LAO ENVIRONMENT OUTLOOK 2012




MONRE

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The process for preparing this report was guided by a GoL ministries and chaired by the WREA. The GoL ministries included the Ministry of Agriculture and Forest (MAF), the Ministry of Planning and Investment (MPI), the Ministry of Public Work and Transport (MPWT), the Ministry of Public Health (MOH), the Ministry of Energy and Mines, and the Ministry of Education. Provincial level support was also provided by LuangNamtha, Xiengkhouang, LuangPrabang, Savannaket and Champasack.

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WREA would like to express its sincere thanks to UNEP for its financial and technical support; and to national and international experts and relevant agencies and organizations for their contributions to the development and refinement of the report.

FOREWORD

Ministry of National Resources and Environment (MONRE), formerly Water Resources and Environment Administration (WREA) recognizes the need in having scientific data and good indictors as basic tools to support decision-making and policy formulation such as the National Environment

Strategy to year 2020. Lao Environment Outlook, an integrated environmental assessment report 2012 are defines as a process of producing and communicating policy-relevant information on key interactions between the natural environment and society categorized by using the DPSIR analytical framework through reporting based on enhancing technical capacity for integrated environmental assessment to strengthen scientific-based policy formulation and supporting national sustainable development plan of the country. The Lao Environment Outlook (Lao EO) was developed in an integrated manner in order to 1) to look at environmental priority issues in the country that are affecting the well-being of the ecosystems and people's livelihood, 2) concrete performance criteria and analysis, and 3) promote participatory and consultative approach

Lao Environment Outlook Report 2012 was a great cooperation between United Nations Environment Programme (UNEP) Assessment Programme and Water Resource and Environment Administration (WREA), Lao People's Democratic Republic (PDR). WREA has in collaboration with local, national and international experts been in responsible for development of Lao Environment Outlook-Lao EO with technical support and financial assistance framework of the United Nations Environment Programme Regional Office of Asia and the Pacific (UNEP/ROAP). The Report was typically prepared under the guidance of UNEP with a view to providing an integrated analysis of key environmental issue of the country, potentially negative impacts and responsive measures of nations worldwide. The report has three parts: 1) People, Environment and Development, 2) State and Trends of environment and ecosystems, and 3) Environment for Development: Policy Options. Lao is a country with potential of development. It is endowed with a diverse and abundant nature. The country has been facing tremendous pressure in depleting its natural resources for economic development. For example, Productive forest which has 20 percent of canopy density remained 41.5 percent in 2002 as compared to 47.2 percent in 1992. Comparing the changes during the period from 1982 to 1992 and the one from 1992 to 2002, deforestation rate in Lao equivalent to 0.56 percent per year. The loss of forest have negative impacts on biodiversity, water, land, air, natural environment, ecology system, socio-economic development, and particularly the livelihoods of the Lao people living in rural areas. However, the country has made importance to implementation on national environment strategy to the years 2020 and the forest strategy to have 70 percent forest coverage by 2020 so that Laos will once more be green, clean and beautiful. MONRE believes that the Report may serve as a good reference for a wider range of target audience including policy-makers, scientists and those who are interested in environment and human welling in Lao PDR.

MONRE would like to express our sincere thanks to UNEP for its financial and technical supports, and to national and international experts and relevant agencies and organizations for their contributions to the development and refinement of the report. MONRE also highly appreciates great efforts that Water Resources and Environment Research Institute (WERI) has contributed to ensure the successful development of the important report.

Mr. Noulinh SINBANDHIT
Minister of Natural Resources and Environemnt

FOREWORD

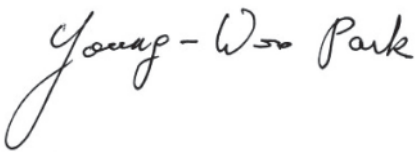
The United Nations Environment Programme (UNEP) is mandated to keep the state of the global environment under review. This mandate is implemented through the Global Environment Outlook (GEO) process, which involves global, regional, subregional, national and city-level assessments. The GEO process is participatory, consultative, and focuses on capacity-building to produce scientifically authoritative information for environmental management and policy development for a wide target audience.

The GEO capacity building programme was highlighted in the Bali Strategic Plan for Technology Support and Capacity Building---an agreed intergovernmental framework that strengthens capacity of developing countries and countries with economies in transition.

The Lao Environment Outlook 2012 report is a product of UNEP's capacity building programme in partnership with the Water Resources and Environment Administration (WREA) and other national institutions. The report finds that Lao PDR has 68 percent of its land covered by forests, significantly higher than the world's average which stands at 30 percent. As Lao PDR is vulnerable to the impacts of climate change, the sustainable management of this 15.8 million hectares of forests contributes to climate change mitigation as well as improvement of livelihoods of local communities. Mining and hydropower production are becoming the main sources of revenue for the country. With 28 per cent of its population still in poverty, the rich natural capital of the country is not only the key asset towards the country's ambitious development agenda, but also serves as a safety-net for people's livelihoods.

I hope this report will serve as a sound basis for environmental policy formulation and in advancing the country's sustainable development agenda.

It is indeed very timely that this report is launched during the establishment of the Ministry of Natural Resources and Environment (MONRE) and just before the Rio+20 Conference. I look forward to enhanced collaboration between UNEP and MONRE in their efforts towards environmental conservation and sustainable development.



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ADB	Asian Development Bank
ASEAN	Association of South Asian Nations
CBD	Convention on Biodiversity
CIAT	International Center for Tropical Agriculture
CIDSE	International Cooperation for Development and Solidarity
CPAWM	Center for Protection Areas and Watershed Management
DFRC	Division of Forest Resources and Conservation
DHUP	Department of Housing and Urban Planning
DIC	Division of International Cooperation
DICI	Division of International Cooperation and Investment
DLF	Department of Livestock & Fisheries
DMH	Department of Meteorology and Hydrology
DOA	Department of Agriculture
DOC	Department of Communication
DOE	Department of Electricity
DOE	Department of Environment
DOF	Department of Forestry
DOI	Department of Irrigation
DOI	Department of Industrial
DOM	Department of Mining
DOM&H	Department of Meteorology and Hydrology
DOP	Department of Planning
DWR	Department of Water Resources
EIA	Environment Impact Assessment
EEA	Environment Education and Awareness
EQMHCC	Environment Quality Monitoring Hazardous Chemical Center
EMMU	Environment Management and Monitoring Unit
EPL	Environment Protection Law
EU	European Union
FAO	Food and Agriculture Organization
FAF	Faculty of Forestry
FIPD	Forest Inventory and Planning Division
FSC	Forest Stewardship Council
GDP	Gross Domestic Product
GIS	Geographic Information System
GoL	Government of Lao PDR
GPS	Global Positioning System
GTZ	German Agency for Development Cooperation
HDI	Human Development Index
HRD	Human Resource Development
IDA	International Development Association
ILO	International Labor Organization
IMF	International Monetary Fund
IPCC	International Monetary Fund
IUCN	International Union for Conservation of Nature

JICA	Japanese International Cooperation Agency
LAO PDR	Lao Peoples Democratic Republic
LARREC	Living Aquatic Resources Research Center
LNMC	Lao National Mekong Committee
MAF	Ministry of Agriculture and Forestry
MCTPC	Ministry of Communication, Transport, Post and Construction
MDGs	Millennium Development Goals
MEAs	Multilateral Environmental Agreements
MIC	Ministry of Industrial and Commercial
MONRE	Ministry of Natural Resources and Environment
MPWT	Ministry of Public Works and Transport
MH	Ministry of Heath
ML&SW	Ministry of Labour and Social Welfare
MEM	Ministry of Energy and Mines
MOE	Ministry of Education
MPI	Ministry of Planning and Investment
MOF	Ministry of Finance
MOH	Ministry of Heath
MOI	Ministry of Interior
MOJ	Ministry of Justice
MRC	Mekong River Commission
NAFRI	National Agriculture & Forestry Research Institute
NAPA	National Adaptation Programme of Action
NBCAs	National Biodiversity Conservation Areas
NBSAP	National Biodiversity Strategy and Action Plan
NCCR	National Centre of Competence in Research
NEC	National Environmental Committee
NORAD	Norwegian Agency for Development Cooperation
NPEP	National Poverty Eradication Programme
NPSEs	Nam Papa State-owned Enterprises
NSC	National Statistics Center
NSEDS	National Socio-Economic Development Strategy
NTFPs	Non-Timber Forest Products
NUOL	National University of Laos
ODA	Overseas Development Agency
PECs	Provincial Environmental Committees
REDD	Reducing Emissions from Deforestation and Forest Degradation
STEA	Science Technology and Environment Agency
SPC	State Planning Committee
SUFORD	Sustainable Forestry and Rural Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention for Climate Change
UNFPA	United Nations Population Fund

UNICEF	United Nations Children's Fund
UXO LAO	Unexploded Ordinance Clearance Programme
WASRO	Water Supply Regulatory Office
WB	World Bank
WCS	Wildlife Conservation Section
WEPA	Water Environment Partnership in Asia
WFP	World Food Programme
VUDA	Visakhapatnam Urban Development Authority
WHO	World Health Organization
WERI	Water Resources and Environment Research Institute
WRCC	Water Resources Coordination Committee
WREA	Water Resources and Environment Administration
WWF	World wide fund for nature

EXECUTIVE SUMMARY

The Lao People's Democratic Republic (Lao PDR) is a landlocked country in the center of the Southeast Asian peninsula. The topography is predominantly mountainous, with almost 80 percent of the land hilly and mountainous terrain. The climate is seasonally tropical with prominent wet and dry seasons. Annual rainfall ranges from about 1300 mm in the Northwest and 4000 mm in the Southern Annamite range. The maximum temperature is 35.5 to 39.5 °C in March and April, and the minimum temperature from December to January is 13.5-17.5 °C. The annual average temperature is 26.5 to 27.5 °C.

The total population in 2010 was 6,256,197 of which 80 percent live in the rural areas, with GDP per capita of USD1088. In 2011, out of 179 countries Lao PDR was ranked 138th in terms of human development.

The economic and population growth in Lao PDR provokes concerns over urban environment deterioration. Urban areas are experiencing higher population growth rates than the national average, signifying significant urban migration.

Lao PDR is mostly rural and has about 5.9 million hectares of cultivable land, of which 800,000 hectares are arable for rice or secondary crops under shifting cultivation systems. Shifting cultivation is common in most of the hilly and mountainous areas in northern and central eastern parts of the country. Land degradation takes several forms such as nutrient depletion, structural decline and compaction, biological decline, chemical deterioration and soil erosion.

The national poverty level is estimated at 28 per cent, but the levels at village level vary widely. The highest poverty levels are found in the mountains of the south, along the border with Vietnam. The lowest levels are found in urbanized areas and around the larger towns, on the Bolavan plateau (possibly reflecting the good agricultural conditions with fertile brown basalt soils and favourable climate conditions).

It is estimated that 35 percent of all water in the Mekong River originates from watersheds within Lao PDR. About 80 percent of water flow materializes during the rainy season and the rest during dry season. For the time being, there are insufficient data to construct an indicator capturing the adequacy of water supply for agriculture. One of challenges is to expand the irrigation capacity to overcome localized temporary water shortages.

General pressure on water resources of the country derives from its incompatible legal and institutional capacity to respond to the rapid economic development and population growth in recent years. Another new issue is flooding, which has significantly impacted Lao PDR in recent years. There have been nine large floods since 1960s (1966, 1971, 1978, 1995, 1996, 2000, 2002, 2005 and 2008).

Overall air quality in urban and rural areas in Lao PDR is not considered to be polluted. Lao PDR does not have large scale industry, with air pollution mainly from mobile sources such as unpaved roads and those roads under construction. Water Resources and Environment Agency (now the Ministry of Natural Resources and Environment) has developed ambient air quality standards. Air quality monitoring in Lao PDR is very recent and limited in its scope. As the monitoring of air quality is only conducted for 3 consecutive days per year, the results are insufficient for comparison with annual WHO guidelines.

The most serious health problems are still those of infectious diseases, as well as water borne diseases. Five major causes of morbidity and mortality are malaria, pneumonia, gastritis, influenza and diarrhea. Life expectancy in Lao PDR is 65 years old.

The current forest area which has more than 20 percent of canopy density, according to national definition, is 9.5 million hectares, about 40 percent of total land area compared to 47 percent in 1992. However, all forest covered areas that have more than 10 percent canopy density, based on the criteria of Global Forest Resources Assessment, remain at 68 per cent, of which forest, including evergreen, mixed deciduous, dry dipterocarp and plantation forests, accounted for 41.5 percent. Potential forests, including abandoned shifting cultivation areas, accounted for 2.2 percent; bamboo brakes 2.3 percent; and currently deforested and degraded forest lands 25.6 percent.

Besides the quantitative changes, forest quality has also deteriorated. Forest degradation encompasses decreases in stocking density, changes in species composition and size structure, and reductions in wildlife and plant populations.

Surveys conducted in cooperation with foreign experts have recorded at least 166 species of reptiles and amphibians in Lao PDR. Ten amphibians are threatened and one species is likely to exist in Lao PDR only. The surveys have reported 247 animal species including new genera with high international profiles: *Pseudoryx, Pseudonovibos, and medamuntiacus vuquagensis*

To date, there is no country-level study on past and existing climate change in Lao PDR. Lao PDR has responded to this issue through a REDD (Reducing Emissions from Deforestation and Forest Degradation) strategy and has set up a REDD task force. It has also recently attracted a number of bilateral and multilateral activities including capacity building, technology transfer, project implementation and other readiness related activities, as well as being actively engaged with regional and global actions supporting REDD.

Lao PDR submitted a National Adaptation Programme of Action to Climate Change to the UNFCCC in 2009. The National Adaptation Programme of Action summarized impacts related to climate change in the country, including nine large floods, and identified priority project proposals on mitigation and adaptation to climate change. Most of the proposals are linked to avoiding deforestation, supporting community forest management, and providing alternative livelihoods.

The Lao PDR National Constitution has a clear policy regarding the environment, including biodiversity as stated in Article 17. The Five-Year National Socio-Economic Development Plan also has environment aspects. Moreover, Laos is currently working on and implementing a number of strategies to manage natural resources more effectively and sustainably such as forestry and biodiversity strategies.

Environmental education and awareness as well as biodiversity education and awareness are of utmost importance to Lao PDR. In this regard, it has been incorporated into the schools' curricula. These attempts have also been conducted in the form of meetings, lectures on policies, strategies, laws and regulations, as well as publishing in mass media.

With 28 per cent of its population still in poverty, the Lao PDR National Poverty Eradication Programme (NPEP) is central to the national development agenda. The NPEP encapsulates the essence of the Lao PDR's approach towards achieving the goal of exiting the group of least developed countries by 2020. The country's rich natural capital of the country not only provides livelihoods but also serves as a safety-net, especially the poor, and is the key asset underpinning the country's ambitious development agenda.

PART I : PEOPLE, ENVIRONMENT AND DEVELOPMENT OF LAO PDR

CHAPTER 1 GEOGRAPHY AND CLIMATE OF LAO PDR

The People's Democratic Republic of Lao (Lao PDR) is situated in the centre of the South East Asian peninsula between 13°54' and 22°30'N and between 100°05' and 106°38'E. It is surrounded by Cambodia, China, Myanmar, Thailand and Vietnam, and covers an area of 236 800 square kilometers (km^2). The country extends approximately 1,000 kilometres (km) at its longest length in a northwest to southeast direction. The upper half of the country is broader than the south with a maximum width of about 470km. Topography is predominantly mountainous with cultivated floodplains along some reaches of the Mekong River and its larger tributaries. Almost 80 per cent of the land surface is hilly and mountainous. It is a landlocked country with more than 40 per cent of it consisting of stocked forests.

Figure 1: Map of Lao PDR

Source: Overview map of the Lao PDR (Messerli et al, 2008)

The climate of Lao PDR is seasonally tropical, with a pronounced wet and dry season. The lowest levels of mean annual rainfall are about 1,300 millimetres (mm) in the northwest, while the highest levels are well above 4,000 mm in the southern Annamite range. The majority of the lowlands experience between 1,500 — 2,000 mm of rainfall annually. This amounts to 90.9 per cent of the total rainfall in rainy season (May – October) and 9.1 per cent of rainfall in dry season (November – April). The total rainfall by year is given in the table below.

Table 1.1: Total Rainfall by Year (Unit : mm)

Meteorology Station				
Year	Luangprabang	Vientiane. Capital	Savannakhet	Pakse
1980	1 559.5	2 291.4	1 635.6	1 524.5
1985	1 093.4	1 253.5	1 205.1	2 545.2
1990	1 641.6	1 552.1	1 713.5	1 704.0
1995	1 616.9	2 019.8	1 342.3	1 647.5
1996	1 601.0	1 756.0	1 938.0	2 193.0
1997	1 180.0	1 629.6	1 335.2	2 604.4
1998	1 163.7	1 477.4	1 080.4	1 733.5
1999	1 352.6	2 170.7	2 357.1	2 446.6
2000	1 486.7	1 499.8	1 557.8	2 598.4
2001	1 795.0	1 659.0	1 919.9	2 348.6
2002	1 601.8	1 846.7	1 982.0	2 478.0
2003	1 399.0	1 481.0	1 492.3	2 029.1
2004	1 472.7	1 629.6	396.7	1 977.9
2005	1 435.0	1 667.8	1 768.2	1 956.1
2006	1 205.6	1 930.3	1 398.7	2 694.5
2007	1 295	1 667.5	1 444.7	1 967.5
2008	1 708.7	2 201.6	1 565.7	1 907.6

Source : Lao Statistics Bureau 2009

The temperature in Lao PDR changes from the northern region to the central and southern regions. The maximum temperature is 35.5-39.5°C in March to April, and the minimum temperature is 13.5-17.5°C in December to January. The annual average temperature is 26.5-27.5°C. The average maximum and minimum temperature by year is given in table 1.2 and Figure 1.2.

