

FORESTRY RESOURCES AND THE UNDERLYING CAUSES OF DEFORESTATION AND FOREST DEGRADATION IN LAO P. D. R.

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INTRODUCTION

Lao P.D.R ranks among the least developed countries in the world. Its economy depends largely on the country's natural resources base. Even though the economy is expected to gradually diversify over the years to come, use of the country's natural resources will remain the key to future economic growth and to generate foreign exchange.

While the country's relatively rich forestry resources have already been significantly exploited, water and mineral resources remain largely unexploited and could constitute one of the pillars of future economic growth if adequately managed. However, accelerated population growth and the opening up of the economy are likely to place significantly higher demands on the natural resource base and some degradation is already apparent. In the face of weak infrastructure and institutional capacities, this could lead to significant over-exploitation and rapid depletion of the natural resources, especially the forest resource base.

This report focuses mainly on forestry and forest resources and the main causes of deforestation related to the management of the country. The key issue is the accelerated degradation of Lao's forests due to the traditional practice of slash and burn agriculture of upland people, uncontrolled forest fires in the dry season, logging and the conversion of forestland to other uses.

The country's rich biodiversity resources are under increasing threat due to the rapid disappearance of forested land and the absence of a conservation system. Although Laos still has significant unused land resources, the degradation of upland areas due to shorter fallow periods and encroachment by lowland farmers on neighboring uplands are increasingly becoming a concern. The main issue in the area of forest resource management is the threat of forest degradation and the potential loss of agriculture, hydropower capacity and the resulting environmental impact.

This report also focuses on the current state of Lao cypress forests and the main causes of cypress forest degradation. This paper also addresses governmental policies on cypress forest conservation and other activities related to cypress forests.

PART I.

THE HISTORICAL VIEW OF FORESTRY AND FORESTRY RESOURCES IN LAOS

DESCRIPTION OF THE COUNTRY

1. Physiography

The landlocked Lao P.D.R, extending over 236,800 sq km, is situated in the tropics. It is a club-shaped elongated country stretching over 950 km from the North to the South, with a width of 400-500 km in the North and 100-200 km in the Southern stretch.

2. Topography

Except for the alluvial plains of the Mekong valley below the 200 meter elevation, over 80% of the country is mountainous, of which a little over half has an elevation between 1,000 and 2,000 meters with sub-tropical temperatures. Broad flat alluvial valleys extend up the tributaries of the

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Mekong in continuation of the plains. Undulating plateaus, mostly from 200 to a little over 500 meters in elevation, lie between the plains and the mountain range.

Northern Laos is a part of the mountainous mass extending into the neighboring countries of Thailand, Myanma, China, Vietnam and Cambodia.

3. Historical Perspective of the Use of Forests by the Villagers

Forest products other than lumber are an important consideration because most of the population is located in rural areas and several necessities of life come from the forest.

These include wood for fuel, charcoal, poles, bamboo, rattan, wood shingles, sticklac, benzoin, edible nuts, fruits, roots and berries.

From a volume standpoint, wood for fuel and charcoal are the most significant products, consuming up to 3 to 4 million cubic meters annually. Generally this use results in little conflict with commercial logging for lumber, since the material preferred for fuel is both smaller in size and of a different species than trees selected for lumber. However, shortages have developed in many localities due to over-cutting for fuel wood (Vientiane municipality, Louang Prabang, Xieng Khouang, Savannakheth and Bokeo provinces).

The extraction of yang oil offers considerable possibility for conflict, since the trees are in demand for lumber and the sap is used by villagers for lamp fuel, waterproofing baskets, etc. Each tree tapped by a rural family is considered to be their property. If loggers select these for cutting, the villagers are paid 5,000 kips per tree.

Cutting poles can conflict with commercial forestry if villagers are allowed to select the straightest, strongest, fastest growing trees from the plantation, thus downgrading the standard.

LUMBER PRODUCTION AND TRADING IN THE PERIOD OF THE KING ROYAL

1 Lao Timber Processing

Since 1965 Lao lumber has been exported to neighboring countries, most of it in the form of timber. Only a small amount is put through primitive machine processing this being mainly for internal use. Sale to offshore markets was very limited, although many species have sufficient value to warrant the high transportation costs across Thailand and eventual shipping to other countries, normally as Thai origin wood products.

Table 1: Number of Sawmills by Daily Capacity, 1970

Location	Small 1 - 10 cu m/day	Medium 10 - 30 cu m/day	Large Over 30 cu m/day	Total daily capacity	Total annual capacity log scale cu m
Vientiane	1	1	10	650	182,000
Pakse	8	11		240	62,000
Savannakheth	1	9	1	230	56,000
Ban Houay Sai		4	1	120	30,000
Sayabouly		6		120	30,000
	1		3	110	30,000
Paksane	1		3	110	30,000
Thakhek		2	2	100	28,000
All others including 6 USAID-RLG Portable	13	6	-	150	32,000
Totals	24	39	17	1720	450,000

*Actual logs use estimated at 335,000 cu m due to mill breakdowns, log shortages, etc.
335,000 cu m x 60% lumber recovery = 201,000 cu m lumber production

2. Lumber Export 1965-1969

Table 2: Regulated cutting and export 1965-1969 (in cu m or otherwise stated)

Fiscal year	Legal cutting	Export in logs	Lumber recovery 60%	% Export	Non-Exported Lumber
1964 - 65	55,702	22,923	19,670	18	16,090
1965 - 66	69,918	19,519	30,240	12	26,583
1966 - 67	67,752	2,068	39,410	68	12,606
1967 - 68	91,039	1,454	53,750	64	19,240
1968 - 69	78,289	3,071	45,130	66	15,092
1969	116,689	6,000	66,410	60	16,410

