



Lao PDR ENVIRONMENT MONITOR





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Lao PDR has a remarkable range of natural resources and environmental riches, despite being categorized as a ‘least developed country’. With almost half of the country under forest cover and abundance of water and a low population density, Lao PDR has a diversity of species that is found in few other countries in the region. The country’s economic development is largely dependent on its natural resources, mainly water (for hydropower), forests and minerals.

Once the Land of a Million Elephants, Lao PDR is now confronted with numerous environmental challenges. The unsustainable exploitation of resources has resulted in degradation of land and loss of natural habitats. This degradation, combined with declining water quality and increasing threats to air quality, is disproportionately impacting the poorest groups in the country. This report studies the level of natural resource degradation and declining environmental quality, and their implications for long-term sustainable development and quality of life in a country where poverty reduction remains a key challenge.

In response to declining environmental conditions, the country has made important strides in instituting changes in partnership with local communities and international organizations. Over the past five years, the country has invested millions of dollars in improving environmental management, focusing on building capacity among Government agencies and raising awareness more broadly, establishing protocols for monitoring and managing environment indicators, and making site-based investments. The results of these investments have been mixed. The challenges facing the environment in Lao PDR are many and varied, requiring a more strategic approach.

The Lao Environment Monitor 2005 is the first of a series of monitors presenting a snapshot of environmental status, and key trends and challenges in Lao PDR. Its purpose is to engage and inform stakeholders of key environmental changes as they occur, in an easy-to-understand format. The report focuses on the general status of environment. Using charts and graphs the Monitor benchmarks trends in natural resources and environmental quality. In addition, this Monitor analyzes the effectiveness of Government policies and assesses the capacity of institutions to address environmental issues.

Information has been obtained from a variety of sources, including the Lao Government and Bank publications, academic and scholarly material and personal experience. Several surveys and assessments were undertaken to obtain additional data and insights: (i) A *Capacity Assessment* was undertaken to assess the effectiveness of the country’s institutions regulatory framework; (ii) *Public Environmental Expenditures* were reviewed to better understand the allocation and trends in environment-related expenditures; (iii) A *Survey of Environmental Attitudes* was undertaken to assess the perceptions of individuals working in environmental professions in Lao PDR; and (iv) the Poverty-Environment Nexus in Lao PDR was further studied. The results of these surveys and analyses are included in the report.

This Monitor builds on the experiences of other Country Environment Monitors in the region and embraces the key principles articulated by the framework for preparing Country Environmental Analysis initiatives of the Asian Development Bank and the World Bank. The Monitor has three sections. Section 1 reviews trends in natural resources and environmental quality, along with their linkages to poverty. The capacity of Government institutions, policies, legislation and instruments are assessed in Section 2. The environmental challenges confronting the country are analyzed in Section 3.

This Monitor is the result of a collaborative exercise that involved staff from various Lao Government agencies, coordinated by the Environment Research Institute in STEA, and the World Bank. Preparation of this report was closely coordinated with the Asian Development Bank and the United Nations Environment Program.

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank	MAF	Ministry of Agriculture and Forestry
ASEAN	Association of Southeast Asian Nations	MCTPC	Ministry of Communications, Transport, Post and Construction
BSc	Bachelor of Science	MDG	Millennium Development Goals
CBD	Convention on Biological Diversity	MF	Ministry of Finance
CCD	United Nations Convention to Combat Desertification	MIC	Ministry of Information and Culture
CITES	Convention on International Trade in Endangered Species	MEM	Ministry of Energy and Mines
CPAWM	Center for Protected Areas and Watershed Management	MoE	Ministry of Education
CPI	Committee for Planning and Investment	MoInt	Ministry of Interior
DAFOs	District Agriculture and Forestry Offices	MoH	Ministry of Public Health
DCTPC	Department of Communications, Transport, Post and Construction	NAFES	National Agriculture and Forestry Extension Service
DFRC	Division for Forest Resources Conservation (DoF/MAF)	NAFRI	National Agriculture and Forestry Research Institute
DGM	Department of Geology & Mines	NBCA	National Biodiversity Conservation Area
DHUP	Department of Housing and Urban Planning	NCEHWS	National Center for Environmental Health and Water Supply, MoH
DoE	Department of Electricity, MEM	NEC	National Environment Committee
DoE	Department of Environment, STEA	NNT- NPA	The Nakai Nam Theun National Protected Area
DOF	Department of Forestry	NPA	National Protected Area
DoI	Department of Industry	NTFP	Non-Timber Forest Product
DoP	Department of Planning, MAF	NUoL	National University of Lao PDR
DoR	Department of Roads	OECD	Organization for Economic Co-operation and Development
EdL	Electricite du Laos	PA	Protection Agencies
EDC	Environmental Data Center (ERI/STEA)	PAFO	Provincial Agriculture and Forestry Office
EEA	Environmental Education and Awareness	PM	Particulate Matter
EIA	Environmental Impact Assessment	PSTEO	Provincial Science, Technology & Environment Office
EMMU	Environmental Management and Monitoring Units	SEM	Strengthening Environmental Management
EPL	Environmental Protection Law	SEMD	Social and Environment Management Division
EQMC	Environment Quality Monitoring Center	SEMFOF	Social and Environmental Management Framework and Operational Plan
ERI	Environment of Research Institute (STEA)	Sida	Swedish International Development Cooperation Agency
ESD	Environment and Social Division	STEA	Science, Technology & Environment Agency
FAO	Food and Agriculture Organization of the United Nations	TSP	Total Suspended Particulates
FRC	Forest Research Center	TT	Teacher Training
GDP	Gross Domestic Product	UDAA	Urban Development and Administration Authority
GoL	Government of Lao PDR	UNEP	United Nations Environment Program
HPO	Hydropower Office	UNFCCC	United Nations Framework Convention on Climate Change
ICEM	International Centre for Environmental Management	UNICEF	United Nations Children's Fund
IED	Industrial Environment Division	URDD	Urban and Rural Development Division
IMF	International Monetary Fund	UXO	Unexploded Ordnance
IUCN	The World Conservation Union	WCS	Wildlife Conservation Society
LEM	Lao Environment Monitor	WHO	World Health Organization
LFNR	Lao Front for National Reconstruction	WRCC	Water Resources Coordinator Committee
LNCE	Lao National Committee for Energy	WRI	World Resource Institute
LNMC	Lao National Mekong Committee	WRM	World Rainforest Movement
LNMCS	Lao National Mekong Committee Secretariat	WSS	Water Supply and Sanitation
LTUF	Lao Trade Union Federation	WWF	World Wide Fund for Nature
LWU	Lao Women's Union		
LYU	Lao Youth Union		

Unless otherwise noted, all dollars are US Dollars
Exchange rates: kips per US dollar - 9,860 (November 2006)



EXECUTIVE SUMMARY

Lao PDR is a landlocked and mountainous country, which is surrounded by Cambodia, China, Myanmar, Thailand and Vietnam. It is a multi-ethnic society, with a cultural diversity unparalleled in the Indochina region. About 73.2 percent of the country's 5.6 million people live on less than US\$ 2 per day. With a per capita GDP of US\$ 402, it is one of the poorest countries in the East Asia and Pacific Region. The country's human development ranking is 143rd among 175 countries. With this level of poverty, the country's natural resource base becomes of critical importance in poverty alleviation and growth. However, natural resource degradation, combined with inadequate provision of environmental services is disproportionately affecting the poor in Lao PDR.

Natural Resources Degradation

In Lao PDR, forest cover currently stands at 41.5 percent of the area of the country. It has a large volume of internal renewable water resources and considerable mineral resources, such as gold, lignite and copper. These natural resources have catalyzed past economic growth, but mismanaged exploitation has caused significant environmental damage to the country.

Much of the land in Lao PDR is susceptible to soil erosion as a result of the large amount of land with a high degree of slope, the types of soils and the high rainfall. Soil erosion is compounded by shortened fallow periods, resulting in lower productivity and ever increasing demand for more land.

Shifting agriculture is used in forested lands to cultivate the upland areas. Some forms of shifting agriculture, including long rotational swidden, are not harmful to the land and are suitable for Lao PDR. However, pioneer 'slash and burn' is still used in Lao PDR.

Lao PDR is rich in forest cover relative to many other Asian countries. In 1940, forests were estimated to cover 17 million ha, approximately 70 percent of the land area. Recent surveys suggest that this figure is being reduced by an average of 53,000 ha per annum, with a 2004 cover of 41.5 percent.

Lao PDR is one of the most biodiversity-rich countries in Southeast Asia. Despite relatively poor information, it is

known that over-harvesting and wildlife trade are by far the greatest threats to biodiversity, placing much of it at risk of local extirpation domestic and increasing foreign demand. As part of its efforts to conserve its biodiversity, Lao PDR currently has 20 National Protected Areas (NPAs) and two Corridors, covering almost 3.34 million hectares, or 14 percent of the country. If the area under provincial and district protection is added, the area increases to 5.3 million hectares, or 22.6 percent of the land area.

Lao PDR's protected areas are among the most remote areas in the country. However, human use of these areas is rising as a result of increased population growth in traditional communities, migration, and settlement. In addition, both protected areas and the land around them face increasing degradation as a result of expanding agricultural frontiers, illegal hunting, illegal logging, and uncontrolled burning.

The hydropower potential of Lao PDR is high compared to other countries in the lower Mekong River Basin, providing the Government with an opportunity to earn foreign income to support socio-economic development. The hydropower sector has developed rapidly; annual production rising to 3,674 million KWh as of 2002.

The total renewable water resources of Lao PDR are estimated at 190 billion m³ per year. However, development emphasis on expanding land cultivation and increasing exploitation of hydropower potential is putting additional pressure on the resource base.

Environmental Quality

In Lao PDR, surface water is the major water source for urban supply as most towns are located along the rivers, while groundwater is the main source for the rural population. Whilst still within acceptable limits both surface and groundwater quality are declining. With rising populations in urban and upland areas, water pollution issues will become increasingly important in the near future. Sixty four percent of Laotians have access to safe drinking water.

Throughout Lao PDR there is a high incidence of gastrointestinal diseases, such as diarrhea and dysentery,

caused by inadequate water supply, poor sanitation and sewerage, and poor hygiene. Seventy percent of the urban households have access to satisfactory sanitation facilities such as cistern flush or pour flush toilets, but this sharply contrasts with the 36 percent coverage in rural areas where 80 percent of the population lives.

Vientiane Capital City is presently establishing sewage system, the country's first. On-site wastewater disposal and treatment facilities, mainly septic tanks, are often poorly designed, constructed and maintained and therefore perform badly. In addition, discharges from some major industrial and mining establishments are also polluting water sources.

The generation of solid waste in urban areas in Lao PDR is on the rise, and poses an emerging threat to the quality of surface and groundwater. Expanding urban populations, combined with poor collection and largely inadequate disposal facilities, are compounding the level of pollution.

The current annual waste generation is 270,000 tons. Domestic waste accounts for the bulk of it. The average daily urban waste production is 0.75 kg per capita. Vientiane Capital City and the four secondary towns account for 0.8–1.4 kg per capita per day. Only Vientiane and the four secondary towns have landfills, but the disposal areas are small, and have no leachate collection or monitoring wells. Over two thirds of municipal waste could be recycled, but the current scale of recycling in Lao PDR is still very modest.

Current urban air pollution in Lao PDR is at a safe level. However, air quality is expected to worsen if adequate mitigation measures are not taken immediately, especially in Vientiane Capital City, where the number of vehicles has been growing annually at almost 10 percent during the past decade.

Indoor air pollution, caused by use of wood-stoves, is prevalent, but no data are currently available on this issue.

There is limited information on the current levels of hazardous chemicals (including heavy metals and

persistent organic pollutants or POPs) in the aquatic and terrestrial environment of Lao PDR. As the country continues to develop its industrial capacity, it is expected that hazardous chemicals will become an increasingly important issue in the future.

Environmental Management

The institutional structure for environmental management in Lao PDR consists of: (a) the Science, Technology and Environment Agency (STEA) as the main manager, monitor and coordinator of the environment at the national level, and a number of other ministries and institutions in charge of mitigating environment issues arising from their sectoral development activities; (b) national committees which guide inter-sectoral coordination among agencies; (c) provincial and district entities which have devolved responsibility for environmental protection at the local level; and (d) mass organizations which support the government in promoting participation and awareness.

Recognizing the cross-sectoral character of environmental conservation and protection, the Lao Government has created multiple coordination bodies to facilitate inter-agency and provincial coordination. These include the National Environment Committee (NEC), the Water Resources Coordination Committee (WRCC), and the Lao National Mekong Committee (LNMC).

In 2000, the Government began implementing its decentralization policy to transform the province into the strategic unit, the district as the planning and budgetary unit, and the village as the implementing unit. Most national agencies, including STEA and MAF are making progress in devolving their authority to the provinces but are constrained by lack of human and financial resources.

Lao PDR has also started to put in place a sound legal framework for environmental protection and natural resources conservation. The Environmental Protection Law of 1999, supported by its Implementing Decree of 2002, is the principal environmental legislation in the country. It includes measures for the protection, mitigation and restoration of the environment as well as guidelines for environmental management and monitoring.



EXECUTIVE SUMMARY

The recent approval of the Nam Theun 2 Hydropower Project, funded by a consortium of international financiers, is a significant milestone in Lao's commitment to pursue the path of sustainable development. This Project's design embeds several pioneering environmental and social features that will enhance its sustainability, and serves as a good model for replication in Lao and elsewhere.

Main Challenges

The Government of Lao PDR has made important strides in instituting changes that could slow the pace of natural resources degradation, in partnership with local communities and international organizations. Recent institutional achievements include: enacting the environmental impact assessment decree; development of a policy to safeguard the environmental and social sustainability of the hydropower sector; creation of an Environment Protection Fund; strengthening the regulation for wildlife trade in endangered species; creating a specialized agency to protect and manage the Nam Theun Watershed; decentralizing environmental functions to provinces; improving water and air quality monitoring; and establishing a third-party monitoring protocol to report on environmental impacts of development projects. Furthermore, sustainable management of the country's natural resources and responsible governance of the benefits accrued from their use has been identified as an integral part of the government's recently approved National Growth and Poverty Eradication Strategy (NGPES).

Despite this progress, environmental threats continue – deforestation has increased, threats to protected areas are rising, and urban environmental problems are now emerging. These have been exacerbated by rapid growth, lack of human resources, inadequate financing, uneven enforcement of environmental laws, and growing demand for natural resources from neighboring countries. The main challenges are:

Forests and Forest Products

- Creating a system of National Production Forest Areas (NPFA) through formal arrangements with local communities, which would ensure benefit sharing arrangements and increased participation

to empower communities to use forest revenues for local development efforts.

Land Management

- Establishing a nationwide land administration system, increasing dialogue, consultations and community involvement, as well as promoting and developing local or traditional practices in land management and in the land policy development process.

Biodiversity and Habitats

- Strengthening the NPA system, by increasing budgets for recurrent expenditures and working with local communities in NPAs to better protect and sustainably manage biodiversity.
- Implementing the National Biodiversity Strategy and Action Plan (NBSAP) in partnership with local communities where local knowledge and traditions are respected.

Water Resources

- Exploiting the hydropower potential of Lao PDR in a sustainable manner, by giving careful consideration to environmental and social issues, as demonstrated by the Nam Theun 2 Hydropower Project. This experience could be replicated in other hydropower projects currently under development.
- Improving the efficiency of water utilization in agriculture, hydropower generation, and water supply.

Urban Environment

- Improving, through local governments and Urban Development and Administration Authorities (UDAA), sewage systems, solid waste collection, recycling and disposal.
- Expanding access to safe water supply and sanitation to cope with increasing demand for environmental services.

Institutions and Instruments

- Developing skills and capacity in the country to implement and enforce the environmental legislation and policies.
- Clarifying regulatory mandates among different ministries and agencies, and strengthening enforcement.

- Strengthening institutional coordination through the National Environment Committee.
- Adopting and scaling up environmental management models that have already been developed under specific projects like the Nam Theun 2 Hydropower Project.

Financing

- Increasing budget allocation for environmental functions several fold from its current low-level. Instituting a governance mechanism that ensures proper allocation of revenues from the use of natural resources for addressing environmental issues.
- Operationalizing the Environment Protection Fund as an effective financing entity.
- Promoting and developing the active involvement and participation of the private sector in investing in environmental sectors, such as reforestation, recycling and reusing waste, sewage treatment, river bank erosion, environmentally sound technology in industrial development.

Awareness and Participation

- Raising basic awareness on priority environmental issues through village awareness programs and mobilizing mass organizations.
- Targeting children and youth through environmental education curricula at all levels
- Strengthening facilities at the tertiary-level, including at the National University of Lao, for conducting advanced studies and research in environmental and natural resources management.
- Establishing knowledge centers such as herbaria, national parks, botanical gardens and ecology centers to expose and educate Laotians to the country's unique ecological assets and riches.



ENVIRONMENTAL INDICATORS

Natural Resources, Environmental Quality and Environmental Management Indicators

Agenda	Indicators	Value	Year
<i>Natural Resources</i>			
Land Resources	Cultivated land area (percent of total land area)	8	2003
Forest Resources	Proportion of land area covered by forest (percent)	41.5	2004
	Rate of deforestation (hectares per year)	53,000	2004
Protected Areas and Biodiversity	Ratio of area protected to maintain biological diversity to surface area (percent including national, provincial and district)	22	2004
Water Resources	Land equipped for irrigation during the dry season (ha)	214,832	2003
	Land effectively irrigated during the dry season (ha)	130,000	2003
	Hydropower production per year (million KWh)	3,674	2002
	Fisheries production (tonnes per year)	80,000	2001
<i>Environmental Quality</i>			
Water Pollution	Access to safe drinking water (percent of population: rural, urban, total)	60, 75, 64	2004
	Access to improved sanitation (percent of population: Rural, Urban, total)	36, 70, 44	2004
Solid Waste	Solid waste generation in urban areas (kg/capita/day)	0.75	2004
	Solid waste collection efficiency of urban households in the five larger urban areas (percent)	45	2003
	Number of sanitary landfills	5	2003
Air Pollution	Number of passenger cars per 1000 people	7.4	2003
	Carbon dioxide emission (metric tons per capita)	0.1	1999
General Health	Under-five mortality rate (number per 1,000 live births)	106	2000
<i>Environmental Management</i>			
Institutional Capacity (Staffing)	Environment staff at national level: STEA (DoE, ERI)	47	2003-2004
	Staff at Provincial level: PSTEOs	300	2003-2004
	Environment staff at Implementing sector agencies (MAF, MCTPC, MEM, and MOH)	278	2003-2004
	Staffing at national level for the management of NPA (DFRC/MAF, staff per 1 million ha of national protected areas)	4.8	2003-2004
	Staffing at Provincial level for the management of NPA: PA (Staff per 1 million ha of national protected areas)	45.3	2003-2004
Environment Expenditure	At the national level (percent of total Public Expenditure)	0.6%	2001-2002
Environmental Education	Number of students enrolled for undergraduate environmental studies.	40	2004

Comparison of Environmental Indicators among Mekong Countries

Environmental Indicators	Lao PDR	Cambodia	Thailand	Vietnam
Number of Population (persons)	5,609,997	13,363,421	64,865,523	82,689,518
Land area (sq.km.)	236,800	181,040	515,113.6	331,114
Forest (1,000 sq. km.)	126	93	148	98
Deforestation (average annual % change 1990-2000)	0.4	0.6	0.7	-0.5
Land under protection (% of total land)	14	18.5	13.9	3.7
Water use (% of total resources)	0.3	0.1	8.1	6.1
CO2 emissions (metric tons per capita)	0.1	0.1	3.2	0.6
Access to an improved water source (% of total pop.)	64	30	84	77
Access to improved sanitation facilities (% of total pop.)	44	17	96	47
Environmental expenditure (% of total expenditure)	0.6	-	1.2-1.4	0.8-1

10%

- Public expenditure spent on environmental protection (0.6%)
- Provincial staff who work on environmental protection
- Primary schools with proper latrines
- Use of pesticides in agriculture

20%

- Land area under protection (national, provincial and district)
- Population residing in urban areas
- Villages with access to electricity
- Manufacturing as a proportion of GDP

30%

- Land area with slope greater than 30 degrees
- Population living below poverty line

40%

- Villages practicing slash-and-burn agriculture
- Population with access to improved sanitation

50%

- School-age children infected with soil transmitted parasites
- Agricultural land affected by UXO
- Garbage collected in 5 largest towns
- Land area under forest cover

60%

- Population with access to safe drinking water
- Target for forest cover by 2020
- NTFPs as a source of rural family cash income

70%

- Ethnic minorities as a proportion of total population
- Municipal waste that can be recycle



SECTION 1: TRENDS IN THE ENVIRONMENT

NATURAL RESOURCES

OVERVIEW

As much as 73.2 percent of Lao PDR's population lives on less than US\$2 a day. On the other hand, the country is rich in natural resources, with forest cover at 41.5 percent of total land area¹. This natural resource base is of critical importance for the country's poverty alleviation and growth.

The economy of Lao PDR is primarily natural resource based with more than 50 percent of GDP from agriculture, forestry, livestock and fisheries. Most communities also rely on fuel wood for energy and many on non-timber forest products (NTFPs) for food supply. Lao PDR is comprised of diverse ethnic groups whose social systems, cultural characteristics and identities are linked to their local ecosystems.

While rich in natural resources, including hydropower potential, forestry and NTFPs, modern agriculture in Lao PDR is constrained by limited availability of flat land. Population growth remains relatively high at almost 3 percent per year, increasing the pressure on natural resources in rural areas.

Recent studies have shown that the poorer districts in Lao PDR are especially susceptible to land and forest resources degradation².

Land Degradation and Poverty

About half of the total land area in the poorest districts has an average slope of more than 30 percent³. With little technical and financial support in finding more productive options to dry-rice cultivation, the poor have had to supplement low crop yields by resorting to already declining NTFPs.

Poverty and Natural Resources in Lao PDR

Areas	Indicators:	Poverty and Geographic Analysis:
Poverty	Poverty incidence 1997/98	Highest in the North
	Number of poor 1997/98	
Forest	Deforestation (%) 1993-97	Highest in the North and poorest group
	Deforestation (km ²) 1993-97	
Land	Agricultural land per capita 1997	Lowest in the North and poorest group
	Sloped land (% of total land)	Highest in the North and poorest group

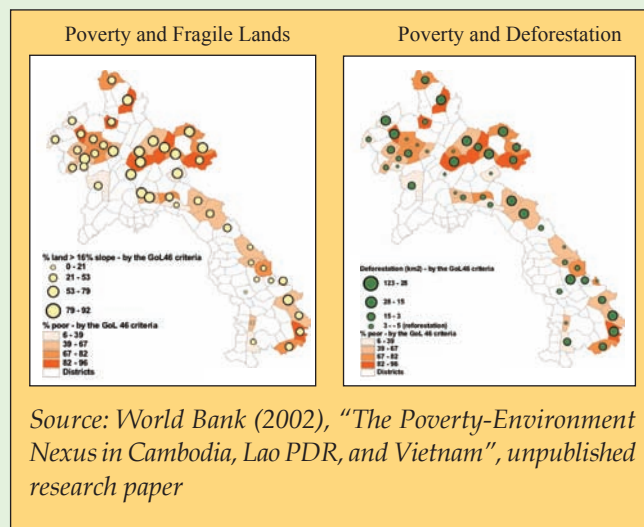
Source: *Poverty and Environment Nexus Study Report*.

Over the last decade, the poorer districts in Lao PDR have also experienced a greater decline in agricultural lands, largely because of the poor quality of soil and increased soil erosion although, the rate of deforestation is similar to the national average.

Many villages practicing shifting agriculture report substantial declines in agricultural land productivity (as much as 50% decline) due to shortening of fallow periods from 14-15 years to as little as 3-4 years, causing serious nutrient depletion.

Deforestation and Poverty

Studies indicate that the livelihood and quality of life of the poor is affected by past deforestation, and deterioration in the quality and quantity of forest resources. To understand the extent of the problem better, a closer look at the state of Lao PDR's land resources, forest resources and protected areas, biodiversity and habitats, and water resources follows.



Source: World Bank (2002), "The Poverty-Environment Nexus in Cambodia, Lao PDR, and Vietnam", unpublished research paper

¹ Source. Draft Report on Legal Framework of Forestry Sector for Forest Strategy 2020, DoF/MAF 2004

² GoL, 2004 - National Growth and Poverty Eradication Strategy (NTPES)

³ World Bank (2002), "The Poverty-Environment Nexus in Cambodia, Lao PDR, and Vietnam", unpublished research paper.