Table 1.2: Average Maximum and Minimum Temperature by Year (Unit: °C)

Meteorology Station								
Year	Luangprabang		Vientiane Capital		Savannakhet		Pakse	
	Max	Min	Max	Min	Max	Min	Max	Min
1980	31.9	20.5	31.5	22.4	32.0	22.1	32.0	23.2
1985	34.9	16.4	34.2	21.0	35.4	18.0	33.6	20.3
1990	31.2	20.0	31.0	22.6	29.4	24.2	32.1	23.0
1995	31.2	20.0	31.0	22.6	29.4	24.2	32.1	23.0
1996	30.8	20.2	30.9	22.2	31.3	21.8	31.8	23.3
1997	31.6	20.3	31.4	22.6	31.4	21.6	32.1	23.1
1998	32.5	20.2	32.5	23.2	32.7	22.8	33.1	24.4
1999	30.8	20.2	30.9	22.2	31.3	21.8	31.8	23.3
2000	31.4	20.1	31.4	22.2	30.3	20.8	32.3	23.4
2001	31.6	20.9	31.7	22.6	31.4	21.5	32.8	23.1
2002	30.9	20.3	31.6	22.5	32.4	22.0	33.1	23.6

2003	32.0	19.9	31.8	22.3	32.4	22.6	32.5	22.8
2004	31.7	19.4	31.2	22.1	31.7	21.1	32.4	23.1
2005	32.2	19.8	31.8	22.7	31.8	22.0	32.4	23.7
2006	32.6	20.3	31.7	22.5	32.2	22.1	32.5	23.5
2007	31.2	20.0	31.0	21.9	31.3	21.1	31.8	22.7
2008	31.1	20.1	30.5	22.0	30.0	20.2	31.8	22.5

Source : Lao Statistics Bureau 2009

Figure 1.2: Average Maximum and Minimum Temperature 1980-2008

Year	Luangprabang		Vientiane		Savannakhet		Pakse	
	Max	Min	Max	Min	Max	Min	Max	Min
1980	31.9	20.5	31.5	22.4	32.0	22.1	32.0	23.2
1985	34.9	16.4	34.2	21.0	35.4	18.0	33.6	20.3
1990	31.2	20.0	31.0	22.6	29.4	24.2	32.1	23.0
1995	31.2	20.0	31.0	22.6	29.4	24.2	32.1	23.0
2000	31.4	20.1	31.4	22.2	30.3	20.8	32.3	23.4
2005	32.2	19.8	31.8	22.7	31.8	22.0	32.4	23.7
2008	31.1	20.1	30.5	22.0	30.0	20.2	31.8	22.5

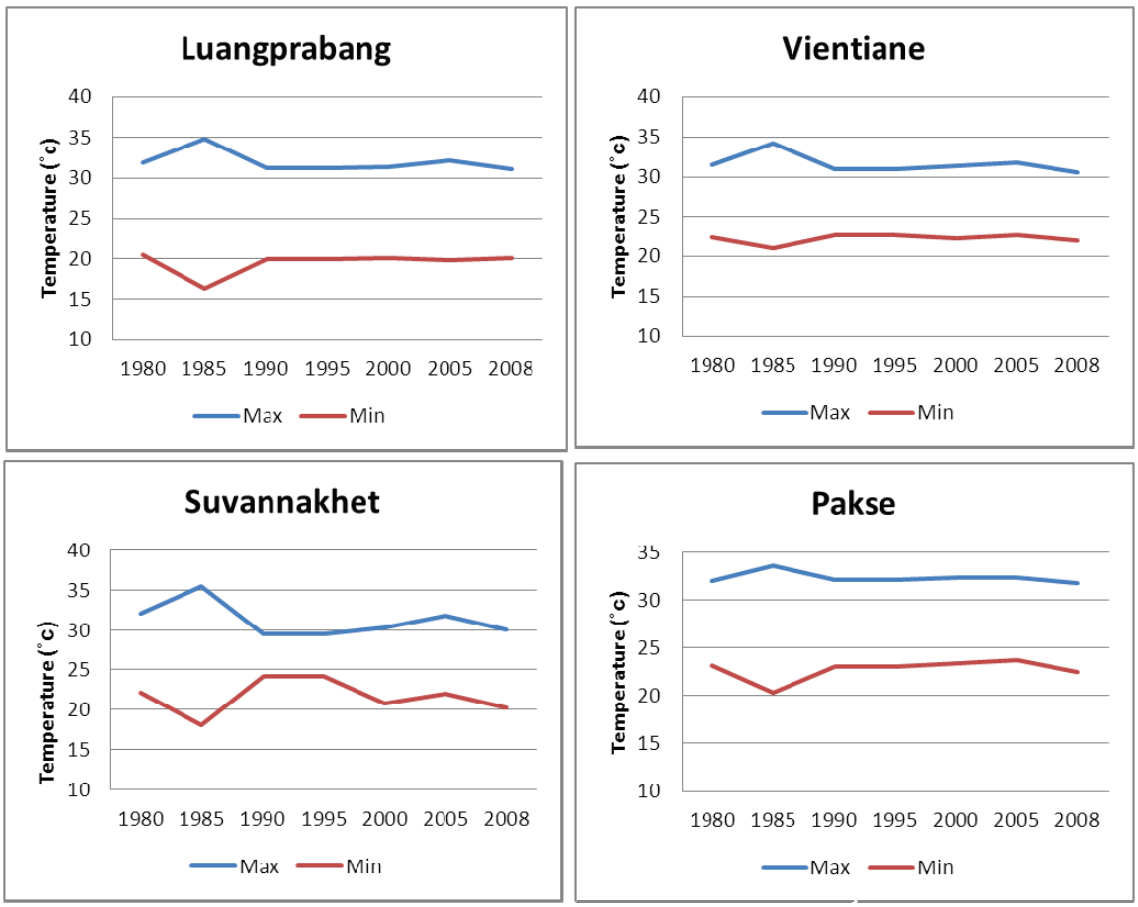


Table 1.3: Average Maximum and Minimum Humidity by Year (unit: percent)

Meteorology Station								
Year	Luangprabang		Vientiane. Capital		Savannakhet		Pakse	
	Max	Min	Max	Min	Max	Min	Max	Min
1980	96	46	89	52	96	55	89	53
1985	97	52	92	56	95	55	90	56
1990	93	60	90	55	91	51	89	53
1995	97	51	91	54	95	54	84	54
1996	97	48	91	48	94	54	81	52
1997	98	51	91	55	95	50	85	53
1998	97	52	90	50	92	52	83	53
1999	96	59	91	57	89	54	88	54
2000	95	51	92	54	90	54	87	55
2001	95	51	92	55	87	54	87	52
2002	96	55	92	55	93	58	84	52
2003	96	75	91	72	95	75	87	70
2004	96	55	92	54	94	55	86	52
2005	96	55	90	54	94	58	86	55
2006	95	57	92	54	94	58	87	54
2007	97	52	91	52	92	51	88	52
2008	96	56	92	58	96	59	87	56

Source : Lao Statistics Bureau 2009

CHAPTER 2 SOCIAL DEVELOPMENT AND POVERTY

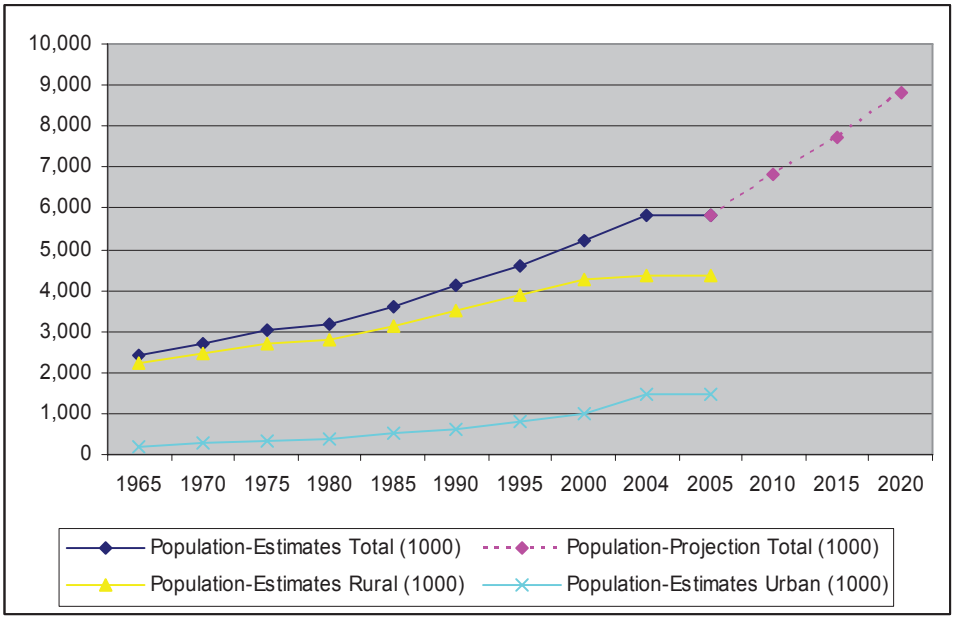
Lao PDR has one capital and 16 provinces. In 2008, it was estimated that the total population of the country was some 6 000 379 people of which approximately 80 per cent live in rural areas (Department of Statistics 2009). The population consists of 49 ethnic groups with four main languages including Lao–Tay, Mone-Khamae, Hmong-Iewmian and Chinese-Tibetan. Lao PDR had a GDP per capita of US$875 in 2008. According to World Bank estimates, it is one of the poorest countries in the East Asia and Pacific Region. In 2011, the country's human development ranking was 138 out of 179 countries (UNDP 2012) with an overall score of 0.524. However, the HDI of Lao PDR has continuously improved over the past few years. With this level of poverty, the country's natural resource base becomes of critical importance in poverty alleviation and economic growth. However, natural resource degradation, combined with inadequate provision of environmental services is disproportionately affecting the poor in Lao PDR. The prevailing economy of Lao PDR is heavily dependent on natural resources as the country is dominated by subsistence production, with the majority of the population relying on farming and the collection of Non Timber Forest Product (NTFPs) for their basic livelihoods. In 2000, nominal GDP was estimated to be 13.48 billion kip or US$1.65 billion and grew to over US$4 billion in 2007, according to IMF estimates (IMF 2005, 2009). Per capita GDP increased from US$114 in 1985 to US$330 in 2000. In 2010 Lao PDR achieved per capita GDP of US$1088 (Lao Statistics Bureau 2012). However, the incidence of poverty remains high, with 28 per cent of the population thought to be living in poverty (MAF2010).

2.1 Population and Urbanization

The economic and population growth in Lao PDR provokes concerns of a deteriorating urban environment. Urban areas are experiencing higher population growth rates than the national average, signifying urban migration. Vientiane Prefecture is the capital city of the Lao PDR and is one of the main commercial gates of the country. It has the largest number of people (740,010 in 2008). Although the size of the city (3,920 km^2) is significantly smaller than other capital cities, the city functions as a major economic and social centre. This makes Vientiane the most urbanized area of the country. In recent years, urban environmental issues in Vientiane Prefecture have been given particular attention. There are several reports that highlight urban environmental issues in Lao PDR, including the Country Environment Review by ADB, the National Environmental Action Plan by the government of Lao PDR and Lao State of the Environment report (STEA 2001). These reports cover issues such as water supply, drainage systems, sewerage systems, solid waste management, roads and transportation, and cultural conservation (Sithimolada 2000).

As of 2010, the population of Lao PDR was 6256 197 and is growing at an average of 1.8 per cent annually. Urban population makes up only 21.8 per cent of the country's total population, making it the least urbanized country, next to Cambodia, in South East Asia. The annual urbanization rate of 3.8 per cent is almost same as those of neighboring countries such as Cambodia, Myanmar and Vietnam (UNESCAP 2009). Although the country's urban areas generally still have low populations, the rate of urbanization of Vientiane and other major cities, such as Savannakhet, are growing at a much higher rate. Although urban, commercial and industrial activities are currently carried out at low levels, pollution of air, land and water is starting to become a problem in some areas. Urban areas are experiencing higher population growth rates than the national average, signifying rural urban migration. The national annual growth rate in 1995 was 5.4 per cent and 4.9 per cent in 2000. Although the growth rate has declined, urban areas are expanding and population density is growing.

Table 2.1: Population growth and projection (1965-2020)



Source: National Statistics Center, 2005

As a least-developed country economy, Lao PDR's most serious health problems are still those of infectious diseases, as well as water borne diseases. The major causes of morbidity and mortality are malaria, pneumonia and diarrhea. The main cause of death for children under 5 years old is pneumonia. Life expectancy at birth is at 65 years old (WHO 2011)

2.2 Education and Literacy Rate

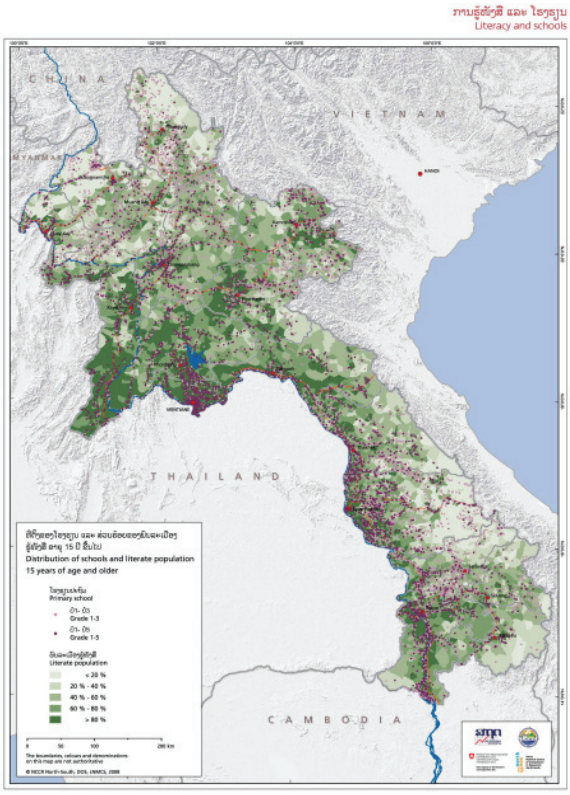
2.2.1 Literacy and Schools

The official average national literacy rate for the population aged ≥15 years is 72.7 per cent, but there are substantial differences between women and men, urban and rural populations and different ethno-linguistic groups. In regards to the spatial pattern of literacy in Lao PDR (Figure 2.1) one can observe that areas with high literacy rates are found in and around major urban centres, provincial capitals, and along the Mekong River. The southern part of Xayabury stands out as a rural area which has high literacy rates. Furthermore, the provinces of Xiengkhuang and Huaphanh have quite high literacy rates. Conversely, the northern parts of Phongsaly and Luangnamtha and the eastern parts of Khammuane and Savannakhet provinces have a serious literacy problem.

The distribution of primary schools reflects the different literacy rates throughout the country and along the major axes of transportation. Yet, there are exceptions to this pattern. In Phongsaly, Luangnamtha, Oudomxay, and eastern Savannakhet there is a reasonable density of schools but very low literacy rates. This suggests that low literacy is often not a problem related to infrastructure, such as schools, but rather a problem of skills, such as teacher availability, qualifications, salaries, curricula, language of instruction, and levels of poverty.

[1] *Human Development Report 2005*

Figure 2.1: Spatial Patterns of Literacy in Lao PDR



Source: Messerli et al, 2008

2.2.2 Accessibility of Primary Schools

The existence and the travel time to a school is naturally a defining factor of literacy. Out of 10 553 villages, 35 per cent report the presence of a school offering full primary education from grade one to five. Another 45 per cent of villages have a primary school with grades one to three, while 20 per cent of villages are without a school of any kind.

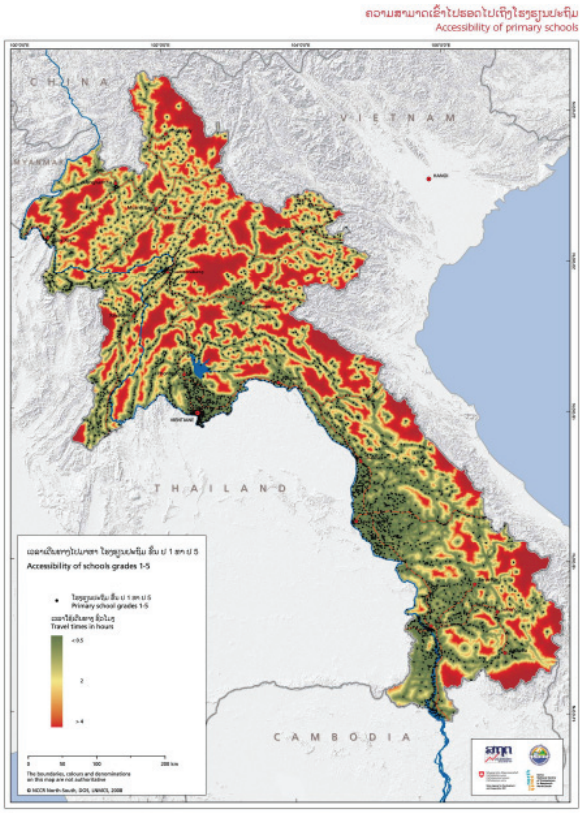
The spatial pattern shows that people living in more densely populated lowland areas and along the major lines of transportation are closer than one hour from the nearest school. However, students in remote areas are increasingly deprived of this educational opportunity and often live more than four hours away. Table 2.2 shows the accessibility to primary schools for villages and people in Lao PDR.

Table 2.2 : Accessibility of villages and people to the nearest primary school (grade 1 to 5) in terms of different classes of travel time

Accessibility class:	Percentage of villages:	Percent of population:	Cumulative percent of population:
0 to 0.5 h	75.3	86.5	86.5
0.5 to 1 h	6.8	4.0	90.5
1 to 2 h	7.7	4.2	94.7
2 to 3 h	4.7	2.5	97.2
3 to 4 h	2.5	1.3	98.5
More than 4 h	3.0	1.5	100

Table 2.2 shows that many villages and even a higher number of people are quite close to a village with a school offering education from grade 1 to 5. As much as ninety per cent of the population could reach such a school in less than one hour. From these calculations we can conclude that even if some regions urgently need better school infrastructure, the policy focus should be on transforming this potential accessibility to schools into actual access. This implies that the schools are not only functioning and have teachers with salaries and proper training but in terms of the students implies that ethnic minorities are not disadvantaged because of their language, that families have the economic and social means to send them to school, and that boys and girls have equal opportunities.

Figure 2.2: Accessibility of Primary School



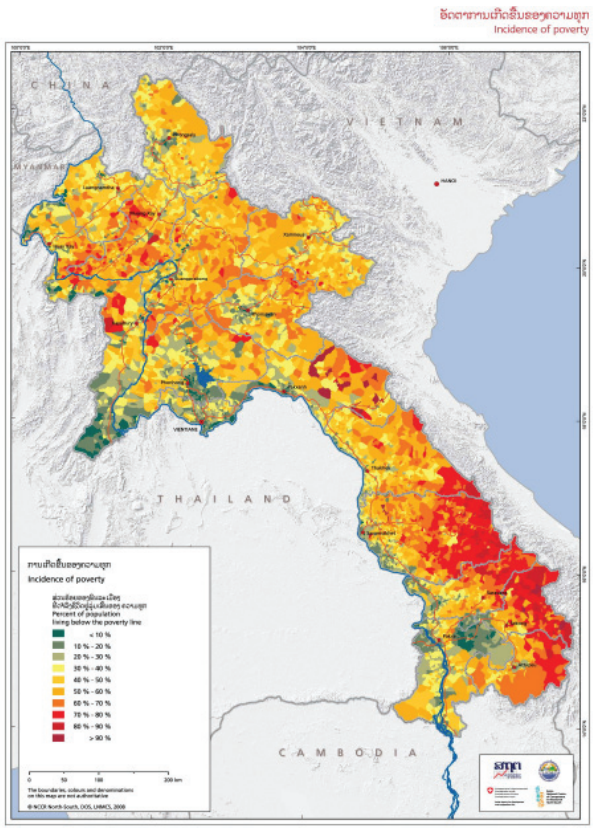
Source: Messerli et al. 2008

2.3 Poverty

2.3.1 Incidence of Poverty

The poverty density map (Figure 2.4) identifies the poor areas of the country. The darker the red on the map the higher the poverty level,, and the darker the green the smaller is the percentage of the population living below the poverty line. While the national poverty level was an estimated 28 per (MAF 2010), the poverty levels at the village level vary widely. The highest poverty levels are found in the mountainous parts of the south, along the border with Vietnam, while somewhat lower rates can be found in most villages of the northern uplands. The lowest poverty levels, on the other hand, are found in urbanized areas in and around the largest towns; on the Bolaven plateau (possibly reflecting the good agricultural conditions there, with fertile brown basalt soils and favourable climatic conditions); and in the southern part of Xayaboury province along the border with Thailand.

Figure 2.3: Incidence of Poverty in Lao PDR



Source: Messerli et al. 2008, Epprecht et al. 2008

The map used in Figure 2.4 gives further details of the spatial distribution of poverty within such areas. For example, in Luangprabang province the map shows green areas along the MekongRiver and in and around Luangprabang town. Furthermore, the village poverty map reveals a stretch of green in the orange and red areas, marking the lower Nam Ou valley (which coincides with the first section of the main road connecting Luangprabang and Oudomxay towns). These areas with a relatively low incidence of poverty are surrounded by mountainous areas with much higher poverty levels.

Villages near the rivers often benefit from flat land, the year round availability of irrigation water, and from the transportation provided by the river, all of which tend to reduce poverty levels. In addition, many urban areas in and around the district and provincial towns of the northern mountainous provinces appear clearly as green patches. This is can be seen in Phongsaly town, but also in Muang Sing town in northern Luangnamtha province, and Phonsavanh town in Xiengkhuang province.

In the northern part of the country, the influence of the road network on poverty levels is particularly visible in some places. For example, there is a green stretch of villages between Vientiane and Luangprabang, and to a lesser extent between Luangprabang and Xayaboury, and further on to Paklay in Xayaboury province. This corresponds to the path of the highway connecting the towns and may be an indication of the impact of market access on poverty levels. Similarly, the greenish stretch running from the centre of Huaphanh province towards the border with Vietnam marks the path of the road from Xamneua town to Viengxay and the border of Vietnam, indicating the potential of border trade to benefit the local populace.

The road from Oudomxay town to the MekongRiverharbour in Pak Beng is clearly visible, running southwest from Oudomxay in a fairly straight line towards the MekongRiver. In the south, besides the green areas along the Mekong River valley, villages with lower poverty levels stretch along the road connecting the National Road No.13S in the Mekong River valley with Laksao and the border crossing to Vietnam, a transit route running west-east through Borikhamxay province, which serves as an important channel for trade between the two countries.