3. Lao Woods Suitable for Export (compiled by USAID/IND/Vientiane, August 1970)

Table 3: Suitable species for export

Category	Local name	Scientific name	Retail lumber US\$/cu m	Estimated Volume for Export per year
2	May puay	<i>Lagestroemia spp</i>	58	30,000
1	May Dou	<i>Pterocarpus macrocarpus</i>	66	20,000
2	May Nhang Khao	<i>Dipterocarpus alatus</i>	34	12,000
3	May Bak	<i>Anisoptera cochinchinensis</i>	26	16,000
1	May Tae Kha	<i>Afzelia xylocarpa</i>	60	11,000
3	May Hao	<i>Tarrietia cochinchinensis</i>	34	16,000
2	May Khen Hin	<i>Hopea ferrea</i>	60	5,000
3	May Xi Khao	<i>Shorea vulgaris</i>	52	5,000
4	May Tong	<i>Sandoricum indicum</i>	22	10,000

4. Land Use Policies during the Period of King Royal

Even the ownership of land was doubtful. A system of acceptable titles existed in the cities but the ownership of rural areas depended largely on holding and controlling the land more than through legal title. Taxes collected on land were negligible to non-existent.

The Lao Government Royal (LRG) Forest Service claimed the ownership of extensive areas, which were named and referred to as "Forest Reserves". However, boundaries were not delineated, and personal and other means of preventing trespassing were lacking. Any citizen could informally take up any unoccupied parcel; if use continued over a period of time the rights therefore established could be bought and sold.

Even in areas designed by law or royal decree for specific purposes, squatters' rights were protected by custom and tradition until the current rice crop was harvested. Even if squatters had cleared the land, they were entitled to payment if they were to be legally displaced.

During that time, as a result of the social and legal structure of the country, delineation of Forest Reserves had very little effect unless the land was managed or actively protected against trespassing.

On the other hand, practically all timber (with the exception of the King's teak forest) was the property of the Lao Government Royal Forest

5. Forest Policy and Law in the Period of the Royalty of the King

During the period of French rule, various regulations pertaining to the user were formulated but

these were not strictly applied.

In the period of the Indochina war, there was no distinct forest policy, but Law No 89 from 1951 and the supporting Regulation No 79 provided adequate legal authority to the Water and Forest department for the management of forests. The law was established specifically for silvicultural intent.

However, the above forestry laws and regulations were only the basic instruments to control the movement of logs, sawn timber at control points and illegal fellings from nearby forests.

PART II

FORESTRY AND FOREST RESOURCES

Lao P.D.R is highly dependent on forest resources as a source of foreign exchange (about 54% of foreign exchange earnings in 1991 were derived from forest products) and income for a large share of its people. Given the country and particularly the limited variety of exportable products, Lao P.D.R. will remain dependent on income generated by the forest sector in the future and does therefore not have the option to put all its forest resources under protection. What is therefore needed is a balance between sustainably managed production forests and protection forests in key areas, such as critical watershed areas worthy of protection because of their rich biodiversity.

Table 4: Total area identified by land use and vegetation type, in the year 1989, for the whole country.

No	Land Use Group / Land Use and Vegetation Type	Acronyms	Area (1000)	Area (%)
1	<i>Current Forest</i>	<i>CF</i>	<i>11,167.9</i>	<i>47.162</i>
	Dry Dipterocarp	DD	1,206.5	5.095
	Lower Dry Evergreen	LDE	85.5	0.361
	Upper Dry Evergreen	UDE	1,061.0	4.480
	Lower Mixed Deciduous	LMD	866.0	3.657
	Upper Mixed Deciduous	UMD	7,448.9	31.457
	Gallery Forest	GE	87.5	0.369
	Coniferous	S	132.3	0.559
	Mixed Coniferous / Broad-leaved	MS	208.5	1.184
2	<i>Potential Forest</i>	<i>PF</i>	<i>8,949.0</i>	<i>37.791</i>
	Bamboo	B	1,531.9	6.469
	Unstocked	T	6,791.4	28.680
	Ray	R	625.6	2.642
3	<i>Other Wooded Area</i>	<i>OW</i>	<i>1,444.4</i>	<i>6.099</i>
	Savannah / Open Woodlands	SH	912.5	3.854
	Heath Scrub Forest	SR	531.7	2.245
4	<i>Permanent Agriculture land</i>	<i>PA</i>	<i>849.5</i>	<i>3.587</i>
	Rice Paddy	RP	789.4	3.334
	Agriculture Plantation	AP	17.8	0.075
	Other Agriculture Land	OR	42.3	0.179
5	<i>Other Non-Forest land</i>	<i>NF</i>	<i>1,269.5</i>	<i>5.361</i>
	Barren Lands / Rock	R	116.1	0.049
	Grassland	G	822.8	3.474
	Urban Areas	U	84.2	0.356
	Swamps	SW	35.4	0.149
	Water	W	210.9	0.891
	<i>Total</i>		<i>23,680.0</i>	<i>100.000</i>

Source: Department of Forestry, National Office of Forest Inventory and Planning

1. The Status of Forest Resources in 1989

Statistics from the National Office of Forest Inventory and Planning identifying the land use group and vegetation type are shown in the table below:

2. The Status of Forest Resources in 1996-97

The table below shows the current situation of forest cover in the whole country. However, they are only unofficial data, surveyed by the Forest Cover Project.