LAND RESOURCES

The Lao People's Democratic Republic (Lao PDR) is a landlocked country with a total area of 236,800 km² or 23,680,000 hectares. Urban areas take up less than one percent of the total land area (**Figure 1**).

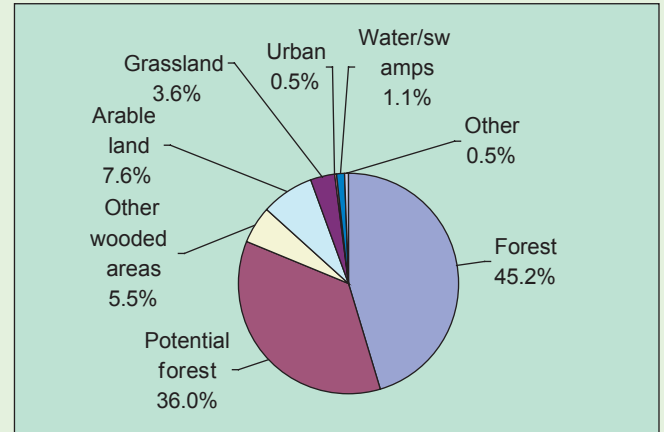
The country is divided into sixteen provinces, one special zone, and Vientiane Capital City. With a population of about 5.6 million⁴ in 2005, the Lao PDR is the second least populated country in the Association of South-East Asian Nations (ASEAN). Its population density is 24 person for every 100 hectares, as compared to 72, 122, and 236 persons per 100 hectares in Cambodia, Thailand, and Vietnam, respectively. The urban population in Lao PDR makes up an estimated 20 percent of the total population.

Limited Arable Land

Lao PDR's mountainous terrain precludes expansive permanent agriculture, with 70 percent of the land area having a slope of more than 20 degrees. The area suitable for intensive agriculture is estimated at nearly 1.9 million hectares, or only 8 percent of the total land area⁵, which consists of permanent pasture, arable lands and permanent crops (**Figure 2**).

The arable land consists mainly of narrow valleys and the productive, silt rich flood plain of the Mekong River and its tributaries. The arable land under cultivation is estimated to be 800,000 ha. This comprises 43 percent of the intensive agricultural land, or only 3.4 percent of the total land area. Rice is grown on 78 percent of this land⁶.

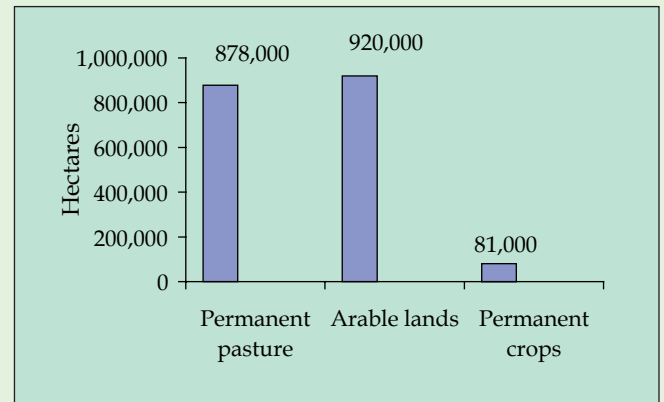
Figure 1. Estimated Land Area in Lao PDR in 2000



Source. MAF/NAFRI 2000.

Note : Potential forest is land that is degraded that could be returned to forest. Or land that was once forest that has been converted into another temporary land use but which could be returned to forestland.

Figure 2. Agricultural Lands in Lao PDR (ha in 2002)

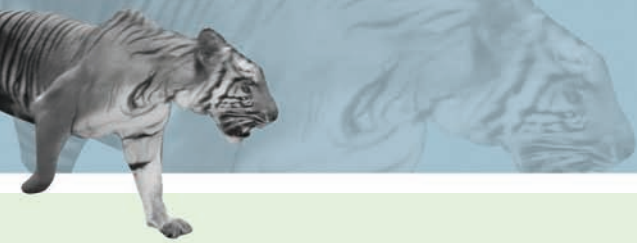


Source: FAO, 2004 - FAOSTAT (apps.fao.org/faostat)

⁴ CPI 2005

⁵ FAO, 2004 - FAOSTAT (apps.fao.org/faostat)

⁶ FAO, Aquastat 2003 (www.fao.org)



Improving Agricultural Productivity

While agriculture still accounts for about half of GDP, and employs over four-fifths of the population, the actual share of agriculture to GDP continues to decrease (Figure 3) while manufacturing and service sectors are growing. The annual growth in agricultural output is also declining, estimated at less than 3 percent in 2003.

The Government has put emphasis on developing cultivable lands through irrigation (Figure 4). In 2003, the total area equipped for irrigation during the wet and dry season was 310,170 and 214,832 ha, respectively⁷. The main irrigated crop is rice. Other irrigated crops grown in the dry season include vegetables; however, this is largely limited to areas near urban markets in Vientiane, Savannakhet, Saravane and Champassack.

However, the area actually irrigated is far below the area equipped for irrigation. It is estimated that only 60 percent⁸ or 130,000 ha of land equipped for irrigation is effectively irrigated during the dry season, comprising 16 percent of the lands under cultivation (see also page 27). Pumping costs and inaccessible markets, particularly in the north, do not make paddy cultivation attractive in the dry season, except in areas near urban markets.

The government is also putting emphasis on increasing the availability of secure land title to increase communities' incentives to invest in improving productivity.

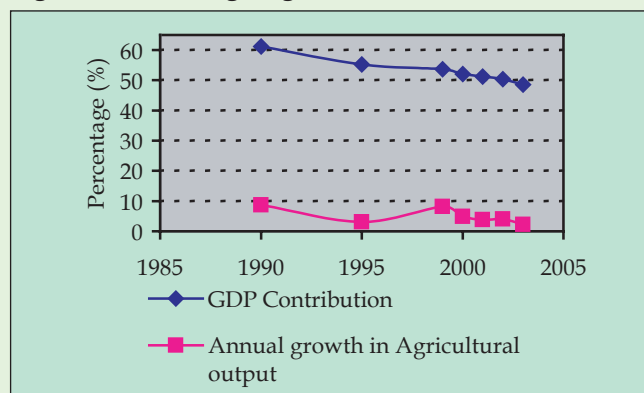
Shifting agriculture is used in forested lands to cultivate the upland areas. Some forms of shifting agriculture, including long rotational swidden, are not harmful to the land and are suitable for Lao PDR (see Table 1). However, pioneer 'slash and burn' that encroaches on virgin forestlands is still widely practiced in Lao PDR⁹.

⁷ MAF, *Agricultural Statistics Yearbook 2003*

⁸ WRCC, *personal communications*.

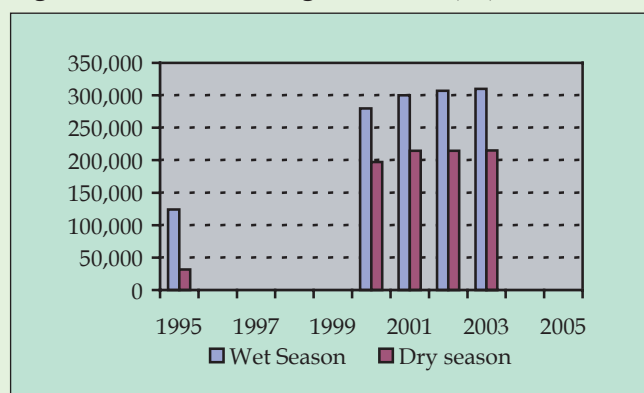
⁹ NSC/CPC, 2004 - *The households of Lao PDR. Social and economic indicators. LECS-III 2002-2003*.

Figure 3. Percentage Agriculture to GDP



Source: ADB, 2004 -. *Key indicators of Developing Asian and Pacific countries*.

Figure 4. Increase in Irrigated Areas (ha)



Sources: UNEP, 2001; MAF, *Agricultural Statistics Yearbook 2003*

Table 1. Type of Shifting Agriculture

Description	Current Government Approach
Sedentary cultivation using conservation farming practices on upland or sloping land areas (and perhaps on allocated land) ('het asip khong ti')	Preferable (Sustainable)
Swidden or rotational upland cultivation without encroaching on new forest areas or in agreed agricultural zones ('het hay bap moun vien')	Acceptable (Sustainable)
Pioneer slash and burn ('het hay leun loey')	Unacceptable (unsustainable)

Source. GoL, 2004: *NT2 Social and Environmental Management Framework and Operational Plan*.

Increasing Land Pressure

Despite having a low population density, with annual population growth of 2.8 percent and decreasing productivity of much of the arable land, the pressure on land resources for cultivation is rapidly increasing.

Decreasing productivity arises from many factors, chief among them being soil erosion. Unsustainable forms of land-use, combined with mountainous terrain, predominantly poor soils and high rainfall, makes much of the land in Lao PDR susceptible to soil erosion. Soil erosion is compounded by shortened fallow periods and increased pesticide use, resulting in lower productivity and ever increasing demand for land.

The pressure on suitable land for agriculture is further aggravated by the fact that Lao PDR was subjected to heavy bombing during the Indochina war, resulting in large areas of land ridden with dangerous unexploded ordnance (UXO) throughout many parts of the country (Box 1). UXO is a critical impediment to agricultural development and land utilization. As the population increases, resulting in higher demand for land for infrastructure, construction, agriculture and wells, UXO is a serious impediment.

Box 1. Landmine and UXO Clearance Initiative

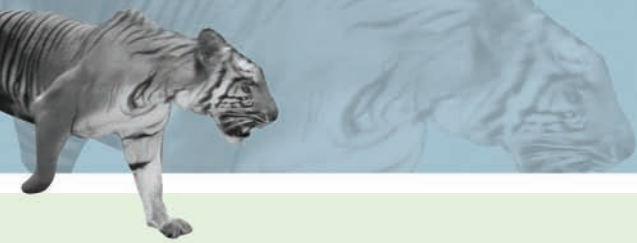
Lao PDR suffers from unexploded ordnance (UXO) remaining from the Indochina war era. Approximately two million tons of ordnance were dropped on Lao PDR during the conflict. Of the 18 provinces in Lao PDR, 15 are significantly affected by UXO. It is estimated that UXOs are still present in nearly 50 percent of the total arable land area of Lao PDR.

A UXO Lao Steering Committee was set up consisting of representatives of relevant ministries and affected provinces. The mission of UXO Lao is to 'reduce deaths and injuries from UXO and to open up land for agriculture and other development'.

In 2002, 840 hectares were cleared by UXO Lao and a total of 100,000 larger and smaller bombs, mines, and other UXOs were removed and/or destroyed.

Sources: Lao PDR Landmine Monitor Report 2002, and Lao Urban Data Book 2003.





FOREST RESOURCES AND PROTECTED AREAS

Rich in Forest Resources

Lao PDR is rich in forest resources. Mixed deciduous forest is the predominant forest type (Table 2). Smaller areas are covered by dry dipterocarp, dry evergreen and coniferous forests.

In 1940 forests were estimated to cover 17 million ha, approximately 70 percent of the land area. In 1989, the forest cover accounted for 47 percent of the land area. The forest cover ranges from about 65-70 percent in the southernmost provinces to only 25 percent in some northern provinces. The largest and least disturbed blocks of forest are in the central and southern part of the country (Figure 5). Surveys suggest that this is being¹⁰ further reduced by an annual 53,000 hectares per year, resulting in approximately 10.2 million hectares or 41.5 percent cover in 2002 (Figure 6).

Contributing to the National Economy

With little economic diversification, Lao PDR continues to rely heavily on its natural resources to support national development and secure livelihoods for its people. Wood products account for more than 35 percent of Lao PDR's total export revenues, and forestry contributes more than 15 percent of GDP¹¹.

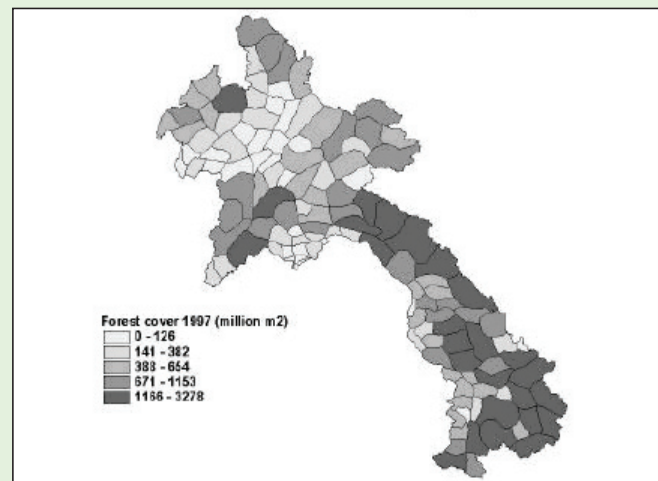
In the 1960s, small plantations were established in the Mekong Valley to secure watersheds and protect against flooding. Species planted were mainly teak, rosewood and black trees. Soon after species of eucalyptus and other fast-growing trees were introduced. About 1,900 ha of plantations were established prior to 1976.

Table 2. 1992 Forest Types in Lao PDR

Forest Type	Area (ha)	Percent of Land Area
Dry Dipterocarp	1,207,680	5.1
Lower Dry Evergreen	94,720	0.4
Upper Dry Evergreen	1,065,600	4.5
Lower Mixed Deciduous	852,480	3.6
Upper Mixed Deciduous	7,459,200	31.5
Gallery Forest	94,720	0.4
Coniferous	118,400	0.5
Mixed Coniferous/ Broadleaved	284,160	1.2
Sub-total Forest Cover	11,176,960	47.2
Non-forest Cover	12,503,040	52.8
Total Land Area	23,680,000	100.0

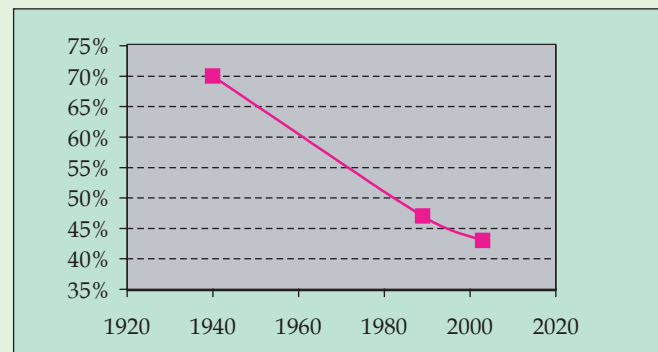
Source: National Office of Forest Inventory and Planning

Figure 5. Forest Cover in Lao PDR (1997)



Source: Mekong River Commission (MRC), 2001

Figure 6. Changing Forest Cover



Source: UNEP/ADB, 2004

¹⁰ UNEP/ADB, 2004 - Greater Mekong Sub-region; Atlas of the Environment.

¹¹ FAO Country Profiles (www.fao.org)

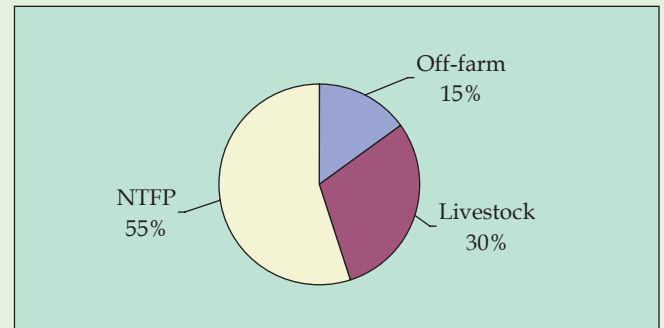
To meet its new ambitious forest sector targets, the government intended to establish 400,000 ha of plantations, beginning in 1993. Today, only 57,281 ha of plantations have been planted, although they suffer from lack of appropriate investment, management techniques, regulations and procedures. Many of these plantations were replanted several times because of management failure and fire, and most performed poorly in strict economic terms.

The Lao PDR forest industry is largely comprised of small-capacity sawmills, exploiting keruing (*Dipterocarpus alatus*) and mersawa (*Anisoptera costata*) as the principal commercial species. There are 125-150 sawmills in Lao PDR, with a total capacity of approximately 1.2 million cubic meters. More than half of this capacity is in two provinces, Khammouane and Savannakhet, and eight mills account for over a quarter of total capacity. In 2003/4, Lao's mills consumed more than 400,000 cubic meters of timber.

Contribution to Food Security

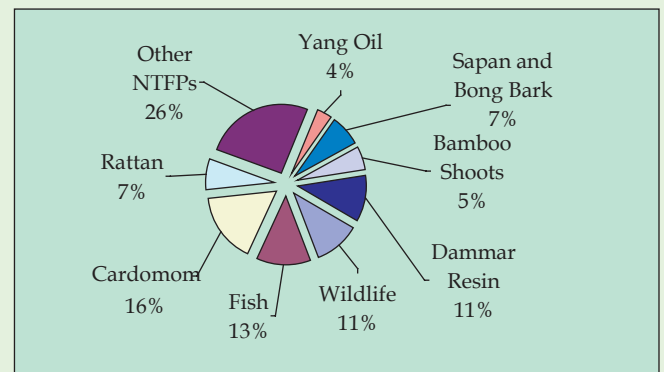
Non-Timber Forest products (NTFPs) are crucial for meeting subsistence needs and for achieving food security for the majority of rural Lao households. An average rural family consumes the equivalent of US\$280 per year in NTFPs¹². This is of particular note since the average per capita income is about US\$402. The role of NTFPs is especially important given the occurrences of droughts, pests and rodents which often reduce the available rice yields. In addition, collection and sale of NTFPs provide on average 55 percent of family cash income¹³ (Figure 7).

Figure 7. Lao PDR Household Income



Source: IUCN, www.iucn.org/places/asia/pdf/Ntfplao.pdf

Figure 8. Income from NTFPs

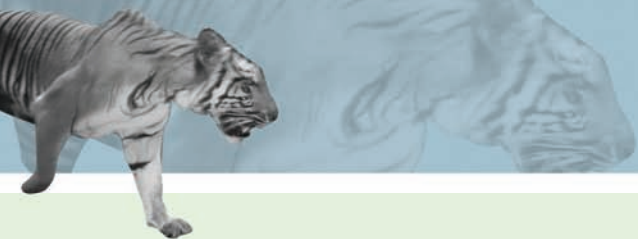


Source: IUCN, www.iucn.org/places/asia/pdf/Ntfplao.pdf



¹² Robichaud et al, 2001, *Review of the NPA system in Pao PDR*.

¹³ Foppes and Ketpanh, 1997, *The use of non-timber forest products in Lao PDR*.



The relative importance of individual NTFPs to the average income of rural households is illustrated in **Figure 8**. The most traded NTFPs in Lao PDR include benzoin, turpentine and rosin, damar oil, honey and wax, cardamom, rattan, bamboo and sugar palm. Medicinal plants are also an important portion of this trade and are harvested regularly. Conversely, the most important NTFPs for food security and local protein consumption are bamboo shoots, greens, fish, wild tubers, and invertebrates (such as snails and insect larvae). Most, if not all, taxa of wild vertebrates are used by at least some ethnic groups, either for food, medicine or trade.

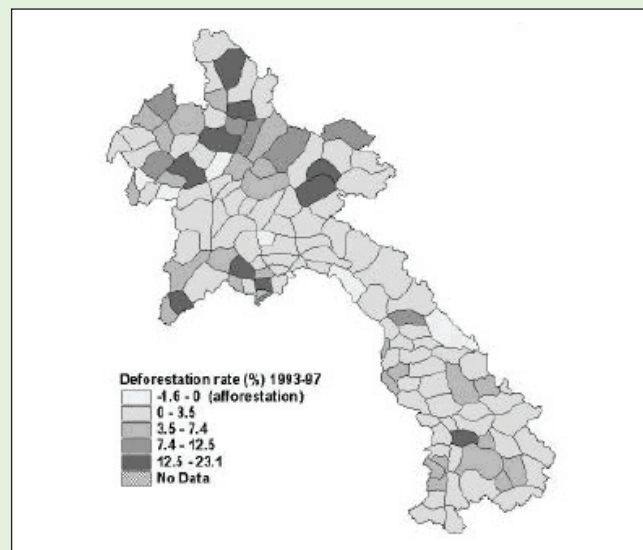
Disappearing Forest Resources

Deforestation and forest degradation remain a significant environmental problem in Lao PDR. Deforestation rates in certain districts have been more than 20 percent over the period 1993-1997 (**Figure 9**). Other blocks of forest are becoming increasingly fragmented and disturbed, resulting nationally in a rapid contraction of mature forest, and decreasing degrees of tree cover and crown density.

In a number of upland forest areas, deforestation is mainly a result of logging and unregulated commercial exploitation. In addition, local pressures include unsustainable exploitation practices, shifting agriculture and poverty, all of which are putting pressure on the remaining forests.

Commercial Logging is permitted only in areas with forest management plans, and logged areas should be replanted and well-maintained. Commercial logging is based on annual quotas, which in turn are based on assessments made at the provincial level. Since logging is prohibited in protected areas, the pressure on production forests is enormous, often leading to clear-cutting and forest degradation.

Figure 9. Deforestation Rate (1993-1997)



Source: Mekong River Commission (MRC), 2001

Unsustainable Exploitation practices have led to the depletion of NTFP resources. As pressure on land increases, rural villagers are increasingly turning to NTFPs as a ready source of income. This leads to their accelerated exploitation, which in turn is rapidly diminishing their availability. Growing market demand for NTFPs that are increasingly scarce elsewhere in South-East Asia is also causing accelerated and unsustainable exploitation.

Approximately 80 percent of domestic energy consumption for cooking is based on fuel wood. The estimated amount of annual fuel wood used by local communities is about 4-5 million m³/year (about 1 m³/person/yr)¹⁴, often leading to excessive fuel wood gathering, tree felling, and further pressure on the remaining forests. However, this alone is not a significant cause of forest degradation.

¹⁴ Phanouvong, 1997, *Energy demand and supply in Lao PDR*. In *Production, Utilization and Marketing of Wood fuel in Lao PDR*. FAO).

Protecting Forest Resources

As part of its efforts to conserve its forest resources and biodiversity (see page 22), Lao PDR established the National Protected Area (NPA) system through a Prime Ministerial Decree in 1993. The decree states that the National Protected Areas (NPAs), formerly known as National Biodiversity Conservation Areas (NBCAs), are managed resource areas (*IUCN Category VI* Protected Areas). They are designed to (i) preserve natural resources, (ii) protect the abundance of nature and the environment of such nature, and (iii) preserve the beauty of natural scenery for leisure resorts, study and research.

The following restrictions are placed on land-use within each NPA, unless specific exceptions are made by government: logging, collecting forest products, excavation or mining, expansion of shifting cultivation, exploitation of cultural or historical assets, use of explosives, chemicals or poisons, and burning.

Lao PDR has established 20 NPAs and two Corridors, covering almost 3.4 million hectares, or more than 14 percent of the country. Moreover, large areas have been designated as Protection or Conservation Forest at Provincial and District levels (**Table 3**). All these classes of forest now cover over 5.3 million ha, bringing the total land area under some degree of protection to more than 22 percent.

The management of the NPA System is based on an integrated conservation and development approach, which seeks to maximize local development while minimizing degradation of the area's biodiversity.

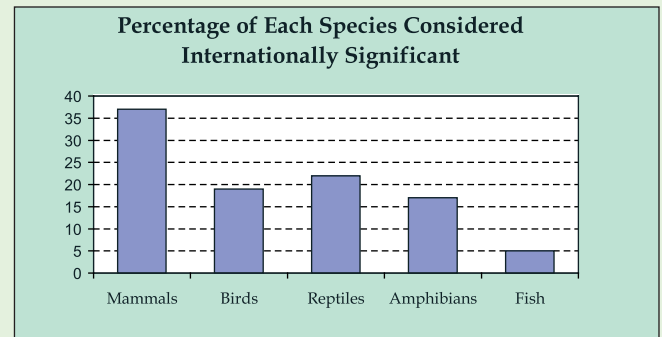


Table 3. Lao PDR Protected Area System

Level	Number	Total Area (ha)	Percent of land area
National	20 NPAs	3,310,200	13.98
	2 Corridors	77,170	0.33
	<i>Sub-total:</i>	3,387,370	14.31
Provincial	57 Conservation Areas	931,969	3.94
	23 Protection Forests	461,410	1.95
	<i>Sub-total:</i>	1,393,379	5.89
District	144 Conservation Areas	503,733	2.12
	52 Protection Forests	55,713	0.23
	<i>Sub-total:</i>	559,446	2.35
Total:		5,340,195	22.55

Source: Sigaty. Draft Report on Legal Framework of Forestry Sector for Forest Strategy 2020.