2.3.2 Density of Poverty

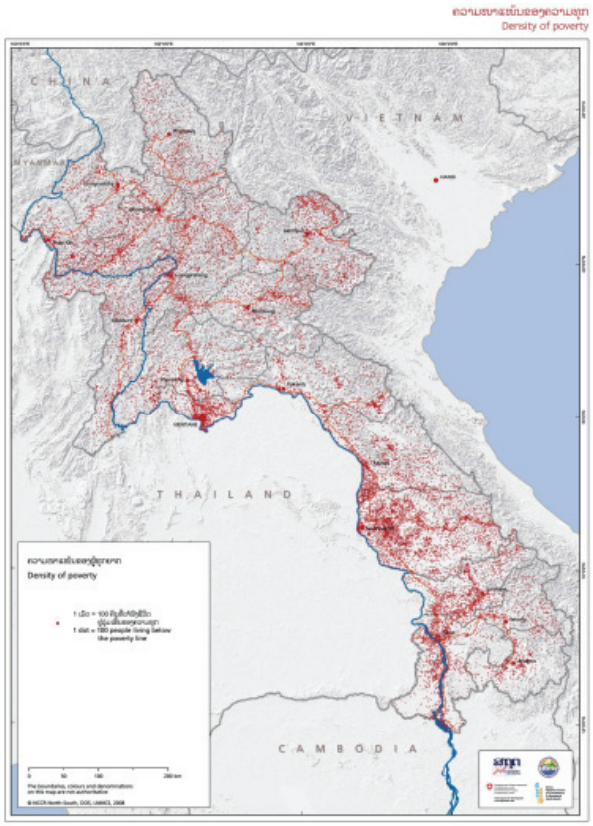
Another way to look at the spatial distribution of poverty is to examine the poverty density, defined as the number of poor people living in a given area (Figure 2.5). This depicts the spatial distribution of the absolute number of poor people. Mapping out the number of people living below the poverty line shows clearly where most of the poor live. Each dot on the map represents 100 people living below the poverty line. Interestingly, the poverty density map tells a very different story about where the poor live compared to the incidence of poverty, even though both maps are based on exactly the same poverty estimates.

What were identified as poor areas before are now the areas with the fewest poor people, while most of the areas identified on the other map as the least poor now appear as regions with the highest number of poor people. Generally less poor areas largely correspond to areas with high population densities, whereas the poorest areas are typically sparsely populated. This situation results in high poverty densities despite comparatively low incidences of poverty, and vice versa, meaning that most of the poor live in less poor areas.

Nevertheless, high incidences of poverty do coincide with relatively high densities of poverty, particularly in the mountainous parts of Oudomxay, and along National Road No 9 that connects Savannakhet town with Lao Bao on the border with Vietnam. Overall, most poor people live in the more densely populated lowland areas along the Mekong corridor, in and around VientianeCity, and other urban areas of the country.

This has implications related to the wider context of accessibility. On the one hand, poor people living in poor and sparsely populated areas usually have less access to services such as markets, medical and educational services, and sources of information, typically available in more densely populated and urban areas. On the other, it is much easier to reach the poor in the less poor, more developed, and more densely populated areas than it is in the poor and sparsely populated areas. To reach the same number of poor people in poor remote areas is significantly more expensive than reaching them in highly populated areas. An important implication of this map is that if all poverty alleviation efforts are concentrated in the areas where the poverty level is the highest, including the southeast, most of the poor will be excluded from the benefits of these programs.

Figure 2.4: Incidence of Poverty in Lao PDR



Source: Messerli et al. 2008, Epprecht et al. 2008

2.4 Road network system

Over the past 15 years a high percentage of the Government's public investment programme has been devoted to rebuilding the road system, with impressive results. The entire road network amounts to about 32 600 km, comprising 7 160 km of national roads,

8 950 km of provincial roads, 6 620 km of district roads, and an estimated 9 800 km of community or access roads (Table 2.3). Of the total road network, some 4 590 km are paved, with the remaining sections either gravel or earth roads (Ministry of Public Works and Transport 2009).

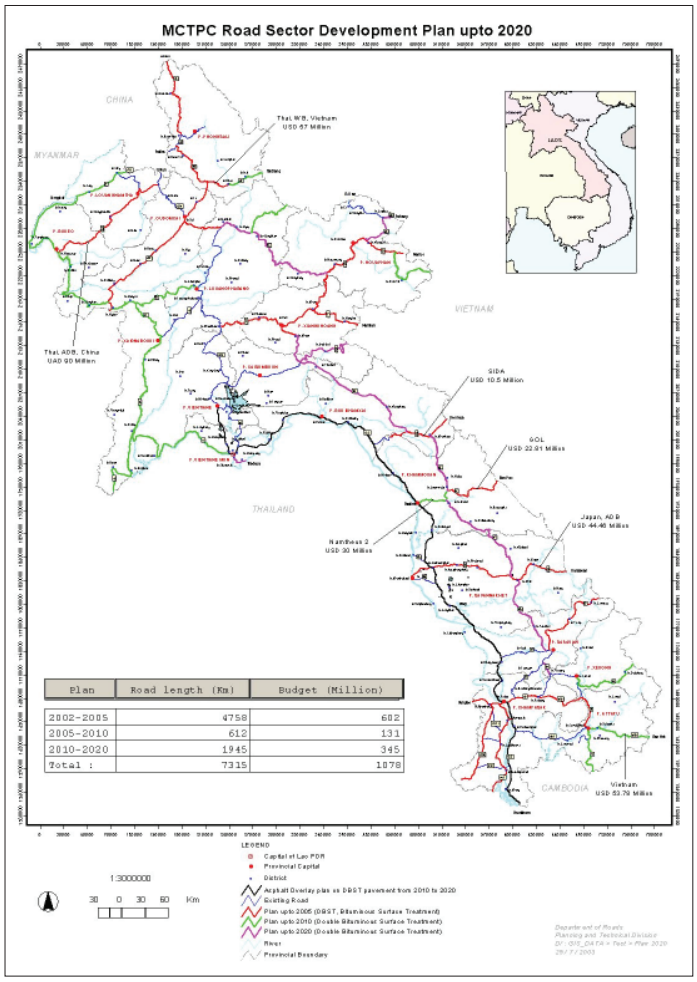
Table 2.3 Road network system

Road Inventory and Pavement Type in Lao PDR, 2002 Region	National Roads (km)				Provincial Roads (km)				Urban/District/Community (km)			
	Paved	Gravel	Earth	Total	Paved	Gravel	Earth	Total	Paved	Gravel	Earth	Total
North	1,416	1,061	340	2,816	2	1,119	1,612	2,734	78	735	2,383	3,197
Centre	1,355	578	242	2,175	232	1,571	1,726	3,530	224	2,101	3,514	5,840
South	1,059	478	630	2,168	102	1,256	1,327	2,660	120	757	6,595	7,518
Lao PDR	3,830	2,118	1,212	7,160	337	3.947	4,666	8,952	423	3,595	12,492	16,529

Source: Ministry of Public Works and Transport 2009

Recent investment has been concentrated on the upgrading of the arterial road network, notably NR13. Some of the critical east-west links connecting Thailand and western Lao PDR to the border of Viet Nam (NR6, NR7, NR8 and NR9) were completed by 2004 (NR8 and NR9). The Northern Economic Corridor (NR3) connecting Thailand via Lao PDR to China was completed by 2007. Now attention is increasingly on the local road network.

Figure 2.5: Road Sector Development Plan up to 2020



Source: Ministry of Public Works and Transport 2009

Lao PDR is now much better integrated than at the beginning of the 1990s and significant progress has been made in securing the sustainability of these investments. Nevertheless, continued development and strengthening of the transportation system in Lao PDR is still required, and significant challenges remain:

- Just over 50 per cent of the national road network is paved, with about 70 per cent of the national road network accessible for all of the year.
- Restricted traffic ability of the provincial and district road network during the rainy season; less than 60 per cent of district centres have year-round access.
- According to the 1997/98 survey, more than 40 per cent of villages are six kilometresor more from a main road and nearly half are not accessible during the rainy season.

- Villages in the Northern Region are particularly isolated. Some have no access to social services and markets, even during the dry season, underscoring the need for a major effort to upgrade rural roads.
- Despite growth rates of about 17 per cent annually, traffic on the road system is light. On the national road network, the average traffic flow varies between 250-1000 vehicles daily, while on district and community roads the average traffic flow is one tenth of these levels.
- The Lao PDR has one of the lowest road densities in the region (129 km/1000 km^2) (UNESCAP 2009), reflecting its relatively large land area and small population. Traffic volumes are very low in part because the small yet widely dispersed population and the mountainous terrain in much of the country makes provision of transportation services very costly.[1]
- Financing the maintenance of the local road network remains uncertain. The recently established Road Maintenance Fund is directed to firstly maintaining national roads. Funding for maintenance of local road networks increases progressively as the requirements of the arterial network are covered.[2]
- Overweight vehicles are a serious problem contributing to road deterioration.
- Road accidents have increased sharply, underscoring the need for educational programmes on road safety and other measures.[3]
- Although a rail system would provide an alternative mode of transport, high development costs means that the system is likely to be limited in the short and medium term to the short link now planned into the Thai rail system.
- Domestic and cross-border transit agreements must be facilitated in order not to hamper the optimal use of the transportation system and impede the growth of trade.
- Institutional capacity to manage the overall transportation system continues to require strengthening, especially at the provincial and district levels.

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[1] Volumes on primary roads are 250-1000 vehicles per day, while traffic on community roads are a tenth of these levels. The number of registered vehicles is currently increasing at about 17 per cent annually

[2] Several donor projects are directed to upgrading and maintaining provincial, district and community roads.

[3] Two donor-assisted projects are providing support to improve road safety and other assistance is planned.

CHAPTER 3 ECONOMIC DEVELOPMENT

AUSAID has reviewed the overall economy of Lao PDR. The Lao economy is dominated by subsistence agriculture, upon which approximately 80 per cent of the total population relies, while the cash economy has made little inroad into remote areas. Notwithstanding significant improvements in recent years, infrastructure constraints limit the efficiency of agriculture. Compared with other developing countries, the national government has a low ratio of revenue to GDP. However, since the Lao Government adopted a policy of economic liberalization it has made progress towards a more market-based economy. Market prices are in place for most products, the currency has been floated and a fledgling private sector is growing. The high inflation and currency devaluation from which Laos suffered in the late 1990s had eased by 2006. From January to July 2007, inflation remained less than five per cent, anchored by a stable currency. However in June 2008 inflation was 10.25 per cent (year on year), though it dropped to a forecast of 0.2 per cent in 2009 as a result of the global financial crisis.

Table 3.1: Revenue from Tourism and Major Exports, 2004-2008 (Unit: Millions US$)

Product	2008		2007		2006		2005		2004	
	Revenue	Rank	Revenue	Rank	Revenue	Rank	Revenue	Rank	Revenue	Rank
Tourism	275.5	2	233.3	2	173.2	2	146.7	1	118.9	1
Gaments	255	3	132.0	3	126.1	3	107.5	3	99.1	2
Electricity	97.1	4	72.1	5	101.1	4	94.6	4	86.2	3
Wood Products	59.3	5	72.5	4	96.6	5	74	5	72.4	4
Coffee	5.6	8	32.3	7	9.7	8	9.5	8	13	8
Agrcultural Products	47.9	9	42.4	6	39.2	6	26.6	6	20.5	6
Minerals	801.9	1	558.8	1	485.6	1	128.3	2	67.4	5
Handicrafts	3.4	9	4.6	9	1.1	9	2.7	9	1.9	9
Other Industrics	30	7	12.8	8	1.2	7	11.9	7	13.4	7

Source: Ministry of Industry and Commerce, Lao National Tourism Administration, 2009

Lao PDR is increasingly open to international trade. The country is on track to reduce its tariffs on imports from other ASEAN nations to less than five per cent, as required under the ASEAN Free Trade Agreement, and tariffs on most product groups for trade with non-ASEAN countries are less than 20 per cent. However, the regime lacks transparency. In practice trade and investment are more heavily regulated – including through import and export licensing. A Law on the Promotion of Investment approved in 2009 is expected to deliver benefits to foreign investors as it intends to facilitate, standardize and streamline application processes and combine foreign and domestic investment regulation in the one legislation. Further details are expected to be revealed in its implementing decree.

Lao PDR has a number of economic advantages. It is situated in an economic growth area, sharing borders and common interests with Thailand, Vietnam, Cambodia and China. While the domestic market is very small, millions of people live within 100 kilometres of Lao borders which should generate new market opportunities as transit routes are further developed. Laos is increasingly utilizing its abundant natural resources. On 8 December 2008, the Lao National Assembly passed a Mining Law, however, implementation documents are yet to be completed.

But further reforms will be necessary if Laos is to achieve its goal of graduating from Less Developed Country status by 2020. Many state-owned banks have difficulty managing their debt and will need to be radically reformed. Foreign exchange transactions could be better managed. Stronger private sector growth should follow if land titling – and the rule of law more generally – improves, and more transparent economic information becomes available (Australian Government 2012).

As the economy and communications networks have developed, the average GDP per capita increased from US$295 in 2000, to US$368 in 2005, and to US$438 in 2008 in 1990 US dollars (UNESCAP 2009). The 2008 GDP is US$1,986 in 2005 Purchasing Power Parity dollars. According to information from the Committee of Planning and Investment, the agriculture and forestry industries are expected to accounti for 40.7 per cent of the GDP. The industrial sector should be 33.3 per cent of the GDP, while the services sector should account for 26 per cent of GDP (Lao Statistics Bureau 2009).

3.1 Tourism

Tourism has been introduced into the Lao PDR hoping that it boosts the national economy. The Lao National Tourism Authority was founded to help achieve this. Many tourist sites and activities have been promoted in order to attract more foreign tourists. The "Visit Lao Year 1999-2000" was marketed by the Lao government to promote how it had opened its doors to tourism. The objectives of the "Visit Lao Year 1999-2000" were to attract tourist to come and visit the Lao PDR, promote the country as one of rich culture and natural beauty, and to increase national revenues. The Visit Lao Year 1999-2000 was inaugurated in 1997. Since this time, the tourism industry has grown rapidly (Tables 3.2, 3.3, and 3.4). This is visible in the high number of guesthouses and restaurants in major cities like Vientiane and LuangPrabang. The number of guesthouses in LuangPrabang and XiengKhuang during 2002-2005 has increased from 102 to 108 and 10 to 14 respectively. In Vientiane, units increased from 85 to 162 during the same period (Lao National Tourism Administration 2009). Even in provinces on the way to tourist sites, such as Bolikhamxay, more restaurants (from 20 units in 2002 to 100 units in 2005) were operating during 2002-2005. One big selling point for LuangPrabang followed UNESCO declaring it as a World Heritage site in 1998.

Table 3.2: Number of Hotels, Guesthouses, Resorts, Restaurants and Entertainments

Province	Type									
	Hotel		GH,Resort		Restaurant		Entertainment		Total	Total
	2007	2008	2007	2008	2007	2008	2007	2008	2007	2008
Attapeu	3	3	13	14	35	29	6	4	57	50
Bokeo	4	5	28	28	13	19	12	1	57	53
Bolikhamsay	14	12	23	25	89	100	6	2	132	139
Champassak	31	35	111	119	18	18	15	15	175	187
Houaphanh	5	5	40	39	80	24	3	8	128	76
Khammouane	6	5	38	18	85	6	6	3	135	32
Luang Namtha	3	4	53	70	38	67	5	6	99	147
Luang Prbang	21	31	203	161	104	54	7	2	335	248
Oudomxay	9	8	57	52	91	86	7	5	164	151

Phongsaly	4	4	34	33	31	64	0	0	69	101
Saravane	0	3	23	20	19	9	0	2	42	34
Saravannakhet	13	15	68	68	60	19	8	4	149	106
Sayabouli	3	3	48	60	29	22	8	6	88	91
Sekong	2	3	45	15	20	20	0	0	37	38
Vientiane Capital	79	114	169	185	69	69	40	92	357	460
Vientiane Province	4	40	157	179	148	122	27	12	336	317
Xieng Khouang	10	11	40	34	47	14	3	2	100	61
Total	211	265	1.12	1.12	976	742	153	164	2.46	2.291

Table 3.3: Number of Accommodation Establishments 2002- 2008

Province	Number of Establishments						
	2002	2003	2004	2005	2006	2007	2008
Attapeu	4	5	5	12	14	16	17
Bokeo	22	22	25	24	26	32	33
Bolikhamxay	23	25	25	26	29	37	37
Champassak	65	106	110	126	127	142	154
Houaphanh	10	34	40	39	41	45	44
Khammouane	17	13	17	18	26	44	23
LuangNamtha	30	65	70	50	64	56	74
LuangPrabang	116	137	120	163	173	224	192
Oudomxay	26	50	55	63	64	66	60
Phongsaly	19	29	26	36	38	38	37
Saravane	11	22	21	22	23	23	23
Saravannakhet	30	53	60	67	72	81	83
Sayabouli	7	35	43	47	57	51	63
Sekong	1	8	8	17	16	17	18
Vientiane Capital	113	163	194	224	242	248	299
VientianePrvince	53	90	105	122	138	161	183
XiengKhouang	13	30	33	32	43	50	45
Total	560	887	957	1088	1193	1331	1385

Table 3.4: Number of Rooms 2002- 2008

Province	Number of Rooms						
	2002	2003	2004	2005	2006	2007	2008
Attapeu	74	107	107	190	322	240	262
Bokeo	267	262	303	309	316	378	379
Bolikhamxay	331	366	379	435	523	571	636
Champassak	925	1298	1364	1616	1679	1879	2072
Houaphanh	124	240	317	338	350	421	432

Khammouane	295	206	356	394	412	624	523
LuangNamtha	287	534	588	536	671	615	814
LuangPrabang	1275	1414	1410	1722	188	2162	2243
Oudomxay	316	515	731	703	821	787	848
Phongsaly	192	246	193	273	308	298	294
Saravane	96	174	221	230	254	362	273
Saravannakhet	504	979	995	1257	1236	1627	1758
Sayabouli	99	377	395	431	510	561	751
Sekong	15	69	69	172	160	164	188
Vientiane Capital	2739	3412	4004	4891	5342	5476	7237
VientianePrvince	920	1772	1734	1890	2077	2284	2773
XiengKhouang	166	318	500	441	844	633	690
Total	8625	12289	13666	15828	17633	19142	22173

Source: Lao National Tourism Administration 2009

The Laos National Tourism Authority clearly states what the role of tourism is for Lao PDR. It is to promote local handicraft products, create employment, and to increase the national income. In the recent National Tourism Development Strategy 2006 – 2020, three main parts of Laos have been identified for development: Northern Part, including Luangprabang, Luangnumtha, Xiengkhuang and Borkeo; the Middle Part, including Vientiane Municipality, Khammuoane, and Savannakhet; and the Southern Part, including Champasak, Attapue and Salavanh.

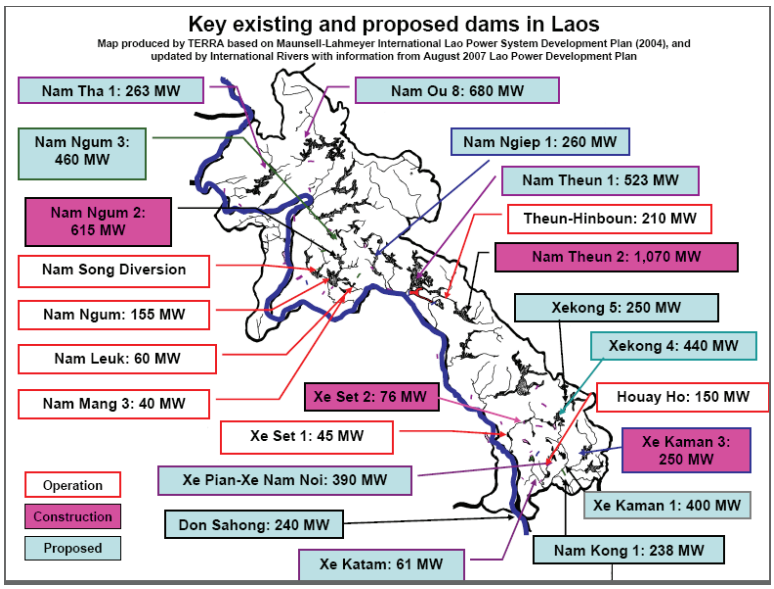
The marketing by the Lao National Tourism Authority has had an effect. In 2005, 1 095 315 foreign tourists visited the country, bringing in revenue of more than US$146 million. The number of visitors to Laos in the first two months of 2006 was 221 773 people, a 40 per cent increase from the same two month period the previous year. The majority of tourists during this period were from Thailand, while 30 980 visitors were Vietnamese, and 22 670 tourists were from non-ASEAN countries.

