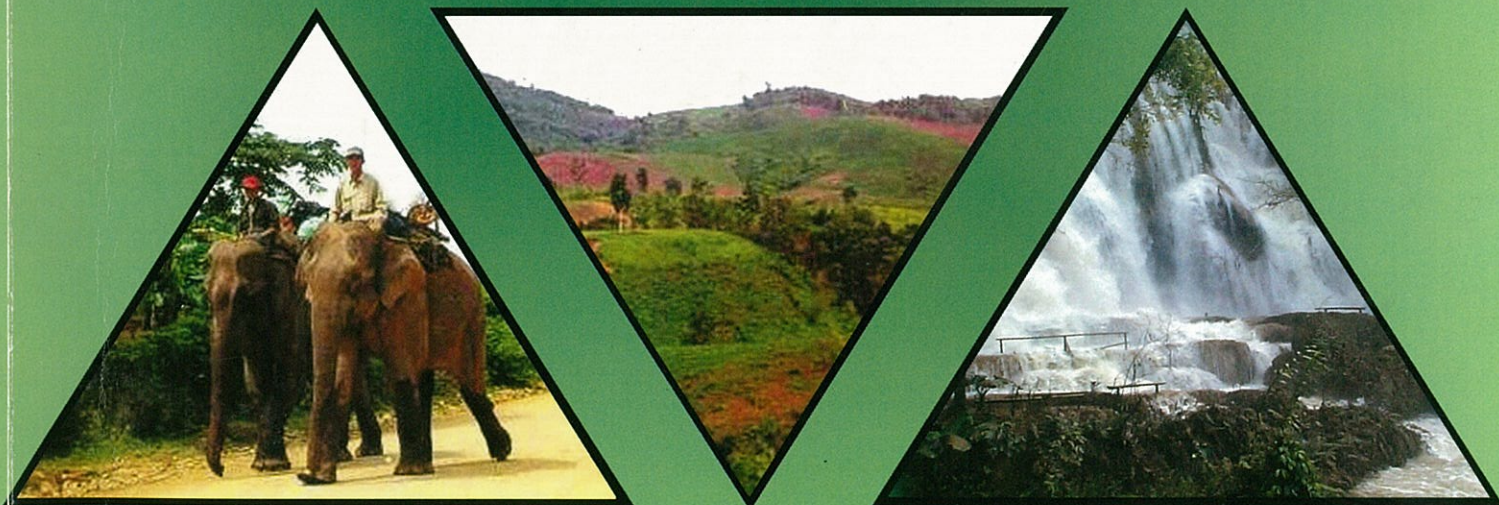


# State of the Environment



## Lao PDR



# 2001



**NORAD**

DIREKTORATET FOR  
UTVIKLINGSHJELP  
NORWEGIAN AGENCY FOR  
DEVELOPMENT COOPERATION



**UNEP**

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# LAO PDR : State of the Environment 2001

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**NORAD**

DIREKTORATET FOR  
UTVIKLINGSHJELP  
NORWEGIAN AGENCY FOR  
DEVELOPMENT COOPERATION



UNEP

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Thailand



## FOREWORD

Executive Director  
United Nations Environment Programme

The Rio Earth Summit in 1992 formulated an action plan, Agenda 21, a multifaceted process to address the full range of development and environmental issues involving participation of governments, international organizations and major groups in the quest for sustainable development

The publication of the Global Environmental Outlook series, GEO-1, followed by GEO-2000, the Millennium Report on the Environment, involved a participatory assessment process to review the state of the world's environment and to chart a new process for global environmental policy. The diversity and magnitude of environmental problems are outlined, with a call for more complete and precise analyses of the poorly understood linkages between human actions and environmental outcomes. Although the number of policy responses is growing, low priority continues to be afforded to the environment in national and regional planning. GEO-2000 stressed the need for the development of more comprehensive and long-term mechanisms for monitoring and assessing the effects of environmental policies on environmental quality; and for more integrated policy making and action-based programmes to serve the needs of the people.

The United Nations Environment Programme (UNEP) is mandated to produce a Global State of the Environment Report in 2002 (GEO-3) for the 2002 Earth Summit i.e., Rio + 10, and this global assessment will be enriched by producing State of Environment (SoE) reports at the national, sub-regional and regional levels. In 1998, the UNEP Regional Resource Centre for Asia-Pacific (UNEP-RRC.AP) collaborated with the Norwegian Agency for Development Cooperation (NORAD) to carry out a process on Strengthening National Capabilities on Environment Assessment and Monitoring towards the Preparation of the Global State of the Environment Report 2002, thus linking national to regional and global initiatives.

This National State of the Environment (SoE) Report of Lao PDR is the one of seven national reports from the above process, focusing on two Asia-Pacific sub-regions, namely South Asia (Bangladesh, Bhutan, Maldives, Nepal and Sri Lanka) and the Greater Mekong Sub-regions (Lao PDR and Vietnam). The Science Technology and Environment Agency (STEA) of the Government of Lao PDR, which is the national implementing agency, has played a very crucial role in carrying out this participatory assessment process in soliciting input from various government sectoral agencies. Around 30 agencies and 55 individuals were involved in the process. With the substantive support from the Thailand Environment Institute (TEI), the designated collaborating center, this assessment exercise has been successful and instrumental in providing significant input to the various assessments. It aims at providing guidelines for environmental action planning, policy setting and resource allocation for the coming decades, based on a sound analysis of the state of, and trends in, the nation's environment.

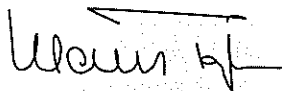
Five priority key issues for the state of environment report for Lao PDR have been identified in consultation with the Science Technology and Environment Agency (STEA) as per UNEP guidelines and analyzed following "pressure-state-impact- response" (PSIR) analytical framework. The same process has been followed by rest of the countries covered under this project, leading to the identification of their key environmental issues. These can then be addressed subsequently through action-based programmes in the next phase of the planning process.

The five key environmental issues identified for Lao PDR are: (1) forest resources, (2) water resources, (3) land resources, (4) biodiversity, and (5) urban environmental management. Land, water, and biodiversity resources are adversely affected by improper forest harvesting and management practices, forest fires, shifting cultivation, and encroachment of the forestlands for agriculture. Many forest concession areas have been exploited at a rate higher than the sustainable rate of timber extraction. The depletion of forest resources due to over harvest and illegal logging activities involves significant loss of government revenue. Most land degradation is associated with

shifting cultivation and unplanned upland agriculture. The high proportion of slopping land in the country, its predominant soil types, and heavy rain fall combine to make a significant part of the country susceptible to soil erosion. Threats to the country's biodiversity resources are emerging because of increased logging, land conversion for agriculture, practice of subsistence farming methods, and infrastructure developments such as road construction, electricity network development and hydropower project development. Wildlife has been subjected to intense pressure even with a relatively low over all human population density. Even though the country possesses a great wealth in water resources, some 40% of the rural population have access to potable water. Water shortage in the reservoirs has affected the generation of hydropower, and the large-scale and several medium-scale irrigation systems are remained underexploited and facing operational and maintenance difficulties affecting the agricultural production. Growing expansion of industry and tourism sectors in the urban centers of the country, combined with rural urban migration has led to an exponential increase in urban environmental problems stress and stressed the cultural fabric of the ethnically diverse country.

The SoE assessment for Lao PDR provides a sound basis for the development of action plans, the next stage of the planning process for the coming decades in this new millennium. The report aims to provide concrete guidance for action planning, policy setting and resource allocation for the coming decades to improve the state of the environment of Lao PDR and the welfare of her people.

UNEP will continue to provide leadership in the region for the preparation of environmental assessment reports at national, sub-regional, and regional level and the capacity building necessary to support these assessment activities.



**Klaus Töpfer**

United Nations Under-Secretary General and Executive Director  
United Nations Environment Programme  
August 2001



## FOREWORD

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Environment, over the last years, has become an issue of increased interest from people all over the world. Every government has to work towards sustainable development and environmental preservation. On a global scale, countries become more and more involved in environmental issues, particularly in the wake of Rio and other summits of international importance.

In the recent years, the speed of development in the Lao PDR has picked up. This was connected to more rapid natural resources utilization and economic expansion, but also to the emergence of environmental and social problems. Although our environment, compared to other countries, is still quite intact, the trend shows accelerated resource depletion. For the years to come, and in order to fulfil our government's goal to improve the living conditions of our multi-ethnic population, development will still require the utilization of the country's natural resource base. Therefore, environmental management is an important pre-requisite for sustainable development.

This State of Environment Report gives an overview on the general and most prominent environmental features of the Lao PDR. It points out environmental problems requiring attention and possible methods to solve them. The Report will be used as a basic tool for socio-economic development planning as well as for environmental protection. We also hope that this report will contribute to the Global Environment Report.

The creation of this State of Environment Report was guided by the United Nations Environment Program Regional Resource Center for the Asia and Pacific, which has graciously facilitated training, staff qualification, data collection and layout. These activities were supported financially by the peoples of Norway, through the Norwegian Agency for Development Cooperation. On behalf of our government I would like to thank everybody who has contributed to this State of Environment Report.

A handwritten signature in black ink, appearing to read 'Noulinh SINBANDHIT'.

**Noulinh SINBANDHIT**  
President of Science Technology and  
Environment Agency

## ACKNOWLEDGEMENTS

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UNEP would like to thank the many individuals and institutions who have contributed to the preparation of *Lao PDR: State of the Environment 2001*. They included individuals in Government departments, intergovernmental organizations, academic institutions, and voluntary organizations. A full list of contributors, reviewers and participants of the national State of the Environment training and consultation, are included in the Appendix. Special thanks are extended to:

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Department of Environment  
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### **SEAMCAP Collaborating Centre**

Thailand Environment Institute (TEI), Thailand

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The Norwegian Agency for Development Cooperation (NORAD) provided the required financial support needed to the Strengthening Environmental Assessment and Monitoring Capabilities in South Asia and Greater Mekong Subregion (SEAMCAP) Project under which the *Lao PDR: State of the Environment 2001* has been prepared.

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# PART I EXECUTIVE SUMMARY

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## *Project Description*

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In the Asia Pacific Region, a number of activities that provide foundation for moving towards 2002 have already been initiated by the UNEP Environment Assessment Programme for Asia Pacific (EAP-AP). The Norwegian Agency for Development Cooperation (NORAD) and UNEP/EAP-AP agreed to collaborate on a project which aims to strengthen the environmental assessment and monitoring capabilities in South Asia and the Greater Mekong Sub-region. The goal of this project is to strengthen the capacity of and assist national governments in establishing a strong information technology base for data processing, modelling and analysis requirements that supports State of Environment (SoE) assessments and reporting, and improve the basis for decision making in the handling of important/emerging environment problems. The project thus aims to enhance the capacity of national governments in South Asia and the Greater Mekong Sub-region to make accurate environmental assessments; improved decision making towards sustainable development; enhance the availability of information on all aspects of environment and socio-economic development; and establish a strong information network with a uniform format of data. The project would concentrate on real data management (i.e. actual quantitative and spatial data collection and their storage in appropriate format, data exchange, and dissemination), analysis, SoE assessment and reporting at national and regional level.

The purpose is to prepare the Lao PDR SoE report for the period 1999-2000 following the UNEP/EAP-AP guidelines. The SoE report will provide the leaders of Lao PDR with an assessment of the State of the Environment in their nation and possible warnings of future problems. It will also be a contribution to the regional report and an input to the "2002 Global State of Environment Report" and "2002 Earth Summit".

## *Background*

---

State of the Environment Reports have been under preparation since 1974 in various forms such as national environment action plans, national conservation strategies, national environmental profiles, etc. The State of the Environment Report 2000: Lao PDR (SoE) report is the first of its kind for Lao PDR. It provides a general picture

of present biophysical and socioeconomic conditions and an overview about how human activities are affecting the environmental conditions. It also provides understanding of the implications of these conditions on human health and economic well being and outcomes of the policy responses that were adopted.

## *Methodology*

---

The report was prepared with consultations held with senior government officials (of Lao PDR). The comments and observations from the consultations contributed to a greater depth and breadth about the different aspects dealt. All data used in the preparation of and for presentation in this report are from secondary sources such as - different ministry publications of Lao PDR etc., published reports from international journals, reports of various bilateral organisations like the World Bank, the Asian Development Bank, web sites etc. Certain information was also received via mail (mostly electronic), from time to time. These are incorporated in the report.

## *Contents of the Report*

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The document has been prepared in four main parts:

Part I Executive Summary

Part II Sections 1 - 4 present a national overview of environmental trends by resources and the associated driving forces. In Section 5, a summary sketch of the overarching regional and national environmental criteria deriving from conventions, agreements and treaties have been presented.

Part III Analyses of five key issues in the State-Pressure-Impact-Response (S-P-I-R) framework.

Part IV Summarizes the salient findings, conclusions and broad recommendations.

## *Major Findings*

---

Lao People's Democratic Republic is a land-locked country sharing its borders with five nations. Its land area is a little larger than Great Britain's but contains approximately 10% of the population. General physiographic character is undulating with high percentage of sloping land as a national average. The capital Vientiane is located near the Thailand border and the two countries

bear strong cultural and economic ties. Lao PDR has the lowest urbanisation level in Southeast Asia at 23% and yet has the distinction of being the country with the highest per cent annual urban growth at 5.1%. According to the United Nations Development Programme, Lao PDR currently ranks 140th on the Human Development Index with a per capita income of US\$ 350 (Socio-Economic Development Strategy 2001). However, its integration into the Association of Southeast Asian Nations (ASEAN) in 1997 and imminent prospects for membership to the World Trade Organization (WTO) are pointers at the transformations that offer many opportunities and challenges for the Government and people of Lao PDR in the future.

The broad-based study of the national physical resources, ecological resources, human development and human quality of life values, in Part II, led to the identification of five key environmental issues concerning Lao PDR namely, (i) deforestation (ii) water resources (iii) land degradation (iv) biodiversity and (v) urban environment. The major findings from the S-P-I-R analysis in Part III narrowed down following areas of focus:

### **1. Forest Resources**

Lao PDR forest cover, 47% of total land area, remains among the highest in the region. However, deforestation rate is very rapid. A number of factors contribute to deforestation in the absence of a national resource planning and management framework. Due to which, commercial forest exploitation is increasing, shifting cultivation impacts forest environments increasingly and hydroelectric projects can be an additional pressure. Standards of management practices have to be improved and local community participation has to be adopted over a wide range of aspects like demarcation of forest lands, allocation planning, zoning, setting priorities, and targets, regulating access (for example, to recently logged forests), biodiversity protection, reforestation programme, etc. Definition of production forests must be made to include those that provide products for local use. Logging quota allocation contracts should be made including rehabilitation/regeneration and reforestation clauses. Stable agriculture land has to be made available in uplands with appropriate alternative income options to reduce pressure from shifting cultivation. Land erosion due to high degree of slopes in Lao PDR gets compounded with deforestation in uplands. Loss of soil fertility due to reducing fallow periods combined with the possibility of fertilizer abuse requires pro-active prevention measures. Land degradation cycle needs special attention with respect to the

sedentary cultivation programme prepared for settling upland farmers. Legislation on biodiversity conservation is needed in Lao PDR. Cross border trade of live animals and body parts requires regulation. Biodiversity conservation and land degradation protection can be combined with forest management programmes.

### **2. Water Resources**

Lao PDR possesses a great wealth in water resources. The country has the highest per capita availability of renewable freshwater resources in Asia. Irrigation and rural water supply are important for Lao PDR development. Irrigation improvement is a countrywide requirement. Gravity irrigation in mountainous areas and pumped water schemes for the lowlands are preferred. The government is pursuing the policy of transferring the irrigation system management responsibility to farmers associations. However, on the whole farmers lack the management skills. Community training is a key success requirement. Rural water supply includes sanitation improvement objectives and is currently focussed on community involvement. Water quality protection and monitoring would also require rural people involvement. Therefore, single agency supervision is being contemplated for its implementation. However, hydropower development as an export earner is being contemplated to achieve the socio-economic development and economic objective for Lao PDR.

### **3. Urban Environment**

Rural urban migration, tourism and industrial sector growth will contribute to increased waste production, both liquid and solid. Solid waste disposal, wastewater treatment, roads and transportation sectors need attention in the urban environment sector. Solid waste service faces insufficiency of funds and equipment compounded by poor maintenance and displays poor area coverage. There is only one wastewater treatment plant in Lao PDR. Most of urban roads require pavements. Overall, road congestion is not a problem yet due to low vehicle ownership, which has been found to be rising in the two wheeler section, however. Roads and junctions still have capacity although some may require geometric design improvements and other betterment interventions. Transportation plans are seen as precursors of any road development projects. Funds are lacking. Urban Master Plans are needed for most urban centres. Funds may be a limiting factor. Urban development planning and management improvements along with municipal improvements require higher prioritisation in the overall national development planning. Urban electrification

programme requires target enhancement. However, there is not yet a major problem of pollution, but the future industrialisation will be major issue of pollution and should be included in this section.

#### ***4. Others***

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A number of issues are related with a diverse set of needs ranging from human resource development, awareness building, creation of a reliable national database system, an environmental planning and management framework to an environmental assessment system. In effect, only a multi pronged approach can be effective in tackling the current and emerging issues and prepare Lao PDR to face the challenges of sustainable environment management of the

future.

#### ***Recommendations***

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In Part IV, recommendations are put forth that focus on each of these four areas, which should help to minimize the environmental effects as Lao PDR increases its social and economic development pace. Implementing these recommendations can enable the developmental activities to become more culturally, environmentally, and economically sustainable. A table of the recommendations follows.



## 1. Measures for Forest Resources

Thrust Area	Community Involvement Measures	Government-level Measures
<b>Forest Management</b>	<ul style="list-style-type: none"> <li>improve villagers' living standards in pilot areas through village forestry and village development projects.</li> <li>consult and develop land use and development plans to guide forest concessionaires in logging operations</li> <li>improve villagers' ability to manage forest through extensive training</li> </ul>	<ul style="list-style-type: none"> <li>NAFRI develop information database accessible to all government authorities and other interested entities</li> <li>develop policy and legal framework for sustainable forest management</li> <li>develop national guidelines for village forestry systems for sustainable forest management</li> <li>develop land use and development plans</li> <li>allocate forest land to villagers</li> <li>improve forestry staff's ability to manage forest through extensive training</li> </ul>
<b>Reforestation Programmes</b>	<ul style="list-style-type: none"> <li>involve local participation in ongoing reforestation programmes</li> </ul>	<ul style="list-style-type: none"> <li>continue expansion of reforestation efforts through the extension of ongoing Lao-ADB Forest Plantation Project</li> <li>facilitate and expedite drafting of implementing forestry regulations; phased implementation of sustainable forest management regulations to improve forest resource management</li> <li>carbon sequestering through examination of innovative approaches to forest conservation linked to multilateral environmental agreements and international conventions and protocols for development of carbon sinks</li> </ul>
<b>Shifting Cultivation</b>	<ul style="list-style-type: none"> <li>establish and operate land development task forces consisting of district level and project personnel along with local consultants to determine intensification of land use at the district level to implement community-based land resource management through provincial rural development committees.</li> <li>capacity building in the agricultural research extension system to provide: <ol style="list-style-type: none"> <li>planting materials and advice on pest and disease management, crop variety biodiversity and sustainability</li> <li>non-polluting crop production techniques such as organic farming, paddy field aquaculture integrated pest management; and</li> <li>development and utilisation of locally produced bio-pesticides.</li> </ol> </li> </ul>	<ul style="list-style-type: none"> <li>strengthen capacity of the National Agriculture and Forestry Research Institute (NAFRI) to serve as the main body for natural resource planning and land use planning</li> <li>operate (NAFRI) pilot "adaptive research" projects that combine integrated agricultural research and socio-economic research, particularly on degraded lands and remote areas.</li> <li>implement community-based land resource management, coupled with a land allocation policy based on land's capability for sustained food and fibre production, community needs, and labour availability rather than a fixed size limit.</li> <li>capacity building in the agricultural research extension system</li> <li>review and revise agricultural and forest land tax system to reduce tax rate for land owners using "best management practices" such as who practice soil conservation and non-polluting, sustainable land use and penalise farming practices causing pollution, soil erosion or biodiversity reduction.</li> <li>support development of small and medium-scale irrigation projects on steep lands in order to relieve farming pressure</li> <li>establish nurseries in productive areas to produce appropriate seed and seedling for the nation's uplands and lowlands and other environmentally suitable uplands farming products such as tree crops and vegetables (e.g. cardamom, benzoin, sesame and bamboo, etc.).</li> </ul>
<b>Forestry and Land Use Training</b>	<ul style="list-style-type: none"> <li>understanding of government policies, regulations and objectives.</li> <li>understanding of various sustainable and unsustainable farming systems.</li> <li>basic knowledge of soil condition.</li> <li>knowledge of basic survey measurement techniques.</li> <li>understanding of socio-economic and land tenure issues.</li> </ul>	<ul style="list-style-type: none"> <li>understanding of various sustainable and unsustainable farming systems.</li> <li>knowledge of forest classification criteria and their application.</li> <li>ability to interpret aerial photos and topographic maps.</li> <li>basic knowledge of soil condition.</li> <li>knowledge of basic survey measurement techniques.</li> <li>understanding of socio-economic and land tenure issues.</li> <li>ability to communicate effectively with villagers and understand their points of view.</li> </ul>
<b>Biodiversity Conservation</b>	<ul style="list-style-type: none"> <li>implement sustainable biodiversity conservation systems along side forest management in pilot areas in cooperation with villagers and other stakeholders.</li> <li>improve villagers ability to manage forest allocate forest land to villagers and promote sustainable village-based forest management through extensive training.</li> <li>disseminate through appropriate media, the information that has been collected on the 20 NBCAs to community stakeholders.</li> <li>conduct special training and environmental education in biological resource conservation for involved community.</li> <li>run similar projects outside the NBCAs involving local participation.</li> </ul>	<ul style="list-style-type: none"> <li>develop policy and legal framework for sustainable forest management.</li> <li>develop legislative framework for wildlife protection on incentive based policy rather than command and control basis.</li> <li>develop and implement sustainable biodiversity conservation systems along side forest management in pilot areas in cooperation with forest and conservation authorities, villagers and other stakeholders.</li> <li>improve forestry staff's ability to manage forest through extensive training.</li> <li>improve villagers' living standards in pilot areas through village development projects along side village forestry projects</li> <li>institutional and government capacity building support in cataloguing national biodiversity resources.</li> <li>disseminate through appropriate media, the information that has been collected on the 20 NBCAs to all stakeholders</li> <li>conduct special training and environmental education to departmental staff in biological resource conservation</li> <li>document and run similar projects outside the NBCAs.</li> </ul>

## 2. Measures for Water Resources

Thrust Area	Community Involvement Measures	Government-level Measures
<b>Irrigation</b>	<ul style="list-style-type: none"> <li>preparation of community based catchment management plans for priority catchments</li> <li>farmers training in irrigation management, for priority catchments.</li> <li>farmer training in irrigation scheme design and management, irrigation scheduling and O&amp;M with regard to Water Resource Master Plan, SRIDP, FIAT etc.</li> <li>community training in management and preservation of water resources</li> </ul>	<ul style="list-style-type: none"> <li>improvement of meteorology network</li> <li>establish central data compilation centre</li> <li>technician training in irrigation scheme design and management, irrigation scheduling and O&amp;M with regard to Water Resource Master Plan, SRIDP, FIAT etc.</li> </ul>
<b>Rural Water Supply</b>	<ul style="list-style-type: none"> <li>training component for the community preparation before actual participation in water supply and source-protection management system adoption.</li> <li>community training in management and preservation of water resources</li> </ul>	<ul style="list-style-type: none"> <li>establish central data compilation centre</li> <li>community demand assessment studies with regard to Water Resource Management Action Plan.</li> <li>identification study for priority catchments</li> <li>pilot programmes in less accessible villages to define special approaches needed with ethnic minorities</li> </ul>

## 3. Measures for Urban Environment

Thrust Area	Measures
<b>Funds for the urban environment infrastructure</b>	<ul style="list-style-type: none"> <li>implement visitor service tax and other innovative income generators from tourism industry</li> <li>allocate the funds from visitor tax to provincial and municipal level bodies to</li> <li>from ear-marked income, off-set costs of urban environmental management infrastructure and public service maintenance.</li> </ul>
<b>Urban environment framework</b>	<ul style="list-style-type: none"> <li>prepare master plans for urban development</li> </ul>
<b>Urban Transportation</b>	<ul style="list-style-type: none"> <li>urban transport modernisation through the examination of potential for upgrading urban transport systems in Vientiane and secondary towns.</li> <li>examine potential of leveraging grant funds (Global Environment Facility: GEF) for introducing sustainable public transport system utilising hydropower generated electric power.</li> <li>assess feasibility of using renewable energy to reduce rural poverty by providing opportunities of alternative livelihood schemes and thereby off-set pressure on biodiversity.</li> </ul>
<b>Water supply</b>	<ul style="list-style-type: none"> <li>urban water supply development</li> </ul>
<b>Flood and erosion control</b>	<ul style="list-style-type: none"> <li>urban river erosion control and urban flood control in Louangphabang, Pakse, Savannakhet, Thakhek, Bokeo, Xayabury, Bolikhamxay and others. municipalities</li> </ul>

## 4. Institutional Strengthening Measures

Measures	Actions
<b>STEA Institutional Capacity Strengthening Programme</b>	<ul style="list-style-type: none"> <li>upgrade the facilities</li> <li>strengthen capacities at <ul style="list-style-type: none"> <li>research</li> <li>environmental monitoring</li> <li>training of the Environmental Management Unit (EMU) and the National University of Lao PDR (NUOL)</li> </ul> </li> </ul>
<b>Natural Resources Management Unit Institutional Capacity Strengthening</b>	<ul style="list-style-type: none"> <li>upgrade the facilities</li> <li>strengthen capacities at <ul style="list-style-type: none"> <li>research</li> <li>natural resources management of the Forestry School and NUOL</li> </ul> </li> </ul>

