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Enhancing livelihoods in Lao PDR through environmental services and planted-timber products

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Stephen Midgley, Jeff Bennett, Xeme Samontry, Peter Stevens, Khamphone Mounlamai, Dao Midgley and Alan Brown

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Cover: ACIAR project staff in a smallholder teak plantation with an underplanting of rattan at Ban Kok Ngiew, Luang Prabang province, Lao PDR (Photo: Tony Bartlett)

Foreword

In Lao PDR, the Australian Centre for International Agricultural Research (ACIAR) is supporting research that enhances livelihoods of smallholder farmers involved in agroforestry and other agricultural practices. During the 2012 ACIAR–Lao country consultations, stakeholders indicated that more research is needed on integrated agroforestry systems that improve livelihoods for poor farmers, support the Government of Lao PDR's program to address shifting cultivation and increase forest cover, provide incentives to farmers for improved land management practices, and enhance the quality of value-added wood products. In order to support the development of two new ACIAR research projects, ACIAR commissioned this background study of the current situation regarding payments for environmental services (PES) and the value chains for wood products from planted forests in Laos.

The important concept of paying for environmental services is beginning to receive considerable attention in developing and developed countries. PES aim to provide financial benefits to farmers and land managers who implement improved practices that enhance environmental services, such as carbon sequestration, protection of water quality and biodiversity conservation. The challenge is to develop practical mechanisms to determine the value of a particular environmental service and how funds can be efficiently paid to those who provide them.

Plantation forests and agroforestry systems, using high-value species such as teak, are becoming more widespread in Laos and many of these are owned by smallholders. In time, timber from such planted forests will provide much of the resources required by the wood-products industry. However, at present there are many issues that need to be addressed to improve the value chain so that a greater price can be paid to smallholders for the logs they grow. These include complex administration and regulations, balancing supply and demand, value-chain inefficiencies and lack of expertise and equipment appropriate for processing plantation timber. A major impetus is to increase value-adding within Laos rather than mainly exporting logs.

This technical report provides a thorough exploration both of these disparate topics that are intrinsically linked by their focus on the forests of Laos and their aim of improving livelihoods for thousands of Lao people, many of whom live at or below the poverty level in the margins of urban areas. It then presents a summary of the researchable issues and recommends how these could be tackled.

Nick Austin, Chief Executive Officer, ACIAR

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Abbreviations

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
ANU	Australian National University
ASEAN	Association of Southeast Asian Nations
CA	Concession Agreement
CoC	chain of custody
dbh	diameter breast height
DoF	Department of Forestry
DoFI	Department of Forest Inspection
EIA	environmental impact assessment
EPF	Environmental Protection Fund
ES	environmental services
EU	European Union
FLEGT	Forest Law Enforcement Governance and Trade
FRDF	Forestry and Forest Resource Development Fund
FSC	Forest Stewardship Council
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GoL	Government of Lao People's Democratic Republic (PDR)
ha	hectare
HRDME	Human Resources Development for the Market Economy (in Lao PDR)
IFC	International Finance Corporation
ITL	Illegal Timber Law (European Union)
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
LFIA	Lao Furniture Industry Association
LNCCI	Lao National Chamber of Commerce and Industry
LPTP	Luang Prabang Teak Program
LWPIA	Lao Wood Processing Industry Association
MAF	Ministry of Agriculture and Forestry
MoF	Ministry of Finance
MoIC	Ministry of Industry and Commerce
MPI	Ministry of Planning and Investment
MRC	Mekong River Commission
NAFRI	National Agriculture and Forestry Research Institute
NGO	non-government organisation
NLMA	National Land Management Authority
NPA	National Protected Area
NSEDP	Seventh National Socio-Economic Development Plan (2011–2015)
NT2	Nam Theun 2
NTFP	non-timber forest product
NTPC	Nam Theun 2 Power Company
NUoL	National University of Laos
PES	payments for environmental services
PMO	Prime Minister's Office
R&D	research and development
RBO	river basin organisation
REDD	Reducing Emissions from Deforestation and Forest Degradation
SUFORD	Sustainable Forestry and Rural Development (Project)
t	tonne
TFT	The Forest Trust
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNIDO	United Nations Industrial Development Organization
US$	United States dollar
USA	United States of America
USAID	United States Agency for International Development
VALTIP	Value adding to Lao PDR plantation timber products (ACIAR project FST/2005/100)
WMPA	Watershed Management and Protection Authority
WREA	Water Resources and Environment Administration
WWF	World Wide Fund for Nature

Currency (January 2011)

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Information from this report has been used to develop two Australian Centre for International Agricultural Research (ACIAR)-funded forestry projects: FST/2010/012, 'Enhancing key elements of the value chain for plantation-grown wood in Lao PDR'; and FST/2011/003, 'Effective implementation of payments for environmental services'.

Notes on the authors

Stephen Midgley—Mr Stephen Midgley, a forester and development specialist, is principal of Salwood Asia Pacific Pty Ltd, a company that seeks to link Australian businesses with forest industries in the Asia–Pacific region. He has worked in Asia for over 37 years through long-term projects in Lao PDR, Nepal, Sri Lanka and China and via many short-term projects throughout the region during his career with Australia's national research body, the Commonwealth Scientific and Industrial Research Organisation (CSIRO).
Email: <stephen.midgley@salwood.com>

Jeff Bennett—Professor Jeffrey Bennett is Director of Environmental and Economics Research at the Crawford School of Public Policy at the Australian National University. He has over 30 years experience researching, consulting and teaching in the fields of environmental economics, natural resource economics, agricultural economics and applied micro-economics. He is a Distinguished Fellow of the Australian Agricultural and Resource Economics Society and an elected member of the Mont Pelerin Society. His current research interests focus on the development and application of techniques to estimate the value of non-marketed environmental benefits and costs, and the analysis of alternative institutional structures that give private owners and/or managers of natural resources the incentive to provide environmental benefits.
Email: <jeff.bennett@anu.edu.au>

Xeme Samontry—Mr Xeme Samontry is a professional forester and is currently National Project Facilitator for the Climate Protection through Avoided Deforestation (CLiPAD) project. As a senior officer of the Government of Lao PDR, he was formerly Deputy Director General of the Department of Planning in the Ministry of Agriculture and Forestry, where he also held the post of Deputy Director General of the Permanent Office. He was formerly Director General of the Department of Forestry, and spent 2 years as General Manager of the Nakai Plateau Village Forest Association associated with the Nam Theun 2 Power Company.
Email: <xemesamonty@yahoo.com>

Peter Stevens—Dr Peter Stevens taught at the Australian National University and at Griffith University. He first worked in Laos during 1968–71 as a soil scientist with the Lao–Australian Reforestation Project, and later during 1999–2001 as Donor Coordinator to the Ministry of Agriculture and Forestry. He has also worked in many other countries, particularly Bangladesh, Turkey and Sri Lanka. For about 10 years he was Coordinator of Development Assistance Projects with CSIRO Forestry.
Email: <peter_stevens@y7mail.com>

Khamphone Mounlamai—Mr Khamphone Mounlamai is a forester and currently Deputy Director, Research Management Division, National Agriculture and Forest Research Institute (NAFRI) in Laos. He was formerly attached to the Ministry of Agriculture and Forestry, before which he was a senior research scientist with a professional interest in the commercial development of teak, eucalypts and other species of commercial potential in Laos.
Email: <kphonemou@yahoo.com>

Dao Midgley—Ms Dao Midgley has had a long association with forestry development projects in many Asian countries. Fluent in several languages in addition to her native Lao, Dao has a strong interest in anthropology and possesses skills in cross-cultural communication and has been part of previous ACIAR studies in Laos and Papua New Guinea.
Email: <dao.midgley@salwood.com>

Alan Brown AM—Mr Alan Brown, a former Chief of the CSIRO Division of Forestry, ACIAR project leader and member of the Center for International Forestry Research (CIFOR) Board, is currently Production Editor of the journal *Australian Forestry.*
Email: <alananderika@grapevine.com.au>

Summary

Lao PDR is well endowed with natural and planted forest assets which provide substantial environmental value to the country and to the regional and international communities. In contrast to its neighbours, the country has 42% forest cover, has a high level of biodiversity and provides some 35% of the water flows to the Mekong River system. The Government of Lao PDR (GoL) has set a target of achieving 70% forest cover by 2030. Payments for environmental services (PES) are an option to offer incentives to farmers or landowners in exchange for managing their land to provide some specified environmental service. The four main services currently of interest to policymakers, managers and supporting projects in Laos are water, carbon, biodiversity and landscape beauty as the basis for ecotourism. The capacity of Laos to maintain and enhance these services, the required resources and incentives, and the value of these services to the local, regional and international communities is being assessed as a matter of priority.

GoL has firm policies that are clearly directed towards economic growth and poverty alleviation, and has recognised the planted forestry sector as one of the highest priorities leading towards economic growth and increased revenues in remote rural areas. The expanding planted-forest sector based on rubber, eucalypts, acacias and teak may reach 500,000 ha and will create an annual supply of wood of about 4 million cubic metres (m^3) that can support the processed-wood industries. However, the capacity of these industries needs to be strengthened if they are to operate profitably in the highly competitive and sophisticated regional market, and to maximise the returns to smallholders and the wood-processing industries. Logs and sawn timber from natural forests still represent the majority of wood exports from Laos and to date the country has not been able to extend wood processing up the value chain and to broaden into value-added production. The Lao wood-processing industry has experienced difficulties competing against established, advanced secondary and tertiary manufacturing centres in Vietnam and China.

Almost all activities within the Lao forestry sector are guided by the Forest Strategy 2020, endorsed in 2005, which in turn is consistent with the Seventh National Socio-Economic Development Plan (2011–2015) (NSEDP), the Agricultural Development Strategy 2011–2020 and the associated Agricultural Master Plan 2011–2015.

This report has two linked and combined aims and seeks to:

- examine opportunities and identify researchable issues leading to enhanced livelihoods for small landholders involved in forestry, agroforestry and other agricultural practices through payments for the provision of environmental services (ES) such as carbon sequestration, protection of water quality and biodiversity conservation
- examine and identify researchable issues and opportunities across the value chain for planted forest–grown wood in Laos.

There is a great complexity in the institutional framework relating to management and monitoring of natural resources and the environment in Laos. At least 18 agencies with some involvement were identified in the course of this study. It is challenging for national agencies and international organisations to assign responsibilities for establishing, managing, monitoring and utilising plantations and natural forests, and all aspects of PES. The provincial administrative authorities—which exercise broad discretion within the policy guidelines provided by national legislation, decrees and regulations—play an important role. If rural livelihoods in Laos are to be improved through PES, and from more productive timber plantations and wood industries, the problematical institutional arrangements must be clarified and simplified.

Payments for environmental services

Forests provide many ES upon which much of life depends: food, fuel, building materials, fresh water, climate regulation, flood control, nutrient and waste

management, maintenance of biodiversity and cultural services. These services receive significant support and interest from most of the agencies and institutions within Laos.

The definition of PES used for this study is that provided by Tacconi (2011): 'A transparent system for the additional provision of environmental services through conditional payments to voluntary providers'. This definition stresses four important components of any PES scheme: (i) *transparency,* in that the terms and conditions are known to all so that competition in supply is unrestricted and that the potential for corruption is reduced; (ii) *additionality*, in that the contribution of any supplier with the scheme is in addition to that which would have been forthcoming without the scheme; (iii) *conditionality*, wherein the ES being purchased are well defined and that contracted actions and/or outcomes are monitored under a PES scheme; and (iv) the providers of ES must be acting *voluntarily*.

PES schemes are no longer experimental in many parts of the world but now involve the payment of significant amounts of money. The literature for watershed service schemes alone suggests a rapid pace of growth, a wide diversity of schemes and a broad geographical footprint. A range of important political, administrative, financial, social and operational considerations influences decisions on PES. The study draws upon the report by Emerton and Lopaying (2011) which examines PES options for the development of a river basin fund for the Nam Ngum River Basin in Laos.

The principles of incentives for PES and improving land use in Laos have been considered positively within policy levels of GoL. There is government commitment, but GoL also recognises that there are many challenges in sourcing and managing funds, determining the appropriate amount of funds and prioritising payments. Disciplined and transparent regulation will be required to ensure the success of any PES scheme, as observed by Emerton and Lopaying (2011):

> PES work best when they are founded on a clear and scientifically-proven link between particular land uses and the provision of specific ecosystem services. If a buyer is being asked to pay for their consumption of a particular ecosystem service, then the PES scheme must guarantee that this will be provided. Demonstrating these links requires significant knowledge, rather than broad assumptions and unverifiable hypotheses. In most cases, potential buyers are interested in a very specific service (erosion control, clean water supply and other tangible outputs and services), and will want to be shown the proof that this is what they are getting.

Value chains for plantation-grown timber

Laos already has a small but vibrant wood-products industry, with considerable expanding plantation resources of rubberwood, eucalypts, acacias, teak and other species serving both international and domestic markets. The value chain connects tree growers in rural Laos with processors, furniture producers and exporters based in Luang Prabang, Vientiane and elsewhere, and comprises numerous components including cultivation of trees by farmers, harvesting and transport, primary and secondary processing, and exports of wood products. Efficiency in the value chain may be measured in terms of time, money, quantity and quality, and will also include non-tangible factors such as convenience, reliability and responsiveness. Inefficiencies within the value chain may result in mismanagement of plantations, poor incentives for wood producers and misuse of timber resources. The efficiency of the value chain and wood-products industries in Laos is particularly hindered by the numerous conflicting and confusing regulations imposed by the government.

The prospects for improving rural livelihoods through improving the efficiency of value chains directly depend upon increases in log prices and management of demand to match times of household need of the smallholder. Strong market demand also enhances employment opportunities for those involved in harvesting and transport. Within the planted-wood value chain, several factors can determine how the processor or trader may pay more to the grower. These include: increased final export prices; improved efficiency in plantation production and decreased processing costs; decreased taxes and other imposts; reduced harvest and transport costs; and improved reliability of supply.

The Lao wood-processing industry is being influenced by increased regional demand for wood products and global markets that have become increasingly sensitive to timber sourced illegally or unsustainably. The large markets of North America and Europe have responded legislatively through the Lacey Act (United States of America) and the Illegal Timber Law (European Union), and in Australia

similar legislation, the Illegal Logging Prohibition Bill 2011, is currently before the Australian Senate. Along with legislative means to encourage trade in legally sourced timber, global markets are seeking to encourage sustainable management of forests and limit irresponsible or illegal management by the adoption of one of two major international certification systems operated by the Programme for the Endorsement of Forest Certification, the world's largest forest certification system, and the Forest Stewardship Council (FSC). Group certification, via FSC, has been achieved in Laos through a small group of smallholder teak growers near Luang Prabang. Among the challenges for broader acceptance of certification is the need to accommodate small and legal processors. However, such small enterprises registered for business, using legally grown plantation wood, find it difficult to meet the current complex and sometimes confusing guidelines for FSC chain-of-custody supply chains and are effectively excluded from these processes. There have been suggestions that other systems might be suitable for small sawmills, such as Verification of Legal Compliance or Verification of Legal Origin.

The study examines possibilities for long-term engagement with the teak plantation resource in Luang Prabang province where estimates of scattered, smallholder plantation areas vary from 10,000 ha to 26,500 ha. Reliable information on volumes of timber available and the age and size classes of this resource underpin investment plans for wood processors and marketing plans for new products. There has been no reliable inventory completed of the plantation teak resource in Luang Prabang province, and remote imagery offers promise for the application of such technologies across the province.

Skills development of all operators in all parts of the value chain, from smallholder growers through to exporters, remains critical. The National University of Laos, Pakpasak Technical College and regional technical colleges, the Lao Furniture Industry Association's Competency Centre and the government forestry agencies are all making valuable contributions. Several donors and non-government organisations support the Lao wood-products sector including, but not restricted to, the Lao–German Cooperation, the Japan International Cooperation Agency, the World Bank, the Finnish International Development Agency, the Asian Development Bank, The Forest Trust, the World Wide Fund for Nature and the Lao Forest and Trade Platform, and the Australian Centre for International Agricultural Research (ACIAR).

This study examines the opportunities for research and development in relation to: (i) the possibilities for payments (and other incentives) for improved ES; and (ii) minimising the constraints and inefficiencies in the log value chains, thus improving returns to smallholders and wood processors. Some general themes for research relating to both policy and operations are suggested.

Introduction to forests and wood industries in Lao PDR and their regulatory framework

Mixed-age smallholder teak plantings, Xieng Ngeun, Luang Prabang province, Lao PDR (Photo: Stephen Midgley)

Contoured rubber plantations, Luang Namtha, northern Lao PDR (Photo: Stephen Midgley)

Management of forests, the environment and wood industries

Introduction

Lao PDR is one of the least developed countries in South-East Asia and has a total land area of 23.68 million hectares (ha), 79% of which is mountainous. It has considerable natural resources in its forests, water resources and minerals and these are significant for cultural development, environment protection and economies at the national, regional and village levels. The population is growing at 2.4% per annum and will increase from 6.2 million in 2010 to over 7 million in 2015 (DoF 2011). About 80% of the population are rurally based and about 85–90% of them are dependent upon subsistence farming. There are more than 10,000 villages in the country, many of which are not accessible by motorised vehicle (DoF 2010). Figure 1 shows the location of Laos in relation to the countries it adjoins.

Although Laos retains the highest proportion of forest and woodland in mainland South-East Asia, the records of the Department of Forestry (DoF) indicate that the total area of forest declined dramatically from 70% of the land area, or about 17 million ha, in 1940 to 11.6 million ha in 1982, and to only 40% (about 9.5 million ha) in 2010 (Table 1). Manivong and Sandewall (1992) estimated that between 1982 and 1989, forest cover declined from 49% of total land area to 47%. In contrast, the area of potential forest (less than 20% canopy cover, and areas classified as degraded forest) increased quite rapidly from about 8.5 million ha to about 11 million ha during the same period. The area of permanent agricultural land also increased, from about 700,000 ha in 1982 to about 1.2 million ha in 2002 (Phimmavong et al. 2009). While the reasons for the declining areas of forest differ across Laos, shifting cultivation and logging are blamed as the main causes of forest degradation in the country (Fujita and Phanvilay 2008).

All natural forests are owned by the national government, which plays a key role in their management. Trees in plantations are owned by a variety of domestic and foreign owners through direct investment by forest industry companies, farmers and private individuals. Reliance upon plantations as a source of wood will increase as population growth and economic development lead to increasing pressure on forests and forest land. The balance between demand for environmental services (ES) and demand for land and forest products will play a key role in the future production of forest services and it is increasingly likely that international mechanisms will support production of ES (FAO 2011).

The Forestry Strategy 2020 is the key document that underpins current Lao government policy for forests and forestry. Endorsed in 2005, this strategy guides the development of the forestry sector in line with the National Growth and Poverty Eradication Strategy and other national strategies and plans. Poverty reduction remains at the forefront of the strategy which has several targets including:

- improving the quality of forest resources by natural regeneration and tree planting for protection and livelihood support
- providing a sustainable flow of forest products for domestic consumption and household income generation
- preserving species and habitats
- conserving environmental values in relation to soil, water and climate.

Particular focal areas include: land-use planning, village-based natural resource management, sustainable harvesting, rationalisation of the wood-processing industry, tree planting, law enforcement and participation to prevent unauthorised activities, and protection of watersheds. Achieving and maintaining 70% forest cover has been a long-term goal that remains high on the Forestry Strategy 2020 agenda (Yasmi et al. 2010).

The Forestry Strategy 2020 is consistent with the Seventh National Socio-Economic Development

Figure 1. Map of Laos showing its neighbouring countries and key locations discussed in this report

Table 1. Land use in Lao PDR, 2010

Land-use type	Area (ha)
Current forest area	9,544,000 (40%)
Potential forest area (stocking <20% canopy—includes areas classified as degraded forests)	8,272,000 (35%)
Other land use (incl. agriculture, urban areas etc.)	5,864,000 (25%)

Source: DoF 2011

Plan (2011–2015) (NSEDP) and the Agricultural Master Plan 2011–2015. NSEDP provides the means to implement the Socio-Economic Development Strategy and transform the country into a modern and industrial society. It acknowledges the fundamental importance of agriculture and forestry and seeks to systematically develop all aspects of the sectors in line with industrialisation and modernisation priorities in areas that have favourable conditions; ensure food security; promote commodity production for domestic use and export; improve productivity; and enhance end-product quality. Specifically, for the forestry sector, it seeks to increase forest coverage to 65% of the total country's area by 2015, rehabilitate 3.9 million ha of deteriorated forest and reforest 200,000 ha. Additionally, it seeks to expand the certified production forest area by 10% by 2015 and to apply modern technology in production, especially improving the value-adding of products, and to be able to compete in the international market.

NSEDP highlights and develops the links between environmental protection, natural resource management and sustainable development and ensures that socioeconomic development is fully aligned with protection of the environment and sustainable development of water resources. It aims to mitigate the effects of climate change and establish clean development and carbon credit mechanisms to maximise the benefits for the country.

The importance of tourism is recognised through an aim to increase the annual inflow of tourists to about 2.8 million people, and develop natural,

cultural and historical tourist sites and attractions, and promote ecotourism, ensuring sustainability through people's participation (Ministry of Planning and Investment 2010).

The Agricultural Master Plan is based on the Agricultural Development Strategy 2011–2020. This strategy provides the framework, vision and long-term development goals of the government for the sustainable development of the sector, including forestry. A major goal is that sustainable forest management will preserve biodiversity and will lead to significant quantitative and qualitative improvements of the national forest cover, providing valuable ES and fair benefits to rural communities as well as public and private forest and processing enterprises (MAF 2010).

The Lao wood-products industry

While the agriculture and forestry sectors are guided by the Ministry of Agriculture and Forestry (MAF), responsibility for forest industries, including timber sales, was transferred from MAF to the Ministry of Industry and Commerce (MoIC) in 2008 following revisions of the Forestry Law and the Law on the Processing Industry, endorsed by the National Assembly in 2005 (Sayakoummane and Manivong 2008). The Forestry Law is currently under review to accommodate the new Ministry of Environment and Natural Resources and the emergence of markets for carbon. In the 1990s, wood and wood products accounted for 40% of export earnings and this figure dropped to 20% in 2002–2003 (Tong 2009). Barney et al. (2010) estimated that timber sales accounted for roughly 12% of overall government revenue in 2006 or about US$57 million (Puustjarvi 2007).

Exports

The bulk of exports is either unprocessed wood or basic sawn wood and planks, with minor quantities further processed into strip parquet flooring, furniture and various other secondary products. The export of high-value wood products such as furniture remains extremely low, at between 1.7% and 3.2% of the total value (Tong 2009).

While bilateral trade statistics are not published by the Government of Lao PDR (GoL), importing-country statistics indicate that Thailand, Vietnam and, to a lesser extent, China are the dominant markets for Lao timber products (Figure 2).

To date, Laos has not been able to extend wood processing up the value chain into value-added production, and logs and sawn timber still represent the vast majority of wood exports (Barney et al. 2010). Vietnam imports a mix of logs and sawn wood, Thailand mainly sawn wood and China mainly logs. The Lao wood-processing industry has difficulties competing against established, advanced secondary and tertiary manufacturing centres in Vietnam and China. Therefore, export of secondary or finished products from Laos is extremely limited despite log and sawn-wood export bans (Barney et al. 2010).

Figures provided by MoIC (Table 2) show that recent Lao exports of timber derived from plantations have been dominated by teak (*Tectona grandis*), with some recorded exports of jackfruit (*Artocarpus* spp.), a farm-grown tree which is a well-regarded furniture timber. A large proportion of the exports has been in the form of squared logs. Of interest has been the emergence of India as a purchaser of Lao teak. India constitutes about 75% of the global market for plantation teak (Midgley et al. 2007). Sugimoto (2009) estimated that about 7,000 cubic metres (m^3) of teak was harvested annually in Luang Prabang province, of which 95% was exported. Sawathvong (2010) suggests that the current annual teak harvest in Luang Prabang province is about 20,000 m^3. Both of these figures, based upon field studies, differ from the figures extracted from the records of MoIC, which appear to be underestimates. The figures confirm the view that there are good opportunities for the Lao wood industries to add greater value in Laos.

Problems faced by the industry

Ownership of wood-processing factories in Laos is dominated by the private sector. The industry has difficulty in complying with international sustainability standards (such as the Forest Stewardship Council (FSC) chain of custody (CoC) certification scheme) because of legality issues and lack of tracking systems and processes, and finds it challenging to compete against established facilities in neighbouring countries.

The divisions of roles and responsibilities between MAF and MoIC are unclear and often become confused in the field. For example, which of the two ministries has power to set operating standards and register wood-processing machinery? MAF (2010) acknowledges the need to cooperate closely with other agencies and aims to work with MoIC and the Lao National Chamber of Commerce and Industry (LNCCI) to draft operating standards for registering wood-processing machinery.

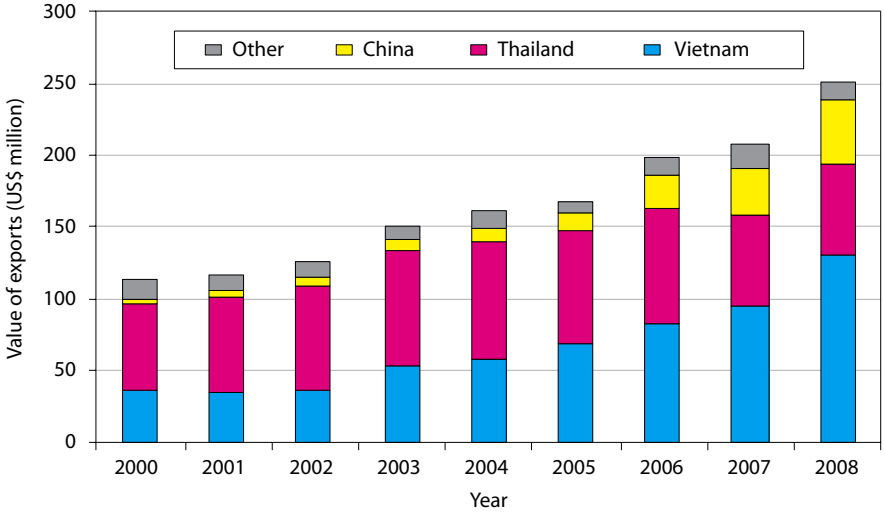

Figure 2. Lao timber product exports (all species), by country (Source: Barney et al. 2010)

Table 2. Summary of Lao plantation timber exports, October 2009 – December 2010

Species	Province (source)	Product type	Volume (m^3)	Export to
Teak	Luang Prabang	Logs	392	China
Teak	Luang Prabang	Logs	278	India
Teak	Luang Prabang	Sawn lumber	281	Thailand
Teak	Luang Prabang	Logs and sawn lumber	269	Thailand
Teak	Luang Prabang	Logs	102	Vietnam
Teak	Champassak	Logs	103	Thailand
Jackfruit	Champassak	Logs	257	Vietnam
Jackfruit	Xekong	Logs	95	Vietnam
Total			*1,777*	

Source: Department of Import and Export, Ministry of Industry and Commerce

MAF (2010) has recognised that there is an overcapacity in processing, and that modern processing equipment is unavailable for a number of reasons. R. Bruesseler (pers. comm.) also observed that at the macro-level the Lao sawmilling industry has a serious overcapacity and that there exists competition for natural forest resource and consequently companies are beginning to consider plantation wood more closely. This view was confirmed by Trockenbrodt (2010), who suggested that the combination of overcapacity and shortage of raw material is encouraging wood processors to look more closely at the planted-wood resource.

Foreign investment in wood processing has occurred, but has been constrained by unreliable access to timber, as GoL and provincial governments maintain discretionary powers over the allocation of annual quotas for wood from natural forests (Barney et al. 2010). Such constraints have the potential to influence both related investment and the availability of plantation-grown wood.

Actions taken to develop the sector

The wood industry is still at an early stage of development and consists mainly of a large number of small- and medium-size sawmills, plywood mills and other wood-processing or manufacturing installations (Sayakoummane and Manivong 2008). Officially, the government tries to strongly promote downstream processing and export of finished or semi-finished

wood products, including furniture, but reform has been slow, with only a few existing secondary wood–processing facilities undertaking improvements (Sayakoummane and Manivong 2008). The Australian Centre for International Agricultural Research (ACIAR) has recently concluded a 3-year project (FST/2005/100, 'Value adding to Lao PDR plantation timber products' (VALTIP), which has provided some initial research and capacity building to Lao training institutions and to a number of small–medium wood-processing and manufacturing enterprises.

The private sector has established two associations to support the wood-processing industries. First is the Lao Wood Processing Industry Association (LWPIA) which was established in 2006. Its members are primarily sawmillers who convert harvested logs (from both planted trees and natural forests) into squared logs, timber and lumber. Most have kiln-drying capacity and some have secondary-processing facilities. LWPIA aims to facilitate the allocation of government timber quotas to individual factories and is expected to play key roles in technology upgrading and skill improvement, marketing cooperation and promotion of exclusively legal logs among members. The association is also encouraging CoC certification in relation to the processing and export of certified wood. The President of LWPIA, Mr Thongsavanh Souliyamath, is Managing Director of the Lao Furniture Industry Company (a processor of furniture from planted teak)—one of two companies in Laos with CoC certification—and is a member of the World Wide Fund for Nature/The Forest Trust (WWF/TFT) Lao Forest and Trade Platform.

Second, the Lao Furniture Industry Association (LFIA) was formed in 2003 and now has a membership of 150 factories representing 40% of the industry, having grown from a membership of 45 companies in 2007 (*Vientiane Times*, 2 October 2007). Almost all association members are located in Vientiane and some have additional facilities in other provinces. Members are not involved in log harvest from natural forests and buy logs, squared logs and sawn timber from members of LWPIA. However, for wood from planted trees, they make direct purchases from growers and arrange harvest or purchase logs and squared logs from traders of plantation timber. LFIA has recently announced plans to establish a 'wood bank' to ensure supply of raw material to furniture makers (*Vientiane Times*, 7 June 2011). The Chairman, Mr Khamphay Somsana (President, Khamphay Sana Group), is a leader in the construction industry and is keen to use his successful business skills and contacts to develop the Lao furniture sector. In an industry-led initiative to overcome the serious issues associated with the lack of trained and skilled staff, LFIA has established a Competency Centre at a facility provided by Mr Yothin Vesaphong, former LFIA President, who is Director of the Centre.

According to the Deputy Chairman of LFIA (*Vientiane Times*, 7 June 2011), there are plans to merge LFIA with LWPIA. This is a reflection of the similar objectives and shared challenges of the two organisations.

MoIC data show that there has been an increase in furniture production and a reduction in sawn wood production. Tong (2009) reports a general perception of wood processing in Laos of operations that are inefficient, have low recovery rates and generate low-value products. Issues that obstruct progress to higher value wood processing and exports are the decreasing supply of raw materials, limited access to finance, poorly skilled workers and lack of technology.

The government has launched a reform plan for the wood industry that aims at either closing or merging factories to promote efficiency and also seeks to promote final product processing and export.

Institutional framework

There is a great complexity in the institutional framework relating to the management and monitoring of natural resources and the environment in Laos, together with associated information and research and development (R&D) support. At least 18 agencies with some involvement were identified in the course of this study. It is therefore difficult for the national agencies themselves, and international organisations, to assign responsibilities for: (i) establishing, managing, monitoring and utilising plantations and natural forests; and (ii) all aspects of payments for environmental services (PES). It is also important to respect the roles of the provincial administrative authorities that exercise broad discretion within the policy guidelines provided by national legislation, decrees and regulations.