Figure 10. International Significance of Species

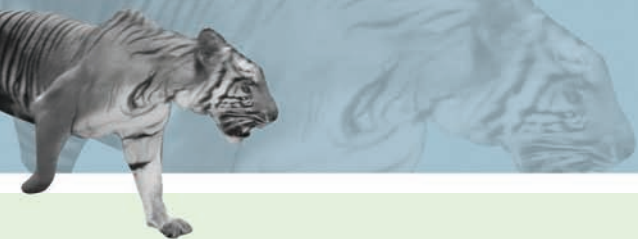


Source: Duckworth et.al., *Wildlife in Lao PDR: 1999 Status Report*

Table 4. Mammal Species Richness in Lao PDR

Species	Number of Species
Primates	13
Canids	2
Bears	2
Cats	8
Rhinos	2
Pigs	2
Deer	9
Bovids	6
Elephant	1
Dolphin	1

Source: Duckworth et.al., *Wildlife in Lao PDR: 1999 Status Report*



BIODIVERSITY AND HABITATS

Rich in Biodiversity

Lao PDR is one of the most biodiversity-rich countries in Southeast Asia. A small population with a tremendous diversity of ethnic groups, a multiplicity of ecosystems, and a low rate of natural resource exploitation compared to neighboring countries have allowed significant natural and cultivated biological resources to survive and to be developed.

The variety of habitat types of high international significance in Lao PDR (**Box 2**) supports a great diversity of species. Of the 1140 animal and plant species reviewed in 1999¹⁵, 319 are considered of national or global conservation significance based on their limited numbers and limited range. In recent years a number of species, genera and even families of mammals (e.g. the Saola, *Pseudoryx nghetinhensis* and Large-Antlered Muntjac, *Muntiacus vuquangensis*), birds, reptiles, amphibians and fish that are new to science have been identified in Lao PDR (see **Box 4**), while the known ranges of many other species have been extended.

Lao PDR has the highest number of large mammals in Southeast Asia (**Table 4**). Most of the Lao populations of these mammals are both highly endangered within Lao PDR, and of global significance. For example, the Kouprey (*Bos sauveli*), one of the most endangered mammals globally, is thought to now only exist, if at all, in southern Lao PDR. Similarly, the Lesser One-horned Rhinoceros or Java Rhinoceros (*Rhinoceros sondaicus*) has been recently found in Xayabouly Province¹⁶.

Box 2. Main Habitats in Lao PDR of High International Significance

Evergreen Forests of the Annamite Mountains and Foothills.

This is considered the most biologically distinct ecosystem. Species endemism is high for many taxa. Included are extremely wet forests, which are formed by an interaction of monsoon patterns and local topography. Annamite forests are found only in Lao PDR, Vietnam, and Cambodia, but they are probably of highest quality in Lao PDR, due in part to lower human pressure.

Central Indochina Limestone Karst: Like the Annamites, species endemism is high and the habitat is found elsewhere only in Vietnam.

Dry Dipterocarp Forests of the Mekong Plain. Found mainly in southern Lao PDR, and characterized by relatively flat, low elevation land with grass and herbs under widely spaced deciduous trees (predominantly Dipterocarpaceae). It is typically studded by permanent or seasonal pools, which are of high importance for a variety of wildlife, from large ungulates to rare waterbirds.

Bolavens Plateau. This massif between the Mekong and the Annamites in southern Lao PDR is a habitat of high distinctiveness. It occurs only in Lao PDR.

Northern Highlands. The mountains of the north are biogeographically distinct from the Annamites in the central and southern part of the country, with different species assemblages.

Mekong River. Lao PDR has a pivotal role in the conservation of the biodiversity of the Mekong. Not only does much of the river run through Lao PDR and along its border, more of the drainage that feeds the river is found in Lao PDR (25%) than any other country. The Mekong undergoes major seasonal changes in flow rate and the exposed channel during low flow season is of outstanding significance to wildlife (Duckworth et al. 1999).

Other Rivers and Streams. Because of the extensive mountainous topography of Lao PDR, streams are a widespread and key habitat. The fish diversity in streams of Lao PDR is very high, and so is endemism (Baird 1998; Baltzer et al. 2001).

Source: ICEM, 2003. *Lao PDR National Report on Protected Areas and Development.*

¹⁵ Duckworth et al, *Wildlife in Lao PDR: 1999 Status Report*

¹⁶ WWF, 2004

Disappearing Habitats and Wildlife Populations

For a long time the remoteness of protected areas has contributed to the protection of the biodiversity that lives within their boundaries. However, human use of these once remote areas is rising as a result of increased international biodiversity market demand, population growth in traditional communities, migration, and settlement. As a result, expanding agricultural frontiers, illegal hunting, illegal logging, and uncontrolled burning have led to a decline in biodiversity resources.

Biodiversity Surveys (mostly partial) have been completed in only some areas. Many areas have not been covered, and existing surveys need to be repeated to detect trends. Despite the lack of detailed information, over-harvesting and wildlife trade are clearly the principal reasons for the decline in biodiversity, threatening much of it with local extirpation.

There is a long tradition of hunting in Lao PDR, and rural communities are dependent on hunting and harvesting of wild products to supplement seasonal rice harvests. However, new hunting methods using automatic weapons, explosives and steel cable snares have had a considerable impact on wildlife populations and have led to over-harvesting.

Box 3. Hunting of the Siamese Crocodile

The Siamese crocodile (*Crocodylus siamensis*) is one of the most endangered species of crocodile in the world, found only in Lao PDR, Cambodia and Thailand. Today, the crocodile is known to exist in only three locations in Lao PDR- two wetlands in Sanamxay District, Attapeu Province and one wetland in Xayboully District, Savannakhet Province. Hunters living around these areas are aware that the Siamese crocodile is a protected species and harvest of crocodiles is illegal, but they continue to hunt because of the financial incentives from international traders for skins and live animals, and because of the lack of enforcement of existing prohibitions.

Source. www.wcs.org

Box 4. Striped Rabbit Revealed in Lao PDR Forest



Source. Trinh Viet Cuong / Fauna & Fauna International

By BBC Environment Correspondent Alex Kirby (1999)

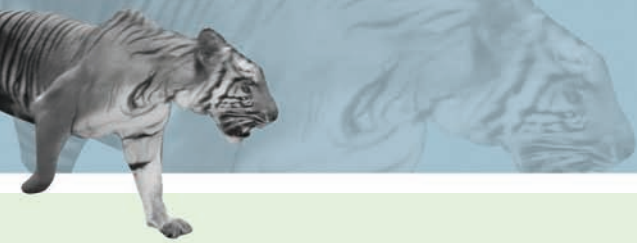
A new species of striped rabbit (Annamite Striped Rabbit, *Nesolagus sp.*) has been found in the mountain forests of Lao PDR and Vietnam. The furry, red-bottomed creatures have black and brown stripes across their face and back. They resemble the endangered Sumatran striped rabbit, the only other known striped rabbit.

A British biologist, Rob Timmins, found the new rabbits in a Lao PDR market. Diana Bell, an expert on rabbits at the University of East Anglia in the UK, analysed them.

"This discovery is extremely exciting and underlines the biodiversity value of the mountain forests in Southeast Asia" Dr Bell said. The discovery, reported in the journal Nature, follows recent sightings or photographs of other rare mammals from the same area.

In the last few years a forest pig and a hoofed animal like an antelope, the Saola, have also been found in the region.

Source: BBC Online, Friday, August 20, 1999



Similarly, commercialization of the trade in wildlife products has also increased with improved access to previously remote areas. Wildlife has been traded in and through Lao PDR for centuries, and anecdotal evidence suggests that trading levels have shown no sign of decreasing in recent decades. **Table 5** shows the annual sales of wildlife during the 1990s. As wildlife populations decline, the value of wild products increases. Much of this trade takes place from areas in or near NPAs, as shown in **Figure 11**.

Although much wild meat is consumed within the country, there is also a massive illegal trade of live animals and animal parts from and into neighboring countries. The Lao wildlife traded internationally is predominantly used for traditional medicine. The most valuable products are certain turtles and tiger (*Panthera tigris*) bones, which are traded to buyers in neighboring countries (**Table 6**). A wide variety of other species are also used, including many which are or were common, such as geckoes, snakes, civets, otters, gibbons and Douc Langurs (*Pygathrix nemaeus*). The greatest volumes traded are probably in pangolins and turtles.

Having signed the Convention on International Trade in Endangered Species (CITES) in May 2004, and due largely to the efforts of the Ministry of Agriculture and Forestry (MAF) and the Wildlife Conservation Society (WCS), as well as a national gun amnesty, the wildlife trade has become less visible nationwide. However, without more effort to curb demand both locally and internationally, wildlife will continue to disappear throughout Lao PDR.

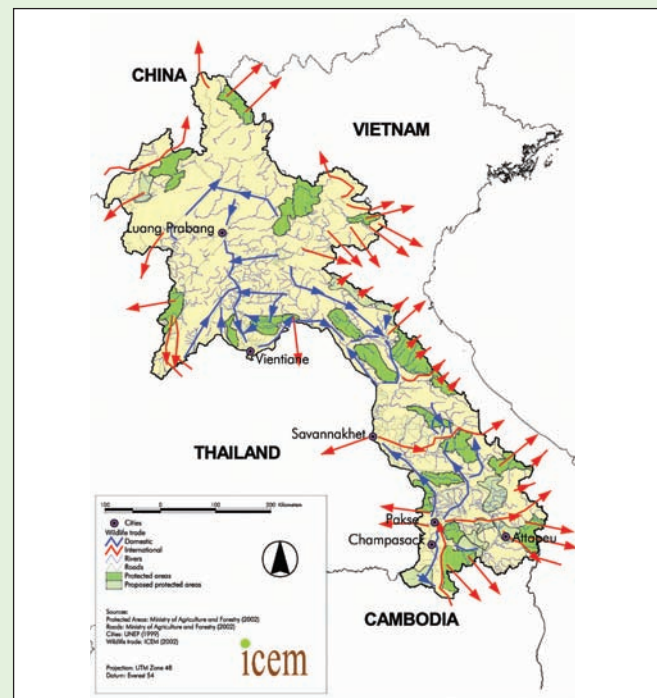


Table 5. Annual Sale of Wildlife in Lao PDR

Taxa Traded	Number of Species	Number of individuals	Weight (kg)	Value (US\$)
Mammals	23	10,000	33,000	160,000
Birds	33	7,000		
Reptiles	8	4,000		

Source: Srikosamatara et al. 1992

Figure 11. Sources of Wildlife for Trade in Lao Across Borders



Source: ICEM, 2003. Lao PDR National Report on Protected Areas and Development.

Table 6. Average Market Prices (2001) for Selected Species

Species Traded	Price (USD) per kg
Tiger	60-90
Pangolin	21-52
Golden Turtle	100-150
Muntjac	3

Source: Nooren and Claridge, 2001 – *The end of the Game*.

Conservation of Aquatic Biodiversity

The Mekong is one of the most species-rich river systems in the world, and the native fish fauna in Lao PDR is known to include 47 out of a total of 91 families recorded in the Mekong Basin. In 1986, a total of 211 fish species were known from Laos. However between 1995 and 2001, as a result of a series of detailed surveys (mainly undertaken for the environmental assessments of proposed hydroelectric dams)¹⁷, this had more than doubled to 456. Most of the additions were of species already known from neighboring countries, but about 100 were new to science. Many of these were quite small and of no direct commercial interest, but there are also some large species of considerable economic importance at the local level. Of the total number of indigenous fish species, about 25 species are used in aquaculture (see page 31).

There are 30 commonly occurring fish species within the Lao section of the Mekong which migrate between at least two different countries¹⁸. Man-made alterations of water flow and discharge, resulting from water resource developments, modifies aquatic habitats and consequently affects fish and other aquatic organisms' migratory behavior and spawning, water quality, and the availability of food resources for fish. Other major threats to aquatic ecosystems include (i) water pollution (domestic, industrial, aquacultural and agricultural), (ii) over-harvesting, and (iii) introduction of exotic species for aquaculture. The Mekong Giant Catfish (*Pangasianodon gigas*), which can grow to 3 meters in length and weigh more than 300 kg, is now endangered due to habitat destruction, over-fishing and development.

In Lao PDR, 71 percent of all farming households fish part-time on a seasonal basis¹⁹. Besides fish, small aquatic species including snails, frogs, clams, crustaceans, etc., are an important source of nutrition for rural poor households, providing animal protein, vitamins, and minerals. Given the importance of aquatic resources to food security and as a supplement to household income, there is an urgent need for baseline and monitoring studies of fish, fisheries and aquaculture to reliably predict the impacts of water resource development, pollution, and use of aquatic resources. Awareness of the value of fisheries and aquatic resources to the subsistence economy of Lao PDR also needs to be raised.

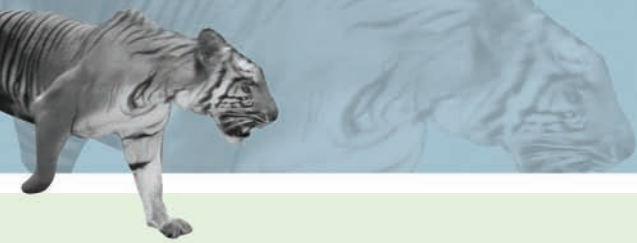


A Giant catfish from Mekong River being taken to market. (Photo by Zeb Hogan)

¹⁷ Sources: Kottelat, M. 1998. *Fishes of the Nam Theun and Xe Bangfai basins (Laos), with diagnoses of twenty-two new species (Cyprinidae, Balitoridae, Cobitidae, Coiidae and Odontobutidae)*. *Ichthyological Exploration of Freshwaters* 9: 1-128. Kottelat, M. 2000. *Diagnoses of a new genus and 64 new species of fishes from Laos (Teleostei: Cyprinidae, Balitoridae, Bagridae, Syngnathidae, Chaudhuriidae and Tetraodontidae)*. *Journal of South Asian Studies*. Kottelat, M. 2001. *Fishes of Laos*. Wildlife Heritage Trust Publications, Colombo.

¹⁸ Schouten, R. 2003. *Threats to healthy fisheries in the Lower Mekong Basin*. Water Utilisation Programme, Mekong River Commission, Phnom Penh.

¹⁹ 1998 Agricultural Census.



WATER RESOURCES

Abundant Resources

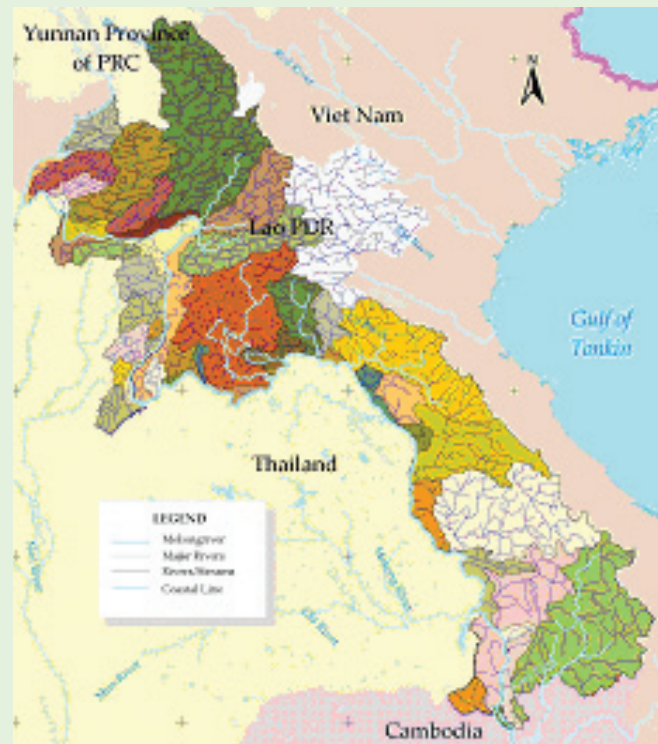
The Mekong River flows for about 1,860 km through Lao PDR. The Mekong River basin covers nearly 90 percent of the total area of the country (Figure 12). In addition to the Mekong, several smaller river basins drain from Lao PDR towards Vietnam.

The rivers' discharge follows the pattern of rainfall: about 80 percent during the rainy season (May-October) and 20 percent in the dry season, from November to April. For some rivers in the central and southern parts of the country (particularly Nam Xebangphay, Nam Xebanghieng and Nam Xedone) the flow in the dry season is reduced to around 10 to 15 percent of the annual flow. The water level in the Mekong River may fluctuate by up to 20 m from wet to dry seasons.

A significant part of Lao PDR water resources is generated within its own watersheds (Table 7). Average annual rainfall ranges from 1,300mm per year in the northern valleys to 3,700mm per year at higher elevations in the South. This corresponds to an annual rainfall of 434 billion m³, of which less than half is estimated to be runoff. Accordingly, Lao PDR has estimated (internal) renewable water resources (IRWR) of 190 billion m³ per year or 35,000 m³ per capita per year. This makes it the largest per capita volume of IRWR in the region: Cambodia, Thailand and Vietnam have 9,201, 3,344, and 4,690 m³ of IRWR per capita per year, respectively.



Figure 12. Main Rivers Basins in Lao PDR



Source: UNEP/ADB, 2004 – Greater Mekong Sub-region, Atlas of the Environment.

Table 7. Lao PDR's Estimated Water Flows

	From	Flow estimate (billion m ³ /year)	Percentage
In:	Inflow from China, Myanmar, and Thailand	143	43%
	Lao PDR internal water resources (including 38 billion m ³ /year of groundwater recharge)	190	57%
	<i>Total inflow:</i>	333	
Out:	Outflow to Cambodia	323	97%
	Outflow to Vietnam	9	2.7%
	Lao PDR Water usage	1	0.3%
	<i>Total outflow:</i>	333	

Source: FAO, 2003 – Review of world water resources by country and Aquastats 2003; WRI Country profile 2003 (earthtrends.wri.org)

However, generalized water figures can be deceiving, as water demand and local availability often do not match, causing local water constraints, shortages, and/or natural disasters. For example, over the past decade, Lao PDR has suffered from both severe droughts and floods. In the year 2000, 1,104 km² in seven provinces were flooded, affecting 450,000 people.

Competing Water Users

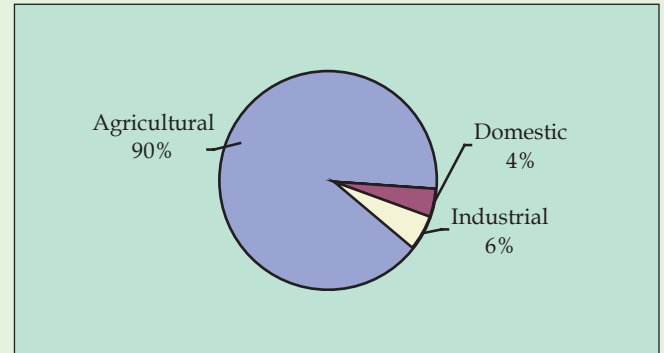
Currently there is relatively little competition between the various users of water because of the relative abundance of water and the small population. Total water usage is relatively limited, estimated at 1 billion m³ per year in 2000²⁰. An estimated 90 percent is used for agricultural purposes, while domestic and industrial supplies use 4 and 6 percent, respectively (see **Figure 13**). The two sectors that most impact water resources management are irrigation and hydropower.

Developing Irrigation

The Government has given high priority to investment in the irrigation sub-sector to increase the amount of land available for cultivation (see Land Resources section). It has supported projects that focus on the development of community-managed irrigation schemes, pump irrigation systems, extension training for farmers, and irrigation-ecosystem management systems (see **Figure 14** and **Table 8**).

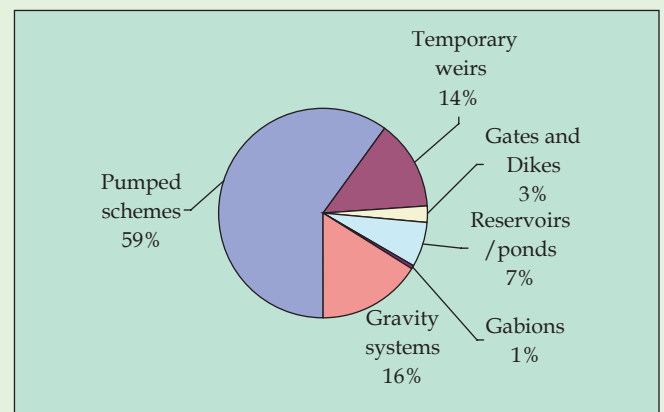
Surface water is the only source of irrigation in Lao PDR. Dry season irrigation is mainly concentrated near the major cities: Vientiane Capital City (59 percent of total dry season irrigated areas), Savannakhet (11 percent) and Luang Prabang (6 percent)²¹.

Figure 13. Average Annual Water Usage



Source: FAO Aquastats 2003 (www.fao.org)

Figure 14. Type of Irrigation Systems (2002)



Source: MAF, Statistical Yearbook 2002

²⁰ Source FAO Review of World Water Resources by Country (2003)(www.fao.org)

²¹ Source: FAO (www.fao.org)

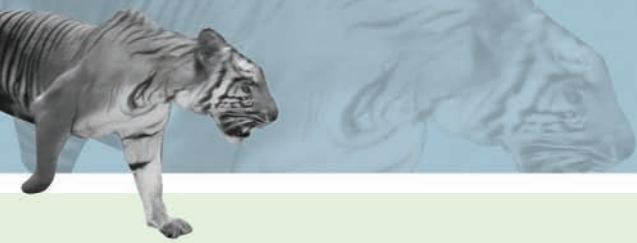
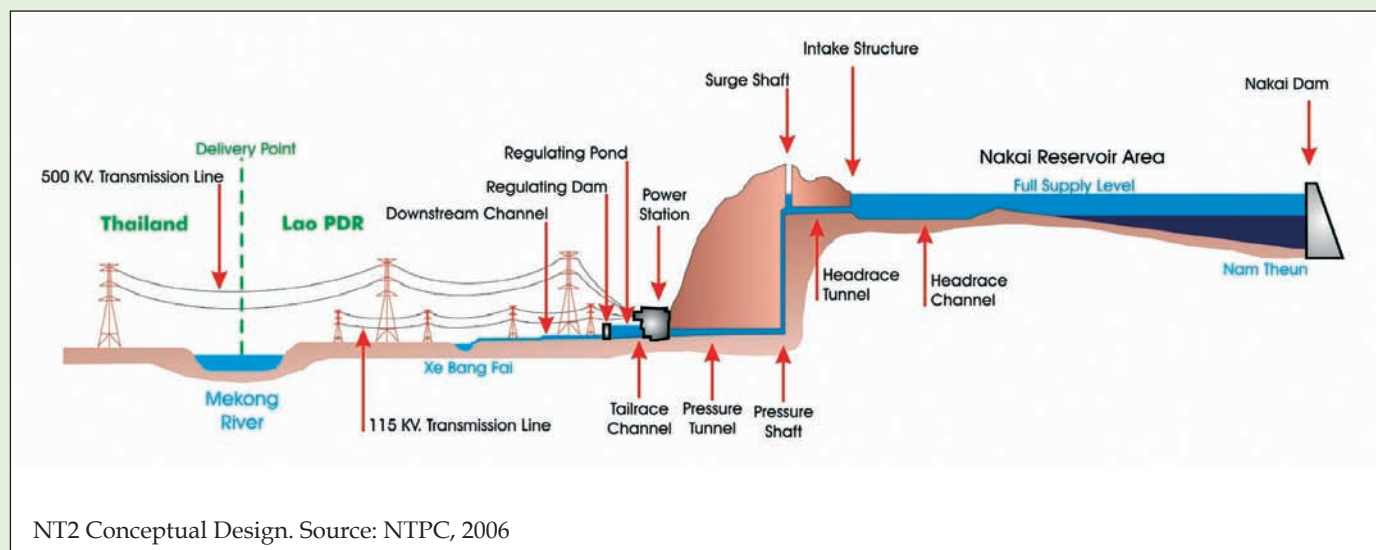


Table 8. Type of Irrigation Schemes in Lao PDR

Size	Type of water control	Description	Location	Population involved
Small schemes < 100 ha	Weir schemes	Traditional wet season supplementary irrigation systems. Most of them are less than 50 ha.	Mountainous provinces	1-2 villages, up to 50 households
	Pumped schemes	Designed for dry and wet season irrigation.	Along the Mekong and its tributaries	
Medium schemes 100-500 ha	Weir schemes	Wet season supplementary irrigation. Most build with external assistance.	In the floodplains	Up to 8 villages, up to 500 households
	Pumped schemes	Designed for dry and wet season irrigation.	Along the Mekong river and its tributaries.	
	Reservoir schemes	Gravity irrigation in dry and wet season. Build by provincial irrigation services on behalf of communities. Gravity irrigation in dry	Near Savannakhet Province.	
Large schemes > 500 ha	Reservoir schemes	and wet season	Near Vientiane Capital City, Bokeo, Xayabouly, and Savannakhet Provinces.	
	Pumped schemes	Dry and wet season irrigation	Along the Mekong river and its tributaries.	