Measures	Actions
<b>Decentralised Management Authority</b>	<ul style="list-style-type: none"> <li>• devolve greater authority for natural resources management and environmental protection to local officials</li> <li>• facilitate and promote understanding of important environmental protection issues</li> <li>• create coordination among agencies responsible for different environmental management aspects</li> <li>• strengthen provincial level environmental office and branches (provincial) of central agencies through extensive environmental training</li> </ul>
<b>Decentralised Environment Management Programme</b>	<ul style="list-style-type: none"> <li>• facilitate role of provincial environment offices in environmental policy planning and implementation by providing:                             <ul style="list-style-type: none"> <li>• technical assistance to provincial environment offices</li> <li>• physical assistance</li> </ul> </li> <li>• strengthen institutional capacity</li> </ul>
<b>Integrated Environmental Management</b>	<ul style="list-style-type: none"> <li>• establish interdependent, collaborative and responsive teams across ministries.</li> <li>• involve local stakeholder participation to prepare plans and projects</li> <li>• ensure local stakeholder participation in scheme implementation .</li> </ul>

### 5. Environmental Assessment Database System, Human Resource Development and Awareness Building Measures

Braod Measures	Specific Thrust Areas	Actions
<b>Information Database System Improvement</b>		<ul style="list-style-type: none"> <li>• establish centralised Information Management System (IMS) for environmental resource data for government planning and development agencies and project developers.</li> <li>• assign agency with experience and potential capacity such as STEA to develop and operate IMS in partnership with the development ministries, the The Committee for planning and Cooperation, the Investment Management Committee, and other relevant agencies</li> <li>• fund appropriately in order that data collected by the various agencies can be stored, processed and retrieved easily and without cost to government agency users? establish centralised Information Management System (IMS) for environmental resource data for government planning and development agencies and project developers.</li> </ul>
<b>Human Resource Development</b>	<b>Environmental Assessment and Monitoring</b>	<ul style="list-style-type: none"> <li>• develop multidisciplinary capability within STEA and development sector agencies</li> <li>• establish courses in Lao PDR institutions for advanced studies</li> </ul>
	<b>Environmental Management</b>	<ul style="list-style-type: none"> <li>• provide practical, on-the-job training to managers and technicians over the short and medium terms in the areas of:                             <ul style="list-style-type: none"> <li>• agriculture</li> <li>• forestry</li> <li>• water resource</li> <li>• industrial sector</li> </ul> </li> <li>• provide supplementary training on specific priority environmental problems, such as:                             <ul style="list-style-type: none"> <li>• pollution control and monitoring</li> <li>• protection of water supply sources</li> <li>• watershed management</li> <li>• forestry techniques</li> </ul> </li> </ul>
	<b>Environmental Education and Awareness Building</b>	<ul style="list-style-type: none"> <li>• increase awareness building over various levels through:                             <ul style="list-style-type: none"> <li>• community-consultation on resource management</li> <li>• community-based resource management</li> <li>• introduction of environmental issues in the school curriculum;</li> <li>• public awareness building programmes using mass organisations such as Buddhist associations, the Women's Union etc.; and</li> </ul> </li> <li>• integration of environment into community, district, provincial level planning and consultation programmes</li> </ul>
	<b>Local Government Level</b>	<ul style="list-style-type: none"> <li>• decentralise natural resources and environmental management by supporting local government with:                             <ul style="list-style-type: none"> <li>• Information management</li> <li>• Sanitation and solid waste management</li> <li>• Natural resource conservation and management</li> <li>• Programme development and management</li> <li>• Wastewater management and quality control</li> <li>• Public participation development and public relations</li> <li>• Use of modern office equipment</li> <li>• English language training</li> </ul> </li> </ul>

# PART II OVERVIEW OF MAJOR ENVIRONMENTAL DEVELOPMENTS AND TRENDS

## 1 NATIONAL PHYSICAL RESOURCES

### 1.1 SOIL AND LAND

Lao PDR is situated in the centre of the Southeast Asian peninsula between 13°54' and 22°3'N and between 100°05' and 107°38'E, and covers an area of 236,800 km<sup>2</sup>. The country extends approximately 1,000 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 470 km. Topography

The parts of Lao PDR within the Basin drain westwards to the Mekong River, often through hilly or mountainous terrain, particularly in the north and east of the country.

Considerable and complex differences exist in resource endowments across the country. The Central region and the South, endowed with plains along the Mekong and other rivers, contain fertile soils and land that can be irrigated. In contrast, the North is mountainous and rugged, with no irrigable land other than limited mountain valleys (DOF 1992). The soil is

**Table 1.1a Total Area of Various Land Use and Vegetation Types, Distribution on Slope Classes ('000 ha), 1989**

Land Use Group	0-5%	6-19%	20-30%	31-59%	>60%	Total Area
Current Forest	2,679	651	3,795	3,072	971	11,168
Potential Forest	1,137	589	3,969	2,741	512	8,948
Other Wooded Areas	516	70	340	323	195	1,444
Permanent Agricultural Land	826	20	4	0	0	850
Other Non-Forest Land	410	51	364	323	122	1,270
<b>Total</b>	<b>5,568</b>	<b>1,381</b>	<b>8,472</b>	<b>6,459</b>	<b>1,800</b>	<b>23,680</b>

Source: DOF 1992.

is predominantly mountainous with cultivated floodplains only along some reaches of the Mekong River and the larger tributaries. Almost 80% of the land surface is hilly and mountainous terrain.

More than 1/3 of the country area has a slope more than 30%. The slope exceeding 20% occupies more than 2/3 of the area. The distribution is roughly the same within the different land use groups except for Permanent Agricultural Land of which most is found on flat land or in moderate slope less than 20% as shown in Table 1.1a.

The steepness differs widely among the regions. In the North, only 6% of the area has steepness below 20% and nearly half of the land has slopes exceeding 30%. In the Central part, about 30% of the area is on flat land or in moderate slopes whereas in the South these flat lands occupy 62% of the area (DOF 1992).

About 80% of the land area of Lao PDR is in the Mekong Basin. Two discrete portions of Lao PDR lie outside the Basin and are located in an eastern parcel of Houaphanh Province and the Province of Xiengkhouang. These areas are located in the northern half of Lao PDR and drain eastwards towards the Vietnamese coast.

heavily leached and acidic. The majority of households in the North therefore practice shifting cultivation. Approximately 280,000 households are reported to survive on shifting cultivation (State Planning Committee/National Statistical Centre 1999 and ADB2000b).

According to National Environment Action Plan (NEAP), Lao PDR occupies the following three main agricultural climatic zones (STEA 2000a):

- The mountainous north with elevations over 1,000 m and steep slopes is dominated by moist to dry sub-tropical climate with annual rainfall between 1,500 to 2,000 mm. The area experiences a cooler dry season and hence higher intra-annual temperature variation than the rest of the country. Soils in the North tend to be heavily leached and acidic with low water retention capacity and generally low fertility. The combination of a rugged terrain and relatively poor soils leave little room for intensive agricultural production.
- The mountainous part of the Centre and the South has elevations between 500 and 1,000 m

(and some peaks over 2,000 m) but generally moderate slopes. Tropical monsoon climates dominate these regions with annual rainfall from 2,500 to 3,500 mm apart from some localised rain shadow zones on the Boloven Plateau. Soils here resemble those in the North with exception of the Boloven Plateau which has deep, well structured, less acidic soils with relatively good water retention and drainage capacity.

- The river plains along the Mekong and its tributaries include the Vientiane plain, the narrow plain in Borikhamxay and northern Khammouane, the larger plain of Khammouane, and Savannakhet and a series of smaller plains in the southern provinces of Champassak, Saravane and Attapeu. These support more than 50% of the population

crops were maize, vegetable and industrial crops. The total harvested area, production and yield of the crop production is shown in Table 1.1b.

Lao PDR has about 5,500 people per thousand ha of cultivated cropland, compared to some 3,000 in Thailand and over 11,000 in Viet Nam. Lao PDR's ratio is high for the country that has the lowest population density in the region. This points to the fact that pressure on the cultivated land is increasing, particularly in the north and in rural areas close to villages and communications infrastructure.

The quality and capability of the country's land resources have not been mapped in detail, but empirical evidence suggests that climate, topography and geology combine to make most of the sloping land susceptible to erosion and more suited to production of trees than to arable

**Table 1.1b Crop Growing Area, Production and Yield in 2000**

Crop	Area (ha)	%	Production (tonnes)	Yield (tonnes/ha)
Cereal	708,000	87.0	2,305,500	2.76
- Rice	690,000	78.4	2,230,000	3.23
- Lowland rice paddy	500,000	54.6	1,635,000	3.27
- Dry season rice paddy	110,000	6.7	465,000	4.23
- Upland rice paddy	80,000	17.0	130,000	1.63
- Maize	10,000	5.9	23,600	2.36
- Starchy Root Crop	8000	2.8	51,900	6.18
Vegetable	40,000	3.9	255,200	5.75
Industrial Crop				
- Coffee, Peanut, Cotton, Tobacco, Sugar-cane, etc.	71,554	9.1	246,900	3.38
<b>Total</b>	<b>788,162</b>	<b>100</b>	<b>2,251,159</b>	<b>2.86</b>

Source: MAF 2000

and are dominated by a moist tropical climate with annual rainfall varying from 1,400 to 2,000 mm. The floodplains and adjacent levies are generally characterised by recent alluvial deposits which are acidic and shallow, with low organic matter and low fertility. The younger alluvial soils of the floodplains are more fertile than the older terrace soils, but they are often subject to wet-season inundation.

The total cropland or crop harvested area in Lao PDR in 2000 was 708,0 Th. ha (MAF 1999) of which 690,0 Th. ha (78.4%) was rice paddy area. The rice paddy area included lowland rice paddy 54.6%, dry season rice paddy 6.7% and upland rice paddy 17%. The other

crops. While the country has considerable tracts with low population density, the overall resource base is fragile and carrying capacity is likely to be lower than in other countries in the region (STEA 2000a).

## 1.2 FOREST

Lao PDR has the most remaining pristine tropical rainforests in Southeast Asia. Although forest cover has declined greatly in the last 20 years, the decline has occurred more sharply in neighbouring countries. The country still retains forest cover of outstanding extent when compared with Thailand, China (Yunnan Province) and Viet Nam (IUCN 1999). The total forest area in 1989 was 11,168,000 ha or 47% of the total area, which gave Lao PDR one of the highest ratios of forest cover to total land.

There are many forest types in the country. In the North there are dry evergreen forest, scattered areas of tropical montane deciduous forest and small areas of subtropical montane forest. Along highland areas of the Annamite Mountains and Bolovens Plateau there are tropical montane evergreen forest and small areas of pine forest and forest on limestone. The Mekong River Plain covers mainly by lowland semievergreen dipterocarp forest. Dry dipterocarp forest and mixed deciduous forest are found in the Southern part of the country (ADB 2000b).

The Government classifies forests into 5 categories under the Forestry Law (NA 1996). Those forests are protection forest, conservation forest, production forest, rehabilitated forest and degraded forest or defoliated land.

Forest resources contribute substantially to the Lao economy. Forest product exports have provided an average of more than 40% of annual official exports (IUCN 1999). They provide a variety of non-wood forest products, fuelwood, and construction wood to meet the subsistence needs of the rural people. Fuel and charcoal are the most important domestic uses of wood, accounting for 85% of annual production. Commercial logging accounts for the remaining 15% of the total volume (ADB 2000c).

Non-wood forest products provide an important source of revenue to the local population. Among the most important commercial non-timber products are sticlac, cardamom, bamboo, benzoin, rattan and pine resin. Small amounts of these products are exported, mostly to Thailand and Viet Nam (STEA 2000a). In addition to commercial products, there are some 150 products harvested from the forest that are important for rural households.

The forest areas contain a rich diversity of ecosystems and species of great national and international importance. By protecting watersheds and controlling soil erosion, forests also provide other valuable environmental services important to the well-being of people, e.g. supporting agriculture and hydro-energy production.

Population growth, slash and burn cultivation and overexploitation of forest products are becoming increasingly unsustainable. This syndrome, combined with uncontrolled logging, forest fires, and the effects of wartime bombing and chemical defoliation, has greatly reduced both the forested area and also the quality of much of the remaining forest.

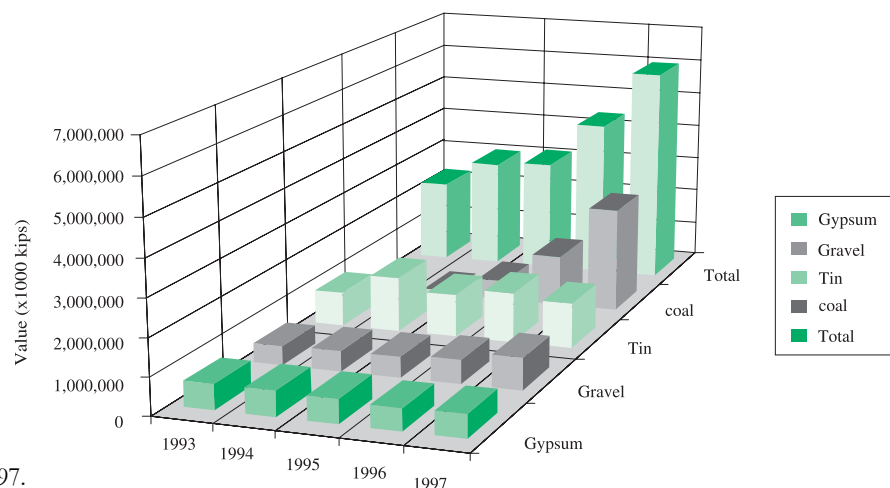
### 1.3 MINERAL

Lao PDR is rich in mineral resources, including tin, coal, oil, iron, copper, gold, gypsum, zinc and salt. They are just starting to be exploited and become products of national significance (MIH 1997). Although Lao PDR has good mineral potential, only 1% of the country's GDP comes from mining (STEA 2000a).

Tin is the most significant ore mineral, with reserves estimated at 10 million tonnes of ore, with a grade of 0.24% tin. Proven gypsum reserves are totally 150 million tonnes. Major Lignite deposits are found in Northwest Lao PDR. The proven reserves are more than 800 million tonnes. Little is known about the quality and extent of reserves of the other mineral resources. However, precious metals, gemstones (mainly sapphire), lead, zinc, and chromium; and industrial minerals show potential for high exploitation in the future.

Figure 1.3 Values of Major Mineral Production, 1993-1997

Source: MIH 1997.



Source: MIH 1997.

As Figure 1.3 shows, the value of mineral production has steadily increased during the period 1993-1997. The national revenue generated from mineral industry during 1993-1997 accounted for 18.8 billion kips (MIH 1997). In 1997 the revenue from mineral industry was 6,028 million kips which increased from 1996-more than 37%. The major production is coal (2,875 million kips), tin (1,230 million kips), gravel (865 million kips) and gypsum (624 million kips).

Lao PDR has significant and unexploited mineral resources that could become an important source of future growth. The Government's policy has been to rely on the private sector to develop mineral resources. However, an environmental assessment system should be established for the mining sector and should include clear guidelines for environmental management during the design, planning and operation of mining projects in the country.

## 1.4 ENERGY

### 1.4.1 Energy Consumption

Lao PDR is endowed with significant indigenous energy sources. The tributaries of the Mekong River within the country have few large-scale dams and reservoirs and hold a tremendous potential for hydropower development. There are major lignite deposits at Hongsa in northwestern part with proven reserves of about 810 million tonnes, of which over 530 million tonnes are deemed economically recoverable. Energy content is estimated at 8-10 megajoules per kg with a relative low sulfur content of 0.7-1.1% (ADB 2000b).



Photo 2.1 Num Ngum Dam, Vientiane Province

Energy use in the country is dominated by household consumption of traditional fuels, mainly wood and charcoal. In 1999, fuel wood was used for 90% of total energy consumption. The other sources were electricity 5% and petroleum product 5% (MIH 2000).

Indigenous fuel wood is the main source of energy consumed in Lao PDR. It has many household purposes in both rural and urban areas. Fuel wood is a major source of energy for cooking and lighting, especially in the rural areas. Even though the present electrical distribution network is available in many provinces such as Vientiane, Savannakhet, Champassak, Khammouane, Saravane, etc., but mostly is limited to the urban areas.

All petroleum products, as the other source of energy consumption, are imported and mostly used in the transport sector (UNESCAP 1992). The import of petroleum products increased from 76 thousand tonnes in 1987 to 118 thousand tonnes in 1990, to 638 thousand tonnes in 1996 and to 968 thousand tonnes in 1997 (MIH 1997).

There are four main sectors in energy consumption. These are household sector, commercial sector, transport sector and industry/agriculture sector. The household sector accounted for more than 90% of the total energy consumption (UNESCAP 1992).

### 1.4.2 Electricity Generation

Almost all the electricity generated in Lao PDR is from hydropower. In 1999 the installed capacity of hydropower was 627 MW (97.4%) while another 17 MW capacity (2.6%) was produced from diesel generator. The population with access to electricity is 20% of total population which domestic electricity consumption is 571 GWh or 100 KWh per capita (MIH 2000).

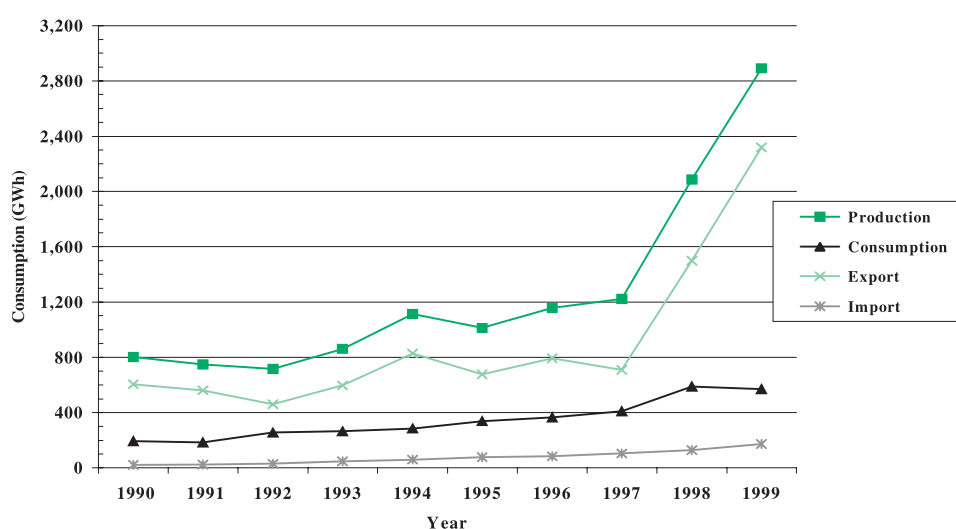
In 1999, total electricity generation was 2,890 GWh, representing an increase of 38.5% from the previous year. Total domestic consumption was 571 GWh, while export to Thailand amounted to 2,319 GWh. Electricity imported from Thailand and Viet Nam totaled 173 GWh, representing 6% of total production. Table 1.4 and Figure 1.4 show electricity production, consumption, export and import of Lao PDR from 1990 to 1999 (MIH 2000).

Table 1.4 Electricity Production, Consumption, Export and Import, 1990-1999 (GWh)

Year	Production	Consumption	Export	Import
1990	801	194	607	22
1991	747	185	562	23
1992	714	254	460	29
1993	860	264	596	48
1994	1,113	284	829	58
1995	1,013	337	676	77
1996	1,158	366	792	84
1997	1,224	410	710.2	104
1998	2,086.5	586.5	1,500	127.7
1999	2,890	571	2,319	173
<b>Total</b>	<b>12,606.5</b>	<b>3451.5</b>	<b>9,051.2</b>	<b>745.7</b>

Source: MIH 2000

Figure 1.4 Comparison of Electricity Production, Consumption, Export and Import Source: MIH 2000



Source : MIH 2000

The Ministry of Industry and Handicrafts (MIH) is responsible for the energy sector, including the electricity subsector. Electricity generation is the responsibility of Electricite du Laos (EdL). EdL is responsible for the planning, design and construction of its own facilities in generation, transmission and distribution, including both urban and rural electrification. The Science, Technology and Environmental Agency (STEA) in the Prime Minister's Office is the main coordinating agency for environmental planning and management across all sectors and is responsible for the environmental review and approval of hydropower projects.

The major constraint of economic growth and poverty reduction in rural areas is the lack of electricity. Only 8%

of rural Lao PDR households are connected to electricity grid, compared with over 60% in Vientiane. Households which are not connected to the grid pay high prices for electricity (ADB 2000b).

With the highest potential of hydroelectric generation in the region, Lao PDR should be able to supply more electricity to the people, especially in the rural area. However, to build a hydropower plant project, not only financial benefit to be concerned, the related agencies have to be involved in the environmental assessment, planning and management to ensure the maximum benefits both in socio-economic sector and the environment condition.



## 2 NATIONAL ECOLOGICAL RESOURCES

### 2.1 WATER RESOURCES

#### 2.1.1 Surface Water Resources

The climate in Lao PDR is typically tropical monsoon. A rainy season starts from mid-April to mid-October. The annual average rainfall is 1,600 mm but ranges from 1,300 mm in the northern valley to over 3,700 mm at high elevations in the South. About 75% of the rainfall occurs during the rainy season. The water level in the Mekong River may fluctuate by up to 20 m between wet and dry seasons (FAO 1999a).

About 80% of the Lao PDR's territory is located in the Mekong Basin, while the remaining 20% covers basins

The Mekong River is the main river in Lao PDR. Demarcating the border with Thailand, the river flows in Lao PDR for about 1,898 km, most of which is navigable. The major tributaries of the Mekong in the Lao PDR include large basins covering several of small and larger streams flowing throughout the year. These include Nam Ou, Nam Tha, Nam Beng, Nam Khan, Nam Ngum, Nam Theun, Nam Ngie, Nam San, Nam Kading, Xebangfay, Xebanghieng, Xedone and Xekong (MIH 1998). Lao PDR's main rivers with their length are shown in Table 2.1a.

The annual flow into tributaries of the Mekong River totals approximately 270,000 million m<sup>3</sup> (MCM). The monthly volume of water flow depends on the season. During the rainy season, the water flow reaches up to 80% of the total annual flow. In the dry season, it would be about 20% of the total annual flow<sup>1</sup> (MIH 1998).

Table 2.1a Main Rivers and Length in Lao PDR

Names of River	Flows by	Length (km)
Mekong River	Lao PDR	1,898
	Lao PDR-Thailand	919
Nam Ou	Phongsaly-Louangphabang	448
Nam Ngum	Xiengkhouang-Xaysomboun SZ-Vientiane Prov.-Vientiane Mun.	354
Xebanghieng	Savannakhet	338
Nam Tha	Louangnamtha-Bokeo	325
Xekong	Saravane-Xekong-Attapeu	320
Xebangfay	Khammouane-Savannakhet	239
Nam Beng	Oudomxay	215
Xedone	Saravane-Champassak	192
Nam Xekhanong	Savannakhet	115
Nam Kading/Nam Theun	Khammouane-Borikhamxay	103
Nam Khane	Houaphanh-Louangphabang	90

Source: MAF 1999.

of Nam Neun and Nam Mat in Xiengkhouang. The catchment areas for all tributaries of Mekong River in the country represent 26% of the total Mekong Catchment areas, and contribute 35% of the total annual flow of the Mekong River. The estimated area of inland water resources is 723,500 ha. Of which, 200,000 ha are from the Mekong River; 54,000 ha from other main rivers; 57,000 ha from reservoirs; 1,500 ha from swamps; 406,000 ha from rice fields; and 5,000 ha from fish ponds (STEA 2000a).

In addition to the Mekong, six small river basins drain from Lao PDR towards Viet Nam. They are the Nam Tale, Nam Ma, Nam Mat and Nam Ca rivers, and the other two are the Nam Louang and Nam Mo. They converge in Viet Nam before reaching the sea.

The annual supply of renewable freshwater is 270,000 MCM, or in excess of 54,000 m<sup>3</sup> per capita (1998 population). Annual current demand of 228 m<sup>3</sup> /person is only a small fraction of the supply (STEA 2000a).

Monitoring results show generally good water quality in the Mekong system. The types of water are classified as calcium carbonate/bicarbonate due to the influence of limestone in the areas. Chemical Oxygen Demand (COD) in the mainstream is about 1.5 mg/l and the dissolved oxygen concentration (DO) is as high as 7-8 mg/l (STEA 2000a).

Lao PDR has the highest per capita availability of renewable freshwater resources in Asia. However, by 1996 only 60% of the urban and 51% of the rural population had direct access to a good supply (WRI 1998). Although water demand is expected to increase, serious competition for water resources is not expected to be a problem during the period of years 2001-2005.

### 2.1.2 Groundwater Resources

Lao PDR can be classified into 2 geological areas: the Annamian Region and the Indosinian Region. The Annamian Strata which occupy most of Northern and Eastern part of the country, include granites, metamorphic, volcanic and Paleozoic rocks. The Indosinian strata which mainly occupy the Mekong plain, consist of sandstone, siltstone, shale, mudstone, limestone, conglomerate and basalt (ADB 1998). From these geological rock units, three different aquifer systems can be found:

\* The Annamian aquifers occur randomly. These are local systems that discharge locally to the river or its tributaries. The potential water supply from groundwater in the Northern part of the country is considerable in view of the high amount of recharge available. Water quality is reasonably good but with high iron content. Yields up to 5 liters/sec can generally be anticipated.