Ministry of Agriculture and Forestry

MAF is the main government agency responsible for the management of natural resources associated with forests and agricultural land, including forestry and forest conservation, and protected areas. MAF is the main agency responsible for the sustainable development and management of the plantation sector, and is mandated to formulate/develop and implement relevant policies, laws and regulations related to forestry. The ministry participates actively in processing and approving both national and foreign investment projects, including tree plantation projects in cooperation with the Ministry of Planning and Investment (MPI), the National Land Management Authority (NLMA) and other agencies.

Department of Forestry

DoF is an agency within MAF. It provides services related to forest management, protection and development to ensure an effective and sustainable use of forest resources throughout the country. The main duties of DoF are to:

- implement policies on forestry activities outlined by the Resolutions of the Party Congresses into comprehensive strategies, detailed master plans, programs and projects
- formulate and develop forestry law, laws on the aquatic life and wildlife, and other legal acts related to forestry into decrees, decisions, orders, procedures and technical instructions
- research and recommend policies, methods and measures on tree planting, forest regeneration, management, protection and use of forestry resources
- monitor, supervise and evaluate the implementation of master plans, programs and projects
- inspect, monitor and evaluate the output from the implementation of laws promulgated by the National Assembly, and decrees, decisions, orders and regulations issued by the government on the management, protection, use and sustainable development of forest resources.

Department of Forest Inspection

In January 2008, revisions to the Forestry Law of Laos adopted by the National Assembly led to the establishment of a new Department of Forest Inspection (DoFI). DoFI is the primary government response to problems and complaints associated with illegal logging, land encroachment, smuggling of timber and wildlife, and forest-related corruption. The Director General reports directly to the Minister responsible for forest inspection, forestland and investigations, and the department exercises independence over forest inspections and investigations. Provincial Offices of Forest Inspection were established in all 17 provinces and staffed with 277 personnel that were transferred from DoF.

DoFI's budget is currently financed through the government Forestry and Forest Resources Development Fund and a Japan International Cooperation Agency (JICA) Policy and Human Resource Development grant. Future funding will come through revenue-sharing allocations from the

Nam Theun 2 Power Company (NTPC) and forest development initiatives that are currently at various stages of planning.

DoFI's mandate was defined in MAF Decision No. 0340/MAF, dated 5 March 2008. In that decision, DoFI became a direct secretariat to the Minister on forest inspection, forestland and investigations against offenders of the Forestry Law and the Aquatic and Wildlife Law. The Director General of DoFI was given the responsibility for the 11 articles stipulated in the MAF decision.

Prime Minister's Office

The Prime Minister's Office (PMO) is a state organisation that serves as staff support for, and as a close aid to, the Prime Minister, coordinating and studying various issues related to the collective administration and state management of the country. The responsibilities of PMO are wide and important and include:

- monitoring the progress of operation of the mechanism of the government, ministries, sectors and local administrative authorities and providing information and data necessary for the finalisation of the policies and issues of the government
- executing orders, instructions and resolutions of government meetings and helping the Prime Minister to prepare action plans and projects
- coordinating with various agencies of the government and local administration
- preparing documents and reports for the Prime Minister and participating in meetings of the Cabinet for reporting
- editing the Prime Minister's reports to be presented to the Party Central Committee, Politburo and National Assembly
- enforcing regulations on document management and managing the conservation work of the National Archives
- carrying out cartographic surveys and measurement and aerial photography through the Department of National Geography in support of strategic plans of socioeconomic development, national defence and security, and scientific and technical research
- studying draft state policies on personnel administration and management
- studying policies, rules and measurements on tourism and the tourism industry and managing and supervising the activities of the Lao National Tourism Administration
- studying and managing scientific, technological and environmental development
- formulating policies on mass sports activities and planning, guiding, managing and supervising these activities
- making contact with offices of prime ministers of fraternal and friendly countries for the benefit of cooperation and exchange of experience according to the agreement of the government, convening meetings of sectors and local authorities to discuss and recommend issues deemed necessary
- creating working and living conditions in economic and social aspects which are favourable in both the domestic and foreign situation for the Prime Minister
- supervising political and ideological affairs, party building, personnel training and national security, improving work and modifying the working methods of the Prime Minister
- monitoring, summarising and submitting to the cabinet the advantages and disadvantages of the process of implementing laws, policies, plans, regulations and rules, as well as the operation of central and local services.

A number of organisations within PMO have an interest in natural resource management and provision of ES.

Water Resources and Environment Administration

The Water Resources and Environment Administration (WREA) is attached to PMO and has a mandate to ensure environmental protection and sustainable development. It is responsible for conducting, approving and monitoring environmental impact assessments (EIAs) and issuing environmental certificates. Within WREA, there are several departments including the Environment Department, the Water Resources and Environment Institute, the Lao National Mekong Committee and the Department of Meteorology and Hydrology. WREA has responsibility for the Lao commitment to the Convention on Biological Diversity and to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). It was scheduled to gain the same status as a ministry in late 2011 (see 'Postscript' below). WREA also maintains a 'coordination network' at the provincial level and with key ministries such as MAF and MoIC, and it plays an important part in the investment approval process because each investment project must pass

an EIA process and obtain an environmental certificate under Lao law.

National Land Management Authority

NLMA, also within PMO, was established in 2006 and has the same status as a ministry although it is attached to PMO. The authority is mandated to draft laws and regulations on land management and, in cooperation with other relevant agencies, to investigate, register and develop land-use management plans and strategies. NLMA also cooperates with other agencies to consider and issue land-use certificates, and is obligated to monitor, control and evaluate land use within the country. NLMA has a network of offices at the provincial and district levels but, due to limitations of human and technical resources, other relevant agencies (such as MAF) sometimes play a lead operational role in land survey which is the first step towards land concessions and titles.

Science and Technology Authority

The Science and Technology Authority, also within PMO, is responsible for the certification and protection of intellectual property related to cultural rights and traditional knowledge.

National Environment Committee

The National Environment Committee operates within PMO and is chaired by the Deputy Prime Minister. It coordinates and advises the government on environmental management, strategies, regulations and plans. It is a multisector committee and its membership is made up of members at vice-minister level and other senior government staff.

Ministry of Industry and Commerce

MoIC is responsible for facilitating trade and the movement of commodities in and out of Laos. MoIC has responsibility for the forest industries, including timber sales, policies for and licensing of wood-processing industries, and working with wood processors to foster domestic and export markets. Within the ministry, the Department of Import and Export maintains export and import data. This responsibility was transferred from MAF in 2008 following revisions of the Forestry Law and the Law on the Processing Industry, endorsed by the National Assembly in 2005 (Sayakoummane and Manivong 2008).

Economic Research Institute for Trade

The Economic Research Institute for Trade (ERIT) within MoIC was established in 1999 and is a key department with a mission to provide research and policy advice and act as an advisory body for the ministry. ERIT supports MoIC with advice on issues relating to World Trade Organization accession, the Association of Southeast Asian Nations (ASEAN) Free Trade Agreement implementation, trade policy and enterprise law, and conducts research on trade-related economic issues relevant to Laos.

Ministry of Planning and Investment

MPI is the lead agency for the promotion of investment and is responsible for coordinating the investment approval process. It is a key government institution in the development of plantations in Laos at both the national and provincial levels where capital is sourced from foreign direct investment. After an investment proposal has been submitted to MPI, the ministry will distribute it to all concerned agencies. MPI organises monthly meetings to discuss investment projects, at which other relevant government agencies can make comments. The ministry has some responsibility for planning investments in the plantation and other sectors. Since 2004, for example, MPI has been drafting a socioeconomic development plan for northern Laos, in cooperation with Chinese experts and with financial support from the Government of China. MPI also has budget allocation functions (along with the Ministry of Finance, MoF). While MoF determines the overall budget amount, MPI allocates it to certain projects and activities (Hicks et al. 2009).

National Economic Research Institute

The National Economic Research Institute (NERI) within MPI was established in 1997 as a strategic research institute under the supervision of the Committee for Planning and Investment, now MPI. NERI's major roles are to assist MPI to monitor macro-economic indicators, formulate long-term national, regional, provincial and sectoral policies; conduct research on a wide range of issues, including development policies and economic management mechanisms; provide economic data and information; train planning and statistics officials in economic management; and cooperate with local and foreign economic research institutes.

Provincial Administrative Authorities

Provincial Administrative Authorities have a high level of responsibility and discretion within broad national policy guidelines to pursue provincial, budgetary and socioeconomic development strategies. They play an important role in consideration and approval of large investment and development agreements and maintain working relationships with adjacent provinces in neighbouring countries within the national framework of diplomatic relations. For example, southern provinces such as Xekong and Attapeu have recently developed increasingly close economic relations with Vietnam for investment in rubber plantations (Barney and Canby 2011).

District Administrative Authorities

District Administrative Authorities have responsibility for the day-to-day implementation of the district socioeconomic development programs. The District Agriculture and Forestry Offices register smallholder plantations and issue plantation certificates, which are the foundation for legal ownership and management for smallholders and other growers.

Research and teaching institutions

The National Agriculture and Forestry Research Institute (NAFRI) is a technical department within MAF and was established in 1999 in order to consolidate agriculture and forestry research activities within the country and develop a coordinated National Agriculture and Forestry Research System. The mandate of the institute is to carry out technical research activities on agriculture, forestry, meteorology and hydrology in order to provide all related information, technologies and results/findings to agriculture and forestry development planning based upon the government's policies and guidelines.

The Forestry Research Centre (FRC) and the National Agriculture and Forestry Research Centre (NAFReC) are both centres within NAFRI. FRC maintains programs related to silviculture (including rehabilitation of degraded lands and agroforestry), non-timber forest products (NTFPs) and tree seed and tree improvement research. NAFReC is located at Ban Huaykot, 30 kilometres (km) south of Luang Prabang, and was established in 2004 as the first regional research centre established by NAFRI in its strategy to develop decentralised, multidisciplinary research. Its roles include conducting studies and technical research on agriculture and forestry production technologies that have high productivity and to ensure sustainability to meet the needs of the north.

National University of Laos

The National University of Laos (NUoL) is the leading university in Laos. Founded in 1996, it now has 12 faculties, including the Faculty of Forestry and its Centre for Natural Resources Management and Climate Change. The Faculty of Economic and Business Management maintains an interest in natural resource economics. The university houses the Centre for Environment and Development Studies, which conducts research and supports studies towards a Bachelor of Environmental Sciences and Management. The main objective of the centre is to educate graduates on the development pressures that are inherent in the sustainable management of Lao natural resources.

Souphanouvong University

Souphanouvong University, based in Luang Prabang, is one of the newest universities in Laos and has four faculties—education, agriculture and forest resources, economics and tourism, and engineering. The university's focus is on the eight provinces of northern Laos. The Department of Forest Resource Management commenced in 2006, and has an enrolment of about 80 students per year. The department has good contacts with those involved in the management and growing of teak and NTFPs and has been granted control of 2,000 ha of land by the local authority on the western side of the Mekong River.

Mekong River Commission (regional institution)

The Mekong River Commission (MRC) was formed in 1995 following agreement between the governments of the Lower Mekong River Basin (Cambodia, Laos, Thailand and Vietnam) and aims towards joint management of the shared water resources and development of the economic potential of the river. MRC was built on the United Nations–founded Mekong

Committee established in 1957. In 1996, China and Myanmar became Dialogue Partners of MRC. The commission promotes the coordinated development and management of water and related resources, in order to maximise economic and social welfare in a balanced way without compromising the sustainability of vital ecosystems. Over 100 different ethnic groups live within the Mekong's boundaries, making it one of the most culturally diverse regions of the world. The Lower Mekong River Basin is home to about 60 million people, most of whom are rural farmers and fishers; more than one-third live on less than a few dollars per day.

Postscript

In June 2011, the National Assembly approved structural changes to GoL which included the creation of a new Ministry of Natural Resources and Environment. The new ministry will assume the responsibilities of the former WREA and include the activities of NLMA. At the time of writing, the division of responsibilities between the new ministry and MAF was unclear.

Payments for environmental services

Phu Kham gold and copper mine (Photo: Stephen Midgley)

What are environmental services?

Forests provide a great many environmental services (ES) upon which much of life depends—food, fuel, building materials and fresh water; climate regulation; flood control; nutrient and waste management; maintenance of biodiversity; and cultural services. Of these, four in particular (biodiversity, maintenance of soil and water quality in watersheds, climate regulation and carbon, and landscape beauty—the basis for ecotourism (Chaudhury 2009; Lasco and Villamor 2009) receive significant support and interest from most of the agencies listed in the previous section, recognising that the forests are important for supplying clean water, supporting conservation, preserving biodiversity and acting as buffers for natural disasters (Tong 2009).

Biodiversity

Biodiversity (or biological resources that comprise ecosystems, such as genes, populations, species and communities) is fundamental for the functioning of ecosystems. Biodiversity helps in nutrient and water cycling, soil formation and retention, and the production of food, fibre and medicines. It also provides regulating services, such as pollination, pest and disease control, and seed dispersal (Chaudhury 2009). Biodiversity contributes directly to poverty reduction in at least five key areas: food security, health improvements, income generation, reduced vulnerability, and ecosystem services. Conservation provides a strong source of support to the development and poverty reduction targets that are outlined in the Millennium Development Goals (MDGs) concerned with hunger, education, gender, child mortality, maternal health and disease. At the same time, the degradation of biodiversity and natural ecosystems poses a significant barrier to the achievement of the MDG targets.

In its report to the Convention on Biological Diversity, the Water Resources and Environment Administration (WREA 2010) noted that the high international conservation significance of forests and other habitats in Lao PDR has been explored through eco-regional analysis. Eco-regions are contiguous habitats or ecosystems recognised by the World Wide Fund for Nature (WWF) as areas of highest significance in the world for biodiversity conservation. There are five large eco-regions in Indochina, four of which are in Laos: Annamite Range Moist Forests; Indochina Dry Forests; Northern Indochina Sub-tropical Moist Forests; and the Mekong River and its catchment.

Emerton (2009) observed that Laos is one of the most forested countries in Asia, and ranks as one of the richest in biodiversity in the region. There are an estimated 8,000–11,000 flowering plants and more than 700 species of birds in Laos (Stenhouse and Bojö 2011). About 40% of Lao land area, or 9.5 million ha, is under forest. Fish diversity and endemism are considered to be very high in the rivers, water bodies and other natural and constructed wetlands that are estimated to cover just under 945,000 ha or 4% of Laos. With the exception of a small number of introduced fish used for aquaculture, almost all of the fish caught in Laos are indigenous species (Emerton 2005). As part of a concerted effort to conserve its wealth of biodiversity, the Lao Government created a high-quality network of 21 National Protected Areas (NPAs) which currently cover more than 29,000 km^2, 14% of the total land area. As observed by the Food and Agriculture Organization of the United Nations (FAO 2011), protected areas are the main hope for biodiversity conservation.

Laos also has important agrobiodiversity. Local farmers use indigenous crop and livestock varieties and their genetic diversity, and these play an important role in agricultural production. Laos lies within the primary centre of origin and domestication of Asian rice, *Oryza sativa*, and more than 13,000 samples of rice have been collected in the country, including wild species and spontaneous interspecific hybrids between wild and cultivated rice. Most livestock originate from stock domesticated within Laos or in nearby China and Vietnam, and can be considered to be of indigenous or traditional breeds (Emerton 2009).

Some 80% of the Lao people live in rural areas and are economically dependent on biological resources that underpin the livelihoods of most households that rely upon harvesting wild plant and animal products for their day-to-day subsistence and income.

Despite the conservation significance of Laos' wild species and ecosystems, and the high economic reliance on them, biodiversity loss is a major problem. In addition to the loss of forest areas, Emerton (2009) observed that overfishing is rapidly depleting aquatic biodiversity, at the same time as wetlands and water bodies are being degraded due to upstream water diversion and on-site land reclamation. The proportion of rice production in Laos made up of indigenous varieties has been decreasing over time, as improved cultivars and introduced varieties have become more common and have been promoted by government agricultural extension agencies and donor projects. In 1993, it was estimated that less than 10% of the rainfed lowland area was grown to improved varieties. By 2000, more than 70% of the area in some provinces along the Mekong River valley was planted with improved varieties, and all of the dry-season irrigated rice was composed of introduced or improved varieties—today only upland fields are planted wholly with traditional varieties (Emerton 2009). An analysis by Emerton (2005) estimated that direct use of biodiversity in Laos, at household and commercial levels, is worth some US$650 million annually.

Although Laos has had no extinctions in the past 7 years, the International Union for Conservation of Nature (IUCN) Red List for animals suggests it has 12 critically endangered, 33 endangered and 59 vulnerable species, making 104 animal species with high-risk of potential loss. In addition, Laos has 48 near-threatened species that are dependent on conservation, an additional 50 species are data deficient and 867 species of least concern. The IUCN Red List for plants suggests Laos has 5 critically endangered, 7 endangered and 7 vulnerable species, making 19 plant species at high-risk of potential loss (Clarke 2010).

In their World Bank study, Stenhouse and Bojö (2011) found that the Government of Lao PDR (GoL) regards the protection of biodiversity, primarily from the perspective of poverty alleviation, their prime development policy driver. The National Biodiversity Strategy to 2020 and Action Plan to 2010 (GoL 2004) include as main goals to 'maintain the diverse biodiversity as one key to poverty alleviation and protect the current asset base of the poor'. They provide an overview of the rich biodiversity of Laos and note that all sectors will have to share the costs and benefits of conserving biodiversity, and that the implementation of protected areas will incur some opportunity costs.

Maintenance of soil and water quality in watersheds

Laos plays an important custodial role in the management of the Mekong River's waters, providing about 35% of the water flows to the river (Phomsoupha 2010). Water issues are under constant scrutiny via investment in hydro-power schemes and through Lao membership of the Mekong River Commission (MRC). With its abundant water supplies and mountainous topography, Laos has the potential to provide plentiful cheap hydro-electricity to surrounding countries and is perceived as 'the battery of Asia'. GoL has identified 60 large potential hydro-power dam projects, of which almost 20 are either completed or under construction. The long-term success of these projects depends on having well-managed catchments to provide a steady flow of sediment-free water.

Tong (2009) observed that water is particularly important for irrigation and hydro-power in Laos. Developing a competitive irrigation system is a major government objective to guarantee subsistence rice production and food security for rural households. In recent years, public investment in the irrigation sector has constituted 40–50% of total public investment in the agriculture and forestry sectors. Potential protection forests for 51 watershed areas along the main Mekong tributaries and 25 existing and proposed hydro-power dams have been preliminarily identified on maps.

Water supply is closely linked to forest area. The network of NPAs plays an important role in sustained supply of high-quality water because they tend to be forested and are located mainly in upper catchments. The importance of NPAs in water resource management is acknowledged, and improved protection of upland catchments is a prominent feature of government policy. Other good reasons for effective management and catchment protection include biodiversity conservation and border security (ICEM 2003). Corbett (2008) found that external commercial interests that illegally extract natural resources from NPAs threaten biodiversity resources. A recent development in response to existing pressures is the establishment of management plans for the country's NPAs through the use of the Forestry and Forest Resources Development Fund (FRDF), created in 2005 to mobilise financial resources to support and

strengthen forest management, environmental protection and sustainable development of forest resources (and explained in greater detail later in this report).

The government is committed to water resource management at the policy and strategic level and has enacted the Water Resources Law and approved the 1998 Water Sector Strategy and Action Plan. Water resource management is divided into national and river basin level management. At the national level, a national water resources plan will be prepared, followed by river basin level plans. The government is undertaking the first water basin management approach in the Nam Ngum catchment, where mechanisms incorporating river basin planning into provincial and national planning processes have been designed and introduced (Anon. 2007; Boualapha 2011).

Climate regulation and carbon

Reducing Emissions from Deforestation and Forest Degradation (REDD) is an initiative to create a financial value for the carbon stored in forests through offering incentives for developing countries to reduce emissions from deforested lands by investment in low-carbon paths to sustainable development. 'REDD+' goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.

GoL treats carbon issues seriously, and responsibility for forest carbon issues lies with the Ministry of Agriculture and Forestry (MAF). In January 2011, the Minister of Agriculture and Forestry announced the establishment of a task force (committee) for the implementation of REDD activities. This committee comprises 20 senior people at Director General and Deputy Director General levels from relevant ministries and departments within GoL[1], social organisations and the National University of Laos (NUoL). For other climate and carbon issues, WREA has been assigned the task of coordinating and implementing the United Nations Framework Convention on Climate Change (UNFCCC) and is the Designated National Authority for the UNFCCC's Clean Development Mechanism (Tong 2009).

The Department of Forestry (DoF) (S. Sawathvong, pers comm.) estimates that land clearing, logging and forestry degradation account for 70% of carbon emissions in Laos. DoF (2010) has identified as major issues: carbon ownership in relation to land tenure; benefit-sharing arrangements; law enforcement and related governance issues, especially dealing with awarding of licences and concessions; and the establishment of credible baselines and benchmark emission levels for carbon. A lack of capacity at national and provincial levels to undertake the comprehensive social, economic and environmental appraisals that form the legal basis for concessions was also identified as a constraint.

Assignment of potential benefits from REDD+ is complicated by the wide range of forest resource tenure rights, including state property; communal rights and private rights assigned to individuals, corporate bodies and non-profit organisations; and open access. As a result, several different stakeholders may have rights and interests, and consequently entitlements, to REDD+ benefits. The entitlement of ethnic groups and local communities to REDD+ benefits presents a particular problem because they typically do not hold registered title and enforceable rights over the land they manage (DoF 2010).

Laos is among eight countries[2] approved by the Forest Investment Program (FIP) to develop pilot proposals and investment strategies. FIP is a targeted program of the Strategic Climate Fund—one of two funds within the framework of the Climate Investment Funds hosted by the World Bank, which acts as trustee and administrator. FIP supports developing countries' efforts to reduce deforestation and forest degradation and promotes sustainable forest management that leads to emission reductions and the protection of carbon reservoirs. It achieves this by providing scaled-up financing to developing countries for readiness reforms and public and private investments, identified through national REDD readiness or equivalent strategies.

[1] Ministry of Agriculture and Forestry, Ministry of Energy and Mines, Ministry of Planning and Investment, Ministry of Finance, Ministry of Justice, Division of External Finance, Department of Environment, Department of Electricity, Department of Forestry, Department of Forest Inspection, Department of Law, Department of Mining, Department of Planning, Forest Resource Management Department, Lao Chamber of Commerce, Land Planning and Development Department, Lao Front for National Construction, Lao Women's Union, National Agriculture and Forest Research Institute, National Land Management Authority, National University of Laos, Water Resources and Environmental Agency.

[2] Other countries are Brazil, Burkina Faso, Democratic Republic of the Congo, Ghana, Indonesia, Mexico and Peru.

A dialogue involving GoL and the relevant multi-donor banks (World Bank, Asian Development Bank (ADB) and International Finance Corporation (IFC)) is now preparing a FIP investment strategy for Laos which will identify initiatives with carbon-positive outcomes. Notionally, Laos has been allocated an indicative US$30 million via FIP with the prospect of competitive access to a reserve fund of some US$150 million.

Landscape beauty as the basis for ecotourism

GoL has sought to supply and maintain landscape beauty services through the creation of its NPA network and the protection of natural and cultural heritage sites. Although there are no global estimates of the value of providing ES supporting landscape beauty and recreation, the Ecosystem Marketplace estimates that US$1 billion is spent annually on ecologically responsible tourism (Lasco and Villamor 2009). Although the market for landscape beauty services is relatively immature, it is reflected in the demand for ecotourism. International tourist arrivals to Laos increased sixfold between 1995 and 2007. In 2010, Laos welcomed 2.5 million foreign tourists, an increase of 25% over 2009 (PATA 2011), offering revenues in excess of US$290 million and making it the second-largest contributor to gross domestic product (GDP) after mining (Khanal and Babar 2007). Since 2002, ecotourism has become an important part of this economic activity in Laos. Khanal and Babar (2007) estimated that more than half of Lao tourism earnings were derived from ecotourism, a reflection of the strong competitive advantage conferred by the country's natural environment and peaceful culture. Ecotourism provides financial benefits to local stakeholders and a broad range of livelihood options on forest lands. Expectations resulting from ecotourism in NPAs include conservation advocacy; wildlife threat and resource-use monitoring; a deterrent to illegal activities; conservation education and awareness raising; and potential long-term changes in resource-use patterns with links to ecotourism income generation (Schipani and Marris 2002).

GoL expects tourism to remain a substantial contributor to its economic growth, and has made tourism development initiatives, with the focus on ecotourism, one of 11 priority sectors to help improve standards of living. Ecotourism is considered by GoL as a means of generating income for the local people and raising awareness on environmental conservation, encouraging local production and protecting multi-ethnic culture and traditions. The country has two cultural World Heritage sites endorsed by the United Nations Educational, Scientific and Cultural Organization (UNESCO), 15 national cultural and natural heritage sites and a network of 21 NPAs. Additionally, the country is positioning itself to be a land link and crossroad of commerce, economic cooperation and tourism in the subregion (Khanal and Babar 2007).

What are 'payments for environmental services'?

Background

The Food and Agriculture Organization of the United Nations (FAO 2011) reported that undervaluation of the ES provided by forests due to the limited ability of market and institutional systems to manage non-commodity values is a threat to the maintenance of forest stands in South-East Asia. Services such as conservation, amelioration of the impacts of climate change, and protection of land and water resources are provided by all forests to a lesser or greater extent. Markets for these services are limited because property rights for them are complex and costly to form. Furthermore, institutional jurisdictions designed to control and manage them, both at the national and international level, are often fragmented due to the broad array of goods and services produced by any one area of forest. However, increasing awareness of the importance of these environmental service functions of forests, and of the diminishing extent of forest resources able to provide them, is now influencing forest management in Laos.

Recently, payments and rewards for the provision of ES have gained popularity as a way to promote and maintain production of non-commodity benefits from forests and other natural resources. The reported experience suggests that the implementation of schemes for payments for ES (PES) will successfully provide ES benefits only under specific conditions, which are discussed in this report. Other mechanisms supporting non-commodity utilisation of forests, including state control and community ownership, and benefit sharing, are likely to be further refined in the future as demands on forests switch increasingly from products to services. The institutional mechanisms best suited to stimulating and maintaining ES from forests have yet to be identified. However, the following options have been tried and/or are being considered in Laos: Environmental Protection Fund, Forestry and Forest Resources Development Fund, Watershed Management Protection Authority (via the Nam Theun 2 Power Company, NTPC), contracts with non-government organisations (NGOs), REDD+ payments, and agreements between ecotourism groups and communities.

The purpose of PES and benefit-sharing schemes

The purpose of these schemes is to design, initiate and implement mechanisms that will ensure the provision of ES while simultaneously providing tangible monetary benefits and intangible social benefits to rural smallholders, their communities and the nation. A successful system will need to satisfy various conditions outlined in this report, each of which will affect the establishment and operation of effective and sustainable incentive mechanisms for the provision of ES in Laos.

Many specific ES were identified in the Millennium Ecosystem Assessment (Hassan et al. 2005). They include:

- production of food (crops, livestock, capture fisheries, aquaculture, wild foods)
- production of fibre (wood, other plant products, animal fibres)
- conservation of genetic resources
- production and regulation of reliable supplies of fresh water of guaranteed quality
- regulation of air quality
- regulation of climate
- regulation of soil erosion
- regulation of disease
- regulation of pests
- provision of pollination services
- reduction of natural hazards
- disposal of wastes
- provision of cultural services.

Most relevant agencies in Laos agree that the three ES that are receiving the most money and interest worldwide and in Laos are:

- climate-change regulation (including carbon sequestration)
- watershed services (including maintenance of soil quality and mitigation of sediment production)
- biodiversity conservation, especially in natural forests.

Improvements in these three ES will make significant contributions to mitigating the major environmental problems in Laos, which include:

- uncertainty about the probable impacts of climate-change and methods to minimise these impacts
- maintenance and improvement of land productivity for village and national livelihoods
- declining area and quality of natural forests
- unreliable water quantity and quality from watersheds, and soil erosion and sediment production
- declining biodiversity, especially in natural forests.

It is understood that all relevant national and international agencies involved with Laos have agreed that PES primarily relate to ES rather than to a more restricted, biologically based, definition of 'ecosystem' or 'ecological functions'.

The reasons for introducing PES (and similar) schemes are varied and might include all or some of the following:

- reward villagers for 'doing the right thing in land management' for biodiversity improvement
- maintain water quantity, reliability and quality (chemical and sediment) in dams, streams and rivers
- reduce soil erosion in uplands and lowlands to improve water quality, sediment loads and soil fertility
- increase forest cover by stimulating natural forest management, commercial plantations, farm forestry, community forestry and regenerating forest on degraded land
- improve agricultural productivity, village livelihoods and carbon sequestration
- increase any form of plant cover (grasses, shrubs, trees, tree crops, agricultural crops) for the same reasons
- improve village livelihoods to improve social equity across the nation
- maintain and improve biodiversity, mainly in the natural forests
- maintain viable, varied and sustainable native fish stocks
- other desirable outcomes.

Definitions and concepts

The international decline in supply of ES—ranging from the protection of species from extinction through to the maintenance of water supply quality—has been a cause for concern for a number of decades. This concern has been expressed in both developing- and developed-country contexts. It has also been the cause of frustration, given that there would appear to be ample demand for these services (and hence the concern for their loss) as well as plenty of potential suppliers. The problem has been that the demand for ES has not been able to 'connect' with those who are capable of supplying the services demanded. These frustrations have been most apparent in developing-country contexts because the source of demand for services such as biodiversity protection has largely been in developed countries and outside the domain of domestic political control.

Market issues

In the case of ES, the usual market processes that allow buyers to engage with potential sellers have not been able to emerge, or they have emerged in a weak form that has not been able to allow satisfaction of the demands for services. However, market processes have, on the other hand, become well established to link buyers with sellers of goods and services who, in their production activities, bring about the decline in ES. Put simply, in the process of market competition for natural resources, the extractive, profit-driven uses where demand is apparent and financially rewarding to suppliers has trumped environmental service provision where demand is not apparent to suppliers and hence is not financially rewarding.

This is despite the prospect of resource extraction making society worse off: the ES provided by a resource may generate more social wellbeing than the alternative extractive use. However, the inability of the demand for ES to provide a competitive financial rate of return to those controlling the resource has meant that inefficient (from a societal perspective) resource use choices have prevailed.

It is instructive to contemplate the reasons why ES demand has not been 'visible' and hence competitive against extractive use demand for those making natural resource use choices. The existence of relatively high 'transaction costs' when ES are being exchanged plays a big role.

Transaction costs and property rights

Transaction costs are the expenses that buyers and sellers face in organising and carrying out the process of exchanging resources. If these costs are greater than either party can expect to enjoy as benefits from an exchange, then the transaction will not take place. So if the transaction costs associated with arranging an exchange of resources to provide ES are relatively high, that exchange will not be entered into. Rather, a relatively low-cost exchange for extractive purposes will be executed. The resource will thus be used for extractive purposes instead of to provide ES.