Source: FAO (www.fao.org)



Benefiting from Hydropower Potential

Lao PDR has a theoretical hydroelectric potential of about 23,000 MW, excluding the Mekong River itself. Of this, about 18,000 MW may be technically exploitable. Currently Lao PDR has nine hydropower projects around the country with a total capacity of 624 MW (Table 9). The hydropower sector has developed rapidly: the annual production has risen to 3,674 million KWh (Figure 15) in 2002, and construction has recently begun on the Nam Theun 2 project, which will add another 1,070 MW capacity by the end of 2009. On average 65 to 80 percent of the annually produced energy is exported.

The Government continues to give priority to power sector development to expand electrification in the country and export electricity to neighboring countries (Box 5 and Figure 16). The latter would generate revenues which could be used for priority poverty reduction programs. Currently, domestic energy consumption is growing at 8 to 10 percent annually. However, energy use in cooking within the country is still dominated by the use of fuel wood, which accounts for an estimated 80 percent of total energy requirements.

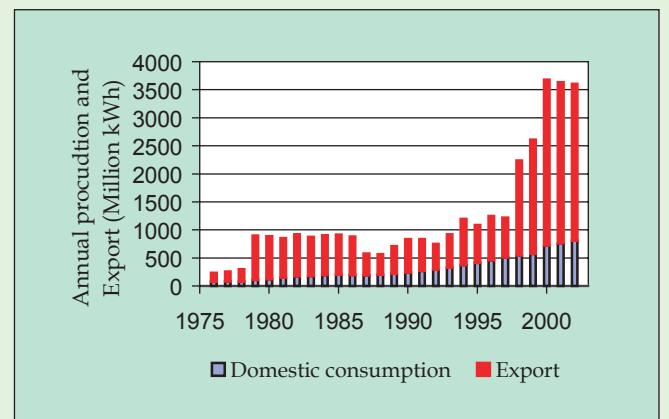
Table 9. Existing Lao PDR Hydropower Plants

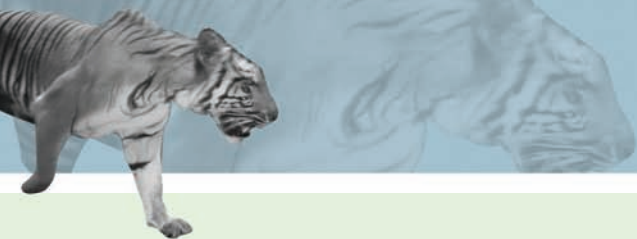
Project & Province	Year of completion	Capacity (MW)	Annual Production (Million KWh)
Nam Leuk (Vientiane)	2000	60	230
Houay Ho (Attapeu)	1999	150	617
Nam Theun-Hinboun (Khammouane)	1998	210	1,620
Nam Ko (Oudomxay)	1996	1.5	-
Nam Phao (Bolikhamsay)	1995	1.6	-
Xeset (Saravane)	1994	45	180
Nam Ngum (Vientiane)	1970	150	998
Nam Dong (Luang Prabang)	1970	1	5
Selabam (Champassack)		5	24
Total		624	3,674

Source: LNCE, 2004 (www.poweringprogress.com)



Figure 15. Hydropower Consumption and Export





Threats to Aquatic Resources

The emphasis of the Government on rural development through increased land cultivation and increased investment in hydropower development is increasing pressure on water and aquatic resources, including wetlands and fisheries. Threats include²²: (i) unsustainable fishing practices such as gill netting and poison and blast fishing, (ii) introduction of exotic fish species (i.e. carp and tilapia), (iii) hunting and trading of aquatic wildlife and migratory water birds, and (iv) weed infestation (e.g., *Mimosa pigra*), pesticides, and pollution.

Wetlands play a very important role in the subsistence and commercial economy of the country. Although wetland resources – fish, crustaceans, turtles, frogs, and insects – are important in all parts of the country, they are particularly valuable in the lowlands since much of the lowland forests have been cleared for agricultural use. Wetland resources are harvested for food security in times of rice deficits, as well as for an ongoing source of plant products and protein.

Most of the important wetlands are located along the Mekong River, in particular in the Siphandone region, Champassack province of southern part of Lao PDR²³. Near the border with Cambodia, a large wetland 35 km east of the Mekong, is surrounded by seasonally flooded forest (Bung Nong Ngom) and has a rich fish fauna and a number of large mammals (Asian elephant, *Elephas maximus*; tiger, clouded leopard, *Pardofelis marmorata*; deer, Kouprey), resident and migratory waterfowl and the endangered Siamese crocodile. One of the world's most endangered mammals, the Irrawaddy Dolphin (*Orcaella brevirostris*), occurs in two areas of Lao PDR: the Mekong River from Cambodia upstream to Khone Phapheng Water Falls; and, the Sekong River and the lower reaches of its major tributaries. Further to the north, permanent marshes exist at the confluence of several tributaries (Paksan and Paksam marshes) with the Mekong River. The Nam Ngum reservoir is the largest of its type in Lao PDR and supports a diverse fish fauna.

²² Claridge, 1996 - *An inventory of Wetlands of the Lao PDR*. (IUCN/Gland)

²³ Source: MRC and Hatfield Consultants Ltd., 2003 - *Mekong River Awareness Kit*.

Box 5. Power Sector Development

The goals of the power sector policy are to (i) maintain and expand an affordable, reliable and sustainable electricity supply within the country; and (ii) promote power generation for export to provide revenues for national development.

Planned Lao PDR Hydropower Plants

Project and Province	Capacity (MW)	Type and Purpose
Nam Beng (Oudomxay)	45	Storage, hydro. Domestic
Hongsa lignite (Xayabourly)	640	Thermal, coal. Export, Thailand
Nam Ngum 5 (Xieng Khouang)	70- 100	Storage hydro. Domestic
Nam Ngum 3 (Xay somboun) (alternatively Nam Ngum 3E)	444-(580)	Storage hydro. Export, Thailand
Nam Ngum 2 (Xay somboun) (alternatively Nan Ngum 2A and 2B)	615 (159+183)	Storage hydro. Export, Thailand
Nam Mang 3 (Vientiane)	35	Storage hydro. Domestic
Nam Ngiep 1 (Bolikhamsay)	366	Storage hydro. Export, Thailand
Nam Mo (Xieng Khouang)	100	Storage hydro. Export, Vietnam
Nam Theun 3 (Bolikhamsay)	236	Storage hydro. Export, Vietnam
Nam Theun 2 (Bolikhamsay)	1070	Storage hydro. Export, Thailand
Nam Theun 1F (Bolikhamsay)	400	Storage hydro. Export
Xeset 2 and 3 (Saravane)	70+16	Run-of-river. Domestic
Xe Pian - Xe Namnoi (Champassack, Attapeu)	392	Storage hydro. Export, Vietnam
Xe Kaman 3 (Attapeu)	307	Storage hydro. Export, Vietnam
Xe Kaman 1 (Attapeu)	468	Storage hydro. Export, Vietnam
Huay Lamphang Gnai (Sekong)	70	Storage, hydro. Domestic
Thak Ho (Champassack)	35	ROR (Mekong main- stream) Domestic
Nam Kong 1 (Champassack)	238	Small storage/ semi-ROR. Export

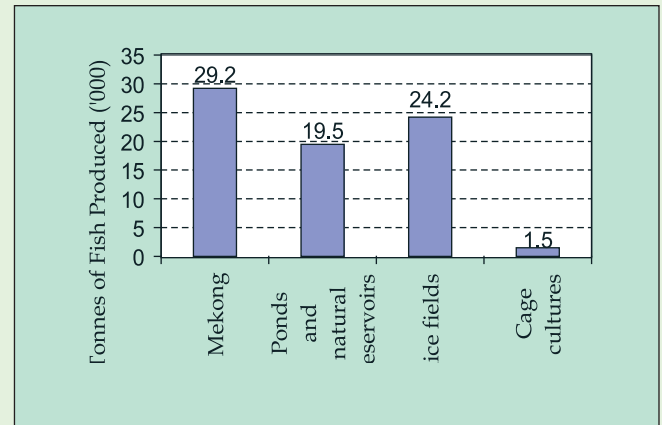
Source: LNCE, 2004 (www.poweringprogress.com)

Fish and Fisheries play an important economic role in Lao PDR, contributing 13 percent to the national GDP annually²⁴. Most fishing is for subsistence, although there is significant commercial fishing in the Nam Ngum reservoir and along various other parts of the Mekong River and its main tributaries. Commercial fishing is also practiced in ponds and paddy fields in parts of the country with reliable access to markets (**Figure 16**). Finfish dominate the overall catch, but approximately 30 percent of the catch within the country by weight is composed of mollusks, crustaceans, insects, amphibians and reptiles.

The average annual per capita consumption of fish in 2003 has been estimated at 25 kg per year²⁵. Over the last decade, fish consumption has increased by 24 percent and accounted in 2003 for 37 percent of total animal products consumed. Particularly in the rural areas, fish are the primary source of animal protein in the Lao diet.

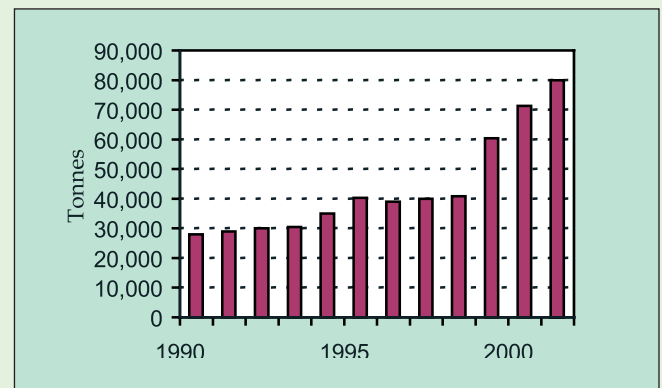
Total fish production has increased three-fold from 28,000 tonnes in 1990 to 80,000 tonnes in 2001 (**Figure 17**). In 1999, over 8 percent of rural households were engaged in aquaculture²⁶. The remaining catch is harvested from the Mekong River and its tributaries, reservoirs, swamps and rice fields.

Figure 16. Sources of Fisheries Production (2001)



Source: Sverdrup-Jensen, 2002, *Fisheries in the lower Mekong basin: Statistics and Perspectives*.

Figure 17. Fish Production in Lao PDR

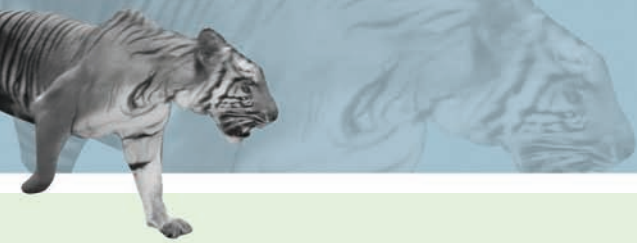


Source: FAO, 2004 –FAOSTAT (apps.fao.org/faostat)

²⁴ FAO Aquastats (www.fao.org)

²⁵ NSC/CPC, 2004 - *The household of Lao PDR. Social and economic indicators. Lao Expenditure and Consumption Survey 2002/03. LECS 3.*

²⁶ Singkham Phonvisay, 1999, *Report on fishery resources and fishery policy development.*



ENVIRONMENTAL QUALITY OVERVIEW

Environmental health impacts from inadequate water supply and sanitation, and indoor air pollution, appear to be disproportionately affecting the poor in Lao PDR. With the rising population, both water and air pollution is on the rise – with consequent effects on mortality and morbidity. Recognizing this, the government’s definition of poverty embraces important environmental services, such as access to safe water and sanitation.

Poverty and Access to Clean Water and Sanitation

Throughout Lao PDR, there is a high incidence of diarrhea and dysentery caused in part by inadequate water supply, poor sanitation and sewerage, and absence of wastewater treatment facilities. With rising populations in urban and upland areas, water pollution is getting worse.

Also the poorest districts have less than half the national average of daily water use, due to less access to water for either personal use or irrigation purposes.

Poverty and Indoor Air Pollution

More than 95 percent of the population use wood or charcoal for their daily cooking. The use of wood fuel and charcoal is far more prevalent among poor households than in the general population.²⁷ This, together with the mountainous terrain of northern Lao PDR, a colder climate, different cultural practices and housing styles, and more indoor cooking, suggests that indoor air pollution may cause respiratory health problems for the poor people in upland areas. There are, however, no studies of indoor air pollution carried out in Lao PDR to date.

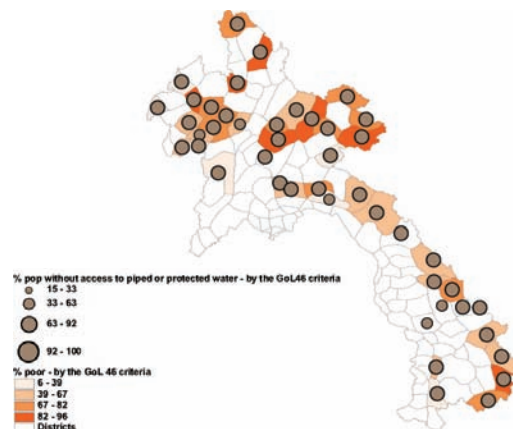
The following sections on water quality, solid and hazardous wastes, and air quality highlight the inadequacy of environmental services, especially to the poorest groups.

²⁷ Sources: NSC (1995), *Population Census 1995 and FAO (1997), Production, Utilization and Marketing of Woodfuel in Lao PDR, Bangkok, Thailand*; NSC/CPC, 2004 - *The household of Lao PDR. Social and economic indicators. Lao Expenditure and Consumption Survey 2002/03(LECS 3)*.

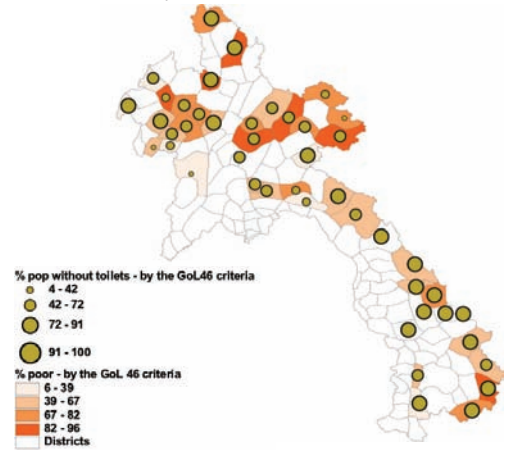
Poverty and Environmental Quality in Lao PDR

Areas:	Indicators:	Poverty and Geographic Analysis:
Poverty	Poverty incidence 1997/98	Highest in the North
	Number of poor 1997/98	
	Sloped land (% of total land)	Highest in the North and poorest group
Indoor air pollution	Households using fuel wood (%)-potential indoor air pollution problem	High in all regions and poverty groups (medium in Vientiane Municipality and least poorest group)
Water supply	Piped water supply (1995 Census)	Low in all regions and poverty groups (medium in Vientiane Municipality and least poorest group)
	Reliance on river water (1995 Census)	Highest in north, south, and poorest group
Sanitation	No toilet facilities (1995 Census)	Highest in south and all poverty groups (medium in lowest poverty group)
Urban environment	Air pollution	Medium in largest cities
	Solid waste, water and sanitation	

Poverty and Access to Clean Water



Poverty and Access to Sanitation



Source: PEN Sustainable approaches to poverty reduction in Cambodia, Lao PDR and Vietnam, 2006

WATER QUALITY

In Lao PDR, surface water is the major water source for urban water supply, while groundwater is usually a main source for the rural population in lowland areas, particularly in the central and southern parts of the country, where the groundwater table is sufficiently high and of sufficient quality. In the upland areas, particularly the north and east of the country, water is usually supplied by gravity-flow systems, mostly from streams (surface water), but also from springs (groundwater), although this tends to be limited to communities living in remote areas.

Surface Water Quality

The Government is currently preparing national ambient water quality standards (Table 10). In general, the water quality of rivers within the Lao PDR is considered to be good. The level of oxygen is high and the nutrient concentration is low.

Nevertheless, higher sediment loads are affecting several rivers, varying considerably from 0.41 to 3.45 tonnes per hectare per year. Tributaries and river reaches with high sedimentation are the Xe Banghieng, Xe Done, Nam Ou, and the upper and lower stretches of the Mekong.²⁸

Under pressure from rapid demographic growth, socio-economic development and urbanization, however, water quality is deteriorating. In urban areas, pollutants from roads, commercial and industrial areas, and private properties wash into drains and watercourses. Litter, dust and dirt, oil and grease, particles of rubber compounds from tires, particles of metal, glass and plastic from vehicles, and lead are common pollutants. Residential properties and open spaces contribute sediments and nutrients. Urban drains also act as secondary sewers carrying industrial discharges, septic tank seepage and overflows in wet weather.²⁹

Table 10. Tentative Ambient Water Quality Classes for Fresh Surface Waters

Class	Description
Class 1	Unpolluted water supply safe for human consumption without treatment, provides habitat for sensitive aquatic biota and body contact recreation
Class 2	Water supply safe for human consumption after normal treatment process, habitat for biota and suitable for recreation and aquatic biota
Class 3	Medium quality water suitable for human consumption after normal treatment process, irrigation supply, and aquatic biota
Class 4	Somewhat polluted water used for human consumption only after special treatment and for industrial supply
Class 5	Polluted fresh water suitable for navigation

Source: NEAP 2000 Draft, STEA

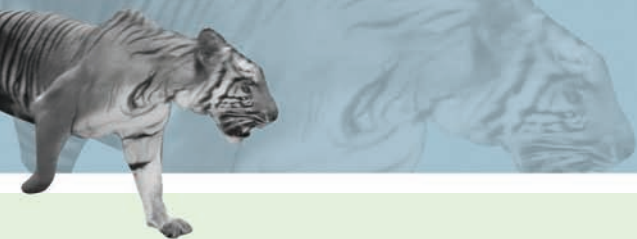


Grandfather and young boy are helping each other to pump water from the ground using a home-made wooden hand-pump.

Photographer: Thomas Meadley, WSP-EAP LCO Team Leader

²⁸ ADB, 1998, *Water Sector Study*, ADB.

²⁹ ADB, 1998, *Water Sector Study*, ADB.



It is common practice to dispose of sewage to surface drains and drainage channels. As a result, wastewater is invariably contaminated with faecal matter from latrines and coliforms from septic tank effluent.

There has been an increase in the output of in the industrial sector from 8 percent of GDP in 1999 to 11.3 percent in 2003³⁰. The total number of industries has grown nearly four-fold from 1994 to 2003 (Table 11). However, the growing number of industries has increased the risk of pollution. The larger mills and industries of concern in Lao PDR are pulp and paper, timber, food processing and garment manufacturing. Most of these have only limited wastewater treatment systems for reducing waste concentrations and loads in the final effluents to waterways. Likewise, the increasingly large number of smaller industries also produces an increasing risk of pollution.

With the exception of once-off wastewater data collection carried out in 2002 (see Box 6), no regular monitoring is being carried out.

Groundwater Quality

There is little information available on groundwater quality in Lao PDR, even though it is the main source of rural water supply. No systematic monitoring of impacts of fluoride, pesticide, nitrate from fertilizer and other chemical pollutants is carried out.

Arsenic contamination is not considered a high risk in Lao PDR³¹. Groundwater surveys carried out in 2002/2003 in 7

Box 6. Monitoring Wastewater in Vientiane

Wastewater monitoring was conducted in Vientiane in 2002. Samples were collected from 15 monitoring stations. Parameters measured were pH, conductivity, alkalinity, BOD₅, COD and temperature. The monitoring results show that the average of all parameters are within acceptable limits, although certain samples exceeded standards for Class A wastewater discharge, issued by the Government in 1994.

Wastewater Quality in Vientiane Capital Jan-Dec 2000

Parameters	Unit	Range of	Avg results	Standard*
pH		6.38-8.44	7.34	6 - 9.5
Conductivity	us/cm	110 - 782	362.62	
Alkalinity	mg/l	57 - 250 (CaCO ₃)	175.56	
BOD ₅	mg/l	5 - 35 (O ₂)	14.09	< 20
COD	mg/l	70 - 200 (O ₂)	115.93	< 120
Temperature	°C	12.2 - 30	24.42	

Source: Waste Water Analysis, EQMC - ERI, 2002

Note: * Standard for class A wastewater discharge.

Table 11. Industrial Growth in Lao PDR

	Large (> 100 employees)	Medium (10-100 employees)	Small (< 10 employees)	Total
1994	80	343	5,523	5,946
1995	89	363	10,374	10,826
1996	112	408	14,134	14,654
1997	119	437	15,375	15,931
1998	99	462	15,953	16,514
1999	94	493	19,806	20,393
2000	95	512	20,962	21,569
2001	116	542	22,916	23,574
2002	112	604	24,026	24,742
2003	119	614	24,874	25,607

Sources: MEM, NSC/CPC

³⁰ ADB, 2004 -.Key indicators of Developing Asian and Pacific countries.

³¹ MRC, 2003 - State of the Basin report 2003.

(Table 12). However, the methods adopted for treatment and disposal of wastewater are generally not satisfactory. Most households rely on soak pits for wastewater disposal. With the exception of a short 2.8 kilometer interceptor and an associated waste stabilization pond, there is no sewerage system in Vientiane or in other urban areas in Lao PDR.

All buildings are supposed to have on-site wastewater disposal and treatment facilities such as septic tanks, but the facilities are often poorly designed, constructed and maintained and therefore perform poorly. The problems with the present system of on-site sanitation are in certain locations exacerbated by a flat terrain, high water table and low soil permeability, resulting in a failure of the systems, overflow of effluent and pollution of surface waters and drains.

Access to sanitation in rural areas in 2004 was only 36 percent³². Of these, flush latrines with septic tank or sewage system accounts for only 0.1 percent (Figure 18). The majority has no latrines, resulting in the use of fields, marshes, and watercourses for disposal of human wastes.

Specific re-use of wastewater for other water usage (e.g. irrigation) is not yet being applied in Lao PDR.

Planning for Improved Water Supply and Sanitation

The Government has committed itself to implement the Millennium Development Goals (MDG), as prepared collaboratively by the UN, WB, IMF and OECD and agreed to in 2000. The MDGs for water supply and sanitation (WSS) are to halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation. The status for Lao PDR in 2000 is given in (Table 13).

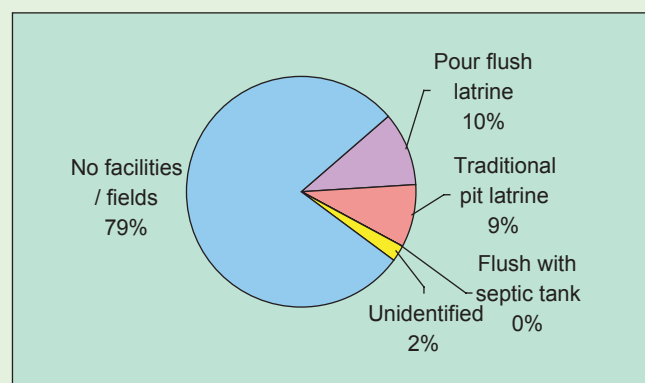
³² Source: National Center for Environmental Health and Water Supply, 2004

Table 12. Urban Household Toilet Facilities (1995)

	Modern	Normal	Dry	Other	None
Vientiane	5.9%	71.6%	11.4%	0.6%	10.5%
Luang Prabang	2.6%	58.4%	18.4%	1.2%	19.4%
Thakhek	1.6%	53.1%	7.6%	0.6%	37.1%
Savannakhet	2.1%	65.1%	3.8%	0.3%	28.7%
Pakse	2.0%	73.0%	3.2%	0.5%	21.4%

Source: Adapted from ADB/MCTPC, 2003 – Lao Urban Data Book.

Figure 18. Rural Sanitation, 2000

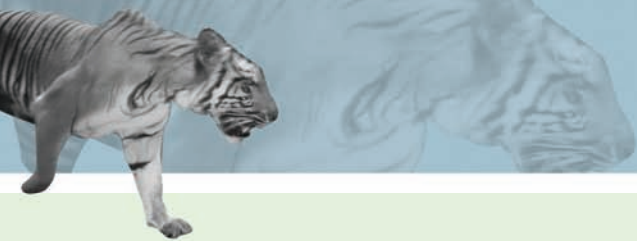


Source: Access to Improved Sanitation: Lao PDR”, WHO / UNICEF, 2001.

