Poverty - Environment Initiative (PEI) Lao PDR
Issues Brief 01-2012:

Ecosystem services and poverty alleviation: A case study of land use in Oudomxay province

Key findings and recommendations:

- New commercial crops like maize and rubber have the potential to contribute towards rural poverty alleviation over the short-run but may lead to costly loss of ecosystem services and long-term environmental degradation.
- The traditional practices of upland rice farming and collection of non-timber forest products are currently sustainable land uses, but are largely subsistence activities. These land uses are increasingly vulnerable to expanding commercial plantations.
- Results from this case study demonstrate that traditional financial analyses often overstate the returns from commercial agriculture land use as they do not take into account the longer-term environmental costs, which can potentially cancel out any short-term gains from the land use.

BRIEF The capacity of commercial agriculture plantations to alleviate poverty in rural areas of Lao PDR is increasingly weighed against its potential impacts on ecosystem services, sustainability of land resources and traditional livelihood systems. An evidence-based research of four land use types in Northern Lao PDR demonstrates that commercial agriculture plantations (rubber and maize) has the capacity to alleviate poverty in the short-run. Without necessary environmental safeguards in place however, it exposes land resources to serious environmental risks and loss of ecosystem services. By comparison, the traditional land uses that were studied (upland rice farming and non-timber forest collecting) are largely sustainable practices but are unable to contribute towards alleviating poverty of rural households.

This study, led by the National Economic Research institute, suggests that current agricultural land uses promoted for poverty alleviation will have to be improved if they are also to contribute towards the broader sustainable development goals of Lao PDR. Measures to mitigate the potential environmental impacts of commercial agriculture plantations must be integrated into the land use and farming practice. In the case of the traditional land uses, value-added options and alternative environmentally friendly income generating activities should be promoted with the farmers.

Immediate research and rigorous assessments of the ecosystem service consequences of land use decisions in other regions of Lao PDR are urgently needed to build a solid baseline of information across the entire country. These assessments of the ecosystem services of land resources should be mainstreamed into the national development and planning process as a necessary standard practice to ensure Lao PDR can fully achieve sustainable growth that benefits all Lao people.

Poverty reduction strategy in Lao PDR: promoting commercial agriculture and plantation systems

Economic growth and foreign investment are key engines to address poverty alleviation in Lao PDR, as stipulated in the 7th National Socio Economic Development Plan (NSEDP) 2011-2015. With most foreign earnings generated from utilization of natural resources and more than 80 percent of the population still relying on agriculture, appropriate and sustainable land resource development in the agriculture sector of Lao PDR is critical.

Over the last decade, availability of abundant forest and land resources and cheap labor have attracted substantial foreign investment into Lao PDR, particularly to the agricultural sector. Two of the more important commercial crops are maize and rubber. The total planted area in maize grown has expanded substantively since 2006 and has exceeded 210,000 hectares in 2010. Correspondingly, maize production has increased from about 403,000 to over 850,000 tons in the same time period, with an average yield of about 4.8 tons per hectare in 2010.[1] Rubber plantations have expanded dramatically from under 6,000 hectare (ha) in 2003 to nearly 30,000 ha in 2007, and almost 250,000 ha in 2010,[2] a continuing upward trend until the government's recent revision of the rubber plantation policy.[3]

To achieve the poverty reduction and sustainable development goals of the 7th NSEDP, land use decisions will require careful consideration of both financial and environmental consequences. Lifting rural farm households in vulnerable upland areas above poverty line through the use of commercial agriculture plantations may have implications for the sustainability and resilience of the natural resource-based livelihoods of these areas.

The issue: Is commercial agriculture plantation development an environmentally sound poverty reduction strategy?

To address the issue above, an evidence-based research in Oudomxay province of Lao PDR was carried out to assess the financial and environmental costs and benefits of four land use systems: rubber and maize plantations, upland rice farming and non-timber forest product collection.