Table 5: Forest cover, year 1996-97, whole country

No	Forest type	Forest code	Area (ha)	Area (%)
1	Forest cover	FC	9,063,943.44	39.45
	-Evergreen forest high density	F11	1,130,340.57	4.92
	-Evergreen forest low density	F12	1,655,231.33	7.20
	-Evergreen forest medium density			
	-Mixed, Evergreen, Deciduous forest high density	F13	530,256.86	2.31
	-Mixed, Evergreen, Deciduous forest low-medium density	F17	410,661.84	1.79
	-Mixed forest	F18	2,232,968.55	9.72
	-Deciduous forest high density	F19	1,503,430.20	6.54
	-Deciduous forest low density	F20	711,424.40	3.10
	-Forest regrowth	F22	582,447.56	2.53
	-Forest plantation	F40	305,244.14	1.33
		F54	1,937.99	0,01
2	Non-Forest Cover	NFC	13,914,627.95	60.6
	Wood and shrubland			
	-Evergreen type	F61	8,818,394.78	38.38
	-Grassland	F62	716,727.26	3.12
	-Bamboo	F63	143,069.41	0.62
	-Dry type	F64	350,595.30	1.53
	-Cropping area < 30%	F81	1,302,814.46	5.67
	-Cropping area > 30%	F82	548,235.16	2.39
	-Agriculture land	F91	1,232,446.02	5.36
	-Barren land	F92	782.52	0.00
	-Rocks	F93	215,824.65	0.94
	-Urban	F94	21,114.08	0.09
	-Water	F95	168,443.53	0.73
	-Other	F96	1,207.95	0.01
	-Wetland	F97	17,967.66	0.08
-Clouds	F99	377,005.17	1.64	
	Total		23,680,000.00	100,00

Note: Unofficial data from the Forest Cover Project Source: Mekong Secretary Committee, Forest cover project

3. Location and Number of Sawmills in 1988-1990

Table 6: Recent number of sawmills

Location	Number of sawmills 1988	Nominal capacity (1,000 cu m) 1988	Number of sawmills 1990	Nominal capacity (1,000 cu m) 1990
Vientiane	19	105	33	173
Savannakhet	9	71	20	105
Thakhek	3	21	9	61
Parkse	5	22	6	30
Parksane	3	9	4	15
Other areas	13	63	16	74
Total	52	291	88	458

The above data show that within only 2 years the number of sawmills increased from 52 to 88, and this led to the amount of wood production increasing from 291,000 cu m to 458,000.

However, official annual log harvests have increased steadily over the past 4 decades, averaging 75,000 cu m/year during the 1960's, 140,000's cu m/year during the 1970's, and 270,000 cu m in the 1980s, but increasing significantly to 300,000-450,000 from 1990 to 1993 as the provincial government resorted to logging to boost provincial revenues in the face of budgetary autonomy. Following decentralization and the central government's renewed control over natural resources, official log production quotas have been established at an average of 275,000 cu m / year in the 1990s, approximately the annual allowable cut adopted by the Tropical Forest Action Plan (TFAP). Illegal logging is estimated to amount to another 100,000 cu m / year, raising the total annual cut to almost 50% above the estimated sustainable timber removal rate.

In addition to wood actually harvested and removed from the forest, there is the associated waste, breakage, and decay, which significantly increases the actual removal rates. As harvesting activities are poorly coordinated, many logs are often trapped in the forest and the first landings during the rainy season. Even when logs are stored at second landings to ensure uninterrupted supply to the wood industry, delays of up to 12 months from felling to use are common. Due to the long storage, it has been estimated that about 30%-40% of wood volume and value are lost from the stump to sales point.

Most of the timber harvested is for commercial purpose and another 100,000 cu m are estimated to be cut annually by forest based communities for sale and to meet local needs. The major part of this comes from open area isolated tree stands and does not affect a potential commercial forest.

More than 80% of the country's energy consumption is wood based. It has been estimated that the average fuel wood consumption is about 1.5 cu m / person / year or about 5-6 million cu m per annum. Most of this is harvested by local communities for their own use and is often taken from slash and burn areas and understorey shrubs. Currently, fuel wood still does not pose a serious forest problem in Laos.

4. Export of Timber, Lumber and Plywood

Since 1965, Laos has extracted and exported abroad to meet their national income needs.

The above table can show only Lao timber, lumber and plywood exported in some periods, due to a change in government policy.

Table 7: Timber, Lumber and Flywood Exports in Laos in some years
(X \$1,000 US dollars)

Year	Timber	Lumber	Flywood	Remark
1966	234.247	79.236	-	The number of the products is estimated in US dollars
1967	59.376	746.027	-	"-
1968	39.696	1,014.702	-	"-
1969	52389	915.882	-	"-
1970-84	-	-	-	Data is not available due to the changing of government policy
1985	4,112	871	143	The number of the products is estimated in US dollars
1989	5,749	12,657	137	"-
1990	3,465	17,028	247	"-
1991	3,003	32,796	175	"-
1992	9,596	27,285	61	"-
1993	7,582	31,239	73	"-
1994-98	-	-	-	Data not available

Note: The data from 1967 to 1970 are from the evaluation by the forestry sector, 1970

The data from 1985 to 1993 are from World Bank staff estimates

5. Present State of Deforestation and the Degradation of Forests

Based on the National Reconnaissance Survey, 1989, and the data from the Forest Cover Project, 1997, the total forest area of Lao P.D.R. has rapidly decreased by about 470,000 ha (67,000 ha per year) from 11.64 million ha (49%) in 1982, to 11.17 million ha (47%) in 1989, and if compared with the data from the Forest Cover Project in 1997, the forest cover has been reduced from 47% in 1989 to about 40% in 1997. That means the degradation of the forest is still rapidly continuing. However the data from the Forest cover Project have not yet been officially accepted by the department of forestry. Therefore, the exact rate of deforestation is not yet identified. The table below is the official rate of forest declination within a 7 year period.

The findings are remarkable, especially in the north and middle parts of the country. The degree of deforestation is higher in the Southern part of the country.