\* The Indosinian group of aquifers, which has regional flow, includes rock of Indosinian Moyennes and Superieures and is relatively young. They are mostly freshwater sediments, although there are horizons of brackish water, and one major zone of saline water. Yields of 12-24 liters/sec can be developed. Limestone in the Central Lao PDR is strictly Annamian in age, but its location places it logically in the Indosinian flow system. It has been described as having enormous groundwater resources.

\* The alluvial aquifers associated with the sedimentary deposits of the Mekong River are not rated highly as aquifers.

To date the only regional assessment of groundwater potential is the on-going study of groundwater in the Provinces of Champassak and Saravane funded by JICA. Several hundreds of wells have been drilled throughout the country mainly for rural supply but also for a few cottage and small-scale industries. In most cases, the depth of the rural water supply wells in lowland areas varies between 30-45 m and the yields vary from about 1 liters/sec to not more than 5 liters/sec (ADB 1998).

The groundwater resources remain the main sources of potential rural and small town water supply, especially in lowland areas located far from the surface water sources such as the Southern and Western part of Champassak Province, the hinterlands of the Xebangfay, Xebanghieng and Xedone valleys.

### 2.1.3 Irrigation

Lao PDR has abundant water resources that could be used for irrigation. In the mountainous areas, gravity irrigation can be developed. In the plains, there is a potential for reservoir, groundwater and pumping irrigation development.

In recent years, public investment in the irrigation sector has been about 40-50% of the total public investment within the agriculture and forest sector. By implementing the different irrigation plans since the establishment of Lao PDR (1975), irrigation infrastructure has expanded at the rate of 5-6% per year. This figure is significant for irrigation development by increasing supplementary irrigation to 25% of the total agricultural land covering irrigated rice fields of 91,860 Th. ha and 105,00 Th. ha of other crops during the dry season. This achievement has contributed to the development of the livelihood of the rural people.

The irrigated areas during the wet season were 280,000 ha or about 35% of the country's cultivated land. These irrigated areas have increased more than 70% from the year 1997 where only 164,270 ha of land could be serviced in the wet season (ADB 2000a). Table 2.1b shows the distribution of irrigation command area by type of system in the year 2000.

Table 2.1b Distribution of Irrigation Command Area in Lao PDR

Type of System	No. of System	Wet Season Irrigated Area (ha)	Dry Season Irrigated Area (ha)
Small dam (concrete weir)	631	53,744	27,294
Storage Reservoir	170	18,550	12,578
Pumping	3,176	138,203	135,860
Watergate	53	6,430	4,388
Traditional Weir	18,150	60,894	16,121
Gabion Weir	60	2,179	929
<b>Total</b>	<b>22,240</b>	<b>280,000</b>	<b>197,130</b>

Source: STEA 2000b

The Government's strategy for increasing the number of irrigation command areas is to use gravity and pump schemes to increase water supply and irrigate more land during the dry season and to shift from large, capital-intensive schemes; and to move away from government-managed systems toward farmer-managed systems.

#### 2.1.4 Hydropower

Hydropower is the most abundant and cost-effective energy source in the Greater Mekong River Basin with a theoretical hydroelectric potential of about 31,200 MW (AusAID 1996). In Lao PDR about 18,000 MW is technically

There are 9 hydropower plants providing the capacity of 624 MW. The details of these main plants are shown in Table 2.1c. There are also many small hydropower plants that provide another 3 MW and make the total capacity 627 MW.

The Government has developed a hydropower development policy to fulfil the following objectives.

- Provide a source of foreign exchange to fund economic and social development and accelerate poverty alleviation.
- Meet the commitments specified in inter-

Table 2.1c Existing Hydropower Plants in Lao PDR

No.	Project	Installed Capacity (MW)	Year of Completion	Province
1	Nam Ngum 1	150	1970	Vientiane
2	Theun-Hinboun	210	1998	Khammouane
3	Houay Ho	150	1999	Attapeu
4	Nam Leuk	60	2000	Vientiane
5	Xe Set	45	1994	Saravane
6	Selabam	5		Champassak
7	Nam Ko	1.5	1996	Oudomxay
8	Nam Dong	1	1970	Louangphabang
9	Nam Phao	1.6	1995	Borikhamxay
	Other Small Plants	3		
	<b>Total</b>	<b>627.1</b>		

Source: DANIDA 1998

exploitable, with 12,500 MW found in the major Mekong sub-basins and the remainder in minor Mekong or non-Mekong basins. Less than 5% of the country's hydropower potential has been developed over the last thirty years but under present policy, the rate of development will drastically increase (DANIDA 1998).

- government MOUs with Thailand and Vietnam.
- Satisfy growth in domestic electrical energy demand, currently running at 8% to 10% annually.
- Explore the mutual benefits of cross border exchanges and sales of electricity with the People's

Republic of China, Cambodia and other countries of the sub-region.

- Extend rural electrification so as to promote better socio-economic conditions within rural communities.
- Replace dependence on imported fuels for energy generation.

According to the hydropower development policy, hydropower projects can be divided into two types to meet different market requirements, namely domestic generation projects and export generation projects (DANIDA 1998).

- **Domestic Generation Projects:** These projects aim to supply the domestic market but can also be brought on ahead of need to earn export revenue. The generated electricity will typically be exported initially but progressively diverted into the local grid as local demand increases. Domestic projects are typically 60 MW or less and may be built to service remote areas or feed into the developing grid systems.
- **Export Generation Projects:** These projects are specifically designed to meet export commitments but may also supply local demand in the vicinity of the project. The projects are normally medium or large, with outputs of 100 MW or more. The private sector plays a major role in the implementation of these larger export power projects.

### 2.1.5 Wetland and Aquatic Resources

Lao PDR is intimately associated with one of the world's major wetlands - the Mekong River system. The Mekong basin covers about 80% of the country. Less than one quarter of this is lowland plains, which contain the majority of the Laotian wetlands and are the most densely settled and economically significant parts of the country (IUCN 1996).

The country has a number of wetland areas which are of international significance, including the Mekong River, the Xe Pian, Xe Khampho, Bung Nong Ngom complex, the Khone Falls-Siphandon cataracts, the Xe Kong Plains,

the Xe Champhon - Nong Louang wetlands and the Nakai plateau, and possibly the Soukhouma wetlands.

There are various estimates of the area of wetlands in the Lao PDR, ranging from 590 km<sup>2</sup> to 21,000 km<sup>2</sup> (IUCN 1996). The truth is that until accurate mapping



Photo 2.2 Harvested Fish from Num Gum Reservoir in the Huay Mor market, Vientiane Province

can be carried out, backed up by ground surveys, the area of wetlands cannot be known precisely.

The Mekong River and its tributaries are the main source of capture fisheries. Catch there represents over 60% of all landings. The main fishing methods are beach seines and drifting gillnets, although longlines and traps are also used. Most boats in use are flat-bottomed riverine style canoes; however, boats equipped with longtail engines are becoming more common, similar to those in use in coastal zones in the region. The main landing zones are near the urbanized areas of Vientiane, Thakhek, Savannakhet and Pakse; landings take place along the bank of the Mekong river and its tributaries. Rice fields are another important source of capture fisheries landings. Catches from hydropower reservoirs also contribute to landings, but productivity is usually low.

In Lao PDR, capture fisheries dominate the present aquatic food supply in Mekong River, its tributaries, swamps, rainfed rice field, the flood plains, reservoirs (natural and man-made) and a number of soft wet lands. In 1995, the capture fisheries yielded about 26,000 to 28,000 tonnes annually, while FAO reported that the fisheries yield in 1997 was 40,000 tonnes (FAO 1999b).

Department of Livestock and Fisheries (DLF) estimated that in 1997, the aquaculture production areas of fish ponds 3,016 ha, rice-fish culture 4,563 ha and small water bodies 7,019 ha (FAO 1999b). Productivity of the fish ponds is still low at a median value of about 500 kg/ha.

Limited data from rice-fish culture indicates productivity from fish stocked is approximately 150-200 kg/

ha (this excludes naturally recruited species). Natural ponds and small irrigation dams are not fertilised and rarely fed. Some stocking may take place and thus production of all species should be estimated as 300 kg/ha. Actual production of stocked fish is probably lower.

Moreover, the aquatic life in the Mekong River is characterised by its diversity. Unfortunately, little is known about its biology, including data on lifecycles, habitats and migration patterns. A ground-breaking study funded by IDRC through the Department of Livestock and Fisheries (DLF) provides valuable data. Fish represents the most important source of animal protein to the Lao PDR, comprising from 30 to 50% of total animal protein consumption (FAO 1999a).

**Table 2.1d Value of Imported Aquatic Projects, 1994-1998**

Year	US\$ Million
1994	1.6
1995	1.9
1996	2.7
1997	1.9
1998	0.1

Source: STEA 1999.

The Government considers fisheries (and livestock) as one of the most promising commercialisation opportunities for the agriculture sector. This is directed at the attainment of national food security and programmes run by the DLF aim to improve fish production and preserve indigenous aquatic resources.

Large-scale hydropower and other projects in the Mekong River and its tributaries may cause significant changes to the river system in Lao PDR. For example, fish migration routes may be impeded by dams or barrages. Due to limited knowledge about fish biology, it is difficult to predict the impacts of individual projects.

Officially, fishery resources do not contribute to export earnings. However, unofficial export under the form of border exchange is considered significant. Regarding the import of fishery products, there are no data on quantity. The value has been recorded as shown in Table 2.1d.

To sum up, the biological resources of wetlands come under the same kinds of pressure as terrestrial resources, to which they are usually ecologically linked. The ADB (2000a) reports on a number of critical issues affecting wetlands and the resources that they support:

1. Unsustainable fishing practices - the use of gill nets, blast fishing, fishing with poisons, pumping out of wetlands and inappropriate use of wing traps (impacts on migratory fish species);

2. Introduction of exotic fish species (carp and tilapia) into natural wetlands;

3. Hunting of wildlife and migratory waterbirds;

4. Trading in wetland wildlife, for example, turtles, tortoises, native fish species, Siamese crocodiles, with Thailand and Viet Nam acting as both pipelines for other countries, including the People's Republic of China (PRC), as well as directly absorbing some of the trade itself;

5. The impact of dams, for example, drying out of overflow wetlands, which are important fish breeding and nursery grounds; decrease in or loss of fish stocks through

blocking migration or changing water quality; possibility of increased vector-borne diseases e.g. malaria and liver fluke; and impacts on rice production;

6. Weed infestation, such as the large-scale invasion by *Mimosa pigra* in Savannakhet;

7. Abuse of DDT, methyl parathion and other pesticides, including their use as a tool for harvesting aquatic fauna;

8. The increasing threat of pollution as more industrial development is established in the Lao PDR, especially in major urban centres along the Mekong River, and as inadequate water quality standards are implemented if they are implemented at all;

9. A range of concerns related to irrigation projects, including soil related physico-chemical issues, e.g. salinisation, alkalisation, waterlogging, sedimentation and erosion; loss of fauna and flora in wetlands deprived of water by irrigation reservoirs; impacts resulting from the use of agro-chemicals associated with the production of irrigated crops; and socio-economic aspects, such as relocation of people out of affected areas; and

10. Increasing sedimentation of rivers, streams and reservoirs with poor forestry practices associated with commercial logging and shifting cultivation the most likely cause.

Fisheries development is seen to offer opportunities for attaining food self-sufficiency, with export options considered a long term objective. At present, export fish to Thailand remains illegal, but a thriving informal trade exists nevertheless. The DLF states that its first priority is to train farmers on how to culture fish. Also important was the development of regulations to control fisheries activities in rivers and reservoirs. Such enforcement would, in the case of the Mekong River, require cooperation with Thailand and possibly Cambodia.



Photo 2.3 Harvest fish from Num Gnum Reservoir, Vientiane Province

## 2.2 BIODIVERSITY AND WILDLIFE

The country's rich biological diversity will continue to dwindle away if the current rate of deforestation continues unabated. The highly mountainous terrain of the country creates wide variations in climate, soils, and ecological niches, leading to locally adapted and diverse biota. The original vegetation cover of the Northern Highlands consisted primarily of dry evergreen forest with, in



Photo 2.4 Megaderma Spasma, Nakai Numtheun NBCA, Khammouane Province (Source: IUCN)

contrast to the Annamites, substantial areas of deciduous forest at a range of altitudes. Shifting cultivation and forest fires have removed patches of forest on limestone and the fragments of a formerly extensive pine forest on the broad-leaved forest (ADB 2000b). Throughout the North, large areas of Imperata grassland, bamboo and other secondary vegetation flourish. Wetlands consist primarily of swift flowing rivers and streams, but the area includes also the Nam Ngum Reservoir, the country's largest manmade water body (230-450 km<sup>2</sup>, depending on season) and an important fishery (ADB 2000b).

In the regional context, Lao PDR is situated in the Indochinese subdivision of the Indomalayan Realm. The country contains parts of four biogeographic units (ADB 2000b). Their unit of "Annam" encompasses the Annamite Range and extends across Viet Nam to the South China Sea. The other three zones are sub-units of "central Indochina": the "tropical lowlands", the "tropical montane", and the "sub-tropical transition zone". The Indochinese fauna includes species shared with the Himalayan (species that have spread along the coast of Southern PRC), with the Chinese Palearctic South, and with Northern India through the Assam-Burma transition zone (ADB 2000b). The Annamite Range and the Mekong River are the main natural barriers in the area, forming the limits of the range of a number of species and sub-species.

The Mekong Plain physiographic unit originally was covered by lowland semi-evergreen forest, with extensive areas of dry dipterocarp forest and mixed deciduous forest. Much of the semi-evergreen forest has been logged, although large relatively intact areas still remain, primarily in the south and on the more inaccessible slopes. The lower slope areas are subject to some shifting cultivation pressure, which, coupled with seasonal fires, results in conversion to more deciduous forest types and, in heavily used areas, to shrubland and savanna. Remaining dry dipterocarp forests are widely subject to seasonal burning and livestock grazing. The most intensive human use of the Mekong Plain occurs in low-lying flat areas that are inundated during the rainy season. These areas are now largely converted to rainfed paddy fields.

Wetlands in the Mekong Plain include fast-flowing water courses, meandering rivers, and streams with oxbow lakes and seasonally inundated floodplains, freshwater ponds and marshes, seasonally flooded grasslands (formerly extensive), reservoirs, and rainfed and irrigated paddy fields. Almost all are subject to fishing and other forms of human disturbance, usually at high levels. The Sipandone wetlands or Khone Falls, a widening of the Mekong River at the Lao-Cambodian border, is noteworthy as the world's widest rapids.

A total of 319 out of 1,140 species included in the review are of national or global conservation significance (IUCN 1999). They comprise of 67% of the large mammals, 53% of the bats, 6 percent of the Insectivora, 14% of the murid rodents, 22% of the birds, 25% of the reptiles and 2% of the amphibians.

Institutions and activities dedicated to wildlife conservation are under resourced. Currently, the richness of Lao PDR's wildlife has less to do with conservation efforts than with the country's low human population density and consequently extensive forest cover. Although hunting pressure is high, the relative abundance of habitat and, in some areas, its long distance from human settlements, have provided partial protection for the country's wildlife. However, human population and development pressures are rising, especially since 1990. Wildlife throughout Lao PDR is declining, precipitously so in some areas and/or among some species.

At present, many species that require complete protection are not apparently listed (e.g. Black Ibis), while some common species that do not require any protective measures are listed as subject to hunting controls (e.g. drongos) (IUCN 1999). The latter situation severely compromises the credibility and enforceability of the legislation. The Division of Forest Resources Conservation (DFRC) in the Department of Forestry is currently drafting the regulation on protected areas, aquatic and wildlife management. It will be supplemented by proposed new definitions of protected species, based on information gathered from surveys of the past several years.

Biodiversity conservation efforts are of recent origin in Lao PDR. The DOF established the DFRC in 1999 to undertake surveys of wildlife and their habitats. Recognition of the programme by the National Forestry Action Plan prepared in 1990-1991 enhanced DFRC's importance as part of the forestry management and conservation programme implemented during the 1990s. Field studies operated through DFRC helped to identify the best remaining forest areas and wildlife populations, and also led to the discovery of several new species of mammals during the 1990s, such as the saola and large-antlered muntjac.

The establishment of 20 National Biodiversity Conservation Areas (NBCAs)<sup>1</sup> has begun to protect the country's biodiversity. An integrated conservation and development (ICAD) approach is being used to manage several of the NBCAs. The ICAD approach is being implemented as a pilot under the WB/Global Environment Facility (WB/GEF) project in four protected areas. Donor funding is being used to support the preparation of protected area management plans, technical assistance, rapid biodiversity appraisal, zoning of protected areas (including land use classification), training of DOF protected areas management staff, and infrastructure and civil works.

In addition to the centrally designated protected areas, large areas have been designated as protection or conservation forests at the provincial and district levels, some of which will be upgraded to official protected area status in the future. Together, the protected areas and the provincial and district conservation and protection forests cover 8 million ha, or 76% of the land in the forestry sector (ADB 2000b).

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<sup>1</sup> based on a criteria developed by IUCN, comprising 12-14% of the land area, of which 12 areas currently are receiving international donor support

### 3 HUMAN ECONOMIC DEVELOPMENT

#### 3.1 ECONOMIC PERFORMANCES

Lao PDR's economy remains undiversified and is heavily dependent on the country's natural resource base. The Government has committed itself to introducing a market-oriented economy. This reform started in 1986 when the government decided to free the food market for rice and other food staples. In subsequent years, the government floated the national currency, the kip, relaxed interest rates, opened up to foreign investments and privatised many small enterprises (HANDLEY 1993). Both the UN Development Programme and the IMF have and are continuing to guide

the country's economic transition, as conveyed in the New Economic Mechanism (NEM), which relaxed restrictions on private enterprises.

One striking feature of economic development in Lao PDR has been the relative decline of the agricultural sector, which still accounts for over half of GDP and employs over four-fifths of the population. Under the New Economic Mechanism (NEM), there has been a rapid expansion in the output of the industrial sector, particularly manufacturing. Consequently, the share of agriculture to GDP declined from 60.7% in 1990 to 56.4% in 1994 and 52.1% in 1998 (Table 3.1 a,b). Nonetheless, the economy remains predominantly agriculture in nature.

Table 3.1a Growth in Value of GDP by Sector, Lao PDR, 1990 - 1998\*

Year	Percent per Year				GDP per Capita (\$US)
	Agriculture	Industry	Services	Total	
1990	8.7	16.2	-0.5	6.7	200
1991	-1.7	19.9	6.5	4.0	230
1992	8.3	7.5	3.9	7.0	260
1993	2.7	10.3	7.7	5.9	280
1994	8.3	10.7	5.5	8.1	320
1995	3.1	13.1	10.2	7.0	377
1996	2.8	17.3	8.5	6.9	395
1997	7.0	8.1	7.5	6.9	362
1998	3.7	8.5	4.8	4.0	261

Note:\* Comparison at constant (1990) prices.

Source: ANDERSON 1999 and ADB 2000d

Table 3.1b Composition of GDP by Sector, Lao PDR, 1990 -1998\*

Sector	1990	1992	1994	1996	1998
GDP (Million Kips)					
Agriculture	371,835.4	395,537.0	439,786.5	466,205.5	517,066.9
Industry	88,104.9	113,587.2	136,566.5	183,996.7	215,739.0
Services	147,376.9	163,038.2	187,070.3	221,614.9	249,707.5
Import Duties	5,364.0	9,635.2	16,637.9	21,438.8	10,412.0
Total	612,681.2	681,797.6	780,061.2	893,255.9	992,925.4
GDP (%)					
Agriculture	60.7	58.0	56.4	52.2	52.1
Industry	14.4	16.7	17.8	20.6	21.7
Services	24.1	23.9	23.7	24.8	25.1
Import Duties	0.9	1.4	2.1	2.4	1.0
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100</b>	<b>100.0</b>

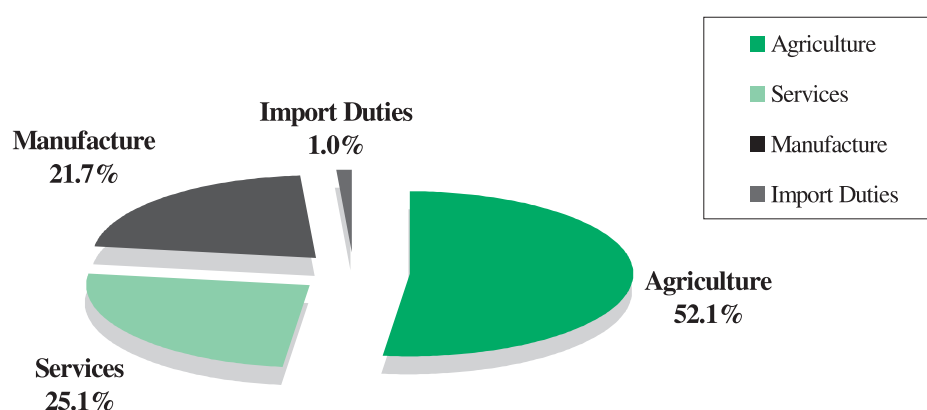
Note:\* Comparison at constant (1990) prices.

Source: MAF 1996 and ADB 2000c



Gross Domestic Product of the country consists of 4 sectors; agriculture, industry, service and import duties. In 1998, total GDP of the country was 992,925.4 million kips where agriculture (as stated above) accounted for 52.1%, industry 21.7%, service 25.1% and import duties 1% (Figure 3.1). In each sector, there were the sub-sector components, as shown in Table 3.1c.

Figure 3.1 Composition of GDP by Sector, 1998



Source: MAF 1999

Table 3.1c Detail of GDP by Sector and Sub-sector in 1998\*

Sector	GDP (Million Kips)	% in Sub-sector	Total (%)
<b>Agriculture</b>	<b>517,066.9</b>		<b>52.1</b>
- crop production	269,954.0	52.2	
- livestock and fishery	192,972.0	37.3	
- forestry	54,440.0	10.5	
<b>Industry</b>	<b>215,739.0</b>		<b>21.7</b>
- manufacturing	164,455.0	76.2	
- construction	26,714.0	12.4	
- electricity, gas and water	20,513.0	9.5	
- mining	4,057.0	1.9	
<b>Services</b>	<b>249,707.5</b>		<b>25.1</b>
- retail and wholesale trade	102,269.0	41.0	
- transportation and communications	56,845.0	22.8	
- finance	1,655.0	0.7	
- governmental service	29,314.0	11.7	
- others	59,624.5	23.8	
<b>Import Duties</b>	<b>10,412.0</b>		<b>1.0</b>
<b>Total</b>	<b>992,925.4</b>		<b>100.0</b>

Note:\* Comparison at constant (1990) prices.

Source: MAF 1999 and ADB 2000c

### 3.1.1 Agriculture Sector

There are 3 main components in the agriculture sector; crops, livestock and fisheries, and forestry. In 1998, crop production accounted for 52.2% of total agriculture value added. Livestock and fisheries also represented a significant proportion (37.3%). The remainder of 10.5% was accounted for by forestry (MAF 1999).

#### Crop Production

In 1998, about 788,162 ha of land was under cultivation, of which 617,538 ha or 78.4% was devoted to rice cultivation (MAF 1999). However, only around 10% of the total land in Lao PDR, is considered suitable for agricultural activities. Cultivation is carried out according to two distinct patterns, one for the lowlands and one for the highlands. Approximately 55% of rice is grown in the lowlands. Lowland agriculture involves permanent farming communities, which enjoy irrigated fields. In the highlands, farming communities are to some extent migratory, continuing to pursue swidden “slash-and-burn” methods in which forest areas are cut to the ground and burnt in preparation for planting. The Government currently attempts to discourage swidden agriculture among the highland people, in order to prevent deforestation.

Important crops in the lowlands include wet rice, corn, wheat, cotton, fruit and vegetables. In the mountains, dry rice, tobacco, tea and coffee represent the major cash crops.

#### Livestock and Fisheries

Livestock production, which includes buffaloes, cattle, pigs, poultry, goats and sheep, also contributes appreciably to the economy. A considerable amount of agricultural activities are at the subsistence level. Value added from livestock and fisheries was recorded in 1998 at 192,972 million kips (MAF 1999).

The rivers produce a steady supply of fish-an important source of nutrition for the population at large. The huge lake (230-450 km<sup>2</sup>, depending on season) created by the damming of the Nam Ngum supports a number of experimental fisheries.

#### Forestry

The Lao PDR forests are endowed with valuable hardwood, which continues to be an important source of foreign exchange earnings. In 1998, value added from forestry was recorded at 54,440 million kips while exports

of wood products including sawn timbers amounted to 32.2 million US\$. In addition, exports of logs generated 8.5 million US\$ (MAF 1999).

The Government policy is shifting towards the promotion of wood processing from exports of raw logs and lumber. However, full implementation of this policy is hindered by shortage of capital and technical skills within the country (ASEAN 2000).

### 3.1.2 Industry Sector

Manufacturing, construction, electricity and mining comprise the industry sector. In 1998, manufacturing accounted for more than three fourths (76.2%) of industrial value added. Construction and electricity shares were at 12.4% and 9.5% respectively while the share of mining was minimal at 1.9% (ADB 2000c).

Within manufacturing, the garment sector attracted the most foreign investment and also recorded the largest growth. Though most manufactured goods used in the country are imported from Thailand or elsewhere, there are a few factories in Vientiane that produce soft drinks, beer, cigarettes, bricks and cement. Increased foreign investment may eventually involve joint manufacturing ventures. However, the lack of skilled labour will invariably hinder growth in this sector.

### 3.1.3 Service Sector

In 1998, the service sector accounted for 25.1% of the country's GDP. Three most important components of total value added were retail and wholesale trade (41.0%), transportation and communication services (22.8%) and government services (11.7%) (ADB 2000c). Service sector growth has resulted from the rapid increase of retail and wholesale trade, hotels and restaurants. The fast growth of these sub-sectors is reflective of the open door policy of the Government. In 1998, more than 500,000 tourists visited the country, 8% increase from 1997 and 24% increase from 1996 (NTA 1998). The other sub-sectors, which also contributed to the growth, were banking, insurance and real estate.

