associated with increased power generation. Increasingly, other hydro-electric developments in Lao PDR are recognising, and paying for, the watershed services provided by NBCAs and protected forest catchments. Nam Leuk Dam, for example, allocates 1 per cent of gross revenues to *Electricité du Lao* for conservation in Phou Khao Khoay NBCA, and the proposed Nam Theun 2 dam plans to return US$1 million a year to watershed management in and around Nakai-Nam Theun NBCA.

Options for the commercial development of wild species

NEPL has a high biodiversity and is an important gene pool and in-situ repository of wild species, some of which are globally unique, rare or endangered. These plant and animal resources have potential commercial values for a range of domestic, industrial, agricultural and pharmaceutical applications. It is important to emphasise, though, that such values are highly speculative, are frequently overestimated, and will not increase either incentives or funding for biodiversity conservation (Simpson 1997).

NEPL's wild species may have future options for medicinal and pharmaceutical applications — a broad range of medicines obtained from forest products is already used among local communities. In the developed world 25 per cent of all medical drugs are based on plants or plant derivatives; in developing countries the figure is 75 per cent (Pearce and Moran 1994). Recent research indicates that the higher plants of the world's tropical forests contain about 375 potential pharmaceuticals, approximately one in eight of which have already been discovered. A complete collection and screening of all tropical plant species should be worth about US$3-4 billion to a private pharmaceutical company, and as much as US$147 billion to society as a whole (Balick and Mendelsohn 1995).

Although data are not available for Lao PDR, various studies have looked at the pharmaceutical value of tropical rainforest species in other countries and protected areas. It has been estimated, for example, that the minimum expected genetic value arising from medicinal applications of wild plants in Korup National Park, Cameroon, is US$7 per ha (Ruitenbeek 1989). In Belize, the sustainable harvesting of rainforest plants for medicinal purposes is thought to have a overall net present value of $3,327 per ha at local market prices (Balick and Mendelsohn 1992).

5.3 Global economic benefits

NEPL has economic value in terms of the atmospheric regulation services it provides, especially carbon sequestration. Growing vegetation stores carbon and sequesters it — locks it up — thereby helping to mitigate or avoid global warming. Estimates of the amount of carbon sequestered by tropical forest vegetation range from 10 tonnes of carbon per ha (tC/ha) per year for grasslands over and above alternative agricultural land uses (Sala and Paruelo 1997), 100-150 tC/ha of closed secondary forest, to 200-200 tC/ha for closed primary forest (Myers 1997). The total carbon density in Asia-Pacific forest vegetation has been estimated at 166 tonnes/ha (Sedjo and Sohngen 2000).

The release of carbon dioxide, and its effect on global warming, give rise to a range of economic costs. These include health costs, sea-level rise and consequent damage to infrastructure, agriculture, fisheries and other production, and needs for protective infrastructure and mitigation efforts. Although still approximate, the economic benefits and costs avoided of carbon sequestration have been estimated. The benefits of carbon sequestration have been estimated at between US$5-25 per tonne (Shogren and Toman 2000); the average cost of damage from global warming has been valued at a minimum of US$20 per tonne of carbon released (Fankhauser and Pearce 1994).

Using conservative estimates (90 tC/ha for forested areas and 10 tC/ha for grasslands), and an average damage cost avoided of US$7.50 per tonne of carbonb, the economic benefit of maintaining natural vegetation in NEPL as a carbon sink may be worth some US$175 million.

It is likely that if NEPL lost its protected status, conversion of the forest to other land uses would gradually take place. Assuming a slow degradation of forest area and depletion of forest resources over 50 years, and ascribing a 50 per cent likelihood of this occurring, the annual carbon sequestration value of climate change damages avoided would be US$1.74 million per year.