Table 8: Decrease of forest areas (1982 to 1989) (x 1.000 ha)

Location	Forest areas 1982 (a)	Forest areas 1989 (b)	(a)-(b)=(c)	Decrease rate (c/a) %
Northern part of Lao	3,765	3,563	203	5.4
Central part of Lao	3,927	3,739	188	4.8
Southern part of Lao	3,945	3,866	79	2.0
	11,637	11,168	469	4.0

Source: Department of Forestry, National Office of Forest Inventory and Planning

6. Underlying Causes of Deforestation and Degradation of Natural Forest.

The official data from the National Reconnaissance Survey show that the total forest cover was about 11.2 million ha (47%) in 1989, and if compared with the unofficial data from the Forest Cover Project, the declination of forest cover decreased to 906 million ha in 1997 (39.4%). During a nine year period, about 2,140,000 ha of the forest area was lost (237,000 ha per year).

The main causes of deforestation are as a result of many factors:

- (1) Shifting cultivation
- (2) Forest fires

- (3) Logging
- (4) The rate of population increase

Shifting Cultivation

The data from the National Reconnaissance Survey show that traditional slash and burn farming was about 626,000 ha in 1989. Over half of the shifting cultivation area is located in the North, about one quarter in the Center and less than 20% in the South. The Tropical Forest Action Plan estimates that each year up to 100,000 ha of forestland are cleared by shifting cultivators. This figure does not seem to be supported by the more recent data from the National Reconnaissance Survey and the Forest Cover Project. First, the total forest area lost annually amounts to 67,000 ha (and it is not likely that over 30,000 ha annually regenerate into forestland) and secondly, a significant share of forestland loss appears to be covered by other land uses, including permanent agricultural land. Even though many studies in the department of forestry have estimated the area used for shifting cultivation in each period of the survey, the exact amount of shifting cultivation area is not clearly identified due to a lack of data and information to follow up the changing of the forest area. However, the data below illustrate the number of families practising slash and burn agriculture.

Table 9: Families practising slash and burn agriculture in the whole country

No	Province	No of families	No of people
1	Vientiane Municipality	5,000	22,000
2	Phong Saly	15,830	93,980
3	Luang Namtha	10,916	65,496
4	Oudomxay	30,279	181,000
5	Bokeo	10,000	30,240
6	Luang prabang	50,000	276,000
7	Huoaphanh	33,000	299,000
8	Xayabury	25,000	90,000
9	Xieng Khuang	15,000	30,000
10	Vientiane	18,000	96,000
11	Borikhamxay	16,000	92,000
12	Khammouane	15,000	82,000
13	Savannakheth	14,000	68,000
14	Saravanh	6,000	35,000
15	Xekong	5,000	17,000
16	Champasack	5,400	30,000
17	Attapeu	3,000	17,000
18	Special Region	N.A	N.A
		277,000	1,637,526

Source: Department of Forestry, provincial data report 1992

Forest Fires

Associated with land clearing for shifting cultivation, the expansion of permanent annual agriculture and grazing areas for cattle annually affect a further 100,000 ha of forest land. Fire, although seen as an important tool to farmers, has severe negative effects gradually eroding the forest area and preventing natural regeneration by killing young trees and other biodiversity. However, the exact area under fire per annum is very difficult to estimate.



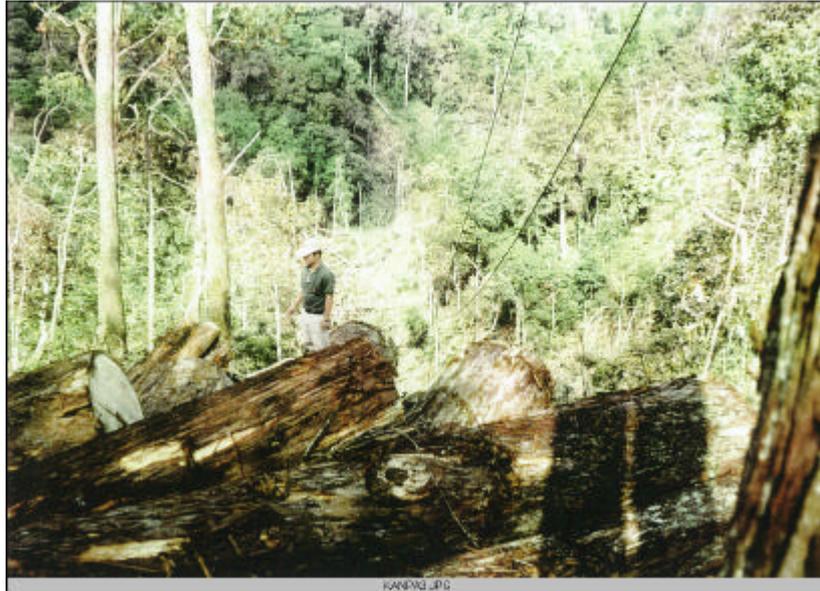
Picture 1: Forest fires in mountainous areas (Northeastern part of Vientiane province)

However, every year forest fires are still a significant issue within the forestry sector and they continue to concern local authorities. To control forest fires, the forestry sector has collaborated with local authorities to enact many regulations and decrees as well as to provide some technical guidance to the local people to encourage them to pay attention and to control forest fires.

Logging

In the past, around 30,000 ha of forestland have been logged annually. While logging seldom results in the disappearance of the affected area's forest cover (i.e. reduction of crown density below 20%), it is clearly a major cause of deforestation to the extent that the current removal of timber is significantly above the annual sustainable extraction rate. In the absence of adequate harvest planning techniques and control, logging concessionaires have further developed poor logging and harvesting practices, which result in unacceptable levels of damage to the residual forest. Some forest is damaged by lumber extraction (see picture 2).