Societies and individuals have developed numerous strategies to lower transaction costs so that exchanges will be more frequent and the gains from those exchanges will be more rewarding. One key strategy has been the development of systems of property rights that are both well defined and also well defended against transgression. With the greater certainty afforded by property rights, exchanges in markets have proliferated to the benefit of both buyers and sellers.

However, property rights are not always easy (low cost) to define and defend. Goods and services which have 'public good' characteristics fall into this case: those who do not pay for the provision of public goods cannot be excluded from their use. Hence, the concept of a private property right when used in the context of such public goods becomes problematic. Many ES have these characteristics. Hence, the transaction costs facing buyers and sellers of these services are generally large enough to prevent exchanges occurring.

In particular, potential buyers of ES have the incentive to 'free-ride'. Once an environmental service is provided, the benefits it supplies are available to all—even those who do not pay for provision. Hence, beneficiaries can enjoy the good without paying, so long as others do pay. They will thus hold back from paying in the hope that others will. Because all beneficiaries have this incentive, the prospect is that all will hold off paying and hence no supply will be made available. This incentive is especially strong when there are large numbers of potential beneficiaries who are scattered geographically, as is the case with ES.

To rectify this failure of 'decentralised' activity to ensure socially desirable levels of ES supply, different forms of 'collective action' alternatives have been developed. For example, governments step in to become 'producers' of ES with demand being 'mobilised' through the collection of taxes. Around the world, governments own and operate estates of national parks to provide ES. NGOs also act to coordinate voluntary donations from the public to fund private supplies. These NGOs try to lower the transaction costs of individual buyers of ES by acting as 'middlemen' to ensure supply. Hence, for example, the Nature Conservancy finances purchases of environmentally targeted property from donations.

Conceptualising 'payments for environmental services'

The literature reveals a range of definitional approaches to PES. The first approach stresses the trade or exchange aspect of PES and implies that the transaction costs involved in the exchange process have been reduced to the extent that voluntary exchange is advantageous to both buyers and sellers. For example, Wunder (2005) defines PES as 'a voluntary transaction where a well-defined ES (or a land use likely to secure that service) is being "bought" by a (minimum one) ES buyer from a (minimum one) ES provider, if and only if the ES provider secures ES provision (conditionality)'.

The emphasis of PES is therefore away from collective action being based on government 'command and control' style policies. Rather, PES schemes attempt to simulate market processes of supply and demand: the decentralised, voluntary processes of markets are used in the context of collective actions designed to promote ES provision.

However, the approach taken by Wunder (2005) has been seen by some writers as excessively restrictive because it implies that such schemes are completely voluntary on the parts of both buyers and sellers. It therefore ignores the prospects of governments forcing the mobilisation of demand through general taxation and using the funds so secured to purchase ES from voluntary suppliers (rather than becoming owner-managers of environmental assets as governments do when they purchase land for national parks).

The Wunder definition therefore neglects the significance of transaction costs and the free-rider problem in the provision of ES. It also neglects to some degree the importance of 'collective action' in its variety of forms, in the linking of demand for and supply of ES—if voluntary agreements were able to ensure supply, there would be no rationale for the development of public policy for collective action to ensure more efficient provision of ES.

Hence Muradian et al. (2010) redefine PES as a 'transfer of resources between social actors, which aims to create incentives to align individual and/or collective land-use decisions with the social interest in the management of natural resources'.

So while Wunder's definition takes a very market-orientated approach in which government action can be justified in terms of reducing transaction costs so that exchange can take place, the approach by Muradian et al. is more directly focused on intervention targeting social goals.

As Farley and Costanza (2010) state, the Muradian et al. approach is one 'in which ecological sustainability and just distribution take precedence over market efficiency in furthering social interests'. What this appears to ignore, however, is the potential advantage that PES have over more conventional environmental supply options, which is the additional efficiency that the injection of aspects of market provision that PES can give. For instance, if transaction costs can be lowered by government intervention (for example, by the establishment of well-defined and defended rights to water and land), then competition between alternative buyers and alternative sellers can stimulate trade in ways that maximise social net benefit. Even where government steps in to act as the 'representative' of those in the community wishing to buy more ES, it can structure PES that ensure competition between alternative suppliers so that provision is achieved cost-effectively. In both cases, market processes are used as a tool to facilitate 'ecological sustainability'. In terms of 'just distribution', payments made by buyers to willing sellers provide a mechanism through which the incomes of suppliers are enhanced. Determining if this transfer of wealth is 'just' is more difficult as distributional matters are necessarily value judgments.

Definition used in this study

A definition that avoids the restrictions of both the Wunder and the Muradian versions and provides guidance on some of the features required for a sound PES scheme is that offered by Tacconi (2011): 'a transparent system for the additional provision of environmental services through conditional payments to voluntary providers'.

This definition stresses a number of important components of any PES scheme:

- First, it needs to be *transparent* in that the terms and conditions are known to all so that competition in supply is unrestricted and the potential for corruption is reduced.
- Second, it involves *additionality* in that the contribution of any supplier with the scheme is in addition to that which would have been forthcoming without the scheme. This attribute is important in the prevention of 'perverse incentives' whereby potential suppliers are encouraged by the inception of a PES scheme to harm their environment or to state that their intention is to harm the environment at some stage in the future in order to receive payment under the scheme to stop harming it now and/or in the future. Additionality also involves the concept of leakage whereby positive actions to supply ES under a PES scheme lead to negative actions which harm the environment outside the geographical scope of the scheme. Part of the process needed to deal with additionality is the determination of the PES scheme's scale. This requires setting the boundaries of the scheme (geographically and temporally) and defining buyer and seller eligibility.
- Third, Tacconi's definition also involves *conditionality*. This means that payments to suppliers under a PES scheme are made only after the contracted services are delivered. The first implication of conditionality is that the ES being purchased are well defined or that there is a well-known and documented relationship between actions taken under a PES scheme and the desired environmental outcomes. The second implication is that contracted actions and/or outcomes are monitored under a PES scheme.
- Finally, the definition requires that providers are acting *voluntarily*. Where a scheme is not voluntary there is no guarantee that suppliers are being made better off through their involvement. Without voluntary engagement, the assurance that trade generates improvements in wellbeing for suppliers is lost.

The conditions Tacconi sets out for PES are critical in terms of their operation in reflecting market forces. A key strength of PES is their capacity to offer some of the power of the market in a setting where markets do not typically form. Voluntary participation, competition between suppliers and the structuring of an agreement that requires delivery of an outcome are key features of the operation of markets that ensure the cost-effective and efficient production of goods and services. The goal is to use PES so that some of the pitfalls of collective action—including

the potential for cost padding, failure to deliver and even fraud (through to corruption)—can be avoided.

Other definitions of PES schemes (Noble et al. 2009) do not involve some of the key elements Tacconi includes and so can be faced with more of the dangers of command-and-control style collective action. For instance, 'benefit-sharing' schemes—where payments made for the protection of environments are divided among the various people or communities with interest or control over the relevant area—often do not include the additionality or conditionality characteristics. Voluntary participation may be incomplete where a majority decision across a group delivers an outcome that involves payment to all parties. So while such benefit-sharing schemes may be regarded as PES, they do not embody the same market-style principles that Tacconi's concept of PES involves. It is important to note also that, frequently, benefit-sharing schemes involve the distribution of income achieved from the extraction of resources that may adversely affect the environment (e.g. payments from mining or forestry operations). They are effectively rewards for the loss of ES and can, perversely, have an adverse effect on the incentive to protect the environment. They usually have no inclusion of additionality or conditionality for environmental improvement.

While PES schemes involve the identification of demands for ES and the mobilisation of funds reflecting those demands, they also provide a source of income to the suppliers of ES. Only if there is a source of income associated with the provision of ES will those with control of the resources that can generate those services be willing to give up competing extractive uses of their resources. In other words, the net income from the provision of ES must be generally greater than the net income from extractive uses for the resources to be allocated for ES supply.

It is important here to consider in detail the concept of net income, which includes cash and non-cash benefits. A supply activity will involve the generation of revenues and costs. For instance, the harvesting of timber from a forest will involve receipts from the sale of timber as well as costs associated with fuel, machinery, labour etc. So too does the provision of ES. Those with responsibility over a forest may choose not to harvest trees for timber but instead maintain their forests for biodiversity and water-quality purposes. That may involve some direct costs associated with managing the forest. It will also involve the 'opportunity cost' of forgone timber net income.

However, if PES are received, they will mean the receipt of cash income. Furthermore, the maintenance of the forest for ES may also bring some other benefits. They may involve the receipt of cash from other sources. For instance, the production of some cash crops (nuts, berries) and providing forest access for 'ecotourism' may be compatible with the provision of ES from a forest. There may also be non-cash benefits. For instance, the water-quality benefits of forest protection would also be enjoyed by the local people as well as those downstream. It is the combination of such cash and non-cash benefits that will be considered relative to the costs. However, the contribution of cash earnings from PES schemes will be a critical component, especially in communities where little cash is available.

International trends in financing mechanisms: policies, programs and priorities

The emergence of PES schemes over the past decade has followed a recognition that the insertion of some market-incentive elements into environmental policies can assist in achieving desired results at lower cost. The antecedents of the PES trend are to be found in the environmental pollution literature where experiments with trading pollution permits (as opposed to the imposition of command and control regulations), particularly for sulfur dioxide pollution from coal-fired power stations could generate considerable resource savings and reduce pollution. Transferring this logic across to the 'nature protection' environmental debate, experiments were undertaken in which various schemes rewarded participants for achieving environmental goals for payment.

The advantages of being able to specify a goal (additionality) and then make payments only on achievement of those goals (conditionality) meant that schemes more closely resembled market contracts.

Three primary areas have developed as focal points for PES schemes: biodiversity protection, watershed protection and carbon-emission sequestration. The way in which demand for these ES can be mobilised has led to a classification of schemes into government financed (where governments act to link buyers and sellers either directly through the provision of taxation revenue as a source of funds for payments or indirectly through actions as a buyer using other sources of funds) and user financed

(where private individual and corporate interests are mobilised). There are also some 'mixed' models in which both private and public sectors are involved. Wertz-Kanounnikoff et al. (2008) provide South American examples of both kinds of PES scheme including urban water users paying for watershed catchment protection in Ecuador and the Mexican Government funding payments for not logging forests.

PES schemes are no longer experimental. They now involve the payment of significant amounts of money, as Table 3 indicates for watershed services payments and Table 4 for biodiversity payments. The update provided by Stanton et al. (2010) for watershed service schemes alone suggests a rapid pace of growth, a wide diversity of schemes and a broad geographical footprint:

> Our research identified a total of 288 payments for watershed services (PWS) and water quality trading (WQT) programs in varying stages of activity around the world. Of the programs identified, 127 were actively engaged in transactions in 2008. Programs are developed and implemented by various sectors including government, private, non-governmental and community groups.
>
> In 2008, the transaction value from all active programs is estimated at US$9.3 billion. Over the entire span of recorded activity, total transaction value is estimated at slightly more than US$50 billion, impacting some 3.24 billion hectares.

Internationally, the Conservation Reserve Program (FSA 2012) in the United States of America (USA) is the world's largest PES scheme, with landholders being paid to take agricultural land out of production. In Europe, the Common Agricultural Policy

Table 3. Estimated size of payments for watershed services

Payment type	Estimated current size of payments globally (US$/year)	Estimated current size of payments in developing countries (US$/year)
Voluntary private-sector watershed management payments	$5 million (many public payments for environmental services (PES) are partially private, e.g. Costa Rica, ~ 30% private electrification funds; Ecuador, public utility revenues)	Costa Rica, ~ 30% private electrification funds; also Ecuador, public utility revenues. Environmental Safety and Health in Costa Rica operates independently of the Fonda Nacional de Finaciamentio and invests roughly $45,000 a year in protecting the watershed.
Government-mediated watershed PES	$1,000 million (New York City, ~$150 million; Wetland Reserve Program $240 million; EQUIP estimate 50% for water-related services ~$500 million; Mexico program)	Mexico program, $18 million; Costa Rica program, $5 million; China program, $43 billion across 10 years; South Africa program, $65 million.

Source: Lasco and Villamor 2009

Table 4. Estimated size of payments for biodiversity services

Payment type	Estimated current size of payments globally (US$/year)	Estimated current size of payments in developing countries (US$/year)
Regulatory-driven species offsets (including US Conservation Banking)	$45 million in the USA; program just started in Australia and possibly similar program in France, size unknown	Unknown how many species offsets are driven by environmental impact assessment (EIA) regulation in developing countries
Land trusts, conservation easements (expenditures by non-government organisations for conservation)	US$6,000 million in USA alone	Size and use of easements in developing countries unknown; roughly $2 billion/year (McKinsey – World Resources Institute – The Nature Conservancy)
Voluntary biodiversity offsets (offsets outside the regulatory framework)	$20 million for offsets	Probably some 50% of the global market
Government conservation payments and biodiversity offsets	$3,000 million—just flora-and fauna-orientated programs (not including water and soil conservation)	Costa Rica, over $14 million; current global expenditures on protected areas are estimated at approx. $6.5 billion/year

Source: Lasco and Villamor 2009

also involves payments being made to farmers who do not use their land for production. The goals of these policies are to generate ES as well as cultural benefits (protecting the landscape and way of life) but they also have agricultural protection goals. By taking land out of production, the extent of farm surpluses generated by subsidies and trade restrictions is reduced and farm incomes are increased.

Another large-scale agricultural PES scheme is in China where farmers are paid to convert land from cropping to tree crops, perennial pastures and 'ecological plantings' under the Conversion of Cropland to Forest and Grassland Programme. Again, ES provision is a goal given the problems of land and water erosion in western China. However, there are also social goals involved, with labour from farms being freed to supply the needs of rapid industrialisation.

In the Australian context, PES schemes have been focused on achieving natural resource management objectives at lowest cost. They have particularly related to initiatives on private land, partly because of the property right vestment to land in Australia whereby freehold title owners are less restricted in their activities unless significant political upheaval is contemplated. Put simply, payments are required for changes in land use. To achieve goals cost-effectively, the favoured means of progressing PES schemes in Australia has been through reverse auction mechanisms, such as BushTender in Victoria (DSE 2012). These involve landowners being invited to tender for the supply of ES. The tender must specify the actions to be taken and the amount of payment required. Both additionality and conditionality are specified in most schemes and they are voluntary. Through competitive tendering, governments that act for the buying public using taxpayer funds can select the bids that provide the sought-after goals at lowest cost.

Offset schemes are also in place whereby developers are required to buy substitute ES for any lost during a development process. This creates a demand for environmental service provision from potential suppliers able to generate substitute services. For instance, areas of undisturbed vegetation may be sought by mining companies to offset the clearing of vegetation at a mine site. By purchasing and then covenanting the forested land so that it cannot be cleared, the mining company increases the stock of protected land to replace the area cleared by its mine proposal. This type of scheme results from a regulatory approach by government that requires no net loss of ES over a geographical space. Firms are forced under the regulation to become buyers of ES.

Such offset schemes can be facilitated through the creation of 'banks' of environmental service–providing assets. For instance, areas of protected wetland may be set aside or deposited in a bank of such assets so that they are available for withdrawal should a development process require an offset.

These Australian developments have paralleled developments in the USA and Europe. The Conservation Reserve Program in the USA is based on an auction system. The Common Agricultural Policy programs in Europe have been more frequently based on payments according to production forgone, but recent reforms have shifted the emphasis to payments for specific environmental or cultural outcomes.

Less emphasis has been given to the use of market forces in developing-country PES schemes. A recent Australian Centre for International Agricultural Research (ACIAR)-funded project has engaged with the Chinese forestry authorities at national and provincial levels to experiment with the use of auctions (Wang et al. 2011). In that experiment, land-use change investments formerly made through the Conversion of Cropland to Forest and Grassland Programme (CCFGP) on the basis of a standard per unit area rate were reconfigured so that access to funds was available only to those farmers successful in a reverse auction. Farmers in Sichuan province were asked to submit (voluntarily) bids for land-use change actions—mostly the planting of trees on steeply sloped land. Payment to successful bidders was conditional on work being performed (a contract was signed between the forest agency and each farmer) and additionality was assured because only already cleared land was eligible for funding (so that there was no incentive for farmers to clear forest to receive the payments). Further development of the scheme is to be pursued by the State Forestry Administration, given the success of the trial application. The cost of land-use change was significantly lower than comparable CCFGP sites and the proposed changes were better targeted to achieving environmental service provision.

Criteria for effective PES, benefit sharing and other incentive mechanisms

There are many political, administrative, financial, social and operational considerations when making

decisions on incentive mechanisms. The following considerations (which include observations made by Wunder 2005) will help establish a framework for analysis and to identify the necessary research topics and development activities which are discussed later in this report.

Political and administrative support considerations

1. Any scheme for PES for the four most important ES—climate change, watershed services, biodiversity conservation and landscape beauty—must receive significant political support within Laos and adequate financial support from within Laos and from international and commercial sources.
2. Numerous government agencies might consider that they have (or should have) roles and responsibilities in managing an incentives mechanism scheme that will encourage provision of ES, in receiving funds from national and international sources and in distributing them as PES to selected beneficiaries. Confusing institutional conflicts must be resolved before a PES scheme is introduced.
3. It will be necessary to decide whether the agency which measures and certifies that ES have been provided will be the same agency that disburses the PES.
4. Any government agency which is involved in any component of the PES scheme must possess sufficient numbers of staff trained to specified standards in their responsibilities. The provision of suitable *initial* and *continuing* training will be a serious constraint on the successful operation of a PES system unless it is effectively addressed.
5. Likewise, continuing research will be necessary to improve the methods of measuring ES and assigning monetary values to each environmental service. Continuing research must evaluate the beneficial and detrimental economic, social and environmental impacts of the scheme.

Financial considerations

1. While any financial incentives must produce desired, nominated environmental outcomes, it is also essential that they improve household livelihoods among the rural beneficiaries.
2. Having chosen the ES which are to be enhanced by PES, it is then necessary to assign monetary values to each environmental service. This will require careful research.
3. Secure sources for the funds need to be established for incentive mechanisms, such as the payments required from developers and operators of hydro-electric schemes in Laos. Finding the sources of funds to pay for carbon sequestration may be more problematical.
4. Transparent, simple methods and pathways are essential for receipt and disbursement of funds through a reliable, efficient, approachable, honest and trusted institution.

Social considerations

1. It is also important to ensure that PES for the four main types of ES will be mutually beneficial to both suppliers and consumers of ES, and transparent. Participation in the scheme must be voluntary. PES must be conditional on the implementation of well-defined actions by the suppliers of ES, and must produce desired, nominated, environmental outcomes. PES might also stimulate suppliers of ES to provide additional forms of ES.
2. Beneficiaries (mostly rural smallholders) must be clearly identified (either as individuals and/or communities) as those who are primarily responsible for providing the ES for which the PES are being made.
3. All potential recipients need to understand all aspects of the PES scheme and agree to participate. It is also essential that they are accountable for providing the agreed ES.

Operational considerations

1. It is essential to devise robust procedures by which selected ES can be simply, quickly, objectively and cooperatively measured or predicted by both villagers and relevant government officers using practical field methods. Ideally, the *criteria* (for which *practical indicators* must be developed) should be *outputs* (actually achieved or reasonably predicted) rather than *inputs* (such as numbers of trees planted). Some outputs include: areas of natural forest managed at measured and/or quantitative standards, amount of carbon sequestered, water quality, biodiversity measures such as wildlife abundance, and several others. Research is required to expand the list of criteria and practical indicators.
2. It will be important to set up and implement practical systems for monitoring and evaluating the PES scheme, and procedures for regular

review and improvement of the scheme must be instituted.

3. Factors that might be detrimental to the successful introduction and operation of the PES scheme must be carefully identified and evaluated before and during the operation of the scheme.

Summary of best practices and lessons learned on PES

In their study examining options for the development of a River Basin Fund for the Nam Ngum River Basin in Lao PDR, Emerton and Lopaying (2011) took a broad and practical interpretation of PES (in this case referred to as payments for *ecosystem* services). The following extract from their report provides very helpful guidelines and expands upon the criteria previously discussed.

1. PES are a particularly useful funding mechanism for river basin organisations (RBOs) which lack other sources of self-generated revenues. When RBOs do not have the mandate to operate commercial services, collect user fees or levy penalties and fines, PES can provide an important supplement to public budget allocations.
2. PES schemes usually involve payments to upstream land and resource users, not just to RBOs. Although a RBO may fulfil the coordinating and planning role in implementing PES schemes, and even act as the intermediary or third party through which payments are made, it is upstream land and resource users (including government agencies who manage protected areas or forests as well as local communities) who are ultimately responsible for securing ecosystem services—and they need to be rewarded for this. Aside from some kind of management fee, it is unusual for PES to be a pure income stream for RBOs. A large portion of the revenues must typically be passed on to the upstream groups that need to be funded or incentivised to engage in sustainable land and resource management practices.
3. There is no 'standard' PES model. There is now almost two decades of experience in implementing PES, worldwide. Although a multiplicity of models coexists, no single one has so far emerged as the standard approach to PES. There remains a great deal of flexibility in the way in which PES schemes can be designed and implemented.
4. PES work best when they are founded on a clear and scientifically proven link between particular land uses and the provision of specific ecosystem services. If a buyer is being asked to pay for their consumption of a particular ecosystem service, then the PES scheme must guarantee that this will be provided. Demonstrating these links requires significant knowledge, rather than broad assumptions and unverifiable hypotheses. In most cases, potential buyers are interested in a very specific service (erosion control, clean water supply, and so on), and will want to be shown the proof that this is what they are getting.
5. PES require that there is a clear demand and willingness to pay among users. PES schemes often start from the supply side, and build up considerable expectations among ecosystem service providers, and only then begin to look for a buyer of these services. Yet in most cases it is relatively easy to identify how and from where ecosystem services are being generated—but it is much more difficult to identify buyers who are willing to pay for them. Without demand, there can be no market.
6. PES schemes must be feasible in financial terms. All too often, PES schemes rely on subsidies from outside to operate. They do not function as a stand-alone market mechanism, and when external funding and expertise run out, so the scheme comes to a halt. One particularly important element is to look at the long-term staffing, operational and administrative costs of running the PES scheme, and ensure that there will be adequate funds to sustain them. A second element is to ensure that the running costs are not so high that they leave insufficient funds for the actual payments to be made for ecosystem services—these, after all, are the reason for PES in the first place. A third element is to ensure that the payments to be made are of a high enough level to cover the costs of ecosystem conservation—if ecosystem service providers are not earning sufficient returns, then the scheme is unlikely to be sustainable. A fourth element is to investigate the transaction costs for the parties involved. If procedures are too cumbersome and

time-consuming, neither buyers nor sellers will find it worthwhile to participate.

7. PES are founded on negotiation and stakeholder participation. While sound science and financial appraisal are critical in designing successful PES, whether schemes actually take off—and in what form they are implemented—is largely down to buyers and sellers negotiating an agreement that they are both happy with, and willing to abide with. The amount of time that such negotiations take is often underestimated, as is the effort that must be made to ensure broad consensus among all of the buyers and all of the sellers in a particular scheme. If even one participant is unhappy with the arrangements that have been defined, then the scheme may fail.
8. PES require a supportive regulatory and institutional framework. Although they are almost always voluntary agreements, PES require that the broader conditions are in place to enable and support them, and to protect the rights of both buyers and sellers. A dedicated law is not necessarily required, but existing regulations must enable PES, and certainly should not contradict or disallow them. Key points to bear in mind relate to the definition of ecosystem services, the terms and conditions under which they can be rewarded or compensated, who can receive funds and who must pay, penalties for non-compliance by either party, property rights, contracts, and the retention and use of funds for conservation. With few exceptions, PES also require a neutral and independent third-party mediator or negotiator, as well as technical advice and expertise. Without the institutional capacity to deliver this support, PES run the risk of failing.
9. PES schemes require close monitoring of compliance and the ongoing provision of services. Monitoring is essential for ensuring that buyers are getting what they are paying for and that sellers are being rewarded or recompensed adequately. It is also necessary in order to adapt to changing conditions and adjust the functioning of the PES mechanism should problems arise.

Incentives and improved land use in Lao PDR

The range of environmental services from forests

Forests provide not only timber but also ES, including a large range of non-timber forest products (NTFPs) that are important for rural livelihoods (Table 5). However, since all those values are not reflected in the markets for goods and services, forests tend to be undervalued in the competition with other land uses (Stenhouse and Bojö 2011).

Forest resources

Lao PDR has lost more than 50% of its forest cover since the 1940s, and a large fraction of the existing forests is degraded. In the decades between about 1950 and 1990, unsustainable forest management, shifting cultivation and slash-and-burn subsistence farming were the main drivers of deforestation and forest degradation in the country. Investment in land development has increased since 2002, and the drivers of deforestation are now linked with investment based on global or regional agricultural commodities and infrastructure development. Table 6 summarises the most recent available data on Laos' forest resources and their historical change (Clarke 2010).

Forests in Laos are classified in three categories (Table 7) under the Forestry Law and these were briefly described by Stenhouse and Bojö (2011).

Protection forest

These are areas that are strategically important for national defence, natural disaster protection and environmental protection. They provide protection for water resources, riparian areas, roadsides and soil. The areas are divided further into *total protection/core zones* (areas at high risk of environmental degradation; for example, a slope of over 35°), which are strictly protected and where any activity is prohibited, and *controlled use zones*, where there is not a high risk of environmental impact and where people can collect wood and NTFPs. These protection forest areas are important, as much of the land in Laos is susceptible to soil erosion due to its topography, and the protection forest also provides corridors between protected areas.

Conservation forest

These areas are dedicated to the conservation of biodiversity, ecosystems, scenery, and sites valuable for, for instance, tourism or cultural reasons. They include *total protection/core zones*, which are areas of key habitat and where it is strictly prohibited to conduct forestry, hunt wildlife or harvest NTFPs or to enter without authority. The *controlled use zone* can be used for NTFP collection and hunting of non-protected species with traditional tools, in certain seasons, and only for subsistence use. Conservation forests include the protected area system and also village conservation forest areas, which can be located outside protected areas. Conservation forest can also be corridor zones and buffer zones for protected areas. Of the 9.8 million ha of forest area in Laos, half is in the protected area system, designated as NPAs, Provincial Protected Areas and District Protected Areas. The 21 NPAs account for over 20% of the total land area of Laos.

Table 5. Types of ecosystem services from forests

Environmental services	• Food • Fresh water • Fuel • Fibre • Biodiversity conservation • Medicines
Regulating services	• Climate regulation • Flood regulation • Disease regulation • Water purification
Supporting services	• Nutrient cycling • Soil formation and conservation
Cultural services	• Aesthetic • Spiritual • Educational • Recreational

Source: Stenhouse and Bojö 2011

Table 6. Forest cover change in Lao PDR 1982–2002

Forest category	Area ('000 ha)			Annual change (%)		
	1982	1992	2002	1982–1992	1992–2002	1982–2002
Current forest	11,637	11,168	9,825	–0.4	–1.2	–0.9
Potential forest	8,554	8,950	11,151	0.5	2.5	1.2
Other wooded land	1,545	1,444	287	–0.7	–8.0	–22.0
Permanent agriculture	709	849	1,200	2.0	4.1	2.0
Non forest	1,235	1,269	1,217	0.3	–0.4	–0.1
Total	*23,680*	*23,680*	*23,680*			

Source: Clarke 2010

Table 7. Forest categories in Lao PDR

Classification	Management level	Description	Area ('000 ha)
Conservation	National	21 areas and 2 corridors	3,500
Conservation	Province	76 areas	644
Conservation	District	136 areas	495
Protection forests	National	262 areas	4,758
Production forests	National	51 areas	3,089
Total			*12,486*

Source: Clarke 2010

Production forest

These are natural and planted forests dedicated to wood production to satisfy the national socioeconomic plan and for poverty eradication. Management plans and monitoring are required under Forestry Law. Of the 9.8 million ha of forest in Laos, one-third consists of Production Forest Areas (PFAs). The PFAs are meant to have formal arrangements with local communities to share some of the revenues from sustainable logging to benefit local development. This has been implemented in PFAs in nine provinces though the Sustainable Forestry and Rural Development (SUFORD) Project, which is implemented by DoF and local communities with financing and technical support from the World Bank and the Ministry of Foreign Affairs of Finland.

Carbon resources

Based on GoL data that used default values provided by the International Panel for Climate Change (IPCC), emissions from annual deforestation of 134,000 ha over the last 10 years have been estimated by classifying existing forests into two ecological zones—tropical moist deciduous forests and tropical dry forests. These data classify 50% of Lao forests as tropical moist deciduous and 50% as tropical dry forests. Based on IPCC default biomass values, it was estimated that tropical moist deciduous forests contain about 216 tonnes (t) carbon (C)/ha and tropical dry forests contain about 203 t C/ha. Emissions based on the annual deforestation trend yielded 13.4 million t C/year or 48.4 million t of carbon dioxide equivalent (CO_2e)/year (Clarke 2010). Subsequent studies have applied alternative models and these have provided new estimates for carbon resources. The Readiness Preparation Proposal (DoF 2010) applied the National Forest Inventory dataset and equivalent carbon stock values and estimated emissions from deforestation at 51–65 million t CO_2e/year between 2010 and 2020 (Clarke 2010).

Watershed resources

Laos is exceptionally well endowed with water resources and 60% of the urban population and 51% of the rural population has access to clean water. The water supply in Laos consists mainly of rainfed river systems. Average annual rainfall ranges from 1,300 mm in the northern valleys to 3,700 mm at higher elevations in the south. This corresponds to an annual rainfall of 434 billion m^3, of which over half is estimated to be run-off. The Mekong tributaries in Laos contribute some 35% of the whole lower Mekong Basin flow, and the monthly distribution of the flow of the rivers in Laos closely follows the pattern of rainfall: about 80% during the rainy

season (May–October) and 20% in the dry season (November–April).

Water usage is predominantly agricultural at 82%, followed by industrial 10% and domestic 8%. Of the 270.0 billion m^3 of available water, 5.7 billion m^3 is used for households, industry and agriculture, leaving 264.3 billion m^3 as flow in the rivers. An important water use is hydro-power: the country has the potential to produce 23,000 megawatts of electricity, of which only some 5% has been developed.

The mainstream Mekong flows for 1,700 km, either along the Lao border or in Lao territory (ASEAN Regional Centre for Biodiversity Conservation 2009). The Mekong Basin makes up 88% of the land area of Laos, and within that area there are numerous streams and subcatchments that support rich biodiversity and fisheries. Thus, the country plays a pivotal role in the conservation of the Mekong River and its associated aquatic ecosystems. The mainstream Mekong supports a diverse aquatic fauna and is regarded as one of the most species-rich river systems in the world, with the total number of fish species estimated to be over 450. The lower Mekong River supports one of the world's largest inland fisheries. Some 70% of farming households in Laos fish part-time or seasonally and 80% of fish consumed by Lao villagers comes from the wild (Stenhouse and Bojö 2011).

Biodiversity resources

Forests in Laos represent a variety of eco-regions and harbour diverse wildlife species. Laos has the greatest number of large mammal species in South-East Asia, including the Asian elephant, 13 species of primates, 9 species of deer, 8 cat species, including the Indochinese tiger, and 6 bovids, including the rare and endemic kouprey. In 1999, 1,140 animal species of Laos were reviewed and 319 are considered nationally or globally significant due to their limited range and/or numbers. With a high level of biodiversity, Laos encompasses some of the most significant forest areas remaining in South-East Asia. However, the combined loss of forest cover and overexploitation of wildlife populations pose significant threats to species including the tiger, gibbon, Asian elephant and crocodile, among others. Nearly two-thirds of the Lao population live in rural areas, practise small-scale agriculture, and rely on wildlife as a source of animal protein or as a means to meet economic needs (Stenhouse and Bojö 2011).