Table 13. Status of Lao PDR Millennium Development Goals for WSS (2004)

	Percentage of population with access to improved drinking water sources	Percentage of population with access to improved sanitation
Rural	60,06%	35,66%
Urban	75%	70%
Total (assuming 20% of urban population)	63,8%	44,25%

Source: The National Center for Environmental Health and Water Supply, 2004



Southern Provinces³³ showed that only one percent of the 680 wells tested had levels over the current drinking water quality standard for Lao PDR of 0.05 mg/l. However, the study identified local areas of higher risk for arsenic contamination.

Bacteriological contamination of groundwater often occurs, due to poor construction and maintenance of sanitation facilities around water sources, and results in water-borne diseases.

Improving Safe Water Supply

Although Lao PDR has the largest per capita volume of renewable water resources in Asia, a quarter of urban dwellers and 40 percent of the rural population are without access to safe drinking water. Nearly 60 percent of the urban population have access to a piped water supply, while another 15 percent are within reach of supplies but not directly connected. Also, in addition, many older properties have access to groundwater through dug wells that are now used only for non-potable supply.

In rural areas, access to clean water is still limited, estimated at around 60 percent in 2004. In certain areas, villagers may have to travel up to 1 or 2 kilometers to get water, which is often of low quality.

Poor Sanitation and Sewerage

In 2004, an estimated 70 percent of the urban population in Lao PDR had access to satisfactory sanitation facilities. In Vientiane, the proportion of urban households with satisfactory sanitation facilities such as cistern flush or pour flush toilets was estimated at more than 75 percent in 1995.

Box 7. Supply of Water and Sanitation Services

Urban water supply throughout the country is presently under the responsibility of Nam Papa, the state-owned service providers under the jurisdiction of each province. Nam Papa Vientiane comes under the jurisdiction of the Vientiane Capital City authorities. The Department of Housing and Urban Planning (DHUP) of the Ministry of Communication, Transport, Post and Construction (MCTPC) has management and investment oversight for urban water supply. DHUP has the duty to periodically review the policy and strategy of Nam Papa including standards of customer service and priorities for urban water supply development. In 1999, the Water Supply Authority (WASA) was set up to bring regulatory oversight to the sector.

Rural water supply is under the responsibility of the National Centre for Environmental Health and Water Supply (Nam Saat) of the Ministry of Public Health. In 1997, Nam Saat introduced the "Demand Responsive Approach (DRA)" for demand-based planning. The goal is to increase sustainability through improved sense of ownership by ensuring community "voice and choice". The key principle is that choices are made by users for investing in improving water and sanitation services, based on a range of technical and financial options presented to them. As a result of this approach, communities become the "decision makers" while Nam Saat and its partners act as facilitators to support local decisions based on informed choices.

There are beginning to be a few examples of Private Sector Participation (PSP) for design, construction and management of rural water supply and sanitation infrastructure in villages. These are unregulated at present. A successful example is in Ban Saphai Neua, Champasack Province, with water supply being provided to 200 households (approx. 1,200 persons). PSP was applied to this household piped water service after approval of a ten-year license by the district authorities. The female owner of the system undertook surveying and data collection to assess demand and agreed a tariff rate with the village authorities and community to cover the full costs of the water supply service. The tariff was initially set at 650 kip/m³. Use of the service includes signing of a contract by each household requiring the service, with the cost of connection paid in advance by the household. Under GOL's decentralization program, Nam Saat (the agency in the Ministry of Health responsible for rural water supply and environmental hygiene) has also launched a program called "HASWAS" (Hygiene Awareness, Sanitation, and Water Supply, a component of the Provincial Infrastructure Project in Oudomxay and Phongsaly Provinces) to help provincial offices to use the private sector for supply and construction of water supply and sanitation infrastructure in villages, with the completed systems being managed by the communities.

Source: "Building Blocks Used To Achieve Rural Water Supply and Sanitation (RWSS) Sector Policy Reform in Lao PDR", Nam Saat, WEDC and WSP-EAP, 2004.

³³ Source: National Center for Environmental Health and Water Supply, 2004

Poor Storm Water Drainage

Storm water drainage in most urban areas consists of roadside drains leading ultimately to natural streams or rivers. Drains are generally not adequately interconnected and do not form a network. In the larger towns, drains are lined in the town centre areas, and covered in front of commercial establishments.

The flat and low-lying topography of Vientiane Capital City, combined with its proximity to the Mekong River, means that storm water drainage is a perennial problem resulting in frequent flooding of large parts of the city, and in health risks (see also **Box 8**).



Box 8. Environmental Health Concerns

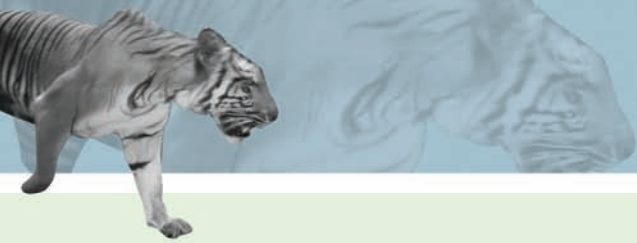
As the population of Lao PDR grows and becomes more concentrated with development, especially along watercourses that are used simultaneously for water supply and waste disposal, health risks increase. Where people use streams directly for drinking, bathing or washing, the water is polluted, and the potential for contracting diseases is high. Common diseases include dysentery, cholera and typhoid. There are also concerns in some places over heavy metal pollution. Populations gathered around water also risk dengue fever and malaria, which are carried by mosquitoes.

Progress has been made over the past ten years in improving health systems in Lao PDR. For example, the number of health facilities has increased by 75 percent over the last 5 years, mortality from malaria has been reduced by 60 percent in rural areas, as compared to 1996, and under-five infant mortality has dropped from 170 in 1995 to 106 in 2000.

However, there are many remaining challenges:

- The health status of the Lao population compares poorly to regional standards;
- Under five mortality rates are twice as high in rural areas as in urban areas;
- In many rural areas there is still limited access to health services;
- Severe poverty, malnutrition, illiteracy superstition, and non-hygienic lifestyles are causes of under utilization of public health services;
- The low quality of health services is another cause of under utilization;
- Availability of four essential drugs (chloroquine, paracetamol, antibiotics and ORS) is limited in rural areas.

Source: GoL, 2004 - National Growth and Poverty Eradication Strategy.



MUNICIPAL SOLID WASTE

The generation of solid waste in urban areas in Lao PDR is on the rise, and already degrading the quality of surface and groundwater. Expanding urban populations, poor collection, and largely inadequate disposal facilities are compounding the level of pollution.

Waste Generation Increasing

The annual waste generation in 2004 was 270,000 tons. Domestic waste accounts for the bulk of materials generated. The average urban waste production in Lao PDR is 0.75 kg per capita per day. Vientiane and the four secondary towns account for 0.8–1.4 kg per capita per day (Table 14). Solid waste in Lao PDR comprises mainly of organic material, plastic, paper, and glass, cans and other metals (Figure 19). Hazardous and toxic wastes such as batteries, old paint cans, aerosols and other refuse are also mixed with these wastes. The comparatively low content of organic material in municipal solid waste is mainly due to the fact that a large proportion of food waste is recycled as animal feed even in urban areas.

Open Dumping Predominates

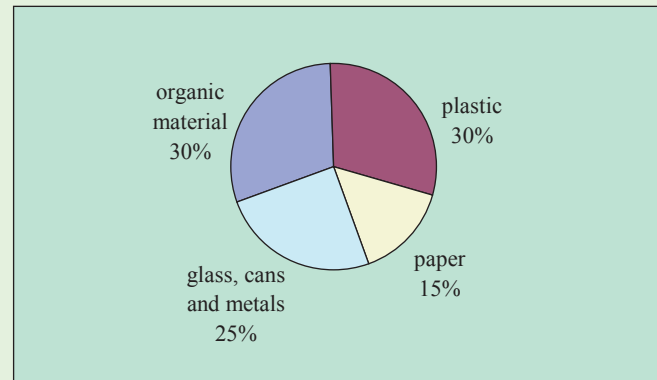
According to a recent survey in 57 urban areas, only Vientiane City and the four secondary towns of Luangprabang, Thakhek, Savannakhet and Pakse use landfills for solid waste disposal (Table 15). However, the disposal areas are small, and have no leachate collection and monitoring wells. Elsewhere, open dumping and burning are common practice for waste disposal in Lao PDR. Hazardous and infectious wastes are often disposed of with municipal waste (Box 9).

Table 14. Average Per Capita Waste Production, Secondary Towns (2002)

Town	Per capita waste production
Vientiane City	0.8 kg
Luangprabang	1.0 kg
Thakhek	0.8 kg
Savannakhet	1.0 kg
Pakse	1.4 kg

Source: MCTPC/UNDP/NORAD LAO/96/006: Solid Waste Management in Secondary Urban Centres of Lao PDR

Figure 19. Waste Composition in Lao PDR



Source: ADB, 2001, *Environments in Transition: Cambodia, Lao PDR, Thailand and Vietnam*.

Table 15. Landfills in the Four Secondary Towns

	Luang Prabang	Thakhek	Savannakhet	Pakse
Date started	June 2002	Aug 2000	Aug 2000	July 2000
Site Area	15 ha	9 ha	13.5 ha	13.5 ha
Disposal Area	3.5 ha	2.2 ha	4 ha	2.2 ha
Lifespan	10+ yrs	10+ yrs	5-10yrs	5 yrs
Leachate Pond	Yes	Yes	Yes	Yes
Geotextile Liner	No	No	No	No
Leachate collection	No	No	No	No
Monitoring wells	No	No	No	No

Source: MCTPC/UNDP/NORAD LAO/96/006: Solid Waste Management in Secondary Urban Centres of Lao PDR

This improper waste disposal results in environmental impacts such as ground water contamination, leachate, odor, and production of methane which can lead to fire and explosive hazards. All of these increase the risk of disease.

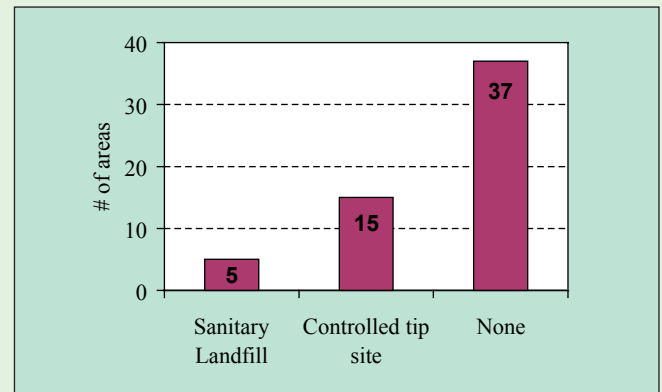
Collection Ratios Low, But Rising

Despite the existence of landfills in Vientiane and the four secondary towns, collection services are limited to accessible areas and profitable target groups such as markets and high-income households. The average collection ratio for urban households in the five larger urban areas is 45 percent. Only in Luang Prabang does the collection ratio reach more than 50 percent. In smaller towns, solid waste collection is often limited to commercial establishments in the town centre and the market place.

Recycling Minimal

Approximately 70 percent of municipal solid waste consists of plastic, paper, glass, cans and metals, which have the potential to be recycled commercially, and reused in various manufacturing and industrial activities. However, the current scale of recycling in Lao PDR is still very modest (see Box 10).

Figure 20. Disposal Practices in 57 Urban Areas



Source: ADB/MCTPC, 2003 – Lao Urban Data Book.

Table 16. Solid Waste Collection

Urban Area	Percent with collection service	Total # of house holds	Disposal method
Vientiane	48%	55,503	Landfill
Luangprabang	83%	7,443	Landfill
Thakhek	36%	6,118	Landfill
Savannakhet	39%	10,466	Landfill
Pakse	32%	8,202	Landfill
Weighted average	45%	87,732	

Source: ADB/MCTPC, 2003 – Lao Urban Data Book.

Box 9. Vientiane Solid Waste Management

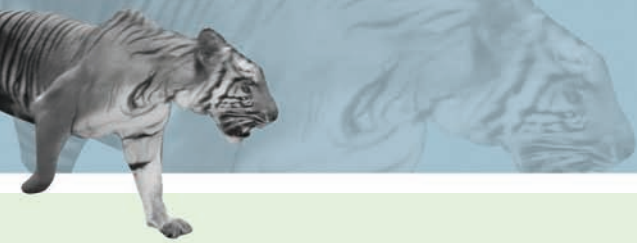
In Vientiane 1997, only 5 percent of urban households were served by a solid waste collection system and only 10 percent of the solid waste generated was estimated to be collected. Today, with improvements in the solid waste management system, 48 percent of the urban households in Vientiane are now served by solid waste collection services. About half of the solid waste generated is now collected and disposed of at the sanitary landfill facility located 18 kilometers from the city centre. It accepts domestic, construction, industrial and hospital waste, and provides separation for hospital waste within fenced compound. The waste is collected by Vientiane Municipal Services.

There are limited environmental and social safeguards concerning handling of waste, no regular covering with soil, no leachate control, and the site is adjacent to agricultural land. The landfill is accessible to scavengers and animals. Rudimentary recycling is undertaken for plastics, paper, and scrap metals. At the recycling area an unpleasant smell is produced.



Hospital waste section of the Vientiane landfill

Photo: Iain Watson (2003)



HAZARDOUS CHEMICALS

Hazardous chemicals of concern include heavy metals such as mercury, lead, cadmium, arsenic, chromium, copper, and zinc as well as persistent organic pollutants (POPs) such as dioxins and furans, polychlorinated biphenyls (PCBs), and various pesticides and herbicides that are now banned globally. At present their environmental impact is still poorly understood in Lao PDR. STEA initiated an inventory of hazardous chemicals in December 2003, and the National Hazardous Chemicals Strategy and Action Plan is currently being revised.

Heavy Metal contamination results primarily from industrial activities, which are increasing significantly as the country develops. Of particular concern is lead production and rudimentary metal smelting facilities in the country, as well as releases of mercury, cyanide, copper, cadmium and other heavy metals from mining activities. Surface water quality in areas downstream of industrial and mining activities therefore needs to be carefully monitored to avoid potential human impacts.

Persistent Organic Pollutants Presently, herbicides and pesticides are used only in moderate levels in Lao PDR, mostly as a result of low per-capita incomes and traditional agricultural practices in rural areas. However, there is evidence of banned pesticides and herbicides still being imported into Laos from neighboring countries, and dumping of empty barrels in landfills has been recorded in Vientiane Capital City and other major cities. There is a lack of baseline information on the extent of the problem in the country, and its potential effects on human health.

PCBs are still found in old transformers throughout Lao PDR, but these are being phased out. PCB oils are now being adequately stored in the country, but there are concerns related to historical spills and dumping sites.

Dioxin and furan contamination in Lao PDR occurs mainly from combustion of solid and industrial waste, burning of wood and oil for fuel, and forest fires. However, significant quantities of dioxin were also released during the Indochina War from the use of Agent Orange and other toxic herbicides. Dioxin residues may

occur near the Vietnam border and along the former Ho Chi Minh Trail. Dioxin is known to have serious health and environmental impacts.

Box 10. Company Wants to Sift Through Your Trash

Schools and villagers are being encouraged to collect and recycle rubbish through a system supported by local NGO, PADETC, UNDP and the government. A private company, Lao Chareon Recycling Centre has agreed to buy all the rubbish that villagers can bring to any of the 60 recycling centres.

Hard rubbish will be collected at segregated points and purchased by Lao Chareon. Glass, paper and plastics will be collected. Organic refuse will also be gathered and used to make compost, which besides being sold, will also improve farming yields in the local area.

“As Vientiane grows, it is becoming apparent that we may soon face a rubbish crisis. Private business, often major contributors of refuse, need to take the lead, and act before piles of solid waste block our waterways, litter our streets and increase the risk of disease,” said Mr. Uodone of Lao Chareon. Our company is very happy to be part of this initiative.

“This scheme will also raise awareness on the issue of refuse and make people conscious that what they throw away eventually impacts on their environment,” added Mr. Khamserm of PADETC. “Until recently, there were no plastic bags in the market. Things were wrapped in banana leaves. We need to instill a change in culture, so that people understand what it means to throw away.”

Besides providing an income for poor villagers, the scheme will help Vientiane take pressure off its landfills, not to mention decrease the workload for dustmen and garbage collectors.

Source: UNDP Press Release March 2003

AIR QUALITY

Clean Air

Ambient air quality standards have yet to be formalized, but overall air quality in urban and rural areas in Lao PDR is currently at acceptable levels.

Air quality monitoring in Lao PDR is very recent and limited in scope. Monitoring of air quality in Vientiane was conducted in September 2002 – February 2003 (Table 17). The key pollutants measured were total suspended particulates (TSP), particulate matter smaller than 10 microns (PM₁₀), sulfur dioxide (SO₂), and nitrogen dioxide (NO₂). The monitoring results show that the averages of all pollutants comply with international standards (Table 17).

Pollution on the Rise

There are comparatively few industries in Lao PDR, but the number is increasing. Despite a lack of data, the threat from industrial air pollution is considered much less than that from vehicular pollution in urban area.

The numbers of vehicles, especially motorcycles, is rapidly increasing, with an average annual growth of more than 9 percent during the past decade (Figure 21). This pollution source is expected to become most prominent in Vientiane Capital where more than half of all vehicles are used.

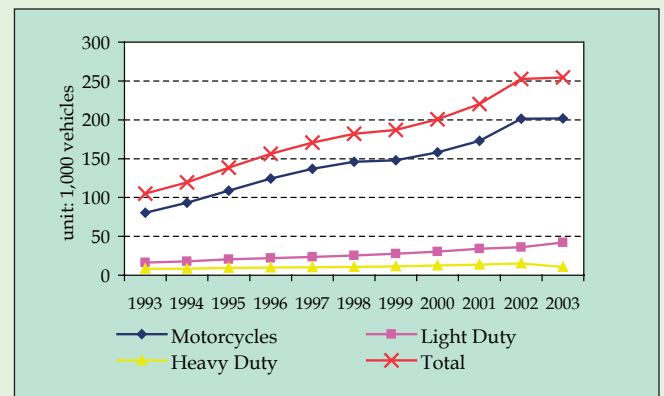
Even though most fuel used for transport in Vientiane is unleaded and low in sulfur, vehicles are still the major source of other pollutants: TSP, PM₁₀ and CO. Particulate matter, especially PM₁₀, has the most serious potential impact on health, including decreased lung function, cancer and possibly death from respiratory illness.

Table 17. Ambient Air Quality in Vientiane Capital from Sep 02 – Feb 03

Pollutants	Unit	Range of results	Average of results	Ranges for international standards
TSP	mg/m ³	0.082 - 0.296	0.165	0.33
PM ₁₀	mg/m ³	0.040 - 0.089	0.068	0.12 – 0.15
SO ₂	mg/m ³	0.025 - 0.276	0.108	0.32 – 0.36
NO ₂	mg/m ³	<0.001-0.057	0.014	0.30

Source: *Ambient Air and Noise Monitoring in Vientiane Municipality – MEM, STEA and DANIDA, 2003*

Figure 21. Number of Vehicles in Lao PDR, 1993 – 2003



Source: MCTPC, 2003



INSTITUTIONS AND LEGISLATION

INSTITUTIONS

The institutional structure for environmental management in Lao PDR consists of: (i) national committees that guide inter-sectoral coordination among agencies; (ii) STEA as the main manager, monitor and coordinator of environment matters at the national level, and other relevant ministries with the mandate to mitigate environment and social issues arising from their sectoral development activities; (iii) provincial and district entities that have devolved responsibility for environmental protection at the local level; and (iv) mass organizations which support the government in promoting participation and awareness. The key environmental institutions are shown in **Figure 22** and their respective roles are further clarified below. The approximate number of staff for the main environmental agencies is presented in **Table 18**.

National-Level

The Science, Technology, and Environment Agency (STEA), which was established under the Prime Minister Office in 1993, includes the Department of Environment (DoE) and the Environmental Research Institute (ERI). STEA is the principal Government agency for formulating and guiding environmental policy in the country. These two departments are the national focal points for environmental management, including the development of strategies, policies, regulations, programs and projects, implementing Government responsibilities in environmental impact assessment, environment monitoring, and research and training activities. Additional Departments and Research Institutes under STEA are active in environment management including: (i) the Department of Intellectual Property, Standardization and Meteorology, which concentrates on protecting traditional or local knowledge rights; (ii) the Technology Research Institute, which focuses on promoting and developing the use of renewable energy and appropriate technologies in remote areas of the country; and (iii) the Institute of Scientific Research, which focuses on biosafety issues.

The Ministry of Agriculture and Forestry (MAF) has a diverse portfolio of functions, which includes crops, livestock, soil, irrigation, fisheries, watershed management, forests and protected areas, and is mandated to mitigate impacts and promote sustainability of agriculture and forest development. MAF includes the Department of Forestry (DoF), which regulates all aspects of forest exploitation and conservation.

The Committee for Planning and Investment (CPI), formerly known as CPC, is the national economic planning agency that is responsible for integration and approval of sectoral and provincial development plans into the overall national long-, medium-, and short-term plans and Public Investment Plans.

The Environmental Protection Law of 1999 requires each sector Ministry to issue its own procedures on Environmental Impact Assessment, based on STEA regulations. These include:

- the *Ministry of Communications, Transport, Post and Construction (MCTPC)*, responsible for management of road projects, transport, housing and urban planning. It also oversees urban wastewater treatment, urban water supply and sanitation, riverbank erosion control, and construction.
- the *Ministry of Energy and Mines (MEM)*, responsible for industrial and mineral development, power development, including hydropower, fossil fuels and renewable energy;
- the *Ministry of Public Health (MoH)*, responsible for rural water supply and sanitation, and environmental health issues.

Inter-sectoral Coordination

Recognizing the cross-sectoral nature of environment issues, the Lao Government has created multiple coordination bodies to facilitate inter-agency and provincial coordination. These include:

- the *National Environment Committee (NEC)*, established in 2002. The main responsibilities of NEC are to coordinate and provide advice to GoL and its agencies regarding environmental management, strategies, regulations and plans. The NEC consists of management level officials from 14 key agencies, and is chaired by the Vice Prime Minister, with the STEA President and the MAF Minister acting as Deputy Chairpersons. The Secretariat is housed in STEA.
- the *Water Resources Coordination Committee (WRCC)* was established in 1999 to improve water resources management. Its main responsibilities are to formulate and implement water resource policy, including management of water allocations. The WRCC consists of management representatives from STEA, MAF, MEM, MCTPC, MoH and LNMC.
- the *Lao National Mekong Committee (LNMC)*, established in 1999 to formulate policy, strategic plans, projects and programs related to water resources development in the Mekong Basin. It also works to ensure development cooperation with other Mekong riparian countries, other countries and donors.

Decentralized Entities

In 2000, the Government began implementing its decentralization policy. The Government aims to transform the province into the strategic unit, the district into the planning and budgetary unit, and the village into the implementing unit. Most national agencies, including STEA and MAF, are making considerable progress in devolving their authority to the provinces. Centrally appointed Provincial Governors administer the country's 16 provinces, Vientiane Capital City and Xaysomboun Special Zone, and are responsible for the devolved functions.

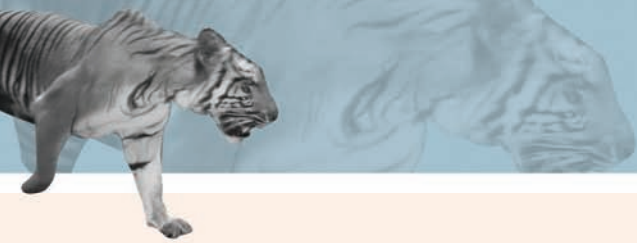
Decentralized STEA Offices have been established in Vientiane Capital City, Xaysomboun Special Zone, and in the form of 16 Provincial STEA Offices (PSTEOs). The PSTEOs are housed under the Provincial Cabinet, under the guidance of the Governor, and report to both the Governor and STEA. On average, a PSTEO consists of five staff members, namely a Chief of Unit, as well as technical and administrative staff. Further decentralization of functions to Districts and Villages is ongoing.

MAF's mandate in forestry and protected areas management is implemented through Provincial Agricultural and Forestry Offices (PAFOs) and District Agricultural and Forestry Offices (DAFOs). Most PAFOs and DAFOs are well represented in all the provinces. NPAs are generally staffed and managed by the relevant PAFOs/DAFOs. The most common arrangement is for the NPA Head to be assigned from the PAFO, and his core staff drawn from a mix of PAFO and DAFO staff. Field offices are now established in nine of the 20 NPAs.

Starting in 1995, responsibilities for urban development were decentralized from the ministerial departments at provincial and prefecture level to the level of an urban local authority. As a result, Urban Development and Administration Authorities (UDAA) have gradually been established in Vientiane Capital City and four secondary towns (Luang Prabang, Thakhek, Savannakhet and Pakse) to improve urban management, and have taken over the responsibilities of the PCTPC in the larger towns³⁴. The roles and mandates of the UDAA's are currently being reviewed and integrated as part of the overall national decentralization policy³⁵.