In addition to the direct negative effects of excessive and ill managed logging in the forest, logging is often a catalyst for further degradation by the local population. By opening up and providing access to previously untouched forest areas, logging sets the stage for further degradation through encroachment by lowland farmers or by shifting cultivators, as management of logged over forest areas is virtually non-existent. This is particularly the case in the Center and in the South. The fact that the reduction in high density forest area is significantly above the loss of total forest cover in the South and the Center, combined with the marked expansion of permanent agricultural land suggests that logging followed by the eventual conversion of logged over land into permanent agricultural land is a significant factor leading to deforestation in the South and the Center.



Picture 2: Timber being extracted

The Rate of Population Increase

As mentioned above the degradation of forest in Laos is mainly in the North and the Center. One of the main factors in the destruction of forests is by slash and burn farming resulting from an increasing population in the mountains. It has been causing soil erosion (Northern part of Vientiane province).



Picture 3: Un-sustainable slash and burn farming in mountainous areas.

The rate of the population increase in Laos has been as high as 2.9% per year since 1980, which is the highest among neighboring countries. Within two decades the Lao population has increased from 3 million to 4.5 million. On the other hand, after the stabilization of the political situation,

Laotian refugees have been coming back to the country since 1990. Most of them are mountainous ethnic groups who use traditional agriculture cultivation systems, the so called " slash and burn farming system". Once again they are destroying forests for their survival.

PART III.

MAY LONG LENG OR LAO CYPRESS (*CHAMEACYPARIS OBTUSA* OR *C. FORMOSENSIS*)

1. Introduction

Lao cypress is one of many pine species specifically found in the high mountains of the Northeastern part of the country. Currently, it is an important lumber export species to Japan through the Taiwan Lumber company replacing the Taiwan cypress. Since 1991, Lao cypress has not yet been identified by botanical analyses. Based on the progress report of TSUBURAYA, he guesses it is closely related with the species of *Fokienia hodginsii* or *Fokienia kwaii*.

Only the mountain people seem to know the character of this species. However, since 1992, it has started to be logged only for export. Traditionally, local people have been using Lao Hinoki for generations. e.g. the wood is used for coffins, material for roofing and wall and water containers.

2. Characteristics of a Lao Cypress Forest

The Lao Hinoki forest is not a pure forest; it is mixed with other species. Normally it grows up in a cluster, each one consisting of around 10 to 50 trees.

The rate of the population increase in Laos has been as high as 2.9% per year since 1980, which is the highest among neighboring countries. Within two decades the Lao population has increased from 3 million to 4.5 million. On the other hand, after the stabilization of the political situation, Laotian refugees have been coming back to the country since 1990. Most of them are mountainous ethnic groups who use traditional agriculture cultivation systems, the so called " slash and burn farming system". Once again they are destroying forests for their survival.

Table 10: List of the tree species in Lao cypress

No	Local name	Scientific name	English name	Remark
1	May Long Leng	<i>Chameacyparis obtusa</i>	False cypress	Occur in clusters
2	May Ko	<i>Quercus spp, Pasania spp, Castanopsis spp</i>	Oak	Distributed in the whole area
3	May Hing Hom	<i>Cunninghamia lanceolata</i>	Pine species	Occur in clusters
4	May Sachouang	<i>Cinamomum iners</i>	N.A	
5	May Mouath	<i>Aporosa microcalyx</i>	-"	
6	May My	<i>Schima wallichii</i>	-"	
7	May Lang Dam	<i>Diospiros spp</i>	-"	
8	May Khom Phath	<i>Biscofia trifolia</i>	-"	
9	May San Dong	<i>Dillinia spp</i>	-"	
10	May Phao	<i>Engelhardtia clisolepis</i>	-"	
11	May Xai	<i>Mangletia spp</i>	-"	
12	May Leuat Nok	<i>Knema oblongifolia</i>	-"	
13	May Hing	<i>Keteleeria davidiana</i>	Pine species	
14	May pek Khon kay	<i>Podocarpus imbricatus</i>	Pine species	
15	May Tao Khaen	<i>Podocarpus spp.</i>	Pine species	
16	Other			

Source: NOFIP, Department of Forestry

Based on the data shown above, a Lao natural cypress forest is not a pure forest. It is an Upper Evergreen Mixed forest, which has grown up with many species, including both broad-leafed and coniferous trees. However, a hundred species in this type of forest have yet to be identified. (see the picture shown below)

3. Distribution of Lao Cypress Locations

Table 11.: Location of Lao Cypress

No	Location	Area	Volume	Year of survey	Remark
1	Phou Sam Soum (X.K)	6,700	92,700	1991-1992	Exploited
2	Phou Long Math (X.K)	2,800	12,900	1992-1993	Not yet exploited
3	Phou Len Le (X.K)	2,300	38,500	1992-1993	Not yet exploited
4	Phou Xang Kom (H.P)	5,000	8,700	1993-1994	Exploited
5	Nam Thong (X.K)	30,100	80,000	1992-1993	Exploited
6	Phou Bia (.XS.B)	37,900	163,000	1991-1992	Under exploitation
7	Phou Leuy (H.P)	N.A	4,255	1990-1991	Exploited
8	Phou Pha Deang (.X.S.B)	N.A	1,200	1992-1993	Not yet exploited
9	Nam Xoth (B.L.K.X-K.M)	N.A	8,000	1992-1993	Some exploited
10	Phou Ong Hon (B.L.K.X)	2,500	3,145	1991-1992	Exploited
11	Gnoth Gneuang (H.P & X.K)	10,000	20,000	1998-1999	Surveyed
12	Bouam Vay (X.K)	4,000	10,000	1998-1999	Surveyed
13	Phou Liou (H.P)	6,000	13,000	1998-1999	Surveyed
14	Phou Louang (H.P)	10,000	1,000	1998-1999	Surveyed

Note: H.P - Houa Phan Province X.K - Xieng Khoiang Province
 X.S.B - Xay Som Boun Special zone B.L.K.X - Bolikhamxay Province
 K.M - Khammouane Province

The above data show that the location of the Lao cypress forest is distributed in the Northeastern part of the country with an elevation variance from 1,000 m up to 2,000 m above sea level, and it is mixed with other species like oak and other pine species. However, within the 14 areas which have already been surveyed, some of them were completely exploited by a joint venture company through the concession system. At any rate, the exact number of Lao cypress has not yet been verified due to a lack of information from the provincial forestry sector.