Clarke (2010) reported that the Wildlife Conservation Society considered the greatest conservation challenges in Laos were the domestic and international wildlife trade and unsustainable hunting for subsistence consumption. Some of the country's most charismatic species, such as tigers, are heavily targeted by poachers. Because their own prey has been depleted, the tigers sometimes resort to killing livestock, which leads to conflicts with rural communities. Loss of habitat poses an additional strain on remaining wildlife populations, and researchers are still working to understand the ecology and distribution of the animals facing the greatest threat. Because of these factors, the role of threatened species in the forest ecosystem and the impacts their loss could have on forest ecology are difficult to predict. Rice-field expansion, illegal logging and poaching pose significant threats to many species and their habitats, especially because most wildlife populations are very small.

Wetland resources

GoL has a longstanding wetland management program and aims to develop guidelines for sustainable long-term management of the country's wetlands. A 1993 inventory of wetlands in Laos reported around 965,000 ha of wetlands (Table 8) within 50 km of the Mekong mainstream (Clarke 2010). Laos joined the Ramsar Convention in 2010, and designated the country's first two wetlands of national significance:

- Xe Champhone Wetlands in Savannakhet province which provide important food and livelihood resources for about 20,000 people, including a vital source of sustenance for people and livestock in the dry season. The wetlands are also home to the critically endangered Siamese crocodile as well as a number of turtle species
- Beung Kiat Ngong Wetlands in Champassak province which support around 11,500 villagers who live around the site and depend on its fisheries, subsistence agriculture and NTFPs.

Role of foreign investors in providing environmental services

Foreign investment in Laos presents considerable opportunity for development of incentive-based mechanisms for the provision of ES. Most foreign investors will have commitments and responsibilities to their shareholders that encourage environmental care and maintenance of ES. Foreign investment licences in Laos between 2000 and 2009 were dominated by the electricity (hydro-power) and mining sectors, attracting capital of US$4.1 billion

Table 8. Estimated area of wetlands (ha) within 50 km of the Mekong mainstream

Geographical area	Land type										Total
	Floodplain wet rice	Permanent dam or reservoir	Permanent lake	Floodplain grassland	Permanent flooded grassland	Seasonal flooded grassland	Seasonal flooded shrubland	Permanent swamp	Seasonally flooded swamp	Pool in perennial river	
Vientiane prefecture	92,886	38,376	376	702	541	1,404	2,964	435	120	–	137,804
Vientiane	27,342	45,000	–	–	–	–	–	–	–	–	72,342
Xayaboli	9,930	–	–	–	–	–	–	–	–	–	9,930
Luang Prabang	1,716	–	–	–	–	–	–	–	–	–	1,716
Hong Sa	4,857	–	–	–	–	–	–	–	–	–	4,857
Udom Xai	3,541	–	–	–	–	–	–	–	–	–	3,541
Bokeo	4,563	–	–	–	–	–	–	–	–	–	4,563
Luang Namtha	8,502	–	–	–	–	–	–	–	–	–	8,502
Bolikhamxay	47,324	–	–	–	–	–	–	955	–	–	48,279
Khammouane	56,863	–	8,502	–	–	–	–	–	–	2,886	68,251
Savannakhet	192,654	–	2,964	–	–	–	–	18,409	–	–	214,027
Champassak	251,758	–	1,092	6,552	–	–	42,510	7,410	–	–	309,322
Saravane	68,172	–	–	–	–	–	13,884	–	–	–	82,056
Total	*770,108*	*83,376*	*12,934*	*7,254*	*541*	*1,404*	*59,358*	*27,209*	*120*	*2,886*	*965,190*

Source: Clarke 2010

and US$3.0 billion, respectively (according to the Department for Promotion and Management of Domestic and Foreign Investment, Ministry of Planning and Investment). Investment during this period in the agriculture sector (US$1.1 billion) and wood industries (US$118 million) was much lower. China is now the largest source of foreign direct investment in Laos.

Foreign investors can reasonably be expected to adhere to international standards with regard to the environment. Among the guidelines and standards that encourage environmental responsibility are:

- Equator Principles
- United Nations Global Compact
- United Nations Environment Programme (UNEP) Principles for Responsible Investment

and guidelines and principles developed by:

- World Bank
- International Finance Corporation (IFC)
- International Association for Impact Assessment
- Millennium Ecosystem Assessment
- World Business Council for Sustainable Development
- Dow Jones Sustainability Index.

In their World Bank report, Stenhouse and Bojö (2011) found that mining and hydro-power projects can provide and leverage resources that might otherwise not be available for strictly environmental conservation projects in Laos and provided the following examples:

- establishing new protected areas or adding area to existing protected areas
- strengthening the management of existing protected areas and increasing their funding base (e.g. funds provided by NTPC for the management of Nakai Nam Theun Protected Area, which forms the Nam Theun 2 (NT2) watershed)
- providing new funds for research into endangered species (e.g. research into the range and population of elephants in the NT2 area and research into endangered species through the Sepon mine, both of which would probably have been unfunded otherwise)
- increasing or making new efforts to raise awareness and environmental education (e.g. Phu Bia Mining is providing funds and staff to coordinate with Department of Forest Inspection (DoFI), NUoL and the Wildlife Conservation Society to provide awareness raising in local communities about the illegal wildlife trade)
- training opportunities (e.g. Phu Bia and Sepone mines have both increased the capacity of the local provincial Water Resources and Water Administration (P-WREA) office).

NTPC is among the better known of the foreign investments in Laos. Its shareholders and financiers have insisted upon a high standard of environmental care and have matched this commitment with significant payments for maintenance of ES in the catchment area. This commitment resulted in the establishment and financing of the Watershed Management and Protection Authority (WMPA) where NTPC is paying a total of $31.5 million over 31 years (Stenhouse and Bojö 2011) for environmental protection and monitoring, and for protecting the livelihoods of the enclave villages. This represents the highest level of long-term funding of any protected area in Laos. This commitment to maintenance of ES is now regarded by many as a benchmark for investment in Laos.

Another example in the hydro-power sector is the Theun Hinboun Hydro Project, which provides a contribution of $200,000 annually to the Environmental Protection Fund (EPF) but requires that 50% of the funds are directed towards the benefit of the communities in the project area.

In the mining sector, there are also examples of payments to serve the interests of ES. In addition to the contributions listed by Stenhouse and Bojö (2011), Phu Bia Mining[3] makes an additional environment-focused contribution of US$1/t of copper produced and US$1/ounce [28.3 g] of gold produced. At current levels of production, this represents a contribution of some US$125,000 annually.

[3] Phu Bia Mining Limited, a subsidiary of PanAust (Australia), has a Mineral Exploration and Production Agreement (MEPA) with GoL that regulates exploration and mining within a contract area of 2,636 km^2 in Laos. It has two operations, the Phu Kham Copper–Gold Operation and the Ban Houayxai Gold–Silver Project. During 2010, the Phu Kham operation produced 67,806 t of copper, 58,152 ounces (oz) [over 1.6 t] of gold and 507,590 oz [14.4 t] of silver, and in 2011, the expected production was 62,000–65,000 t of copper and 50,000–55,000 oz [1.4–1.6 t] of gold. The Ban Houayxai Project is scheduled to reach steady-state production in 2012 and is expected to produce over 100,000 oz [2.8 t] of gold in its first year of operation.

MMG[4] mine at Sepon has established a leading Biodiversity Offset Program with the aim of supporting the conservation of key ecosystems and species to offset the impacts of its mining developments and has supported two projects:

- baseline survey of the Namkok Headwaters Area in cooperation with provincial and district authorities, the Wildlife Conservation Society and NUoL. The survey identified areas of high biodiversity value and included indigenous knowledge surveys, camera 'traps' for larger species, sound recordings for birds and other species and pitfall traps for reptiles
- Siamese crocodile wetland conservation project—the Siamese crocodile is the third-rarest crocodile in Laos. A 3-year working agreement has been signed with the Wildlife Conservation Society to undertake genetic sampling of the crocodile, restore wetland habitat and develop community livelihood programs to support maintenance of the wetland.

MMG has also established an environmental fund which is supported at a contribution rate of US$1/t of copper produced and US$1/ounce [28.3 g] of gold produced. How these funds will be spent is unclear. As part of its commitment to communities in the development area surrounding the Sepon mine, MMG connected 22 local villages to the electricity grid and provided medium- and low-voltage cables and transformers at a cost of US$420,000.

Policy, legislative and institutional framework for biodiversity management in Lao PDR

GoL recognises the importance of the country's biodiversity in national policy and over the past 20 years it has strengthened the framework governing the protection of these resources. In a rapid participatory biodiversity assessment conducted for the Scandinavian forestry company Stora Enso's proposed eucalypt plantation program in southern Laos, IUCN identified the complex legislative framework that underpins biodiversity conservation in Laos (IUCN 2008). This list, which includes the Forestry Law, the Water Resources Law and the Environmental Protection Law, will underpin options for incentives for providing ES.

The legislative framework for biodiversity is outlined in the National Biodiversity Strategy to 2020 and Action Plan to 2010 as the guiding platform under the Convention on Biological Diversity. Other laws and decrees of relevance include the Environmental Protection Law (1999), Prime Ministerial Decree No. 164/PM on the Establishment of the Lao PDR National Protected Area System (1993), Regulation on the Management of NBCAs [National Biodiversity Conservation Areas], Wildlife and Aquatic Animals No. 0360 (2003), Forestry Law (2005, amended 2007), the Aquatic and Wildlife Law (2007), Land Law (2003), Water Resources Law (1996), the Forestry Strategy 2020 (2005). Table 9 summarises these documents and shows how they relate to the sustainable use and management of biodiversity (see also Oberndorf 2010; Stenhouse and Bojö 2011).

The World Bank study conducted by Stenhouse and Bojö (2011) provided a detailed list of key laws and regulations relating to natural resource management in the hydro-power and mining sectors. They found that, in principle, the existing laws and regulations were strong, but the country's capacity to implement and enforce these laws needs to be strengthened. The study also found:

> The laws are sound in encouraging the protection and sustainable use of natural resources by minimising the environmental impact of such activities as road construction, power development, and mining associated with development projects. However, the legislation does not specify types of penalties for breaking the law. The overall impression is that the main constraining factor is not the legislation itself but rather the lack of human and financial capacity to implement it.

Policy and administrative considerations

In a wide range of frank policy-related and operational interviews made with senior officers from national and international agencies during the course of this study, many observations relating to incentives, benefit sharing and PES were noted.

[4] MMG is wholly owned by Minmetals Resources Limited (MMR), which is listed on the Hong Kong Stock Exchange. The majority shareholder is China Minmetals Non-ferrous (CMN) which owns 71.56% of MMR shares. In June 2009, the original Sepon developer, OZ Minerals, sold the operation to the MMG group of businesses. Since 2003, this company and its predecessor have made contributions in the form of taxes and fees to GoL totalling some US$600 million.

Table 9. Legislative framework pertaining to biodiversity conservation in Lao PDR (Source: IUCN 2008)

Legislative document	Description
National Biodiversity Strategy to 2020 and Action Plan to 2010	Laos became a party to the Convention on Biological Diversity (CBD) in 1996. In accordance with CBD guidelines, and with International Union for Conservation of Nature (IUCN) support, the Government of Lao PDR (GoL) in 2004 completed the National Biodiversity Strategy to 2020 and Action Plan to 2010 (NBSAP), which highlight current threats to biodiversity and priority areas for engagement. The strategy outlines seven areas of work that will be implemented in order to reach its overall goals. The main objectives of NBSAP include: improve biodiversity data and fill data gaps through basic and applied research; improve biodiversity management and monitoring; harmonise legislation and regulations related to biodiversity; and increase public awareness and participation in sustainable management of biodiversity. Human resource development is a key component of the strategy, which emphasises that improved capacity, with respect to both decision-making and research, is necessary for sustainable biodiversity conservation.
Prime Ministerial Decree No. 164/PM on the Establishment of National Biodiversity Conservation Areas (1993)	Decree 164/PM of October 1993 was among the first legislation enacted by GoL that established the National Protected Area (NPA) system, an objective of which is to preserve natural resources, including the forest, wild animals and water. The establishment of the NPA system lays a good foundation towards comprehensive conservation of Laos' biodiversity. Management of the NPAs has received further development in subsequent regulations aimed at protecting biodiversity and sustainable natural resource utilisation.
Environmental Protection Law (1999)	This addresses the protection of the environment and natural resources as well as biological diversity (Article 15). The law also provides the basis for conducting project-related environmental impact assessment to reduce and mitigate environmental impact—accordingly, a Regulation on Conducting Environmental Impact Assessment in Lao PDR was subsequently issued. Article 12 in the current draft revision of the Environmental Protection Law refers to payment for ecological services and suggests that methods and processes for payment for ecological services will be established separately.
Forestry Law (2005, amended 2007)	Biodiversity conservation is covered in the first Forestry Law where biodiversity is provided under the forest resources which individuals and organisations have the obligation to protect. The law was amended in 2007. Key amendments include classification of forestland into three categories as opposed to five in the previous version. A specific section is devoted to forest preservation, which deals with the conservation of plants and animals and non-timber forest product species. The law also provides for organisations having the right to make decisions concerning land conversion and approval of concessions. The law defines the nature, functions, objectives and legal status of conservation forest with the aim to protect and conserve biodiversity and requires the government to engage participatory management of protected areas with villagers. It also provides for zoning within NPAs into totally protected zones, controlled use zones and corridor zones.
Aquatic and Wildlife Law (2007)	A new law on the protection of wildlife and aquatic animals was enacted and passed by the National Assembly in late 2007. This enactment signifies the growing importance of wildlife and aquatic animal conservation and protection in Laos. As a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the enactment reinforces Laos' commitment to the protection and management of wild fauna under CITES. The law sets out the principles, regulations and measures to protect, enhance and manage fauna biodiversity sustainably. It provides the basis for the different levels of protection in respect of the three national wildlife and aquatic animal category lists: List I (prohibited), II (managed) and III (general category), and their management requirements. What is important is that the law calls for the formulation of a general wildlife management, development and protection strategy that sets out the direction, action plans, projects and measures on immediate and long-term bases. The law also provides the framework for the inventory, uses, import and export of wildlife and aquatic animals on a managed basis.

Table 9. (continued)

Legislative document	Description
Regulation on the Management of National Protected Areas, Aquatic and Wildlife (2003) (No. 0360 of Dec. 2003)	Practical management of NPAs is exercised by applying this regulation. It provides for the NPA establishment procedures, the distinction of conservation zones, planning and development of a protected area management plan, and prohibitive activities that can have a detrimental impact on wildlife and aquatic animals, as well as the institutional management responsibilities. The regulation also lists the Lao prohibited wildlife and aquatic animal species category I and managed species category II.
Water Resources Law (1996)	This law provides a comprehensive framework for the use, development and protection of water and water resources in both quantity and quality, including water-related biodiversity. The law sets out the obligations and principles for the development and protection of water sources and resources, including environmental protection. A specific category of 'water source pertaining to biodiversity conservation' is defined in the law to protect biodiversity of plants and animals and the natural environment having important and special values. For the medium- and large-scale use of water and water resources, an environmental impact assessment is necessary, among other requirements.
Land Law 04/03 NA, 21 October 2003	The Land Law provides for the allocation of land to individuals, families and organisations for legal use. One of the land user's obligations is to protect the environment, and that land use must not result in land degradation and negative impact on the natural and social environment.
Forestry Strategy 2020 (2005)	In July 2005, GoL adopted its Forestry Strategy to the Year 2020 (FS 2020). This is an official document to guide the sustainable management and development of the forestry sector in line with national policies, strategies and priority programs for national socioeconomic development and environmental conservation. It identifies 146 actions to be tackled, including actions for the conservation and protection of biodiversity. As a comprehensive package, the FS 2020 calls for improving the legal and regulatory framework, improving the management and development of the country's NPA system, controlling wildlife trade, enhancing conservation awareness and strengthening research.

These observations included:

1. Most respondents are keen to set up mechanisms to accommodate PES and benefit-sharing schemes, which are conceptually accepted, but there is considerable uncertainty about the best operational procedures.
2. PES are an inter-sectoral issue requiring common planning mechanisms and a sympathetic legislative framework. A major challenge for Laos is that ES fall under three sets of legislation—Forestry Law, Water Resources Law and Environmental Protection Law—and there is no specific supportive legislation, although the draft revision of the Environmental Protection Law has Article 12, which specifically mentions PES. In addition, Prime Ministerial Decree No. 333 on Protection Forests (Article 29, Para 4) places obligations on organisations which use protection forests. It states: 'In the case of mining, road construction, hydro-electric power construction, the building of water reservoirs, tourism activities or other development projects, the developers must contribute the funds for the management, the protection, the conservation of the protection forest and maintain the environment in that area'. Para 6 suggests that funds raised be payable to FRDF.
3. Laos is experiencing ad hoc, project-based policy with regard to PES-related issues and there is a need for this legislation to be reviewed and policy coordinated, with any such review including carbon and issues surrounding sharing of benefits. Most mining and hydro-power projects have developed their own incentive or benefit-sharing mechanisms, depending on the outcomes of the negotiations for Concession Agreement (CAs). Although there are several project-based systems for PES, there may be no enforcement mechanism to ensure companies pay and meet their obligations.
4. Without a clear legislative framework, there are no rules and guidelines in place for PES and other incentive-based mechanisms for ES—each sector manages as they see fit within their sector's laws and regulations. All GoL revenues should be

directed via the Ministry of Finance (MoF) but there is no mechanism for subsequent disbursement that will meet the needs of the organisations, companies and projects paying for the ES. To be able to facilitate the payments of funds for PES, MoF needs a decree or law to which it can respond. All PES discussions at a policy level arrived at a common challenge—sympathetic and effective engagement with MoF. It is necessary to include incentives and PES into the mainstream of planning and budgeting, and synchronise this with the finance system to ensure sustainability after project-based support ceases.

5. There is no mechanism to distribute benefits equitably to concerned stakeholders. There seems to be no common understanding for an efficient and transparent means of funds dispersal. The potential revenues from development projects and investments are substantial (the NTPC contribution of US$1 million/year adjusted for inflation to WMPA is an example) and each agency would like to have better access to the royalties from mines and dams, and all believe they can deliver additional benefits for rural livelihoods. How do we create funds and ensure that they are spent in the most appropriate fashion to meet the needs of the nation and the projects? This will require new laws which will have to go through the National Assembly. For example, MAF has responsibilities within the Nam Theun catchment but has not received direct support from WMPA which was established using funds from NTPC.
6. There was a uniformly positive response to the concept of establishing a pilot program to test PES and other mechanisms and test related laws and regulations to ensure that operational procedures are both effective and equitable to all stakeholders. Options suggested that a pilot project could be based upon a formal administrative unit (such as a province, and Khammouane was mentioned) or a geographical entity such as a river basin organisation (RBO) (Nam Theun/Nam Kading and the Nam Ngum basins were mentioned). Both alternatives have advantages and disadvantages: the provincial option has clear lines of authority and responsibility within existing law, and the Nam Ngum Basin Committee would be a good selection as a pilot program because it is underpinned by a Prime Minister's Decree and headed by a national committee that includes the Ministry of Energy and Mines, MAF, MoF and WREA, plus the provinces, all with their agreed roles and responsibilities. An important challenge will be to effectively engage MoF to ensure long-term financial support for PES, beyond the life of any project.
7. Despite national laws on the environment, and associated decrees, the environmental standards adopted by various projects are frequently dictated by the lenders. GoL encourages potential investors to adhere to such international standards as the Equator Principles which are supportive of incentive-based mechanisms for the provision of ES.
8. GoL officers were impressed with the progress made with PES and similar programs in Costa Rica and Vietnam where pilot programs had allowed the ideas and concepts of PES to develop and be tested before being more widely disseminated. Such positive experience was gained with cooperation and coordination between various administrative agencies. Vietnam has its own 2009 Biodiversity Law which was endorsed in 2010.
9. There is lack of clarity in the division of roles for ES across government agencies; DoF is well established and is responsible for management of the nation's forest resources and for national carriage of REDD+ (carbon) programs; WREA is responsible for issues relating to water but has limited staff and resources to do this effectively. They are attempting to link the environmental channels with the financial flows. Current systems of PES and benefit sharing are largely project-driven.
10. Divisions of responsibility for elements of ES are evident within GoL: responsibility for the nation's forests and related biodiversity and for forest-based carbon (and REDD+) initiatives are the responsibility of DoF; WREA has responsibility for water and for auditing and monitoring all environmental issues; and responsibility for Lao commitments to the Convention on Biological Diversity are the responsibility of the Science and Technology Agency within the Prime Minister's Office (PMO), which also has an interest in agrobiodiversity, protection of traditional varieties and traditional knowledge.
11. The strengths and capacities of different government agencies vary. During interviews, it became apparent that not all GoL agencies were suitably equipped with trained staff and adequate resources to accomplish the roles expected

of them. Agencies such as the National Land Management Authority (NLMA) and WREA play critical roles but have limited staff and resources, especially at the provincial level, to do this effectively.

12. There needs to be transparency of systems and clear understanding of what is being bought or paid for: for example, whether GoL departments or project developers should make direct payment to local households for activities such as planting and maintaining trees, with payment based upon percentage tree survival.
13. There is some inconsistency between the expectations of projects and the realities of the GoL system and the sharing of responsibilities between the provinces and districts, whereas line agencies have responsibility for on-ground delivery of national policies.
14. Measurement of effectiveness of PES and similar initiatives in addressing national priorities such as poverty alleviation and livelihood improvement has proved difficult. Such measures require a long time frame and annual changes are generally too small to be evident.
15. Effectiveness of PES and similar initiatives need not require large sums of money. Ecotourism has a strong impact upon local communities and offers excellent opportunities for local employment. There are direct links with poverty reduction and livelihood improvement. The amounts of money are generally small but the impacts are large. An example in Laos is 'The Gibbon Experience' in Bokeo Province, and another is in Dong Hua Sao NPA in Champassak where Green Discovery operates an ecotourism venture.

Operational considerations

Emerton and Lopaying (2011) have prepared an excellent review of the options for the development of a river basin fund for the Nam Ngum River Basin in Laos. They list the four main types of national funds that could provide models for consideration in provision of financial resources for government-run activities in land management. An extract from their report is reproduced below, slightly edited.

Through a decade of experience, GoL has established a number of internal funding mechanisms, each backed up by law. There are four major national funds: the Environmental Protection Fund, Poverty Reduction Fund, Forestry and Forest Resource Development Fund and Road Maintenance Fund. These serve mainly to channel international funds and domestic budgets/revenues to particular sectors and activities.

Autonomous funds: these funding agencies are established by Prime Ministerial Decrees. All funding flows to a special account held in the Bank of Laos. All expenditures are made in line with audit requirements. Regular quarterly plans and reports are submitted to the Board of Directors for records and approval. The eligible recipients of the fund are groups of people, NGOs, the private sector and government agencies. The advantage of this kind of fund is that it is very flexible. It can absorb all kinds of contributions from developers and donors. The disadvantage is that it cannot access the government budget line because it is external to line ministries' budgets, which are submitted for approval to the National Assembly annually. It is also not under the line of government monitoring procedures in regular (out of line) budget. There are two funds of this kind operating in Laos: the Environmental Protection Fund and the Poverty Reduction Fund.

Budgetary funds: these funding agencies are also established by Prime Ministerial Decrees, and are chaired by the minister concerned. The Executive Office operates the fund on a day-to-day basis. All expenditures are payable according to an annual budget plan that is integrated into the annual budget plan of the relevant ministry, which is submitted through the Ministry of Planning and Investment (MPI) and MoF to the National Assembly for approval. Audits are undertaken when required. The advantage of this kind of fund is that it follows the national Budgetary and Tax Law (only one in- and out-door) and can potentially access the national budget through the ministry concerned. It is easy for the government to monitor all income and expenditure in the regular (in-line) budget. The disadvantage of this funding mechanism is that it is not flexible for donors, developers and other contributions, and the recipients are limited to government agencies (the private sector and communities can only be subcontractors). Examples of these kinds of funds are the Road Maintenance Fund under the Ministry

of Public Works and Transportation, and the Forestry and Forest Resources Development Fund under MAF.

Private funds with cooperation between government and the private sector: each developer has its own obligation to contribute to environmental management and social development in the particular area where the activity is located. Under the Concession Agreement (CA), the obligation is stated clearly as regards the contribution to such activities and the institutional arrangements for implementation. Most development projects are in the construction phase. These include NT2, Nam Ngum 1 and Nan Lik 1-2 hydro-power companies; and Phu Bia and Sepon mining companies. All have their own fund stated clearly on the CA. However, only NT2 revenue is actually being implemented. The others are still in the process of being established.

International funding: REDD+ and PES are in the process of initiating funds to operate in Laos. PES are in the process of applying good practices from international experiences, particularly in the Nam Et, Phou Louy, Nam Ha and Nam Kading and Nam Poui protected areas. REDD+ is currently in a preparation/readiness phase, and is anticipated to begin implementation from 2010–2013.

Emerton and Lopaying (2011) describe the four types of funds in considerable detail and offer comment on their functionality. In particular, two funds—the Environmental Protection Fund (EPF) operated from within WREA and the Forestry and Forest Resources Development Fund (FRDF) under MAF—offer examples of how funds can be directed towards provision of ES. The following descriptions of the functions of EPF and FRDF are slightly edited extracts from the Emerton and Lopaying (2011) study.

Environmental Protection Fund

Objectives

EPF was established by Prime Ministerial Decree No. 38/PM, dated 21 February 2005, as a financially autonomous organisation to strengthen environmental protection, sustainable natural resources management, biodiversity conservation and community development in Laos. The idea of the fund took 7 years for translation into action with appropriate institutional and legal support.

Organisational structure

EPF consists of the Board of Directors and Executive Office. The board is chaired by the Deputy Prime Minister and vice-chaired by the Minister of MoF, and has seven members representing line ministries. The Executive Office consists of the Director and two executive assistants. The remaining personnel are technical administrative support staff. All the staff are hired from the market (i.e. they are non-government staff).

Sources of income

Under the EPF Decree, five main sources of income are defined for EPF: (i) national and international endowment funds; (ii) the national budget; (iii) contributions by development projects; (iv) contributions by business and the private sector; and (v) interest generated by EPF capital. Up to now, three of these five sources of income are being used. Another national budget (about US$2–3 million) has been requested from the government and it is under consideration by GoL. The other two remaining sources are barely being utilised (see Figure 3).

The income of EPF is derived from World Bank grants, an endowment fund capitalised by the Asian Development Bank (ADB), contributions from developers (particularly in the mining sector), a grant from the United Nations Educational, Scientific and Cultural Organization (UNESCO) and interest generated by its capital. Income sources are shown in Table 10.

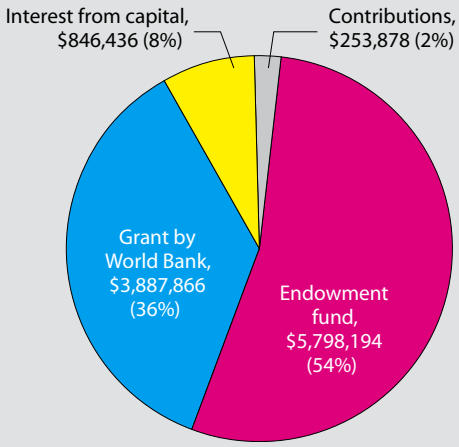

Figure 3. Environmental Protection Fund sources of income in 2011

Table 10. Environmental Protection Fund income 2006–2010

Source of income	US$	Kip (million)
Grant	7,023,000	56,184
World Bank	*7,000,000*	*56,000*
UNESCO[a]	*23,000*	*184*
Asian Development Bank endowment fund	5,798,194	46,386
Contributions from developers	265,878	2,127
Interest from the capital	896,756	7,174
Total	*13,983,828*	*111,871*

[a] United Nations Educational, Scientific and Cultural Organization
Note: US$1 = 8,000 kip

Scope of financing

EPF provides financing for environmental management according to three principles:

- grant
- loan with low interest for environmental management (wastewater treatment, recycling process etc.)
- co-finance with other donor agencies.

The scope of financing by EPF is based on the areas defined under the National Environment Strategy and Action Plan. These are supported via five 'windows':

- *Window 1: policy implementation and capacity enhancement*. The scope of this window covers five areas: (i) environmental and social monitoring and policy implementation support (safeguard monitoring support); (ii) integrated river basin management; (iii) hydro-power sector policy support; (iv) social safeguards management (resettlement policy support); and (v) environmental education and awareness.
- *Window 2: biodiversity and community investment.* This window supports two main activities: (i) community environment management and livelihood improvement; and (ii) protected area management.
- *Window 3: pollution control.* Three main activities are supported by this window: (i) solid waste management, including hazardous waste management; (ii) wastewater management; and (iii) pesticide control and awareness.
- *Window 4: water resources management.* The main activities are: (i) integrated river basin management; (ii) environmental stream management; and (iii) wetland management.
- *Window 5: sustainable land resources management.* The main activities are: (i) mitigation for bare land; (ii) mitigation for intensive land use; and (iii) mitigation of desert soil.

Since 2006, EPF has financed 202 subgrants, to a total value of US$5.74 million. Most grants were given under windows 1 and 2 as the 'Lao Environment and Social Project' (LEnS). LEnS is funded by the World Bank, and focuses on the three provinces that surround the NT2 dam (Bolikhamxay, Khammouane and Savannakhet). The remaining funds are spent across all parts of the country. Table 11 shows the grants made under EPF to date.

Funding flow

EPF has opened four accounts for its activities:

- saving account for the capital (endowment fund) to generate interest for EPF operation
- special account at the Bank of Laos for funds transferred from World Bank to EPF

Table 11. Subgrants by Environmental Protection Fund 'window'

Sources of income	No. of grants	Amount (US$)
Window 1: policy implementation and capacity enhancement	109	1,953,748
Window 2: biodiversity and community investment	54	3,376,092
Window 3: pollution control	30	229,932
Window 4: water resources management	4	103,545
Window 5: sustainable land resources management	5	81,537
Total	*202*	*5,744,854*

- current account for daily disbursement
- saving account for contribution by developers and other sources.

Funding inflows: The funds flowing to EPF do not go through the government budget line. Funds from international donors are transferred directly to the EPF account at the Bank of Laos, after it has gone through the relevant donor procedures. The funds are transferred through MoF. Other local sources of income are transferred directly to another EPF account at the Banque Pour Le Commerce Exterieur Lao. This is shown in Figure 4.

Funding outflows: All funds flow out directly from the EPF account to the subgrant account, either at national or local level, depending on the area where the subgrant is located. The funds are treated as an advance on a quarterly basis, and the advance for the next quarter is transferred once the preceding advance has been cleared.

All disbursements and clearances follow MoF financial procedures and audit requirements. Annual audits are carried out by an audit firm (for those activities funded by international donors) and the National Audit Authority (for those activities funded by GoL). Audits are conducted at the end of the financial year, during November.