3.2 Hydropower

The hydropower potential of Lao PDR is relatively high. The government also has an opportunity to earn foreign income to support other development sectors. The hydropower sector has developed rapidly, with annual production rising to 3.67 million KWh in 2002 (Figure 3.1).

Hydropower is the most abundant and cost effective energy source in the Greater Mekong River Basin with theoretical hydroelectric potential of about 18,000 MW in Lao PDR. However, as of 2001, less than 5 per cent (624 MW) of the country's potential for hydroelectric power had been developed. As of 2007, Lao PDR had ten hydropower plants operational, with an additional 12 sites planned to be ready to export energy to Thailand by 2015. According to the latest forest assessment, 31 forest areas for hydropower dam construction have been identified as potential sites in line with the government policy to respond to regional energy demand, amounting to 140 635 hectares altogether (Department of Forestry 2005). The hydropower sites are drivers of deforestation.

Figure 3.1: Existing and proposed dams in Lao PDR



Source: International Rivers 2007

3.3 Forestry

Forestry accounts for slightly more than 5 per cent of GDP. However, its significance is much larger. Wood processing industries contribute 12 per cent of manufacturing industry production value (2 per cent of GDP) and informal subsistence utilization is unmeasured. As agriculture accounts for some 50 per cent of GDP, forestry may contribute some 15-20 per cent of the non-agricultural GDP (Lao Statistics 2009).

In 1994, 30 per cent of total export value came from wood products (including timber) (Table 3.5). As other exports in 1990swere heavily based on imported inputs, the importance of the forestry sector is even larger in terms of net foreign exchange earnings. Further, there were in-kind barter and other exports to neighboring countries not included in export statistics. Although the absolute value of timber exporting has been increasing since 1990s, its share in total exports has decreased recently, due to the increases in exporting minerals.

Table 3.5: Exports 1994-1996 and 2005-2007 (US$ million)

Export Category	1994	1995	1996	2005	2006	2007
Gold	n.a.	n.a.	n.a.	90.7	117.9	93.2
Copper	n.a.	n.a.	n.a.	112.1	409.3	446
Electricity	24.8	24.2	29.7	125	122.6	114.1
Wood products	**90.3**	**80.2**	**113**	**156.2**	**195.6**	**179**
Garments	58.2	76.7	64.1	114.9	151.2	152.8
Other exports	127.1	132.2	114.6	97.7	136	335.6
Total exports	**300.4**	**313.3**	**321.4**	**696.6**	**1132.6**	**1320.7**
Percentage Wood products / total exports	30	26	35	22	17	14
Percentage Gold & Copper / total exports	n.a.	n.a.	n.a.	29	47	41

Source: IMF 2000, 2009

Market information is incomplete and sometimes contradictory. There is no real information about the domestic market and total consumption of wood products. A substantial proportion of output is exported but the exact proportion is not recorded and the export data varies substantially. The major export markets are to neighboring countries with Thailand, Vietnam and China accounting for about 80 per cent of the export value. Japan and the EU account for most of the balance. The classification of products used by Ministry of Industry and Commerce (Ministry of Industry and Commerce 2010) differs from the international system so that it is difficult to compare reported exports from Lao PDR with reported imports by consuming countries. The latest information from MOIC is given in Table 3.6.

Table 3.6 Wood product exports 2007-8

Items	ASEAN		ASIA-OCE-USA		EU		Total	
	m^3	$ US'000	m^3	$ US'000	m^3	$ US'000	m^3	$ US'000
Finished products	19,002	35,345	10,840	3,420	46	573	200,906	39,428
Sem.fin. products	0	7,487	95	43	32	26	31,614	7,557
Timber (log)	31,487	6,753	2,359	208	-	-	48,938	6,962
Wood	46,579	2,966	Sets	2,506	-	-	Sets	5,473
Furniture	Sets!							
Total	268,086	52,552	13,294	6,180	78	599	281,458	59,422
Export value of whole country								1,307,459
Import value of whole country (including equipment for investment, aid)								1,364,824
Balance								- 57,365
Share of wood export with export value of whole country								4.5 %

Source: Ministry of Industry and Commerce 2010

3.4 Minerals

Despite Lao PDR's mining potential, mining activities only accounted for about 1 per cent of GDP in 2000 (STEA 2000). However, recent figures now suggest that the mining sector is a major contributor to GPD (Table 3.5). In both 2006 and 2007, only export of Gold and Copper reached more than 40 per cent of Laos' total exports. Laos has currently approved 178 mining projects by a total of 127 companies, 85 of which are foreign owned (Department of Mines 2008). Given the rich unexploited mineral resources in Lao PDR, including tin, coal, iron, copper, gold, gypsum, zinc, sapphire and other minerals, and the role mining activities have played in deforestation elsewhere, mining activities, both legal and illegal, could be a potential driver of deforestation in Lao PDR. This needs to be researched further.

PART II: STATE AND TRENDS OF THE ENVIRONMENT

CHAPTER 4 ATMOSPHERE

4.1 Drivers of change and pressures

Lao PDR does not have many large scale industries. However, the industry sector in Vientiane is growing rapidly. Motor vehicle use is also increasing. This is adding to Lao PDR's carbon footprint.

Energy production in factories can be roughly categorized into two main types of fuel: firewood and fossil fuel. Burning firewood causes emission of particulate and carbon monoxide. But high technology factories that burn fuel oil are increasing. Burning of fuel oil (or diesel) causes black fumes, sulfur dioxide and oxides of nitrogen. Even though the factories are using different kinds of fuel, these fuel types are causing degraded air quality. Particulate, sulfur dioxide and oxides of nitrogen are discharged into the atmosphere and are affecting people in cities across Lao PDR.

Rapid economic growth of the country will increase industrial development, resulting in higher pollutant levels.

4.2 State and trends of air quality

The Environment Quality Monitoring Hazardous Chemical Center (EQMHCC) and the Water Resources and Environment Research Institute (WERI) housed by the Water Resources and Environment Administration (WREA) monitor the ambient air quality. The monitoring is conducted in limited time and scope.

Air quality monitoring in Vientiane was conducted on only 3 consecutive days per year, the data results are insufficient for comparison with annual guidelines of the World Health Organization (WHO) but they can be compared with 24 hour standards. Table 4.1 shows results of monitoring conducted in September 2002-Febuaray 2003:

Total suspended particulate matter (TSP): monitoring data for all the locations indicate concentration levels ranging from 82 µg/m^3 to 296 µg/m^3, with an average of 165 µg/m^3. The latest WHO guidelines (updated 2000 and 2005) do not have a guideline set for TSP, but the WHO 24-hour guidelines for TSP in 1987 was at 120 µg/m^3. This suggests that TSP is a problem in Vientiane Capital.

Particulate Matter (PM_{10}): monitoring results in Vientiane Capital showed a range of concentrations between 40 µg/m^3 to 89 µg/m^3, and an average of 68 µg/m^3. If the measurements are compared to the 2005 WHO 24-hour guideline update (50 µg/m^3), only 4 or 13% of the measurements comply to the standard. This suggests that PM_{10} is also a problem pollutant for Vientiane Capital.

Sulfur dioxide (SO_2): measurements in Vientiane Capital show varying levels depending on location. The measurements range from 25 µg/m^3 to 276 µg/m^3, with an average of 108 µg/m^3. This suggests that SO_2 is a more serious problem compared to PM_{10} and TSP.

Nitrogen dioxide(NO_2): measurements in Vientiane Capital are generally very low having only a maximum reading of 57µg/m^3. WHO does not have 24-hour guideline for NO_2 but does have a 40 µg/m^3 annual guideline and 200µg/m^3 hourly guideline. Considering that most NO_2 readings (90%) in Vientiane Capital are below 10µg/m^3, NO_2 is not a problem in the city.

Table 4.1: Ambient air quality in Vientiane municipality from Sept 2002 – Feb 2003

Pollutants	Unit	Range of results	Average of results	WHO standard 24-hour mean
TSP	µg /m^3	82-296	165	
PM_{10}	µg /m^3	40-89	68	50
SO_2	µg /m^3	25-276	108	20
NO_2	µg /m^3	<1-57	14	

Source: MIC, WREA and DANIDA 2003, WHO 2005

In February 2008, a field survey was done in the agriculture area of Nalongkoun Village, Vientiane Province, to conduct background air sampling according to the Persistent Organic Pollutants (POPs) monitoring survey manual. The sampling records and meteorological information air sampling records are summarized in table 4.2.

Table 4.2: POPs concentration in ambient air samples of Nalongkoun Village, Vientiane Province, Lao PDR.

N:	List of PoPs	Result (Pg/m^3)
1	Hexachlorobenzene (HCB)	360
2	P,P'-DDE	8.0
3	P,P'-DDE	7.3
4	O,P'-DDE	3.0
5	O,P'-DDE	0.86
6	Trans-Chlordanes	10
7	Cis-Chlordanes	7.7
8	Trans-Nonachlors	6.3
9	Cis-Nonachlors	0.70
10	Heptachlor	3.4
11	Cis-heptachlorepoxide	0.45

Source: EQMHCC 2008

4.3 Responses

WREA developed ambient air quality standards (Table 4.3). According the proposed national standards, the overall air quality in urban and rural areas in Lao PDR is not considered to be polluted.

Indoor air quality in Lao PDR is a serious concern but no information available on this issue. The extent of problem needs to be studied urgently, considering that a significant households still use wood and charcoal for cooking, especially the poor. This would provide options to improve the health of the poor households and to make significant contributions by Lao PDR to the global efforts to mitigate global warming (UNEP and WHO 2011).

Table 4.3: Tentative standards for ambient air quality

Pollutant	Averaging time	Standard
TSP	24-hour avg	330 µg /m^3
	Annual avg	100 µg /m^3
PM10	24-hour avg	120 µg /m^3
	Annual avg	50 µg /m^3
Lead (Pb)	1-month avg	1.5 µg/m^3
Ozone (O_3)	1-hour avg	200 µg /m^3
SO_2	1-hour avg	78 µg /m^3
	24-hour avg	30 µg /m^3
	Annual avg	100 µg /m^3
NO_2	1-hour avg	320 µg /m^3
CO	1-hour avg	30 mg/m^3
	8-hour avg	10.26 mg/m^3

Source: WREA 2010a

CHAPTER 5 WATER

5.1 Drivers of change and pressures

Most of the domestic water supply in Lao PDR is adequately supplied by streams and rivers. The majority of people in rural areas obtain their water supplies from streams, rain water, and water from public standpipes or wells for drinking. Bathing and laundry washing usually take place in streams or at public standpipes. Nevertheless, some parts of the country experience water shortages during the dry season, particularly in the headwaters of some rivers and areas far from perennial rivers.

General pressure on water resources of the country is compounded by Lao PDR's incompatible legal and institutional capacity to manage its rapid economic development and population growth in recent years. New issues are flooding and drought, which have started to significantly impact the country in recent years.

5.2 State and trends of water resources

Table 5.1: water resource distribution in the Mekong Basin

	Country						
	China (Yunnan Province)	Myanmar	Lao PDR	Thailand	Cambodia	Vietnam	Mekong River basin
Catchment area as % of MRB	22	3	25	23	19	8	100
Average flow (m^3/sec) from area	2,410	300	5,270	2,560	2,860	1,660	15,060
Average flow as % of total	16	2	35	18	18	11	100

Source: MRC 2003

About 80 per cent of Lao PDR's water flow materializes during the rainy season and the rest during the dry season. Despite this underlying abundance, unusual rainfall patterns in some years, high evaporation, floods, and droughts affecting some agricultural areas of the country, are among the problems affecting water availability. One of the challenges to Lao PDR is to expand its irrigation capacity (including water storage and distribution infrastructure) to overcome localized temporary water shortages in a country so richly endowed with water resources. Lao PDR had almost doubled its irrigation areas from 138,077 hectares in 1995 to 270,742 hectares in 2005 (MAF 2006). Rice production has dramatically increased from 1.3 million tonnes in 1993 to 2.7 million tonnes in 2007 (MAF 2010). For the time being, there is insufficient data to construct an indicator capturing the adequacy of water supply for Lao agriculture.

Table 5.2 Water Usage in Lao (in million m^3)

Sector	Volume	Percentage (%)
Agriculture	4674	82
Domestic supply	456	8
Industry	570	10
Total	5700	100

Source: WEPA 2012

The available water in Lao PDR is 270 billion cubic meters and from this figure, only about 5.7 billion cubic meters or 2 percent has been used for differing industrial sectors (WREA 2012). The remaining balance of 264.3 billion cubic meters flows into natural rivers to enhance ecosystem services and functioning.

The piped water system in Lao is considerably low, with water accessible to 138 600 households (825 500 persons). Around 52.5 per cent of households in urban areas have access to clean water from water supply systems in municipalities (Vientiane, LuangPrabang, Thakek, Savannakhet, and Pakse). The pipe system has a capacity to pump about 240 000 m^3/day. The per capita consumption ranges from 255 liters per capita per day (L/c.d) for Vientiane through to 45 L/c.d for Phongsaly (WASRO 2008).

In rural areas only 1 per cent of the population have clean water supplies. Nearly 53 per cent of households in rural areas have a water source located close to residential areas. The other remaining 47 per cent of households are required to travel further from their homes to collect water. About 27 per cent of the rural population use septic toilets and about 10 per cent use pit latrines (WASRO 2008).

5.3 Impacts

The most obvious impact on water availability is increased use of underground water. This can reduce supply in some areas, such as expanding urban and industrial sites. The water's contamination level is also generally unknown due to a lack of quality assessment. It is revealed that in general there is limited available information on groundwater in Lao PDR. The only regional assessment of groundwater potential is a JICA-supported study of groundwater in Champasak and Saravane provinces. This study shows that groundwater is an important source of water for rural communities, as well as for cottage and small- scale industries. Many wells have been drilled throughout the country for this purpose and for irrigation. In most cases, the depth of the rural water supply wells in lowland areas varies between 30 and 45 meters and the yields vary from about 1 litre/sec to not more than 5 litres/sec (WEPA 2012). Groundwater is, and will probably remain, the main source of rural and small town water supply, especially in lowland areas located far from other surface water sources. Risk to groundwater use can be caused by poor quality, such as high content of arsenic; upstream users; and by local communities themselves through overuse or contamination. If surface water storage is developed further and there is less flooding, groundwater recharge will be reduced. This is probably not a serious problem in the short term, but a survey and database of groundwater conditions and usage would better enable the assessment of possible risks. To date, there are a limited number of regulations and measures to manage and protect groundwater at all levels of the country, while accessibility and impacts from uncertain and contaminated groundwater quality are potentially increasing.

Water-borne disease (diarrhea, infectious diseases, and skin disease) significantly impacts rural communities. Frequent outbreaks of water-borne diseases indicate that access to clean water is still limited in rural areas. In the most critical areas, such as remote rural communities in the Savannakhet plain, villagers may have to travel up to 1 or 2 kilometers to get two buckets of water, which is often of low quality (WRCC 1998).

The availability of water resources has created favorable conditions for the people of Lao PDR and it provides the potential for socio-economic development. However, the quality of surface and ground water is sometimes poor, creating many types of diseases in both urban and rural areas and in both the rainy and dry seasons. Water and excreta-related diseases, such as malaria, dengue, cholera, typhoid fever, and parasitic infections, are common. This is due to the fact that people in rural areas

often drink raw water without boiling and some households do not use mosquito nets and lack toilets (WRCC 2008).

Bad water quality has an impact on aquatic resources and the vulnerability of aquatic species and their habitats. Rivers and perennial streams are key features in the lowlands and important sources of fish and other aquatic products. They sustain a range of aquatic organisms throughout the year. They are also subjected to large annual fluctuations in volume and flow between the rainy and dry seasons. As these are permanent water bodies, they serve as dry season refuges to a broad range of fish and aquatic animals and are critical habitats for a number of strictly river-based species.

Perennial ponds, marshes, and oxbows are common in the lowland-floodplains. They serve an important function by receiving excess water during the rainy season and holding it throughout the dry season. These water bodies are usually shallow and vary greatly in size over the course of the year - expanding during the rainy season and receding during the dry season. The key species are mainly floodplain fishes, but some riverine fishes are trapped when the water recedes following periods of flooding. Because the water is relatively fertile and shallow in areas, many types of aquatic plants, molluscs, crustaceans, amphibians and reptiles are abundant. Fishing in perennial water bodies such as ponds, marshes and oxbows is less specialized than river fishing and requires less investment. These areas are often of special importance to poor people.

Fish species diversity in the Mekong basin is also important. There are an estimated 1 200 species and about 500 indigenous species that are reported to live in the MekongRiver and its tributaries in the Lao PDR. Of these, nine species are threatened, and 25 species are suitable for aquaculture. In addition, the Mekong fish fauna is characterized by a high degree of within-species diversity. The dynamic nature of this floodplain ecosystem also drives fish to migrate, often over long distances, contributing to both genetic mixing and isolation of populations. Although only a fraction of migratory species has been studied, and only in modest detail, a high proportion of these are thought to have distinct populations within the Mekong Basin (WREA 2010).

The status of the aquatic environment has not been well studied. However, there are some case studies focusing on the aquatic environment, which describes its categories, roles for local people, abundant resources and wetlands. These aquatic resources play an important role in the livelihood of the local people. Particularly in providing sources of protein, especially important to the rural poor.

5.4 Responses

5.4.1 Institutional set-up

Recently, the Lao National Mekong Committee (LNMC) has been reorganized as the National Water Apex Body, in which the Department of Water Resources (DWR), under the Water Resources and Environment Administration (WREA), is functioning as its Secretariat and responsible for macro water resources management throughout the country. Furthermore, the Government has initiated an effort to strengthen related water legislation and institutions. This includes capacity development and the setting up of hydrological boundary-based water resources management in some priority basins of the country. It is planned that the bulk allocation of water resources for domestic water use be used as the model for other sectoral allocations.

The Water Resources and Environment Research Institute (WERI) is setting programs for groundwater capacity assessments and ambient water quality monitoring over the next five years. The National Environmental Quality Standard, issued by WREA, will be the basis for ambient water quality monitoring. Along with other functions on water resources management, responsibilities and coordination arrangements among agencies on groundwater and water quality also need to be strengthened.

The Department of Meteorology and Hydrology (DMH) is strengthening its functional capacity by setting up early warning systems for water caused disasters. This is expected to better serve society and will work in close coordination with the National Natural Disaster Management Committee for post flooding recovery and relief.

For urban areas, the Department of Housing and Urban Planning (DHUP) and the Water Supply Regulatory Office (WASRO) under the Ministry of Public Works and Transport (MPWT) are responsible for urban water supply. DHUP assists the Minister of MPWT in administration of the water supply sector, including: i) formulating sector strategies (medium and long term), ii) preparing training programs on planning and management, and iii) drafting regulations, standards, technical specifications and performance indicators. WASRO assists the provincial authorities in issuing licences to suppliers, undertaking independent tariff reviews, presenting recommendations to the provincial authorities, protecting the standards of service customers receive through ensuring compliance with regulations, resolving disputes between suppliers and their customers, and encouraging suppliers to become more efficient through competition and the publication of regular performance reports. MPWT also put in place a Water Supply Regulatory Committee (WSRC) to direct, monitor and supervise the activities of the water supply regulatory office (WASRO). The Committee reports directly to the Minister. WASRO acts as the secretariat to the WSRC.

TheMinistry of Public Works and Transport (MPWT) carries out the following functions: 1) facilitation and coordination of the development process for water supply and wastewater management systems in urban and rural areas; 2) setting out short, medium and long term strategies on water supply development; 3) staff training on planning and management of water supply systems; and 4) studying of regulations, standards, technical specifications, and performance indicators of water supply systems.