³⁴ Until 1995, there was no administrative separation between urban areas and rural areas with provincial towns forming (part of) a district.

³⁵ Source: ADB, 2003 - Lao Urban Data Book. Development Indicators for the Urban Areas of Lao PDR. Produced under ADB TA No. 3492-LAO Small towns Development Project.



Mass Organizations and Civil Society

Mass Organizations and Civil Societies in Lao PDR are actively involved in participatory planning and awareness raising activities to advance the government's development agenda at the grass-roots level. Their role in environmental protection is just beginning to take shape, as are government practices for engaging civil society in development plans (see **Box 11**). Chief among the mass organizations are the Lao Trade Union Federation (LTUF), Lao Women's Union (LWU), and the Lao Youth Organization (LYO). The Lao Front for National Reconstruction (LFNR) is a Civil Society; it includes senior citizens, veterans, and ethnic groups, defending their interests and also participates in environmental protection activities.

Donors

There are a few locally based international NGOs who support capacity building, research, monitoring, and site-specific investments in the country. In addition, private companies are becoming more involved in environmental protection.

Among the main international donors supporting the government, mass organizations and international NGOs are the Japan International Cooperation Agency (JICA), Swedish International Development Agency (Sida), German Government (GTZ), the Government of The Netherlands, the Agence Française de Développement (AFD), Asian Development Bank (ADB), Canadian International Development Agency (CIDA- Inc.), AUSAID, DANIDA, IUCN, WCS, WWF, FAO, WHO, UNESCO, UNICEF, UNDP and the World Bank. Support is provided in environmental protection, capacity building, forest management, biodiversity

conservation and watershed management through strengthening institutions at the national and provincial levels and financing infrastructure and services (see also **Box 14**).

Box 11. Stakeholder Consultation in the Nam Theun 2 Project

The design phase for the Nam Theun 2 hydropower project involved an unprecedented level of local, domestic and international public consultation to inform development of social and environmental plans.

In total, several hundred local consultations have taken place since 1996 with villages affected by all components of the project, including management of the watershed, reservoir inundation, construction sites, and impacts to downstream river systems. Throughout this process, meetings became increasingly driven by the villagers themselves as discussions became more focused on specific compensation measures, and as lessons were learnt and tools developed, such as use of trained village facilitators, visual aids and break-out discussion groups in addition to plenary sessions. National workshops have involved local government and Lao mass organizations, and for the first time external NGOs and development organizations have been engaged in prior consultation through international workshops in Bangkok, Paris, Tokyo and Washington.

The consultations have been instrumental to finalization not just of the details of resettlement and downstream compensation packages, but also to aspects of overall design such as location of project sites and regulation of downstream flow. Environmental and social plans have been disclosed on websites and through national and local information centers, with summaries translated into Lao.

Environment Protection Fund

The Lao Environment Protection Fund is a financially and administratively autonomous, non-profit organization established as a source of financing to support environmental management, protection and conservation. It was established by Prime Ministerial decree in June 2005, and is expected to begin operations by the end of the year.

It was established in response to commitments within policy documents relating to environmental protection, forestry, biodiversity and water resources. A single fund, able to support a broad range of stakeholders, was created in order to streamline administrative procedures and reduce overheads, and to strengthen inter-sectoral coordination by providing a single mechanism to channel various state revenues and donor funds.

Figure 22. Organization Chart of Selected Government Agencies

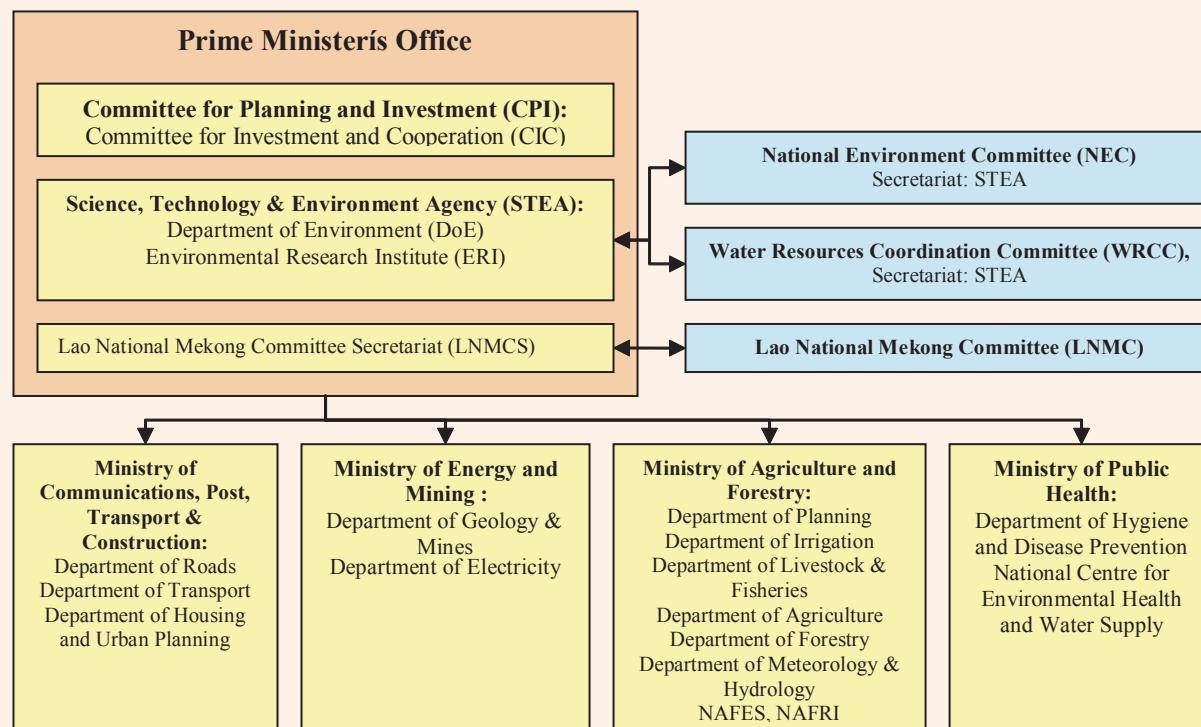
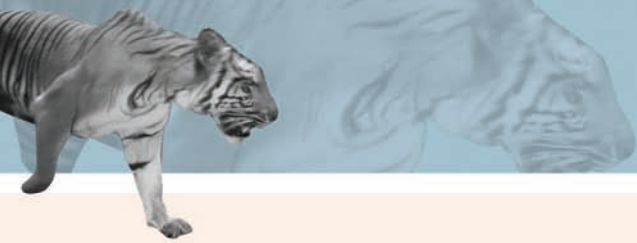


Table 18. Staffing Estimates in Environment Agencies

Agency/Ministry	Total staff (2002-2003)	Specific Environment Units/Divisions	Number of staff in specific Environment units/ Division (2003-2004)	Percent
Central Government:				
• STEA	218	Department of Environment (DoE) Environmental Research Institute (ERI)	66	33%
• MAF	6,823	DFRC (DoF), FRC (NAFRI), and part of NAFES	126	2%
• MCTPC	2,096	ESD (EMMU in DoR) UDD (EMMU in DHUP)	15	1%
• MEM	622	Environment Division (DoE) Environment Division (DoI) Environmental Office (EdL)	17	3%
• MoH	11,124	Department of Public Health and Hygiene	120	1%
Provinces	7,651	PSTEOs, MSTEO, NPA staff, Road Units (DoE).	300	4%
Lao National Mekong Committee Secretariat	35	Professional Staff	17	49%
Total:	28,494		642	2%

Source: ERI Capacity Survey (2003/2004)



LEGISLATION

Many Laws

The Government has formulated a wide array of legislation and regulations for environmental conservation and protection (**Table 19**). The Environmental Protection Law of 1999, supported by its Implementing Decree (2002), is the principal environmental legislation in the country. It includes responsibilities of national environmental agencies, measures for the protection, mitigation and restoration of the environment as well as guidelines for environmental management and monitoring.

The Decree on Environmental Impact Assessment (EIA) was approved in 2000. This regulation describes the process for consideration, approval and certification of development projects (see **Box 12**). Sector specific EA regulations have been developed for hydropower and electricity (MEM) and Road Development (MCTPC).

The Forest Law of 1996, and its various enabling implementation decrees and regulations, describe measures to improve the protection of forests and protected areas. Under this law, specialized decrees have also been issued for specific forestry programs or protected areas.

Enforcement and Inconsistencies of Legislation Need to be Addressed

Environmental legislation has evolved quickly in Lao PDR. Inconsistencies have surfaced in different legislation as a result of different ministries leading the development of sectoral legislation. Principal inconsistencies include conflicting provisions, overlapping mandates given to different ministries, and lack of implementing regulations and supporting environmental standards. The Government is working to address these issues, and to formulate a national system for standardizing and enforcing environmental regulations.

International Agreements

Lao PDR has joined a number of multilateral environmental agreements, and has delegated their implementation among the various ministries and agencies (**Table 20**).

Box 12. Responding to the EIA Decree

To ensure compliance with the EIA decree, each ministry has to establish Environmental Management and Monitoring Units (EMMU). At present a total of 5 EMMUs have been established (MCTPC and MEM).

Division	Ministry/Department	Staff
Environment and Social Division (ESD)	Department of Roads (DoR / MCTPC)	8
Urban and Rural Development Division (URDD)	Department of Housing and Urban Planning (DHUP / MCTPC)	7
Social and Environment Management Division (SEMD)	Department of Electricity (DoE / MEM)	5
Industrial Environment Division (IED)	Department of Industry (DoI / MEM)	5
Environmental Office	Electricite du Laos (EdL / MEM)	9
Total:		34

The EMMUs have developed sectoral EIA related guidelines mainly for road and hydropower sectors, which include screening procedures, management standards, social impact assessments, safety instructions, and resettlement and compensation procedures. Other Departments that have not yet established formal EMMUs are also in the process of developing similar implementing guidelines (e.g. for mining). EMMUs in support of the implementation of the Environmental Protection Law have also been established within all provinces, Vientiane Municipality and Special Zones.

Source: Authors

Table 19. Key Environmental Laws and Regulations

Law	Regulated Activities	Key Contents	Responsible Ministries
Forestry Law (1996)	States principles, regulations and standards for the use of forest lands and resources. Promotes the conservation and rehabilitation of forest resources. Defines roles and authorities of forest management and inspection organizations.	<ul style="list-style-type: none"> Specified procedures for getting approvals from authorized agency is required for individuals and organizations to possess and use natural forests Individuals and organizations have obligation to preserve forest resources including water sources, marine animals and wildlife 	MAF
Water and Water Resource Law (1996)	Regulates the management, exploitation, development, protection and sustainable use of water and water resources	<ul style="list-style-type: none"> MAF is responsible for the survey and inventory of water resources Classifies scale of water use into small, medium and large, the latter two require permits. 	WRCC
Land Law (1997)	Provides rules on management, protection and use of land.	<ul style="list-style-type: none"> All individuals and organizations have obligation to protect the land to ensure that there is no soil erosion, land slip, soil degradation and negative impact on the natural or social environment 	MAF, MEM, MCTPC, MIC, MND, MoInt, MF
Mining Law (1997)	Provides a system of management for the conservation, exploration, mining and processing of minerals for local consumption and export	<ul style="list-style-type: none"> Licensees are required to preserve and restore the land utilized during mining and to rehabilitate the land after mine closure and to guarantee that the project shall have no serious negative impacts. Any person or entity licensed to develop mineral resources shall utilize procedures to limit adverse environmental impacts 	MEM / DGM
	Specifies principles, rules and measures to manage, monitor, restore and protect the environment, natural resources and biodiversity. Ensure the sustainable socio-economic development.	<ul style="list-style-type: none"> All persons and organizations residing in Lao PDR have an obligation to protect the environment STEAs are responsible for overall environmental oversight and coordination Each sector responsible for development projects shall issue its own regulations for EIA, based on general EIA regulation issued by STEA 	STEAs / DoE
Industrial Law (1999)	Regulates the establishment and management of business in industry and handicraft sector	<ul style="list-style-type: none"> All businesses shall ensure the protection of the environment in accordance with EPL Wastes shall be treated in accordance with the relevant waste discharge regulations 	MEM / DOI
	Establishes uniform environmental assessment requirements and procedures for all development projects	<ul style="list-style-type: none"> Organizational responsibilities are specified Procedures and methods for the EA. Requirements for the Environmental Management Plans, Environmental Monitoring and Evaluation, and Public Involvement. 	STEAs / DoE
Implementing Decree of the EPL (2001)	Outlines requirements for the preparation of detailed sector regulations, and provides assistance in achieving the goals of the National Socio-Economic Development Plan (NSEDPP).	<ul style="list-style-type: none"> Ministries and ministerial equivalents shall: Issue and implement sectoral regulations Prepare technical standards and regulations on construction, operation, maintenance, repair, innovation and expansion Issue regulations to protect and control pollution Establish or Improve the EMMUs. 	STEAs / DoE
Electricity Law (1997)	Provides a framework to manage all electricity activities (generation, transmission and distribution)	<ul style="list-style-type: none"> The planning and execution of power projects must take into account social and environmental impact, including those upon ecosystems and wildlife habitats, as well as ensuring economic returns. 	MEM/DoE

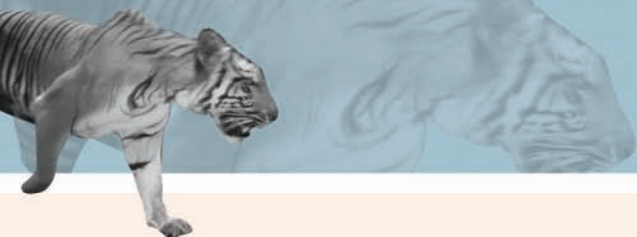


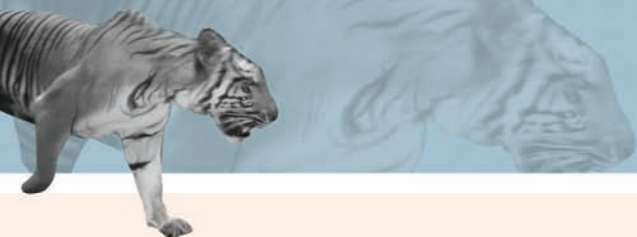
Table 20. Lao PDR International Agreements

Year	Convention	Focal Points	Remarks and Status in Lao PDR
1985	ASEAN Agreement on the Conservation of Nature and Natural Resources	MAF, ASEAN	Lao PDR became a full member of the 'Association of Southeast Asian Nations' (ASEAN) in 1997. The government has been engaged in implementing the 'Hanoi Action Plan' and its environmental strategic plan and is considering a number of agreements with significant influences on the national development and environmental protection.
1987	Protection of the World Cultural and Natural Heritage	MIC	The Government accepted accession to the 'Convention for the Protection of the World Cultural and Natural Heritage' on 20 March 1987 and is taking the legal, scientific, technical, administrative and financial measures necessary for identification, protection, conservation, and rehabilitation of designated heritage sites in the country. Luang Prabang town was designated as the first site and others are being proposed.
1995	Agreement on the Cooperation for the Sustainable Development of the Mekong River Basin	LNMC	The Government signed the 'Agreement on the Cooperation for Sustainable Development of Mekong River Basin' together with other members of the Mekong River Commission on 5 April 1995 and is implementing the 'Mekong River Programs'.
1995	United Nations Convention to Combat Desertification (CCD)	STEA	The Government has been a signatory of the 'United Nations Convention to Combat Desertification' (CCD) since 30 August 1995 and accepted accession to the Convention on 20 September 1996. The Government adopted the 'National Action Plan' (NAP) to combat desertification in 1999 and is revising it.
1995	United Nations Framework Convention for Climate Change (UNFCCC)	STEA	The Government has accepted accession to the 'United Nations Framework Convention on Climate Change' (UNFCCC) on 4 April 1995. The first 'National Communication' was issued in 2000.
1996	Convention on Biological Diversity (CBD)	STEA	The Government has accepted accession to the 'Convention on Biological Diversity' (CBD) on 20 September 1996 and has finalized its 'National Biodiversity Strategy and Action Plan' (NBSAP) for conservation and sustainable use of the nation's biodiversity in 2004. In 2004, the Government signed the convention.
1998	Montreal Protocol	STEA	The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in September 1987. The Protocol was adjusted to accelerate the phase out schedules, and has also been amended to introduce other kinds of control measures and to add new controlled substances to the list. Governments are not legally bound until they ratify the Protocol as well as the Amendment. Lao PDR has ratified the Protocol, but not yet the amendment.
1998	Vienna Convention on the Protocol of the Ozone Layer	STEA	The Government accepted accession to the 'Vienna Convention for the protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer' on 21 August 1998 and has finalized the 'National Action Plan' to deal with this issue in the beginning of 2004.
2000	Millennium Declaration	MOFA	In September 2000, Lao PDR adopted the Millennium Declaration. The Declaration includes the Millennium Development Goals (MDG), a set of development goals related to peace, security and development concerns, including environment, human rights, and governance. The MDG incorporate most of the goals and targets set at the global conferences and world summits of the 1990s.
2004	Convention on International Trade in Endangered Species of Flora and Fauna (CITES)	MAF and STEA	Lao PDR has sign the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in May 2004. CITES entered into force in July 1975 and now has more than 115 member countries. These countries act by banning commercial international trade in an agreed list of endangered species and by regulating and monitoring trade in others that might become endangered.
-	Stockholm Convention on Persistent Organic Pollutants	STEA	Signed but not yet ratified.
-	Wetlands of International Importance Especially as Waterfowl Habitat (Ramsar Convention)	MAF	Under preparation.

Sectoral Approaches

Over the past five years, many sector-specific strategies and action plans had also been approved with the NESAP:

- The *'Water Sector Strategy and Action Plan'* (WSSAP) was adopted in 1998 and a *'Policy on Water and Water Resources'* was prepared in 2000 to ensure that management, exploitation, use and development of water resources are sustainable, equitable, and support the goals of socio-economic development and environmental protection of Lao PDR.
- The *'National Biodiversity Strategy and Action Plan'* (NBSAP) was approved in 2004 with a goal of promoting participatory and sustainable management of biodiversity. It links biodiversity conservation to government priorities in poverty eradication and sustainable development with the aim of protecting the current asset base of the poor
- The formulation of a *'Forestry Strategy to 2020'* was initiated in 2001 with support from Sida and JICA. The Strategy identifies the roles and potential of the forestry sector in achieving the goals of economic growth, poverty alleviation, and environmental stability in Lao PDR. The Strategy is a follow-up of the *'Forestry Vision for 2020'* prepared in 2000, which recognized the need to reverse the negative forestry trends, for example through strengthening the legislative framework for sustainable forest management and improving forest law enforcement.
- The *'Agriculture and Forestry Sector Development Plan'*, prepared in 2001, is comprised of: (i) *Food Production Program*, aiming at achieving food-security by improving quantity, quality and availability of food with specific targets for rice, maize, root crops, meat and fish; (ii) *Commodity Production Support Program*, aiming to develop the agro-processing sector to provide local income opportunities and increase value-added crops; (iii) *Stabilization/Reduction of Slash-and-Burn Cultivation Program*; (iv) *Irrigation Development Program*, aiming at increasing rural incomes and stabilizing rice availability by expanding irrigated areas for both wet and dry season production, and by improving the operation and maintenance of existing irrigation schemes; (v) *Agriculture and Forestry Research Program*, aiming to rehabilitate existing research stations and expand research activities to new areas, and to cooperate with international research institutions; and (vi) *Human Resources Development Program*, aiming to upgrade the technical and administrative skills of ministry staff, and to develop an effective extension service at the provincial and district levels.
- The *'National Policy on Environmental and Social Sustainability of the Hydropower Sector in Lao PDR'* was adopted in 2005 in response to the need to develop Lao PDR's hydropower potential in a way that ensures long-term viability and net benefits for Lao society, and leaves critical aquatic resources intact. The Policy lays out requirements for environmental impact assessment taking into account cumulative impacts, compensation in consultation with project-affected peoples including those downstream of the development, watershed management, conservation offsets for unavoidable ecosystem impacts, use of revenues for social and environmental purposes, monitoring and disclosure. It draws heavily upon the experiences and innovations of the Nam Theun 2 project (See **Box 17**), and aims to streamline the application of the principles followed for that



IMPLEMENTATION FRAMEWORK

National Policies

Since the 1992 Earth Summit, Lao PDR has formulated several National Policies and Strategies on the environment, of which the key documents are outlined in **Table 21**.

The Government has approved its 2020 vision in the form of the National Environment Strategy (NES), which also includes the second National Environmental Action Plan (NEAP) for 2006-2010. The key components focus on: (i) sustainable management of natural resources; (ii) improved environmental management of industries and

infrastructure, urban development, tourism, and special economic sectors; (iii) strengthening of the institutional framework for environmental management and capacity building; (iv) improved private sector involvement in environment management; (v) promoting appropriate financing instruments and mechanisms; and (vi) improved international cooperation.

It is anticipated that 18 Provincial Environment Strategies and Action Plans (PESAPs) will be approved by the end of 2005. Up to now, PESAPs have been approved by the Governors of Phongsaly, Oudomsay, Houaphanh, Sayabouly, Xieng Khouang, Khammouane, Champassack, and Sekong, while others are in the process of final approval

Table 21. Summary of Current Key Environment Policies and Strategies

Year	Title	Agency
1994	First National Environmental Action Plan	STEA
1997	Draft National Resettlement Policy for Major Projects	CPI, STEA
	Draft Public Involvement Guidelines	CPI, STEA
	Sector Strategy & Guideline National Framework - Rural Water Supply & Environmental Health Sector	MoH
1998	Water Sector Strategy and Action Plan 1999-2004	WRCC/ PMO
1999	The Government Strategic Vision for the Agricultural Sector	DoP/MAF
2000	Draft Policy on Water & Water Resources Law	WRCC/ PMO
	Lao PDR Food Security Strategy in the period of 2001-2010	MAF
	Forest Vision for 2020	MAF
	Hydropower Development Strategy	MEM
	5th National Socio-Economic Development Plan	CPI
	Master Plan Study Integrated Agricultural Development Lao PDR	MAF
	Power Sector Environment Policy	MEM
	Social Impact Statement for Electricity Projects	MEM
	Agriculture and Forestry Sector Development Plan	MAF
	2003	Draft National Environmental Quality Monitoring Program (NEQMP) 2003-2010. Final Consultation Workshop, Vientiane, March 24, 2003.
Draft Policy on Resettlement		STEA
National Public Involvement Guidelines		STEA
2004	National Biodiversity Strategy and Action Plan, years 2010 and 2020. June 2004.	STEA
	National Strategy on Environment Education and Awareness to the years 2020 and Action Plan for the years 2006-2010. June 2004	STEA
	National Environmental Strategy years up to the year 2020, and the Environment Action Plan, 2006-2010	STEA
	National Growth and Poverty Eradication Strategy (NGPES)	
2005	National Policy on Environmental and Social Sustainability of the Hydropower Sector in Lao PDR	MEM/ STEA
	Decree 197 on Compensation and Resettlement - 7 July 2005	Prime Minister
	Implementing Regulations and Technical Guidelines on Compensation and Resettlement on 11 November 2005	STEA
	Adopted Implementing Regulations and Technical Guidelines on Compensation and Resettlement on 18 November 2005	MEM

Source: Authors

CAPACITY DEVELOPMENT

In 2004, STEA released the “National Strategy on Environmental Education and Action Plan for 2006-2010” (the EEA strategy). Its key elements include: (i) Strengthening human resource development and capacity building; (ii) Integration of Environmental Education and Awareness (EEA) into the formal and non-formal education systems; and (iii) Strengthening public awareness of environmental issues.

STRENGTHENING MANAGEMENT CAPACITY

In 2003, a survey was carried out by ERI with assistance from the World Bank, to identify management capacity among the staff of the main Ministries and Agencies in Vientiane Capital and six provinces³⁶. The survey showed that: (i) the number of environment staff is quite limited, and generally insufficient to carry out their mandate; (ii) the number of staff with higher and/or appropriate education is also limited; and (iii) the opportunities for the application of professional skills is restricted.

Relatively low levels of education amongst staff within government agencies, combined with overall lack of resources and public expenditure on the environment, limit government capacity to manage natural resources and environmental quality. Increasing staff capacity will rely upon a balance of access to international higher education, on-the-job training, and appropriate personal development planning for staff within their positions. Sectors requiring immediate upgrading include policy development, EIA, pollution control and monitoring, and NPA management (**Box 14**).