Forestry and Forest Resource Development Fund

Background

FRDF is enabled in Law No. 02-03/NA, dated 6 May 2003, and in the Forestry Law No 01-96, dated 11 October 1996 (Article 47). It is established by the Prime Ministerial Decree No. 38/PM, dated 2 February 2005, and is operated by MAF. FRDF aims to finance forest activities such as protected areas management, protection forest management, plantation establishment, production forest management, water resources protection and environment management, biodiversity conservation, and policy implementation and dissemination pertaining to forestry and forest resources management.

Objectives of fund utilisation

The objections of the fund are:

- protection of protected areas and national biodiversity conservation areas
- plantation establishment, regeneration of forest, watershed management and environmental protection

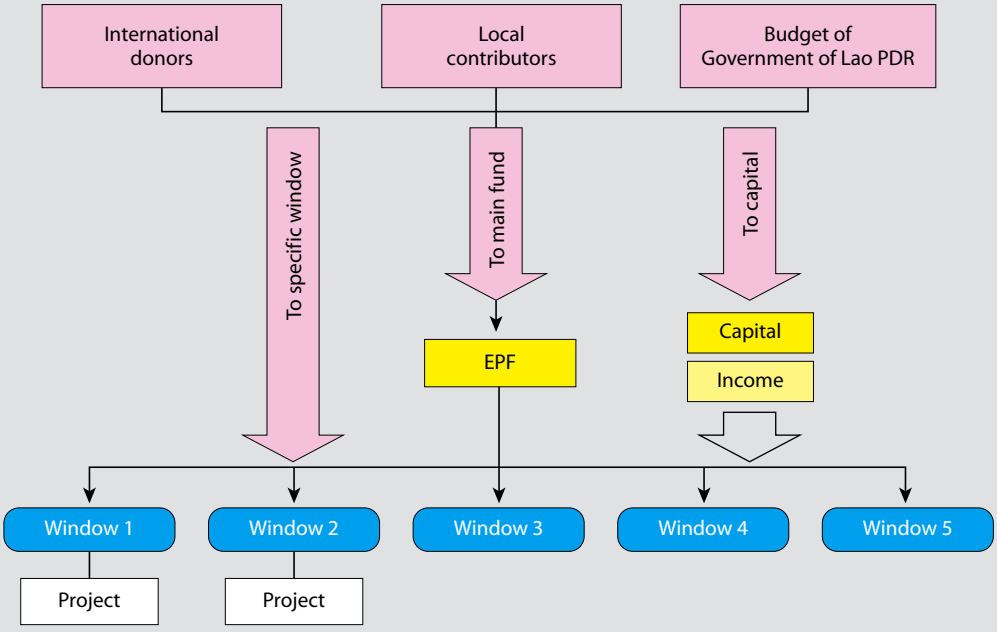

Figure 4. Environmental Protection Fund (EPF) funding inflow (see text for explanation)

- protection and propagation of plants, animals, wildlife fauna and flora (terrestrial and aquatic life) to ensure survival and increase the population of these species
- forest, forestland and forest resources inventory
- sustainable forest, forestland and forest resources management
- conduct of research and extension on forest activities
- dissemination of laws, rules and techniques related to forestry activities
- management of forest development fund activities
- granting of awards to individuals and organisations that have made outstanding achievement in protecting and regenerating forest and forest resources.

Organisational structure

FRDF consists of a Board of Directors and Executive Office. The board is a non-continuous authority, but organised within MAF. The Deputy Minister of MAF is the President; the General Director of the Department of Forestry is Vice-president; the General Director of Agriculture and Extension Service, MAF, is Vice-president and Chairperson of the Secretaries' Board; and four remaining members are General Directors representing MoF, WREA, PMO and the Department of Planning within MAF.

Sources of income

Sources of income for FRDF are:

- forest royalty fees for the use of forest, forest land and forest resources
- fees for timber and NTFPs harvested from plantations
- fees for forest and forest resources inventory and forest land
- contributions from national and international profit-orientated organisations involved in business activities in the forestry sector, including NTFPs and wildlife
- contributions from not-for-profit sources involved in the forestry sector, such as international agencies, national agencies, individuals, and private and public organisations
- other income, including interest from bank deposits and net returns from investments
- income consisting of a share of the money derived from competitive bidding for the sale of timber derived from production forests.

Additionally, Article 31 of the Decree on Protection Forest, signed on 19 July 2010, states clearly that all hydro-power developers and those who run ecotourism businesses have to contribute 1% of their annual revenue for protection forest management. Although implementation arrangements have not yet been designed, FRDF would be a potential operator of the funds described by the decree.

During the past 5 years, FRDF has gained funds from only one source (income consisting of a share of the money derived from competitive bidding for the sale of timber derived from production forests), to a total of 41 billion kip.

Scope of financing

The following activities were funded during the past 5 years:

- 'protection forest' protection and protected area management
- plantation establishment and establishment of forests for water sources and environmental protection
- biodiversity and species protection and conservation
- forest land and forest resources surveys
- sustainable management of forests, forest resources and forest lands
- forest scientific studies
- policy and regulation dissemination
- FRDF operation
- rewarding best practice in forest management and reforestation.

Funding flow

Funding inflows: Up to now, income has been derived from only one source by FRDF; that is, income from a share of the money derived from competitive bidding for the sale of timber from production forest. This income is collected through MoF and put into the national treasury as a part of national income.

Funding outflows: FDRF plans its annual budget as a category of the MAF annual budget and submits this to the government. The National Assembly approves the annual budget plan of the line ministries, covering the FRDF budget under MAF. Annual financial management reports are submitted to MoF for information. Audit takes place when necessary.

Unresolved issues

In discussing operational aspects of the management of incentive-based PES, interviews conducted in the course of this study with several senior officers from national and international agencies revealed a number of operational issues for supporting incentives for ES. Among the issues raised were those outlined below.

FRDF and EPF are two of several options that GoL may consider in disbursing funds relating to PES.

EPF has provided US$3.5 million over 5 years and is aiming to double the size of the fund to spend more than US$2 million/year. Management of EPF has considered a range of mechanisms for disbursing funds to benefit affected people; for example, the Theun Hinboun Hydro Project provides a contribution of US$200,000/year but requires that 50% of the funds be directed towards the benefit of communities in the project area.

There is concern within management of EPF about the competency and capacity of local agencies and communities to deliver results.

There is a strong need for national funding for management of National Biodiversity Conservation Areas (now called NPAs) and PES may be one solution. Some of the unresolved questions relate to clarifying who gets paid, what incentives are needed at the household level to encourage change, and what incentives are demonstrably effective.

The World Bank is encouraging adoption in Laos of PES, benefit sharing and related mechanisms through three initiatives:

- funding of LEnS which is complementary to NT2 activities and aims to strengthen GoL capacity. The project operates in Bolikhamxay, Khammouane and Savannakhet, and helps with the development and implementation of: (i) policy implementation and support (via the Environmental Impact Assessment (EIA) Decree which links to the new Environmental Protection Law); (ii) sustainable hydro-power policy; (iii) resettlement and compensation decrees; (iv) river basin development decrees; and (v) technical assistance to responsible agencies
- community investment for biodiversity conservation through provincial administrations, IUCN and WWF
- management of funds—support to EPF and capacity building. Funding has been provided through different 'windows', which allows discrete funding to appropriate agencies.

GoL is willing to examine alternative means of operational delivery. NTPC is a private Lao company operating under a CA. WMPA is a government agency specifically formed to look after the NT2 watershed for the term of the concession. The company owns the water in the watershed and will pay US$1 million annually (inflation-adjusted, currently $1.2 million) to WMPA to maintain water quality. Payments from NTPC are made directly from an NTPC account to WMPA—this was a condition of the World Bank. NTPC pays an annual dividend to GoL, which is a 25% shareholder, and this sum is in addition to royalty payments and is also separate from the US$1 million paid to WMPA. It is expected that returns from the project to GoL will exceed $2 billion over the next 25 years.

WMPA operations are guided by the Socio-Environmental Management Framework and Operation Plan (SEMFOP) which is the Master Plan for WMPA and describes what is to be measured and how it will be measured. It is consistent with GoL policies and provincial and district objectives. The work plans include the four goals of MAF: (i) food security; (ii) commodity production; (iii) stabilisation of shifting agriculture; and (iv) sustainable forest management. They also include the 13 measures in the MAF Action Plan. The Khammouane Provincial Administration Authority plays a critical role in the management and operations of WMPA.

There is a need for all staff to have access to the guidelines which govern their operational practices. SEMFOP and the CA are both substantial multi-volume English-language documents written in turgid legal and administrative style (only a 43-page summary of SEMFOP is available in Lao language). The new SEMFOP (due in 2011) will be in both Lao and English but the CA remains the province of the educated few who understand such writings.

A current serious issue is the conflicting priorities between stakeholders: for example, whether trees will be planted close to market, as required by the investor, or where they will provide the most environmental benefits.

MRC concentrates on the Mekong mainstream, but is keen to assist via design guidelines and assessment tools. MRC sees PES as an investment in the maintenance of watershed quality through control of sedimentation. It is necessary to distinguish between PES and compensation to rectify environmental and social damage caused by a development.

MRC is concerned about what happens if the promised ES are not delivered. In the case of NT2, GoL takes control after 25 years of operation—therefore, it is in its best interest to see that sedimentation does not take place. The NT2 operation is well regarded by MRC, and the Theun Hinboun Hydro Project has been well planned.

Prospects for incentive-based mechanisms

Government commitment

The policy environment within GoL appears to be ready for action aimed towards rewarding landholders for ES, judging by:

- policymakers recognising the attraction of rewarding landholders for ES they may provide
- roles and responsibilities outlined in the Forestry Law, Water Resources Law and Environmental Protection Law and emerging amendments therein
- maintenance of environmental values is an important consideration in issuing CAs with project developers for mines, dams for hydro-power and commercial plantations
- project developers are willing to make payments to maintain ES (for example, NTPC US$1.2 million/year, Phu Bia Mining about US$120,000 in 2010)
- money, and the developers and the people demanding the ES, are not a problem.

In addition:

- while there are agencies and people with skills and commitment in the incentives for ES sector—the National Agriculture and Forestry Research Institute (NAFRI), NUoL, MRC, DoF, WREA and others—some capacity building will certainly be required
- any Lao initiative will be uniquely Lao—it is unlikely that programs from other countries could be transported to Laos.

However:

- despite several laws, there is no legislative framework that *specifically* recognises rewards and/or compensation for the provision of ES and allocates responsibility
- as a result, there is no regulatory and operational framework and no agreed means for payments to be made
- a project-based policy approach has developed because of this, and different approaches have evolved: such as EPF (from a non-GoL budget line) and FRDF (GoL budget line)
- there is a great need for national consistency across the GoL institutional framework to ensure that a common approach is adopted
- the active engagement of MoF is essential.

Research topics that will elucidate some of these impediments, and possible methods to overcome them, are discussed later in this report.

Stenhouse and Bojö (2011) found that GoL has shown strong interest in PES, and there has been much discussion of this concept among the government, donor agencies and NGOs in workshops, working groups and meetings: PES is being championed by high-level staff in WREA, NLMA and DoF. During interviews with senior government officers, the levels of government commitment were discussed and two additional and important points were made:

1. GoL understands and appreciates the theory and the practical rationale for PES and other incentives for provision of ES and does not need to be convinced on this point. It is a current issue within government, but GoL wants concrete advice and guidance of how this can be put into practice within the Lao context, reflecting the GoL commitment to poverty alleviation.
2. Any research and development (R&D) supported by ACIAR should involve forest managers and have outcomes of use to broader forest management in Laos. There is some concern about a 'culture gap' developing between NAFRI, NUoL and DoF.

Challenges in sourcing and managing funds

The major sources of funds have been described earlier in this report. Considerations in managing these funds include the following:

1. Currently there is a major focus on hydropower, which raises potential conflicts between independent science and advocacy. The Theun Hinboun Expansion Project (THXP), which is

an investment between Electricite du Lao and Norwegian interests, works closely with the CGIAR Challenge Program on Food and Water. THXP has a commitment to local people and a strong interest in catchment management (with the key variable being sedimentation) and improving livelihoods of relocated people.

2. Emerging Lao interest in RBOs has been encouraged through the 2010 Decision on Establishment and Activities of River Basin Committee (Prime Ministerial Decree No. 293/PM of 15 June 2010) and PES will be important in financing the management of these. A key policy question for GoL is to determine how much power or authority to give the RBO.
3. The first RBO is the Nam Ngum and the second (in preparation) is the Nam Theun/Hinboun. These offer new political opportunities at the provincial level, but it is necessary to get the Ministry of Energy and Mines, MAF, MoF and other relevant agencies to cooperate to make joint and binding decisions at the provincial level.
4. Royalties from hydro-power projects can vary from project to project and are finally negotiated in the CA. They may be as low as 5% for some hydro-power investments. Some companies are reluctant to contribute as they already contribute to clinics, roads, schools etc. and feel that they can deliver more effectively than GoL where leakage might occur. It is unclear how royalties are divided between sectors—health, education and others—and it is very important to ensure that there is a mechanism to directly benefit affected communities.
5. Major challenges are a weak regulatory framework and a judicial system that is over-extended and not well resourced. There is little regulatory experience and capacity within institutions to develop and execute prosecutions. A recurring theme in discussions was the need to help WREA strengthen its capacity to address these issues, although this is not an issue relevant to the ACIAR mandate.
6. MoF—there is an uncomfortable balance between agencies, which need flexibility to deliver benefits to those offering ES, the development projects that provide the funds and MoF, which is responsible for allocating government funds according to agreed priorities.

Determining the amounts of funds

Many PES schemes involve governments establishing policies that act to transform unrealised public good demand for ES into real payments. These policies can take the form of allocating consolidated revenue specifically to PES expenditure, or regulations requiring various entities within society to make prescribed payments into a PES scheme. The latter may involve, for instance, a levy on development activities, an offset funding requirement or a tax on users of resources (energy, water supply, timber, fish etc.).

In all cases, a key element of the policy is the determination of the amount of funding to be allocated to the PES. Conceptually, the amount to be allocated should be that which maximises the wellbeing of people in society. This is achieved by continuing to allocate funds until the extra benefits from the ES produced are equal to the extra costs of the production activities. This concept is premised by the notion that as more ES are produced, the amount that society benefits from additional units of ES falls. It is fundamentally a concept that involves a comparison of benefits against costs.

Implementing the concept is complex in the case of ES because of the challenges of estimating the extent of society's benefits from improved environmental conditions. Because these services are generally not bought and sold in markets (they are public goods) their value cannot be assessed using market data. Comparing them to market costs is thus difficult.

One approach to this issue is to rely on political processes to establish the appropriate level of funding. PES schemes then have the task of distributing the so-decided amount. Policymakers, however, face difficulties in approaching this task. There is little information to guide their determinations. First, there is the need to know how effective actions will be in achieving the production of ES. Second, the value that the community places on those outcomes must be appreciated. Policymakers also face the prospect of having various vested interest groups trying to persuade them of the merits of their particular desired outcome. The danger is that policymakers will make funding choices that favour the most influential interest group rather than the community at large.

To assist the decision-making process, two information sets would be useful. First, an assessment of the 'productivity' of alternative means of generating ES would enable decision-makers to assess how useful different supply approaches will be. In other words,

understanding the biophysical 'cause–effect' relationship between management actions (such as tree planting) and ES outcome (such as sediment load in a stream) is the first step. This assessment requires the definition of what ES are required, and then the inputs of biophysical scientists who are able to predict the ES outcomes arising from a range of alternative supply activities. Hence, for catchment PES, scientists would need, for example, to predict water quality and biodiversity outcomes resulting from planting varying tree types in differing locations throughout the catchment.

The second information set includes estimates of society's values for the ES outcomes. Economists have developed a range of revealed and stated preference techniques to estimate these non-market environmental values in monetary terms so that they can be compared against the costs of alternative schemes. Hence, the assessment task is to estimate social values for improved water quality and biodiversity enhancements. Water-quality improvements may be estimated with reference to the savings in maintenance costs of hydro-electricity generating turbines. Biodiversity enhancements may be estimated using surveys of people in cities and tourists who have a willingness to pay to see species protected.

Together, the productivity and valuation information sets allow a more informed consideration of the additional benefits an ES project is likely to generate. That type of information is more useful to the weighing up of costs against benefits than a purely politically driven decision. It also provides a 'safety valve' against potentially corrupt decisions that are taken to further the interests of specific lobby groups.

Prioritising payments

Once the overall level of funding for a PES scheme has been determined, the distribution of those funds to the potential specific suppliers of the ES has to be carried out. The goal of a PES scheme is to make sure that funds are allocated efficiently. That means selecting suppliers who can deliver the greatest net benefit to society.

In many PES schemes, the task of selecting suppliers is based on an assessment of the supply being offered against the cost being requested. One approach is to select a 'metric' for the ES being produced—a water quality index, for example—or the metric may involve an input into the production process—the number of trees planted, for example. Input metrics are less desirable because they do not convey information about the 'productivity' of the input; for instance, it may be the case that an input in a particular circumstance has no impact on the desired outcome. Where multiple outcomes are being sought (water quality and biodiversity, for example) a complexity of the metric is how to combine the different and sometimes conflicting goals into a single index. Multi-criteria analysis approaches to this task (such as are used in the USA's Conservation Reserve Program and the Victorian (Australian) BushTender schemes) are generally flawed because of the weighting system applied to the combination of goals and problems in selecting which goals to include in the index. These flaws open the schemes to manipulation by vested interest groups.

Once the metric performance has been established (generally using scientific analysis of 'productivity factors'), proposals can be ranked on a 'cost per metric unit' basis, using the amounts required by suppliers as the cost amounts. Supply proposals are then selected from best performing downwards until the allocated PES fund has been exhausted. Advanced PES mechanisms include performance 'premiums' being estimated for bids that deliver greater benefits because they are associated with complementary neighbouring bids.

Contracting arrangements need to ensure that both conditionality and additionality are achieved. Monitoring and performance-based payments are important follow-on activities.

The ACIAR-funded project 'Improving the efficiency of land use change policy in China' (ACIAR/ADP/2007/055) developed a methodology to overcome the difficulties associated with metric construction using multi-criteria analysis by developing specific benefit:cost ratios for each supply proposal. This required the construction of a purpose-built 'productivity' model to estimate the outcomes of each proposal in terms of three specific outcomes: air quality, water quality and biodiversity. This model took into account variations in actions taken (tree species, planting density etc.) as well as ecological conditions (slope, soil type etc). The outcomes so predicted were then combined into an estimate of social benefit generated using per-unit social values (monetary estimates) for each of the three outcomes. This process allowed each proposal to have an estimated monetary benefit of the actions proposed. The ratio of this benefit to the proposal cost (as specified in each bid) was used as the basis for proposal ranking. A higher benefit:cost ratio indicated that the proposal was worth more to society and should have funding priority. Allocation then progresses down the ranking until funds are exhausted.

Value chains for plantation-grown timber

Assembling furniture made from plantation teak at the Burapha Agroforestry Co. Ltd factory, Vientiane, Lao PDR (Photo: Tony Bartlett)

Background to Lao plantation forestry and wood processing

Administrative context

The Government of Lao PDR (GoL) has firm policies that are clearly directed towards economic growth and poverty alleviation and has recognised the plantation sector as one of the highest priorities leading towards economic growth and increased revenues in rural areas (MAF 2010). There is a strong and attractive logic for Lao PDR to expand its plantation sector—the global markets for wood fibre, rubber and solid wood are strong (particularly in the region); population densities are low; there are significant areas of degraded and under-utilised forest land and the bio-climatic conditions suit the suite of plantation species of main commercial interest to an expanded plantations sector—rubber, eucalypts, acacias and teak. These all grow well on appropriate sites, providing adequate silvicultural and management inputs are made (Midgley 2006).

GoL has an ambitious target of achieving a total of 500,000 ha of tree plantations, and 70% (natural and planted) forest cover, by 2020. To encourage achievement of these targets, GoL provides incentives, including allocation or lease of land for tree planting, property rights on planted trees, land tax exemption for registered plantations and free distribution of seedlings to farmers and organisations. A reforestation fee levied on logs and non-timber forest products (NTFPs) harvested from natural forests is also used in nursery construction, seedling production and plantation development. Households contribute to the national resource of wood through smallholder blocks of trees or planting of scattered fruit and other trees on their land.

The Forestry Strategy (DoF 2006) offers a history and context for the plantation sector in Laos. Tree planting has been a national priority since liberation. In 1979, Prime Ministerial Provision No. 74 promoted tree planting on bare land and, in 1980, 1 June was designated National Tree Planting Day. Under the current National Socio-Economic Development Plan, tree planting for commodity production is encouraged. Besides the Forestry Law, Ministry of Agriculture and Forestry (MAF) Regulations No. 196/2000 on Tree Plantation Development and No. 1849/2000 on Tree Plantation Registration, and the annual Prime Ministerial Orders regulating forestry activities (PMO 11/99, PMO 10/2000, PMO 15/01 and PMO 18/02), provide important regulatory support for tree planting.

Plantations are recognised and supported in the current draft Agricultural Master Plan (MAF 2010) which acknowledges that there are some issues to address:

- selection of appropriate tree species
- inadequate tree-growing technology
- seed and seedling quality is low, with no reliable certification
- improving productivity and profitability of plantations
- the legal and regulatory framework is unclear.

MAF (2010) estimates that some 146,600 ha of tree plantations have been established in Laos, mostly in the central region. It is estimated that about 66% have survived. Individual farmers and investors contribute the largest area to national total planted area (47.5%), with an average planted area of between 20 and 30 ha.

Plantation species and their commercial use

Plantations and planted trees have the capacity to provide significant financial benefits to Laos. Assuming that current plantation proposals for Laos are realised (see below), there will be some 300,000 ha of rubber, 167,000 ha of eucalypts and acacias, and about 28,000 ha of smallholder teak established in Laos by 2020. Assuming modest growth rates for rubber (47 m^3/ha solid wood recovery at year 30), 20 m^3/ha/year for eucalypts and acacias and

10 m³/ha/year for teak, this resource will provide a base for sustainable industries based upon plantation-grown wood. The plantation resource could have an annual farm-gate value of US$197 million at full production and will offer further value through primary and secondary processing. For example, Vietnam's industrial plantation resource of 1.1 million ha of eucalypts and acacias provides the foundation for a woodchip export market worth an estimated US$500 million/year and contributes substantially to wood furniture exports worth US$3.9 billion (Griffin et al. 2011). In 2009, Malaysia's exports of processed rubberwood approached US$1.2 billion and Thailand's rubberwood exports were greater than US$2.1 billion.

The Lao resource of planted trees not in plantations has not been quantified but the common sight of planted trees around farm boundaries, in homesteads and around villages and roadsides suggests that this resource is significant. It includes the major plantation species and other species such as jackfruit and mango that are now becoming popular parts of the international furniture markets. Export data (Table 2) suggest that jackfruit wood is now being exported from the southern province of Champassak.

Rubberwood

Rubberwood has gained an important global niche for use in indoor furniture and household utensils and, in some countries, as medium-density fibre board (MDF). Its success and attraction lies in its ready availability, uniform wood qualities, attractive cost and supporting technologies**.** The global rubberwood industry is modern and sophisticated and is worth an estimated US$8 billion annually. Indonesia, Thailand and Malaysia are the world's three largest growers of rubber, and account for two-thirds of the global area planted. Rubberwood has become a major timber species in the Association of Southeast Asian Nations (ASEAN) region.

Laos is currently experiencing a rapid expansion of rubber cultivation, a large proportion of which is financed from foreign sources, mainly China and Vietnam with a lesser amount from Thailand. Douangsavanh et al. (2008) reported an estate of 28,000 ha in 2006 across 15 provinces and estimated that this would reach 184,000 ha by 2010, and Hicks et al. (2009) predicted 300,000 ha by 2020. Some current estimates suggest that the area planted to rubber now totals 227,000 ha (National Agriculture and Forestry Research Institute (NAFRI), pers. comm.). On the assumption that rubber is managed for latex for 30 years and that 47 m³ of wood per ha can be harvested at rotation's end, the rubber estate represents a potential future wood resource of over 470,000 m³ annually.

Eucalypts and acacias

Eucalypts have been planted in Laos for over 50 years and a great deal of scientific effort has gone into identifying species, provenances and hybrids that suit the variety of growing conditions in the country. The main species are *Eucalyptus tereticornis* and *E. camaldulensis*, and hybrids with other species such as *E. urophylla*, *E. grandis* and *E. pellita*. The success of hybrids (particularly K7, a Thai hybrid between *E. camaldulensis* and *E. deglupta*) developed in programs in Vietnam, China and Thailand demonstrates the need for regional networks when dealing with eucalypts.

Tropical acacias can also grow well in Laos. *Acacia mangium* has demonstrated good growth rates over a variety of sites but has struggled with poor site preparation, weed competition and poor nutrition. Recent commercial trials of *A. crassicarpa* and the *A. mangium* × *A. auriculiformis* hybrids developed by the Forest Science Institute of Vietnam demonstrate the potential of these species, which have become well established and productive in other parts of South-East Asia.

Commercial plantations of eucalypts and acacias are grown typically on 7-year rotations. A number of commercial investments in forest plantations using eucalypts and/or acacias have begun:

- Lao Plantation Forestry Ltd, a company jointly owned by Oji Paper of Japan (85%) and GoL (15%), has a Concession Agreement (CA) to establish 50,000 ha of plantations and has established 25,000 ha. The company has an active smallholder component through which 5,000 farmers in Bolikhamxay have planted 3,000 ha.
- Oji Paper (South)—Oji is seeking to expand its interests in Laos and has commenced another solely owned plantation project totalling 25,000 ha in the southern provinces of Xekong and Attapeu.
- Birla Laos is a subsidiary of the Indian conglomerate Aditya Birla, a large and diverse company with business interests in many industrial sectors. The Birla Laos project proposes to establish 50,000 ha of *E. camaldulensis* and eucalypt hybrids. The wood will be directed to its proposed dissolving pulp mill which will be established on the Xe Bangfi River in northern Savannakhet province.
- Stora Enso (Laos), a subsidiary of the Swedish/Finnish pulp and paper company Stora Enso Oy,

is well advanced in the process of completing a 2,000 ha feasibility program for establishment of 35,000 ha of plantations (with an associated out-grower scheme) in five eastern districts of Savannakhet and Saravane provinces.

In addition to these ongoing operations, there are prospective plantation investments from the Chinese companies Sun Paper and Asia Pulp and Paper in Saravane and Savannakhet provinces, plus many smallholder plantings.

Productivity of existing eucalypt and acacia plantations in Laos has been disappointing and much below that experienced in China, Thailand or Vietnam. A 2002 survey of *E. camaldulensis* plantations in Vientiane and Savannakhet provinces estimated average mean annual increment at 6.2 m^3/ha. Commercial firms and self-financing planters consistently performed better, with growth rates of 12–14 m^3/ha/year. The commercial growers listed above have been able to achieve high levels of production through use of best germplasm, weed control, fertiliser application and improved silvicultural practice.

Although eucalypts and acacias have been planted and used in Laos since the 1970s, most commercially mature wood has been harvested and there have been delays in replanting, with the consequence that much of the current estate has not reached commercial maturity. With the exception of Birla Laos, which has a clear plan to establish a dissolving pulp mill, most proponents of commercial plantations maintain options to either process or partially process wood in Laos or to export to wood-fibre industries in Thailand, Vietnam or China. Before these commercial plantations reach a scale able to support commercial wood-fibre operations, a substantial amount of wood will be available for MDF and/or solid wood applications, including construction poles and scaffolding, outdoor furniture, flooring and veneers. In southern China, small eucalypt logs, harvested after 4 years, are processed into rotary veneers and used profitably by the plywood industry. Such utilisation using inexpensive technologies offers potential for the Lao eucalypt resource.

Teak

Recognising the value of teak and the limitations of supply from native forests, teak plantations were initiated in Laos in 1942. In response to strong and sustained market demand for teak timber and to perceptions of future wood shortages, the government has encouraged landowners to establish smallholder plantings of teak for over 30 years. A large proportion of the current teak plantation estate was established and is being managed by many private, small-scale owners and for this reason accurate estimates of areas are difficult to make. The total area of teak plantations in Laos is in excess of 28,000 ha. Luang Prabang province has the greatest concentration of teak plantations in the country—an estimated 26,500 ha—of which 98% belong to farmers and the private sector (Provincial Agriculture and Forestry Office, pers. comm. 2011). Much of this resource is confined to areas close to road or river access because of transport needs for logs or future sale of plantations.

Teak plantations are usually established in association with swidden agriculture, in what is often known as the 'taungya' system. Trees are interplanted for 3 years with agricultural crops such as upland rice, sesame and pineapples; this process offers adequate weed control and protection during the early years of establishment.

Harvesting of teak generally begins after 12 years, with trees reaching a merchantable size of 15 cm diameter breast height (dbh). Most growers coordinate harvest with household needs for finance. Harvest levels of teak are steadily increasing as the resource matures. In 2006, it was estimated that over 7,000 m^3 of plantation-grown teak were harvested in Luang Prabang province, in 2010, 20,000 m^3 (Sawathvong 2010), and it is predicted that in 2012 this will rise to 40,000 m^3. Such a resource of high value, smallholder-grown, plantation-grown tropical hardwood clearly offers attractive investment possibilities for processing locally rather than its dispatch as low-value 'squared' logs to Vientiane or export to other countries (Midgley et al. 2006).

Other species

Among the other species that have been used for commercial plantations in Laos is agarwood, the 'Wood of the Gods' (*Aquilaria crassna*, locally known as *maiketsana*, *mai dam* or *mai hom*). This is a resinous wood used as incense, for medicinal purposes and for perfumery. The increasing rarity and continued high demand and value of agarwood has led to a marked increase in interest in plantation establishment, particularly in the southern Bolevens area of southern Laos. Some of these plantations have been financed via public investment and managed to meet prospectus demand. By the end of 2005, there were an estimated 4,418 ha planted in Laos as the Lao Plantation and Cash Crop Business Association

estimated that 20 million trees had been planted (Midgley 2006). It is unlikely that this resource will be directed towards the traditional wood-processing industries.

Other commonly planted trees for which there has emerged a regional demand for furniture wood include mango (*Mangifera* spp.) and jackfruit (*Artocarpus* spp.). These trees are commonly planted in gardens and are harvested opportunistically at maturity.

International influences

The Lao wood-products industry was introduced in the first section of this report. Both forestry and wood processing are being influenced by increased world demand for wood products, and global markets which have become increasingly sensitive to timber sourced illegally or unsustainably. The large markets of North America and Europe (and Australia) have responded legislatively.

The Lacey Act (United States of America)

The conservation law known as the Lacey Act was extended in 2008 to include timber and provided the USA with an effective means of encouraging the timber industry to exercise 'due care' and preventing imports of illegal timber. All wood imports into the USA now require documentation showing that the wood has been legally sourced.

The Illegal Timber Law (European Union)

The Illegal Timber Law (ITL) of the European Union (EU) will become effective at the beginning of 2013. This law provides a general 'prohibition' against the 'placing on the EU market of illegally harvested timber or timber products derived from such timber'. The process leading to this law, Forest Law Enforcement Governance and Trade (FLEGT), has been part of the EU's policy response to combat illegal logging and associated trade. This is an overarching effort to prohibit placing of illegal timber and timber products on the internal European market, both for conservation reasons and to protect European timber producers from 'unfair' competition.