Section 6

Conclusions and recommendations

Protected areas are often considered to have little or no economic value, and to have little relevance to development. They are typically seen as an non-economic use of land and resources, an obstacle to growth, and a drain on scarce public funds. The example of Nam Et-Phou Loei shows that this is clearly not the case. NBCAs have a demonstrably high economic value, for many groups and sectors.

This includes fuel, medicines, foods, construction materials, crop land and pasture. NEPL contributes subsistence goods worth up to 4.6 million Kip per household per year (11 billion Kip total for the district).

NEPL provides income through the sale of various plant and animal products. NEPL generates household cash income worth up to 2.6 million Kip per household per year (6 billion Kip in total for the district).

Inputs and raw materials include water for irrigation and hydro-electric generation, and basic services and amenities such as clean and regular water supplies and flood control. NEPL enables energy and agricultural sector output in Houaphan Province worth almost 6 billion a year.

NEPL is the source of future economic growth and prosperity, locally, provincially and nationally. It has the potential to support future tourism activities, water developments, and commercial applications of wild species.

Institutional reform

NBCAs also underpin national development goals, priority program areas and ongoing institutional reforms in Lao PDR.

Poverty alleviation

Poverty alleviation is the major focus of the national development strategy for Lao PDR, as defined in the Seventh Party Congress. The government aims to reduce poverty by half by the year 2005, and to eradicate it completely by 2010. Most of NEPL is in Houaphan Province, the poorest province in the country, with a poverty rate of 75 per cent. The per capita GDP for Lao PDR is predicted to be $374 in 2002 (ADB 2001), the GDP for Houaphan Province GDP is estimated at 56 per cent of this, or $204 (UNDP 2002).

The average direct value of NBCA resources for some of the country's poorest villages in Houaphan Province is $486 per household per year, over one third of per capita GDP. For villages inside the NBCA, which are among the most vulnerable in the province, this rises to $734 per household, over half of per capita GDP.

For the poorest households — who suffer rice deficits, own little or no livestock, have limited access to cropland and have few sources of income — NBCA resources comprise up to half of household cash earnings and contribute nearly two thirds of the total household economy.

National development programs

Eight high-priority national development programs have been defined for Lao PDR, including food production, commercial production, infrastructure development and rural development. NBCA resources are a vital food source, providing up to 141 kg of protein and 165 kg of wild plants per family per year. This is worth an average of almost 1.5 million Kip per household per year.

The NBCA also supports district and provincial commerce and infrastructure, including trade in NTFPs, agriculture and the energy sector. If used sustainably, existing and potential developments and applications of NBCA landscapes, goods and services can contribute significantly to future rural development and generate economic benefits at local, district, provincial and national levels.

In 2000 decentralisation became a key strategy for future public sector operations, with provinces defined as strategic units, districts as planning and budgeting units and villages as implementing units. Increasingly, provinces are being charged with generating and collecting revenues which will go towards expenditures for development and maintenance.

NEPL already provides substantial support to provincial revenues and earnings, minimises public expenditures through the provision of essential goods and services, and contributes to village, district and provincial economies:

- the annual worth of NBCA resource use for Viengthong villages is over 16 billion Kip, equal to the total gross product for the district in 2000;
- total government expenditures, of 240,900 Kip per capita, are more than matched by income earned from NBCA resources in Houaphan Province; and
- the equivalent traded value of power generated from the Nam Sat in the Viengthong District portion of the NBCA is worth almost twice as much as the entire annual district revenues for Viengthong District (83.6 million Kip).

These high values provide important and much-needed support for investment in NBCAs. The economic values associated with NBCAs, such as these outlined for Nam Et-Phou Loei, must be factored into planning and decision-making. Until there is a clear understanding of the economic connections between NBCAs and surrounding development processes, NBCAs will continue to be seen as economic liabilities rather than economic assets by both development and conservation planners.