The Ministry of Public Health is responsible for the facilitation, coordination and direction of all rural water supplies; and urban and rural environmental hygiene activities.

Provincial Governments are responsible for coordination, facilitation, and investment support in the development of water supply and wastewater management systems, and environmental hygiene;

Nam Papa State-owned Enterprises (NPSEs) are responsible for management and operation of all water supply and wastewater management systems and development of raw water in urban and rural areas within their respective provincial boundaries. The operations are based on commercial principles and in accordance with three-year rolling corporate plans, as well as and the compliance of the management of sanitary facilities with the sanitation regulation issued. Information made available from nearly all the NPSEs indicates that some simple water quality sampling and testing is being performed at treatment plants and other places in the distribution network. Tests performed include pH, turbidity and residual chlorine.

The National Center of Environmental Health and Water Supply (commonly known as "Nam Saat") under the MOH is responsible for the management of technical aspects in promoting rural water supply and urban and rural environmental hygiene throughout the country. Nam Saat focuses on increasing public awareness, community ownership and public participation in the development process. After constructing clean water schemes, Nam Saat hands over the responsibility for these systems to villagers and acts as a facilitator. In addition, the Lao government supports Nam Saat to provide water supplies and sanitation to the remote and poorest areas of the country. Urban water supply systems are owned by provincial governments and are managed through a delegated model of state-owned enterprises.

5.4.2 Other initiatives

Raising awareness about water-saving is also an important part of the national public administration reform process. Greater public awareness, participation and consultation needs to be incorporated into water resource management activities. These must be based on a commitment to greater transparency in decision-making, accountability to stakeholders and the involvement of communities (villages) in water resource protection and management. Water users and beneficiaries receive information on the management of water resources through mass media such as newspapers, radio, television, newsletters, and technical brochures and other means of communication. Mass media is a common means for disseminating and improving community awareness on water resources management.

The government has set a water supply sector investment goal to progressively increase the availability of safe, piped water to 80 per cent of the urban population by 2020 from current coverage of 52.5 per cent. The main challenge to achieve this goal is that the government has to increase water supply coverage by 27.5 per cent at an additional cost of US$185 million.

CHAPTER 6 BIODIVERSITY

Lao PDR is one of the most biodiversity-rich countries in South East Asia. The variety of habitat types of high international significance in Lao PDR supports a great diversity of species. There are about 1140 animal and plants., while most mammals in Lao PDR are both highly endangered and of global significance.

6.1 Drivers of change and pressures on biodiversity

6.1.1 Economic expansion

Economic expansion has resulted in a negative impact on biodiversity. The principal cause is due to the following activities: overexploitation of biological resources; destructive harvesting techniques; modification and conversion of natural ecosystems; and knock-on effects from other production processes.

For instance, logging is one of the main causes of deforestation. Logging concessions lead to degraded land by converting large tracts of healthy forest. In addition, roads have to be made into the forests in order to get timber. This has also created easier access for wildlife hunters. Other sectors, such as hydropower, also threaten biodiversity. Large areas of land become flooded which displaces wildlife from their natural habitat.

6.1.2 Population and Poverty

The Lao PDR is a Least Developed Country, where poverty affects up to 39 per cent of the population especially in remote areas. There is also a large disparity in development between the city and countryside. The lack of money and alternative means of livelihood are critical factors that drive many people to make unsustainable use of forests. The four fundamental sectors of the Government's strategy on poverty alleviation are agriculture and forestry, health, education, and road infrastructure.

For many generations, Lao rural people have depended on forests and biodiversity resources, particularly agricultural and fishery biodiversity, for the basis of their livelihoods and basic needs. However, poverty still remains high in Lao PDR.The heavy reliance on natural resources makes people particularly vulnerable to natural disasters and crop failures, as well as unstable or changing economic conditions.

Human population and development pressures have increased in Lao PDR, especially since 1990, resulting in increased habitat destruction and the exploitation of numerous species. It is clear that as a result of these pressures the wildlife population is dramatically declining. In remote areas of the country local people practice shifting cultivation clearing forests for agricultural purposes. Incidents of wildlife and human conflict occur when there are attacks on humans and livestock, as well as incidents of crop raiding. The reasons behind these conflicts are mostly connected to habitat pressures and the reduction of the wildlife's natural food through increased human activity.

6.1.3 Consumption pattern changed

The consumption pattern of biodiversity can be divided into a number of different aspects: agriculture; forestry; aquatic; cultural and nature-based tourism; forest watershed catchment protection services; wetland pollution control and nutrient cycling services; and other biodiversity and ecosystem services.

Improved accessibility between districts and towns, combined with an increased external demand, has resulted in a rapid increase in the cross border trade of valuable Non- Timber Forest Products (NTFPs). There has been increasing concern of the sustainability of the trade due to the large volumes actually being extracted.

6.1.4 Inappropriate harvesting of Non- Timber Forest Products

Improved accessibility between districts and towns, combined with an increased external demand, has resulted in a rapid increase in the cross border trade of valuable Non- Timber Forest Products (NTFPs). There has been increasing concern of the sustainability of the trade due to the large volumes actually being extracted.

A NTFP management system that takes into account current factors such as population growth, ownership, commercial sale, and degradation of the environment is not yet devised. Without this, competitive and unsustainable harvesting will continue, leading to further depletion of the existing resources in most areas.

Overexploitation and destructive harvesting techniques are also a concern. Although there is little information about the impacts of subsistence-level resource use, activities in the logging, NTFP, and wildlife trade sectors are known to involve unsustainable exploitation of key areas and species, and sometimes employ destructive harvesting techniques.

6.1.5 Illegal logging

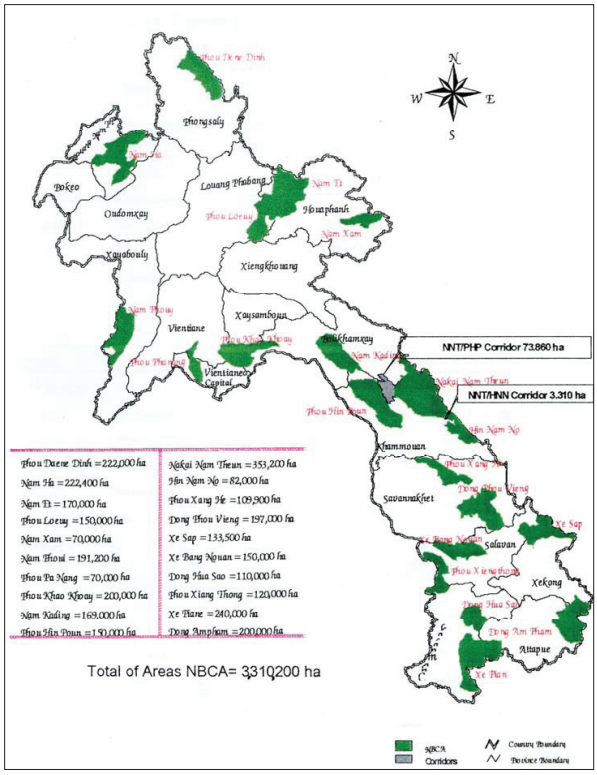
The last few decades have witnessed heavy losses in biodiversity resources due to poor forest management, illegal logging, unsustainable hunting and fishing practices, wildlife trade, and shifting cultivation. This has led to the country's forest cover decreasing, which has had negative impacts in the areas of biodiversity loss and degraded water sources, on people's lives, and in rural areas. The persistent overexploitation of natural resources will result in depriving future generations of vital resources, thereby increasing the risk of poverty.

6.2 State and trends

6.2.1 Protected Areas and Habitat

The total protected areas of Lao PDR, known as National Biodiversity Conservation Areas, are 3.3 million hectares, about 15 per cent of the national land area. Map 6.1 shows the locations of 20 established protected areas throughout the country and the area of each protected area (Department of Forestry 2005; WREA 2010b).

Figure 6.1: Map of National Biodiversity Conservation Area



Source: Department of Forestry 2005

Habitat loss has occurred due to many reasons, such as forest fire, hydropower, forest logging, and shifting cultivation. In remote areas of the country, local people practice shifting cultivation - clearing forests for agricultural purposes and putting pressure on forests in high biodiversity areas. The expansion of shifting cultivation in forest areas has increasingly contributed to deforestation, with an estimated annual clearance of about 300 000 hectares. The Lao PDR Government plans to halt the practice of shifting cultivation by the year 2020. As result of this policy initiative, shifting cultivation decreased by about 25 000 hectares between 1998 and 2000.

Estimates of annual forest loss, however, vary greatly. As such, it is difficult to predict with any certainty what land use changes will occur in the future. Reduction in national forest area in the 1980s was estimated to be between 100 000 - 200000 hectares per year or about one per cent of the 1981 forest area. Of this, approximately half of the forest clearance arose as a result of shifting cultivation[4] . Timber harvesting and forest fires mainly accounted for the rest. Deforestation estimates in the latter part of the 1990s range from 0.3% to 1-2% of the national forest area per year (STEA and Worldbank 2005).

[4] Total shifting cultivation area in any one year was estimated at 300,000 ha. Of this, about one third was cleared for the first time and actually resulted in forest deforestation, and only a small proportion was in areas of high forest.

6.2.2 Species Diversity

Surveys conducted in cooperation with international experts have recorded at least 166 species of reptiles and amphibians. Ten amphibian species are threatened and one specie is likely to occur only in the Lao PDR.Surveys have reported 247 mammal speciesincluding three new species. These consist of the Muntiacustruongsonesis, the Muntiacusvuquangesis and Pseudoryxnghtinhensis, which occur only in the Annamite range, a landmass forming the boundary between the Lao PDR and Vietnam. Out of the reported number of mammal species, 60 have been classified as threatened.

Pafa, Ban Dondeng, Champhone district © Savannakhet 2007

Slow Loris © Lao National Tourism Administration 2010

Birds have been the best-surveyed class of animals in thecountry. Approximately 700 species of birds are recorded in Lao PDR (WREA 2010b). According to a 1996 survey, there are 112 key species of birds. In 1999, this figure was increased to 150 key-species, of which 27 species are globally threatened and 47 species are near threatened (Duckworth *et al*. 1999). Surveys have recorded nearly 90 species of bats, of which 51 are considered to be key species. New species continue to be recorded and, as many areas in the Lao PDR have not been surveyed, more species are likely to be found. Many species are at risk of extinction due to their exploitation for food.

Yellow Rumped © Lao National Tourism Administration 2010

Kha-nyou or Laotian rock rat © Khammouan 2009.

About 500 indigenous fish species are reported to live in the Mekong River and its tributaries in the Lao PDR, according to a 2001 survey conducted by Kotellat and his team (Kotellat 2001). Nine of these species have been classified as threatened and twenty-five are suitable for aquaculture.

Non-Timber Forest Products (NTFPs) are important to the national and local economy as they are used as a resource for subsistence as well as trade. NTFPs have a high commercial value and it is estimated that about half of the cash income of rural households is derived from NTFPs. Previously, NTFPs have received little attention through the national forest policy. Their neglect has probably been due to their diverse and complex nature and their position outside of mainstream economic development.

Lao people consume wild vegetables,including aquatic and terrestrial, annual and perennial plants. This tradition has been handed down from one generation to the next. Many species have been planted in home gardens but their use varies according to local traditions, culture, and naturally availability.

The Lao PDR lies within the centre of the domestication of Asian rice (*Oryzasativa* L.) and it is recognised to be the centre of origin of glutinous rice types, resulting in the country becoming the largest producer and consumer of glutinous rice in Asia (AppaRao*et al* 2001a). The cultivated varieties of lowland rain-fed and upland rain-fed rice differ considerably in morphological, physiological, agronomic, and grain quality attributes. In addition to the traditional varieties grown by farmers, hybrids from cultivated rice and wild rice are also commonly found. The rice varieties found in the Lao PDR differ significantly in terms of their ecological requirements, as is the case of lowland paddy and upland rice and also for the different wild rice types. The National Agricultural and Forestry Research Institute (NAFRI) currently has 13 193 samples of cultivated rice genetic materials and 237 samples of wild rice in cold (medium term) storage. For long-term conservation, duplicate samples have been sent to the International Rice Gene bank at International Rice Research Institute in the Philippines.

Medicinal plants are used in the prevention, diagnosis and treatment of diseases as well as ingredients for health products. The Lao PDR's location in South East Asia provides ecological systems with favourable conditions for the development of biodiversity, including medicinal plants that can be harvested for the production of traditional and modern medicine. (WREA 2004).

6.2.3 Species mutation (new species discovery)

Indochina has received a high profile internationally for being the only region in the world where new genera of ungulates are still being discovered: *Pseudoryxin* 1992 (Dung et al. 1993) and *Pseudonovibosin* 1994 (Peter and Feiler 1994, Timm and Brandit 2001). The validity of a third, the Giant Muntjac (*megamuntiacus vuquangensis*), is to be confirmed (Tuocet al. 1994; Schaller and Vrba 1996). In addition to these new genera several new species have been discovered. These consist of at least one additional muntjac (Giaoet al. 1998), a rabbit (validity as a species to be confirmed) (Surridgeet al. 1999), a civet (validity as a species to be confirmed) (Sokolovet al. 1997) and a remarkable new hystricognath - distinct at the genus level and still under description. Several other potentially new species await reviews of their genera before their novelty can be confirmed. As new species of mammals are being discovered far more frequently than is popularly believed, this rate of discoveries is unparalleled anywhere in the world in recent years.

Since 1994, the Wildlife Conservation Society (WCS) has also played a major role in assisting with faunal survey work. This has resulted in several exciting new species discoveries, particularly along the AnnamiteMountains bordering Vietnam. There has also been a large increase in the knowledge of the bat fauna of Laos, due to surveys in the mid-1990s assisted by scientists at the WCS.

6.3 Impacts

The country's economy largely depends on natural resources. Estimates have been made that biological diversity is the main source of wealth for the country (WREA 2010a). Maintaining the productivity of these important resources constitutes the true value of biodiversity and remains central to any national development strategy.

6.3.1 Damage to agriculture

Biodiversity also incurs costs through wild animal damage to crops. Pest damage to agriculture is also a problem throughout the Lao PDR.

Rodents have been identified by 58 per cent of upland rice farmers as a major constraint to rice production and insects by 38 per cent of farmers. Between 1995 and 1999, an average of 4 000 hectares of crops a year were destroyed by pests. With returns to rice production of 2.7 million kip (about US$2100)/ha/year, this equates to a cost of Kip 10.8 billion (about US$8.5 million) a year (MAF and STEA 2003).

6.3.2 Land and resource use opportunities foregone

A total of 3.3 million hectares of land is classified as actual or as proposed conservation areas and are legally protected (WREA 2010b). The establishment of protected areas precludes certain land and resource uses, most importantly commercial timber harvesting and cultivation. The opportunity costs of these economic activities foregone can be estimated by looking at returns to non-conservation land uses.

Assuming the gradual removal of conservation forests over a 50 year period, the abstraction of commercially viable timber, and the subsequent conversion of cleared areas to crops, gives a gross annual opportunity cost of timber and agricultural production benefits foregone of just under Kip 1200 billion (about US$150 Million) a year at current market prices (Table 6.1).

Opportunity costs are the income and other economic benefits derived from land, resources, investment, and development activities foregone or reduced by the need to conserve biodiversity. Three main categories of opportunity cost currently apply to biodiversity conservation in the Lao PDR:

- Controlling or limiting development technologies and production processes, which pollute, degrade or otherwise harm biological resources and ecosystems (for example, industrial wastewater treatment, sustainable logging practices, mitigation of development and urban impacts on biodiversity). As industrial and urban economic activities remain relatively low-level in the Lao PDR, they do not currently pose major threats to biodiversity and there are no major opportunity costs related to their control. The industrial sector, however, is targeted as a major area for future growth and urban populations are growing rapidly. Biodiversity conservation in the future may imply an increased level of costs in terms of industrial development opportunities foregone.

- Reducing or curtailing land and resource usesare incompatible with biodiversity conservation because they deplete species and convert natural habitats (for example, shifting cultivation stabilization, protected areas, logging, NTFP collection quotas, and bans on hunting). These costs are likely to be high for the Lao PDR. Currently, a wide range of resource utilization activities are limited or banned by law, and efforts are being made to control shifting cultivation and other agriculture in upper watersheds.

- Damage to other economic activitiescaused by wild species (for example, human and livestock disease; and pest damage to agriculture). These costs are significant for the Lao PDR. A significant proportion of rural households suffer regular damage to agriculture from wild animals, and there is a high incidence of insect-borne disease among both humans and livestock.

The first category of opportunity costs is difficult to quantify on the basis of available information. The following paragraphs, however, present partial estimates of the value of land and resource opportunities foregone, and pest damage to agriculture.

Table 6.1: Opportunity costs of crop and timber production foregone in conservation forests.

	Land made available (ha/year)	Potential production value (Kip billion)
0-5% slope (logging and conversion to rice)		
Timber	16 283	302.26
Crops		10.99
6-30% slope (logging and conversion to mixed crops)		
Timber	27 023	501.62
Crops		**24.76**
30-60% (logging only)		
Timber	18 672	346.6
Total conversion of conservation forests		
Timber	**61 978**	1 150.47
Crops		35.75
TOTAL		**1 186.22 (US$150 million)**

Source: authors

The amount of conservation forest under different slopes, extrapolated from national forest figures and excluding land with over a 60 per cent slope, is 3.1 million hectares. Potential commercial timber yields are 100 m^3/ha. It is also assumed that 25 per cent of timber on forest land is accessible for commercial harvest and 25 per cent of land is suitable for crop cultivation (MAF 2005).

Although largely unquantifiable, another important category of land and resource use-related opportunity costs in the Lao PDR are the costs of controlling the illegal wildlife trade and unofficial logging industry. Insufficient data, however, exist to enable these costs to be valued in monetary terms.

6.4 Responses

6.4.1 Monitoring and evaluation of the implementation of biodiversity's policy

The monitoring and evaluation of the proposed biodiversity policy should be based on the indicators set forth and carried out at the end of each designed implementation phase. However, successful implementation will require the support from all partners and levels.

6.4.2 Raising awareness and public participation

Environmental education and awareness as well as biodiversity education and awareness are of utmost importance for the Lao PDR. The benefits of environmental management as well as the management, conservation and sustainable use of biodiversity need to be explained to the public, to the government, to the private sector, to mass organisations, to the mass media, and to local people.

Environmental education, including information on biodiversity and conservation issues, has been incorporated into the curricula of common schools and vocational colleges in the Lao PDR. These curricula and teaching materials were developed by various organisations.

Attempts to raise environmental and biodiversity awareness have also been conducted in the form of meetings, lectures on policies, strategies, laws and regulations. Other forms of dissemination include the publishing of information in the mass media namely in newspapers, magazines and posters, as well as through radio and television broadcasts.

Intervention options include:

- Developing a biodiversity review checklist that integrates the environmental impact assessment and monitoring process
- Enhancing awareness and education regarding the significance of biodiversity resource conservation and its sustainable use.
- Increasing public awareness and education by focusing on the government, as well as the private and public sectors.
- Improving the communication process among all stakeholders.
- Disseminating the principles and targets of the CBD.
- Providing information on the status of biodiversity to the public.
- Creating awareness among the younger generation both within and outside of the education system.
- Increasing the number of qualified staff working in the field of education awareness and biodiversity conservation and management.
- Addressing gender issues in public awareness programmes.
- Upgrading the provision of education for people living in remote areas.
- Ensuring that budget allocations for this field are put in place.

CHAPTER 7 URBAN ENVIRONMENT

The economic and population growth in Lao PDR provokes concerns of a deteriorating urban environment. The capital, Vientiane, has a population of 740,010 people in 2008, and is growing by 4.7 per cent per year.The population of Savannakhet, the second largest urban centre, has more than tripled from 30,000 to 100,000 inhabitants between 1975 and 1995 (Lao Statistics Bureau 2006). Current development trends have spurred the urbanization process due to expanded industry and tourism sectors in the urban centres, combined with rural to urban migration. Such growth is known to lead to an increase in urban environmental problems and stress the cultural fabric of this ethnically diverse country.