## 3.2 SETTLEMENT

Land use has changed significantly over the years. Forestlands have been converted to croplands and agricultural lands, to permanent pastures and other uses, mainly as a result of the food and shelter needs of an increasing population.

Unplanned conversion is a major factor influencing land use changes. Encroachments by settlers and shifting cultivators have opened vast areas of forests, leaving them without adequate protection. Not all forestlands that have been settled or cultivated were developed into productive areas for agriculture.

Most hydropower projects have caused the people to relocate. Although relatively small numbers of families (mostly ethnic minorities) have been resettled, some of resettlements have not reached the social and economic expectations of project planners. In some cases, insufficient land or land of poor crop suitability was given for resettlement compensation. The resettled communities have found it difficult or impossible to earn funds to buy equipment, fertilizer and other inputs necessary for successful farming. Additionally, government services, such as agricultural extension, education, and public health have not necessarily been forthcoming as expected in many areas.

### 3.3 SUPPORTING INFRASTRUCTURE

#### 3.3.1 Communications

The government relies mainly on a radiotelephone network to communicate with remote areas. The country system connects a total of approximately 41,672 (MCTPC 1999). telephones throughout the provinces. The system provides services to the general public but is still considered poor.

#### 3.3.2 Transportation

As of 1998, the road network supported a sprawling system of 23,206.6 km, of which approximately 3,694, is paved and 19,512.3 is unpaved (MCTPC 1999). The country has 36 airports, of which

only 10 airports have paved runways (MCTPC 1999). The ratio of paved to unpaved airstrips remains about 1:3.6.

There are no railways in Lao PDR, except for a small, unused length of track that the French laid during their colonial days in Indochina. Land-locked by six nations on all its sides, Lao PDR has no ports or harbours.

#### 3.3.3 Sanitation Infrastructure Services

##### Water Supply

As of 1996, approximately 52% of total population had access to clean water supply. This estimation also showed that the accessibility of urban population to water supply is 60% and rural population is 51%. The estimated water usage in the urban area was 150 liters per day (WRI 1998). However, only 8% of households had a water faucet in the house. 37% relied on rivers, dams and lakes (NSC 1998).

##### Sewerage

As of 1996, approximately 98% of urban population and about 16% of rural population had adequate sanitation facilities (WRI 1998). It was also estimated that 68% of households did not have a latrine. Only 20% had a flush toilet and 12% a pit latrine (NSC 1998).

#### 3.3.4 Electricity

The Energy statistics show that in 1999, only 20% of the population had access to electricity (MIH 2000). However, it was reported that only 28% of households used electricity for lighting. 59% used kerosene lamps and another 10% used candles (NSC 1998).



Photo 2.5 Downstream of Khon Pha Pheng falls, Champassak Province

## 4 HUMAN QUALITY OF LIFE VALUES

### 4.1 SOCIO-ECONOMICS

#### 4.1.1 Status

The population of the Lao PDR reached 5,218,000 in the year 2000, with an annual growth rate of 2.4% (Lao PDR 2000). The average population density is 21 per km<sup>2</sup>, giving Lao PDR the lowest population density in Asia. The highest population density is in Vientiane municipality, with 149 per km<sup>2</sup>, while the lowest population density is in Xaysomboun Special Zone at 8 per km<sup>2</sup>.

About 85% of the total population are in the rural areas. About 2,220,547 people are engaged in productive work and 936,870 people are unemployed - a classification which includes students 69.4%, domestic workers 12.6% and the aged 14.6%. There are 576,758 people at work in towns and 2,580,659 people work in the countryside (Lao PDR 2000).

Currently, Lao PDR ranks near the bottom of many socio-economic indicators. 39% (CPC: Socio-Economic Development Strategy 2001) of Lao citizens live below the poverty line, as defined by the World Bank. Correspondingly, average life expectancy does not exceed average life expectancy is 59 years (CPC: Socio-Economic Development Strategy, 2001) compared with 79 years in the United States (WB 2000). An estimated 80% of the population is engaged in the agricultural sector, which includes crop cultivation, livestock, fisheries and forestry. The country's annual per capita income in 1998 was US\$ 350 (Socio-Economic Development Strategy 2001). However, in case of Lao PDR these low income-levels reflect the minimal standards of living affecting the majority of people in the country.

Rural areas, where 85% of the country's population live, suffer most severely from underdevelopment. Poverty leads to lower quality of life and other problems namely health impact, malnutrition, lack of access to basic social services, etc. Most of the poor live in rural areas where the incidence of poverty is more than twice that in the urban areas. According to the Human Development Index, a social indicator of a country's well being, Lao PDR ranks 140 out of 174 nations and below all its Southeast Asian neighbours (UNDP 2000).

#### 4.1.2 Regional Disparities

More than ten years of economic transformation have not yet achieved to narrow the gap between the rich and poor regions of the country. In terms of development, the central provinces represent the most economically dynamic regions of Lao PDR (EIU 1999). The centre regions have benefited from their close proximity to Vientiane, which has attracted the lion's share of investment. Consequently, a developed communications and transportation infrastructure has supported the economic core of the country. Yet, as Lao PDR goes through the process of market liberalisation, its apparent uneven development across the regions calls the entire process into question. For a purported socialist state, the uneven distribution of wealth inherent in the capitalist system confronts Lao PDR with disturbing contradictions. How the government corrects for these imbalances will determine the future direction of its policies towards economic liberalisation.

Since market liberalisation began in the 1980s, the country has witnessed impressive gains, albeit from an initial low base. Nonetheless, the current economic picture hides a wealth of problematic variations at the regional levels. For a country of its size, Lao PDR's relatively small population is dispersed unevenly and usually along ethnic lines. Not unrelated, the country's uneven economic development has contributed to ethnic and regional marginalization, where the Lao Loum in the central lowland areas have benefited most from market and institutional reforms. GDP per capita of the central region is 7% greater than in the southern region and 62% higher than the impoverished northern one (BOURDET 1998). The wealth of the nation is located in the central region, where the capital Vientiane acts as the commercial, financial and administrative/governmental core for the entire country. From Table 4.1, column 1, the GDP per capita of the two wealthiest provinces (from the central region) exceeds the national average by about 40%, while that of the three poorest provinces (located in the north) accounts for only 60%. Social indicators in the succeeding columns of Table 4.1 reinforce this regional bias. Clearly, the central region has more access to basic social services than the other regions, with the northern provinces lagging far behind the rest of the country. Many factors contribute to the current disparities, such as the growth of the service and manufacturing sectors in central and southern centres, as well as the stagnant agricultural sector in the northern provinces.

Table 4.1 Socio-economic Indicators by Province, Lao PDR

<i>Province</i>	<i>GDP Per Capita (Mean = 100) 1992-93</i>	<i>Literacy Rates<sup>a</sup> Males - Females %/1995</i>		<i>Primary Education Not Completed<sup>b</sup> %/1995</i>	<i>Infant Mortality Rates<sup>c</sup> %/1995</i>	<i>Use of Electricity of All Households<sup>d</sup> %/1995</i>	<i>Access to Safe Water of All Households<sup>e</sup> %/1995</i>
<i>North</i>							
Phongsaly	63	44.8	25.0	87.2	94	3.1	0.4
Louangnamtha	58	46.6	19.6	87.9	119	8.5	5.1
Oudomxay	77	59.8	24.3	88.4	88	5.5	12.3
Bokeo	79	56.8	27.3	85.9	82	11.2	1.9
Louangphabang	79	68.3	38.5	81.8	132	9.8	10.4
Houaphanh	56	71.0	40.8	80.4	125	27.1	1.8
Xayaboury	74	75.2	54.8	71.3	130f	11.9	2.4
<i>Centre</i>							
Vientiane M.	142	92.2	78.9	46.1	72	84.0	48.0
Vientiane	136	83.6	60.7	63.1	102	41.3	7.8
Xaysomboun-SZ	--	69.5	30.9	80.3	138	9.3	0.9
Borikhamxay	111	77.6	52.6	73.6	136	17.4	3.8
Khammouane	111	70.7	43.1	77.9	83	22.9	8.5
Savannakhet	94	70.2	43.6	76.0	80	25.3	21.0
Xiengkhouang	92	73.7	47.1	74.4	121	15.9	1.8
<i>South</i>							
Saravane	99	65.7	35.2	83.4	86	9.0	11.1
Xekong	108	55.9	24.0	89.1	96	7.0	7.9
Champassak	121	84.7	59.4	69.4	91	16.8	22.2
Attapeu	95	69.2	37.2	84.8	93	4.0	4.1
Lao PDR	100	73.5	47.9	73.4	104	25.4	15.1

Sources: BOURDET 1998

Notes: Xaysomboun-SZ is a new province formed using parts of Vientiane Province and Xiengkhouang.

<sup>a</sup> Literacy rates concern the population aged 15 years and above.

<sup>b</sup> Proportion of the population (aged 6 years and above) with no or not completed primary education.

<sup>c</sup> Infant mortality is defined as the number of children who die during the first year of life per 1,000 births.

<sup>d</sup> Access to electricity concerns the public net, private generators, and car batteries.

<sup>e</sup> Safe water is defined as piped water or protected well/bore hole.

<sup>f</sup> Average for Xayaboury (1) and (2). The province was divided into two parts in the original survey.

The country continues to follow a path of economic liberalisation, albeit at a slow and fragmented pace. Its natural resources exploitation seems to favour private investors at the expense of its pristine ecology and indigenous people. Moreover, economic gains have favoured the central regions and have further exacerbated social inequalities, along regional and ethnic lines. At the present rate, Lao PDR's economic growth cannot be sustainable. Regional imbalances, coupled with ethnic stratification - leading to potential ethnic unrest- and environment degradation, will stress the country's social cohesion and limit its potential for development.

Budget allocations to the social sectors have traditionally been very low. In recent years, rising national

consciousness of the low levels of human development and social services has led the Government to increase social sector budgetary allocations over the years.

There has been a clear and continuous improvement in the budgetary situation since 1990. Tax revenues as a percentage of GDP have gradually increased, from 6.4% in 1989 to 10.8% in 1996. During the same period, the fiscal deficit fell from 20% to 8.8% (Lao PDR 1998).

Lao PDR should continue market reforms in order to maintain economic growth, but that growth should achieve equity and improvements in the quality of life for its people. This requires further strengthening of the social sectors, improving the quality and levels of public provisioning for

social services, providing people with employment opportunities and ensuring better access to productive assets and credit.

By forthrightly addressing regional disparities, re-evaluating agricultural policies and natural resources exploitation, Lao PDR can better manage the transition to the modern world and capture the best that globalization has to offer without becoming overwhelmed by its capricious capital markets and hostile cupidity.

## 4.2 PUBLIC HEALTH

Increased public expenditure (0.7% of GDP in 1991 to 1.5% in 1999) and substantial external assistance to the health sector have improved the health condition in Lao PDR (ADB 2000d). The infant mortality rate is around 96 per 1,000 and the maternal mortality rate was around 650 per 100,000 in 1998. Child malnutrition rates remain high at 43%. There is a clear need to increase spending on health, but there are also concerns that the impact of the past health expenditures have been limited.

Nearly 85% of villages claim malaria as their major health problem. Malaria alone accounts for 44% of all hospitalisations in Savannakhet and Bokeo municipalities. Rural populations living in or near forested and hilly areas along streams are most at risk.

Another mosquito-born disease, dengue fever, is also widely prevalent in the country. Acute respiratory illnesses and diarrhoea remain major causes of child mortality after malaria. The poor health conditions reflect the inadequacies of the health system and people's lack of access to quality health care. The high incidence of diseases also reflects failures in the provisioning of basic social services including access to safe drinking water and appropriate environmental sanitation.

The public health care system has, however, expanded over the years with positive outcomes. The Expanded Programme on Immunisation (EPI), launched in 1982, uniquely covers almost all villages, reaching even the most remote. The EPI has removed measles as a major cause of child mortality. About 61.5% of children have received the measles vaccine. In 1995, over 90% of villages were visited, on an average of four to six times by health personnel for the EPI service. The number of children not immunised fully with Diphtheria, Pertusis and Tetanus (DPT3) fell from 32% in 1994 to 11% in 1995 (NSC 1998).

Despite these advances, rates of immunisation remain low among children. Recently gathered data from the Mother and Child Health Institute (MCHI) reveal that in 1997 only 28.3% of children aged 12-23 months received the DPT3. 32.9% received the Oral Prevention Vaccine (OPV3) and only 23% of the children had an immunisation cards to show proof of immunisation.

Recently conducted village surveys point to the limited coverage and reach of medical facilities and personnel across the country, including hospitals, dispensaries, medical practitioners and trained nurses. The quality of services and care is also reportedly poor. Modern health care, provided from well-equipped and staffed facilities, is unavailable in the majority of rural areas.

Women, in particular, face serious health and survival risks in this situation, given the extremely high fertility rates in the country. The Fertility and Birth Spacing Survey conducted in 1996, reports a Total Fertility Rate (TFR) of 6.4 pertaining to the period five years before the survey. Estimates of TFR for one year preceding the Survey are even higher at 7.1.

Lao PDR also faces the potential danger of the spread of HIV/AIDS. The first AIDS case was reported in 1991. By August 1998, 91 cases of AIDS and 288 HIV-positive cases had been reported (NSC 1998). However, in the absence of a proper surveillance system, these figures are not considered reliable. Although initially small, the number of HIV/AIDS cases may explode exponentially and impose considerable burdens on an already weak public health system.

During the National Socio-Economic Development Annual Plan Period (1998-1999), more emphasis has been put on improving public health. The Government aims to reduce the incidence of major diseases, such as malaria, diarrhoea and acute respiratory system infections. In addition, they have increased efforts in disease prevention through education programmes throughout the country. At the same time, the services system has been improved with increased construction and technical promotion funds in the field of public health. The Government is aiming to provide between 60-70% of the rural population with access to clean water and 40-50% with hygienic latrines.

### 4.3 EDUCATION

Development in Lao PDR is constrained by low educational attainment, inadequate education quality, and a lack of technical training (STEA 2000a). Although current gross enrolment rates in primary and secondary education represent impressive gains, the adult literacy rate remains very low. In 1998, the adult literacy rate (age 15 and above) of male population was 82%. (NSC, 1999)

There has been progress in extending the primary school system in Lao PDR over the past five years. While the gross enrolment rate for primary education is around 116%, the net enrolment rate is about 76% (only 72% for girls). The net enrolment rate for lower secondary is only 15-20%. The net enrolment rates for primary and secondary education are much lower in rural areas due to barriers of access and cost constraints. There is a serious gap in the quality of education between urban and rural areas. In rural primary schools, only 60% of students have books. Most primary school teachers in rural areas are untrained since trained teachers are mainly concentrated in urban areas. Posting and retaining better-qualified staff in rural areas is problematic. The regional, rural/urban and gender disparities weaken the education system (ADB 2000d).

Low efficiency of public expenditure seriously pervades the education system. While public expenditures on education have marginally increased from 1.9% of GDP in 1991 to about 2.0% in 1999, recurrent expenditures have rapidly declined from 80% of total education expenditures in 1991 to 46% in 1999. As a result, repetition rates and dropout rates are as high as 25% and 12% per annum, respectively. Primary completion rates are only around 60-65% and estimated at 55% in rural areas. To achieve the Government's goal of universal primary education by 2012, there is an urgent need to address critical issues of the education sector including insufficient access to complete primary education, weak planning and management capabilities, inadequate financing, especially recurrent costs, and poor quality (ADB 2000d).

### 4.4 THE COUNTRY'S HERITAGES

Lao PDR has many visitable sites which are important attractions and are of cultural value and represent major aspects of the heritage of the country. These heritage sites can be classified into 4 categories namely cultural heritage sites, natural aesthetic sites, archaeological sites and historical sites.

#### 4.4.1 Cultural Heritage Sites

##### That Louang or the Great Stupa

The most unique edifice in Lao PDR is That Louang or the Great Stupa, located in Vientiane. A "That" is a spire



Photo 2.6 That Louang in Vientiane Municipality

or dome-like structure that commemorates the life of the Buddha. The staff and begging bowl, of the wandering Buddha may have inspired the distinctive shape. Many That are said to contain sacred relics, parts of Buddha's body, e.g. a hair, nail or piece of bone.

That Louang was constructed in 1566 by King Say Setthathirat and restored in 1935. The stupa is situated 3km north of the centre of the city.

##### Louangphabang Province



Photo 2.7 Tat Kongs Water Fall in Louang Phabang Province

Louangphabang is the jewel of Indochina. The ancient royal city is surrounded by mountains at the junction of the Mekong and its tributary the Khan river. Louangphabang has dozens of temples and religious sites.

Louangphabang, with its many temples, Palace Museum and other historic buildings, has been designated a World Heritage Site and is currently receiving international assistance on conservation of historical sites and improving the urban environment. As part of the UNESCO plan, new buildings have been limited and development must be in keeping with this magical place.

### Pak Ou Caves

Pak Ou Caves, the cool limestone caves, situated 25 km upstream from Louangphabang at the confluence of the Ou and Mekong rivers. The best attractions here are the two caves, Tham Ting and Tham Phun, that house countless numbers of Buddha images that have been left over hundreds of years by devotees.

### Wat Xiengthong

Wat Xiengthong is situated on the bank of Mekong River, on the wedge of land formed where the Mekong and Nam Khan meet. It was constructed in 1559/1560 A.D. by King Say Setthathirath. Wat Xiengthong is the most beautiful of the monasteries of Louangphabang and represents the typical Lao art style.

### Louangnamtha Province

Located in the northern part of Lao PDR, Louangnamtha Province shares its northwestern border with Myanmar and its northeastern border with China. The province is home to 39 minorities - the largest number in the country.

UNESCO currently funds an ecotourism project in Louangnamtha with the objective of contributing to sustainable development in the province. The project hopes to provide education, conservation, management and sustainable economic benefits for the local population.

#### 4.4.2 Natural Aesthetic Sites

### Vang Vieng

Vang Vieng, situated 160 km north of Vientiane, is home to the Hmong and Yao people. The main

attraction of Vang Vieng area is the limestone karst that lines the Song River. The karst is honeycombed with caves, tunnels and waterfalls.

### Nam Ngum Lake

Nam Ngum Lake is situated about 80 km to the north of Vientiane. The beautiful scenery over the Nam Ngum river and its green valley is enhanced



*Photo 2.8 Nam Ngum reservoir, Vientiane Province*

by the presence of a vast, spectacular lake. This is a man-made reservoir for a hydroelectric power dam, generating most of the electricity sold to Thailand. The forests with a wide variety of woods are still there on the thousands of islands dotting the lake. It is a rewarding experience to cruise around by motorboat or spend the day or the week-end at one of the many bungalows or on the "floating restaurant boat" to enjoy the picturesque scenes of water, islands, forests and charming fishing-villages.

### Khammouane Province

Khammouane province contains two vast wilderness areas known as the Khammouane Limestone NBCA and the Nakai - Nam Theun NBCA. The Khammouane Limestone is a maze of limestone karst peaks forming a stone forest of caves, rivers and pristine jungle. The National Tourism Authority of Lao PDR is currently investigating ecotourism projects in this region.

### Bolaven Plateau

Situated in the northeast of Champassak Province, the plateau is a fertile farmland specialising in coffee, tea, cardamom and fruit. The plateau houses a dozen mainly animist ethnic minorities, including Laven, Alak, Katou, Ta-Oy, Houne, Ngai and Suk communities.



### Si Phan Done - Four Thousand Islands

The southernmost part of Champassak Province forms the border with Cambodia. Here, the Mekong River spreads to a width of up to 14 km during the rainy season forming hundreds of islands and islets. The larger islands are inhabited and the largest southern island, Don Khone has an old disused 5 km railway, built by the French as part of the Mekong bypass route. The river cannot be navigated south of Don Khone because of the Khone Falls - the smaller Samphamit Falls and the larger Khon Pha Pheng Falls - the biggest in Asia, and maybe the widest falls in the world. The endangered Irrawaddy dolphins are often spotted near the falls.



*Photo 2.9 Tham Ting Cave in Louang Phabang Province*

#### 4.4.3 Archaeological Sites

##### Wat Phu

Wat Phu (mountain temple), located in the province of Champassak is a site that dates back to the 5th century. The Khmer Hindus built the original temple at the top of a hill on the site of a fresh water spring. The peak of the hill is said to resemble a lingam or Shiva Phallus. The exact history of Wat Phu is unclear, but it was certainly the site of a temple of the Khmer Empire that eventually made Ankor Wat its capital. At the top of the temple site are a number of carved rocks, resembling a crocodile, a naga (a cobra) and an elephant. It is believed that these rocks were used for human sacrifice.

Wat Phu, which is an impressive ruin of Khmer style, currently receives international assistance for conservation and visitor facility development and may one day become a World Heritage Site.

##### The Plain of Jars

The Plain of Jars, situated in Xieng Khouang Province, north of Vientiane, is the biggest attraction of the province. Situated near Phonsavan are several grassy areas on which stand stone jars, about 1 to 2.5m high with the biggest of 3.25m high. The jars are between 2,500 to 3,000 years old. Their provenance and function remain a mystery. Local legend says that they were made to ferment rice wine after a victory against a wicked chieftain in the 6th century.

The Plain of Jars, which comprises of hundreds of unique stone jars, has been proposed for international assistance for conservation and development of visitor facilities and is expected to apply for and receive a World Heritage Site designation.

#### 4.4.4 Historical Sites

##### Patuxai (Anousavary) - Victory Monument

This Victory Monument is situated at the north end of Lan Xang Avenue. Constructed in 1958, the architecture is inspired by the Arc de Triomphe in Paris with typical Lao motifs. In the daytime, visitors can climb the monument and enjoy excellent views of the city.

##### Historical Buildings (French Colonial Style)

Historical buildings include French Colonial style structures in several urban areas particularly Vientiane and Louangphabang. Many of these buildings have deteriorated over the years because of lack of maintenance, although a few have been restored. Some government agencies have indicated their interest in restoring other Colonial buildings and a few have commenced programmes for this activity. Historical sites give interesting architectural accents to urban spaces and urban character. Efforts should be continued and increased to restore these buildings and convert them to modern uses, including for tourist facilities.

## 5 INTERNATIONAL COMMITMENTS AND OBLIGATIONS

### 5.1 UNITED NATIONS CONVENTION ON BIOLOGICAL DIVERSITY (CBD), 1996

Lao PDR accepted accession to this Convention on 20 September 1996. As a signatory to this Convention, Lao PDR agreed to the following:

- To develop a national strategy for conservation and sustainable use of the nation's biological diversity - Lao PDR is in the early stage of developing a Biodiversity Action and strategy
- To develop regulatory provisions for protecting threatened species and populations;
- To integrate conservation and sustainable use of biological resources into national decision-making;
- To conduct an Environment Assessment (EA) of proposed development projects with a view to minimising harmful affects; and
- To take measures for an equitable sharing of the results of research and development in genetic resources.

### 5.2 UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE (UNFCCC), 1992

The Lao PDR has accepted accession to this Convention on 5 January 1995. As a signatory to this Convention, the Government agrees to conduct and publish national inventories of the mass balance of greenhouse gas emitted and removed by the nation's sources and sinks, respectively. The first national communication was issued in 2000.

### 5.3 UNITED NATIONS CONVENTION TO COMBAT DESERTIFICATION (CCD), 1994

Under this treaty, the Government agrees to adopt an integrated approach addressing the physical, biological and socio-economic aspects of desertification. Lao PDR has been a signatory since 30 August 1995 and accepted accession to the Convention on 20 September 1996. The Convention came into force on 26 December 1996.