Oudomxay province is located in Northern Lao PDR. It has gone through rapid land use change over the past 5 years. The area planted in maize grew by 12% per year on average during this time while upland rice area dropped by around 3% per year. Correspondingly, maize production grew by about 15% per year while upland rice production dropped by 6% per year on average. Rubber is only recently planted in the province with total planted area of about 24,000 ha in year 2010. The pattern of land use change clearly indicates the transition of agriculture in Oudomxay province from subsistence farms to semi-commercial and commercial plantations.

The research questions are simple: Is this land use change in the study sites of Oudomxay province financially and economically good for long-term development goals? How can the findings of this study contribute towards the national poverty alleviation strategy?

A multidisciplinary group of national experts[4] was established to carry out the study under the leadership the National Economic Research Institute (NERI) and with support from UNEP-UNDP Poverty Environment Initiative (PEI) program. The study used an ecosystem service approach to identify the types of services that are associated with each land use (see Table 1).

[1] UN FAOSTAT data (http://faostat.fao.org/)

[2] Source: Forestry Research Center, 2006 and 2007, State of Rubber Planting in Lao PDR in Regional Workshop on Rubber Development in Lao PDR, 9-11 May, 2006; Linkham Douangsavanh et al., Meeting Regional and Global Demand for Rubber: A Key to Poverty Alleviation in Lao PDR, a working paper, The Sustainable Mekong Research Network, 2008. The 2010 figure is estimated from provincial statistics.

[3] Limits set on future rubber plantations, Vientiane Times, September 16, 2011.

[4] The PEI-NERI national experts represent the following institutions: NERI, National Agriculture and Forest Research Institute, National University of Laos, Water Resources and Environment Institute, Land and Natural Resources Research Institute, and Department of Forestry, MAF.

Rank	Ecosystem Services	Land use systems			
		Rubber	Maize	Upland rice	Forest
1	Food products (quantity and diversity)		x	x	X
1	Non food products (timber, fiber fuel wood, other raw material)	x	x	X	X
2	Nutrient cycling	x		X	X
2	Freshwater regulation and supply	x		x	X
2	Biodiversity regulation	x		X	X
2	Air quality and micro-climate regulation	x			X
2	Human health quality (on-site/off-site)	x		x	X
4	Cultural and amenity (livelihoods, lifestyles, recreation)			X	X

Table 1: Key ecosystem services identified with the four land use systems

Note: The use of 'x' and 'X' in table above correspond to expected smaller or larger flows of ecosystem services generated from the land use, as perceived by the national experts group

Financial and economic benefit-cost analyses were used to compare across the four land use types: two traditional land use practices (collection of non-timber forest products and upland rice farming) and two commercial crop plantations (maize and rubber). The financial analysis is used to analyze the financial returns of the land use systems from private or farmer perspectives. The economic analysis is based on a broader societal perspective (e.g. opportunity cost of labor) and includes environmental effects. Only key on-site environmental effects are quantified, namely soil fertility loss and environmental health effects. Other non-quantifiable and off-site environmental effects are assessed using a participatory approach (See Table 2).

The objective of the project is to support progress towards poverty reduction through the integration of the environmental concerns into development planning and implementation of the National Socio-Economic Development Plan. Specifically, the case study will generate better information on linkages between ecosystem services of different land uses and their contribution to the wellbeing and livelihoods of the rural poor.

Photo 1: Local products from the forest at the local market

Case study of ecosystem services and land use

The evidence-based research study is conducted in Oudomxay province (See Figure 1). Four villages in three districts of the province were selected for the case study, each with land use dominated by one of the four agricultural systems identified for this research. Villages located downstream of the four land use types were also surveyed to identify the potential downstream and off-site effects of the different land use practices.