The Government is working with several donors to strengthen capacity of staff through both management and on-the-job training. Examples of capacity building with STEA and other agencies are listed in **Box 14**.

³⁶ Phongsaly, Oudomxay, Borikhamxay, Saravane, Sekong, Champasack and Vientiane Capital.

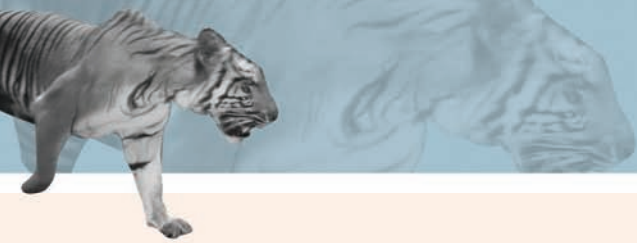
Box 13. NPA Management Constraints

National Protected Areas (NPA) are usually managed by the relevant Provincial Agriculture and Forestry Office (PAFO) and their corresponding District Forest Offices (DAFOs). Field offices are currently operational in nine of the 20 NPAs. Because of a shortage of personnel and a lack of proper enforcement of regulations, biodiversity is rapidly disappearing and local communities are losing out to outside exploitation of these resources. With less than an estimated US\$15,000 per annum for management of the NPA system, there is little ability to implement existing laws or enforce regulations.

Basis data for Protected Areas

Protected Areas	NPAs
Land Area (ha):	
North	1,025,600
Central	1,331,100
South	953,500
Number with field offices	9
Staff Assigned to NPAs:	
2000	224
2004	150
Budgets:	
2000	US\$ 15,000

For some NPAs, however, efforts are underway to find additional sources of sustainable funding: Nam Ha NPA receives some revenue from ecotourism; Phou Khao Khuay NPA is managed by the Ministry of Defense and receives its budget from Nam Leuk’s hydropower revenues; and Nakai Nam Theun NPA will receive an unprecedented level of funding from the Nam Theun 2 project over the next 31 years. It is also intended that the Environment Protection Fund will channel some revenues from development projects to protected areas in future, and the LENS project is providing support to protected areas in central Lao as a model for future EPF funding.



Box 14. Strengthening Environmental Management Capacity

Ongoing strengthening of environmental management capacity is principally supported by the Swedish International Development Cooperation Agency (Sida) and the ADB and largely, but not exclusively focused on STEA.

Since 2001 Sida has been supporting capacity building for effective environmental management in Lao PDR through the “*Strengthening Environment Management*” (SEM) project. Phase 1 of the project focused on the following four main activities: (i) Developing capacity in management and administration, develop tools for management, namely policy and environmental management strategy; (ii) Develop Environmental Impact Assessment activities; (iii) Develop and promote environmental management education and awareness; and (iv) Support PSTEOs in three pilot provinces (Oudomxay, Xieng Khuang, and Champassack). Phase 2 of the SEM project, which will cover the period of 2005-2010, is expected to further expand the activities at both central and local levels in a total of nine provinces.

STEA, with support of the ADB, has implemented a “Environmental and Social Program Loan”, addressing critical policy measures with regard to environmental and social management in the energy and transport sectors. As a result of the program loan and accompanying technical assistance, STEA has: (i) successfully established a donor coordination mechanism for environmental and social management, (ii) initiated the preparation of Provincial Environmental Action Plans and Strategies, (iii) established the Third Party of Independent Environment Monitoring System; (iv) established sectoral reporting on social and environmental compliance, (v) established a twice-yearly Environmental Newsletter, (vi) established the Environmental Protection Fund and will support operationalization of the Fund through provision of the initial capital endowment by ADB; and (vii) MAF has approved a Policy on Water Resources and developed a watershed monitoring and information system.

Following the achievements of the Sida and ADB supported activities, the Government and World Bank have developed the “*Lao Environment and Social*” (LENS) Project, which began implementation at the beginning of 2006. The Project will establish two funding windows in the Environment Protection Fund, one of which will develop capacity to implement a range of environmental policies, including the National Policy on Environmental and Social Sustainability of the Hydropower Sector in Lao PDR and integrated river basin management, and support experiential environmental learning.

Source: Authors

Public Expenditure for Environment

In Lao PDR, budget allocation and expenditures for environment are not accounted separately. Expenditures are spread over a large number of Government Agencies, and have never been subject to a detailed combined audit. Moreover, environmental expenditures are not always well defined³⁷; e.g. expenditure on water supply and water resources management were not included for present purposes. Despite these uncertainties, the

figures presented here provide an adequate estimate of the overall magnitude and trend of environmental spending.

It is estimated that the total environmental expenditure averages US\$ 0.6 million per year (**Figure 23**). In 2002, environmental expenditure was roughly 0.6 percent of total government spending, around half of what Vietnam (0.8 to 1 percent) and Thailand (1.2 to 1.4 percent) spend on environmental protection.

³⁷ The budget for STEA for FY02/03 and FY03/04 is 105,576 and 132,626 US\$, respectively.

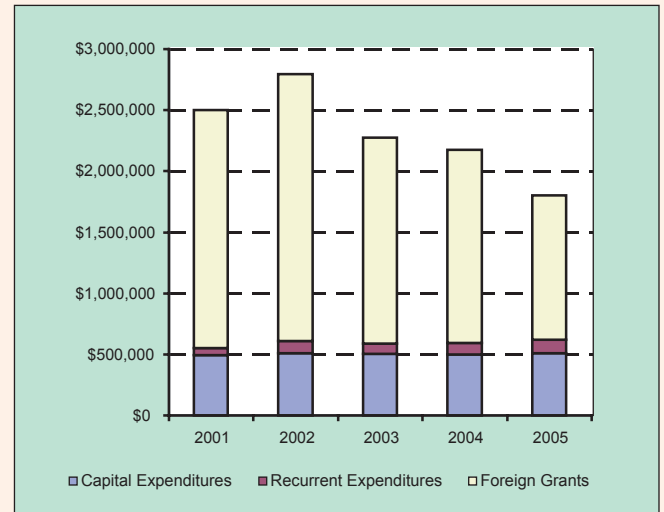
Recurrent environmental expenditures³⁸ have increased from an estimated US\$ 0.06 million in 2001 to US\$ 0.11 million in 2005. About half of recurrent expenditure is made by STEA, while an estimated 40 percent is from provincial PSTEOs and PAFOs. Despite the gradual increase, however, government financial support remains very low, and insufficient to address environmental management needs.

Total capital expenditure between 2001 and 2005 averaged US\$ 0.5 million per year, approximately 5 times recurrent expenditure. More than 90 percent was spent by MCTPC on environmental and social assessment and mitigation related to ODA-funded road projects³⁹. Capital expenditures by other ministries are typically less than their recurrent costs. However, environmental capital expenditures can vary strongly between years due to required counterpart contributions to ODA-supported projects.

Donor Projects

Environmental management and protection in Lao PDR is still heavily dependent on foreign grant funding. Principal donors during the last 5 years included Sida, ADB, and the World Bank (Box 14). In total over the last five years, Lao PDR received approximately US\$ 10 million of external funding to strengthen its institutional capacity. There is insufficient data available to estimate the amount targeted specifically to local government.

Figure 23 Annual Environmental Expenditure 2001-2005

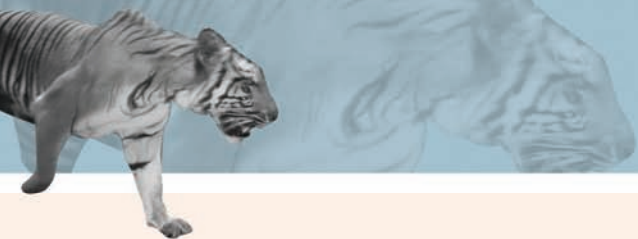


Source: STEA



³⁸ Because not all Agencies have detailed data available, recurrent expenditures is generally estimated from staff numbers in the specific Divisions or Departments using standard staffing and operational budget allocations.

³⁹ Yearly figures for MCTPC's capital expenditure were not available, so total amounts were averaged over 5 years.



ENVIRONMENTAL EDUCATION

Providing Education

Environmental education at the primary and secondary school levels is based on teaching manuals, course books, posters and leaflets provided to both teachers and students. These include six supplementary reading books, each with an environmental theme, aimed at primary school students, reading books in the “*World Around Us*” series, and the integration of environmental concepts into the ‘*English Language for Secondary School*’ series⁴⁰ and into teacher training curricula.

Moreover, the Government, in cooperation with the Wildlife Conservation Society (WCS), has been developing a “*Curriculum Enrichment Program in Environmental and Life Sciences*” and a “*Health, Environmental and Clean Water Supply Program*” for primary education.

The country’s first undergraduate degree program in environmental management (**Box 15**) commenced in 2004 at the National University of Lao PDR (NUoL). Additionally, the Faculty of Forestry designed a curriculum module called “forestry and the environment”. This module include three main topics: income generation and forestry; forestry, water and watershed management; and soil use. The Faculty of Economics at NUoL has also incorporated an environmental economics module into the Faculty’s economics course.

Box 15. Country’s First Degree Program in Environmental Management

The Faculty of Social Sciences of the National University of Lao PDR (NUoL) launched the first five-year B.Sc. Program in Environmental Science and Management in September 2004. This course provides the first opportunity for formal environmental education in Lao PDR. Forty students are currently enrolled in the program. The five-year Program will cover a array of environmental topics and includes 11 Modules:

1. Environment and development
2. Ecology
3. Environmental law and administration
4. Pollution and its effects
5. Agriculture production and environment
6. Forest resources and environment
7. Water resources and environment
8. Urban, infrastructure development and environment
9. Industrial and mining development and environment
10. Integrative EIA
11. Integrated watershed management

Source: Authors

⁴⁰ STEA, 2004 - *National Strategy on Environmental Education and Awareness for 2020 and Action Plan for 2006-2010*.

PUBLIC AWARENESS

Through its EEA Strategy, the Government emphasized that an informed constituency and wider appreciation for the importance of the environment are necessary conditions to garner support for its protection and effective management.

Raising awareness has become an important activity of the Government. All PSTEOs, in cooperation with NGOs and Mass Organizations like the LWU and LYU,

are implementing specific programs to increase public awareness across the entire country on issues like health, environmental education, and poverty reduction.

The Government promotes special environmental days, which include Tree Day, Fish Release Day, World Population Day, World Water Day, and World Environment Day. In addition, environmental education has been disseminated through the mass media such as newspapers, radio and TV and through local language publications (**Box 16**).

Box 16. Biodiversity Field Guides in Lao PDR

The promotion of environmental awareness and education is recognized as a high priority at global, regional and national forums, yet there is still a lack of easily accessible biological information in many developing countries. Few countries in Asia, Africa and South America have local language field guides to any of their animals or plants. This lack of accessible information in local languages hampers all biodiversity training, awareness building, and park ranger capacity, and reduces access to necessary information for adequate environmental assessments of development projects.

To offset this, the World Bank and several NGOs in Lao PDR have supported the publication of field guides to the local mammals, birds, turtles and fish. These field guides are useful tools in providing additional information and skills, which can empower national scientists and local communities to better promote, and benefit from, biodiversity protection, including through the development of alternative livelihoods based on sound biodiversity management.

Source: Authors

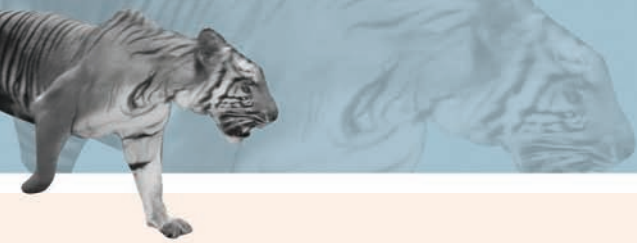
Environmental Attitudes

To gain a better understanding of environmental attitudes amongst key stakeholders, the Environmental Research Institute conducted a survey with assistance from the World Bank during February and March 2004, to assess the attitudes of individuals working in the environmental profession in Lao PDR. Questionnaires were completed by 146 persons in environment sections of government agencies, NGOs, and at NUoL.

The aim of the survey was to uncover the factors that inspire someone to care about the environment, and which leads one to decide to work in this sector. Key findings include:

- Reasons for working in the environment field were often related to people's upbringing and their source

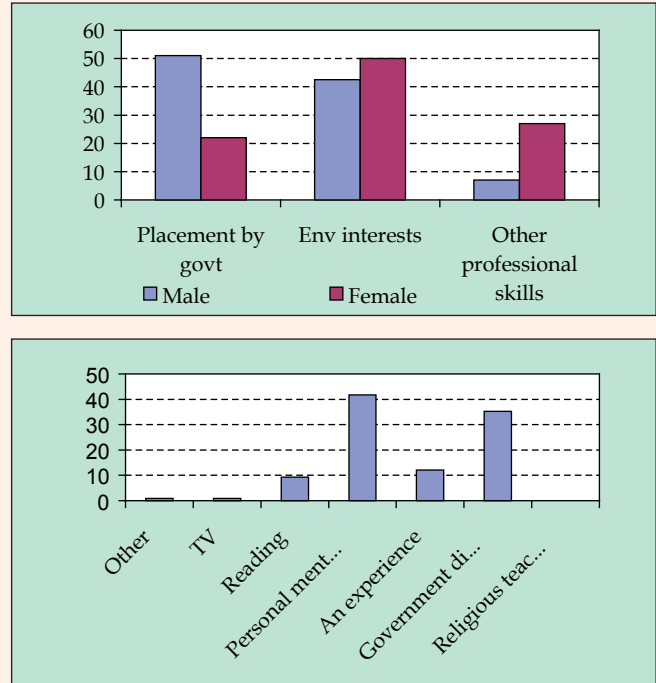




of environmental inspiration. Respondents with a 'mixed' or 'urban' upbringing were more likely to work in the environment field because of an interest in protecting the environment. Similarly, respondents whose source of inspiration came from either a 'personal mentor or teacher' or 'an experience' were more likely to work in the environment field out of interest. Interestingly, more women than men responded that they worked in the environment field out of interest, or because of other professional interests (Figure 24).

- A majority of respondents – mostly younger people who had had a mixed upbringing – cited a personal mentor or teacher as the leading inspiration for their interest in the environment (Figure 24).
- When asked about the wildlife trade, respondents who thought the trade had increased were more likely to have been educated in Lao PDR, have had a mixed upbringing, and cite a teacher, mentor or an experience as their source of environmental inspiration. Respondents who did not think that the trade had increased were more likely to have been educated outside of Lao PDR, had an urban upbringing, and cite a government directive, reading or TV as their reason to work in the environment.
- 44 percent of respondents had visited two to five NPAs. Almost one half of respondents had visited no more than one NPA in their lifetime. More than 40 percent of the respondents cited scenery as the attraction for visiting NPAs (Figure 25).
- Younger respondents were more likely to cite global warming as their primary environmental concern, in contrast to older respondents who were more likely to cite habitat loss and degradation as their main concern.
- Moral values and economic arguments were considered of great importance to convince others of the value of nature, but were not listed as being as important to the respondents themselves (Figure 25).

Figure 24. Reason for (i) Choosing Employment and (ii) Do Environmental Work



Source: ERI, 2004

Figure 25. Reasons for (i) visiting NPAs and (ii) Valuation of the Environment



Source: ERI, 2004





SECTION III: CHALLENGES

Overview

The Government of Lao PDR has made important strides in instituting changes slow the pace of natural resources degradation, in partnership with local communities and international organizations. Recent achievements include: enacting the environmental impact assessment decree; development of a policy to safeguard the environmental and social sustainability of the hydropower sector; creation of an Environment Protection Fund; strengthening the regulation for wildlife trade in endangered species; creating a specialized agency to protect and manage the Nakai Nam Theun Watershed; decentralizing environmental functions to provinces; improving water and air quality monitoring; and establishing a third-party monitoring protocol to report on environmental impacts of development projects. Furthermore, sustainable management of the country's natural resources and responsible governance of the benefits accrued from their use has been identified as an integral part of the government's recently approved National Growth and Poverty Eradication Strategy (NGPES).

Despite this progress, negative trends continue in forest cover and the status of protected areas, and urban environmental problems are emerging. The effectiveness of efforts to address these trends is limited by constraints on finances and expertise, and increasing international demand for Lao natural resources. In addition to its internal efforts, Lao PDR will have to reach out to international neighbors and partners to resolve certain environmental challenges.

Highlighted below are the key policy responses undertaken in priority areas, and the challenges that remain to be addressed over the next five years.

Forests and Forest Products

The Government has taken key initial steps to bring production forestry under control and to integrate it more effectively into poverty eradication efforts. Participatory forestry, through which local people are enabled to manage and directly benefit from the sale of timber and other forest resources, have had a remarkable and demonstrated success in Lao PDR. This, and other improved commercial forest management approaches, if applied, will deter illegal and uncontrolled logging, and

form the core of a viable forestry reform program.

The Government has identified and is soon to finalize formal creation of a **system of National Production Forest Areas (NPFA)**, beginning with eight areas, totaling 500,000 hectares. The NPFA system is to be brought under scientific management through formal arrangements with local communities that prescribe benefit-sharing arrangements and participation, and empower communities to use forest revenues for local development efforts. It may be useful for the Government to consider extending this approach to around half of the commercially valuable forest outside the National Protected Areas, which would directly benefit about 1.5 million people.

Land Management

Since 1999, the country has taken several major steps to develop policies and implement programs in land administration, distribution and management.

The Government's long-term goal is to establish a nationwide land administration system and provide secure tenure to all eligible land holdings. To achieve these, the Government needs to accelerate land-titling activities. Specific attention should be given to: (i) women's rights in land titling; (ii) increasing dialogue and consultations in the land policy development process; (iii) community involvement in land titling including exploring options for communal land titling in areas where this is the preferred option; and (iv) promoting and developing traditional or local knowledge in land use management

As part of the ongoing land policy development process, the government needs to address state land management as a priority, and review the modalities of the land allocation program. The latter has had documented adverse environmental and social impacts on communities practicing traditional long-rotational (swidden) agriculture.

Until 1997, the Government policy regarding shifting agriculture largely focused on stabilization and the encouragement of settled agriculture in an effort to limit land degradation. However, this policy has subsequently

evolved to a more pragmatic approach, in which long-rotational swidden is permitted. To maximize the results of this new policy, the Government needs to increase the involvement of local communities in land use zoning, define the extent of these agricultural zones, and develop land use agreements to mitigate against future encroachment into undisturbed forest areas.

Biodiversity and Habitats

Lao PDR is home to a great diversity of animal and plant species, many of which are globally significant and provide food security for many rural people. However, modification and conversion of natural ecosystems, over exploitation of biological resources and destructive harvesting techniques are serious threats to Lao's rich biodiversity.

Achieving the poverty reduction and biodiversity conservation goals of NBSAP requires engagement from all levels of government and Lao society. Public awareness, education and community involvement are critical elements for conservation of biological diversity. The knowledge and experiences of local and indigenous people must be taken into consideration and fully used. Awareness and policies need to be extended to stimulate a sense of community involvement and ownership.

As part of its efforts to conserve biodiversity, more than a fifth of land area is under protection through a network of 20 National Protected Areas (NPAs), two Corridors, and several provincial and district level protected areas. Despite these designations and the enabling legislation, the allocated budgets and subsequently the levels of protection in all protected areas are minimal and reportedly widespread logging and poaching.

To address these issues, the Government needs to increase budgets for recurrent expenditures, and work in a participatory manner with local and enclave communities in NPAs. A model for participatory protected area management has been developed in Lao PDR from past experience is a number of projects. It relies upon developing village resource use agreements, village conservation teams and sustainable livelihood options, and builds on principles of community empowerment, inclusiveness and adaptive management. It is extensively

elaborated in the Social and Environmental Management Framework and Operational Plan for the Nam Theun Watershed. This model needs to be pursued far enough to allow a comprehensive assessment of its performance, and needs to be adapted for the levels of sustained funding that might feasibly be available for Lao protected areas.

Water Resources

With the largest per capita water availability in Asia, Lao PDR is planning to tap this potential to spur economic growth by developing hydropower, expanding irrigation facilities and increasing water supply. Hydropower generation has increased five-fold in the last 25 years, and is expected to further expand three-fold in the next five years with the construction of Nam Theun 2.

Over the next quarter century, Lao PDR has the potential to generate 18 percent of the 23,000 megawatts of hydropower that can be generated in the country. Nevertheless, the exploitation of this hydropower potential needs to be carefully balanced with environmental and social pressures, to ensure that the country's vast water resources are developed in a sustainable manner. Of key concern are the potential cumulative impacts of numerous hydroelectric developments, and impacts on fisheries and other aquatic resources in the Mekong Basin.

The Nam Theun 2 Hydropower Project has already provided models and principles that have been included within the National Policy on Environmental and Social Sustainability of the Hydropower Sector in Lao PDR. Some existing projects have already begun to reverse course and implement remedial actions to improve environmental and social conditions, and a timetable for completion of this work will be set as part of the implementation framework of the policy.

Since, the likelihood of locating multiple hydropower projects within an eco-system are high, the use of cumulative impact analysis (as was done for the proposed Nam Theun 2 Hydro-electric Project) should become an integral part of the country's power sector planning. The Lao Environment and Social Project (see **Box 13**) will support integrated river-basin management



systems, which would then be taken into account in cumulative impact assessments under the hydropower sustainability policy. Besides hydropower use, there is also need to improve the efficiency of water utilization in agriculture and water supply sectors. Building on the creation of the Water Resources Coordination Committee (WRCC), the Government needs to further expand its policy and implementation arrangements towards achieving an integrated approach to water resources management in the country.

Urban Environment

Given the low-level of access to safe water supply (35 percent) and sanitation (29 percent), priority should be accorded to expanding services.

Despite the low degree of urbanization in the country, the population in urban areas is already experiencing environmental health risks from inadequate collection and disposal of solid waste, inadequate sanitation coverage and little, if any, treatment of wastewater.

Proper solid waste management is only functional in certain urban areas. Wastewater treatment is still new to the country, and to cope with the increasing need for environmental services, local governments and UDAAAs (with support from the National Government) are under pressure to further implement and operationalize these services in Vientiane and the other larger urban centers. This would encompass: (i) improving solid waste collection, recycling and disposal; (ii) expanding access to safe sanitation; (iii) protecting water sources from pollution; (iv) involving the private sector to partner with local government to deliver these services; (v) effectively applying the UDAA's 2002 cost recovery regulation to partially recover operation and maintenance costs from service users; and (vi) intensifying capacity building efforts of local governments.

Hazardous Chemicals

There is limited information on the current levels of hazardous chemicals in the environment of Lao PDR. As the country continues to develop its industrial capacity, it is expected that hazardous chemicals will become an important issue in the near future, if appropriate mitigation measures are not implemented.

Determination of baseline levels of pesticides, herbicides, heavy metals, PCBs and dioxins/furans in the aquatic and terrestrial environment is therefore urgently needed, so that long-term trends can be monitored in future. The presence of Agent Orange dioxin hotspots in Lao PDR needs to be investigated, since there are potential impacts to human health in areas where these chemicals may have been stored or applied in significant quantities.

Institutions and Instruments

Central to addressing environmental challenges is the rapid development of skills and capacity in the country to make institutions work effectively. Inadequate human resources (2 percent of public sector staff) and very low state funding (less than 1 percent of government budget) significantly constrain the implementation and enforcement of tremendous legislation and policies that have been enacted to protect the country's vast natural resources from environmental degradation. Environmental models have been trialled under various donor projects, but resources are often lacking to apply these more widely once the projects end.

Building on the recent advances made through capacity building initiatives supported by the ADB and Sida, the following need to be tackled urgently:

(i) addressing the critical shortfall of environmental personnel needed in the country to address the above challenges by: (a) encouraging the NUoL to double its intake of students studying environment, ecology, tropical botany, taxonomy, entomology, zoology, toxicology, socio-economics, environmental engineering, and environmental economics, which would require significant strengthening of the curriculum, teaching materials and related infrastructure; (b) supporting vocational schools to introduce short-term diploma programs in different environment topics; and (c) increase the number of on-the-job training programs undertaken for national and provincial staff, and concurrently ensure that trained personnel are retained for longer periods than at present;

(ii) further strengthening of the staff capabilities in STEA to improve their skills in environmental and social

Box 17. Enhancing Environmental and Social Sustainability – of Nam Theun 2 Hydropower Project

A suite of environmental and social mitigation programs has been designed around the Nam Theun project covering the entire footprint of the development from the Vietnamese border to the Mekong, and at a total cost of around \$120 million.

The **Nam Theun Watershed**, comprising Nakai Nam Theun NPA and two corridor areas, has been declared as a protected area by prime ministerial decree, and will receive funding from the developer for 31 years. The boundary of the Watershed has been demarcated, and management funds will be spent on both protecting biodiversity and improving the quality and sustainability of the livelihoods of its inhabitants.