### 5.4 CONVENTION CONCERNING THE PROTECTION OF THE WORLD CULTURAL AND NATURAL HERITAGE (WHC), 1972

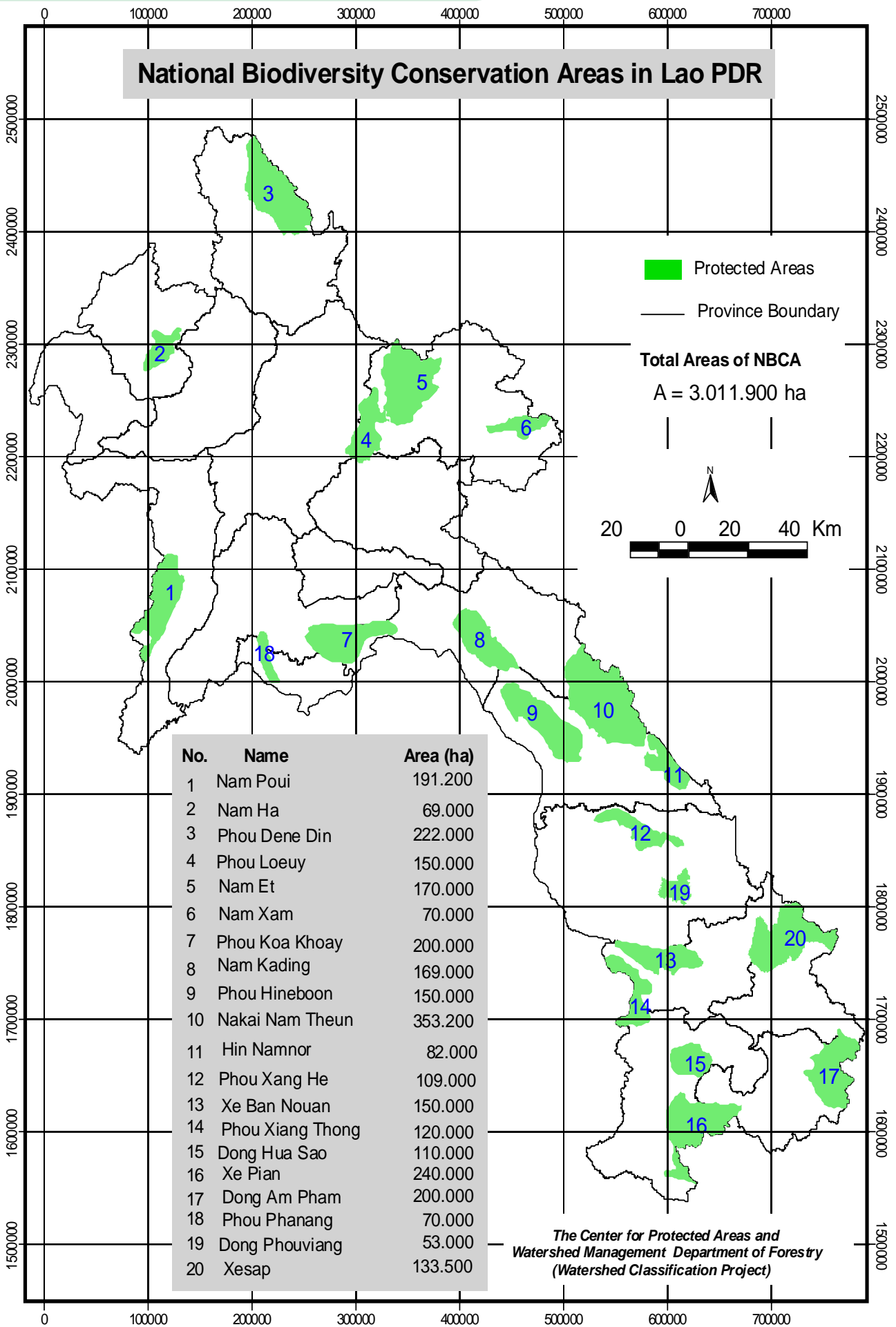
Under this Convention, the Government agrees to take the appropriate legal, scientific, technical, administrative and financial measures necessary for identification, protection conservation, presentation and rehabilitation of designated heritage sites in Lao PDR. The Government ratified this Convention on 20 March 1987.

### 5.5 THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEplete THE OZONE LAYER, 1987

The Lao PDR accepted accession to this Protocol on 21 August 1998. The Government agrees to reduce emissions of industrial halogen gases, e.g. chloro-fluorocarbons, by a specific amount by 2005. However, with low industrial capacity, the country is not a major country producing halogen emission.

### 5.6 MEKONG RIVER COMMISSION AGREEMENT

Signatories to this treaty agree that transfer of Mekong River and tributary water outside of the Mekong River Basin can occur only by consensus among the four country members. Member countries agree to coordinate in water project planning and monitoring of Basin waters. The member countries signed this Agreement on 5 May 1995.







## PART III KEY ISSUES

### 1 FOREST RESOURCES

#### 1.1 STATE

Currently, in Lao PDR, forest areas cover up 25% of land in some northern provinces and as much as 70% in the southern regions (AusAID 1996). The forest resources continue to decline at a rapid pace. During the 1940s, the forest cover represented about 70% (16 million ha) of the total area and the figure fell to 64% at the beginning of the 1960s (WRM 2000). Current official figures put this



Photo 3.1 Timber Transportation, Khammouane Province

number at 47% (11.6 million ha). Forest clearing continues at the rate of 300,000 ha per annum (AusAID 1996). At this rate, the country's last remaining forest areas will disappear over the next 38 years.

Forest resources play a central role in the Lao economy. In 1998, forest products accounted for 42% of the country's foreign exchange earnings (STEA 2000a). In the foreseeable future, the dependence on forest products will continue, due to the limited diversification of the Lao economy. Correspondingly, there may be strong pressures in Lao PDR to resist limitations to commercial forest exploitation. Forests provide a variety of non-timber forest products, fuel wood, and construction wood to meet the subsistence needs of the rural people. Forest areas contain rich ecosystem diversity and species of great national and international importance. In addition, forest areas provide other valuable environmental services to the well-being of the local people by controlling soil erosion, protecting watersheds and supporting agriculture.

Rural households, comprising an estimated 85% of the population, depend directly on forest areas



Photo 3.2 Rice-straw Pile after Shifting Cultivation, Louang Phabang Province

for farming and other means of livelihood (ADB 2000a). At least half of the country's population practise some form of swidden agriculture on forest lands to grow upland rice and other vegetation. Many families in the uplands often have up to 20 different plots of land within the forest that are at various stages of forest regrowth. Typically these farmers clear and cultivate plots in the forest for one or two seasons, and then abandon them for anywhere from 8 to 20 years. In addition to farming, rural communities also collect edible forest foods and medicines, hunt and raise livestock on common land. In fact, many communities depend on the forests for more than half of their food supply throughout the year.



Photo 3.3 Shifting Cultivation Practice in Mountain Slope in Vientiane province

In the north, the lack of flat land for permanent and stable agricultural cultivation contributes to the traditional practice of shifting cultivation. This is increasingly expanding due to population growth. The hill-tribe people, mostly in the northern region, continue to practice the upland cultivation system. On the other hand, in the centre and the south, forested areas face more pressures from encroaching lowland farmers. As irrigation is rainfall dependent, both drought and excessive rain limit yields. Yields are low due to the use of traditional rice varieties and lack of knowledge and training in the use of organic fertilizers. This leads towards increasing cultivation area for rice self-sufficiency, which is achieved either by re-cultivating patches earlier cleared but left to fallow thereby reducing the fallow period or, by clearing more forest lands. Importantly, research has overlooked the complexities contributing to the depletion of forest cover by shifting cultivations. In 1999, about 600,000 ha was identified as shifting cultivation land (STEA 2000a).

The Government attributes deforestation of about 200,000 ha per annum, to shifting cultivation. Such figures support the claim that an annual loss of about 100,000 ha comes from activities other than shifting cultivation. Some estimates place illegal logging at 100,000 m<sup>3</sup> of timber per year even though official figures of seized wood, reach only about 15,000 m<sup>3</sup> (STEA 2000a).

Officially, the Government does not attribute much forest depletion to commercial logging activities, whether legal or otherwise. The annual allowable timber logging is about 600,000 m<sup>3</sup> while 40% of removals (150,000 m<sup>3</sup>) is considered as wastage due to poor harvesting, planning and technique (STEA 2000a). The official volume harvested in year 1997 was 661,700 m<sup>3</sup> with significant volumes (an estimated 50%) being derived from hydroelectric development sites rather than designated production forests. The logging of dam sites is financially attractive since no regeneration of forests is required (ADB 2000b).

Logging consumes around 12,000 ha of forest land area annually, either officially or illegally. The major cause of deforestation is over-logging, or removal of timber above the annual sustainable extraction rates. In the absence of adequate harvest planning techniques and control, logging concessionaires use poor and out-of-date practices, which result in more than allowable levels of damage to the remaining forest areas (STEA 2000a), severely affecting forest regeneration cycles over prolonged periods.

## 1.2 PRESSURE

Improper harvesting practices and management, destruction due to fire, encroachment and shifting cultivation are the main reasons for loss of forest in Lao PDR. The specific factors, which contribute to deforestation, are summarised below:

### 1.2.1 Excessive Timber Harvest

Excessive timber harvest occurs most seriously in the central and the southern provinces. Many forest concession areas have been exploited at a rate higher than the sustainable Rate of Timber Extraction of 15 m<sup>3</sup>/ha (STEA 2000a)<sup>2</sup>. Timber harvesting consistently exceeds annual production quotas in some provinces. Such exploitation may derive partially from timber removal for anticipated hydro-electric projects, transmission lines, or road construction (STEA 2000a).

Actual wood harvested and removed from the forest also creates residual effects in the form of associated waste, breakage and decay which significantly increases the overall removal rates. An estimated 30% to 40% of wood volume and value are lost from the stump to the sales point arising out of delays between felling and use because of poor planning and technical difficulties. Delays of up to 12 months from felling to use are common. The long storage results in degradation of logs affecting both volume and value. A conservative estimate places the annual cost of log degradation and wastage at almost \$US 3 million. In addition, wood waste may occur in constructing road rights-of-way, log landings, camps, transmission lines, hydropower projects and mining extraction (STEA 2000a).

### 1.2.2 Shifting Cultivation

An estimated 6% of the total population practices shifting cultivation (ADB 2000b). As of 1998, shifting cultivation areas in the north represented 70% of the total rain-fed upland area. Past figures had underestimated this form of land-use. The central and southern regions (where lowland rice predominates) account for roughly 16% and 14% of shifting cultivation, respectively (NSC, national Statistics Centre). Despite programmes by the MAF to stabilise and reduce slash and burn cultivation, highland farmers continue to rely on upland rice for subsistence. Upland rice is the main crop in the northern regions, especially in Phongsaly, Louangnamtha, Oudomxay and Louangphabang Provinces (STEA 2000a).

Reduced fallow periods result in reduced soil fertility leading to reduced yields. Yields are simultaneously exposed to other constraining factors such as, in the descending order (cited by farmers), weeds, rodents, drought and insect pests (AusAID 1996). Soil fertility reduction being gradual, as may be expected, is considered by farmers to be the least contributing factor for yield drop. Shifting cultivation thus remains one of the major factors of the depletion of forest land. (STEA 2000a).

### 1.2.3 Forest Fires and Upland Encroachment

The impacts of forest fires and the encroachment of upland areas by lowland farmers also contribute to the depletion forest resources in Lao PDR. As previously stated, the Government estimates that shifting cultivation practices with concomitant forest fires clear about 300,000 ha of forest land.

Encroachment of patches of forest land, cleared by upland farmers but left fallow, by formerly lowland cultivators also reduces upland fallow periods resulting to diminished upland land resources; thereby, triggering more forest clearing by the uplanders. These and other causes remaining officially unrecognised, the policy of reducing shifting cultivation will continue to cause hardship and hinder efforts to engender better management of logging activities (AusAID 1996). The expansion of permanent agriculture removes an estimated 30,000 ha per annum of forest area (STEA 2000a).

### 1.2.4 Forest Management and Sustainability

Logging, with the direct negative effects of excessive exploitation, coupled with insufficient government capacity in forest management, often acts as catalyst to further degradation by the local population (STEA 2000a). By opening up and providing access to previously inaccessible forest areas, logging often sets the stage for further depletion through encroachment by lowland farmers or by shifting cultivators, particularly in the absence of managed harvest areas. This situation occurs specifically in the centre and the south (STEA 2000a).

The absence of adequate harvest planning techniques and control result mainly from budgetary constraints; lack of skilled staff; and inappropriate or insufficient regulations and guidelines implementable by provincial agencies at the grassroots level (STEA 2000a).

## 1.3 IMPACT

Deforestation leads to lower water discharge in the dry season. Greater sediment loads and floods in the rainy season are of special concern to agriculture in the delta.

Reduction of high density forest area, significantly above the sustainable rate of timber extraction - combined with the marked expansion of permanent agricultural land - suggests that logging followed by eventual conversion of logged land into permanent agriculture land contributes appreciably to deforestation in the centre and the south. The focus on short term profit maximisation without commitment to sustained yield management will further exacerbate deforestation pressures.

### 1.3.1 Economic Loss

Because of Lao PDR's dependence on forest resources for foreign exchange earnings and as a source of economic growth, another important consideration is the degree of revenue loss from resource pricing and contract arrangements that fail to maximise rent capture from resource use.

Depletion of forest resources due to over harvest and illegal logging activities involves significant loss of government revenue. The estimated annual loss in government revenue due to illegal logging is \$US 21 million (STEA 2000a). Declaring high value species as low value species at second landings and at the border exit points (in order to reduce logging and export taxes) is also a common practice. False specifications of species results in an annual loss in government revenue of \$US 1 million (STEA 2000a).

### 1.3.2 Loss of Livelihood

Deforestation poses an immediate threat to forest dependent communities, biodiversity conservation, and delivery of various forest products and services to meet present and future needs. Its negative impacts are already being felt, especially in rice-deficit areas where the rural populations rely heavily on wood and non-wood forest products to augment their farm production.

## 1.4 RESPONSE

Government efforts to control illegal logging have included confiscating private equipment (e.g. chainsaws) and limiting the issuance of, or revoking, licenses to many



sawmills and furniture factories that have operated in violation of forestry regulations. The emerging importance of the forest resource for the Government of Lao PDR is evident.

Absence of a land tenure regime has been a causal factor for deforestation and depletion of forest area in the past. In 1991, Lao PDR adopted a new constitution, which enshrined the principle that land belongs to the State, but individuals are guaranteed rights to use it. Land titles have not yet been distributed, but the principle has been accepted and a land market has been developing rapidly since 1992. A land registry survey is planned for the irrigated areas.

#### 1.4.1 Strengthening Laws and Regulations

In order to control public access to land and forest resources, the Government, starting in 1989 revised its natural resources management policies as a result of its concerns over the degradation of natural resources. In November 1993, the Government issued Prime Ministerial Decree No. 169/PM on Management and Use of Forest and Forest Land, which sought to engender efficient management, utilisation and conservation of forest and forest land resources. Subsequently in November 1996, the Government promulgated a new Forestry Law, which integrated the contents of Decree 169/PM.

One of the main activities within the policy framework of Decree 169/PM focuses on the land and forest allocation programme (baeng din baeng paa). The programme aims to control shifting cultivation and reduce the pressures on forest resources by distributing responsibility for the management of land and forest resources to villagers themselves.

#### 1.4.2 Forest Protection Plans

Forest management by the state alone will not make forestry sustainable; other stakeholders, especially villagers, need to be involved in planning and resource management. It is also understood that, in most cases, conservation objectives can be met only by integrating conservation efforts with development activities.

In 1989, the First National Forestry Conference concluded that a new system of sustainable forest management needed to be established. Completed in 1991, the National Forestry Action Plan (NFAP), followed soon after by the Environmental Action Plan, pursued this thematic focus further.

Forests play a significant role in regional ecosystem stability and the Government proposes to target public involvement to achieve environmentally sustainable forestry management. The Tropical Forest Action Plan (TFAP) carried out a series of forestry studies. Consequently, an environmental action plan is being developed that involved local populations in forest conservation and management (AusAID 1996).

#### 1.4.3 Reform of Forest Sector Policy

The significant depletion of forest resources provides an impetus for comprehensive reform in forestry laws and regulations. The government is committed to this process and has undertaken a number of actions that aim to bring the management of the country's forest resources under sustainable control and development.

Starting in 1996, the government reformed the management of the forestry sector by issuing laws and a decree covering forest and land use management. The principal legislation dealing with the land use planning and land forest allocation (LUP/LA) consists of the Land Law, promulgated in May 1997 and the Forestry Law, promulgated in November 1996. The reform of the mechanisms of forest management includes community control of forest lands, zoning and provision of incentives to manage forests sustainably within the concession.

#### Improved Forest Management Systems

- clear demarcation of production, community and protection forests;
- development of forest management plans to guide commercial timber extraction in specific production forest areas (annual allowable cut, pre-logging inventory, improved silvicultural techniques, improved residual forest re-growth, appropriate post harvest treatment);
- enforcement of contractual responsibility of forest enterprises for harvesting, in accordance with forest management plans; such contracts should be comparable and consistent and contain incentives that support the management and sustained yield of forest resources; and
- improve coordination between logging and local processing to reduce wastage.

### Pricing and Rent Capture

- application of border parity prices to all logs, regardless of whether they are exported or processed domestically;
- retain of logs of high value species for domestic processing; and
- establishment of a market intelligence system to maximise revenue generation from exports.

### Institutional Strengthening

- establish effective enforcement and control mechanisms (forest regulation and control unit, stationary and mobile checkpoints at strategic locations) to minimise illegal logging, mis-specification and surreptitious exports;
- training DOF staff to strengthen its capacity in forest inventory and land use planning, forest management, silviculture, scaling and protection;
- establish a Forest Management Fund financed by a fixed percentage contribution from forest taxation revenues for improved forest management activities; and
- develop and adopt comprehensive land use and forestry legislation.

### Land-Use Planning and Allocation

This policy involves local communities in resource management through land-use planning and land allocation based on the Government's participatory process at the village and community level. GOL will continue to support local government to develop and implement effective land use planning and to provide equipment, training and operational budgets. GOL has adopted an eight-step process for land use planning and land allocation, which is outlined below:

- i. preparation for implementing land use planning and land forest allocation activities.
- ii. survey and mapping of village boundary and forest and agriculture land use zones.
- iii. data collection and analysis.
- iv. village land use planning and land allocation meeting.
- v. field measurement.
- vi. preparation of agricultural and forestry agreements and transfer of rights to villagers.
- vii. land use management extension.
- viii. monitoring, control and evaluation.

#### 1.4.4 Strengthening the Capacity and Information Base for Planning and Resource Management

Through the Lao-Swedish Forestry Programme (LSFP), considerable efforts have been made to improve the knowledge of the resource base by means of forest inventories. Forest department staff has begun using the generated information for planning and resource management. In addition, participatory planning methods and appropriate resource inventory methods are also being developed.

## 2 WATER RESOURCES

### 2.1 STATE

Lao PDR possesses a great wealth in water resources. The northern region captures a rainfall of approximately 1,300 mm per year and the southern region 3,000-3,700 mm per year. An estimated 35% of all water in the Mekong River originates from watersheds within Lao PDR. These watersheds form 26% of the total watershed area of the Mekong Basin. About 80% of the water flows in streams during the rainy season and the rest during the dry season.

Irrigation and hydropower represent two sectors of national socio-economic importance. Along the Mekong River, the potentials of its tributaries in the country for the production of hydropower represents 40% of other tributaries in the Mekong basin, along which less than 5% have been developed (ADB 1998).

#### 2.1.1 Surface Water Resources

The estimated area of inland water resources totals 723,500 ha. Of this, 200,000 ha flow from the Mekong River, 54,000 from other main rivers, 57,000 from reservoirs, 1,500 from swamps, 406,000 from rice fields and 5,000 from fish ponds (STEA 2000a).

The annual national supply of renewable freshwater totals 270,000 MCM, or in excess of 54,000 m<sup>3</sup>/person (1998 population), compared to the current demand of only 228 m<sup>3</sup>/person (STEA 2000a). Lao PDR has the highest per capita availability of renewable freshwater resources in Asia. However, as of 19963, only 60% of the urban and 51% of the rural population had direct access to water supply (WRI 1998).

In general, based on international water quality control standards, the water flowing in the Mekong River is still of good quality with a high content of oxygen. The river has a silting rate of 41 tonnes/km<sup>2</sup>/year to 345 tonnes/km<sup>2</sup>/year, which may be considered as high during the rainy season. However, silting is still possible at a lower rate when compared to other rivers in tropical areas (MIH 1998). The highest silting occurs in Nam Ou, Xebanghieng and Xedone. The quality of wastewater from industrial projects and urban areas still meets water quality standards, especially with standards applied to neighbouring countries (MIH 1998).

#### 2.1.2 Groundwater Resources

To date the only regional assessment of groundwater potential is the on-going study of groundwater in the Provinces of Champassak and Saravane funded by JICA. Several hundreds of wells have been drilled throughout the country mainly for rural supply but also for a few cottage and small-scale industries. In most cases, the depth of the rural water supply wells in lowland areas varies between 30-45 m and the yields vary from about 1 liters/sec to not more than 5 liters/sec (ADB 1998).

The groundwater resources remain the main sources of potential rural and small town water supply, especially in lowland areas located far from the surface water sources such as the Southern and Western part of Champassak Province, the hinterlands of the Xebangfay, Xebanghieng and Xedone valleys.

The major use of groundwater is for irrigation purposes. Although irrigation by groundwater represents a possible form of irrigation development, its current capacity does not exceed 100 ha.

#### 2.1.3 Water Usage

Water resources in Lao PDR have been exploited in agriculture, industry (electricity), communication, tourism, education and research. Rural communities catch fish in the country's largely free-flowing streams and rivers.

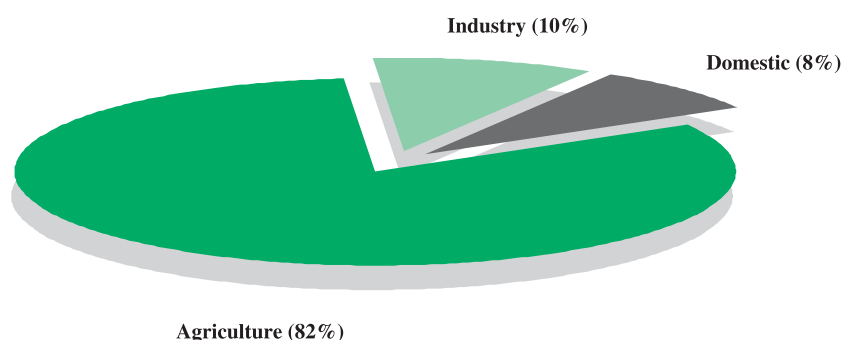
Currently, about 60% of the population in urban areas receive water supply. Apart from this, shallow well water is used for household use, but not as drinking water. Other major sources of water in urban areas may include streams and groundwater sources. Water supply in rural areas is the responsibility of the Clean Water Project. Sources of water supply in rural areas include groundwater sources and shallow well water. Data from the clean water supply and environmental hygiene sector indicate that in 1996, water supply in rural areas averaged about 51% (WRI 1998).

The use of surface water mainly aims at supplying urban areas. The Water Supply Company has the role of preparing programmes and implementing all works pertaining to the production and distribution of drinking water. The Ministry of Health takes charge of water supply to rural populations, while urban water supply falls under the control of the Urban Planning Department within the

Ministry of Communications, Transports, Posts and Constructions (FAO 1999a). As previously stated, Lao PDR has the largest available renewable freshwater per capita ratio in Asia. However, such figures have little value in resource management (AusAID 1996). total water withdrawal was estimated at 1,000 MCM in 1987, of which 82% went for agricultural purposes, 10% for industry sector and 8% for domestic use (Figure 2.1).

land development, dikes and flood protection structures. Two separate departments also contribute namely, the Department of Hydrology (DOH) and the Department of Irrigation (DOI). The former is responsible for collecting and analysing climatic and hydrological data, and for flood forecasting, while the latter provides central planning and co-ordination of irrigation development throughout the

**Figure 2.1 Water Withdrawal by Sector**



Source: FAO 1999a.

#### 2.1.4 Rural Water Supply and Sanitation

Although significant efforts have been undertaken over the past decade to increase the access to potable water- as a major contributor to improved health - improvements need to continue. While official statistics indicate that some 40% of the rural population have access to potable water, only about half of these water systems actually function (STEA 2000a). Past efforts focused on establishing facilities in as many locations as possible. However, inappropriate technologies were selected and often resulted in systems being installed for which no spare parts are available in Lao PDR (STEA 2000a). Latrine construction is generally of very poor quality and technicians have failed to pay attention to the technical and social issues involved. As a result, villagers complain of collapses and odours, and find latrines unattractive to use. Furthermore, the lack of equipment, supplies and operational budgets has constrained both water supply and access to adequate sanitation.

#### 2.1.5 Irrigation Usage

The Ministry of Agriculture and Forestry and the provincial authorities share responsibility for maintenance, repair and construction works for agricultural hydraulics,

country. DOI also offers advice to provincial administrations on matters concerning irrigation services. DOI consists of the following divisions: technical management; operation and maintenance; machinery, administration and planning, and co-operation and the irrigation training. The Study Survey and Design Centre, under this department, has the capacity to survey and design 10,000 ha/year and supervise the work's realisation, in co-operation with provincial administrations. The function of the Irrigation Section of each province is to provide services in the survey, design and supervision of construction, while a construction enterprise undertakes the implementation of projects (FAO 1999a).

Implementation of different irrigation plans (since the establishment of Lao PDR in 1975) has helped the irrigation infrastructure to expand at the rate of 5-6% per year. Correspondingly, supplementary irrigation increased to 25% of the total agricultural land covering the irrigated rice field of 91,860 ha and 105,000 ha of other crops during the dry season. This achievement invariably improved the living conditions of rural people.

Table 2.1a shows the distribution of irrigation command area by type of system in the year 2000.

Table 2.1a Distribution of Irrigation Command Area in Lao PDR

Type of System	No. of System	Wet Season Irrigated Area (ha)	Dry Season Irrigated Area (ha)
Small dam (concrete weir)	631	53,744	27,294
Storage Reservoir	170	18,550	12,578
Pumping	3,176	138,203	135,860
Watergate	53	6,430	4,388
Traditional Weir	18,150	60,894	16,121
Gabion Weir	60	2,179	929
<b>Total</b>	<b>22,240</b>	<b>280,000</b>	<b>197,130</b>

Source: STEA 2000b

While wet season irrigation is common throughout the country, dry season irrigation is mainly concentrated near the major cities: Vientiane, Savannakhet and Louangphabang (FAO 1999a).

River diversion is the main source of water for irrigated schemes, particularly the smaller ones (Figure 2.1b). All areas are irrigated by surface irrigation; sprinkler and micro-irrigation are not used in Lao PDR (FAO 1999a).

In the dry season, the actual irrigated area falls far below its maximum; only 43% of the equipped area is actually

irrigated. Pumping costs and difficulties with market access for other cash crops, particularly in the north, render paddy cultivation unattractive in the dry season. Nevertheless, after poor yields during rainy seasons, the irrigated areas in the dry season produce higher yield than normal, presumably to compensate for the low production of the previous season (FAO 1999a). During the wet season, the areas actually irrigated may reach 96% of the total equipped area. In the north, beaver dams are in use but generally get flushed away several times a year. A typology of irrigation schemes is presented in Table 2.1b.