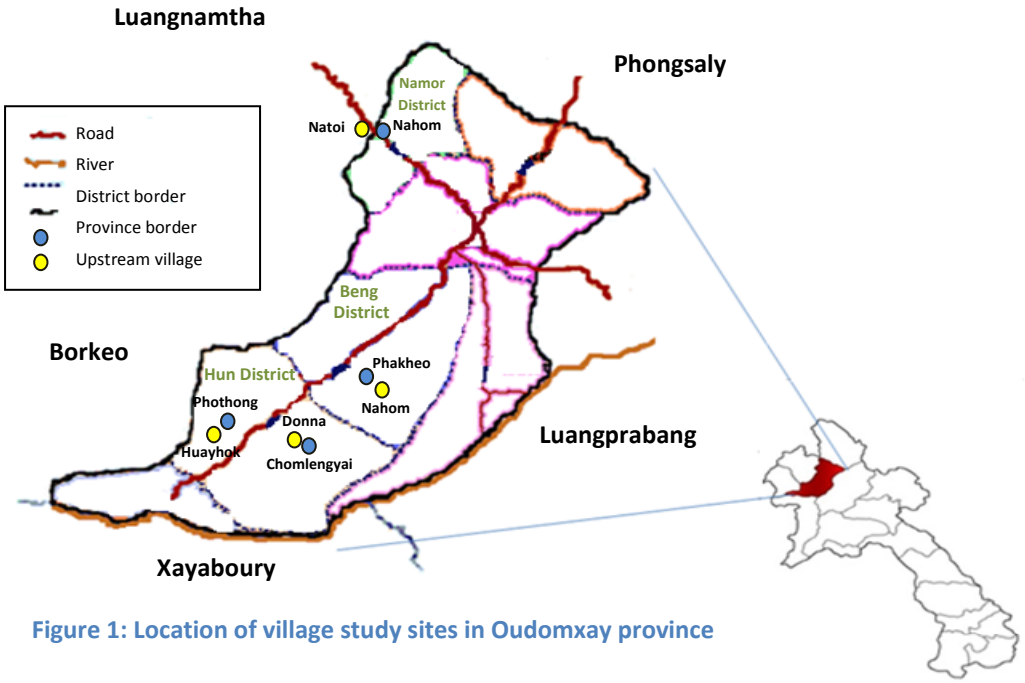

Figure 1: Location of village study sites in Oudomxay province

The rural livelihood and poverty context

The characteristics of the farming households in the four selected villages are quite similar. In general, the two villages with dominant traditional practices of non-timber forest product collection and upland rice farming have a higher proportion of poor and very poor households than the two villages largely practicing maize and rubber plantations, despite the fact that the rubber plantations are not yet mature enough for production.

The structure of household incomes are quite varied and generally come from a variety of sources (see Figure 2). Upland rice farming is practiced by all households, and is still an important commercial crop for the households. Average gross household income of maize farmers is relatively much higher than others. Compared to the national standard minimum average annual (net) income of 2.16 million kip per person[5, 6], all the study villages are below the poverty line with possibly exception of the village planting maize (average 2.98 million kip per person).

Farmers practicing collection of non-timber forest products and upland rice farming typically have cash incomes that are at subsistence level. These types of land use are generally environmentally sustainable but as they require extensive land area, are facing increased pressures. The expanding maize and rubber plantations in this region have replaced mainly fallow forests and old upland rice areas.

The practice of rubber plantations has had an impact on household livelihoods; as rubber replaced annual crops, the losses in cash income from farming can be quite serious for households with little savings or capital over the first 6 years of the plantation before rubber trees are mature enough to be tapped.

[5] Decree No.285/PM dated 13.10.2009 sets rural poverty rate at 180,000kip per person per month.
[6] Exchange rate used throughout this document: 1 USD = 8,530 kip based on date of research