Australian legislation to control imports of illegal timber products

The Illegal Logging Prohibition Bill 2011 is, at the time of writing, before the Australian Senate. The legislation recognises that illegal logging is a major problem for many developing nations. It contributes to forest degradation, loss of habitat and biodiversity, threatens sustainable livelihoods and contributes to global carbon emissions. The legislation aims to prevent the importation of illegal forest products into Australia, and to encourage the production and use of forest products sourced using sustainable forest-management principles.

The legislation will aid in the removal of unfair competition to the Australian timber industry from illegally logged timber products. Australia will join the USA and members of the EU as nations actively working to eradicate illegal logging. The Bill provides for the development of regulations to prescribe due diligence requirements and timber products to be regulated. These elements will be developed in consultation with stakeholders and will commence 2 years after the proposed legislation passes the Parliament. The Bill also establishes offences and penalties, including up to 5 years imprisonment for importing illegal timber products, as well as a comprehensive monitoring and enforcement regime (DAFF 2012).

Certification

Along with legislative means to encourage trade in legally sourced timber, global markets are seeking to encourage sustainable management of forests and limit irresponsible or illegal management, by the adoption of one of two major international certification systems operated by the Programme for the Endorsement of Forest Certification, the world's largest forest certification system, and the Forest Stewardship Council (FSC).

Requirements for certification in the tropical hardwood sector are currently being driven by corporate social responsibility policies of larger retailers and manufacturers and are expected to receive a major boost with introduction of the ITL. Large house-builders, retailers, the public sector and merchant customers all demand chain-of-custody (CoC) certification for most products and there is a widespread expectation in Europe that demand for certified tropical wood will pick up strongly over the next 2 years as the EU moves towards full implementation of the ITL (ITTO 2011).

Global companies operating in Laos, such as Stora Enso and Oji, recognise the benefits associated with certification and wish to gain FSC certification for their plantations in Laos. Group certification, via FSC, has been achieved for a small proportion of

the Luang Prabang teak resource. Among the challenges for certification is the need to accommodate the small and legal processors. However, small, legal enterprises registered for business, using legally grown plantation wood, cannot meet the current guidelines for FSC/CoC supply chains and are effectively excluded from these processes. There have been suggestions that other systems might be suitable for small sawmills, such as Verification of Legal Compliance or Verification of Legal Origin.

Recognising the challenges GoL faces to address these international influences, the World Wide Fund for Nature's (WWF's) Global Forest and Trade Network and The Forest Trust (TFT) initiated the Lao Forest and Trade Platform in 2009. This is a collaborative partnership in Laos aiming to strengthen responsible forestry practices and encourage trade links between companies committed to achieving and supporting responsible forestry. The initiative is supported by the Swiss State Secretariat for Economic Affairs and United States Agency for International Development (USAID) through the Responsible Asia Forestry and Trade program.

A report recently published in the annual *Tropical Timber Supplement* published by the *Timber Trades Journal* (quoted in ITTO 2011) noted that the continuing willingness of European manufacturers and retailers to pay premium prices for certified tropical wood will be challenged by the lack of willingness by final consumers to pay extra for certified wood. This leads to questions regarding payment for the substantial costs that underpin certification. If final consumers in the EU are satisfied with wood which meets the requirements of the new ITL, will there be a market demand for more-expensive certified wood?

Regional demand and industries

The Lao forestry and the wood-products industry is strongly influenced by the vibrant wood industries of its neighbours, particularly China and Vietnam, which are major importers of Lao logs, timber and wood products, and both have substantial export-orientated wood industries. China is the world's largest importer of logs and timber, in 2009 importing over 184 million m^3 roundwood equivalent (RWE). Timber trade between China and ASEAN countries reached US$10 billion in 2010 (International Wood Markets Group 2010). China is now the world's largest exporter of processed forest products, with exports totalling US$49 billion in 2010 (International Wood Markets Group Inc. 2011). Of this, US$10.5 billion was for wooden furniture. Vietnam exported over US$3.2 billion worth of furniture in 2010 (Vietnews 2010) and an estimated 80% of this was based upon imported logs and timber.

China will expand its capacity to influence the Lao wood industries with the opening of the proposed Chinese railway, Boten–Luang Prabang–Vientiane, in 2015. This railway will offer more efficient and cheaper means of log and product transport to Vientiane and to established industries in China. Other planned improvements to regional transport infrastructure will also offer opportunities for export of logs and wood products; providing both an opportunity and a threat to the established industries in Laos.

The sophisticated furniture industries in China and Vietnam present challenges and questions for the industry in Laos. What role should the Lao industry play? Should it compete with, or complement, the wood industries in neighbouring industries? Can the industry match the scale, quality, efficiency and price of the industry in China and Vietnam? Does it make better business sense to simply supply raw materials and semi-finished products to these neighbouring markets? Processors in Laos believe that they have two main advantages over their counterparts in Vietnam and China: they are closer to the resource and electricity is both cheaper and more reliable in Laos. This observation suggests that kiln-dried, rough-sawn lumber may be produced more efficiently in Laos than in neighbouring countries, if the costs and quality of the labour force and the technologies are comparable.

The domestic market

Timbers from planted trees have become an important part of the domestic wood markets in Laos as the availability of hardwoods from natural forests decreases and their prices increase. Laos is experiencing a boom in construction and there is an increased use of teak and eucalypts for inexpensive furniture, panelling and doors. This is strongly evident in cities such as Vientiane and Luang Prabang. In addition, wood from planted trees, particularly teak, has become the utility timber of choice in most lowland villages, where it is used for furniture and construction. With several restrictions now placed on wood from natural forests, it is inevitable that domestic demand for wood from planted trees, which

faces fewer restrictions, will increase. Restrictions on transporting wood between districts and between provinces will need to be reviewed and relaxed if growers are to make the best use of market opportunities for their planted trees. Provision of appropriate, small-scale harvesting and processing technologies for utilisation of planted trees is necessary if village communities are to make best use of the resource of planted trees. Many of the village craftsmen who are equipped and experienced in using natural forest hardwoods are unaware of the features and processing requirements of planted wood.

The wood-processing value chain

Value-chain concepts

Kaplinsky and Morris (2002) offer the following description of the value chain:

> The value chain describes the full range of activities which are required to bring a product or service from conception, through the different phases of production (involving a combination of physical transformation and the input of various producer services), delivery to final consumers, and final disposal after use.

Eddah and Franzel (2010) suggest a value-chain assessment that looks at the complex range of activities implemented by various actors from the raw material to the retailing of the final product. It starts with the production system of the raw materials used to make a product and includes linkages with other enterprises engaged in trading, assembling, processing and providing business-development services, among others. It not only looks at activities implemented by a single enterprise but also includes all backward and forward linkages, up to the level at which the raw material produced is linked to the final consumer. Value-chain analysis has emerged since 1990s as a novel approach for understanding how power and benefits are incorporated in and distributed to various actors along commodity chains. The value chain connects tree growers in rural Lao PDR with processors and furniture producers based in Luang Prabang, Vientiane and elsewhere, and exporters to overseas markets. Efficiency in the value chain may be measured in terms of time, money, quantity and quality and include non-tangible factors such as convenience, reliability and responsiveness; commonly, 'efficiency' will refer to a combination of two or more of these factors. Inefficiencies that inevitably exist within the value chain may result in mismanagement of plantations, poor incentives for wood producers and misuse of timber resources.

In interpreting issues along the value chain for plantation-grown timbers, it is understood that the free-on-board (FOB) export price for product ultimately determines how much the processor or trader can pay the grower for trees in the plantation. Growing costs of the trees will have little influence upon prices received. Market prices for furniture determine the prices for the manufacturer, which determine the amount paid for sawn-wood inputs and the payments for logs made to traders and growers. Policies of GoL seek to improve the returns for logs grown by plantation growers. This can obviously be done through growing higher quality logs that offer better product value recovery. However, an examination of Mohn's (2009) value chain for plantation timbers (Figure 5) suggests other means through which prices for logs from smallholder growers may be improved, including:

- increasing final export price
- decreasing processing costs
- decreasing taxes and other imposts
- reducing harvest and transport costs.

Most Lao processors of plantation timbers are making the transition from wood from natural forests. This transition process has presented some cultural challenges as millers move away from a resource which is understood and where the procedures are well known, to a situation where supply can be sporadic, bureaucratic processes unclear and the resource presents technical challenges.

Mohns' (2009) map of the value chain for plantation teak in northern Laos (Figure 5) covers the entire system from the forest to exported product at competitive world market prices and is instructive for its application to other plantation species as these resources mature.

The Luang Prabang Teak Program (LPTP), an initiative of the Luang Prabang Provincial Agriculture and Forestry Office with management support from TFT through its partnership with WWF in the Lao Forest and Trade Platform, has recognised the challenges raised by Mohn's study. Several other supporters have contributed to the operations of LPTP, including:

- USAID, through its Responsible Asia Forestry and Trade program, has provided funds for general support

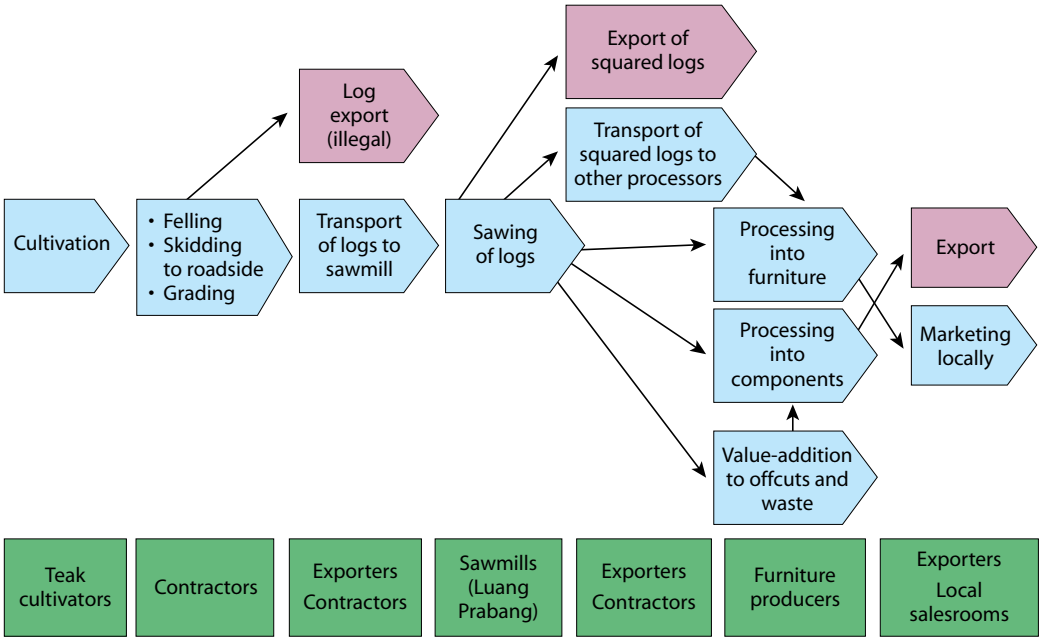

Figure 5. A value chain for plantation teak furniture in Lao PDR (Source: Mohns 2009)

- the Forestry Strategy 2020 Implementation Promotion Project, funded jointly by the Japan International Cooperation Agency (JICA) and the Swedish International Development Cooperation Agency (SIDA), supported a study tour for growers and a pilot land-use planning exercise
- Foundation Ensemble (a French agency) has provided funds for general support
- a number of contributions have been made towards operational expenses through philanthropic donations and commercial contributions through TFT
- the German organisation DGRV[5] has provided training for LPTP and teak growers in business principles
- The Burapha Agroforestry Company has provided on-site training and advice in harvesting, transport and marketing.

Cultivation of trees by farmers

Most tree growers in Laos seek a prompt return from their plantation investment and are readily persuaded to cut trees prematurely if markets exist, despite additional benefits accruing if trees are allowed to grow longer. Cultivation practices should produce trees that offer greatest attraction in the market. Trees are cultivated in a number of ways in Laos: in conventional plantations, in agroforestry systems and as individual trees around farm boundaries and in homesteads.

Conventional plantations and smallholdings

Conventional plantations and smallholdings are established to produce a particular product or to meet a particular purpose. Both companies and smallholder farmers share common challenges in plantation silviculture. Under Lao conditions, these plantings must be integrated with the local communities and local land use and face several technical challenges, as outlined below.

[5] The German Cooperative and Raiffeisen Confederation (Deutscher Genossenschafts- und Raiffeisenverband – Ev DGRV) is the national apex organisation and top-level auditing confederation of the German cooperative sector. About 5,300 primary cooperatives are part of the German cooperative system in all economic sectors (agriculture, banking, small-scale industry commodities, buying and marketing groups and services). In addition, DGRV has been involved in cooperative development activities worldwide for over 20 years. Since 2004, DGRV has carried out a regional program in South-East Asia to support cooperative systems as a contribution to poverty alleviation.

Seasonal moisture stress

Despite good annual rainfall, on most sites this is seasonal and the dry-season moisture stress limits growth. This influences species choice, management techniques and planting times to moderate the dry-season stress.

Soils and nutrition

Basic information on soils and nutrition is lacking in most cases. Site preparation methods are variable and there is little knowledge on maintenance of soil fertility and best fertiliser application. Growers may avoid fertiliser application or arbitrarily apply fertiliser of a quality and in quantities governed by budgets, not by the needs of the tree.

Weed control

Effective weed competition is essential for successful plantation establishment. Although mechanical control of weeds is commonly practised (through slashing or ploughing between rows), there has been a popular reluctance to use even the most benign herbicides such as 'Roundup'. While conventional plantation establishment areas have been small, weed control has remained a manageable issue, especially when intercropping approaches have been developed. However, weed control will become a more significant issue in the future when greater areas of plantations are established and labour availability becomes limiting.

Appropriate germplasm

Selection of appropriate and robust germplasm for all tree-planting systems is a priority. Despite availability of improved teak germplasm from government authorities, this is not being widely used by growers. It is unfortunate that, despite many years of species–provenance research work in Laos, a large proportion of current commercial plantings of eucalypts are of a single *Eucalyptus deglupta* × *E. camaldulensis* hybrid, developed in Thailand and known as K7. In the rubber sector, the large suite of new plantings is reportedly dominated by four clones. There is a need to expand the options for germplasm and there is an attractive option to capitalise upon close relationships with both Vietnam and Thailand to gain access to skills and new germplasm in those countries.

Agroforestry systems

The best known agroforestry systems are those used in teak cultivation in northern Laos, where teak is cultivated in its early years with agricultural crops such as pineapples (Midgley et al. 2006). The Australian Centre for International Agricultural Research (ACIAR) project FST/2004/057, 'Enhancing on-farm incomes through improved silvicultural management of teak and paper mulberry plantations in Luang Prabang province of Lao PDR', is conducting research into the growth, management and returns of different teak-based agroforestry systems. More recently, Stora Enso, in its commercial plantation initiative in the southern provinces of Savannakhet and Saravane, has adopted an alley-cropping agroforestry system that will combine community needs for food and livelihoods with commercial production of eucalypt and acacia wood (Karltun et al. 2011). Some rubber plantations are being established using intercropping techniques. Challenges to agroforestry systems remain—complementarity of the tree/agriculture components, grower familiarity with both crops and trees, and market attraction for the trees and intercrops. There is a shared interest in agroforestry systems which suggests that close research and development (R&D) links with commercial enterprises would be useful for all stakeholders.

Trees as boundaries and in homesteads

Popular trees in homesteads, such as jackfruit and mango, produce wood that is well respected in the furniture sector. Boundary trees offer a source of poles and sawn timber for commercial and domestic purposes.

Harvesting and transport

Most of the resource of planted trees in Laos is located within 500 m of a road or river, and harvesting is completed manually using crosscut saws or axes and, occasionally, chainsaws. Approaches to harvesting and transport vary with distance from the road, steepness of the terrain, volume cut (the approach for a single tree differs to that for 200 trees) and the situation (for domestic household use or for commercial sale where someone else will pay or reimburse for harvest and transport). Most logging in teak plantations is selective; only in cases of clearing for infrastructure projects are teak plantations clear-felled.

The use of manual labour to bring logs to the roadside places a natural restriction on log size. Most harvesting systems adopt a standard 2-m length for

plantation logs which limits options for processing. Small piece size also facilitates hand-loading onto trucks. Small log size influences plantation silviculture and rotation length—why grow large trees if they cannot be taken to market? At best, some local traders have chainsaws and improvised loading devices to handle the relatively small logs from standing tree to roadside and finally onto the trucks.

Generally accepted protective and safety measures for harvesting and transport are usually absent in Laos. Most operators understand the need for safety equipment but lack of funds prevents purchase and issue.

Primary processing: sawing and drying

The sawmills that process planted trees vary greatly from small village operations close to the resource that operate when required or when wood is available (perhaps 10 m^3 log input/month) to more sophisticated operations with a capacity of 100 m^3 log input/month.

Close to the resource, sawmills process logs, whereas in centres such as Vientiane most companies purchase timber as squared logs. These 'squares' are sawn into boards of required dimensions using the companies' own sawing facilities. The boards are then held in a storage shed where they are air-dried. In most cases, the air-dried timber is used for the manufacture of wood products for the local market. However, some companies are also using kiln-dried timber for products exported overseas. The timber is dried either in-house using kiln-drying facilities if they are available, or it is sent to another company specialising in kiln-drying (Ozarska et al. 2007). Costs related to kiln-drying can be high. Stacking and unstacking timber into kilns and the 28-day drying schedule (for teak) both add to processing costs.

Ozarska et al. (2007) reported that, in general, the drying practices adopted by several companies were poor. Sawn timber was often not properly stored for air- or kiln-drying, resulting in end-splitting and distortion of timber, and companies demonstrated little appreciation of correct racking procedures and practices. Few companies used moisture content meters in their operation. Given the critical importance of careful drying to the successful utilisation of plantation timbers, wood-processing companies should be encouraged to adopt correct kiln-drying procedures. There has been some progress in addressing these issues under the 'Value-adding to Lao PDR plantation timber products' (VALTIP) project (ACIAR project FST/2005/100). The more successful companies recognise the advantages conferred through kiln-drying and voiced appreciation at the support that ACIAR's VALTIP project had offered.

Some log-grading rules have been developed by individual sawmillers for purchase of teak from private smallholders and these are used as the basis for payment (Burapha Agroforestry Company 2010). The study completed by Ozarska et al. (2007) revealed that no grading rules for lumber are available in Laos.

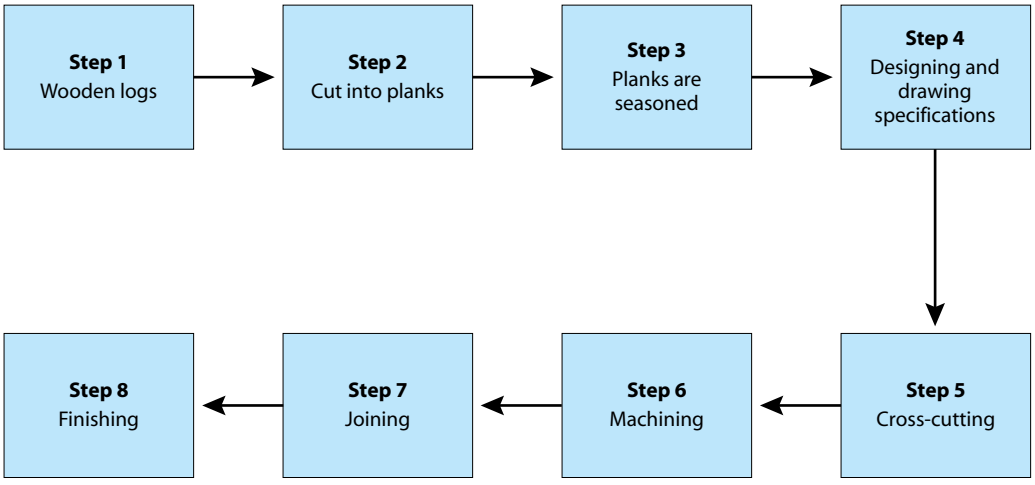

Figure 6. Overview of the manufacturing processes for wood furniture (Source: UNIDO 2002)

Table 12. General production processes and machinery needs for wood furniture

Step No	Description	Machinery required / used
1	Wooden logs are purchased from timber merchants	
2	Logs are cut into planks	Band saw, circular saw
3	Planks are seasoned either naturally or in a seasoning plant	Natural seasoning requires 6 months – 1 year; artificial seasoning takes 8–20 days
4	Drawings and specifications of the furniture item are drafted	
5	Planks are cross-cut planks according to the specifications or drawings	Circular saw
6	Cross-cut planks are machined into the required sizes	Jointer, planer, thicknesser, tenoning machine, mortising machine, sanding machine
7	Different parts are joined to assemble the article	Glue is used; hydraulic press is used for extra strength of joints
8	The item is finished: polished, painted etc.	Air compressor, sprayers etc.

Source: UNIDO 2002

When timber is ordered or purchased, only sizes of timber are specified and, due to lack of grading rules, it is impossible to specify the quality of timber delivered for various applications.

Secondary processing

The United Nations Industrial Development Organization (UNIDO 2002) offered an overview of the standard process for the manufacture of wood furniture (Figure 6). Each of the steps in the manufacturing process requires specialist machinery and these are described in Table 12.

Facilities for secondary processing are based on product specifications incorporating product design, quality and performance. Many processors faced the daunting task of accommodating many product designs with inappropriate, outdated or unsuitable equipment; this often being a consequence of shifting from a natural forest to a planted tree resource. Product design must predict the product performance in various climatic and service conditions and take into account possible timber movements, dimensional and machining tolerances and the most appropriate glues and coatings for the various applications.

The study by Ozarska et al. (2007) found that the production processes in most companies using plantation wood were not properly designed and managed, resulting in low production efficiency. Product quality is influenced by poor or old machinery and its improper use; for example, joints are poorly machined without dimensional tolerances which, when combined with inappropriate moisture content, may result in serious quality problems in the final products. Occupational health and safety conditions in the factories were poor.

Most processing factories need capital to improve their machinery and most factory owners were keen to seek independent and reliable advice on the types of machines needed for various operations, and on proper set-up parameters and efficient use of the machinery.

Many types of glues are used for various applications; glues designed for indoor use are not appropriate for outdoor applications. Many processors use a single polyvinyl acetate (PVA) glue for all applications. Different glues require different timber preparation before gluing (e.g. measuring moisture content of adjacent components, conditioning timber) and gluing parameters (applying proper pressure and pressing time). Minimal variation in moisture content between glued components will enhance bond strength. Similar observations were made for the quality of coated surfaces. The VALTIP project has made some progress on addressing these issues with those wood-manufacturing enterprises that were involved in the project.

Export of wood products

Export opportunities depend upon a working knowledge of market needs. Acquiring this knowledge and maintaining market networks remains a challenge for many of the Lao wood processors. Emerging infrastructure developments in Laos, such as the Chinese railway and new highways, link the Lao

industry with a wider range of market opportunities, and Lao processors are keen to exploit these new opportunities. Limitations to capturing expanded export opportunities include responsiveness and cumbersome government procedures and the length of time it takes to complete documentation, close the container and have the shipment move across the border.

Laws relating to export of wood products

Processing and export of forest products are primarily covered by the Forestry Law and the Law on the Processing Industry. Both of these laws encourage value-adding processing in Laos and the establishment of export-orientated industries. While the export of whole logs is banned under the Forestry Law, exemptions may be made, including significant projects that are conducted in the national interest, such as roads, transmissions and hydro-electric projects, which involve tree-felling (Flanagan 2012). Under the Forestry Law, processing of timber and forest products is encouraged through value-adding to meet domestic demands and to produce finished products for export (Article 50 of the Forestry Law). However, GoL retains a strong influence on the sector as only the government can issue the permission for export of logs from natural forest, logs of protected species from tree plantations, semi-finished timber, sawn timber, tree stumps and galls of trees (Article 52). In addition, transport of logs and forest products within the country must be conducted in accordance with appropriate laws and regulations, requiring payment of resource tax and duties; each log must be marked and stamped and documentation for transport completed. Logs must be transported through pre-determined routes with checkpoints and weighbridges where they must be declared. There are seasonal restrictions to some log movements to protect seasonally wet roads (Article 53).

The Law on the Processing Industry (National Assembly No. 01/99/NA, 3 April1999) determines principles, regulations and measures relating to the establishment, operations and administration of industrial and handicrafts processing activities in order to expand the processing and handicrafts industry and to link the processing industry with agroforestry and planted trees. The law also promotes all sectors of the economy to invest in industrial and handicrafts processing to produce consumer goods domestically to serve as import substitutes and to produce export goods by employing domestic raw materials, such as those from agriculture and forestry. Under the Law on the Processing Industry, domestic and foreign investors are encouraged to invest in industrial and handicrafts processing which use domestic raw materials from agroforestry to process into goods for domestic use and for export. The Ministry of Industry and Commerce (MoIC) has some 14 Regulations of relevance to the wood-processing industries covering matters relating to processing, transport and sale of wood products, along with standard schedules for government fees (Barney and Canby 2011).

Current focus for wood-product exports from Lao PDR

GoL views export of processed wood products as a priority as this encourages the use of a valuable and renewable natural resource and establishment of stable processing industries, and provides local employment. Timber remains one of Laos' major foreign-exchange earners and, according to a recent timber study in Laos, totalled some US$80 million worth of semi-finished and finished timber-based products for the 2010–11 fiscal year (Vientiane Times 2012). Major importers of Lao timber products were Thailand with trading value of about US$22 million, Vietnam with trading value of US$11 million, and Japan with US$4.5 million. This study did not include log exports. Barney and Canby (2011) also found that Lao forest-product export markets (including logs) are dominated by Vietnam and Thailand. While bilateral trade statistics are not published by GoL, importing country statistics indicate that Thailand, Vietnam and, to a lesser extent, China are the dominant markets for Lao timber products (see Figure 2). Vietnam imports a mix of logs and sawn wood; Thailand mainly sawn wood; and China mainly logs.

Government interventions

Privileges and tax concessions offered through the Ministry of Planning and Investment (MPI) and under the Law on the Processing Industry represent major government interventions in the wood-processing sector. The State grants privileges for investment in certain types of industrial and handicrafts processing operations, according to a factory's level of importance. The law also allows the State to determine tax and duty privileges as incentives for industrial and handicrafts processing operations, primarily for those operations that the government considers to have high

priority. Examples include the import of machinery and equipment to establish and operate a factory. Domestic transport and export of the products of industrial and handicrafts processing may receive an exemption from, or reduction of, taxes and duties.

A major recent intervention was the establishment of the Department of Forest Inspection (DoFI) in 2008 which has primary responsibility under the Forestry Law and the Aquatic and Wildlife Law for legal enforcement of forest policies, regulations and legislation, and is responsible for the development of a comprehensive compliance system to prevent, detect and suppress forest crimes over all forest landscapes, resources and supply chains (Flanagan 2012).

Opportunities and challenges

In 2005, the International Trade Centre prepared a sectoral strategy for the overall wood sector (ITC 2005). This study offered an analysis of strengths and opportunities for the total wood industry sector of Laos (Table 13).

Based on the International Trade Centre analysis and upon an extensive stakeholder consultation, Mohns (2009) identified several weaknesses across the value chain for plantation teak grown in Luang Prabang province (Table 14).

Based upon the weaknesses identified in Table 13, Mohns suggested three potential broad interventions to assist improvement:

- Intervention 1: improved harvesting and processing of teak logs by producer groups and small-scale sawmills
- Intervention 2: value-addition by improved utilisation of offcut and waste material
- Intervention 3: improved product design.

Wattanakool (2010) completed a subsequent SWOT (strengths, weaknesses, opportunities and threats) analysis in association with Mohns and offered the following summary of weaknesses:

- uncertainty of supply and availability of raw materials
- rivalry rather than cooperation among many small- to medium-size companies in the industry
- many small companies are unable to realise economy of scale
- lack of process and product-quality standards in place
- low productivity, high product loss and/or product downgrading, and waste due to technology and production-management shortcomings
- limited management, technical and marketing skills
- limited information and understanding of regional/international market requirements
- lack of service providers to support upgrading of processes, skills and products
- limited demand-orientated innovative designs
- weak linkages between suppliers and processors and related clusters.

The opportunities included in Wattanakool's analysis include:

- government policies to support secondary processing and export provide an opportunity to develop a modern industry capable of competing in the world market
- increased investment in plantations with potential to increase raw material supply for secondary processed wood products
- increased demand for legal certified wood products (Forest Stewardship Council (FSC) certified) in overseas markets (e.g. Europe and USA)
- increased demand for wood on domestic and regional markets
- potential for product, process and technological innovations to increase value-added and new market opportunities
- key supporting policies of the forestry sector on sustainable development and environmental protection stimulate foreign investment
- availability of international cooperation to assist forestry development.

Trockenbrodt (2010) also saw opportunities associated with an expanding plantation-wood resource and saw promise in new products based upon glued laminates and finger joints. He also acknowledged that these new opportunities will be associated with a need for factories to re-equip to adapt to the new resource.

During the interviews and the on-site inspections conducted during the course of this study, a number of technical and administrative issues were identified along the value chain by sawmillers and secondary processors. Among the technical issues were:

- dealing with small logs—there was a general recognition that, with the exception of rubberwood and older trees of planted teak, the plantation wood that will be available to industry in Laos will be generally of small size (<30 cm dbh) and fast-grown
- current practice is to harvest in short lengths of 2 m to enable manual handling from the plantation to the roadside. Subsequent transport practices have

Table 13. SWOT (strengths, weaknesses, opportunities and threats) analysis for Lao wood industry (after ITC 2005)

Strengths	**Opportunities**
• Laos is endowed with large natural forests and has ample opportunities to develop into an important hub of wood processing. • Lao wood is of high quality. • There is comprehensive legislation and regulation on domestic and foreign investments relating to commercial and industrial forest plantations and finished wooden products for export. • The existing export wood-product association is ready to improve entrepreneurial spirit in the wood sectors in the near future, which can drive the movement towards value-adding in the whole wood value chain. • The operation of the Sustainable Forest and Rural Development (SUFORD) Project, amounting to US$16.8 million, provided by an International Development Association loan, a grant from the Government of Finland and a contribution from the Government of Lao PDR, will create sustainable production forests in four main provinces, and can also supply regularly materials to the wood sectors.	• The wood-products industry, using raw materials within the country, is the second-best export performer in Laos. • Wooden furniture and carving products, including low-grade and small-dimensioned logs, offcuts and lesser used species, provide potential new added value to the sector. • Sustainable development and environmental protection is a key support policy of the forestry sector that can stimulate foreign investment. • International cooperation is available to assist forestry development. • Public and private wood-processing groups have close links. • Open access to major foreign markets is strengthened by emerging initiatives in the European Union. • Unused capacity exists in sawmills; the pulp and paper industry has potential to expand; big plantations are being developed. • There is increasing domestic demand for construction products, and international niche markets for products such as eucalypt wood, domestic and international tourism (hotels, resorts). • Benchmark best practice from major competitors, such as the Philippines and Vietnam.
Weaknesses	**Threats**
• Workers lack skills. • There is a lack of financial support for producers and exporters. • There are no vocational carpentry schools or training centres for wood-product development. • Geographical interest to investors is lacking (investors may not wish to go to Laos). • The supply of raw material remains problematic in Laos, due to logging in natural forests, which depends upon logging quotas allowed annually by the government. Logging is under the direction of GoL (quotas, state-owned companies). • Technology to support processing is lacking: for instance, there are only a few wood-drying facilities, and there are only traditional sawmills in Laos. • The official quota allocation can supply only a small fraction of the national sawmills. In addition, the sector suffers from a shortage of workers. Sawmills have relatively old machinery that is unsuitable for plantation timber. • The total area of plantations is still too small to sustain the industry. • Existing loans that are not performing create a future loan barrier to new entrepreneurs. • Electricity costs are high.	• Strong competition exists between Laos and neighbouring countries. • Geographical disadvantages lead to high transport costs • Even though Laos is well endowed with natural resources, foreign investors might not be ready to invest if the government cannot offer attractive quotas to them. Furthermore, the geographical location may be a factor that adds to production costs. • The cost of labour is always increasing. • New competitors are emerging. • Deforestation continues for agricultural use due to an increasing population.

been developed around these short log lengths. These short lengths limit processing options
- fast-grown wood tends to split and check if not treated properly after harvest
- growth stresses in fast-grown eucalypts and twisted grain create problems with reliable drying and subsequent processing (and finishing)
- the heartwood–sapwood differentiation for both acacias and teak is an attractive feature for some markets and a disadvantage for others
- sawing accuracy and maintenance of dimensional stability are challenges for smaller operations
- all plantation-grown wood requires kiln-drying for high-quality products, and reliable schedules are required for each species being used
- a new suite of equipment is required for plantation timbers for which information is limited. Processors seek impartial and independent advice on specialised saws and kilns best suited to plantation timbers
- effective use of small plantation timbers will require use of finger-jointing and laminating technologies.