3. Lao Cypress Exploitation and Export

Since 1991, one of many locations of Lao cypress has been surveyed by the National Office of Forest Inventory and Planning (NOFIP) in the Northeastern part of the country (Houaphanh province). One year later it was extracted and exported by a Lao joint venture company. About 7,500 to 8,000 cubic meters were exploited and exported in 1992-1993, with the price 500 to 600 US dollars per cubic meter. After that, many locations of Lao cypress were found and surveyed by NOFIP, and some locations were extracted and exported.

Table 12: List of Lao cypress Exploitation Company In Lao P.D.R.

No	Name of the joint venture company	Year established	Location	Remark
1	BIG-LAO (Lao-Taiwan)	1992	Phou Sam Soum	Xieng Khouang Province
2	Chang Linh Lumber (Taiwan)	1993	Nam thong	Xieng Khouang Province
3	Ching Chang Lumber (Taiwan)	1993	Phou Bia	Special Zone
4	Yu Nan (China)	1993	Phou Xang Kom	Houa Phanh Province
5	B.P.K.P. (State company)	-	Phou Ong Hon, Nam Xoth.	Bolikhamxay Province
6	Kouang Keomany (Lao- Taiwan)	1992	Phou Leuy	Houa Phanh Province

Note: Source is the Department of Forestry, Ministry of Agriculture and Forestry

At present the Koang Keomany company has already ceased operating due to financial and marketing problems. Only five companies are still continuing their activities.

Lao cypress extraction is only for export with the goal being to increase national incomes. Currently the average price of Lao cypress is about 1,000 US dollars per cubic meter. Most of the logs are exported to foreign countries through Taiwanese companies, and the main proceeds from the sale of Lao cypress go directly to the Lao national budget. However, many locations of cypress forests have still not been exploited, and some of these locations have already been designated National Biodiversity Conservation Areas.

4. Historical View of the Deforestation of Lao Cypress Forests

As mentioned above, Lao Hinoki forest has also been deforested in the same manner as other forest areas both in the flat lands and in the mountainous areas. The main causes of Lao cypress degradation are:

- (1) Shifting cultivation by upland inhabitants
- (2) Logging and transportation
- (3) Unregulated cutting
- (4) Forest fires

Shifting Cultivation in Lao Cypress Forest

Based on data from a survey by the National Office of Forest Inventory and Planning, half of the area of each location of Lao cypress was degraded due to the shifting cultivation of upland people who live in or around of the cypress forest, especially the Hmong ethnic group or Lao sung. This ethnic group occupies land at high altitudes, where soil is generally less fertile and high steep slopes exist. There is no arable land for permanent agriculture. Therefore slash and burn is their main occupation to be sufficient in foodstuff. The most common crops are maize and poppy in areas where the temperatures are lower and where there is often Lao cypress forest. The upland rice is cultivated at a lower altitude, where the temperatures are higher. Maize and poppy are planted together as intercropping, requiring ample mineral supply from the soil, and pulses are planted to improve soil fertility. However, agricultural activities tend to be aimed at the highest possible immediate production and do not pay attention to the conservation and stability of the land. The often steeply sloping fields are weeded without great care to allow prolonged cultivation and no trees are left standing. Fires are not paid attention to and are not controlled so they frequently get out of hand. This system of agricultural practice will continue up to the time the soil is completely depleted of nutrients, and the fields will be abandoned without the intention to return after a fallow period. Because of the fragile nature of the ecosystem of these areas the environment is threatened; the abandoned land is vulnerable to soil erosion in the rainy season, and rapidly becomes barren land or savanna with some species of

grasses. It is in these regions that natural rehabilitation and soil regeneration are difficult or impossible.

Logging and Transportation

The logging and transportation system which many companies have been using for extraction of Lao cypress is not a sustainable system, even though the rules, regulations and forestry laws have issued many measures to protect Lao cypress forest as well as other valuable forests.

To ensure well managed and controlled systems with sustainable means, only the central government can issue the extraction license of Lao cypress and selected cutting is allowed. The diameter (DBH) allowed for exploitation has to be bigger than 95 cm. However, in reality, these measures seem to be neglected. (e.g.: the trees are cut down but no rehabilitation has been done in the logging areas or transportation road sites, and there are no studies or research activities to provide appropriate techniques to rehabilitate, manage and protect these valuable forests).

On the other hand, the specific character of the cypress forest is that it mostly occurs in the high altitudes, with some locations on rocky mountains and on high steep slopes. Therefore, replanting the forest is very difficult and it is done at a very high cost.

Due to a lack of forestry professionals who have experience in seedling production and because of a very limited rehabilitation budget, afforestation in the logging sites has not yet been implemented.

The cypress forest in the Lao P.D.R. is not a pure forest. It grows up and forms a cluster, and each cluster consists of about 5 to 20 trees as mentioned above.

Most cypress forests are very old, with an average tree diameter larger than 90 cm and a canopy density of more than 70%. This means that natural regeneration is not likely to occur under these forest conditions.

Unregulated Cutting

Due to the fact that cypress forests grow up far away and in mountainous areas, they are difficult to control and manage. Therefore, they are prone to unregulated cutting or destruction by local people or some bad elements that live in or around the cypress forests. Every year cypress trees will be cut down and used for house construction, coffins and other purposes (e.g. material for house roofing, panels and other uses), and sometimes sold to a nearby middleman. However, no exact information is available on how much, or what number of Lao cypress are illegally cut down each year.