There is a real danger that as long as NBCA conservation concerns are omitted from development and budgeting decisions, and economic concerns are marginalised in NBCA planning and management, their economic value will remain largely unappreciated and uncaptured. This field study makes it clear that NBCAs already make a substantial contribution to village, district, provincial, national and even global economic processes, and have the potential to play an important role in future development and growth. Inadequate investment in NBCAs, and the resulting degradation and loss, can give rise to immense economic and development losses to the Lao economy. Neither the population nor the government can afford to bear these costs, now or in the future.

Section 7

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Annex: Data derivation and sources, Figures 1 and 4

Protected Areas	Ministry of Agriculture and Forestry (2002)
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Roads	Ministry of Agriculture and Forestry (2002)
Rivers	Ministry of Agriculture and Forestry (2002)
Land use	Ministry of Agriculture and Forestry (1997)
Population	Ministry of Agriculture and Forestry (2002)
Poverty	UNEP (1999)
Provinces	Ministry of Agriculture and Forestry (2002)
Villages	Ministry of Agriculture and Forestry (2002)
5-km buffer	ICEM (2002)

Land use

Land use categories for each country have been generalised to achieve cross-country land use categories, as detailed below:

Old land use	**New land use**	**Old land use**	**New land use**
Agricultural hill fields	Agriculture	Mixed broadleaf and coniferous forest	Forest
Agricultural land	Agriculture	Mixed mosaic	Other vegetation
Agricultural plantation	Agriculture	Mixed timber and bamboo	Other vegetation
Agricultural wetland rice	Agriculture	Natural mangrove	Wetland
Bamboo	Other vegetation	Natural regenerating forest	Forest
Barren	Barren	Other	Unclassified
Barren land	Barren	Other agriculture	Agriculture
Cloud	Unclassified	Plantation forest	Plantation
Coniferous forest	Forest	Plantations	Plantation
Cropping mosaic, cropping area <30%	Agriculture	Pure bamboo	Other vegetation
Cropping mosaic, cropping area >30%	Agriculture	Regrowth	Other vegetation
Deciduous	Forest	Regrowth, inundated	Wetland
Deciduous forest	Forest	Rice paddy	Agriculture
Deciduous mosaic	Forest	Rocks	Barren
Dry dipterocarp	Forest	Sand dunes	Barren
Evergreen forest	Forest	Savannah	Other vegetation
Evergreen mosaic	Forest	Scrub	Other vegetation
Evergreen, high cover density	Forest	Scrub with scattered trees	Other vegetation
Evergreen, medium-low cover density	Forest	Seasonally inundated grassland	Wetland
Forest plantation	Plantation	Semi-deciduous forest	Forest
Grassland	Other vegetation	Semi-natural melaleuca	Forest
Habitat mosaic	Other vegetation	Swamp	Wetland
Industrial crops	Agriculture	Unclassified	Unclassified
Inundated	Wetland	Unstocked forest	Forest
Inundated mosaic	Wetland	Upland agriculture	Agriculture
Limestone forest	Forest	Upper mixed deciduous forest	Forest
Limestone karst without forest	Barren	Urban	Urban/industrial
Lower mixed deciduous forest	Forest	Urban or built-over area	Urban/industrial
Lower-dry evergreen forest	Forest	Urban/industrial	Urban/industrial
Mangrove	Wetland	Water	Water
Mangrove plantation	Plantation	Water body	Water
Melaleuca forest	Forest	Wetland	Wetland
Mixed (evergreen and deciduous) medium-low cover density	Forest	Wood- and shrubland, dry	Other vegetation
		Wood- and shrubland, evergreen	Other vegetation
Mixed (evergreen and deciduous), high cover density	Forest	Wood- and shrubland, inundated	Wetland

UNEP poverty indices

Poverty indices data was supplied by UNEP based on work performed by the Stockholm Environment Institute. Indices were developed at district level using "consumption-based" poverty measures. Refer to the SEI report for further details: *Strategic Environmental Framework for the Greater Mekong Subregion.* PP57 Volume 1. SEI, ADB. March 2002.