7.1 Drivers of change and pressures

7.1.1 Urbanization rate and urban migration

Lao PDR has 1.2 million people, 20 per cent of the total population (6 million), living in urban area. The population density in the whole country is 25 persons per km^2. The population density in Vientiane Capital is 189 persons per km^2. The average population growth rate was 2 percent in 2005 (Lao Statistics Bureau 2009). However, urban population has been growing much faster at 4.7 per cent per year. The urbanization rate of 3.8 per cent annually is almost the same rate as neighboring countries such as Cambodia, Myanmar and Vietnam (UNESCAP 2009). Although the country's urban areas still generally have low populations, especially when compared with others in the region, the rate of urbanization of Vientiane Capital and other cities like Savannakhet is growing at much higher rates. Urban population growth, coupled with increasing urban migration, is impacting heavily on fragile urban infrastructures such as solid waste disposal systems. The urban environment also faces increased pollution. Natural disasters, particularly floods and droughts, pose considerable threats to long-term sustainable development. Urban areas in Lao PDR are growing. They are also the places where the country's economic development is most noticeable. They gain increasing access to national and international markets. They also are seeing improved roads, better and more reliable power networks, and digital telecommunication.

7.1.2 Transportation

Urban Transportation in Lao PDR is another issue impacting the country due to the increased number of motor vehicles in the country. The number of road vehicles in Lao PDR grew more than fourfold between 1998 and 2008- from 182 069 to 795 606 (Table 7.1). The number of vehicles in all provinces, particularly motorbikes was increasing more than heavy vehicle and light vehicle.

Table 7.1: Total number of vehicles registered in Lao PDR 1998-2008

Province	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Vientiane Capital City	101231	104328	112827	125025	144690	140853	172294	197492	231869	275473	319511
Pongsaly	947	960	988	1025	1089	469	2074	2335	2339	3596	4955
Luangnamtha	1245	1296	1399	1552	1743	3302	3680	4377	6173	8438	11714
Oudomxay	2091	2145	2290	2506	2870	1671	5356	6937	9583	11751	16168
Bokeo	2165	2199	2298	2443	2723	3499	6532	4450	7381	10113	13159
Luangpra-bang	6437	6549	6880	7361	8172	6845	13822	21093	26207	32767	40358
Xaiyabouly	1195	1269	1526	1896	2555	4265	7263	11118	13706	22963	27370
Hauphan	1554	1576	1638	1726	1861	5139	6972	7810	10851	13289	21470
Xiengkhuang	3535	3630	3889	4254	4845	5997	8968	11439	14197	17751	21827
Vientiane	8399	8584	9042	9693	10670	13601	17259	22579	25231	27664	38174
Bolikhamxay	1599	1639	1755	1923	2205	4902	8169	9920	12482	15340	19793
Khammouane	7388	7539	7950	8531	9481	13334	15066	16975	21002	25102	28847
Savannakhet	24930	25550	27342	29960	34152	35421	51561	59070	121773	95327	110948
Salavanh	1919	1935	1976	2034	2140	2308	8570	10027	11537	13748	16038
Champasack	16083	16452	17457	18915	21399	10081	34063	39751	47706	59069	96438
Sekong	581	595	633	684	777	1432	2074	2160	2438	2769	3538
Attapue	636	653	706	779	911	1715	2416	2873	3815	4450	5298
Xaysomboun	134	142	160	184	225	825	1254	1471	1471	1471	

Remark: The number of vehicle of Xaysomboun Province (including in Xiengkhuang, Vientiane and BolikhamxayProvice, 2008)

Source: Ministry of Public Works and Transport 2009.

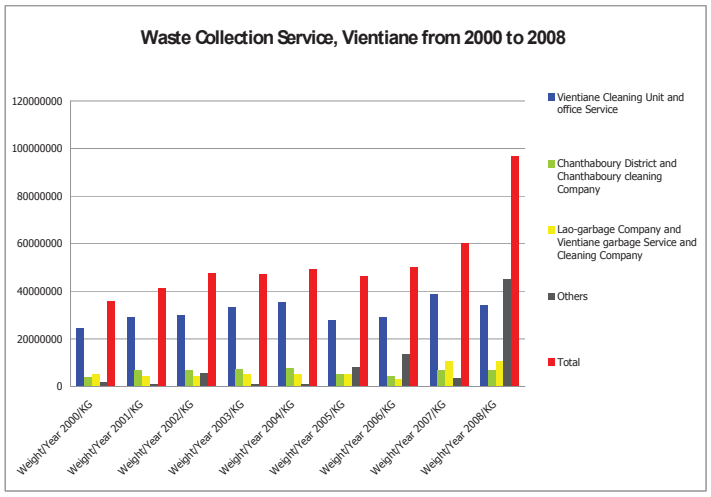
Public transport has been a top priority in solving traffic congestion in Vientiane. For example, Vientiane is researching a Master Plan on Comprehensive Urban Transport. The objective of the study is to formulate a master plan and prepare an implementation plan to help solve traffic congestion and to reduce road accidents. There are no public bus services in urban cities in Lao PDR, only buses available in Vientiane Capital. About 15 per cent of people use the bus and most are students.

Over the past 15 years a high percentage of the Government's public investment programme has been devoted to rebuilding the road system with impressive results. The entire road network amounts to about 32,600 km. This comprises 7,160 km of national roads, 8,950 km of provincial roads, 6,620 km of district roads, and an estimated 9,800 km of community and access roads. Of the total road network, some 4,590 km are paved, with the remaining sections either gravel or earth roads (MCTPC, 2002). Recent investment has been concentrated on the upgrading of the arterial road network, notably NR13. Some of the critical east-west links connecting Thailand and western Lao PDR to the border with Viet Nam are either complete (NR6 and NR7) or expected to be complete by 2004 (NR8 and NR9). The Northern Economic Corridor (NR3) connecting Thailand via Lao PDR to China is expected to be completed by 2007. Government attention is increasingly shifting to the local road network.

7.2 Waste generation – state and trends

Waste generation has been increased significantly in urban centres of Lao PDR, and only about 45-50 percent has been collected. From 2000 to 2008, Vientiane has more than doubled its waste generation and collection, as shown in Figure 7.1 (Source: Ministry of Public Works and Transport 2009).

Figure 7.1: Waste collection in Vientiane from 2000 to 2008



Source: Ministry of Public Works and Transport 2009.

The waste in Lao PDR consists of approximately 30 per cent organic material; 30 per cent plastic; 15 per cent paper; and 25 per cent glass, cans and other metals (STEA and Worldbank 2005). The annual waste generation in 2004 was 270 000 tons. Domestic waste accounts for most of the waste 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 7.2). Hazardous and toxic wastes such as batteries, old paint cans, aerosols and other refuse are also mixed with this waste. The comparatively low content of organic material in municipal solid waste is mainly due to the agricultural lifestyle, even in urban areas, where a large proportion of food waste is recycled as animal feed.

Table 7.2: Average per capita waste production in towns

Town	Per Capita Waste Production
Vientiane Capital	0.8 kg
LuangPrabang	1.0 kg
Thakhek	0.8 kg
Savannakhet	1.0 kg
Pakse	1.4 kg

Source: Ministry of Public Works and Transport 2002.

7.3 Waste disposal

According to surveys in 57 urban areas, only Vientiane City and the four secondary towns of Luangprabang, Thakhek, Savannakhet and Pakse use landfills for solid waste disposal (Tables 7.3 and 7.4). However, the disposal areas are small and have no leachate collection and monitoring wells. Elsewhere, open dumping and burning are common practices for waste disposal in Lao PDR Table 7.5 and 7.6) (Ministry of Public Works and Transport 2002; 2009). Hazardous and infectious wastes

are often disposed in the same areas and manner as municipal waste. There is inadequate solid waste management in the secondary cities of Lao PDR.

It is clear that the landfills were not monitored if they had cause groundwater quality problems, as leachate contains a wide variety of contaminants and hazardous chemicals. During raining season, Surface water run-off from the landfills could also cause waste sediment loads in receiving water bodies (rivers, lakes).

Table 7.3: Waste collection in major urban centres

Waste Collection Service, Vientiane Capital		
Total Urban Area (No. District)	4	
Total Area Waste Collection (No. Villages)		
Waste Volume Collected and Landfilled	120-130 tons/day	
Waste Collection Service, LuangPrabang		
Total Urban Area (No. Villages)	33	
Total Area Waste Collection (No. Villages)	35	
Waste Collection Service, Thakhek		
Total Urban Area (No. Villages)	35	
Total Area Waste Collection (No. Villages)	26	
Waste Collection Service, Savannakhet		
Total Urban Area (No. Villages)	44	
Total Area Waste Collection (No. Villages)	22	
Waste Volume Collected and Landfilled	18-20 tons/day	
Waste Collection Service, Pakse		
Total Urban Area (No. Villages)	43	
Total Area Waste Collection (No. Villages)	39	
Waste Volume Collected and Landfilled	18-21 tons/day	

Source: Ministry of Public Works and Transport (2002).

Table 7.4: Number of landfill and waste collecting facilities in major urban centres

Landfill, Vientiane Capital		
General Characteristics		
Date Operational	1998	
Site Area	62 ha	
Disposal Area	Ha	5 cells with internal roads
Lifespan	15+ years	This estimate may be conservative
Waste Collection and Disposal Equipment		
No. Tipper Trucks	19	
No. Container Trucks		
No. Containers		
No. Backhoe Loaders (Landfill)	1	

Landfill, LuangPrabang		
General Characteristics		
Date Operational	June 2002	
Site Area	15 ha	
Disposal Area	3.5 ha	5 cells with internal roads
Lifespan	10+ years	This estimate may be conservative
Waste Collection and Disposal Equipment		
No. Tipper Trucks	3	1 provided by GTZ; all to transfer to UDAA. Also, 2 older trucks as back-up
No. Container Trucks	1	All to transfer to UDAA
No. Containers	13	6 from Japan, 7 Laos-built provided by PMU. All to transfer to UDAA
No. Backhoe Loaders (Landfill)	1	All to transfer to UDAA
Landfill, Thakhek		
General Characteristics		
Date Operational	05 August, 2000	
Site Area	9 ha	
Disposal Area	2.2 ha	
Lifespan	10+ years	This estimate may be conservative
Waste Collection and Disposal Equipment		
No. Tipper Trucks	2	All to transfer to UDAA
No. Container Trucks	1	All to transfer to UDAA
No. Containers	12	7 from Japan, 5 Laos-built provided by PMU. All to transfer to UDAA
No. Backhoe Loaders (Landfill)	1	All to transfer to UDAA
Landfill, Savannakhet		
General Characteristics		
Date Operational	August 2000	
Site Area	13.5 ha	
Disposal Area	4 ha	Four 1ha cells
Lifespan	5 -10 years	
Waste Collection and Disposal Equipment		
No. Tipper Trucks	2	All to transfer to UDAA
No. Compactor Trucks	1	All to transfer to UDAA
No. Container Trucks	0	
No. Containers	0	
No. Backhoe Loaders (Landfill)	1	All to transfer to UDAA
Landfill, Pakse		
General Characteristics		
Date Operational	July 2000	This was the first of the project landfills to be constructed.
Site Area	13.5 ha	
Disposal Area	2.2 ha	
Lifespan	5 years	Limited lifespan is a major operational issue.

Waste Collection and Disposal Equipment		
No. Tipper Trucks	2 + one 2nd hand purchased later	All to transfer to UDAA
No. Container Trucks	1	All to transfer to UDAA
No. Containers	15	7 from Japan, 8 Laos-built provided by PMU. All to transfer to UDAA
No. Backhoe Loaders (Landfill)	1	All to transfer to UDAA

Source: Ministry of Public Works and Transport 2002.

Table 7.5: Solid waste management in small towns (waste collected)

Name of towns	Waste generation rate (kg/c/d)	No. of village	Waste collected (Tons/day)	No. of trucks
Samneua	0.5	10	12.1	1
Pek	0.5	29	10.2	2
Vangvieng	0.5	11	6.0	1
Paksane	0.5	14	6.1	2
Phongsaly	0.5	9	3.7	1
Namtha	0.5	16	9.0	2
Xay	0.5	24	20.7	2
Houaxay	0.5	15	2.4	1
Sayaboury	0.6	21	15	2
Saravane	0.5	8	3.0	1

Source: Ministry of Public Works and Transport 2009.

Table 7.6: Solid waste management in small towns (disposal area/lifespan)

Name of towns	Operational year	Disposal area (ha)	Lifespan (year)	Landfill tractor
Samneua	2006	1	15	1
Pek	2006	2	15	1
Vangvieng	2006	2	15	1
Paksane	2006	2	15	1
Phongsaly	2007	1	15	1
Namtha	2007	1.5	15	1
Xay	2007	1.5	15	1
Houaxay	2008	1.5	15	1
Sayaboury	2008	2	15	1
Saravane	2008	2	15	1

Source: Ministry of Public Works and Transport 2009.

7.4 Response

Waste management has only recently developed in Lao PDR and there is no appropriate legal framework for it yet. The National Assembly approved a draft law regarding national hygiene, health care, and protection on 6 May 2001. This law defines the main responsibilities for waste management and provides a framework for more detailed regulations. But the implementation has been problematic due to lack of resources.

The main government body responsible for waste management is the Ministry of Public Works and Transport (MPWT) The main agency responsible for the environment is the Water Resources and Environment Agency (WREA). While this agency is involved in the preparation of environmental laws and regulations, it is not directly involved in waste management like in many other countries.

The responsible agency for waste collection and disposal is the local authorities. In Vientiane Capital, it is the Vientiane Cleansing Unit (formally known as the Sanitation and Environment Agency) under the Vientiane Urban Development Administration Authority. For the other cities, the provincial administration and the district office of Public Works and Transport are the key responsible agencies.

The legislative basis for solid waste management in each city is by provincial decree. The provincial decree allocates the responsible agency or committee, defines the general scope of work, and sets the fees to be collected from private households, government offices and commercial enterprises. The provincial decree forms the most effective management tool for supervision and for public co-operation. While these regulations provide a broad legal framework for waste management, there are still many gaps that need to be filled. In particular, rules to support community and private sector involvement have to be set up. The local authorities have also not yet taken serious steps to introduce recycling.

The Government has yet to formulate any wider vision on integrated waste management. An integrated waste management strategy would allow the government to introduce preventive measures targeting all producers of waste, including waste minimization, waste reuse, and recycling. The role of the Water Resources and Environment Administration should be strengthened and clarified. The concept and implications of the 3Rs (reduction, reuse, and recycling) should be promoted, especially through awareness raising and public participation activities. The regulations and measures should be implemented and enforced properly. Finally, the element of monitoring and evaluation of the management practices should be followed up.

CHAPTER 8 FORESTS

Deforestation and land use changes contribute approximately 17 percent of human induced carbon emissions (IPCC 2007). It has been recognized that forests play an important role, not only in climate change mitigation, but also in climate change adaptation. Thus, the role of forests has changed so that they not only provide timber and non-timber forest products, but also a range of environmental services which protect waterways, conserve soil, provide biodiversity habitats, as well as perform numerous other ecosystem services. With the development of new international financing mechanisms to address the benefits forests provide, reducing emissions from deforestation and degradation has been identified as the most cost efficient way to mitigate climate change. Therefore, avoiding deforestation has become a priority of Lao PDR.

Lao PDR is rich in forests. They are a vital economic resource and provide an essential contribution to the consumption and income of the rural poor, as well as conserving biodiversity, soil and water values. The rural population, who make up 80 per cent of the Lao population, relies heavily on the forest for food, fuel, fiber, and shelter. Despite the importance of the resource, deforestation and forest degradation are accelerating at an alarming rate. The combined effect of extensive commercial exploitation and small-scale use and encroachment has led to serious forest loss and degradation. Although specific data is limited, difficult to access, and of mixed quality, enough is known of the contribution of the forest to development to indicate the importance of the sector and the priority need for policy reform.

Government of Lao estimated that Lao had 9.5 million hectares of forests in 2010. One key criteria in the national definition of “forest” in Lao PDR is the trees canopy coverage with more than 20 per cent (Department of Forestry 2005). This is a significant difference from the international definition of 10 per cent trees canopy coverage by the Food and Agriculture Organization of the United Nations (FAO 2010). FAO estimated that Lao PDR had about 15.8 million hectares of forests in 2010.

8.1 Driving forces and pressures

Major causes of deforestation are shifting cultivation,fuelwood collection, agricultural encroachment, and unsustainable logging practices. In recent years, deforestation has been increasingly caused by infrastructure projects (reservoirs, roads) and the conversion of forest lands for agriculture and rural development projects, including resettlement of the population.

Recent reviews and studies on causes of deforestation in Lao PDR found that there are a number of trends that lead to deforestation and forest degradation which can be identified and their long term impact on forest cover and land use can be observed (Table 8.1) (Department of Forestry 2005; MAF 2010; WREA 2010a; Moore *et al* 2011).

Table 8.1: Causes of deforestation

Causes	Significance in contribution to deforestation		Remarks
	1992-2002	2002-2009	
Logging and fuel wood extraction	++++	++++	Commercial logging: decreased Illegal logging: increased Fuelwood extraction: increased
Slash and burning cultivation	+++	++	Decreased in general, with regional differences
Agriculture Expansion	++	++++	Large concession: increased Small investment: increased
Plantation	+	+++	Large concession: increased Small investment: increased
Dams	++	++	Similar
Mining	+	++	Increased

8.1.1 Wood production

Wood products account for more than 35 percent of Lao PDR's total export revenues, and forestry contributes more than 15 percent of GDP.

The amounts of timber harvested from production forests average 224,300 cubic meters (m^3) per year over the last decade. At least 620 000 m3 per year are harvested or collected for traditional wood use and some 1.5 million m^3 for fuel wood and charcoal. In 2005, fuel wood and charcoal provided about 73 per cent of the national total primary energy consumption (Ministry of Industry and Commerce 2006). These other wood products, however, do not come entirely from forests. If half of these traditional forest products were to come from production forests, they might amount to more than one million cubic meters per year. Total extraction from production forests would thus be some 1.3 million m^3 per year.

Unsustainable exploitation of timber and Non-Timber Forest Products (NTFPs) is another cause of forest degradation. For example, approximately 80 per cent 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 m^3/year leading to excessive fuel wood gathering, tree felling, and further pressure on remaining forests (Ministry of Industry and Commerce 2006). Excessive timber harvesting occurs most seriously in the central and southern regions of Lao PDR with many forest concession areas being exploited at a rate higher than 15 m^3/ha, which has been set by government as the sustainable rate of timber extraction. This has led to forest fragmentation and an increased area classified as temporary unstocked forests.

8.1.2 Shifting cultivation

It is generally agreed that shifting cultivation systems can be sustainable with long fallow periods when population densities are low. For Lao PDR, slash and burn agriculture is of particular importance as it is a major land use practice that involves more than 150,000 households or 25 per cent of the rural population (Roder 2001). Productivity of land used in slash and burn agriculture is extremely low, and

even lower if it takes into consideration fallow land. Even with its low productivity, slash and burn is still practiced widely in Northern Laos today. Many areas are still not easily accessible by roads and with no communication infrastructure in most rural areas, providing alternatives for income generation and food security remains a challenge. Moreover, the practice of slash and burn could be difficult to eradicate because of its significance to the traditions and culture of the northern upland people. This is despite it being part of the 2020 environmental strategy to phase out all slash and burn practices by 2010.

Shifting cultivation practices and forest fires are still the main cause of forest degradation in Lao PDR, particularly in the north (Department of Forestry 2005). In north Laos, yields tend to be low, generating increasing pressure on cultivation areas for rice self-sufficiency. While the State of the Environment Report 2001 identified 600 000 hectares of land under shifting cultivation, the government attributed deforestation and degradation due to this technique at about 200 000 hectares per annum in 2001 (STEA, NORAD and UNEP 2001). Of more concern is the trend in which current forest areas in northern Laos have been declining over the past 20 years, while potential forest areas, which incorporate unstocked forests (caused by shifting cultivation), have been increasing.