Forest Fires

Forest fires occur and spread mainly due to the uncontrolled fires of people who practise slash and burn (e.g no fire belt protection around their fields before burning, burning forests for hunting and burning to plant grasses for cattle etc). After the fire spreads, many young populations of cypress as well as other species will burn. Every year a thousand ha of forestland is destroyed by fire with these fires , often occurring from January to April.

5. Current Conservation of Laotian Cypress

Even so, the Lao P.D R. is rich in fauna and flora species if compared with neighboring countries. Many of these countries place a high conservation value on trees such as the Laotian cypress. Due to their special biological distribution, rarity and risk of extinction, it is of particular interest to note the special genus of the pine species called Lao cypress . It is a special species which must be protected, and the Lao government places it high on the list of protected tree species with the strict enforcement of legal action for protection of these special species. Thus, the Government has already established 20 National Biodiversity Conservation Areas throughout the country. However, the special measures to conserve and manage Lao cypress have not yet been completely implemented. These officially declared National Biodiversity Conservation Areas include the locations of Lao cypress, which cover more than 25% of the total forestland in the whole country

Table 13: Location of National Bio-diversity Conservation Areas

No	N.B.C.As name	Area (ha)	Province/where	Remark
1	Phou Deandeen	222,000	Phongsaly	
2	Phou Leui	150,000	Houaphanh	Including Lao cypress locations
3	Nam et	170,000	-“-	-“-
4	Nam Sam	70,000	-“-	-“-
5	Nam Ha	69,000	Luangnamtha	
6	Nam pui	191,200	Xayabury	
7	Phou Khao Khuay	200,000	Vientiane-Borikhamxay	
8	Phou Phanang	70,000	Vientiane municipality	
9	Nam Kading	169,000	Borikhamxay	
10	Nakai-Nam Theun	353,200	Khammouane	Including Lao cypress locations
11	Phou Hinponn	150,000	-“-	
12	Hin Namno	82,000	-“-	
13	Phou Sanghe	109,900	Savannakhet	
14	Se Bang Nouane	150,000	Savannakhet-Saravane	
15	Phou Xieng thong	120,000	Saravane	
16	Dong Houa Sao	110,000	Champasack	
17	Sepiane	240,000	Champasack-Attopeu	
18	Dong Ampham	200,000	Attopeu	
19	Se Sap	133,500	Saravane	
20	Dong Phouvieng	53,000	Savannakhet	
		3,012,800		

Source: Department of Forestry, MAP.

Note: Only three N.B.C.As include Lao cypress locations

CONCLUSION.

This report focused on the state of natural forest resources in Lao P.D.R. and the causes of deforestation in the past and up to the present. Land use policies in each period were also included. The third part of this paper focused on a specific valuable species, the so called Lao cypress or in the Laotian language, *may long leng*, which is a significant export species that has served to increase national incomes.

In the future, if the Lao government does not pay attention to the situation and does not apply strong measures to counter the negative effects of logging, it is uncertain whether Lao P.D.R will continue to be one of the Southeast Asian countries that is rich in natural resources in the next century. Many factors contribute to the degree of deforestation. Currently, attempts are being made to subordinate forest conservation and management as evidenced by the wasteful practice of shifting cultivation amongst forest communities. Forest education and research programs are ill-equipped to take advantage of advances in forest technology. As well, the forest policy is not yet completely implemented at the grass-roots level. Existing biotic pressures are beyond the carrying capacity of forests.

However, to tackle the forest problems, the Lao government has placed great emphasis on the following policies:

- (1) Rational utilization of forest resources
- (2) Reduction of slash and burn for cultivation in both lowland and upland areas
- (3) Protection as well as rehabilitation of both N.B.C.As and degraded forests
- (4) Educational capacity development
- (5) Institutional strengthening

In the five year plan of 1996 -2000, the Department of Forestry has put forth many efforts to

institute the above policies. A series of decrees by the Prime Minister were issued in the early years including:

- Prime Minister's Decree No. 67 on "the national logging ban" Aug. 28 1991.
- Prime Minister's Decree No. 169 , June, 3, 1993 on "The management and use of forests and forest land".
- Prime Minister's Decree No. 186, on "Land and degraded forest allocation for tree planting and protection", Oct, 12, 1994.
- In recent years forestry and water laws were issued and passed through the National Assembly.

However, the above mentioned decrees and laws are only the basic instruments local administrations have been given to implement the policies of government in the forestry sector, their mandate being to conserve and manage the natural resources and the environment.

REFERENCES

- (1). Lao P.D.R., Country Report, 1994.
- (2). Hiroyuki TSUBURAYA, Forest Management, June 1995.
- (3). IUCN the World Conservation Union, Bio-diversity Conservation Protected Areas and the Development Imperative in Lao P.D.R., 1996.
- (4). Lao P.D.R. Socio-economic Development Strategies, June 1994.
- (5). Pheng Souvanthong, Shifting Cultivation in Lao P.D.R., 1995.
- (6). Lao P.D.R., Environment Overview. 1995.
- (7). The Study on Watershed Management Plan for Forest Conservation in Vang Vieng District Lao P.D.R., 1997.
- (8). Department of Forestry, Sawmill Survey, 1989.
- (9). United States Agency for International Development Mission, Forestry Evaluation, November 1970.
- (10). Department of Forestry, National Office of Forest Inventory and Planning, Forest Cover and Use in the Lao P.D.R., December 1992.
- (11). Lao P.D.R., Shifting Cultivation Stabilization Project, 1997.
- (12). National Office of Forest Inventory and Planning, Report of the Field Survey of Lao Cypress in Phou Bia, Phou Onghone, Nam Thong, Phou Leui and Phou Sam Soum.