On the **Nakai Plateau**, surveys and studies of elephants and other wildlife will be used to manage ecosystem transition and to reduce potential wildlife conflict with local people. Large seasonally flooded areas of the reservoir will be protected as Special Conservation Areas to provide fish nursery grounds and maintain the integrity of the corridor between the Watershed and Phou Hin Poun NPA. All aspects of construction and associated activities are subject to rigorous environmental impact reduction and mitigation plans. The developer has guaranteed to roughly double the current income of households resettled from the inundation area, and adopted a target to roughly triple it.

Downstream water release will be aerated, regulated and halted during periods of flood risk. Downstream communities will be compensated with improved livelihoods programs and flood protection measures for potential impacts from increased flooding and disruption to river fisheries.

The entire program will be adaptively managed and subject to multiple layers of internal and external monitoring.

Source: Authors

assessments, including training in the latest technologies for environmental monitoring, sampling and analysis, data management and communications (e.g., IT, GIS, databases, remote sensing, and pollution monitoring), and resettlement planning to implement the recently approved Prime Minister's Decree 197;

(iii) strengthening the capacity of MAF's offices in the provinces and districts to undertake protected area monitoring, patrolling and enforcement tasks mandated by Regulation 193;

(iv) improving cross-sectoral coordination among Ministries and Agencies (CPI, MCTPC, MEM, MAF and STEA) through the National Environment Committee, and strengthening the environmental monitoring and assessment programs undertaken by these ministries;

(v) clarifying overlapping regulatory mandates and strengthening the enforcement capacity of STEA, MAF, other relevant ministries and provincial agencies;

(vi) partnering with local and international organizations to undertake functions for which available staffing and skills in agencies are inadequate; and

(vii) the fundamental and critical improvement of opportunities for participation at local levels and raising awareness of, interest in, and actions for conservation and environmental management.

Financing

Over the past few years, the country has benefited from considerable donor support to strengthen its institutional capacity. Foreign assistance remains the main source of financing. As a result, progress is visible in certain areas of environmental management such as the implementation of Environment Impact Assessment procedures, provincial level planning and public awareness activities. However, continuity of these activities gets disrupted when donor financing ceases. A case in point is the staff available for the protection of the 20 NPAs has declined from 224 in 2000 to approximately 150 in 2004.



The budget allocation for environmental functions needs to be increased several fold from its current low-levels, if the country is to meet its challenging goals. Recognizing that the allocations from the general budget are likely to be low in the immediate-term, the Government is putting in place some specific measures. These include: (a) requiring hydropower concessionaires to fund environmental “offsets” over the life of a concession to support conservation of adjoining watersheds, and this should be expanded to cover mining concessions as well; (b) allocating a portion of the revenues earned from hydropower, mining and other development projects for environmental activities; (c) operationalizing the Environment Protection Fund, with funding support from ADB and the World Bank to finance capital and recurrent expenditure for environmental protection, and eventually to channel the revenues referred to above; (d) continuing to seek funding from donor agencies. Concurrently, efforts should also be directed at instituting a governance mechanism that ensures proper allocation and use of these funds for agreed priorities.

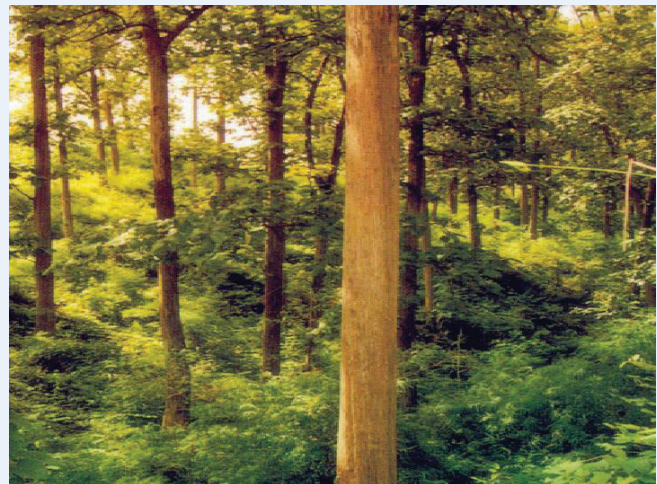
Awareness and Participation

As noted in the attitudes survey, the opportunities for public participation are enormous, and need to be harnessed. Given the low-level of literacy, limited school enrollment and ethnic diversity, a diversified and multi-level approach is needed.

The first is to raise basic awareness on priority environmental issues in the country, such as: (a) village level awareness programs, especially for those dependent on forest products or particularly at risk from pollutants, that recognize the multi-lingual ethnicity of communities. Use of community radios, visual illustrations and information centers should be considered in both raising awareness and enabling their participation; and (b) mobilizing mass organizations (Lao Women’s Union, Youth Organization, etc) and the Civil Societies (National Front of Construction...) to play a more proactive role either by integrating environmental activities in their ongoing programs and/or undertaking targeted environmental programs that explain the dangers of over-exploiting natural resources to village communities.

The second is to target children and youth by proactively introducing environmental education in primary and secondary schools, as well as in Teacher Training Colleges (TTCs), by: (a) developing suitable curriculum and materials for use in schools and TTCs; (b) training teachers in environmental topics and modes of teaching; and (c) encouraging schools to adapt environmentally-oriented extra-curricular activities.

The third is to provide greater flexibility to national and Lao-based international NGOs and Non-Profit Organizations to actively participate in the design and delivery of awareness building programs.



POLICY RESPONSES AND REMAINING CHALLENGES

Key-Issues	Status	Pressures/ Constraints	Government Responses
OVERALL DEVELOPMENT FRAMEWORK			
Development	Decentralization Policy introduced 2000. 5th NSEDP for 2001-2005 being implemented. NGPES approved in 2004. Poverty Reduction Fund (PRF) established in 2002.	Large group of the population currently depend and will depend in the future on Lao PDR natural resources.	GoL developed an integrated package of development & environmental protection policies. As such the GoL tries to balance economic development and sustainable exploitation of natural resources.
DEVELOPMENT OF LAO PDR INSTITUTIONAL SETTING			
Central Government	STEAs created in 1999 under PMO. Line Ministries have major environmental mandates.	Limited capacity and resources. Conflicting mandates and responsibilities.	Strengthening of Human Resources Development of implementing rules and regulations by sector (e.g. hydropower, roads, mining).
Local Governments	17 PSTEOs established in all Provinces/Special Zone. 1 MSTEO established in Vientiane Capital City. 20 NPA established. UDAA established in larger Urban Areas.	Limited capacity in Provinces and Districts Limited coordination and Support from National Government.	Strengthening of Human Resources.
Cross-Sectoral Coordination	Three main coordinating committees (i.e. NEC, WRCC, LNMC).	Committees have limited power over implementing line ministries.	Strengthening of capacity and roles.
Non-Governmental Organizations	Mass organizations (LWY, LYU, LFNR) active in Environmental Management. No formal Lao NGOs exist.	-	Continue Environmental Awareness campaigns.
Private Sector	Involvement of Industrial sector slowly increasing Number and Capacity of national consultants slowly increasing.	Continued pressure on the environment without applying appropriate mitigation measures.	Increase environmental responsibilities of Industries and National Consultants.
ENVIRONMENTAL PLANNING AND PROTECTION			
Environment (general)	2004: NES, 2nd NEAP and 18 PESAPs to be approved (8 PESAPs are completed & approved by Provincial Government).	Action plan too ambiguous: limited capacity and resources for implementation and monitoring.	Government attempts to address priority concerns first. Further implementation of Decentralization Policy.
Water Resources	1998: WSSAP approved. 1999: Draft 'Policy on Water Resources law'. 2005: Hydropower sustainability policy	Lack of coordination between water and land use, environment, and sustainable development.	Establishment of WRCC in 1999. Establishment of Nam Ngum River Basin Committee in 2001. Introduction of IWRM approach in Nam Ngum River Basin.
Agriculture and Forestry Resources	1999: 'Strategic Vision for the Agriculture Sector until 2010' 2001: 'Agriculture and Forestry Sector Development Plan' 'Forestry Strategy 2020'.		Levying financial resources from hydropower for protection purposes
Biodiversity	2003: Regulation on the 'Management of NBCAs, Wildlife and Aquatic Animals'. 2004: Approval of the NBSAP.	Livelihoods of selected communities depend on forest products. National and International trade difficult to control.	Strengthening of monitoring and enforcement at local levels. Levying financial resources from hydropower for protection purposes.
Education and Awareness (EEA)	2003: National Strategy and Action Plan on EEA Government emphasizes importance of Awareness campaigns.	Demand for environmental staff exceeds availability. Insufficient distribution of information materials.	PSTEO operational budgets are mainly for Awareness activities. NUoL introduces a BSc course on Environment Science and Management in 2004.



POLICY RESPONSES AND REMAINING CHALLENGES

LEGAL FRAMEWORK			
Environment (General)	1999: 'Environmental Protection Law'. 2000: 'EIA Regulation'. 2001: 'EPL Implementing Decree'. 2003: 'National Guidelines on the Third Party Monitoring in the Hydro Power and Transport Sectors'	Complex institutional setup. Conflicting provisions. Environmental Quality Standards are lacking. Lack of implementing regulations.	Training of Local Governments. EIA project categories and monitoring system being developed.
Water Resources	1996: Water and Water Resources Law.	Inadequate allocation of water resources. Continued pollution of water resources.	Development of IWRM approach. Preparation of updated water quality standards.
Forest Resources	1993: Establishment of the NBCA (now NPA) system (currently 20 NPAs). 1996: Forestry law.	Insufficient staff and resources to operate and manage NPAs.	Government discusses to levy environmental protection fees for hydropower concessions (e.g. NT2).
Biodiversity	1995: Official banning of Wildlife trade. 2004: Signing of CITES. 2005: Decree 39 establishes NT2 Watershed and WMPA.	Complex to monitor & enforce. Limited control over international trade.	Seeking of international Support. Introduction corridors between the NPAs to increase area and improve migration.
Adequacy of the Administration and Resources			
Public Environmental Expenditure	Restricted budget for Environment. 2005: Environment Protection Fund created	Insufficient resources to properly implement mandates.	Development of alternative funding mechanisms, including use of EPF to channel revenues from natural resource projects and environmental tariffs.
Organizational Operations	Hierarchical Government structure. Strong Sectoral approaches. STEAs have still limited authority as compared to line ministries.	Insufficient coordination and delegation of responsibilities. Unclear mandates of Divisions and Centers. Bureaucratic and formal requirement.	Management training of higher staff. Technical training of Lower staff. Promotion of cross-sectoral cooperation.
Human Resources Development	± 250 'Environmental' staff at Central level ± 300 'Environmental' staff at local levels. Salaries insufficient.	Government cannot attract sufficient competent staff. Limited professional incentives	Increase funding through Donor projects. Set-up of 'Executive Secretariats' with financial and staffing independence (e.g. NT2 WMPA).
Adequacy of the Framework for Implementation			
Management and Protection	No general Environmental Quality Monitoring system in place. Limited number of NPAs operational. Limited capacity of local Governments.	General mismatch between Policies and actual capacity. Roles and Responsibilities between central and local government not always well defined.	Increase overall Environmental Management capacity. Focus on further delegation to and strengthening of Local Governments. Seek external support for Environmental Quality Monitoring System.
Instruments and Enforcement	Mainly 'Command-and-Control' instruments. Lack of Environment Quality Standards. Insufficient Implementing Rules and Regulations. Systematic enforcement not yet operational.	Reluctance to enforce environmental protection. Risk of setting bad precedents. Continued irreversible degradation of forests resources and wildlife.	Development of Environmental Quality Standards. Promote Environmental Awareness campaigns. Seek possible introduction of alternative instruments.
Safeguards and Compliance	Compliance Monitoring difficult to implement.	Lack of 'good practice' examples. Lack of practical skills.	Development of an EIA tracking database. Create success stories of good practices.
Environmental Education	Limited cooperation with different sectors. Insufficient teacher materials. No formal environmental education in Lao PDR.	Insufficient budget and facilities. Education focuses on Central level.	NUoL introduces a BSc course on Environment Science and Management in 2004.

Agricultural Land: Arable land and land for permanent crops and permanent pastures.

Air Quality Standards: The level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area.

Arable Land: Land under temporary crops, temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land under temporary fallow. Excluded are lands abandoned because of shifting cultivation.

Biochemical Oxygen Demand (BOD): The amount of oxygen consumed in the biological processes that break down organic matter in water. The greater the BOD, the greater the degree of organic pollution.

Biodiversity: Refers to the variety and variability among living organisms and the ecological complexes in which they occur. It encompasses different ecosystems, species, and genes.

Carbon Monoxide: A colorless, odorless, poisonous gas produced by incomplete fossil fuel combustion.

Chlorofluorocarbons (CFCs): A family of inert, nontoxic, and easily liquefied chemicals used in refrigeration, air conditioning, packaging, insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere they drift into the upper atmosphere where their chlorine components destroy ozone.

Climate Change (also referred to as 'global climate change'): Used to imply a significant change from one climatic condition to another. In some cases, 'climate change' has been used synonymously with the term, 'global warming'; scientists however, tend to use the term in the wider sense to also include natural changes in climate.

Conservation Forest: Conservation forest (or forest reserves) are forests and forest lands for the purpose of protecting and preserving species of flora and fauna, nature and other precious things in terms of history, culture, tourism, the environment, education and experimental scientific research.

Dissolved Oxygen (DO): The oxygen freely available in water, vital to fish and other aquatic life and for the prevention of odors. DO levels are considered a most important indicator of a water body's ability to support desirable aquatic life. Secondary and advanced waste treatment are generally designed to ensure adequate DO in waste-receiving waters.

Effluent: Wastewater—treated or untreated—that flows out of a treatment plant, sewer, or industrial outfall. Generally refers to wastes discharged into surface waters.

Endangered Species: Animals, birds, fish, plants, or other living organisms threatened with extinction by anthropogenic (man-caused) or other natural changes in their environment.

Greenhouse Gas: A gas, such as carbon dioxide or methane, which contributes to potential climate change.

Hazardous Waste: By-products of society that can pose a substantial or potential hazard to human health or the environment when improperly managed.

Landfills: Sanitary landfills are disposal sites for non-hazardous solid wastes spread in layers, compacted to the smallest practical volume, and covered by material applied at the end of each operating day.

Nitrogen Dioxide (NO₂): The result of nitric oxide combining with oxygen in the atmosphere; major component of photochemical smog.

Organic Pollution: Carbonaceous waste contained in plant or animal matter and originating from domestic or industrial sources.

Ozone Depletion: Destruction of the stratospheric ozone layer which shields the earth from ultraviolet radiation harmful to life. This destruction of ozone is caused by the breakdown of certain chlorine and/or bromine containing compounds (chlorofluorocarbons or halons), which break down when they reach the stratosphere and then destroy ozone molecules.

Particulates: Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog, found in air or emissions.

Permanent Crops: land under flowering shrubs, fruit trees, nut trees, and vines (such as land for coconut, banana, coffee, and rubber plantations), but not land with trees grown for wood or timber.

Permanent Pasture: Land used permanently for at least 5 years for herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land).

PM₁₀: Particulates smaller than 10 microns. Small particulates are of special concern because of their ability to penetrate deep into the lungs and cause major health impacts.

Pesticide: Substances or mixture thereof intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.

Pollutant: Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

Protected Areas: An area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

Production Forest: Production forests are forest and forest lands which have been separated to provided for the requirements of national socio-economic development and peoples' regular and continual daily living needs in terms of wood and forest derived products which do not seriously affect the environment.

Protection Forest: Protected forest are forests and forest land which are divided for the purpose of protecting water sources, preventing soil erosion, strategic areas for national defense, prevention of natural disasters, the environment, etc.

Salinization/Saline Intrusion: The invasion of fresh surface or ground water by salt water.

Sewage: The waste and wastewater produced by residential and commercial sources and discharged into sewers.

Soil Erosion: The wearing away of land surface by water, intensified by land-clearing practices related to farming, residential or industrial development, road building, or logging.

Solid Waste: Non-liquid, non-soluble materials ranging from municipal garbage to industrial wastes that contain complex and sometimes hazardous substances. Solid wastes also include sewage sludge, agricultural refuse, demolition wastes, and mining residues.

Species: 1. A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2. An organism belonging to belonging to such a category.

Sulfur Dioxide: A heavy, pungent, colorless, gaseous air pollutant formed primarily by processes involving fossil fuel combustion.

Total Coliform Bacteria (TCB): A collection of relatively harmless microorganisms that live in large numbers in the intestines of man and warm- and cold-blooded animals. A specific subgroup of this collection is the fecal coliform bacteria - whose presence in aquatic environments indicates that the water has been contaminated with the fecal material.

Total Suspended Particles (TSP): A method of monitoring airborne particulate matter by total weight.

Water Quality Standards: The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses.

Watershed: The land area that drains into a stream; the watershed for a major river may encompass a number of smaller watersheds that ultimately combine at a common point.

Wetlands : An area that is regularly saturated by surface water or groundwater and is subsequently characterized by a prevalence of vegetation adapted for life in saturated soil conditions. Examples include swamps, marshes and estuaries.

Sources : United States Environmental Protection Agency's "Terms of the Environment", revised December 1997; FAOSTAT.



RELEVANT WEBSITE

Organization	Website address	Description & Contents
Asian Development Bank (ADB) ADB Lao PDR	www.adb.org www.adb.org/laopdr	Provides information on environment including environmental initiatives, manual, guidelines, assessment and publications. Details of ADB environmental projects in Lao PDR is also available.
Japan International Cooperation Agency (JICA) JICA Lao PDR	www.jica.go.jp www.jica.go.jp/laos	Presents environmental information on global issues such as cleaner production and climate change. Details of JICA environmental projects and each country profile on environment is also provided.
Mekong River Commission (MRC)	www.mrcmekong.org	Presents extensive information on sustainable development for Mekong river basin. Compile details of its work programs on water, flood, environment, capacity building, fisheries, agriculture, irrigation and forestry.
Lao National Mekong Committee (LNMC)	www.lnmcmekong.org	
Ministry of Agriculture and Forestry (MAF)	www.maf.gov.la	Compiles annual statistical data on agriculture in Lao PDR including crops, livestock, irrigation, meteorology and forestry.
Nam Theun 2 Hydroelectric Project (NT2)	www.namtheun2.com	Provides extensive information on background, environmental, technical, safeguard aspects of Nam Theun 2 hydroelectric project.
Online Support and Training Project for the Groundwater Sector of Lao PDR	www.laoshydrogeology.com	The Online Support and Training Project for the groundwater sector of Lao PDR is presented by Norconsult International. The Laos hydrogeology web site is intended for students, professionals and decision makers, and focuses on practical aspects of groundwater as a resource. The project is primarily aimed at conditions within the Lao PDR but would be applicable to large parts of the Mekong drainage basin with similar geological settings, and as a hydrogeological study in general.
Science, Technology and Environment Agency (STEA)	www.stea.gov.la	Presents information on environmental objectives, missions, plans, programs and key achievements of STEA.
United Nations Development Program (UNDP) UNDP Lao PDR	www.undp.org www.undplao.org	Presents information on energy and environment related to sustainable development and global issue such as Global Environment Facility (GEF) and Montreal Protocol (MP).
United States - Asia Environmental Partnership (US-AEP)	www.usaep.org	Provides links to recent development in environment and its own projects in region
United States Environmental Protection Agency (USEPA)	www.epa.gov	Provides information on all technical and legal aspects of environment. Environmental homepage for kids is also provided.
Water Supply Authority (WASA), DHUP, MCTPC	www.wasa.gov.la	Provides information about the urban water supply sector as it relates to WASA's role as fledgling regulator and the assistance it provides to the government and Nam Papa's nationwide for benchmarking of services and tariff setting.
World Bank World Bank, Lao PDR	www.worldbank.org/environment www.worldbank.org/lao	Presents detail information on environment including environmental strategies, indicators, regional and country information, capacity building, initiatives and all projects.
Wildlife Conservation Society (WCS) WCS Lao PDR	www.wcs.org www.wcs.org/sw-around_the_globe/Asia/laos	Presents comprehensive information on wildlife around the world. Also provide details of several programs such as hunting and wildlife trade, education and awareness, and conservation finance programs.
World Conservation Union (IUCN) IUCN Lao PDR	www.iucn.org www.iucn.org/places/asia/laos.htm	Provides extensive information on environmental management including forest, protected areas, water and biodiversity conservation. Also present details of its work programs and publications.

Geography	Economy/Society
<p>Area: <i>total:</i> 236,800 sq km <i>water:</i> 6,000 sq km <i>land:</i> 230,800 sq km</p> <p>Land boundaries: <i>total:</i> 5,083 km <i>border countries:</i> Burma 235 km, Cambodia 541 km, China 423 km, Thailand 1,754 km, Vietnam 2,130 km <i>Coastline:</i> 0 km (landlocked) <i>Maritime claims:</i> none (landlocked)</p> <p>Climate: tropical monsoon; rainy season (May to November); dry season (December to April)</p> <p>Terrain: mostly rugged mountains; some plains and plateaus</p> <p>Elevation extremes: <i>lowest point:</i> Mekong River 70 m <i>highest point:</i> Phou Bia 2,817 m</p> <p>Natural resources: timber, hydropower, gypsum, tin, gold, gemstones</p> <p>Land use: <i>Arable land:</i> 4.01 percent <i>Permanent crops:</i> 3.34 percent <i>other:</i> 95.65 percent (2005)</p> <p>Irrigated land: <i>rainy season irrigation</i> – 310,170 ha; <i>dry season irrigation</i> – 214,832 ha (2003)</p> <p>Natural hazards: floods, droughts</p> <p>Environment - current issues: unexploded ordnance; deforestation; soil erosion; a majority of the population does not have access to potable water</p> <p>Environment - international agreements: <i>party to:</i> Biodiversity, Climate Change, Kyoto Protocol, Desertification, Endangered Species, Environmental Modification, Law of the Sea, Ozone Layer Protection, Persistent Organic Pollutants</p> <p><i>signed, but not ratified:</i> none of the selected agreements</p>	<p>GDP: purchasing power parity \$12.29 billion (2005 est.)</p> <p>GDP growth rate: 7.3 percent (2005 est.)</p> <p>GDP - per capita: \$460 (2005 est.)</p> <p>GDP - composition by sector: <i>agriculture:</i> 45.5 percent <i>industry:</i> 28.7 percent <i>services:</i> 25.8 percent (2005 est.)</p> <p>Population below poverty line: 34 percent (2005 est.)</p> <p>Inflation rate (consumer prices): 7 percent (2005 est.)</p> <p>Unemployment rate: 2.4 percent (2005 est.)</p> <p>Gross Domestic Investment/GDP: 21.2 percent (2003 est.)</p> <p>Industrial production growth rate: 13 percent (2005 est.)</p> <p>Agricultural production growth rate: 8.3 percent (2003 est.)</p> <p>Service sector growth rate: - 4.9 percent (2003 est.)</p> <p>Agriculture – products: sweet potatoes, vegetables, corn, coffee, sugarcane, tobacco, cotton, tea, peanuts, rice; water buffalo, pigs, cattle, poultry</p> <p>Exports: total value: \$660 million (2005 est.)</p> <p>Imports: total value: \$1200 million (2005 est.)</p> <p>Currency: kip (LAK)</p> <p>Exchange rates: kips per US dollar – 9,860 (November 2006)</p> <hr/> <p>Population: 6,368,481 (July 2006 est.)</p> <p>Population growth rate: 2.39 percent (2006 est.)</p> <p>Birth rate: 35.49 births/1,000 population (2006 est.)</p> <p>Death rate: 11.55 deaths/1,000 population (2006 est.)</p> <p>Sex ratio: total population: 0.98 male(s)/female (2006 est.)</p> <p>Infant mortality rate: 83.31 deaths/1,000 live births (2006 est.)</p> <p>Access to safe water (percent of population): 51 percent (2004)</p> <p>Access to sanitation (percent of population): 30 percent (2004)</p> <p>Life expectancy at birth: 55.49 years (2006 est.)</p> <p>Total fertility rate: 4.68 children born/woman (2006 est.)</p> <p>Literacy (at age 15): total population: 52.8 percent (2003 est.)</p> <p>Net primary enrollment: 76 percent (2000)</p> <p>National capital: Vientiane</p> <p>Administrative divisions: 16 provinces and Vientiane Capital City</p> <p>Independence: 19 July 1949</p>

Sources: The World Factbook, Central Intelligence Agency (CIA), ADB, UNDP and UNEP. Lao PDR Economic Monitor, World Bank, November 2006.



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