8.1.3 Industrial tree plantation

Industrial Tree Plantations were a minor driver of deforestation between 1992 and 2002. However, between 2002 and 2009 this changed with industrial tree plantations becoming a major driver of deforestation as both large concessions and small investments increased activities throughout Lao PDR. Numerous field studies and observations have reported that rubber planting is expanding rapidly in Laos. Private capital, almost entirely from foreign sources, is the primary catalyst for this. The world demand for rubber, particularly new demand from China's expanding economy, has boosted market prices. Investors likely see the abundant land and extensive farming systems of Laos as offering significant potential for increasing rubber supply.

8.1.4 Agricultural expansion

Agricultural expansion has been a long known cause of deforestation in Lao PDR. Between 1992 and 2002 it was considered one of the main drivers of deforestation in the country. Between 2002 and 2009, the rate of forest land conversion attributed to agricultural expansion has increased for both large concession areas and small investments. Recently, the rapid emergence of concession-based commercial contract farming has been identified as one of the key drivers to deforestation. The main commodities of interest in Lao PDR include maize, coffee, soybeans and cassava, with production centered around export markets.

8.1.5 Hydropower

Hydropower is the most abundant and cost effective energy source in the country (see Section 3.3). According to the latest forest assessment, 31 forest areas for hydropower dam construction have been identified as potential sites in line with the government policy to respond to regional demand, amounting to 140 635 hectares (Department of Forestry 2005). The hydropower sites are drivers of deforestation as areas designated for development are seen as financially attractive logging sites as no regeneration of forests is required after logging and no other area to replant and offset what is lost is required.

8.1.6 Mining

To date, there are no studies which analyze the relationship between mining and deforestation in Lao PDR. However, it is expected that mining activities and mineral exploration will increasingly impact forest resources in the future. In 2000, although Lao PDR had good mining potential, mining activities only accounted for about one per cent of GDP (STEA 2001). Recent figures now suggest that the mining sector is becoming a major contributor to GDP (see Table 3.5).

8.1.7 Infrastructure and urban expansion

Infrastructure through the expansion of roads leads to increased access to forest areas. Infrastructure development has increased significantly in Laos PDR over the past few years and is expected to grow as the country develops. This in turn means that increased access to forests could lead to increased pressures on forest resources. No study has thoroughly examined the impact of infrastructure development or urban expansion and forest resources in Lao PDR.

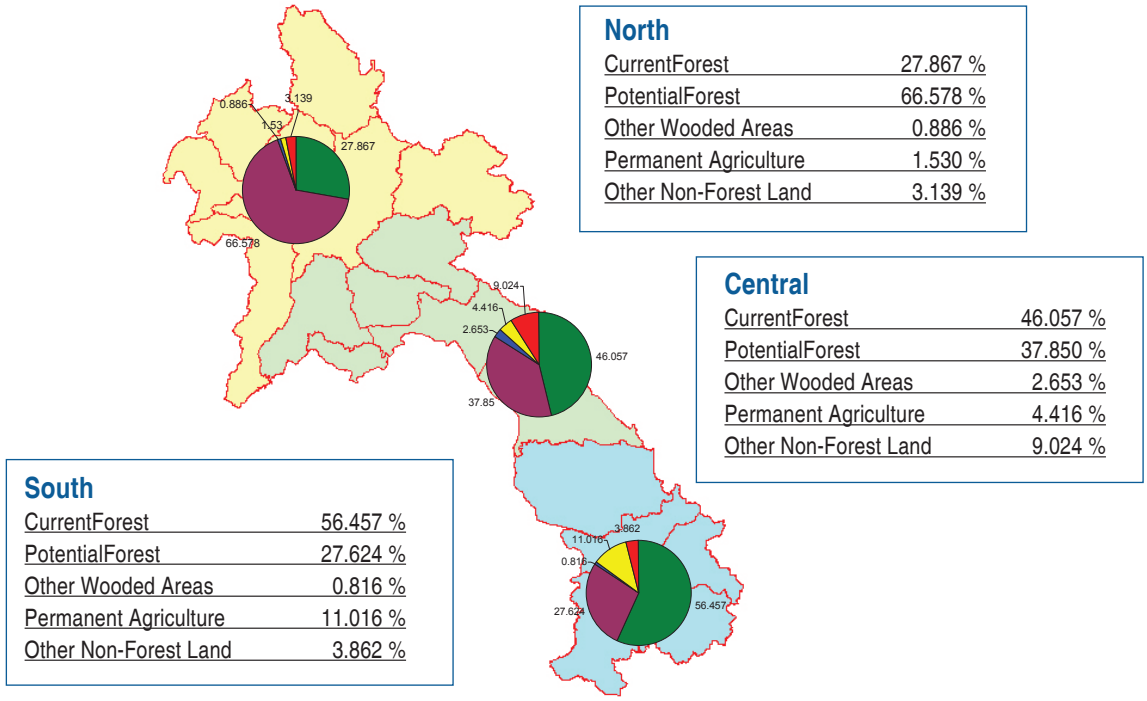
8.2 Forests - state and trends

Lao PDR experienced high deforestation rate in 1965-1982 and 1992-2002 (Table 8.1). More than 5.6 million hectares of forest have been lost in just 45 years, with annual loss at 0.83 percent. However, the average deforestation rate since 2002 has been decreased to 0.3 percent, much lower than the average of 1.3 percent in South East Asia (UNESCAP 2009). Information available estimates that about 74 per cent of the deforestation is in evergreen forests; 16 percent is in deciduous forests; and 10 per cent is in re-growth forests in recent decades. Considering the rich biodiversity in and the dependence of local communities on forests, deforestation isstill a significant environmental problem.

Table 8.2 Forest areas (using national definition)

Year	Area (hectares)	As % of total land area	Data sources	Average annual change (hectares)	Average annual change (%)
1940	16 576 000	70	Department of Forestry 2003; Phongoudome et al. 2008		
1965	15 155 200	64	Phimmavong et al. 2009	56 832 (1940-1965)	0.3
1982	11 636 900	49	Manivong et al. 1992 Vongsiharath 2006	206 958 (1965-1982)	1.2
1992	11 168 000	47	MAF 2005 Vongsiharath 2006	40 000 (1982-1992)	0.3
2002	9 700 000	41	MAF 2005a	1 50 000 (1992-2002)	1.3
2010	9 500 000	40	MAF 2005a	20 000 (2002-2010)	0.3

Figure 8.1 Forest/land use distribution by region in 2002.



Sources: Department of Forestry 2005

According to thereport Forest Cover and Land Use during 1992 to 2002 (Department of Forestry 2005), all forest cover areas which have more than 10 per cent of canopy density remained at 71.6 per cent (or 16.8 million hectares) of the total land area in 2002. Current forest types include evergreen, mixed deciduous, dry dipterocarp and plantation forests, which accounted for 41.5 percent; potential forests, including abandoned shifting cultivation areas account for 2.2 per cent; bamboo brakes account for 2.3 per cent; and temporarily unstocked forest that can be naturally regenerated account for 25.6 per cent.

At the same time, the potential forest area (including bamboo brakes, unstocked areas and areas used for shifting cultivation) has increased from 37.8 percent of the national area in 1992 to the current 47.1 percent. Within the potential forest area, unstocked areas have increased from 28.7 percent in 1992 to 42.6 percent (10.1 million ha) today, an area larger than the current forest.

It can be seen that the change of forest areas is quite extensive in the north as compared to the central and southern regions. The current forest in the north remains at 27.9 percent (2.7 million hectares), a reduction of 8.4 percent from 1992. Whereas the current forest in the central region has decreased by 5.7 percent during this time. The current forest in the southern region remains at 56.5 percent (3.8 million hectares), a reduction of only 1.8 percent. In contrast, the potential forests increased in all regions. The potential forest in the north rose from 56.2 percent in 1992 to 66.6 percent in 2002, similarly, the potential forest areas increased by 10 percent and 6 percent respectively for central and southern regions (Figure 8.1) (Department of Forestry 2005).

At the provincial level, the lowest current forest cover rate in 2002 was 13 percent in LuangPrabang province. The highest was 61 percent in Bolikhamxay province. However, during the last 10 years, the highest depletion of current forest is 18 percent in Phongsaly and Attapeu provinces.

As well as quantitative changes, forest quality has also deteriorated. Forest degradation encompasses decreases in stocking densities, changes in species composition and size structure and reductions in wildlife and plant populations. Thus, forest fragmentation has increased with small forest compartments (less than 10 ha) having increased as a proportion of the total current forest area from 0.9% in 1992 to 6.7% at present, while large forest compartments (larger than 1,000 ha) have decreased from 88% to 54%. Similarly, forest density has decreased dramatically with dense forest declining from 29% in 1992 to 8.2% at present and open forest increasing from 16% to 24.5%. With respect to stand structure, the forest area dominated by large trees has decreased from 4.65% to 3% of the total, area dominated by small-size timber has decreased from 43.63% to 41.26%, while pole-size forests have increased from 51.4% to 55.7% of the total.

Shifting cultivation areas all over the country decreased from 2.6 percent in 1992 to 2.2 percent in 2002. At the regional level, however, the shifting cultivation areas in the North slightly increased from 3.7 percent in 1992 to 4.1 percent in 2002, while in the central region it reduced from 2.1 percent in 1992 to 0.9 percent in 2002, and in the southern part it decreased from 1.6 percent in 1992 to 0.6 percent.

Results of field studies indicate that forests have changed in both negative and positive ways over the past 10 years. A number of areas covered with temporally unstocked forests or that abandoned shifting cultivation have changed to young pole-sized forests and may become healthy forests in the future. In contrast, many areas covered with dense forest ten years ago are now in the state of fallow as a consequence of unsustainable land use. In addition, as the socio-economic development of the country continues, it is expected that forest conversion to other land uses such as infrastructure and agriculture will continue, including for hydropower dams (Department of Forestry 2005).

8.3 Responses: strategies and actions for avoiding deforestation

Deforestation and forest degradation are not new phenomena in Lao PDR and forest strategies have been drafted in the past to address such problems. Overall, the Government of Lao recognizes the rapidly deteriorating forest resource situation and has set development targets to change this for 2005, 2010 and 2020. The targets include stabilizing shifting cultivation by 2005 and phasing it out completely by 2010. Tree plantations are also strongly promoted, and the classification, delineation and special management for protection forests, production forests and conservation forests has commenced (MAF2005).

8.3.1 Establishing National Biodiversity Conservation Areas (NBCAs)

Through Prime Ministerial Decree in 1993, 18 NBCAs were set aside specifically for conservation. Logging, collecting NTFPs, excavation or mining, expansion for shifting cultivation, exploitation of cultural or historical assets, and the use of explosives, chemicals, poisons and burning are prohibited on these areas. Since then, several more areas have been added so that there are currently 20 NBCAs and 2 green corridors. This means that 5.3 million hectares or about 22 per cent of the total land area is under some degree of protection (MAF2005).

8.3.2 Tree planting

Tree planting and improving the existing forest areas of Lao PDR has been identified as one of the major sector targets, which must be achieved to contribute to poverty reduction. The targets for 2020 are ambitious with natural regeneration occurring on up to 6 million hectares and trees being planted on up to 500,000 hectares in temporary unstocked forests. In the past, tree planting increased by 1700 ha/yr in the early 1990s and 17000ha/yr in the 2000s. Teak, in particular, has started to bring benefits to farmers from this programme of work. However, there was insufficient maintenance of young stands and thinning was rarely done, which both affected quality wood production. Furthermore, selection of sites and species prior to 2005 was not well done. Therefore, there is a need to improve tree plantation profitability, technology and market research during the implementation of the 2020 strategy.

8.3.3 Improving governance and the regulatory framework

The legislative and regulatory frameworks are still being formulated and developed and it is not uncommon to implement annual Prime Ministerial Decrees to cover gaps in the forest law when they are identified. Problems in forest law enforcement and governance are mostly related to harvesting and use of timber and NTFPs (MAF2005). In response, a forest surveillance unit was established under the Ministry of Agriculture and Forestry in 2008, which hopes to improve forest governance and decrease the rate of illegal logging.

CHAPTER 9 CLIMATE CHANGE

To date, there is no country-level study on climate change in Lao PDR. However, the forest sector will play a key role in mitigating and adapting to the impacts of climate change in the future. The predictions made by the Intergovernmental Panel for Climate Change (Cruz et al. 2007)that have relevance to Lao PDR include:

- General increases in the occurrence of extreme weather events.
- It is likely that future tropical weather (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures.
- Freshwater availability is likely to decrease, particularly in large river basins, due to climate change. Along with population growth and rising standards of living, it is estimated with high confidence that more than a billion people in Asia will be adversely affected by climate change by 2050.
- An increase in endemic morbidity and mortality due to diarrhoeal disease primarily associated with climate change is expected in South and South-East Asia.
- The trend in the number of rainy days between 1961 and 1998 has declined. Climate change projections indicate that the rainy season will become shorter in South East Asia.
- When compared to 1961 to 1990 Mekong water flow levels, it is estimated the levels will increase by 35 per cent to 41 per cent in the basin and by 16 per cent to 19 per cent in the delta, with ower values estimated for years 2010-2038 and higher values for years 2070-2099. In contrast, the minimum monthly flows are estimated to decline by 17 per cent to 24 per cent in the basin and 26 per cent to 29 per cent in the delta, suggesting that there could be increased flooding risks during wet season and an increased possibility of water shortage in dry season.
- Flooding could increase the habitat of brackish water fisheries but could also seriously affect the aquaculture industry and infrastructure, particularly in heavily-populated mega-deltas. A decrease in dry season flows may reduce recruitment of some species.

Observed impacts of climate change in Lao PDR are as follows (WREA 2009):

- A total of 29 floods were recorded across the country, including nine large floods (in 1966, 1971, 1978, 1995, 1996, 2000, 2002, 2005 and 2008)
- The majority of floods occurred in the central and southern parts of the country.
- Over the same period eight droughts were also witnessed, three of which were classified as severe.
- In addition, a total of six combined flood-drought events were observed
- In August 2008, Laos suffered devastating flooding , which was some of the worst in the history of climate records in Laos.

9.1 Responses to climate change

9.1.1 Reducing Emissions from Deforestation and forest Degradation (REDD)

The basic idea behind Reducing Emissions from Deforestation and Forest Degradation (REDD) is simple: countries that are willing and able to reduce emissions from deforestation and forest degradation should be financially compensated for doing so. Under the UN Framework Convention on Climate Change (UNFCCC), a number of proposals for an international REDD mechanism have been submitted and there has been growing multilateral and bilateral donor interest on supporting such a mechanism. It is believed that payments from developed countries to developing countries could shift the current economic incentives driving deforestation and make sustainable forest management a more profitable enterprise.

Once an international agreement is reached on REDD, community forests will be identified as a sound framework through which REDD can provide financial and livelihood benefits to forest-dependent communities and indigenous peoples. They do this by acknowledging their essential role in the long-term and sustainable management of forest ecosystems. If the livelihood needs of local people are ignored in the development and implementation of REDD strategies, significant leakage is likely to occur.

Lao PDR has responded with the formation of the REDD Task Force and has recently attracted a number of bilateral and multilateral financed activities for capacity building, technology transfer, project implementation, and other readiness related activities, as well as being actively engaged with regional and global actions supporting REDD.

9.1.2 Forest certification for sustainable forest management

At present there are almost 50 000 hectares of Forest Stewardship Council (FSC) certified forests in Lao PDR. These areas are certified by an FSC accredited certifier, Smartwood, against an interim standard it has developed and adjusted for Lao PDR. This forest certification was introduced by the Sustainable Forestry and Rural Development (SUFORD) project. The first FSC certificate was given at the end of 2005.

The certification process served to build the capacities of forest managers and clarified many legislative and regulatory issues in sustainable forest management for Lao PDR. The process also served as an awareness building exercise within the Lao forest industry. At present, the forest industry and its clients are taking the lead in pursuing Chain of Custody (CoC) systems in Lao PDR. The promoters of forest certification should have started working with the Lao forest industry much earlier in the certification process. Processing companies are definitely one of the key stakeholders in a market driven certification process.

To date, forest certification has been attained in 45,000 hectares of production forests in Lao PDR and the sustainability of forest management has been demonstrated by means of an independent audit. These areas have been certified by international organizations, among which 10 000 hectares are in Don Phousoy Production Forest Area of Khammuan Province, and 35,000 hectares are in the Dong Sithuan's Production forest area of Savannakhet. The two areas have been certified by the Forest Stewardship Council (FSC) and the first annual audit took place in November 2006.

A challenge certification has to face in Lao PDR is related to the quality and the low volumes of certified timber produced and the currently limited access to international markets requiring a certificate. As the majority of the certified areas are located on semi-evergreen tropical forests with mixed species and multi-age stands, sustainable management would require low-impact selective harvesting.

It is worthwhile to note that it is conceivable that there would be certifiable forest management operations in protected areas in the future, but producing only certified NTFPs rather than timber. This scheme is now being initiated by the World Wildlife Fund (WWF) for piloting in Boulikhamxai. This is based on Non-Timber Forest Products (NTFP) production (mainly rattan) with its forest management operations working in the same manner as sub-Forest Management Areas in Production Forest Areas.

9.1.3 National Adaptation Programme of Action to Climate Change

Lao PDR submitted its National Adaptation Programme of Action to Climate Change (NAPA) to the UNFCCC in 2009 (WREA 2009). The forest sector was identified as playing an important role in adapting to climate change. The following project proposals under the NAPA have been proposed for forestry and most are linked to avoiding deforestation, supporting community forest management, and providing alternative livelihoods:

Priority 1

1) Continue the slash and burn eradication programme and permanent job creation programme.
2) Strengthen capacity of village forestry volunteers in forest planting, caring and management techniques, as well as the use of village forests

Priority 2

1) Carry out surveys and identify and develop forest areas suitable for supporting seed production.
2) Promote and establish tree nurseries to provide saplings to areas at high risk from flooding or drought.
3) Raise public awareness on wildlife conservation and forest-fire prevention.
4) Set up and further strengthen the technical capacity of the forest fire management teams at provincial, district and village levels.
5) Initiate a public awareness campaign to disseminate information on forest and wildlife regulations and laws, and strengthen the implementation of these regulations.
6) Develop agro-forestry systems for watershed protection and erosion reduction in steep areas.
7) Develop small reservoirs in upland areas in order to provide water for wildlife, including aquatic animals and plants, during the dry season.
8) Put in place a public awareness campaign on pest and disease outbreaks in wildlife caused by natural disasters and associated preventive measures.
9) Extend the campaign on integrated forest plantation management for crop pest and disease control.
10) Conduct research and select seeds of plant species suitable for flood and drought prone areas.
11) Construct bush fire barriers and forest-fire protection buffer zones in forest conservation areas.
12) Build research capacity on wildlife pests and outbreaks of animal diseases.

PART III: ENVIRONMENT FOR DEVELOPMENT: POLICY OPTIONS

CHAPTER 10 EXISTING POLICIES AND STRATEGIES

10.1 Environment Legislation and Institution

The National Constitution (1st edition 1991 and 2nd 2003) gives clear policy on the environment, including biodiversity. As stated in Article 17: "All organizations and citizens must protect the environment and natural resources: land, underground, forests, fauna, water sources and atmosphere."

In order to attain the Article 17 of National Constitution, Lao PDR has been implementing and working on legislation related to sustainably managing its natural resources and environment over the last 30 years. The Environment Protection Law (EPL), as the key legislation, was promulgated in April 4, 1999.

10.1.1 Environment Protection Law (EPL)

The environment was stated as a legal provision in article 17 of the National Constitution. Before that, the legislation considered as the main policy for environmental protection was the Tropical Forestry Action Plan developed in 1989. Since then, Lao PDR has increasingly regulated environment management, including through the promulgation of the Lao Environment Protection Law, issued onApril 4, 1999.

The EPL identified basic principles of environmental protection as follows:

1) Environmental protection shall be the priority consideration. Environmental mitigation and restoration are considered to be less preferable, but also important activities;
2) The national socio-economic development plan shall include provisions to protect the environment and natural resources;
3) All persons and organizations residing in the Lao PDR shall have an obligation to protect the environment;
4) Whoever causes damage to the environment is responsible for the impact under the law;
5) Natural resources, raw materials and energy shall be used in an economical manner, which minimizes pollution and waste and allows for sustainable development.

The EPL has defined environment as comprised of the following components:

1) Natural resources;
2) Pollution control;
3) Conservation of cultural, historical and natural heritage;
4) Natural disaster.