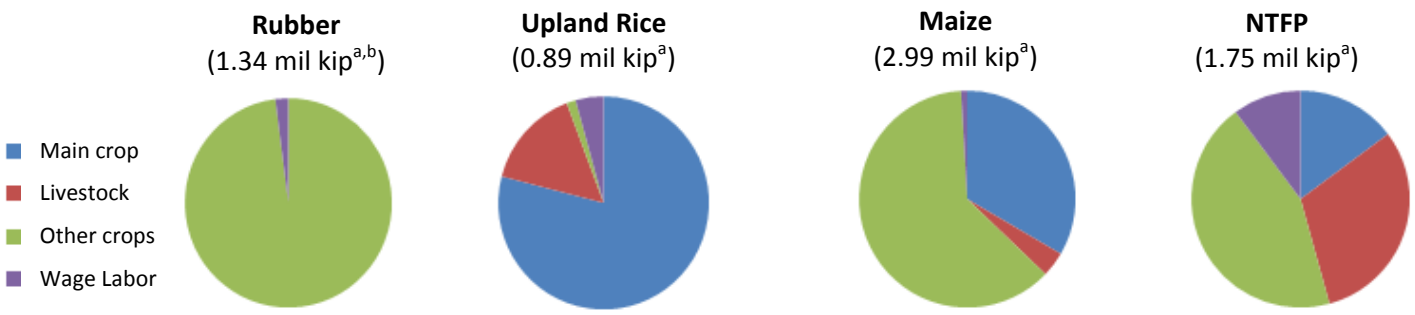

Figure 2: Diversity of income sources for households practicing the respective land use

[a] **average annual income per person from all livelihood use types**

[b] **there are no returns from rubber at moment as the trees are not yet mature enough for latex production**

The ecosystem service consequences

Land conversion in the study area has noticeably changed agricultural activities, the rural social system and environment. Farmers growing maize and rubber spend more time in the plantations, hire external labor and extensively apply chemical herbicides.

The environmental effects of maize production are a cause for concern (see Table 2). From participatory surveys with key informants in both the study area and in downstream villages, there is indication that soil fertility in maize production areas are decreasing at significant rates. Health problems due to increasing and improper uses of chemicals are widespread. Water pollution and sedimentation are increasingly observed in downstream areas. Biodiversity, especially wildlife, are also declining. Although rubber tends to cause less environmental effects than maize, farmers observed that the water table and biodiversity in the surrounding are increasingly degraded. Land in steep slope areas that is planted with rubber trees also exposes the region to potential disaster risks.

Equally important, maize and rubber expansion generates negative externalities to upland rice. The case study shows that conversion of upland rice lands and fallow forests to maize and rubber production reduces the rotation periods of upland rice cultivation, thereby reducing productivity and increasing land degradation.

The economics of land use change

To compare the four types of land uses from the private farmer perspective, a financial analysis is used. Assuming a 30-year period of constant market prices, 12 percent interest rate, the net present values show that rubber is the best option among the four land uses (with over 42 million kip per ha), followed by upland rice and maize. Collection of non-timber forest products has the lowest net present value of only about 2.4 million kip (Table 3). The results explain why farmers have extensively converted land to maize and lately to rubber.

Land use systems	**Perceptions of level of *decreasing environmental quality* (negative change) as a consequence of the land use**		
	Micro-climate regulation	Water supply and quality	Soil degradation and erosion
Rubber plantations	20 %	30 %	20 %
Upland rice farming	30 %	10 %	30 %
Maize plantations	20 %	40 %	20 %
NTFPs/ Forest	10 %	10 %	0

Table 2: Stakeholder perceptions of changes in environmental quality, derived from participatory approach

Based on trends in the study area, the conversion of conservation forests to plantations could also occur if efficient management and enforcement are not in place. The study also compared the financial analyses from different rubber investment models. It found that farmers under contract farming will earn about 25% less than non-contract farming (self-investment).

		Rubber	Maize	Upland rice	NTFP
Financial	NPV	42.17	20.11	21.42	2.35
	BCR	6.90	4.40	78.60	16.40
Economic	NPV	17.85	- 37.32	- 40.13	- 0.82
	BCR	1.50	0.40	0.30	0.70

Table 3: Net present value (NPV, in million kip per ha) and benefit-cost ratio (BCR) of financial and economic analysis, by land type

With opportunity cost of labor, environmental health and soil degradation costs included, economic analyses of the four land uses show that financial analyses have grossly understated the social and environmental impacts. Only rubber plantations as a land use option has a positive net return over 30 years, with about almost 18 million kip. The other three land use options have negative net returns, with lowest from maize plantations and upland rice farms (Table 3).