Table 2.1b A Typology of Irrigation Schemes

Type of Water Control	Description	Location	Population Involved
<b>Small Schemes (&lt;100 ha)</b>			
Weir Schemes	Traditional wet season supplementary irrigation systems. Most of them are <500 ha.	Mountainous Provinces	1-2 villages up to 50 households
Pump Schemes	Designed for dry and wet season irrigation.	Along the Mekong and its tributaries	
<b>Medium Schemes (100-500 ha)</b>			
Weir Schemes	Wet season supplementary irrigation. Most built with external assistance.	In the flood plains	Up to 8 villages up to 500 households
Pump Schemes	Designed for dry and wet season irrigation.	Near Vientiane and Pakse	
Reservoir Schemes	Gravity irrigation in dry and wet season. Built by provincial irrigation services on behalf of communities.	Near Savannakhet	
<b>Large Schemes (&gt;500 ha)</b>			
Reservoir Schemes	Gravity irrigation in dry and wet season.	Two reservoirs: Nam Houm and Nam Souang near Vientiane	
Pump Schemes	Dry and wet season irrigation.	Near Vientiane, using water from the Mekong and Nam Ngum River	

Source : FAO 1999a.

Another classification of irrigated schemes categorises by type of management. Some schemes are wholly managed by the farmers while others receive assistance from irrigation department services. Pump schemes falls under the latter category. Farmers themselves manage more than 80% of the gravity irrigated schemes (FAO 1999a). Most such schemes are in the mountainous north, are few on the whole and serve small communities mostly practicing subsistence methods.

Currently, the state owned and operated irrigation systems contain about 1,169 schemes commanding an area of 106,900 ha. Degraded irrigation systems managed by their owners include approximately 14,331 schemes spread over an area of approximately 57,380 ha. The territory of the Lao PDR where irrigation can be built to cover an area of 800,000 ha and carry approximately 3,140 million m<sup>3</sup> (MCM) of water. About 20% of the population enjoy the free use of irrigation water (MIH 1998). The use of water in agricultural production emphasises small-scale irrigation schemes.

### 2.1.6 Hydropower

Hydropower is the most abundant and cost-effective energy source in the Greater Mekong River Basin with a theoretical hydroelectric potential of about 31,200



*Photo 3.5 Num Ngum Dam, Vientiane Province*

MW (AusAID 1996). In Lao PDR about 18,000 MW is technically exploitable, with 12,500 MW found in the major Mekong sub-basins and the remainder in minor Mekong or non-Mekong basins. Less than 5% of the country's hydropower potential has been developed over the last thirty years but under present policy, the rate of development will drastically increase (DANIDA 1998). At present, there are 9 major hydropower plants in Lao PDR, providing the capacity of 624 MW.



*Photo 3.4 Xong River Diversion Canal to Num Ngum Reservoir, Vientiane Province*

The construction of Nam Ngum Dam represented the Mekong Committee's only truly international hydropower project to come to fruition. Since most of the hydro-electric power is exported to Thailand, the driving force for resource exploitation came from beyond the borders of Lao PDR. 10 countries were involved in the financing and constructing of Nam Ngum Dam. Similarly, the other dams planned for the watershed are likely to be financed under Build-Operate-Transfer (BOT) arrangements involving international consortia. Hydropower development projects in recent years have tended to grow slowly, which may have resulted from the economic-financial crisis that hit the region in 1997. The economic downturn affected most sectors throughout the country.

## 2.2 PRESSURE

Current projections predict an increased demand for water in the long term although serious competition for water resources is not expected to be a problem during the period 2001-2005 (STEA 2000a). Serious water shortages and its concomitant competition are however, evident at the local level.

In the long term, the hydropower sector will remain a major sector of economic growth compared to other resources (MIH 1998). It will bear its pressures on water resources and other related resources such as cultivation land and forests.

### 2.2.1 Deteriorating Irrigation System and Insufficient Maintenance

Irrigation represents one of the main techniques to develop agriculture for the production of food self-sufficiency and commerce. The agriculture sector still depends on weather conditions and primarily entails traditional rice production for subsistence consumption. The dependency on rainfall and current series of flood and droughts has hampered rice production, the country's main food source and commodity. In 1997, degraded irrigation systems managed by their owners included approximately 14,331 schemes spread over an area of approximately 57,380 ha, which could lead to reduction of agricultural outputs, left unattended (ADB 1998).

The large-scale and several medium-scale schemes generally remain underexploited and face operation and maintenance (O&M) difficulties. Government policy tends to transfer management responsibilities to users, but farmers lack management skills for effective scheme and water management (FAO 1999a).

### 2.2.2 Insufficient Returns from Irrigated Rice Production to Finance Sustainable Irrigation System

Irrigation schemes in the Lao PDR are small by international standards (ADB 2000a). Six irrigation command areas have a service capacity of 1,000 ha or more. The largest scheme services only 4,500 ha.

The main irrigated crop is rice. In 1994, farmers cultivated about 11,000 ha with paddy during the dry season and 149,272 ha during the wet season. Other irrigated crops are vegetables in the dry season near urban markets (Vientiane, Savannakhet, Saravane and Champassak). Although no precise data are available, the total figure has been estimated at 2,420 ha (FAO 1999a). Non-irrigated paddy was estimated at 450,000 ha in 1994, of which 49% was upland rice (shifting cultivation). The remaining 51% represented lowland flooded rice in the alluvial plains (FAO

1999a).

The average cost of small-scale weir scheme development is about US\$200-400/ha. Large schemes implemented by the Government, sometimes with external aid, cost between US\$3,500 and \$7,000/ha (FAO 1999a).

According to the MAF Investment Plan for 1996-2000, irrigation utilised nearly two thirds of local funds, which entailed funding crunches in other agriculture subsectors. Also, in light of the investment on irrigation systems, returns on irrigated crops were insufficient to generate self-operation and maintenance of the irrigation schemes setup.

## 2.3 IMPACT

Water shortages in the Nam Ngum Watershed (see details in Box 1) resulted in part from resettlement plans which did not adequately account for water availability at the resettlement locations.

The hydropower development impacts people surrounding the development areas in a variety of ways which include the following:

- the type of storage reservoir most affects people living upstream of the dam and others being pressed to be resettled;
- changes of water channel in downstream areas;
- changes of biodiversity;
- changes of water quality;
- deforestation carried out by resettled people practising shifting cultivation; and
- pumping leading to lower water shortage discharge. (STEA 2000b)

The development of irrigation system aims to increase agricultural production, an important factor in poverty reduction. Weaknesses in the development of irrigation include some of the following:

- high costs in system operation, particularly for the pumping station
- high risk in the loss of water from canals which could not meet the technical standard
- the association of water users lack skills in effective management, causing delays

### ***Box 1 Nam Ngum Hydropower Project Management***

The largest hydropower project completed in the Lower Mekong Basin is the Nam Ngum Project which was finally completed in 1984 with an installed capacity of 150 MW. The case study below illustrates the various stakeholders and perspectives at different scales for watershed management.

Nam Ngum Watershed in Lao PDR is a particularly relevant and interesting area in that it illustrates management issues at a range of scales, from local to international. Nam Ngum Watershed has been the subject of a resource management study supported by the International Development Research Centre. The study has been carried out through the Centre for Protected Area and Watershed Management, Department of Forestry, Ministry of Agriculture and Forestry, Lao PDR. The resource management issues exemplified in this case study are:

#### **Community Based Management**

Approximately 200 village communities live in the Nam Ngum Watershed. Several different ethnic groups are represented, notably Phuan, Hmong and Khamu. Different cultivation systems and associated resource uses (notably wet rice cultivation and shifting cultivation) have combined with a more general pressure on resources to create competition and sometimes conflict on land, water and forest resources. Environmental degradation is a result.

Local initiatives in resource management include demarcation of resource boundaries, for example in the form of community forests. Traditional management of forests and other resources is longstanding, particularly in the more stable communities in the upper part of the Watershed in Xieng Khouang Province. National policy is supportive of local management, but there are many difficulties with implementation.

Potential development cooperation inputs are both institutional and technical in nature. GTZ has a forest management and conservation project in the Xieng Khouang section of the watershed, and this has a strong community and participatory focus. There has been some support for fishing communities at the reservoir edge. JICA has commenced an afforestation project in the central part of the Watershed. However, several parts of the watershed have received relatively little attention.

#### **District and provincial roles in resource management**

An important aspect of resource management in Nam Ngum watershed, as elsewhere, is clarifying the role of intermediate level authorities at district and provincial level.

While a recent policy has been promulgated through decrees at the national level, the capacity of provincial and particularly district authorities to implement such policy is quite limited. Decree 169 on forest land allocation has been interpreted in quite different ways by different local authorities, leading to confusion and sometimes inappropriate demarcation activities at odds with the existing and recognised patterns of use and tenure.

Human resource development at intermediate levels is a high priority for watershed management. Also important is establishment of a watershed framework that enables authorities within one jurisdiction to coordinate with those in another sharing the same watershed.

#### **Watershed stakeholders in resource management**

Nam Ngum watershed is representative of a wide range of existing and potential resource users in Lao PDR and even further afield. It is the country's principle source of hydropower, giving EdL a major stake. Several more large dams are planned. The Nam Song diversion dam has had a recent impact. Logging in the reservoir and in parts of the upper watershed also places demands on the resource base. Conservation interest is represented in the Phou Khao Khouaai Protected Area. Meanwhile, the watershed's approximately 80,000 mainly subsistence-oriented farmers and fishers rely on a resource base that is affected by these wider pressures. In turn, subsistence activities impact on hydropower, forestry and other extractive uses. Development interventions in one area need to take account of impacts in others, and all the relevant stakeholders need to be considered and involved in planning from the start.

#### **National priorities and their local implications**

Nam Ngum watershed is of national interest as the country's principal source of foreign exchange. Weighing up these macro-level priorities against micro-level impacts and considerations is an important resource management task for Lao PDR. This involves a range of issues including compensation mechanisms, livelihood adaptation, natural resource accounting and other tools and methods. Nam Ngum serves as a useful foundation on which planning for other watersheds can be based, particularly those slated for large scale hydropower development.



## 2.4 RESPONSE

In the light of high food security risk of reduced rice production due to lack of irrigation systems and sole dependence on rainfall in most parts of Lao PDR combined with degradation of irrigation systems in many other parts, the public and the local authorities requested aid from the government to increase the irrigated area throughout the country (STEA 2000b).

In recent years, public investment in the irrigation sector was in the range of about 40-50% of the total within the agriculture and forest sector (STEA 2000b). The share of public investment in the irrigation sub-sector increased from 35% in 1991-1992 to 64% in 1994-1995, of which 3.7% was allocated for operation and maintenance (ADB 2000a). At the same time, the government put effort into developing community managed irrigation and has promoted private and communal investments in irrigation.

Gradually, more permanent weirs of mortared rock or reinforced concrete have begun to replace the beaver dams (usually with international assistance) which are highly maintenance intensive structures (FAO 1999a).

Considerable investments have been made in the last 20 years in irrigation development. Although the returns on public investment in irrigation were negligible till 1993, the irrigation sector still receives priority from donor agencies. During the period 1994-2000, about 38% of all planned donor support in agriculture went towards new irrigation projects (FAO 1999a).

Government policy tends to transfer management responsibilities of irrigation systems to users, but farmers lack management skills for effective scheme and water management (FAO 1999a).

### 2.4.1 Water Supply Provision

In terms of water supply, the Government's long term objective aims to provide 80% coverage to the entire population by 2015. During the National Socio-Economic Development Annual Plan Period (1998-1999), it was targeted that 60-70% of the rural population would have access to clean water and 40-50% villages should have hygienic latrines. Although each province has benefited from an urban water supply programme financed by international aid<sup>4</sup>, rural water supply programmes have not been

numerous. Water supply activities still remain concentrated in and around major towns along the Mekong River (FAO 1999a). However, the Government has adopted the water supply sector policy and investment plan for water supply sector in 2000.

### Rural Water Supply Strategy

Faced with limited financial resources and institutional capacity to provide adequate water supply and sanitation services, a national rural water supply and sanitation strategy defining priority areas of intervention is being formulated. With the assistance of UNICEF, the Government has developed the strategy to focus on issues of water supply, waste-water, solid waste and sanitation systems and management. However, this strategy needs to be fully implemented as a priority investment for Lao PDR. A cost-effective way to reach as large a share of the rural population as possible is by focusing first on villages with relatively easy access, where population density is generally higher. Simultaneously, pilot programmes in less accessible areas are being carried out to define approaches needed in areas with various ethnic minorities.

### Community Participation

The revised strategy to improve the rural population's access to water and sanitation focuses on communities' demand and active community involvement to ensure proper operation and maintenance of systems. The communities take an active lead in the selection and construction of systems and commit themselves to setting up an appropriate system to handle maintenance. This in turn will require adequate training of community members in operation and maintenance, provision of technical support (village maintenance persons need to know where to get assistance) and availability of tools and spare parts. Of equal importance, the concept and practice of service charges for the new systems must gain acceptance with the local populace. In the longer-term, the beneficiaries in the project's service area must be expected to pay for project operations, such as interest on capital costs, operation, maintenance, and renovation.

### 2.4.2 Water Quality Monitoring

Through the years, the Government has set up four water analysis laboratories in different regions throughout the country. These laboratories cooperate by exchanging

<sup>4</sup> Financed primarily by Japan, Germany, the Asian Development Bank, the World Bank and the European Union.

<sup>5</sup> The Ministry of Public Health has authority over the Center for Health Environment, Rural Water Supply and Sanitation.

encouraged, and farmers are trained in irrigation management, irrigation scheduling, and O&M. It is expected that, eventually, each WUG will be able to define the water charge needed to sustain the irrigation scheme (FAO 1999a).

To meet the requirements in clean water each year, wells and artesian wells and several hundreds of gravity fed water supply systems have been built. The major directive of the rural water supply strategic plan focuses on the use of water and hygiene, emphasise sustainable use of water, which villagers generally manage on the principle of decentralization through the establishment of a water supply management committee.

Currently, DOF and MAF prioritise management of watersheds. This issue has until now been implemented in the form of projects, which include research and development of water sources in local areas. Implemented projects included the following:

1. Upper Nam Ngum Management Project financed through a grant from the German government;
2. Lower Nam Ngum Management Project, implemented in cooperation with JICA from Japan;
3. Nam Ngum Basin Development Master Plan Project funded by the Asian Development Bank;
4. Mekong projects related to the analysis of data and the increase of water sources development measures, such as water quality grading projects, sustainable natural resources use research project, land use survey and forest coverage assessment project, land erosion study project and marshland project;
5. Projects funded by SIDA for the conservation of forests and identification of NBCAs for their management, including tree species research projects and other forestation projects;
6. Projects implemented in cooperation with other international organisations for the development forest resources development and the environment.

Such water resources management projects emphasis conservation of forest resources and the environment through reforestation simultaneously with social development to improve community living conditions within the context of technical principles related to management.

information and dividing responsibilities over the water analysis process in an efficient manner. For example, management and control of water in the Mekong River and its tributaries are the responsibility of the water analysis laboratory of the Irrigation Department, based on information gathered from over 30 gauges. The water analysis laboratory of the Ministry of Health controls and analyses the quality of drinking water and focuses on water released from industries and other wastes, whereas the water analysis laboratory of the Ministry of Industry and Handicraft controls the quality of water released from factories. The water analysis laboratory of Sciences, Technology and Environment Agency analyses waste water in urban surroundings based on information provided by 14 water sampling stations in Vientiane Municipality (MIH 1998).

#### 2.4.3 Preparation of a Master Plan for Water Resource

A master plan for comprehensive water resources development is currently being prepared for two Mekong tributaries, the Nam Ngum and Nam Theun rivers (FAO 1999a).

Several programmes focusing on infrastructure development have received top priority from the Government for the coming years (FAO 1999a). For example, the Government plans to develop rural roads and the electricity network, construct medium and large-scale hydropower dams, and design and construct small-scale irrigation systems to increase dry season agricultural production.

#### 2.4.4 Implementaion of the water and water rессources law

The water and water rессources law was promulgated in 1996 and its implementing decree in 2001. The law aims for the sustainable use of water resources. The decree divided the task of different line ministries for the water resources management.

#### 2.4.5 Applying Market Mechanisms

Under the New Economic Mechanism (NEM), policy on irrigated agriculture has emphasised the role of markets and prices as allocation mechanisms and a shift to cost recovery for services and facilities provided by government to farmers. Since 1992, farmers have directly paid for electricity and operating costs. The responsibility for all maintenance matters pertaining to secondary and tertiary canals fall on farmers. (FAO 1999a)

#### 2.4.6 Planning the Hydropower construction

The Government has also launched feasibility studies for 21 other hydropower projects at various sites throughout the country. All of these projects are located on tributaries of the Mekong River.

#### 2.4.7 Capacity Building

An initiative called the ‘Strengthening and Restructuring Irrigation Development Project’ (SRIDP) is being implemented. SRIDP aims to develop and provide assistance in implementing strategies in the irrigation subsector. Another project called ‘Farmer Irrigated Agriculture Training’ (FIAT) aims to train technicians and farmers in irrigation scheme design and management.

#### 2.4.8 Implementation of Water Resource Management Actions

The Water Resources Coordination Committee has developed a cross sectoral Action Plan for the period 2000-2005. One of the objectives of these plans is to avoid future watershed degradation that damages natural resources and discourages future capital investment. Catchment management planning is to be funded with revenues from existing and future power generation. The plan hopes to accomplish the following:

- River Basin Management Plan (3 basins);
- Water Allocation Plan; Data & Information;
- Capacity Building; Policies & Regulation Framework;
- Community Involvement

Community based catchment management plans will be developed for priority catchments with existing water projects, in order to serve as a demonstration for catchments that have the potential for future project development.

#### 2.4.9 Decentralising Responsibilities

Until 1994, the Irrigation Department was responsible for the O&M of weirs, dams, pumps and primary canals. The new policy of the Government intends to hand over responsibilities for these activities to WUGs or Water User Associations (WUAs). However, in many cases, O&M are still carried out by the Irrigation Department or its provincial services.

A pragmatic approach has been adopted for a transitional period while the establishment of WUGs is

### 3 LAND RESOURCES

#### 3.1 STATE

Land degradation takes several forms, such as nutrient depletion, structural decline and compaction, biological decline, chemical deterioration (e.g. salinisation), and soil erosion. Tropical forest soils, especially on steep slopes, are particularly prone to deforestation. Most land degradation is associated with shifting cultivation, particularly in areas



Photo 3.6 Abandoned field after Shifting Cultivation, Vientiane Province

where population pressure has led to a significant decrease in the rotation period or where traditional lowland farmers encroach on neighbouring uplands to make up for low and often declining yields on their lowland paddy fields.

Lao PDR is predominantly rural in character and has a potentially cultivable land area of 5.9 million ha (FAO 2000), of which 800,000 ha is cultivated for rice or secondary crops under both lowland terrace and upland shifting cultivation systems. Pasture land makes up another 15% of the cultivable land, while aqua-culture production accounts for 1%. The Government is currently producing a soil map, while the FAO is mapping land use. The remaining untapped agricultural potential suggests that scope exists for irrigation developments (AusAID 1996).



Photo 3.7 Rice Field in Vientiane Province

A recent report shows that from the total land of 236,800 km<sup>2</sup> in Lao PDR, about 37,000 km<sup>2</sup> or 16% of land is subjected to light severity of human-induced degradation. About 197,000 km<sup>2</sup> or 83% is subjected to moderate severity and 3,000 km<sup>2</sup> or 1% is subjected to very severe land degradation. The study also states that the major cause of land degradation is deforestation of the water erosion type (FAO 2000).

The effects of the expansion of permanent agricultural land and shifting cultivation areas on forest resource and land degradation clearly show that land and forest resource management are closely related in Lao PDR (STEA 2000a).

Shifting cultivation systems vary enormously, along with their environmental impacts. However, little is known about these systems (STEA 2000a).

#### 3.2 PRESSURE

While agricultural productivity has risen dramatically, the cost in land degradation has been high. Large areas of the country's cropland, grassland, woodland and forest are now seriously degraded. Land degradation is also altering hydrological conditions.

##### 3.2.1 Shifting Cultivation

Expansion of agricultural land into forest lands not only contributes to the deforestation, but unless agricultural production systems are well adapted to the soil conditions of the former forest lands, cultivation can result in serious land degradation and other downstream impacts such as siltation and decreased stream flow. The Government estimates that about 300,000 ha, is cleared annually for cultivation.

Officially, most land degradation occurs from shifting agriculture. Correspondingly, Lao upland farmers face significant problems of lowering soil fertility, weed infestation and rapid loss of soil moisture that typically come with reduction of fallow periods (AusAID 1996).

##### 3.2.2 Shortening Fallow

Farm system surveys in various parts of the country have shown that fallow periods of less than 10 years cause general degradation of soil fertility, weed infestation and rapid loss of soil moisture (STEA 2000a). High pest infestation results from monoculture further leading to the usage of higher amounts of pesticides much of which gets

washed to downstream surface water sources and some also percolate to contaminate the unconfined underground water table contributing through cumulative impacts, to soil degradation finally.

### 3.2.3 Deforestation

Deforestation is widespread. An estimated 300,000 ha of forest are cleared each year in the country (AusAID 1996). The destruction of the forests is mainly a result of clearance for agriculture. See Deforestation section.

### 3.2.4 Limited Available Land

Availability of agricultural land varies widely by region. The mountainous north has significantly less potential agricultural land and practices significantly more shifting cultivation than the southern and the central regions. The centre and particularly the south have considerable arable land resources, better soil and access to water. A considerable amount of land remains underdeveloped. Nevertheless, the current assessment most likely overestimates available land for permanent agriculture, particularly in the north, which further accentuates the growing shortage of land for agricultural production in particular sub regions within Lao PDR (STEA 2000a).

## 3.3 IMPACT

Land degradation leads to reduced productivity: a lower response to the same fertiliser inputs or, where farmers possess the resources, a need for higher inputs to maintain crop yields and farm incomes. Higher inputs leads back to reduction of productivity and finally degraded land. This has the effect of increasing land shortage still further, thus completing the cycle.

### 3.3.1 Soil Erosion

Soil erosion manifests itself as a localised problem. A recent analysis of sedimentation data in the lower Mekong basin suggests that sediment rates in the southern parts of Lao PDR have increased substantially over the past twenty years. They are among the highest in the region, although the exact causes for the increase have not yet been determined (STEA 2000a). The high proportion of sloping land in the country, its predominant soil types, and heavy rainfall combine to make a significant part of the country susceptible to erosion, particularly if cultivation on a permanent basis occurs under inadequate cultivation systems.

### 3.3.2 Floods from Increased Runoffs

Where vegetative cover is removed, the soil surface becomes exposed to the impact of rain drops which causes a sealing of the soil surface. Less rain then infiltrates the soil. Runoff increases, stream flows fluctuate more than before, flooding becomes more frequent and extensive, and streams and springs become ephemeral.

### 3.3.3 Decrease in Agricultural Yield

Land degradation problems are a direct consequence of shortening fallow periods<sup>6</sup>, which contribute to declining yields (1.5 tonnes/ha with 13-year fallow to 0.7 tonnes/ha with a five-year fallow).

## 3.4 RESPONSE

Substantial efforts have been made by individual farmers, national governments and international agencies to counteract the cycle of land degradation. Some of the major programmes are summarised below.



Photo 3.8 Khon Pha Pheng Fall, Champassak Province

### 3.4.1 Applying Appropriate Technology

Research and development of improved technology under foreign assistance, have been successfully introduced and applied. The lack of soil erosion data should provide an impetus for further research and monitoring in the watersheds of the southern Mekong tributaries, which carry high sedimentation loads.

<sup>6</sup>Data of fallow periods in the country is scarce. DOF's reconnaissance survey suggests an average fallow period of 9 years. However, this aggregate approach has many limitations, especially in view of the widely varying systems in Lao PDR. Surveys in various parts of the country have shown that fallow periods are decreasing and average between 3-5 years in many relatively densely populated areas (STEA 2000a).

### 3.4.2 Land Resource Management Policy

The Government has set up the Land Resource Management Policy with the following aims:

- to gain a better understanding about land capability;
- to implement community based resource management, coupled with a flexible land allocation policy which is based on physical characteristics, needs and labour availability;
- to establish a low cost, well integrated research and extension service to introduce more sustainable agriculture in the low lands; and
- to develop small and medium-scale irrigation in the lowlands to reduce pressure on the lower uplands where more suitable agriculture, such as agro-forestry, can be promoted.

In 1991, Lao PDR adopted a new constitution which enshrined the principle that land belongs to the State, but that individuals are guaranteed rights to use it. Land titles have not yet been distributed, but the principle has been accepted and a land market has been developing rapidly since 1992. A land registry survey is planned for the irrigated areas.

### 3.4.3 Strengthening Institutional Capacity

Because effective land resource management transcends individual ministry sectors, the Government is currently considering enconcing the administration of land allocation, watershed management and natural resources management with the Office of the Prime Minister from the Ministry of Agriculture. Irrespective of the centrality and decentralisation debate, with regard to land resource management practices, the future course must rely on reliable temporal database of land suitability for the various uses and its susceptibility to degradation, which needs to be collected and analysed for making the right decisions. These data are necessary for future land use planning that take the farming systems and practices of rural people into account while monitoring a countrywide performance of agricultural inputs with regard to the achieved outputs.

- Strengthening the capacity of the National Agriculture and Forestry Research Institute (NAFRI) as well as Department of Forestry, Department of Agriculture and Department of Livestock and Fishery to serve as the main bodies for natural resource planning and land use planning. NAFRI should provide a database of information that is accessible to

all government authorities and other interested entities and operate pilot “adaptive research” projects that combine integrated agricultural research and socio-economic research, particularly on degraded lands and remote areas.