**Appendix : List of key organizations related to natural forest conservation
In Lao P.D.R.**

No	Name of the organization	Telephone number	Remark
1	Science Technology and Environment Organization (STENO)	Tel: +856-21-213470	Prime Minister's Office
2	Center for Protected Areas and Watershed Management (CPAWM)	Tel: +856-21-213491 Fax: +856-21-213491	Ministry of Agriculture and Forestry, Department of Forestry
3	National Office of Forest Inventory and Planning (NOFIP)	Tel: +856-21-413184 Fax: +856-21-414181	Ministry of Agriculture and Forestry, Department of Forestry
4	Promotion of Forestry Education at Vientiane Forestry College Project (PROFEP)	Tel: +856-21-414813 Fax: +856-21-732294	Ministry of Education, National University of Lao
5	Forest Management and Conservation Project (FOMACOP)	Tel: +856-21-219561 Fax: +856-21-217483	Ministry of Agriculture and Forestry, Department of Forestry
6	Shifting Cultivation Stabilization Project	Tel: +856-21-416594 Fax: +856-21-416594	Ministry of Agriculture and Forestry
7	Forest Conservation and Afforestation Project	Fax: +856-21-219512 Tel: +856-21-214459	Ministry of Agriculture and Forestry, Department of Forestry
8	Forestry Research Center (FRC)	Tel: +856-21-732282 Fax: +856-21-732282	Ministry of Agriculture and Forestry, Department of Forestry
7	Forest Conservation and Afforestation Project	+856-21-219512	Ministry of Agriculture and Forestry, Department of Forestry
8	Nam Ngum Watershed Management and Conservation Project	+856-21-222483	Ministry of Agriculture and Forestry, Department of Forestry

Figure 1.

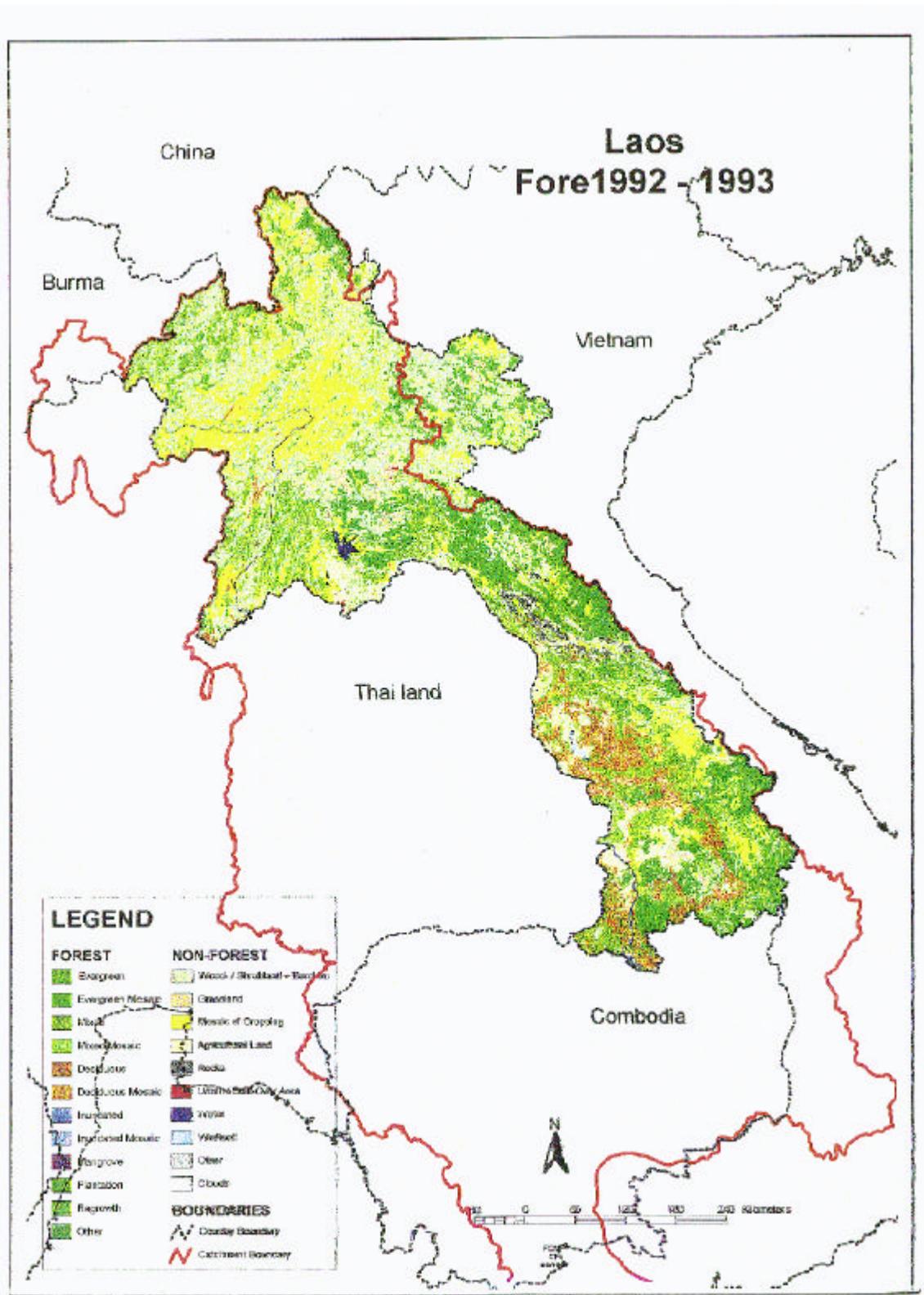


Figure 2.