The implication of economic analysis is clear: rubber is the land use option that generates highest benefits, of the four land use systems studied. However, neither maize nor rubber is necessarily a good land use option for sustainable livelihood of rural households in the long-run without improvements to the practice. The economic analysis does not yet include the non quantifiable environmental effects to downstream villages (as outlined in Table 3). If ecosystem service consequences and externalities are fully valued and incorporated, then returns for rubber and maize could be still much lower.

Photo 2: Use of herbicide by local farmers

Photo 3: Land clearing for commercial plantations

Photo 4: Provincial officer from the Oudomxay Department of Planning supports data collection

The links between ecosystem services and poverty reduction

The case study of selected villages in Oudomxay province has shed some light on linkages between ecosystem services and poverty reduction relative to the the four land use types:

- Planting maize has improved farm income and hence supported poverty alleviation. It has however exposed the area to environmental risks due to poor soil management practices and improper chemical use. The crop is neither economically nor environmentally sound in the long-run without substantive environmental mitigation and sustainable farming practices in place.
- Based on the study projections, rubber has good potential to increase farm income, contributing towards poverty alleviation. The mono crop plantation, however, does expose rural farmers to potential environmental risks when planted in the uplands and steep areas.
- Upland rice and collection of non-timber forest products are currently sustainable land uses but do not generate sufficient income to alleviate rural poverty.
- Given that maize and rubber have expanded at the expense of fallow forests and upland rice farms, the increasing expansion of maize and rubber will increase vulnerability of sustainable upland rice cultivation and livelihoods of non-timber forest product collectors.

Policy recommendations

The policy implications of the study are as follows:

- Measures to prevent environmental degradation in maize plantations, particularly better soil management for maintaining fertility and preventing erosion, and proper measures in the use of chemical herbicides are immediately needed.
- Measures and enforcement to minimize environmental risks from the planting of rubber or other commercial crops in environmentally vulnerable areas such as uplands, catchment areas and steep slopes are needed.
- Value-added options and alternative environmentally friendly activities such as multi-crop farming systems with a mix of annual and tree crops, should be promoted to supplement farm households that rely mainly on upland rice or collection of non-timber forest products.
- Comprehensive and rigorous assessments of ecosystem services from different land uses in the North and other regions in Lao PDR should be carried out for a critical baseline to support informed decision-making on land development.
- Results from this case study demonstrate that traditional financial analyses often overstate the returns from commercial agriculture land use as they do not take into account the longer-term environmental costs, which can potentially cancel out any short-term gains from the land use. Such environmental factors must be considered within the local and national development planning process to ensure that Lao PDR can fully achieve a sustainable growth that benefits all Lao people.

Poverty-Environment Initiative (PEI) Lao PDR Issues briefs

This issues brief series is developed by the Poverty-Environment Initiative of Lao PDR to address poverty and environment issues in the current development and national planning processes. The purpose of the briefs is to provide evidence-based information and practical policy options to support transformation of the Lao economy towards a sustainable pro-poor development path.

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What is PEI?

The United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP) support the Poverty-Environment Initiative (PEI), a program that aims to mainstream poverty and environment issues into national and provincial level planning and development processes. The objective of PEI in Lao PDR is to ensure that the country's rapid economic growth generates inclusive and sustainable development.

PEI supports the strengthening of institutional capacity in national development planning and private investment management, the development of guidelines for environmental and social impact assessments, and the generation of evidence-based research on the social and environmental costs of land use decisions.

The project is coordinated by the Ministry of Planning and Investment (MPI) with project components managed by Department of Planning, Investment Promotion Department, National Economic Research Institute of MPI and the Department of Environmental and Social Impact Assessment of the Ministry of Natural Resources and Environment.

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