- Implementing community-based resource management, coupled with a flexible land allocation policy. The policy should be based on the land’s capability for sustained food and fibre production, community needs, and labour availability rather than a fixed size limit.
- Establishing and operating land development task forces at the district level to implement community-based resource management, which may come under the purview of the provincial rural development committees. The task forces should consist of district level and project personnel along with local consultants. Their function should be to determine intensification of land use (i.e. increased crop production on less steep terraced land and timber production on steeper land).
- Building capacity in the agricultural research extension system to provide
  - i. planting materials and advice on pest and disease management, crop variety biodiversity and sustainability;
  - ii. non-polluting crop production techniques such as organic farming, paddy field aquaculture, integrated pest management; and
  - iii. the development and utilisation of locally produced bio-pesticides.
- Reviewing and revising the land tax system for agricultural and forest lands that reduces the tax rate for land owners that use “best management practices” in their farming methods. The system would reward those who practice soil conservation and non-polluting, sustainable land use and penalise those farming practices that cause pollution, soil erosion or biodiversity reduction.
- Supporting development of small and medium-scale irrigation projects in order to relieve farming pressure on steep lands, which should remain forested.
- Establishing nurseries in productive areas for producing seed and seedlings that are appropriate for the region’s uplands and lowlands, including environmentally suitable products for the uplands farming such as tree crops and vegetables (e.g. cardamom, benzoin, sesame and bamboo, etc.).

## 4 BIODIVERSITY

### 4.1 STATE

Lao PDR ranks as one of the biologically richest countries in the region, not only because of its high rate of taxonomic diversity (or endemism), but also because a large portion of the country still contains relatively intact and contiguous original forest, which allows for substantial and original natural habitats (STEA 2000a).



Photo 3.9 Saola, Na-Kai-Numthuan NBCA, Khammouane Province (Source: IUCN)

Forests in the country contain at least 10,000 species of mammals, reptiles, amphibians, birds, freshwater fish, swallowtail butterflies, and vascular plants. Lao PDR is second to Cambodia in species density in the region and fourth to Thailand, Myanmar, and Vietnam in endemism (ADB 2000b).

The geography provides it with unusually rich biodiversity resources. The country straddles several biological zones and shares the boundaries of the Himalayan, Indo-Malayan, and Chinese regions. There are flora and fauna representative of each of these regions in different parts of the country. Lao PDR is highly mountainous, which creates wide variations in climate, soils, and ecological niches, leading to locally adapted and diverse biota. High endemism in Lao PDR is partly a consequence of its geography and location as a small landlocked country bordered by mid-sized mountains to the North and East, and by the Mekong river delta to the South and West.

Lao PDR has hitherto escaped much of the pressure that the global economy exerts on the natural resources of the region. Until recently, Lao PDR's physical and political isolation has sheltered it from many of the forces acting to reduce biodiversity. Examples of these forces include improved commercial rice varieties; commercial logging that destroys habitat, large-scale resource development and agro-industry. Its environment, therefore, is still relatively healthy by current standards (IDRC 1996).

Many species once common to Indochina now exist in the wild only in Lao PDR. The country is home to 25 species of endangered mammals and birds. The kouprey (*Bos sauveli*) and the Java rhinoceros (*Rhinoceros sondaicus*), both of which are thought to survive only in southern Lao PDR, are two of the most seriously threatened large mammals in the world (Table 4.1a) (STEA 2000a).

Table 4.1a Regional Comparison of Biodiversity, 2000

Biodiversity (number of species)	Lao PDR	Cambodia	Myanmar	Thailand	Vietnam
Land area (mil. ha)	23.7	18.1	67.7	51.3	33.0
Mammal	157	117	300	280	201
Endemic mammals	2	1	6	8	5
Birds	609	545	967	919	586
Endemic birds	3	0	3	2	4
Amphibians	37	28	75	101	72
Reptiles	66	82	241	282	212
Swallowtail Butterflies	39	22	68	56	37
Vascular plants	8,286	7,571	7,000	12,000	8,000
Endemic plants	1,457	1,175	1,071	2,742	800

Source: STEA 2000a.

Note: Where specific data were unavailable, species lists derived from regional distributions or species area curves.

Extensive areas of relatively undisturbed forests, containing rich ecosystems and a diversity of species, which are coming under increasing threat, make Lao PDR a high priority country for global conservation efforts.

## 4.2 PRESSURE

Currently, biodiversity values are being destroyed at ever increasing rates by logging, land conversion for agriculture, subsistence farming methods. Much of this devastation takes place under the rapid growth of development.

As the Lao PDR economy opens up to the outside world, all this is beginning to change rapidly. Consequently, threats to the country's biodiversity resources are emerging, as the high increasing rate of deforestation (300,000 ha per annum) (AusAID 1996).

The growing wealth in the region has further exacerbated the situation; those who have remained affluent in better developed Asian countries continue to increase demand and encourage middle men and impoverished villagers to hunt and trade in wild species (ADB, 2000a). Furthermore, as wildlife populations decline, the value of wild products tends to increase.

### 4.2.1 Agricultural Activities

Impacts of agricultural activities on biodiversity result from a number of often inter-related factors, from changing patterns of traditional land and resource use, subsistence and income supplementation farming through NTFP use, and commercialisation of agriculture (ADB 2000a).

Commercial coffee production and export for example, have become important sources of foreign exchange, with buyers from other countries in the region purchasing coffee beans from village growers. However, commercial production of crops is having a detrimental impact on biodiversity values in some areas by regular expansion of coffee cultivation areas into cleared forests as it is believed that soil of newly cleared forest is the best for coffee production.

In many villages, crop land is physically adjacent to or linked through food chains to water resources, forests and other natural ecosystems (especially wetlands). Agricultural pesticide use will have an increasing impact on natural systems. Given the lack of training and protection, these toxic chemicals are used not only on crops, but also to poison aquatic resources as a harvesting method (ADB 2000a).

Hence, the continuing use of these chemicals poses a serious threat to biodiversity values as well as human health (residual contamination).

### 4.2.2 Hunting and Wild Products Harvesting and Trade

Despite the retention of extensive forest habitat and the discovery of new species of large mammals, biological resources generally remain under threat. In particular, wildlife is subject to intense pressure even with a relatively low overall human population density (ADB 2000a). Commercialisation and trade in wildlife products have also increased as prices have risen and access to previously remote areas improved. Besides subsistence use, various wildlife species may also be sold as food, medicine, and pets for a variety of decorative purposes to buyers within the country.

Lao PDR maintains a long tradition of hunting and rural communities also depend on hunting and harvesting of wild products to supplement seasonal rice harvests. There seems to be few if any taxa of wild vertebrates not used by at least some ethnic groups, be it for food, medicine or in trade.

### 4.2.3 Infrastructure Developments

Infrastructure developments such as road construction, electricity network development and hydropower project development are also constraints to biodiversity due to their impacts on the surrounding environments such as logging, deforestation, wildlife migration, etc. The impact of dams, for example, drying out of overflow wetlands, which are important fish breeding and nursery areas; loss of fish stocks through blocking migration or changing water quality.

### 4.2.4 Transboundary International Issues

Although much of the wildlife is consumed within the country, there is massive illegal movement of live animals and animal parts into neighbouring countries. The international trade in Lao wildlife may involve other species, including many which were common, such as geckoes, snakes, civets, otters, gibbons and Douc Langurs (ADB 2000a). The highest volume of wildlife trade most likely comes from turtles and pangolins, whose prized skins continue to be exported in large quantities. Of high significance to wildlife conservation among the various uses are traditional medicine preparation and food. Lao wildlife may likely have an international market in traditional medicine. Currently, the most valuable products include turtles and tiger bones, which trade across the Chinese border.



Although, there has been variable interest in the Lao PDR in signing the Convention on International Trade in Endangered Species (CITES) agreement; as a result of the accelerated development through multilateral funding institutions of east-west transportation and communication corridors, the cross-boundary trade in wildlife is likely to accelerate (ADB 2000a).

#### 4.2.5 Wetlands

Wetlands in the Lao PDR play an extremely important role in the subsistence and commercial economy. The biodiversity of wetlands plays a critical role in supporting human development. As well as biological values, wetlands also have essential roles in transportation, flood amelioration, hydropower generation, and provision of potable water. Although wetland resources are important in all parts of the Lao PDR, including the mountain rivers and streams, it is in the lowlands where their value is particularly high, since much of the lowland forests have been cleared for agricultural use. As with NTFPs in forested areas, the availability of wetland resources provides an important social security or welfare mechanism in times of rice deficit as well as an ongoing source of plant products and protein (e.g. fish, crustaceans, turtles, frogs and insects). Invariably, the management of wetlands is usually complex and subject to the involvement of a number of government sectoral agencies, as well as local communities.

#### 4.3 IMPACT

The impacts on the biodiversity relate to the loss of relatively rich and diverse wildlife. Continued loss of biodiversity correlates to a reduction in species of wildlife and plants of national significance, economic development opportunities, food security, national heritage values, and recreational and eco-tourism opportunities. Moreover, Lao PDR's rich biodiversity provide many opportunities for educational and research development on tropical biodiversity, which may be hampered by the declining ecosystem.

The activity to allocate specific areas of land to shifting cultivators for sedentary cultivation, as in the present programme of the Government, is of concern, since it involves an intensification of resource use that may be unsustainable without major additional inputs, such as fertilisers. Firstly, declining soil productivity would arise. Moreover, sedentary cultivation without adequate fallow areas will not produce the NTFPs that are an important

element in household economies and nutrition which is likely to increase pressure on reduced biodiversity resources.

The implication of the government's shifting cultivation abatement programme for conservation could be a greater impact on natural resources adjacent to the settlement areas as families both intensify and broaden their harvest of forest and wetland products to raise income that supplements their rice production and replaces NTFPs. When occurring near protected areas, the agricultural activity may jeopardise or compromise the integrity of the areas' conservation values.

For example, because the soil of newly cleared forest is considered the best for coffee production, resident communities within and adjacent to the protected areas have expanded their areas of cultivation into primary forest to produce this economically important cash crop. Thus, negative environmental impacts occur, for example, on the Don Hua Sao protected area and other remaining forest areas (ADB 2000a).

#### 4.4 RESPONSE

In 1993, a Protected Area System (PAS) was established and now comprises 20 National Biodiversity Conservation Areas (NBCAs), covering approximately 3,313,597 ha, or about 14.0% of the total area of the country (Table 4.1b). Twelve additional areas are currently proposed for designation as NBCAs. Management plans for the protected areas. Besides this there are a number of Provincial Protected areas.

NGOs - such as Norwegian Church Aid, CUSO, and the World Conservation Union (IUCN) - all have experience with rural development projects that involve some aspect of biodiversity use and management at the village level in Lao PDR. Therefore, their support is being enlisted to design appropriate field methods to gain the information on biodiversity use and value, in order to structure legislation suitably. Fieldwork to collect this information, and later test legislative models, will be done by staff of these NGOs, after they are trained in biodiversity issues.

##### 4.4.1 Setting up Controls over the Use of Biodiversity Resources

Domestic control over the use of Lao's biodiversity resources is the goal of a pioneering international initiative to research and draft biodiversity access legislation for Lao PDR. Jointly funded by IDRC and the MacArthur biological

Foundation of Chicago, the project recipients include the University of British Columbia (UBC) and the Science, Technology and Environment Agency (STEA) in the Lao PDR Prime Minister's office.

According to some experts, the project to draft bio-access legislation faces two main challenges. First, protecting

approach for in situ biodiversity conservation in Lao PDR, it is also vitally important that efforts are made to conserve the biodiversity of ecosystems outside the NBCA system. The development and use of appropriate environmental monitoring procedures also have the potential to aid and complement Government efforts to introduce sustainable land use practices into both commercial activities and

**Table 4.1b List of National Biodiversity Conservation Area in Lao PDR in 2000**

Name	Year Declared	Area (ha)	Province Covered
1. Phou Daen Din	1993	222,000	Phongsaly
2. Nam Ha	1993 <sup>a</sup>	222,400	Louangnamtha
3. Nam Et	1993	170,000	Houaphanh
4. Phou Loei	1993	150,000	Houaphanh/Louangphabang
5. Nam Xam	1993	70,000	Houaphanh
6. Nam Phui	1993	191,200	Xayaboury
7. Phou Phanang	1993	70,000	Vientiane Municipality Vientiane Province/
8. Phou Khao Khouay	1993	200,000	Borikhamxay/Xaysomboun
9. Nam Khading	1993	169,000	Borikhamxay
10. Phou Hinpoun	1993	150,000	Khammouane
11. Nakai Namtheun	1993	353,200	Khammouane/ Borikhamxay
12. Hin Nam Nor	1993	82,000	Khammouane
13. Phou Xang He	1993	109,900	Savannakhet
14. Dong Phouvieng	1996	197,000	Savannakhet
15. Xe Sap	1995	136,897	Saravane/Xekong
16. Xe Bang Nouan	1993	150,000	Saravane/ Savannakhet
17. Phou Xiangthong	1993	120,000	Champassak/Saravane
18. Dong Hua Sao	1993	110,000	Champassak
19. Dong Ampham	1993	200,000	Attapeu/Xekong
20. Xe Pian	1993	240,000	Attapeu/Champassak
<b>Total</b>		<b>3,313,597</b>	

a: Revised year 1999

Source: STEA 2000a.

resources may prove difficult if the exact nature of those resources has not yet been identified. Second, Lao PDR lacks institutional and governmental capacity to catalogue the nation's resources (IDRC 1996). Correspondingly, Lao PDR has no experience with the legal provisions involved in this type of legislation.

#### 4.4.2 Adoption of Sound Planning and Land Management Practices

While the NBCA system represents the principle

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#### 4.4.3 Information and Knowledge Dissemination

Recent research has expanded knowledge on species distribution and the factors that influence range, population and conservation stature of many species within the country.

#### 4.4.4 Development of Systems for Sustainable Forest Management and Biodiversity Conservation

In 1989, the first National Forestry Conference concluded that a new system of sustainable forest management needed to be established. Government

managing forests alone without the involvement of all other stakeholders, especially villagers, who need to be engaged in planning and resource management, cannot succeed. For example, during the 1990s when stricter government control of the wildlife meat trade, many of the activities became clandestine. The volume and range of species traded are difficult to monitor. Indeed, in some major markets (e.g. Paksane, Borikhamxay Province), overt trading had ceased. Open trading persisted more widely in the north (ADB 2000a). The National Forestry Action Plan (NFAP), completed in 1991, followed soon after by the Environmental Action Plan, pursued this agenda further. In most cases, conservation objectives can be met only by integrating conservation efforts with development activities.

#### 4.4.5 Allocation of Forest for Various Uses

The Government has expanded its system of NBCAs to cover about 12.8% of the total land area. In addition, production and protection forests are now explicitly recognised as forest land use categories. Prime Ministerial (PM) Decrees No. 169 and 186 provide directions on forest land allocation and acknowledge the rights of stakeholders to develop and manage forest resources.

#### 4.4.6 Implementation of the Action Plans for Biodiversity Conservation

Currently, government agencies at the central and local levels, in collaboration with international organisations, are working to finalise management plans for all of the existing protected areas and associated buffer zones. STEA plans to continue its cooperation with other Mekong countries in carrying out a project that includes Xekong and Xe Pian Plain wetlands to demonstrate conservation and sustainable use practices<sup>7</sup> (STEA 2000a). Wetland conservation efforts have included cooperative management arrangements with local people, such as the approach being implemented by the Lao PDR Community Fisheries and Dolphin Protection Project in Khong District in Champassak Province (ADB 2000a).

The Government of Lao PDR proposes to finalise the National Biodiversity Strategy (NBS) with the following:

- Serving as the executing agency (STEA and MAF

jointly) for the NBS and NBAP<sup>8</sup>;

- Ensuring that each NBCA management plan includes consideration of core zones, limited access zones, multiple use zones and national parks;
- Providing secure access to land to ethnic groups in exchange for their adherence to jointly agree upon management plans. These plans are to support village development activities and provide incentives to communities for managing resources on a more sustainable basis and participation in protection efforts;
- Developing a legislative framework for wildlife protection and protected area systems. The approach is expected to rely on incentive-based policies rather than command and control policies;
- Studying the potential for designating the Xe Khampho area and adjacent wetlands as NBCA<sup>9</sup> (STEA 2000a), if feasible as NBCAs, determine the boundaries of these areas and facilitate adoption of a decree by the PMO designating one or more of the areas as NBCAs.
- Establishing the Environmental Protection Fund financed partially by a surcharge on water used for power and irrigation to enable long-term flow of monetary and other resources for environmental protection activities in NBCAs;
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- Installing environmental awareness at the village level and developing alternative livelihoods to shifting cultivation, gathering and hunting. (STEA 2000a)

#### 4.4.7 Ratification of Biodiversity and Wildlife Conventions

Accordingly, several multi- and bi-lateral donors and the international conservation community have joined with the Government of Lao PDR in their efforts to support and contribute to the establishment and management of NBCAs. All of these are in areas that have been identified as having exceptional biodiversity values. A significant part of this aid comes from Global Environment Facility (GEF), which has agreed to fund and support management activities

<sup>7</sup> Cambodia, Lao PDR, Thailand, Vietnam - Mekong River Basin Wetland Biodiversity Conservation and Sustainable Use Programme, Project RAS/97/G42, Draft Project Brief, UNDP, March 20, 2000.

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<sup>9</sup> IUCN, 1996. Important areas that have been proposed for protection are described in Claridge, G.F. (compiler), 1996. "An Inventory of Wetlands of the Lao PDR", Bangkok, Figure 10, p. 30.

of four NBCAs, as an integral element of forest management conservation programme.

The ratification of the Convention on Biological Diversity (CBD) by Lao PDR underscores the need to develop its own legislation controlling public access to its forest areas. As a signatory, Lao PDR retains the right to enact legislation protecting its national interests and guaranteeing domestic returns on any commercial benefits. It will develop its national law as well as other obligations under

this convention once the National Biodiversity Action plan and Strategy is developed.

International NGOs have indicated an interest in co-financing future efforts to control the cross-border wildlife trade through action planning programmes. Such action plans should include development of a training curriculum and manual for Wildlife Trade Law Enforcement, linked closely with similar efforts being developed in Vietnam and Cambodia by other NGOs (ADB 2000a).

## 4 BIODIVERSITY

### 4.1 STATE

Lao PDR ranks as one of the biologically richest countries in the region, not only because of its high rate of taxonomic diversity (or endemism), but also because a large portion of the country still contains relatively intact and contiguous original forest, which allows for substantial and original natural habitats (STEA 2000a).



Photo 3.9 Saola, Na-Kai-Numthoun NBCA, Khammouane Province (Source: IUCN)

Forests in the country contain at least 10,000 species of mammals, reptiles, amphibians, birds, freshwater fish, swallowtail butterflies, and vascular plants. Lao PDR is second to Cambodia in species density in the region and fourth to Thailand, Myanmar, and Vietnam in endemism (ADB 2000b).

The geography provides it with unusually rich biodiversity resources. The country straddles several biological zones and shares the boundaries of the Himalayan, Indo-Malayan, and Chinese regions. There are flora and fauna representative of each of these regions in different parts of the country. Lao PDR is highly mountainous, which creates wide variations in climate, soils, and ecological niches, leading to locally adapted and diverse biota. High endemism in Lao PDR is partly a consequence of its geography and location as a small landlocked country bordered by mid-sized mountains to the North and East, and by the Mekong river delta to the South and West.

Lao PDR has hitherto escaped much of the pressure that the global economy exerts on the natural resources of the region. Until recently, Lao PDR's physical and political isolation has sheltered it from many of the forces acting to reduce biodiversity. Examples of these forces include improved commercial rice varieties; commercial logging that destroys habitat, large-scale resource development and agro-industry. Its environment, therefore, is still relatively healthy by current standards (IDRC 1996).

Many species once common to Indochina now exist in the wild only in Lao PDR. The country is home to 25 species of endangered mammals and birds. The kouprey (*Bos sauveli*) and the Java rhinoceros (*Rhinoceros sondaicus*), both of which are thought to survive only in southern Lao PDR, are two of the most seriously threatened large mammals in the world (Table 4.1a) (STEA 2000a).

Table 4.1a Regional Comparison of Biodiversity, 2000

Biodiversity (number of species)	Lao PDR	Cambodia	Myanmar	Thailand	Vietnam
Land area (mil. ha)	23.7	18.1	67.7	51.3	33.0
Mammal	157	117	300	280	201
Endemic mammals	2	1	6	8	5
Birds	609	545	967	919	586
Endemic birds	3	0	3	2	4
Amphibians	37	28	75	101	72
Reptiles	66	82	241	282	212
Swallowtail Butterflies	39	22	68	56	37
Vascular plants	8,286	7,571	7,000	12,000	8,000
Endemic plants	1,457	1,175	1,071	2,742	800

Source: STEA 2000a.

Note: Where specific data were unavailable, species lists derived from regional distributions or species area curves.

Extensive areas of relatively undisturbed forests, containing rich ecosystems and a diversity of species, which are coming under increasing threat, make Lao PDR a high priority country for global conservation efforts.

## 4.2 PRESSURE

Currently, biodiversity values are being destroyed at ever increasing rates by logging, land conversion for agriculture, subsistence farming methods. Much of this devastation takes place under the rapid growth of development.

As the Lao PDR economy opens up to the outside world, all this is beginning to change rapidly. Consequently, threats to the country's biodiversity resources are emerging, as the high increasing rate of deforestation (300,000 ha per annum) (AusAID 1996).

The growing wealth in the region has further exacerbated the situation; those who have remained affluent in better developed Asian countries continue to increase demand and encourage middle men and impoverished villagers to hunt and trade in wild species (ADB, 2000a). Furthermore, as wildlife populations decline, the value of wild products tends to increase.

### 4.2.1 Agricultural Activities

Impacts of agricultural activities on biodiversity result from a number of often inter-related factors, from changing patterns of traditional land and resource use, subsistence and income supplementation farming through NTFP use, and commercialisation of agriculture (ADB 2000a).

Commercial coffee production and export for example, have become important sources of foreign exchange, with buyers from other countries in the region purchasing coffee beans from village growers. However, commercial production of crops is having a detrimental impact on biodiversity values in some areas by regular expansion of coffee cultivation areas into cleared forests as it is believed that soil of newly cleared forest is the best for coffee production.

In many villages, crop land is physically adjacent to or linked through food chains to water resources, forests and other natural ecosystems (especially wetlands). Agricultural pesticide use will have an increasing impact on natural systems. Given the lack of training and protection, these toxic chemicals are used not only on crops, but also to poison aquatic resources as a harvesting method (ADB 2000a).

Hence, the continuing use of these chemicals poses a serious threat to biodiversity values as well as human health (residual contamination).

### 4.2.2 Hunting and Wild Products Harvesting and Trade

Despite the retention of extensive forest habitat and the discovery of new species of large mammals, biological resources generally remain under threat. In particular, wildlife is subject to intense pressure even with a relatively low overall human population density (ADB 2000a). Commercialisation and trade in wildlife products have also increased as prices have risen and access to previously remote areas improved. Besides subsistence use, various wildlife species may also be sold as food, medicine, and pets for a variety of decorative purposes to buyers within the country.

Lao PDR maintains a long tradition of hunting and rural communities also depend on hunting and harvesting of wild products to supplement seasonal rice harvests. There seems to be few if any taxa of wild vertebrates not used by at least some ethnic groups, be it for food, medicine or in trade.

### 4.2.3 Infrastructure Developments

Infrastructure developments such as road construction, electricity network development and hydropower project development are also constraints to biodiversity due to their impacts on the surrounding environments such as logging, deforestation, wildlife migration, etc. The impact of dams, for example, drying out of overflow wetlands, which are important fish breeding and nursery areas; loss of fish stocks through blocking migration or changing water quality.

### 4.2.4 Transboundary International Issues

Although much of the wildlife is consumed within the country, there is massive illegal movement of live animals and animal parts into neighbouring countries. The international trade in Lao wildlife may involve other species, including many which were common, such as geckoes, snakes, civets, otters, gibbons and Douc Langurs (ADB 2000a). The highest volume of wildlife trade most likely comes from turtles and pangolins, whose prized skins continue to be exported in large quantities. Of high significance to wildlife conservation among the various uses are traditional medicine preparation and food. Lao wildlife may likely have an international market in traditional medicine. Currently, the most valuable products include turtles and tiger bones, which trade across the Chinese border.

Although, there has been variable interest in the Lao PDR in signing the Convention on International Trade in Endangered Species (CITES) agreement; as a result of the accelerated development through multilateral funding institutions of east-west transportation and communication corridors, the cross-boundary trade in wildlife is likely to accelerate (ADB 2000a).

#### 4.2.5 Wetlands

Wetlands in the Lao PDR play an extremely important role in the subsistence and commercial economy. The biodiversity of wetlands plays a critical role in supporting human development. As well as biological values, wetlands also have essential roles in transportation, flood amelioration, hydropower generation, and provision of potable water. Although wetland resources are important in all parts of the Lao PDR, including the mountain rivers and streams, it is in the lowlands where their value is particularly high, since much of the lowland forests have been cleared for agricultural use. As with NTFPs in forested areas, the availability of wetland resources provides an important social security or welfare mechanism in times of rice deficit as well as an ongoing source of plant products and protein (e.g. fish, crustaceans, turtles, frogs and insects). Invariably, the management of wetlands is usually complex and subject to the involvement of a number of government sectoral agencies, as well as local communities.

#### 4.3 IMPACT

The impacts on the biodiversity relate to the loss of relatively rich and diverse wildlife. Continued loss of biodiversity correlates to a reduction in species of wildlife and plants of national significance, economic development opportunities, food security, national heritage values, and recreational and eco-tourism opportunities. Moreover, Lao PDR's rich biodiversity provide many opportunities for educational and research development on tropical biodiversity, which may be hampered by the declining ecosystem.