In addition, the EPL has identified different levels of Environment Management and Monitoring Unit (EMMU) as follows:

1) Central EMMU: Science, Technology and Environment Agency (STEA);
2) Sectoral EMMU;
3) Provincial EMMU;
4) District EMMU;
5) Village head.

The core activities to implement the EPL include:

Dissemination of the EPL

Dissemination of the EPL has been undertaken by different means, including mass media and direct communication with different target groups. STEA has cooperated with the Ministry of Justice in disseminating the EPL to the broader public. At present, the EPL is considered as being extensively disseminated.

EPL Promulgation

The Prime Minister on June 6, 1999 issued instructions for implementation of the EPL by designating responsibilities for line Ministries. This is the framework at the government level to develop enforcement and compliance measures.

Environment Impacts Assessment (EIA)

After the EPL was promulgated, STEA issued the Regulation on EIA on October 4, 2000. This regulation is the framework for the development of sectoral EIA regulations and is a useful tool for different development projects.

Although there is limited sectoral EIA regulation, it has provided environment management agencies the means to regulate environmental activities.

In addition, the Prime Minister issued an order to all provinces and ministries to follow up development activities under their responsibilities to ensure that all projects carry out EIA correctly. Establishment and strengthening the EMMU

Central level: STEA (WREA)

STEA was established by the Ministry of Science and technology in 1993, and was renamed as Water Resources and Environment Agency (WREA) in 2006. At present, it has one department, the Department of Environment (DOE), and one institute, Water Resources and Environment Institute (WREI).

Its mission is to integrate environmental management into the implementation of major development plans and projects. In this context, the Prime Minister issued a decree establishing the National Environment Committee, chaired by the Vice-Prime Minister, to direct and coordinate environmental activities across the country. The committee's vice-chair is Minister of Agriculture and Forestry and its executive secretary is the President of WREA.

Sectoral EMMU

As outlined in the EPL, each ministry has to set up its own EMMU. A limited number have been established, including in the Department of Electricity, the Ministry of Industry and Commerce, the Department of Roads, and the Ministries of Communication, Transport, Communication, Post and Construction. Other departments, such as the Department of Industry, have also established a coordinating unit for the environment.

Provincial EMMU

STEA set up a pilot unit in Savannakhet before the law was passed and it was used as a model for the establishment of others when the EPL was promulgated. Along with the EPL, provincial EMMUs were established and named as the Provincial Office for STE (POSTE). POSTEs are playing an important role and are the main support in all areas that have environmental problems.

District EMMU

A district EMMU is used for local communities. The dissemination of the EPL is undertaken through these EMMUs.

Village administration

The Head of Village acts as the Village EMMU, implementing activities at the ground level. At present, many villages have been playing this role in undertaking environmental activities in their local areas. They are linking with many programmes, including the Land and Forest Allocation Programme and the Slash and Burn Stabilization Programme.

10.1.2 Environment-related Sectoral Laws

The Forestry Law of 1996 and Draft Revised Forestry Law of 2007

The Forestry Law is comprehensive and gives relatively clear directions in many aspects of forestry, including in biodiversity. The Ministry of Agriculture and Forestry has issued several sets of regulations for field implementation of the law. The new revised law included the importance of forestry aspects as the following:

- To accelerate classification and delineation of forests for protection, conservation and production purposes,
- To establish the Forestry State Inspection Department and its activities,
- To develop a sustainable Forest Management Fund.

The Aquatic Animal and Wildlife Law of 2007

The Draft of the Aquatic and Wildlife Law is comprehensive and gives clear directions in many aspects of biodiversity. The law draws on the experience of implementing the Prime Minister's Decree and Ministry of Agriculture and Forestry regulations that were issued after the First Forestry Law.

In addition to the laws outlined above there are other laws that have provisions for environmental protection (Table 10.1).

Table 10.1 Environment related Sectoral Laws

1) Law on Water and Water Resources (11/10/96);
2) Land Law (amended version 21/10/03);
3) Law on Electricity (12/04/97);
4) Law on Mining (12/04/97)
5) Law on Road Transportation (12/04/97);
6) Law on Agriculture (03/04/99);
7) Law on Urban Planning (03/04/99);
8) Law on Roads (03/04/99);
9) Law on Industrial Manufacturing (3/4/99); and
10) Law on Hygiene, Decease prevention and Health Promotion (10/4/2001)

Source: Authors

10.2 Key National Policies on Environment

The National Socio-Economic Development Strategy (NSEDS) (in 2001)

The National Socio-Economic Development Strategy and the 5 Year Action Plan set development targets for 2005, 2010 and 2020. In meeting these targets, the environment plays an important role.

Firstly, the strategy states that socio-economic development shall be efficiently and firmly carried out assuring the *"proportionality between the economic growth, the socio-cultural development and sustainable environment management."* Secondly, shifting cultivation is to be stabilized by year 2005 and eradicated by year 2010. Thirdly, tree plantations for commodity production are to be strongly promoted, with a target area of 134,000 hectares planted to 2005. The fourth priority action is to accelerate classification and delineation of forest for protection, conservation and production purposes.

The Sixth National Socio-Economic Five Year Action Plan (2006-2010)

This plangives clear policy on the environment as following:

1. Laos, a country, which is rich in natural resources, must use abundant natural resources to promote and strengthen national economic growth, poverty alleviation and help our country graduate from under-development status.
2. But development must ensure the sustainability of natural resources.
3. We recognize that socio-economic development, poverty reduction and environment protection must go hand in hand.

A current example of these principles is the development of the Nam Theun 2 hydroelectric project. Through this major project, Laos wants to show how hydropower that is socially, financially, economically and environmentally sustainable can be developed. Not only are the lives of the communities involved and the environment being improved, but Laos will earn revenues that will be used to reduce poverty.

In addition, Laos is currently implementing and working on a number of strategies that will allow it to more effectively and sustainably manage its natural resources. A forestry strategy and biodiversity strategy has been developed during the last decade through the 1991 Tropical Forestry Action Plan, the 1991 National Constitution, and the 1994 National Environmental Action Plan. There has also been legislation related to the environment and natural resources management. This has included promises for the conservation of 21 National Protected Areas, 76 Protection Forests, and the establishment of 500,000 hectares of new tree plantation in degraded areas by 2020. This increases the ratio of tree covered areas in Laos to 70 per cent.

Lao PDR has taken several steps towards the reduction of slash and burn cultivation, the sustainable use of forest resources, the promotion of renewable energy use, pollution control and waste management, and awareness raising. This is reflected by three national campaigns on attaining the MDGs targets on clean water and sanitation, reducing the use of plastic bags and planting one million trees per year in urban areas. Table 10.2 lists selected environment-related sectoral policies and strategies.

Table 10.2 Sectoral Policies and Strategies on Environment

11) Forestry Strategy to the year 2020 12) National Biodiversity Strategy 2020 and Action Plan 2010 13) National Policy on Environment and Social Sustainability of the Hydropower Sector in Lao PDR 14) Policy on Water and Water Resources 15) Water Sector Strategy and Action Plan

Source: Authors

10.3 National Environment Strategy to the Year 2020

In respond to the national policies on environment strategies such as the National Environment Strategy to year 2020, and its 5 year Action Plan have been developed during the last decade. The key parts of these strategies are as follows:

A. Vision

- Environmental management in the country should be implemented in a systematic and effective manner to ensure environmental protection and natural resource conservation.
- Environmental management should be well balanced with economic, social and cultural development and work in parallel with national defence and public security.
- Environmental management should go hand-in-hand with the development of policy, strategy, legal frameworks, institutional reform and capacity building.
- Environmental management should go hand-in-hand with environmental education and awareness in order to encourage public understanding and participation in environmental protection, mitigation and rehabilitation.
- The establishment of financial mechanisms to promote investment in environmental activity.
- The use of the strong environmental position of the country to seek opportunity for international coordination and co-operation.

B. Goals

The primary goal is to ensure proper environmental management and sustainable use of natural resources. This includes the national dissemination of environmental education and awareness, such that the public understand various policies, strategies, and laws in order to allow public participation in informed environmental management. All development projects and operations shall have social and environmental assessment. International and regional co-operation should also be strengthened.

C. Objectives

In order to achieve the vision and goals, the following strategies should be implemented:

- To implement policies to ensure valuable environmental resources are conserved in order to permit socio-economic development, a sustainable environment and sustainable development, as well as the improvement of the livelihood of the people of Lao PDR.
- To protect and preserve Lao PDR's rich and valuable forest resources, natural environment, and eco-system to ensure sustainability of agricultural and forestry industries so they can continue contributing to national economic improvement.

- To manage water resources to ensure multi-purpose and sustainable use and equal access for the general population and to provide resources for the development of other sectors.
- To develop and promote the use of land to ensure rich bio-diversity in order to facilitate agricultural production for domestic, market and export use.
- To develop and promote environmental and social assessment in agricultural, industrial, mining, infrastructure and urban development projects. To promote the use of clean technology and public participation in environmental activity. To take measures to prevent the adverse effects of natural disasters by the establishment of a rescue unit and a system for early-warning.
- To protect and restore natural, historical and cultural heritage, and the sound and ethical traditional practices of the ethnic communities to promote the development of tourism.
- To participate and involve sustainable development processes at international and regional levels, and to fulfill national and international obligations and agreements.
- To develop and promote environmental education and awareness in order to create the conditions for national, regional and international co-operation.

D. First Five Year Action Plan for the 2006-2010

a) Goals and Objectives

The goal and objective of this plan are:

- To develop and improve the foundations for environmental protection by creating policy, strategy, legal frameworks and other measures for national environmental management;
- To establish Environment Management and Monitoring Units(EMMUs) with the provision of sufficient staff to enable the units to operate effectively, and
- To integrate environmental study into formal and non-formal education, including vocational training; to raise public awareness on environmental matters; and to promote public participation in environmental management.

b) Focused Programmes

In order to ensure environmental activities proceed according to the goal and objectives provided in the National Environment Strategy 2010 and 2020 the focused programmes (Table 10.3) are defined as follows:

- To manage and utilize natural resources in a sustainable manner to ensure benefits from the use of land, water, forests, mineral resources and bio-diversity.
- To promote the use of environmental and social assessments, the use of clean technology and systematic environmental inspection for urban and infrastructural development projects, including industrial manufacturing and medium and large scale projects.
- To strengthen the capacity of institutional frameworks and people in charge of environmental management and monitoring.
- To encourage and promote the business sector's involvement in environmental protection, restoration and sustainable use of natural resources.
- To develop financial mechanisms in order to promote and enable individuals and legal entities to contribute to the Strategy and Action Plan.
- To strengthen international co-operation in the area of the environment.

Table 10.3 Focused Programme and Actions

Focused Programme	*Programme Actions*
1. The management of natural resources. (E.g. land, water, forest, mineral resources and bio-diversity)	• Sustainable land use • Sound management and sustainable use of water resources • Sustainable management of forests • Management and efficient use of mineral resources • Management and sustainable use of bio-diversity • Management to prevent and control adverse impact from natural phenomena.
2. Management of the environment in urban, infrastructure, industrial and handicraft, special zones, free trade areas, tourist development projects and operations including national, cultural and historical sites.	• Environmental management in urban development projects • Management of the environment in infrastructure development projects • Management of the environment in industry and handicraft sectors • Management of the environment in special economic zones and free trade areas • Management of the environment for tourist development in natural, cultural and historical sites
3. Institutional reform and capacity building for environment management and monitoring	• Policy and legal frameworks • Institutional aspects • Personnel aspects • Environmental and social impact assessments • Environmental quality monitoring mechanisms • Environmental education and awareness raising • Environmental scientific and technological research
4. Participation of the business sector on environmental protection and rehabilitation, and the sustainable use of natural resources	• Supporting the business sector in their adoption and use of cleaner technology and production methods; and to implement national and international laws and regulations on environmental quality standards • Promoting the use of environmentally friendly production processes across the business sector • Promoting business sector involvement in environment service provision.
5. Promotion of investment and the establishment of financial mechanisms for the environment	• Promoting investment in environmental protection activities by the business sector and individuals • Establishing national, sectoral, and provincial environmental protection funds • Allocating a specific government budget for environmental management
6. Strengthening regional and international cooperation	• Continuing to improve regional and international environmental cooperation • Implementing national obligations under international conventions and agreements as an active member

Source: Authors

10.4 Key Environment Regulations

In order to support the implementation of these environmental and environmental related laws and policies, Lao PDR develops and implements a number of decrees and regulations. The key decrees and regulations are:

Decrees

- Decree on the Implementation of the EPL (2002)
- Decree on Establishing National Protected Areas (1993)
- Decree on the preservation of Cultural, Historical, and Natural Heritage (June 20, 1997)
- Decree on the Implementation of the Forestry law (1999)
- Decree on the Implementation of the Land Law (1999)
- Decree on the Implementation of the Water and Water Resources Law (2001)
- Decree on the Establishment and Activities of the National Environment Committee (February 2, 2002 and new version 2009)
- Decree on the Control of Import, Export and Use of Ozone Depleting Substances (2004)
- Decree on the Environment Protection Fund (2005)
- Decree on Compensation and Resettlement of People Affected by Development Projects (2006)

Regulations

- Regulation on Industrial Waste Discharge (November 3, 1994)
- Regulation on Environment Assessment in the Lao PDR (October 3, 2000)
- Regulation on Management of the National Biodiversity Conservation Areas (NBCAs), Aquatic and Wild Animals (June 7, 2001)
- Regulation on Environmental Impact Assessment for Electricity Development in Lao PDR (November 20, 2001)
- Regulation on Control of Import, Export and Consumption of Ozone Depleting Substances (2004)

Guidelines

- Implementing Environmental Assessments for Electricity Projects (October 4, 2001)
- Draft of Environment Ambient Standard (2009)
- Draft of Pollution Emission Standards (2009)
- Draft of Environmental Management Plans for Electricity Projects (October 4, 2001)

CHAPTER 11 OPTIONS FOR ACTION

Lao PDR has rich natural resources and environmental quality is still good. This is an important advantage for continued social and economic development.

The major causes of environmental degradation cover five distinct categories. These include economic (the unsustainable use of environmental resources); social causes (rapid social development and population growth); natural causes (flood and drought); management capacity causes (institutional, legal frameworks, and human resources), and global warming that precipitates climate change.

11.1 Institutional Arrangement

The Water Resources and Environment Administration (WREA), which was formed through the restructure of the Science, Technology and Environment Agency (STEA), has the mandate to manage environmental matters in Lao PDR. Its role is also to coordinate with other sectors at central and local levels; and develop policies, strategies, and action plans on the environment. The goal of WREA is to create the conditions for other sectors and local authorities to establish environmental management and monitoring units (EMMUs). EMMUs have been established at provincial, municipal and special zone levels. The National Environmental Committee (NEC) was established by Prime Ministerial Decree to direct environmental management and address environmental issues in a uniform manner. Provincial authorities established their own provincial environmental committees (PECs). In 2011 WREA was upgraded to MONRE

11.2 Strategies and Policy Framework

WREA has developed and set the direction to move towards sustainable development in Lao PDR. The guiding principle of development in Lao PDR is to use its abundance of natural resources to promote and strengthen national economic growth, poverty alleviation, help the country graduate from its under-development status, and ensure the sustainability of natural resources. The socio-economic development of the country must be balanced between economic growth, socio-cultural development and environmental preservation. These are the three pillars of the Lao PDR's development policy.

The National Biodiversity Strategy 2020 and Action Plan Year 2010 (NBSAP)

The overall goal of the National Biodiversity Strategy and Action Plan is to maintain the country's diverse biodiversity as one key to poverty alleviation and to protect the current asset base of the poor as support to the implementation of the government's priority programmes. Its main objectives are:

a) Improve biodiversity data and fill data gaps through basic and applied research;
b) Improve biodiversity management and monitoring;
c) Plan and implement a biodiversity specific human resource development programme;
d) Increase public awareness of and encourage participation in the sustainable management of biodiversity;
e) Adjust national legislation and regulations related to biodiversity and harmonise them with Multilateral Environmental Agreements (MEAs);
f) Secure the NBSAP's implementation;
g) Promote country needs driven international cooperation.

In order to achieve the goal and objectives of the Strategy and Action Plan to 2010, it is necessary to define and implement the following areas:

1) Scientific Data and Biodiversity Knowledge Development;
2) Biodiversity Management;
3) Human Resource Development;
4) Public Awareness and Involvement;
5) Institutional and Legal Frameworks;
6) NBSAP Implementation;
7) International Cooperation.

The Lao PDR Forestry Strategy to the year 2020

The Government has set two major national development goals to be achieved by 2020. The first is to graduate from least developed country status and the second is to eradicate poverty. The development of the forestry and biodiversity sectors and the implementation of sustainable forest management are key elements in supporting these objectives. The Strategy clearly recognizes the important roles of sustainable forest and biodiversity management for poverty alleviation through village forest and participatory production forest management.

The forestry sector development targets include improving the quality of existingforested area by naturally regenerating up to six million hectares and planting trees up to 500 000 hectares in unstocked forest area. This forms an integral part of rural livelihood support system, helping ensure stable water supplies and the prevention of natural disasters.

National Environment Education and Awareness (EEA) Strategy to the year 2020 and its 5 Year Plan

The overall objective of the EEA strategy is to ensure that people have environmental knowledge, positive attitudes and values for the environment, and are comfortable participating in sustainable environmental management and conservation of natural resources. This will improve the quality of life for all and ensure sustainable development.

The strategy's five-year plan will focus on ensuring the integration of the EEA into the formal and informal education system; strengthen public awareness on the environment; improve human resource development and capacity building; and to ensure coordination and cooperation on the EEA.

11.3 Conclusion: options for action

Lao PDR is widely recognized as a country rich in natural resources. These natural resources, including Laos' biodiversity, have significantly contributed to the social and economic development of the country for the wellbeing and livelihoods of its people, notably the rural communities. In order to better utilize natural resources for sustained social-economic development, strengthening the implementation of relevant laws and regulations on biodiversity is urgently needed.

At the national level, different initiatives have been formulated including the National Environmental Strategy, the Forest Sector Strategy (under preparation), the Agriculture Sector Strategy, and Decree 164, which establishes the National Protected Area System. Furthermore, achieving the goals set by

the Socio-Economic Development Vision and the National Poverty Eradication Programmme will be difficult without an enhanced resilient environment and the sustainable utilization of natural resources.

Biodiversity is the primary source for the fulfillment of basic needs and provides a basis for adaptation to changing environments. In addition, biodiversity forms an integral part of rural livelihoods and poverty alleviation. It plays an important role in supporting urban and commercial production and consumption in key sectors of the economy. Biodiversity conservation supports a wide range of economic activities and uses, including irrigated agriculture, medium and large-scale hydropower, fish ponds, aquaculture, and urban water supply.

With its rich forest resources, innovative management tools, such as payment for ecosystem services, and new projects under REDD should be implemented to further improve the three forest management systems that have been established in Lao PDR:

1) National Biodiversity Conservation Areas;
2) Protection Forest and Watershed Management; and
3) Sustainable Management of Protection Forest

To speed up the achievement of Millennium Development Goals on accessing to safe drinking water and improved sanitation, Government of Lao has been supporting Nam Papa State-owned Enterprises to improve management and operation of all water supply and wastewater management systems and development of raw water in urban and rural areas. The government has set a water supply sector investment goal. The priority of the Plan is to progressively increase the availability of safe, piped water from current 52 per cent to 80 per cent of the urban population by 2020.

As a least developed country, Lao PDR is vulnerable to the impacts of climate change. The government would focus its adaptation strategy and resources on agriculture, forestry, water resources and public health (WREA 2009).Sustainable management of its 15.8 million hectares of forests will not only be a great contribution of Lao PDR to the global efforts to mitigate climate change, but also help improve the livelihoods of local communities, through the international partnership programme Reducing Emissions from Deforestation and Forest Degradation (REDD).

With 28 per cent of its population still in poverty, the Lao PDR National Poverty Eradication Programme (NPEP) is central to the national development agenda. The NPEP encapsulates the essence of the Lao PDR's approach towards achieving the goal of exiting the group of least developed countries by 2020. The country's rich natural capital not only provides livelihood but also serves as a safety-net, especially the poor, and is the key asset underpinning the country's ambitious development agenda.

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Annex 1 Glossary

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 (NO_2) : 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.

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