Among the social and administrative issues identified were:
- uncertain bureaucratic procedures relating to harvest and transport of plantation wood. Do the same regulations and procedures for wood from natural forests apply for plantation logs and timber?
- high levels of tax, fees and other government imposts (at district, provincial and national level)
- slow government processes to ensure legality of plantation-grown timber
- questions relating to the application of the log export ban for plantation logs

Table 14. Weaknesses in the plantation teak value chain

Teak plantations	Harvesting, transport	Primary processors	Secondary processors	Local markets	Export markets	Policy issues, business environment
Low quality of plantation due to limited management inputs Lack of logging technology restricts plantations to areas along roads Premature harvest of trees leads to income losses and extreme stock depletion Area and age classes of plantations are not known, thus log supply cannot be forecast	Selling standing trees and lack of sealing and grading lead to losses for owners Lack of small-scale harvesting technologies lead to losses in recovery rate and quality of plantation timber Limited road infrastructure leads to high transport costs and log prices by international standards	Unsecured log supply Outdated/ oversized equipment for small plantation logs Cartel structure leads to high sawlog prices Focus on low-value exports of sawn products Non-transparent grading and pricing of sawn wood	Outdated equipment Limited vertical integration with primary processors means unsecured supply of (dried) sawn timber Limited management and marketing skills High sawn-wood prices	Local market rather small in comparison to neighbouring countries Components have to compete with imported medium-density fibre board (MDF) products not available locally	International quality standards not met No certification system in place yet Relatively small raw-material supply base for plantation timber limits export volume Limited design standards	Contradictory foreign investment policies for primary and secondary processing of non-plantation timber Weak regulatory framework for logging operations Complicated, lengthy and costly export regulations No transparency in official operations

Source: Mohns 2009

- slow and cumbersome bureaucratic processes that add substantial cost and uncertainty to the wood furniture business
- uncertain volumes of wood available and challenges associated with coordinating regular commercial quantities of wood from many smallholder suppliers and synchronising periods of smallholder household need for finance with periods of commercial demand for wood[6]
- lack of competitive finance for re-equipping sawmills to accommodate small plantation wood—domestic interest rates for loans to re-equip mills were reported as prohibitive
- dangers of over-capitalising processing facilities to use a limited resource
- lack of a skilled labour force, especially qualified and skilled craftsmen.

In 2007, as part of the ACIAR VALTIP project, a team from the University of Melbourne, Holmesglen Institute of TAFE and the National University of Laos (NUoL) undertook a detailed assessment of the capabilities of nine businesses within the Lao wood-processing industry, including a SWOT analysis (Ozarska et al. 2007). Although this detailed analysis did not assess the entire value chain, it remains an accurate reflection of the wood-processing situation assessed in this study. It noted the optimism within the Lao industry, identified some exciting opportunities for practical intervention and made sensible recommendations. Observations from the assessment included:

- All the assessed companies are using plantation species of various ages, different dimensions and wood quality.
- There are no grading rules for lumber available in Laos.
- Most companies purchase timber as flitches (squares) from various sawmills.
- Sawn timber is not properly stored for either air- or kiln-drying, which results in end splitting and distortion of timber.
- Only three of the nine companies had kiln-drying facilities, with only one of these facilities considered to have an effective production kiln.
- Generally, the product-development procedures do not follow any standards or specifications regarding product design, quality and performance. Quality should be improved to compete in international markets.
- The production processes in most of the assessed companies are not properly designed and managed, with a low productivity level and low production efficiency.
- Many woodworking machines are old.
- Occupational, health and safety conditions in the factories are very poor.
- The companies urgently need capital to improve their machinery. Advice is also required on the types of machines needed for various operations, and on proper set-up parameters and efficient use of the machinery.
- Gluing of timber components does not follow standard gluing requirements. There is a lack of knowledge on the timber preparation, types of glues and gluing parameters.
- The quality of coated surfaces is very poor. There is no proper industrial equipment used for finishing, with the hand brushing method being most commonly applied.
- Many companies are using carved components in their products, with attractive traditional patterns and motifs. This skill and talent should be considered as a great advantage and opportunity for Lao products, as it could be used as a promotional tool for unique designs of 'Lao style', which would be difficult to copy.
- Wood waste-management practices are poor.
- Few companies provide any formal training to their workers. Training is usually provided in-house by more experienced workers.
- Availability and cost of transportation are limiting.
- Quality control for raw materials supplied is lacking.

The companies themselves identified four priority areas for improvement of their wood-processing operations:

- expanding production facilities, including the establishment of sawmills designed for the smaller logs from plantations (rather than those designed for the very large logs from natural forests)
- developing kiln-drying facilities (and associated operational advice)

[6] In northern Laos, the teak resource also plays an important role in the local society and economy. Teak plantations are regarded as 'bank accounts' from which withdrawals and sales of logs can be made at times of financial need within a household. These include times when school fees need to be paid or the costs met for a wedding or a death in the family or the wish to build a new house. These needs are not generally predictable and may not occur when there is an opportunity for a sale. Until producers can obtain credit or financial intermediaries emerge, there is a need to match periods of grower need with periods of market opportunity.

- improving and updating machinery and production processes
- improving quality of products.

Industry interviews conducted during this study confirmed that training is urgently needed in design, production management and proper use of machinery to improve efficiency, product quality and marketing.

If companies are to upgrade their facilities to accommodate plantation timbers and address the challenges identified by the assessment by Ozarska et al. (2007), access to reasonable finance will be needed to make the production improvements.

Government intervention: legality, taxes and other imposts

Government processes or requirements to certify ownership of woodlots, ensure legality and to permit harvest and haulage of logs across district and provincial boundaries are extremely complex and confusing, according to growers and processors interviewed as part of this study. There has been some recent progress in adding some transparency to these processes through TFT's interaction with LPTP.

Legality

The Lao wood industry will be able to capitalise upon the expanding resource of Lao plantation timbers through engagement with international markets. Such engagement will be helped by adoption of FSC certification and related CoC processes, and of principles required by the Lacey Act in the USA and the ITL in Europe. For plantation growers, the basic requirement for legality is the Plantation Certificate which confers several benefits to growers, including:

- land tax relief
- secure and legal title over both the trees and the land
- enhanced market opportunities through a capacity to sell into markets demanding legal timber
- ability to use a secure asset as collateral against loans.

Registration of plantation blocks and provision of a Plantation Certificate can be a lengthy and complex process and expensive for the grower. For example, there are an estimated 26,500 ha of smallholder teak in Luang Prabang province, and this resource is divided into about 43,000 blocks (assuming an average block size of 0.6 ha) owned by some 30,000 growers (estimated). Of this resource, only 2,081 ha in 2,246 blocks have been registered so far—5% of the blocks and 8% of the total resource. There was a rapid expansion of teak planting by smallholders in Luang Prabang province between 1984 and 1986 and this resource is now yielding timber that growers are keen to sell. The backlog in registering teak blocks means that any teak harvested outside the small group of registered smallholdings is technically illegal and cannot enjoy the rightful benefits of access to European and North American markets. Plantation Certificates are the cornerstone of legality for the Luang Prabang teak resource. At the current rate, it will take 80 years to provide Plantation Certificates for all teak growers. At an estimated average cost[7] of 80,000 kip/plot, registration to ensure legality for the Luang Prabang resource of teak will cost smallholders an estimated US$430,000. Given the central importance of the Plantation Certificates to long-term legal supply from the Luang Prabang teak resource, it would be logical to focus efforts towards streamlining and facilitating the Plantation Certificate process and reducing associated costs.

In addition, once legality has been achieved through registration of the plantation block, the additional requirements for FSC certification are challenging to implement and add another level of complexity for growers. Faced with such complexity surrounding legality and following FSC procedures, growers can be readily persuaded to seek the services of a teak log trader who will pay cash and market teak logs without legal paperwork at a time convenient to the grower.

Taxes and other imposts

There is a complex series of government service charges, fees and taxes associated with harvesting and transporting plantation logs. In their program of support to LPTP, TFT recognised the impact that government fees, taxes and other imposts were having upon the efficiency of the value chain. In Luang Prabang province, recent experience has indicated that the prevailing taxes, fees and service charges from the district and provincial forestry authorities and the provincial Department of Finance include:

- export tax, 1% of the total shipment
- measuring fee, 40,000 kip/m^3
- survey fees before issuance of the cutting licence/permit, 7,700 kip/m^3

[7] Registration fees can vary from 50,000 to 150,000 kip/block depending on location (remoteness and time for Department of Agricultural and Forestry Office (DAFO) officers to travel) and size. The fee covers daily allowances for staff and administrative costs involved with providing the certificate.

- provincial profit tax/turnover tax, 80,000 kip/m^3
- log stamps, 12,000 kip/m^3
- registration fees for transport, 7,100 kip/m^3.

For a 2011 shipment of teak thinnings from Luang Prabang to Vientiane, the payment to the grower for his standing trees was US$74/m^3 and the total payment by the buyer for the various government taxes/fees/service charges was an additional US$19.30/m^3. For shipments of squared logs of plantation teak from Luang Prabang to Vientiane, another processor paid a series of provincial taxes at rates between US$94 and US$108/m^3 for squared logs valued at US$590/m^3.

In another case shared during this study, a processor purchased plantation teak logs and paid for harvesting and delivery to the mill at an inclusive rate of 375,000 kip/m^3 (US$47/m^3). Provincial taxes on this log shipment were an additional 350,000 kip/m^3 (US$43/m^3) if the logs were to be shipped out of the province. In addition, fees are paid at district level for transport permits and costs and expenses associated with District Agricultural and Forestry Office (DAFO) officers measuring the trees (about US$10/m^3).

In response to local confusion and a perceived lack of transparency and consistency surrounding national and provincial taxes on plantation teak, Sawathvong (2010) completed a study of the taxes and concluded that a review was required to ensure consistency between national policies and provincial regulations. Among the decrees and documents that govern the promotion and sale of plantation teak are:

- Prime Ministerial Decree No. 96/PM, dated 11 June 2003, with regard to commercial tree planting and environmental protection
- Ministry of Agriculture and Forestry (MAF) Regulation No. 0196/AF, dated 15 August 2000, concerning the long-term development and promotion of tree planting
- Ministerial Directive MAF No. 1849/AF, dated 7 October 1999, concerning registration of tree-planting blocks
- Addendum to Ministry of Finance Directive No. 0715/MF, dated 29 April 2002, concerning the implementation of policy on new land tax
- Minister of Finance Directive No. 1059/MF, dated 13 June 2003, concerning collection of taxes from timber and non-timber forest products
- Luang Prabang Provincial Governor's Directive No. 02/PG.LPB, dated 12 February 2004, concerning the management of logging and transactions of planted timber
- Luang Prabang Provincial Tax Department Instructions No. 1095/PTD, dated 1 August 2007, concerning the calculation of taxes against each consignment of timber and non-timber forest products
- Presidential Decree No. 03/P, dated 19 December 2008, concerning formality and service fees
- Minister of Finance Directive No. 0078/MF, dated 12 January 2009, regarding the implementation of the amended Presidential Decree No. 03/P
- Minister of Finance Directive No. 0523/MF, dated 17 March 2009 (revised version), regarding the implementation of the amended Presidential Decree No. 03/P
- Minister of Finance Directive No. 0509/MF, dated 13 March 2009, for the calculation and collection of taxes on timber and non-timber forest products.

Recently, provincial taxes on plantation teak that is certified appear to have been relaxed by the Luang Prabang provincial authorities. The permanence of this arrangement needs to be confirmed but it could be an important step in providing real benefits to growers for participating in certification initiatives.

These taxes or imposts incurred along the value chain add to the final export price of the product, reducing market competitiveness, or they may be absorbed by the grower through lower stumpage prices.

Given the strongly competitive global markets for wooden furniture, it is unlikely that the high costs of taxes can be absorbed through a higher export price, so taxes usually result in lower prices for growers. Although traders and/or processors may pay these imposts, these payments mean that they can afford to pay less to growers for their logs if they want to maintain a competitive business. Ultimately, the grower pays the price for the high government charges.

The collective set of government imposts/fees/taxes/service charges is high and, as a result, sawmillers cannot pay attractive prices to growers. In response to low prices for their teak, many growers near Luang Prabang are leaving teak cultivation because it is not profitable and because returns from rubber, citrus and other crops are higher.

Inventory

If industry is to seek long-term engagement with the Lao plantation resource, it is important to know how much timber is available and the age and size classes of this resource so forward plans can be

made. Such information underpins investment plans for wood processors and marketing plans for new products. In situations (such as the teak resource in Luang Prabang) where smallholders have established many small blocks, accurate inventories are difficult to make. Estimates of the teak resource in Luang Prabang province vary from 10,000 ha (Midgley 2006) to 26,500 ha (Provincial Agriculture and Forestry Office, pers. comm. 2011); both figures are based upon data collected from district reports assembled from unmeasured estimates provided by village administrations. To date, there has been no reliable inventory completed of the plantation teak resource in Luang Prabang province, although a pilot initiative to use remote imagery as the basis for inventory by LPTP was successful and offers promise for the approach across the province.

Prospects for improved livelihoods through a more efficient value chain

Rural livelihoods will be most positively and directly affected by increases in log prices and management of demand to match times of household need of the smallholder. Strong market demand will also enhance employment opportunities for those involved in harvesting and transport. Market prices and demand for furniture and other wood products determine the prices for the manufacturer, which determine the amount paid for sawn-wood inputs and the payments for logs made to traders and growers. Policies of GoL encourage both tree planting and improved returns for logs grown by plantation growers. Within the planted-wood value chain, a number of factors can determine how the processor or trader may pay more to the grower. These are discussed below.

Increased final export price

Export prices are largely established via the global markets, especially the markets that depend upon the wood industries in neighbouring China and Vietnam. However, there are opportunities for higher prices to be paid through market premiums for wood certified through schemes such as FSC. There is very little certified plantation wood available in Laos, although groups such as TFT and WWF are working with smallholders in Luang Prabang to change this. However, experience reveals basic limitations regarding legality. High-quality wood with good features, colour and stability is always in demand and this opens opportunities for improved silviculture and wood grown on longer rotations.

Improved growing (production) efficiency and decreased processing costs

Better germplasm and improved silviculture will produce higher quality logs which in turn provide better product value recovery. The adoption of sawing and drying technologies better suited to small, fast-grown plantation trees, and improved skills, will offer opportunities to increase efficiency and reduce costs. These improvements will ensure more marketable product for the same amount of effort.

Decreased taxes and other imposts

Any taxes or imposts imposed along the value chain will add ultimately to the final cost of the export product, reducing market competitiveness, or be absorbed by the grower through lower prices.

Reduced harvest and transport costs

Adoption of improved techniques and equipment that result in lower unit costs for harvesting and haulage would encourage competition, and enhance the reliability of supply and availability of commercial volumes of wood.

Improved reliability of supply

Growers who offer a reliable and responsive supply of logs to processors can command competitive prices.

Skills development and capacity building

Background

A recurring theme throughout this study was the critical lack of trained and skilled people to support the Lao wood industry. This observation was made at all stages of the value chain, from harvesting to sawing, drying and joinery and across the public and private sectors. Unskilled fellers in the plantations resulted in wastage during harvest operations. All processors lamented a lack of supervisors and skilled staff for carpentry, joinery, cabinet-making and machinery maintenance and acknowledged the difficulty associated with attracting and keeping skilled staff. Within government, there were few who understood the technical intricacies of the wood value chain and wood processing. Within the training

institutions themselves, questions were raised as to how to train the trainers. In training institutions, students were reported to be reluctant to enter the wood-processing sector—a major technical college, Pakpasak Technical College, has a student population of 4,000 and only 13 of them are studying joinery/carpentry. This is a challenge shared with the Lao garment industry where investments are commonly short term and seek a quick turnover.

A possible explanation for this state of affairs lies in the habits and culture of the wood industry. Factories may have a need for skilled people for 4 months to attend to a particular order but do not have the resources or inclination to keep these people once the order has been filled. Thus, skilled people travel from factory to factory and from order to order. Several processing factories employ on contract Vietnamese or Chinese supervisors and skilled craftsmen to supervise orders from these two countries. Typically, a Vietnamese tradesman or supervisor might be offered a contract for 700–1,000 baht/day (about US$23–33/day) for the life of a particular order, generally about 3 months. Chinese contracted tradesmen received almost double the pay of Vietnamese. It is difficult for a skilled Lao craftsman to find a regular job with a company and this has an impact upon the 'lack of loyalty' mentality complained about by the factory managers.

Wood processors were aware of emerging technologies and acknowledged the need to re-equip and update their machinery—the industry is not afraid of new techniques but there is a lack of skilled professionals and technicians to advise on machinery choice and to install and commission new machines.

Interviews during this study revealed the need for industry standards to be established for the wood-processing sector. It was unclear which organisation would have the skills and commitment to draft and register these standards.

National University of Laos

Professional training in basic wood science and timber engineering is offered through the Faculty of Forestry, NUoL. The faculty commented upon a perceived reluctance by students to enrol in wood industry–related subjects and felt that their lack of training facilities might influence this. Although earlier projects supported by ACIAR and others have left a good legacy of some basic wood-testing equipment, there is a serious need for the university to be offered some more-substantial assistance to establish a wood-products laboratory where students can gain hands-on experience in the processes that will be used for plantation-grown wood. Small chambers to conduct drying tests, and machines to create laminates and demonstrate finger-jointing, are all needed. It has proven difficult for the university to gain access to working examples of these operations in the wider industry: factories might have commercial commitments at the time of university courses and factory inspections are inconvenient or the facilities might be distant from the university.

There is limited capacity in wood science and wood engineering training at the regional universities such as Souphanouvong University at Luang Prabang.

Pakpasak Technical College and regional technical colleges

Despite the need for trained tradesmen in the wood-products sector, joinery and carpentry are not popular technical courses. Leaders at Pakpasak Technical College suggested that public perceptions of wood industries were of a menial and poorly paid job compared with careers in information technology and other more attractive trades. Although there have been no surveys of monthly pay rates or remuneration for recent graduates, it was felt that that electrical/plumbing/welding graduates would be far better off than joinery/carpentry students. There are also technical schools with furniture training in the larger provinces (including Vientiane province at Phon Hong) but these are reportedly poorly equipped and lack skilled staff. Pakpasak Technical College enjoyed a good working relationship with the VALTIP project (ACIAR project FST/2005/100) during which teachers and students were offered training on joinery techniques, and access to information plus kiln-drying and wood-testing exposure at NUoL. Despite this relationship, the college was poorly regarded by most industry informants.

The Asian Development Bank (ADB) has agreed to support a US$20 million project via six regional technical colleges in Laos. There will be four modules (including carpentry). This project will run from the end of 2011 to 2015 with selection criteria directed towards women and people from disadvantaged, rural and ethnic backgrounds. Funds from this project will assist Pakpasak Technical College to re-equip and update its facilities.

Pakpasak Technical College has developed a working relationship with the Lao Furniture Industry

Association's (LFIA'S) Competency Centre (see below) and this helps by exchanging information as well as helping students with practical lessons and providing teachers for 2 months/year.

Lao Furniture Industry Association's Competency Centre

LFIA's Competency Centre is inter-industry and semi-public and run by the association on a not-for-profit basis. The land and the buildings have been provided for an indefinite period by the current Director of the Centre, Mr Yothin Vesaphong, who was formerly Chairman of LFIA. The centre aims to upgrade the skills of the existing work force and offer pre-employment training for others. It runs short courses focused on woodworking and finishing and painting, and this appears to be more attractive and better aligned to the needs of industry than the courses offered by Pakpasak Technical College. The centre also expects to train people at Mr Yothin's furniture factory at Xieng Ngeun, near Luang Prabang, where they can accommodate 20 trainees at a time.

The course curriculum will comprise 30% theory, with the rest devoted to practical work to ensure trainees are properly qualified and experienced. The association also plans to work more in cooperation with vocational schools, so that students could undertake work experience at furniture factories.

The Competency Centre currently conducts a limited number of courses that run for a maximum of 3 months. During the courses, students are exposed to novelties and new technologies. It is expected that the centre will also offer services to the industry, such as contract kiln-drying (it will build a kiln as a service and training facility) and a tool grinding/saw sharpening service (including pick-up and delivery). If eucalypts are to become a larger part of the plantation solid wood resource, there will be a need for specialist training in drying eucalypts.

The centre receives support from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)[8] which has funded the buildings' refurbishment, office and training room. The Lao National Chamber of Commerce and Industry (LNCCI) has facilitated the sourcing of good-quality second-hand machinery from the EU donated to LFIA. GIZ provides one expert and employs three staff for the centre. GoL pays nothing towards this centre—it is privately run and survives on course fees. GIZ does not support the running costs of the centre but has helped prepare the centre's development plan. GIZ will help to extend the range of courses according to demand, including non-formal training for issues relating to occupational health and safety for foremen.

Another way to reduce running costs at the Competency Centre is for manufacturers or dealers (selling lacquer, paints, resins, adhesives, stains, hinges and hardware) to demonstrate their products at the training centre and through its courses. Consideration is also being given to the establishment of a trade demonstration area for the 60 members, for training and product presentation.

The centre expressed a wish to collaborate with Australian-supported initiatives and could run special courses tailored to the needs of Australian projects, or Australian agencies might consider sponsoring particular courses.

Current activities of donor agencies and NGOs in the Lao wood-products sector

Despite the obvious needs of the wood-industry sector in Laos, donor and non-government organisation (NGO) support to the industry has been limited, primarily because of the need for capital investment to undertake the recommended changes to processing facilities. In addition, there has been a historical reliance by the industry on natural forest logs, a proportion of which has been tainted by illegality, and this has discouraged donors.

In the course of this study, industry owners complained that it is difficult to attract finance for re-equipping wood-processing facilities. The sums required (usually less than US$1 million) are too small for commercial loans from agencies such as the International Finance Corporation (IFC) and too large for internal investment. Bank interest rates from local investment banks for loans of this nature are reported to be high; rates of >18% were reported.

[8] Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH [i.e. limited-liability company] is a federally owned enterprise and was established on 1 January 2011. It brings together the Deutscher Entwicklungsdienst (DED) GmbH (German Development Service), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH (German technical cooperation) and Inwent—Capacity Building International, Germany.

Lao–German Cooperation

The Lao–German Cooperation Program, Human Resources Development for a Market Economy (HRDME) in Lao PDR, is a joint effort between GoL and four German development agencies, including GIZ. HRDME focuses on the private sector and small–medium enterprise development and human resource development, particularly vocational education and training. The program has two complementary components: Private Sector Development and Labour Market-Oriented Integrated Vocational Education and Training. It works in partnership with government ministries, the Ministry of Education, MPI, MoIC, the Small and Medium Enterprise Promotion and Development Organisation and LNCCI. HRDME seeks to integrate its activities with those of other donors, including SNV (an international not-for-profit organization based in the Netherlands) on public–private dialogue; UNIDO on small–medium enterprise (SME) development and strengthening LNCCI; and EU and ADB with SME development; and links with the IFC-supported Lao Business Forum. Of particular interest to the wood industry are the HRDME efforts to establish and equip vocational schools.

The German support to the LFIA Competency Centre has been provided through the HRDME activity which has promoted and provided value-chain studies for the cotton and coffee industries and commenced a study on the woodworking sector in 2009 (Mohns 2009; Wattanakool 2010). Such sector analyses are regarded as the basis for investor consideration.

GIZ supports the work of Dr Michael Trockenbodt at the Faculty of Forestry, NUoL, and also the Climate Protection through Avoided Deforestation (CliPAD) project within the MAF Department of Forestry.

Japan International Cooperation Agency (JICA)

JICA has been a long-term supporter of the Lao forestry sector through its collaboration with DoF and the Forestry Strategy 2020 Implementation Promotion Project, and the Project for Reducing Deforestation System Development through Participatory Land and Forest Management in Lao PDR. Neither of these initiatives offers direct assistance to the wood-processing sector.

World Bank and Finnish International Development Agency

The Sustainable Forestry and Rural Development (SUFORD) Project is the largest project in the Lao forestry sector. The SUFORD Project is a multilateral cooperation project between GoL and the World Bank, with technical assistance from the Finnish International Development Agency (Finnida). The overall goal of the project is to institute nationwide systematic forest management which includes specific objectives, such as to: (a) improve the policy, legal and incentive framework enabling the expansion of participatory sustainable forest management (PSFM) throughout the country; (b) bring the country's high-priority natural production forests under PSFM; and (c) improve villagers' wellbeing and livelihoods through benefits from sustainable forestry, community development and development of viable livelihood systems. Examination of industry options for legal wood harvested from sustainably managed forests has been a component of the project.

TFT, WWF and the Lao Forest and Trade Platform

In 2009, WWF's Global Forest and Trade Network and TFT created a collaborative partnership in Laos, the Lao Forest and Trade Platform, which aims to strengthen responsible forestry practices and links to international markets. The platform will help Laos supply responsible forest products to the global marketplace. It has worked towards gaining certification for areas of the Luang Prabang teak resource through LPTP and has assisted processing companies to gain FSC CoC accreditation.

Research and development opportunities

Staff from The Forest Trust working with smallholder grower group chairman Mr Khao Sisomphou to measure teak thinnings, Ban Kok Ngiew, Luang Prabang province, Lao PDR (Photo: Tony Bartlett)

Payments for environmental services

Research issues

When considering the researchable issues on payments for environmental services (PES), benefit sharing and other incentives for improving environmental quality, it is helpful to recall the points that were presented in the earlier section, 'Criteria for effective PES, benefit sharing and other incentive mechanisms', and in the section following that one which summarises the 'best practices' and lessons that have been learned from the operation of numerous PES schemes in many countries over the past two decades (Emerton and Lopaying 2011). All the lessons are important, including indications that smallholders respond positively to attractive market mechanisms, but with respect to identifying researchable issues and topics, perhaps the most important point made by Emerton and Lopaying (2011) is:

> PES work best when they are founded on a clear and scientifically-proven link between particular land uses and the provision of specific ecosystem services. If a buyer is being asked to pay for their consumption of a particular ecosystem service, then the PES scheme must guarantee that this will be provided. Demonstrating these links requires significant knowledge, rather than broad assumptions and unverifiable hypotheses. In most cases, potential buyers are interested in a very specific service (erosion control, clean water supply and other tangible outputs and services), and will want to be shown the proof that this is what they are getting.

Based upon this and the several options identified earlier in this report, two general themes of research activity are suggested relating to both policy and operations as outlined below.

Policy issues:

- selecting a limited range of the most significant environmental services (ES) that improve ecosystem stability and sustainability, and identifying how PES could mitigate associated environmental problems
- providing guidance for policymakers in setting the amounts of funds for PES required for new developments
- developing options for policy frameworks to guide PES schemes that will lower transaction costs in their establishment, especially through reducing risks for participants
- studying the PES schemes that have been implemented in comparable countries, such as Vietnam, in order to learn valuable lessons and to take advantage of practical techniques.

Operational issues:

- ensuring that each selected environmental service can be simply, quickly, objectively and cooperatively measured using practical and robust field methods
- continuing research to improve the methods for assigning monetary values to ES and establish acceptable and agreed monetary values for each unit of environmental service.

Research could be undertaken related to devising and operating a practical system for monitoring and evaluating PES schemes, including regular reviews of, and improvements to, the schemes:

- continuing research to evaluate the beneficial and detrimental economic, social and environmental impacts of the suggested PES schemes, focusing on their capacity to mitigate environmental problems and offer positive outcomes
- undertaking social research with affected communities to ensure that beneficiaries are clearly identified, and understand and accept their responsibilities for providing the ES for which the PES are being made
- enhancing efficiency in equitably distributing benefits in a fashion that improves livelihoods within the context of existing Government of Lao PDR (GoL) policy. This can be defined as ensuring households and communities have equitable opportunities to become engaged, rather than providing equal payments to all regardless of what they do
- continuing research to identify and evaluate the risks to the successful introduction and operation of PES schemes.

Research partners

As demonstrated earlier in this study, many institutions in Laos are involved in natural resource use and management and environmental protection. Research on the provision of ES through PES, benefit sharing and other mechanisms will depend on effective engagement with a network of Lao stakeholders, many of which have research capacity and a commitment to the spirit of PES.

Regardless of the selection of research partner(s), effective engagement with policymakers in the Ministry of Agriculture and Forestry (MAF) and the Water Resources and Environment Administration (WREA) will be critical. At an operational level, links with responsible departments such as the Department of Forestry (DoF) and Department of Forest Inspection (DoFI) will ensure that a culture gap between researchers and those with operational responsibility does not develop. Provincial and district administrations hold the key for implementation of any pilot programs or field research. Given the importance of major development projects to the funding and delivery of PES and other such schemes, an effective engagement with the corporate sector will also be essential.

While it is not possible at this stage to provide a comprehensive overview of research and development (R&D) skills and capacity in Lao PDR with respect to PES and related issues, the following agencies and organisations may be able to contribute to an Australian Centre for International Agricultural Research (ACIAR)-supported program of collaborative research, and all indicated an interest in collaboration during the course of this study.

National Agriculture and Forestry Research Institute

The National Agriculture and Forestry Research Institute (NAFRI) maintains a strong multidisciplinary research skills base and is well known to ACIAR as a staunch, long-term research partner. It would have the capacity to support PES-related studies in the north via the National Agriculture and Forestry Research Centre.

Department of Forestry

DoF is the lead agency for Reducing Emissions from Deforestation and Forest Degradation (REDD and REDD+) issues within MAF. It was also among ACIAR's first R&D partners in Laos. Carbon issues within DoF are coordinated by the Planning Division, the Director of which is Mr Ouphakone Alounsavath, who is acquainted with ACIAR and is a former John Dillon Fellowship holder.