The activity to allocate specific areas of land to shifting cultivators for sedentary cultivation, as in the present programme of the Government, is of concern, since it involves an intensification of resource use that may be unsustainable without major additional inputs, such as fertilisers. Firstly, declining soil productivity would arise. Moreover, sedentary cultivation without adequate fallow areas will not produce the NTFPs that are an important

element in household economies and nutrition which is likely to increase pressure on reduced biodiversity resources.

The implication of the government's shifting cultivation abatement programme for conservation could be a greater impact on natural resources adjacent to the settlement areas as families both intensify and broaden their harvest of forest and wetland products to raise income that supplements their rice production and replaces NTFPs. When occurring near protected areas, the agricultural activity may jeopardise or compromise the integrity of the areas' conservation values.

For example, because the soil of newly cleared forest is considered the best for coffee production, resident communities within and adjacent to the protected areas have expanded their areas of cultivation into primary forest to produce this economically important cash crop. Thus, negative environmental impacts occur, for example, on the Don Hua Sao protected area and other remaining forest areas (ADB 2000a).

#### 4.4 RESPONSE

In 1993, a Protected Area System (PAS) was established and now comprises 20 National Biodiversity Conservation Areas (NBCAs), covering approximately 3,313,597 ha, or about 14.0% of the total area of the country (Table 4.1b). Twelve additional areas are currently proposed for designation as NBCAs Management plans for the protected areas. Besides this there are a number of Provincial Protected areas.

NGOs - such as Norwegian Church Aid, CUSO, and the World Conservation Union (IUCN) - all have experience with rural development projects that involve some aspect of biodiversity use and management at the village level in Lao PDR. Therefore, their support is being enlisted to design appropriate field methods to gain the information on biodiversity use and value, in order to structure legislation suitably. Fieldwork to collect this information, and later test legislative models, will be done by staff of these NGOs, after they are trained in biodiversity issues.

##### 4.4.1 Setting up Controls over the Use of Biodiversity Resources

Domestic control over the use of Lao's biodiversity resources is the goal of a pioneering international initiative to research and draft biodiversity access legislation for Lao PDR. Jointly funded by IDRC and the MacArthur biological

Foundation of Chicago, the project recipients include the University of British Columbia (UBC) and the Science, Technology and Environment Agency (STEA) in the Lao PDR Prime Minister's office.

According to some experts, the project to draft bio-access legislation faces two main challenges. First, protecting

approach for in situ biodiversity conservation in Lao PDR, it is also vitally important that efforts are made to conserve the biodiversity of ecosystems outside the NBCA system. The development and use of appropriate environmental monitoring procedures also have the potential to aid and complement Government efforts to introduce sustainable land use practices into both commercial activities and

**Table 4.1b List of National Biodiversity Conservation Area in Lao PDR in 2000**

Name	Year Declared	Area (ha)	Province Covered
1. Phou Daen Din	1993	222,000	Phongsaly
2. Nam Ha	1993 <sup>a</sup>	222,400	Louangnamtha
3. Nam Et	1993	170,000	Houaphanh
4. Phou Loei	1993	150,000	Houaphanh/Louangphabang
5. Nam Xam	1993	70,000	Houaphanh
6. Nam Phui	1993	191,200	Xayaboury
7. Phou Phanang	1993	70,000	Vientiane Municipality Vientiane Province/
8. Phou Khao Khouay	1993	200,000	Borikhamxay/Xaysomboun
9. Nam Khading	1993	169,000	Borikhamxay
10. Phou Hinpoun	1993	150,000	Khammouane
11. Nakai Namtheun	1993	353,200	Khammouane/ Borikhamxay
12. Hin Nam Nor	1993	82,000	Khammouane
13. Phou Xang He	1993	109,900	Savannakhet
14. Dong Phouvieng	1996	197,000	Savannakhet
15. Xe Sap	1995	136,897	Saravane/Xekong
16. Xe Bang Nouan	1993	150,000	Saravane/ Savannakhet
17. Phou Xiangthong	1993	120,000	Champassak/Saravane
18. Dong Hua Sao	1993	110,000	Champassak
19. Dong Ampham	1993	200,000	Attapeu/Xekong
20. Xe Pian	1993	240,000	Attapeu/Champassak
<b>Total</b>		<b>3,313,597</b>	

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resources may prove difficult if the exact nature of those resources has not yet been identified. Second, Lao PDR lacks institutional and governmental capacity to catalogue the nation's resources (IDRC 1996). Correspondingly, Lao PDR has no experience with the legal provisions involved in this type of legislation.

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## 5 URBAN ENVIRONMENTAL MANAGEMENT

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 rural urban migration. The capital, Vientiane is growing 4.7% per year and the population of Savannakhet, the second largest urban centre, has tripled from 30,000 to 100,000 inhabitants between 1975 and 1995 (an annual growth rate of about 5.4%). Current development trends have spurred the urbanisation process due to expanded industry and tourism sectors in the urban centres, combined with rural to urban migration. Such growth is known from experiences all over the world to lead to an exponential increase in urban environmental problems and stress the cultural fabric of the ethnically diverse country.

### 5.1 STATE

Presently, the scale and extent of environmental problems in the urban centres of Lao PDR are relatively small in comparison to other urban centres in Southeast Asia. Since, the towns are still small, population densities are low, private car-ownership is minimal, and industrial activity is only emerging in a few of the largest towns. The ambient effects of industrial activities are minor and localised in extent (STEA 2000a).

Urban infrastructure and services in all but the largest towns are basic and rudimentary. Reliable piped water supply is only available in Vientiane, the secondary towns and some other provincial capitals (STEA 2000c). There are no interconnected networks for storm water drainage in any areas. Human waste disposal is invariably through on-site systems or in the open - there are no piped sewerage systems except in Vientiane which has sewage treatment. Solid waste collection service is only available in Vientiane and other regional centres. Maintenance of urban infrastructure is severely under-funded and lacks clear definition of responsibility (STEA 2000c).

#### 5.1.1 Water Supply

Most provincial capital towns currently have or are constructing a piped water supply system, distributing treated river water or spring water, through house connections to the majority of households. System reliability is reasonable, although water pressure may often be low. Distribution systems are old and fragile (STEA 2000c). Over 60% of households in provincial capitals have a connection or direct access to a connection. The number is closer to 80-90% for Vientiane and secondary towns (STEA 2000c). Table 5.1a presents the results from the census on source and distance to source for domestic water in urban areas.

Table 5.1a Characteristics of Urban Water Supply, by Distance from Sources, 1995

Water sources <sup>a</sup> for urban households (% of total)	Distance from premises					
	Total	on the premises	< 500 m	500 - 1000 m	>1000 m	not started
Pipe water in/out	44.3	59.6	13.4	4.2	11.6	0.0
Well or borehole - protected	12.8	11.1	16.8	13.0	8.2	3.6
Well or borehold -unprotected	30.4	26.5	37.9	46.7	37.4	3.6
River, stream or dam	11.4	2.4	29.9	33.2	35.0	10.9
Rain water tank	0.1	0.0	0.0	0.3	0.3	0.0
Other	1.0	0.5	2.0	2.5	7.5	36.4
Not started	0.0	0.0	0.0	0.0	0.0	45.5
<b>Total (%)</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>
<b>Number of households</b>	<b>128,519</b>	<b>86,705</b>	<b>38,651</b>	<b>2,814</b>	<b>294</b>	<b>55</b>

Source : STEA 2000c. Notes: aWater source for drinking and cooking.

### 5.1.2 Drainage System

Urban drainage system and its functioning are the key to achieving any environmental improvement to the urban areas. Storm water drainage in most urban areas consists of roadside drains leading ultimately to natural streams or rivers. Drains are generally not adequately interconnected and do not form a network. In the larger towns, drains are lined in the town centre areas, and covered in front of commercial establishments. Water in the drainage system is invariably contaminated with faecal matter from latrines and coliform septic tank effluent, presenting a very direct health risk (STEA 2000c). The absence of overall urban drainage plans with a functioning integrated network combined with the lack of clear arrangements for maintenance, cause flooding and stagnant water pools over large parts of the urban centres.

Investment on infrastructure improvements, as well as efforts to strengthen local resources for operation and maintenance, is not sufficiently aimed at the drainage networks in Lao PDR (STEA 2000c). In addition, technical

support in the preparation of catchment area based drainage plans, with identification of final point of discharge, for the main urban centres have been lacking (STEA 2000c).

### 5.1.3 Sewerage System

None of the urban centres are serviced with a sewerage facility. All disposal of human waste occurs on-site. Except for some public facilities at markets and temple grounds, there are no public toilets in existence (STEA 2000c). Larger and more modern properties have septic tanks, with septic tank effluents (or overflow) often draining to roadside drains. Small private companies are known possessing vacuum desludging vehicles for the periodic cleaning of septic tanks in the larger urban centres, but operating data indicate very little usage made of such service. Older and lower-income houses use pit-latrines of various improvised types. In some of the traditional villages, households might not have any form of latrine (STEA 2000c). Sludge generally ends up in the open roadside drains, or infiltrates on site in the low-density areas. Table 5.1b presents census data on sanitation.

**Table 5.1b Urban Households Served by Sanitation, 1995**

Provinces	Modern Toilet <sup>b</sup>	Normal Toilet	Dry Toilet	Other Toilet	None	Total
Vientiane Municipality	2,578	38,687	6,991	385	7,343	55,984
Phongsaly	7	102	597	570	245	1,521
Louangnamtha	9	748	1,365	308	683	3,113
Oudomxay	31	939	1,922	223	1,942	5,057
Bokeo	2	635	104	2	223	976
Louangphabang	61	3,446	1,116	623	1,099	6,345
Houaphanh	3	231	852	812	270	2,168
Xayabury	1	752	2,160	486	294	3,693
Xiengkhouang	7	364	1,140	457	240	2,208
Vientiane	143	4,611	889	36	2,573	8,252
Borikhamxay	-	698	356	7	541	1,602
Khammouane	47	2,755	314	32	3,046	6,194
Savannakhet	158	7,719	970	195	6,645	15,687
Saravane	36	933	87	26	1,528	2,610
Xekong	4	144	479	145	827	1,599
Champassak	71	5,942	430	37	3,616	10,096
Attapeu	1	159	331	3	243	737
Xaysomboun	-	139	247	2	289	677
<b>Total</b>	<b>3,159</b>	<b>66,004</b>	<b>20,350</b>	<b>4,349</b>	<b>31,657</b>	<b>128,519</b>
<b>Percent of Total</b>	<b>2.5</b>	<b>53.7</b>	<b>15.8</b>	<b>3.4</b>	<b>24.0</b>	<b>100.0</b>

Notes: a "modern toilet" = cistern flush; "normal toilet" = bucket flush, Source: STEA 2000c

Ground water contamination by wastewater from on-site sanitation systems such as septic tanks is often quoted as “becoming a serious issue”. There is no scientific evidence to support such claims (STEA 2000c), due to the lack of studies conducted for such purpose. Therefore, policies on urban wastewater management do not take such claims into consideration. Moreover, at the national level, no strategies have been formulated to outline the conditions under which a full or partial sewerage system should be considered for urban areas. In essence, no guidelines have been promulgated to assign responsibility or create mandatory conditions for the construction, operation and maintenance of sewerage systems in urban areas (STEA 2000c).

#### 5.1.4 Solid Waste Management

Average urban waste production is 0.75 kg per capita per day, consisting of approximately 30% organic material, 30% plastic, 15% paper and 25% glass, cans and other metals (ADB 2000a). Hazardous and toxic wastes such as batteries, old paint cans, aerosols and other refuse also are mixed with these wastes and no separation is required. The low content of organic material in municipal solid waste is mainly due to the agricultural lifestyle even in urban areas, where a large fraction of food waste also acts as animal feed (ADB 2000a).



*Photo 3.10 Urban Solid Waste Dumping, Xienkhouang province*

In general, domestic and commercial waste has the same composition. They are collected from the premises or placed in bins along main roads for pick up by the responsible government agency or by a private specialised company. Waste is transported to a designated dumping site located 2-10 km from an urban area. As of 1996, collection services charged 200-500 kips per km per month (ADB 2000a), with a progressively higher rate for larger commercial enterprises.

In the towns with waste collection systems, there is a broad range of possible arrangements. From different historical backgrounds and administrative arrangements, situations have now arisen with varying degrees of involvement by the private sector in waste collection, but with little apparent definition of responsibilities or setting of performance targets. Final disposal of collected waste invariably occurs at an uncontrolled dumpsite (STEA 2000c).

In Vientiane, a combination of state and private companies, assigned different sections of the four urban districts, take up the task of waste collection. The Municipality Government dictates collection frequency and payments by households. Vehicles in use are a mix of new Japanese trucks, reconditioned French waste collection vehicles and locally purchased vehicles (STEA 2000c).

Only five major towns have some form of solid waste collection systems. In all other urban centres, waste is disposed off on randomly selected plots, or simply anywhere. Occasionally, campaigns may be organised at village level to clean the immediate environment of waste, in particular at the beginning of the rains (STEA 2000c).

Three principal methods used to dispose of solid wastes are municipal landfills, open burning and dumping, usually into a water body or on vacant low-lying land, where some wastes get washed away. The traditional preference is for indiscriminate dumping and occasional burning, resulting in negative environmental impacts including scavenging, smoke fumes, contaminated wastes, production of leachate (that contaminates drinking and groundwater and agricultural land), and the production of methane, a greenhouse gas (ADB 2000a).

#### 5.1.5 Roads and Transportation

Road infrastructure in provincial capital towns consists of surfaced roads-albeit often in bad condition-for the main thoroughfares, while local roads are generally gravel or earth roads. In smaller district towns, virtually all roads are dirt roads, with little traffic (STEA 2000c). With the exception of some roads and junctions in Vientiane, the capacity of the roads is not yet an issue, as vehicle use and ownership remains very low. However, in the 1990s the ownership of small motorbikes grew up at explosively rate - particularly in Vientiane but also noticeable in provincial towns (STEA 2000c).

At the moment there are commonly no lane markings and parkings, except in some areas of Vientiane, or other traffic guidance measures. Traffic behaviour is erratic and unpredictable. The mix of traditional human, and animal, powered modes of transport with modern high-acceleration vehicles leads to growing situations of potential conflict, and increasing fatalities (STEA 2000c).

to urban areas. Currently, Lao PDR lacks an effective system of development control, and therefore the means to control future undesirable development and its concomitant environmental degradation.

### 5.2.1 Drainage System

The existing drainage system is inadequate. Added to that, the contamination of carried liquid waste, with faecal matter from latrines discharging directly into the drainage channels or drains where coliform from septic tank effluents, presents a very direct health risk (STEA 2000c), which would

**Table 5.1c Summary of Conservation Legislations**

Date	Legislation	Purpose
1978	Decree No. 1375 Ministry of National Education and Sports	General intention to protect historic sites and building
1990	Decree No. 139 Ministry of Information and Culture	Nomination of authorities responsible for protecting national heritage
1993	Decree No. 834 Ministry of Information and Culture	Adoption of all historical Lao and Colonial building as part of national heritage
1994	Decree No.174/pm	Listing of 9 sites and building of national important to be protected
1997	Decree of the President of Lao PDR	Historical, cultural and national heritage protection
1997	Decree of Prime Minister of Lao PDR	Organisation of Urban Development and Administration Authority (UDAA)
1999	Decree of the President of Lao PDR	Urban Planning Law
2000	Decree of Prime Minister of Lao PDR	Vientiane Urban Development and Administration Authority

Source: STEA 2000c

### 5.1.6 Cultural Conservation

The Government of Lao PDR has issued a series of decrees aimed at protecting key historical buildings and sites (see Table 5.1c). These legislations designate Government Departments to oversee conservation efforts at historical temples (Wats) and other edifices and to identify areas of national importance. To date, however, there has been no active implementation of “area conservation” of urban heritage artefacts in general, with the exception of Louangphabang (STEA 2000c).

## 5.2 PRESSURE

Urban centres are always attractive places for both educational institutions and employment opportunities. These factors generate increasing in-migration from rural

increase with the rising urban populations using similar sanitation practices. It could also lead to contamination of underground water sources such as wells etc., eutrophication of water bodies leading to pressure build-up on urban water resource etc. Increased risks of water borne and other vector borne epidemics are perceived.

For example, storm water drainage is a serious issue in Vientiane and to a lesser extent in Pakse and Savannakhet (STEA 2000a). The present system suffers from inadequate design and serious lack of maintenance. Most drains are clogged with garbage, reflecting the absence of an organised system for solid waste disposal in Vientiane and other towns. Rehabilitation of the system requires significant investment, which is not warranted unless solid waste disposal in an organised system is also introduced in the urban centres, specially Vientiane.

### 5.2.2 Solid Waste Management

In its present form, the solid waste collection system will not remain financially sustainable. Consequently, private companies operating the systems cannot remain financially viable for long. Moreover, local municipal efforts to achieve a sustainable urban environment will continue to encounter more difficulties without a viable waste collection system (STEA 2000c).

The common risk in all towns with collection system is the gradual reduction in the number of households, willing to pay for collection charges. In part, this reluctance may be due to the lack of satisfaction with the service provided (STEA 2000c). The situation is likely to worsen with the rapid growth of urban centres and the inadequate capacity build-up within the few private companies as well as the government department officials to cope with the increased waste loads accompanying such growth.

### 5.2.3 Roads and Transportation

The development of National Road No. 13 will inevitably stimulate strong growth in vehicle traffic in the coming years (STEA 2000c). Most vehicles added in the future can be expected to be two-wheels due to their low cost. Road space will be exhausted sooner in the long term, due to expected increase in two wheel populations accompanied with possible vehicular pollution due to pollutant discharges.

## 5.3 IMPACT

Common environmental problems associated with urban centers manifest themselves at the following levels.

- Degradation of the quality of urban surroundings that serves as impediment to functioning of physical environment and desensitizes people to accept that deteriorated conditions are abnormal;
- Lack of a sound resource base in municipalities and districts in terms of financial resources, material resources including a sufficient stock of essential equipment and skilled human resources with the capacity to manage urban environmental problems, particularly urban wastes; and
- General decline of the common global environment, although not significant in the context of Lao PDR, as compared to other countries, the Government has committed itself to reversing the trends through participation in global dialogue of environment welfare. In

addition, by addressing these issues early on in the country's development, it can prepare the next generation for environmental exigencies and may enable it to avoid worse situations.

As the country continues to modernize and takes steps further to liberalize its economy, urbanisation and development will tax its institutional and regulatory ability to handle the onslaught of globalization. With the prospect of a development boom facing towns in coming years, several issues important to the urban environment, current and emerging, would be encountered. They include:

#### 5.3.1 Drainage System

With the lack of insufficient drainage system, the urban centres in Lao PDR are now experiencing stagnant polluted waste water in open road-side drains (STEA 2000c). Unsanitary conditions, threat of seasonal epidemics and odour pollution in selected spots are likely to occur and increase with growing urban population unless remedial measures are adopted by preparing comprehensive drainage plans preventing water stagnation or flooding and prevention of sewage from mixing in the storm water drainage system. In addition, unlined drains carrying faecal coliform and other toxins can become a potential source of ground water pollution in the long term affecting some water sources such as open wells, shallow hand pumps and others.

#### 5.3.2 Sewerage System

The current sanitation system in many areas entails an on-site disposal of human waste without the introduction of full water-borne sewerage with treatment facility and safe disposal arrangement (STEA 2000c). Such a system will continue to have a detrimental impact on the public health by mixing sewage in the storm drainage system, polluting natural water courses in the medium to long term as population growth multiplies daily discharge volumes. In addition infiltration of coliform bacteria into soil and ground water sources through percolation with rain etc., will continue to affect human health.

#### 5.3.3 Solid Wastes Management

Proliferation of solid waste has a cumulative impact on aesthetics and finally on human health with all sorts of vector borne disease spread possibilities from all types of sources such as domestic, commercial, industrial wastes. Specifically, hospital wastes can be infective. Increasing populations in urban centres of Lao PDR imply increased health risks due to existing handling method of solid waste

in the near to medium term. In the longer term it is expected that scientific methods would be brought into practice in the municipalities of Lao PDR. Soil and underground water contamination are indirect long term risks associated with leachate infiltration under non-engineered landfills.

#### 5.3.4 Roads and Transportation

Road casualties in Vientiane have reached alarming levels among motorcyclists (STEA 2000c). In provincial towns, this situation will be reached in a few years. The growing use of motorised vehicles (in particular motor bikes) on unpaved roads contributes to respiratory problems caused by the permanent dust in the air. A programme of gradual surfacing of local access roads with appropriate sealing should improve this situation.

#### 5.3.5 Cultural Conservation

A number of conservation decrees have been enacted in recent years. However, with the exception of Louangphabang, which receives considerable financial as well as social support to protect the cultural heritage, systems are in place only by the law to protect the character of entire areas, specific buildings or green areas of special value and interest. An initial requirement is the inventories of assets of historic, cultural or natural significance. Such a programme may require international assistance, but within a framework determined by the Government.

### 5.4 RESPONSE

In the major towns, significant improvements have been achieved during the last five years through a number of large-scale infrastructure development programmes. Attention is now gradually shifting towards smaller provincial capitals (STEA 2000c).

#### 5.4.1 Water Supply

Externally financed rehabilitation and extension programmes are ongoing in a large number of capital and provincial towns, mainly under the ADB seven northern towns and four southern towns and small town water supply projects (STEA 2000c).

Development programmes for water supply aim to provide piped water of adequate quality through house connection to 80% of urban populations in all urban centres with a total population exceeding 5,000. Programmes for larger urban centres, which already have a water supply system will subsequently focus on the replacement of old

distribution networks and reduction of distribution losses (STEA 2000c).

#### 5.4.2 Drainage System

The Government has identified the organisation and finance for drainage maintenance as a priority in the re-organisation of local level government (STEA 2000c).

#### 5.4.3 Sewerage System

In the absence of any form of piped sewerage in the country, the Government will formulate a long term national wastewater strategy to guide any future investment in waste water management (STEA 2000c).

#### 5.4.4 Solid Waste Management

The Ministry of Communications, Transport, Post and Construction (MCTPC) is the ministry with direct responsibility for solid waste management at the national level. The provincial office of Department of Communications, Transport, Post and Construction (DCTPC) takes charge at the provincial level. The administrative arrangements in each province may differ, where individual districts may have authority for solid waste management. Although municipalities do not exist officially, urban areas create de facto municipalities that are recognised as having special needs and are managed through a municipal committee chaired by the provincial governor (ADB 2000a). This committee designates an implementing agency for solid waste issues. In Louangphabang, Savannakhet, Thakhek and Pakse, the UDAA represents the implementing agency.

The Government (STEA 2000c) is implementing gradual expansion of a central solid waste management programme, from the larger to small towns. All central solid waste management systems shall be based on the following criteria:

- i. full coverage of the urban area, and therefore
- ii. full fee paying
- iii. payment by households dependent on level of service
- iv. a minimum investment in mechanical equipment, and an emphasis on organisation and community mobilisation, there by reducing capital and running costs of the systems.

Vientiane represents the only urban area where the commercial venture of recycling has taken root (ADB 2000a). Local markets in secondary towns do not produce solid waste



in sufficient quantity to warrant the transport costs or to interest potential buyers. The Government aims to minimise the volume of waste by encouraging at source waste reduction technologies, and formal recycling as well as by encouraging a form of community participation through structured utilisation of the informal sector communities that presently render a useful service through scavenging (STEA 2000c).

### Assistance Programmes

In mid-1997, UNDP/NORAD supported a major urban solid waste management project in the four secondary towns (STEA 2000c). The project aimed to set reliable but low cost services through greater involvement of community groups. The project aimed to achieve greater involvement of community groups by emphasising the social responsibility of participating in improving the living environment.

Current and past assistance provided by bilateral and multilateral donors include the following:

#### Vientiane

- Rehabilitation of the Sihom Area : A pilot project assisted by the United Nations Capital Development Fund (UNCDF) (\$US 3.0 million) and the United Nations Development Programme (UNDP) (\$US 1.7 million), includes a small waste disposal component providing plastic bins on concrete pads.
- Vientiane Integrated Urban Development Project: An ADB supported programme to upgrade Vientiane's infrastructure, utilising a 10 year \$US 93 million loan.
- Improvement of the Solid Waste management in Vientiane Urban Area : A JICA assisted project to improve the disposal site for solid wastes at kilometre 18, northeast of Vientiane.

#### Secondary Towns

Secondary Towns Integrated Urban Development Project : This ADB loan project for \$25 million will provide assistance to Louangphabang, Pakse, Savannakhet and Thakhek to assist with solid waste management; and to improve roads, embankments and drainage.

### 5.4.5 Roads and Transportation

The Government is concerned about the rapidly increasing volumes of motorised traffic in its urban centres and the resulting threats to the urban environment. The preparation of pragmatic integrated transport plans for the main urban centre is therefore considered a priority, together with the formulation of an overall urban transport policy. The urban transport plan would review the feasibility of implementing mass public transport, in order to slow down traffic growth (STEA 2000c).

The Government intends to increase the capacity of the existing road networks, by introducing traffic management measures on a broad scale. This programme will include the training and possible re-organisation of traffic police. Traffic management will include greater emphasis on traffic safety, focusing on education at schools (STEA 2000c).

### 5.4.6 Cultural Conservation

The Government recognizes the importance of establishing detailed inventories of its heritage as a basis for the protection of buildings and other unique features of its urban environment. Some groundwork for area conservation has been done by the Department of Museums and Archaeology, Department of Housing and Urban Planning in association with French consultants, through an outline proposal for undertaking studies in Savannakhet, Pakse, Thakhek and Vientiane. Their proposal includes the production of inventories of historic buildings, definition of conservation areas "Heritage Protection Zones", design of regulation procedures, and training of local staff. The Department is actively seeking source of funding for the proposed work (STEA 2000c).