Water Resources and Environment Administration

On several occasions during this study, the team was informed that WREA may be elevated to ministry status (Ministry of Environment) in 2011–2012. Subsequently, these changes have been made. Relevant departments for R&D on environmental and water issues as they relate to PES include the Environment Department, the Water Resources and Environment Institute, the Lao National Mekong Committee and the Department of Meteorology and Hydrology. A number of these have had links with Australians and Australian institutions. The drafts of the revised Environmental Protection Law specifically mention PES (Section 12).

National University of Laos

Within the National University of Laos (NUoL), the Faculty of Forestry conducts research related to carbon and climate through the Centre for Natural Resource Management and Climate Change led by Professor Sithong Thongmanivong. Economic issues relating to PES have been researched by Dr Phouphet Kyophilavong, Deputy Director of Economic Department, Faculty of Economics and Business Management, who has established R&D links with the Australian National University (ANU).

Private-sector companies

In the mining sector, both Phu Bia Mining and the MMG Sepon mine have strong commitments to the environment and have strong Australian links. In the hydro-power sector, both the Nan Theun 2 Power Company (NTPC) and the Theun Hinboun projects have commitments to catchment protection and to the principles that underpin PES.

Non-government organisations

Several of the international non-government organisations (NGOs) have strong Australian links and a number indicated that they would be willing to collaborate with an Australian-supported initiative on PES. The Country Director of the International Union for Conservation of Nature (IUCN) and senior staff are Australian-trained (University of Melbourne, ANU); the World Wide Fund for Nature (WWF) has

Australian-trained staff and the Wildlife Conservation Society has several Australian staff. The broader responsibilities of most of these agencies have been described in the general introduction to this report.

Research sites

Senior policymakers have suggested a pilot trial for PES and similar incentives on an agreed area such as a catchment or an administrative area such as a province. If a catchment is chosen, it could be under the Nam Ngum River Basin Organisation, which is currently being established, or under the older, well-established Nam Theun 2 Watershed Management and Protection Authority. NTPC has a mandate to work with international agencies. The Nam Theun/Nam Kading Basin is also a possible candidate for the pilot trial, as it contains some large dams and extensive natural forest in catchments.

ACIAR could make significant contributions to the future success of a pilot trial for PES. There are several important considerations when planning, initiating and operating such a pilot trial:

- If the pilot trial is to be administratively based, it should be within a single province, such as Khammouane, which has a mixture of dams, mines, sustainably managed production forests and plantation initiatives. This arrangement offers adequate financial and administrative support within the boundaries of a single provincial decision-maker.
- Whether the pilot trial is on an 'administrative basis' or a 'catchment basis', it must be planned and implemented with the full involvement of the provincial governor(s) and the provincial administration(s).
- A 'catchment basis' pilot trial is logical from hydrological and biological-ecosystem approaches, but the catchment boundaries may include more than one province and could engender some rivalry between provincial administrations.
- In addition to encouraging the full involvement of the provincial governor(s) and the provincial administration(s), all other stakeholders (district authorities, national ministries, donor agencies, international carbon markets, and others) must also be closely involved.

Before any pilot trial is planned, it is crucial to consider: (i) what ES are to be produced; (ii) how they can be simply and objectively measured, and by whom; (iii) how they can be valued; (iv) the numbers, types and locations of the beneficiaries who are to be paid for producing the ES; (v) questions of land tenure and equitable opportunities for involvement in sharing of benefits from PES produced; (vi) ensuring the full and voluntary cooperation of the beneficiaries, and equal rights to join in a scheme; (vii) the methods for monitoring and reporting the production of the nominated ES; (viii) the methods for reviewing and revising all aspects of the PES scheme; and (ix) the risks and impediments of the proposed pilot trial.

Emerton and Lopaying (2011, p. 29) outline some features of a successful pilot trial in Vietnam—'Forest Protection and Development Scheme in Lam Dong and Son La Provinces, Viet Nam':

> The **PES/Forest Protection and Development Scheme (Viet Nam)** is an example of a PES scheme which involves payments from water users through a national government fund to private landholders and resource users. The idea of payments for ecosystem services began to take hold in Viet Nam in 2005. In 2008, the Government issued Decision No 380/QD-TTg on piloting Payments for Forest Environmental Services in Lam Dong and Son La Provinces. These two schemes have both been developed collaboratively between the Ministry of Agriculture and Rural Development and external donors: USAID/Winrock International in Lam Dong, and GIZ in Son La. Cash payments are received from key water users (hydropower, water bottling companies and other urban and industrial consumers), calculated at VND20/kWh of commercial electricity, and VND40/m^3 of clean commercial water. The revenues collected are retained in separate bank accounts as part of Provincial Forest Protection and Development Funds. Between 10% and 20% is retained by government, and the remainder paid out to environmental service providers. Local households in watershed areas are eligible to receive payments, calculated on a per hectare basis. Decision 380 was later extended to an additional 15 provinces (those with major watersheds and hydropower plants), and at the end of 2010 a new decree was approved which scales up payments for forest ecosystem services to the national level.

GoL authorities have reportedly been impressed by this trial.

Risks and impediments

There are some potential risks for and impediments to the successful implementation of ACIAR-supported R&D projects on schemes for PES, benefit sharing

and other financial incentives. They include at least the following, which (together with others) may be subjected to a formal risk assessment:

- Financial incentives may not produce the desired, nominated, environmental outcomes, and they may not also improve household livelihoods among the rural beneficiaries.
- It may prove extremely difficult to select a limited number of desirable ES and to devise procedures by which the selected ES can be simply, quickly, objectively and cooperatively measured by both villagers and relevant government officers using practical and robust field methods.
- Having chosen the ES that are to be enhanced by PES and similar schemes, it may be extremely difficult to assign monetary values to each environmental service.
- Beneficiaries (mostly rural smallholders) must be clearly identified (either as individuals and/or communities) as those who are primarily responsible for providing the ES for which the PES is being made.
- There may be considerable competition and many unresolved issues between government ministries and other administrative agencies with influence over the administration of any PES (or similar) scheme, including the mechanisms for receipt and disbursement of national and international funds.
- There may be competition for funds between agencies to support their core functions, rather than directing the funds to householders and rural communities and other PES suppliers.
- There may be a shortage of the skills and knowledge necessary to establish 'cause–effect' relationships between protection–restoration activities and ES outcomes.
- There will be some uncertainty about the types of contracts that are effective in the Lao legal and administrative systems, and the availability and competence of the local legal services.
- Governance issues will certainly be serious impediments, particularly those related to responsibility for administering all aspects of any PES scheme.
- There will be problems with the capability of administrators, especially at provincial and district levels.
- Effective R&D on schemes for PES, benefit sharing and other financial incentives depend on the capacity to maintain an effective and communicating network involving researchers, operational agencies and companies and Lao policymakers.

Australian linkages

Numerous Australian institutions and agencies could contribute, under ACIAR-supported projects, to the required R&D related to pilot trials and the planning and implementation of schemes for PES and benefit sharing. They are briefly outlined below.

CSIRO Sustainable Ecosystems

A team led by Dr Stuart Whitten has been actively engaged with several state government authorities and the Australian (Federal) Government in assisting with the development of market-based instruments for natural resource management goals. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) also manages its Mekong Futures initiative, led by Dr Mac Kirby, which examines water, food and poverty in the Mekong Basin. It also monitors climate change in the Mekong Basin and works with the CGIAR Challenge Program on Water and Food to develop water-use accounting systems for the program's 10 river basins.

ANU Crawford School

A team led by Professor Jeff Bennett has been funded by ACIAR to develop a PES auction scheme for land use change in China. A team led by Associate Professor Luca Tacconi has been investigating PES options for the REDD scheme.

University of Sydney

The University of Sydney has links with the CGIAR Challenge Program on Water and Food in Laos.

State governments

The Victorian Government has a number of initiatives, including BushTender and now EcoTender, that have been important contributions to the development of market-based instruments for delivering PES schemes.

The New South Wales Government has numerous offset schemes (under the name 'biobanking') in operation for development projects through the Department of Environment and Climate Change.

Central Queensland University

Professor John Rolfe at Central Queensland University leads a team working on the link between Great Barrier Reef restoration/reef health and terrestrial vegetation that is actively engaged at different

levels of government in the development and application of PES schemes using market-based instruments.

Federal Government

Under the Caring for our Country policy, the Federal Government has engaged in tendering for the provision of natural resource management outcomes. It has also used the process to develop old-growth forest conservation schemes in Tasmania.

Improving returns to smallholders and wood processors through the planted-timber value chain

Research issues

Growing planted trees

Most growers of planted trees aim for early and reliable returns and this depends upon fast growth of the trees and/or a combination with profitable agricultural options. Intercropping, a combination of trees and crops, will offer early returns. Fast growth of the tree component requires access to a selection of high-quality germplasm and adoption of the most appropriate silvicultural management of the tree crop, along with selection of the best suited tree/crop combination. While commercial companies have the resources to purchase or develop best-suited germplasm, there is a need to develop the optimal means of dissemination of high-quality germplasm to smallholders. There is also a need to provide these smallholders with a rationale and guidelines for adopting silvicultural improvements such as pruning and thinning so that their trees will meet market needs in terms of wood quality. There remains an option for collaboration with commercial companies to test the efficiency and economic attractiveness of growing planted trees such as eucalypts and acacias in agroforestry systems.

Legality and government imposts

The major identified constraint to smallholders receiving improved benefits from their planted trees was legality of the resource. Without assured legality, certification cannot be granted, logs cannot enjoy legal status and market restrictions in Europe and North America through Forest Law Enforcement Governance and Trade (FLEGT; which has now been encompassed in the Illegal Timber Law) and the Lacey Act will limit market opportunities. The constraints associated with legality are well demonstrated with the teak plantings in Luang Prabang province. Despite growers and village administrators agreeing on who controls what land and owns which teak trees, there is no formal legal documentation. In the province, only 5% of the smallholder blocks and 8% of the total resource of smallholder teak are legally registered, leaving a valuable planted resource of over 24,000 ha without formal legal status. Legality remains the cornerstone for access to modern markets and, in Laos, the Plantation Certificate is the appropriate document.

Another constraint that limits benefits to smallholders, again in Luang Prabang province, is the suite of government fees, taxes, surcharges and other imposts made on registering plantation blocks, and on harvesting and transporting timber from planted trees. The collective set of government imposts/fees/taxes/service charges is high and, as a result, sawmillers cannot pay attractive prices to growers. In addition, restrictions on transport of wood from planted trees between districts and between provinces limit growers from taking advantage of expanding domestic markets. There is an opportunity to work with the national and provincial governments to increase transparency and establish a closer alignment between provincial practices and national policies.

Harvesting and transport

Harvesting and transport of planted trees from farms and smallholdings is inherently inefficient. Trees are generally grown in small blocks on steep sites close to a road or a river and are sold one-by-one or in small batches. Most planting sites are within 500 m of a road or a river. Trees are generally small at harvest (30 cm diameter breast height (dbh) is common for teak logs in Luang Prabang) and harvesting is done by hand, using a crosscut saw or sometimes a chainsaw. Logs are cut to 2-m lengths and then carried by hand to the road or riverside and loaded onto the

trucks or boats by hand. The whole process is labour intensive and is not well paid, but the employment benefits remain within the grower community. For larger, more valuable logs, small access tracks are sometimes cut to allow entry of trucks to the site and specialist harvest teams employed. Although the labour rates are relatively low and the fixed costs of harvesting and transport are unlikely to be reduced, these operations are a significant cost in the value chain.

Current costs in Luang Prabang province for harvesting of small teak, transport of logs to the roadside and loading them onto trucks are about 50,000 kip/tree, or about 150,000 kip/m^3 (US$20/m^3). Efficiencies through reduced labour days in log extraction might be achieved through use of logging arches or use of modified diesel cultivators (known locally as 'iron buffaloes') which are commonly available in most villages. Small cranes might offer efficiencies in loading logs onto the trucks.

Transport costs for logs, squared logs and sawn lumber from growing sites (such as Luang Prabang province) to Vientiane are typically 300,000 kip/m^3 (US$40/m^3). There may be opportunities for savings once the Chinese railway and the proposed improvements to road infrastructure are complete.

Selling logs

Traditionally, traders have offered growers standard prices for their standing teak trees based on tree girth. This has the advantage of simplicity but works to the growers' disadvantage, particularly for larger trees. Following a program of training for village smallholders, The Forest Trust (TFT)-supported Luang Prabang Teak Program (LPTP) has encouraged the commercial sale of logs by volume (m^3) rather than individual trees (Table 15), resulting in higher prices being paid.

Although prices vary with tree size, form and distance from the road, farmer interviews in early December 2010 suggested that average prices for standing teak trees of diameter 20–30 cm dbh have increased by about 40% since TFT's involvement and adoption of sale by volume (Midgley 2011). Farmer training and simple management aids, such as girth/volume/price tables, will improve farmers' understanding of log pricing and add to value-chain transparency.

Primary and secondary production efficiency

Increasing efficiencies and product recoveries in processing have the potential to make substantial savings, resulting in an increased capacity for primary and secondary processors to pay growers more for their logs. Experience with the teak resource in Luang Prabang province suggests that, as the teak resource matures and becomes commercially attractive, more entrepreneurs will seek to develop primary-processing facilities in villages, close to the resource. There is an opportunity to develop a new suite of designed products based upon plantation-grown teak rather than depend on products designed for large timbers from natural forests. The availability of basic and cheap sawing machinery from China has opened this opportunity to greater numbers of small businessmen. However, poor sawing accuracy, either through equipment inefficiencies or through poorly trained operators, can reduce efficiency and returns for processors.

Plantation establishment trends suggest that there will be a significant resource of plantation-grown eucalypts in Laos in the next 5 years. This will offer opportunities, but, with the exception of the Burapha Agroforestry Company sawmill, very few mills in Laos have experience in kiln-drying eucalypt timber.

Table 15. Estimates of selling prices for teak logs: individual trees versus volumes

Tree girth (overbark, cm)	Volume/tree (overbark, m^3)[a]	Volume/tree (underbark, m^3)[b]	Selling price/tree (standing, on a per tree basis) (kip (US$))	Selling price/tree (standing, on a volume basis, m^3) (kip (US$))[c]
70	0.33	0.27	70,000 (8.70)	148,500 (18.45)
80	0.48	0.35	80,000 (9.95)	192,500 (23.90)
90	0.64	0.43	90,000 (11.20)	236,500 (29.40)
100	0.85	0.59	150,000 (18.65)	324,500 (40.30)

[a] S. Sawathvong, pers. comm., cited in Midgley et al. (2006)
[b] Dieters and McNamara (2010)
[c] Assumes a median price of 550,000 kip/m^3

Figure 7. Drying rough sawn teak boards, Ban Suan Luang, Luang Prabang province (Photo: Stephen Midgley)

There is wider experience with air-drying of teak, typically in standing stacks.

Although this suffices for village applications, kiln-drying is essential if wood is to be used for high-value, export-orientated products. Increasingly, processors are kiln-drying teak and other planted woods used for furniture under standard schedules of up to 28 days; but there is uncertainty as to the purchase and operation of the most appropriate equipment.

Use of the most suitable adhesives and finishes leads to product strength, durability and attractive presentation. While a wide range of commercial adhesives and finishes is available in Laos, only a few are widely used.

Reliability of supply and current role of traders

Supply of commercial quantities of wood from a scattered, smallholder resource base provides challenges for logistics and coordination. Demand for plantation wood is not constant and oscillates with demands from processors, who have strict deadlines to meet orders. Balanced against the commercial needs of the processors for responsiveness and timely delivery of consignments, are the household needs of the grower for whom the smallholding is a 'bank account' used as a financial resource in times of need. However, to continue to attract commercial attention, the smallholders must develop a reputation for responsiveness to demand and reliability in supply. Responsiveness to the needs of the buyers in terms of quantity, quality and timeliness is an essential early step in value-chain efficiency.

Traditionally, an agent or a trader assumes responsibility for assembling commercial consignments of wood from the smallholders in response to a particular order and generally offers growers cash in hand at harvest. While adding a cost to the value chain, the trader attends to the various government processes and pays fees and taxes and delivers the consignment to the sawmill. It is unreasonable, though fashionable, to denigrate the community service offered by traders. Traders are generally members of the growing community and they will make advance payment for trees at times when there is no market and growers are in need of cash. Traders simplify the processes for the growers, attend to the bewildering government processes and travel to government offices to meet all costs for taxes and fees.

Grower groups

Grower groups offer an alternative and potentially attractive means to achieve these important commercial outcomes and deliver additional benefits to growers through delivering wood in a timely fashion. They should be no less efficient or responsive than the trader, and the package of benefits to the grower (which includes price, responsiveness and convenience) should not be reduced. There is no guarantee that simply replacing a trader or an agent with a grower group will add to value-chain efficiency.

There have been attempts to create grower groups to bypass or complement the services of the trader/agent/middleman. Groups can quickly become dysfunctional unless appropriate training and skills development are offered and transparent accountability and clearly defined responsibilities within the group are put in place. Standards of communication within the group and between the group and the buyer can vary, adding an element of uncertainty to interested purchasers of logs. The politics and rivalries within small villages are often reflected in the behavioural dynamics of the grower groups. This can be compounded by low levels of education and a social indifference to, or misunderstanding of, formal processes. Teak owners in Luang Prabang province vary from wealthy, city-based absentee landowners to poor local farmers. Some owners and their families control up to 20 ha and other blocks might be as small as 0.5 ha. In addition, there are growers who have blocks <0.5 ha and others who own isolated or boundary trees. Not all teak-growing households will be represented in a teak grower group. The business case for a grower group must be robust and attractive if villages are to take the best commercial advantage of a consolidated resource. There is a strong case which suggests that grower groups may lack the commercial focus of the trader/agent/middleman and may not improve value-chain efficiency without some outside intervention.

Certification

Certification of planted trees can provide market advantages, including premiums for wood prices and a stable suite of regular clients offering reliable demand in times of market decline. It also offers an opportunity to develop a brand name (such as 'Luang Prabang Teak'). There is, however, no guarantee of this. Certification requires a detailed (and expensive) assessment over an extended period and regular auditing. Growers are obliged to follow certain processes that sometimes appear (to them) inconvenient or unreasonable. The processes for certification can add to the processes put in place by a grower group and these are added in turn to the processes required by government agencies. These various, and sometimes complex, processes have the capacity to impose great stress on growers who find that the simple approach of cash in hand at harvest via the local trader is far more attractive and flexible. These grower concerns are compounded by the challenges of achieving legality, as discussed above. There is the potential to create a perversity through creation of grower groups and adoption of certification schemes; the complexity of rules and processes may encourage growers to return to the services of the local traders.

Plantation trials

Laos has a long history of species assessment trials (dating back to 1968) and these have provided the foundation of information for further advanced trials by commercial enterprises such as Oji, Birla and Stora Enso, all of which have their own R&D programs, including species and clonal assessment trials of eucalypts, acacias and other genera. From industry discussions, these companies all appear to be inclined towards mutually beneficial, pre-competitive sharing of information, especially when many challenges of insects (gall wasp) and disease (rusts and leaf blights) are common to all of their commercial ventures. In collaboration with these companies and research partners at NAFRI, there appears to be an opportunity to assemble available information on species performance across many sites in Laos.

Development of an industry-led value-added timber marketing strategy

All processors interviewed during the course of this study recognised that industry restructure was needed and improvements must be made if they were to compete successfully on international and regional markets. Despite the efforts of GoL to encourage a restructure of the wood-processing industries, processors felt constrained by a lack of competitive finance to fund improvements to equipment and production systems. The financial needs of most factories to make improvements were too

small to attract the attention of international lenders such as the International Finance Corporation (IFC) and the companies lacked the assurance processes to ensure legality and sustainability that many international finance agencies require. However, interest rates for domestic sources of finance in Laos are high and discourage investment in restructure and production improvements. A focused market strategy could be undertaken with the support of the Ministry of Industry and Commerce (MoIC), the Sustainable Forestry and Rural Development (SUFORD) Project and both the Lao Wood Processing Industry Association (LWPIA) and the Lao Furniture Industry Association (LFIA) in partnership with WWF/TFT Lao Forest and Trade Platform. This is a large task and would logically be associated with the identification of alternative sources of finance that would be attractive to those industry members who seek to make better use of the planted tree resource.

Challenges that face the development of market strategies for plantation-grown wood include the relatively low volumes and limited quantities of legal wood available. It would appear appropriate that any support for the development of such strategies should complement the strategies that will be developed by the newly combined LFIA and LWPIA.

Improved wood-processing technologies

Studies conducted by the United Nations Industrial Development Organization (UNIDO 2002), the International Trade Centre (ITC 2005), Ozarska et al. (2007) and Mohns (2009) have all identified several technical improvements that can be made to the Lao wood-processing industries. These have been described earlier in this report and can be summarised as:

- **Intervention 1**—supporting plantations and primary processing of plantation-grown wood
  - improving the response to increased global demand for legal wood products through improving the processes leading to legality of plantations
  - adding transparency to the formal regulations and procedures for plantation logs and timber
  - improving efficiency of harvesting systems
  - improving efficiency and market opportunities for village-scale sawmills.
- **Intervention 2**—value-addition for plantation-grown wood
  - improving sawing accuracy and maintenance of dimensional stability for sawn timber
  - providing knowledge about, and development of, reliable drying schedules for plantation-grown wood of all species
  - developing grading rules for plantation-grown logs and timber
  - developing impartial and independent advice on specialised saws and kilns best suited to plantation timbers
  - improving utilisation of offcuts and waste material
  - improving access to modern technical information and market trends via industry cluster groups.
- **Intervention 3**—improved product design and manufacture
  - improving effective use of finger-jointing and laminating technologies
  - improving use of a range of adhesives and improved knowledge of gluing parameters.

Improved efficiency in processing will help processors to compete more effectively and pay growers more for their wood. There is a need to seek improvements in production by village-level sawmills so these enterprises can engage with the larger wood value chains, including those processors with chain of custody (CoC) certification. There is, of course, little sense in making technical improvements unless these are accompanied by relevant training programs.

Skills development

Availability of skilled and qualified staff remains a limitation for the Lao wood industries, reflected by the need to employ Vietnamese and Chinese supervisors to oversee furniture orders from those countries. In addition, factory managers and responsible government officers lacked many of the professional and business skills necessary for modern wood industries. There is a need for both short-term and long-term training and skills development on the factory floor, at technical colleges and at universities. This is a large task and might be conducted in consultation or partnership with the training institutions and the other donor programs such as the Lao–German program of assistance. At NUoL, there is an opportunity for wood-industry courses to be strengthened through development of a wood-processing laboratory to complement the wood-testing capacity the Faculty of Forestry enjoys. Despite doubts about the relevance

of wood-industry courses offered by Pakpasak Technical College, the college is to receive support from the Asian Development Bank (ADB) to re-equip its training facilities. This offers a timely opportunity to help restructure their courses, develop curricula and make them more attractive to both students and industry. The LFIA's Competency Centre's short courses are relevant and attractive but reportedly vary when German technical experts are absent. This training facility appears to be very suitable for teaching of new techniques.

Technical improvements

Although reported green-sawn recoveries are high (for teak, sawmills report recoveries of 6 m^3 of green-sawn boards from 10 m^3 small teak logs), sometimes the sawing is not accurate or the wood is sawn in a fashion that does not ensure dimensional stability in subsequent drying and other processes. This results in later waste in the production line. Simple technologies for encouraging greater sawing accuracy and ensuring best (and most profitable) sawing patterns would bring a benefit at the village level.

If the Lao industry is to compete, it needs to be based upon kiln-dried timber. Power costs in Laos are lower than in neighbouring countries and this offers a natural advantage for production of kiln-dried timber. While installation of well-designed drying kilns suitable for plantation wood remains the responsibility of the individual business, these businesses should be equipped with appropriate kiln-drying schedules for the wood of all commonly planted tree species.

Strong markets and the Chinese success with rotary veneers from fast-grown eucalypts suggests that veneer technologies would offer profitable opportunities for utilisation of Lao plantation trees. Installation of demonstration Chinese-made spindleless lathes, and the use of rotary veneers, will require information and support.

Increased use of small plantation-grown trees will inevitably result in lamination and finger-jointing of small wood pieces into larger products. Lamination processes use a range of adhesives, depending upon the tree species and the product being made; for example, those adhesives suitable for outdoor applications may not be suitable for indoor applications. There is an opportunity to identify an array of commercially available adhesives and finishes for wood of planted trees which are appropriate for different products and applications.

Research partners

The broad suite of issues identified in this and previous studies of the Lao wood-processing industries suggests that there will no single organisation equipped to address all research issues identified unless the research program is narrowly focused. Given their experience, good relationships and networks in Laos, it would be appropriate that the University of Melbourne (responsible for ACIAR project FST/2005/100, 'Value-adding to Lao PDR plantation timber products'—VALTIP) be asked to assume leadership for an initiative associated with the Lao wood-processing sector. For other potential components of a potential ACIAR project, the following Australian research partners might be considered:

- national policy and industry restructuring—ANU Fenner School; Forestry Tasmania
- social/policy issues; smallholdings will continue to be a source of planted wood; independent assessments of the processes and impacts of issues such as legality and certification on the smallholder wood producers—ANU Fenner School; University of Melbourne
- technical processing issues
  - sawing—University of Melbourne; Queensland Department of Primary Industries
  - drying (new drying technologies, drying schedules)—University of Melbourne
  - adhesives—University of Melbourne; Holmesglen College of TAFE
  - new products (assessment of rotary veneers from plantation-grown eucalypts and teak using spindleless lathes)—University of Melbourne; Chinese Wood Industry Research Institute (Chinese Academy of Forestry).
- training—for technical training in Australia and assistance with training in Laos, the Forest Industry Training Centre at Tumut, New South Wales, could offer assistance or appropriate short courses; ForestWorks (a not-for-profit organisation) also provides opportunities for learning and skill development
- assessment of existing trials and collation of data—CSIRO Australian Tree Seed Centre.

Figure 8 attempts to demonstrate the value chain for planted wood in Laos, identify where current project inputs are being made and highlights areas where strategic inputs might be made.

In Laos, it is important that GoL, particularly DoF and MoIC, and the Lao National Chamber of

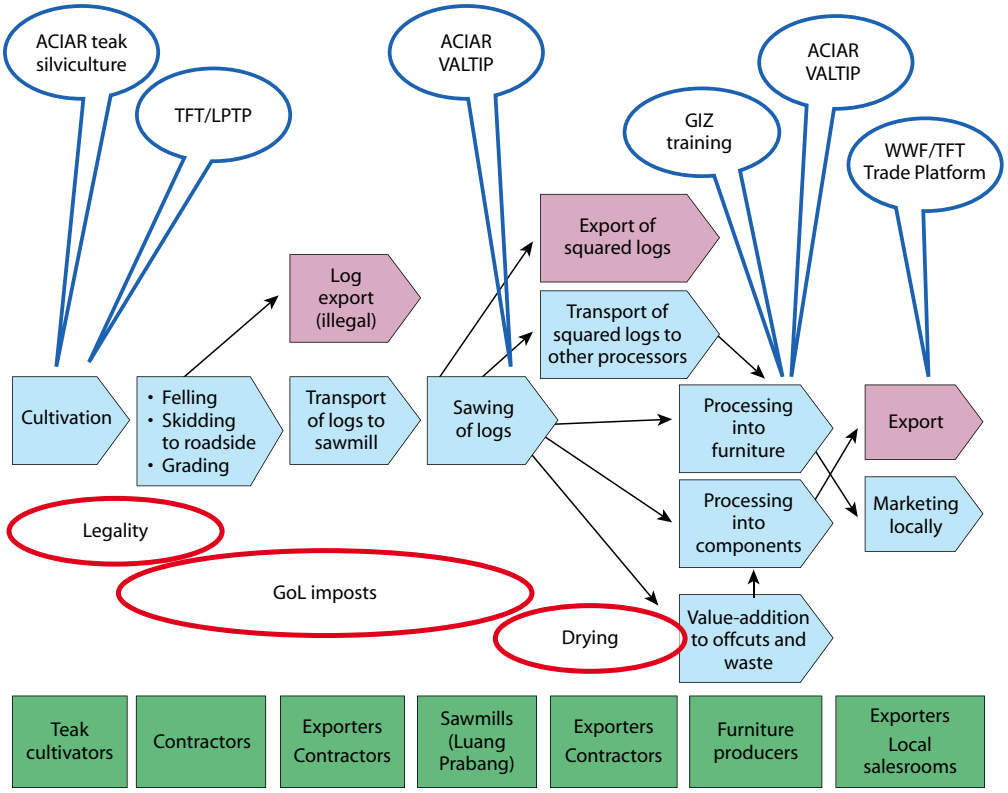

Figure 8. The planted wood value chain in Lao PDR, current project activity and opportunities for strategic inputs. Note: ACIAR = Australian Centre for International Agricultural Research; GIZ = Deutsche Gesellschaft für Internationale Zusammenarbeit; GoL = Government of Lao PDR; LPTP = Luang Prabang Teak Program; TFT = The Forest Trust; VALTIP = 'Value adding to Lao PDR plantation timber products' project; WWF = World Wide Fund for Nature

Commerce and Industry (LNCCI) are engaged fully with any research initiatives. There is an opportunity to improve linkages between suppliers and processors and related clusters. Given the proven capacity of the Faculty of Forestry at NUoL to work effectively with Australian research partners, it is logical that it be considered as a likely Lao partner. In addition, the following groups could offer contributions to an ACIAR initiative:

- LFIA Competency Centre
- Pakpasak Technical College
- the industry cluster formed as part of the VALTIP project, plus the addition of the Lao Furniture Industry factory.

An ACIAR initiative should also maintain contact with other donor-assisted projects operating in the wood-processing sector in Laos. These include:

- Lao–German program of development assistance (via the Human Resources Development for the Market Economy (HRDME) program)
- SUFORD Project
- WWF/TFT Lao Forest and Trade Platform and its partners
- TFT program of support to LPTP.

The TFT collaboration will be particularly useful in any examination of the issues surrounding legality. An ACIAR-supported initiative might also explore possibilities of collaboration with the major commercial plantation growers in Laos, including Birla Lao, Oji, Stora Enso and the major rubber growers.

Potential risks

Risks and threats to the overall wood value chain were considered in the SWOT (strengths, weaknesses, opportunities and threats) analyses conducted by UNIDO (2002), the International Trade Centre (ITC 2005), Ozarska et al. (2007) and Mohns (2009). At the macro-level, threats include:

- strong competition for wood resources from sophisticated wood-processing industries in neighbouring countries
- limited (finite) supply of logs from planted trees in Laos and the capacity of growers to meet wood demands in a timely fashion
- policies and GoL initiatives to restructure the industry to accommodate planted trees unaccompanied by competitive avenues for finance
- distance between the wood supply and the processing industry that can result in high transport costs
- if GoL is unable to address issues of legality of planted trees promptly, then Laos will be unable to capitalise upon opportunities presented by FLEGT (ITL) in Europe and the Lacey Act in the USA
- non-availability of a work force with good skills.

Potential risks at the ACIAR-project level include:

- limited access to facilities of industry partners
- whether GoL, NUoL and the Lao industry are prepared to work with the Australian team
- other external factors in the international or regional wood markets (e.g. the China–Vientiane railway) could undermine the relevance of Australian actions to improve value-adding in the plantation wood sector of the Laos.

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