Initial Environmental Examination

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Lao People's Democratic Republic: Nam Ngum River Basin Development Sector Project

Prepared by the Ministry of Agriculture and Forestry for the Asian Development Bank.

Lao People's Democratic Republic
Peace Independence Democracy Unity Prosperity

Nam Ngum River Basin Development Sector Project
Additional Financing

INITIAL ENVIRONMENTAL EXAMINATION (UPDATED)

Yot Nam Lik Sub-watershed
Kasy District
Vientiane Province

Updated by: Office of the National Project Management
Nam Ngum River Basin Sector Project-Additional Financing

March, 2013

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List of Abbreviations

ADB	Asian Development Bank
BOL	Bank of Laos
CPI	Committee for Planning and Investment
CPC	Committee for Planning and Cooperation
CEI	Community Environmental Improvements
DOF	Department of Forestry
DAFO	District Agriculture and Forestry Office
DoT	Department of Transport
DoU	Department Urbanization
DoA	Department of Agriculture
DOI	Department of Irrigation
DOP	Department of Personnel
DOAE	Department of Agricultural extension
DoE	Department of Education
DoA	Department of Agriculture
ERI	Environment Research Institute
EPL	Environmental Protection Law
FAO	Food and Agricultural Organization, United Nation
GTZ	German Foundation for International Development of GeschellshaftfuerTechnischeZuzammenArbeit
IEE	Initial Environmental Examination
IWMU	Integrated Water Resources unit
IWRM	Integrated water Resources Management
LDC	Least-Developed Country
LUP/LA	Land Use Planning and Land Allocation
MAF	Ministry of Agriculture and Forestry
MIH	Ministry of Health
MPV	Marginal Productivity Values
MOF	Ministry of Finance
MOJ	Ministry of Justice
MOE	Ministry of Education
NAWACOP	Nam Gnum Watershed and Conservation Project
NNRB	Nam Gnum River Basin
NTFP	Non-Timber Forest Product
NNWS	Nam Ngum Watershed
NEQMP	National Environmental Quality Monitoring Program
NGPES	National Growth and Poverty Eradications Strategy
NAFRI	National Agriculture and Forestry Research Institute
NAFES	National Agriculture and Forestry Extension Service
NBCA	National Biodiversity and Conservation Area
OF	Office of Forestry
OA	Office of Agriculture
PLUMP/LA	Participatory Land Use Planning and Land Allocation
PM	Prime Minister
PNE	Potential Negative Effect
PAFO	Provincial Agriculture and Forestry
PPSC	Provincial Project Steering Committee

PIU	Project Implementation Unit
PMU	Project Management Unit
SOER	State of Environment Report
STEA	Science Technology and Environment Agency
TA	Technical Assistance
VODF	Village Own Development Fund
WRCC	Water Resource Coordination Committee

1. Introduction

Nam Ngum Watershed in Lao PDR is a particularly relevant and interesting area in that it illustrates management issues at a range of scales, from local to international. Its watershed has been the subject of resource management study supported by the International Development Research Center (IDRC). The study has been carried out through the center of Projected Area and Watershed Management, Department of Forestry, Ministry of Agriculture and Forestry, Lao PDR.

Approximately 230 villageslocated in the Nam Ngum Watershed. Several different ethnic groups are presented, notably Phuan, Hmong and Khamu. Different cultivation systems and associated resource uses (notably wet rice cultivation and shifting cultivation) have combined with a more general pressure on resources to create competition and sometimes conflict on land, water, and forest resources. Environment degradation is a result from development projects within watershed.

Nam Ngum Watershed is of national interest as the country's principal source of foreign exchange. Weighting up these macro-level priorities against macro-level impacts and considerations is an important resource management task for Lao PDR. This involves a range of issues including compensation mechanisms, livelihood adaptation, natural resource accounting and other tools and methods. Nam Ngum serves as a useful foundation on which planning for other watersheds can be based, particularly those slated for large scale hydropower development (SoE, 2001).

Aprevious project was supported byAsian Development Bank (ADB), has taken an Initial Environmental Examination (IEE) for Nam Lik sub-watershed, Kasy District, Vientiane Province, as one of the subprojects, the IEE covers a wide scope of potential environmental impacts associated with these interventions. The IEE follows guidelines provided by environmental assessment requirements of the ADB, Environmental Guidelines for Selected Agriculture and Natural Resources Development Projects.However, there are two immediate objectives have to be done such as:

- To foster and institutionalize Integrated Water Resources Management (IWRM) in the mainstream management process of the Government at the central, provincial, and district levels;
- To support investment in order to provide livelihood opportunities for the poor and ethnic groups.

In fact, the project has three main significant components namely: (i) IWRM, (ii) Integrated Watershed Management Unit (IWMU), and (iii) Department of Agriculture Extension and Cooperation (DAEC).

1.1 Objectives

The objective of the project is intended analysis of the IEE and others major environmental issues, and to improve the quality of life of villages in sub-watersheds, Nam Ngum River Basin, and enhance the small town roles and market, services, and manufacturing centers supporting the rural hinterland. An integrated watershed management planning would aim to

project the local people's life, agricultural production and infrastructure from serious damages in the sub-watershed areas.

1.2 Project Description

The overall purposes of the project is to establish a method of environmental assessment and integrate watershed management within the Nam Lik sub-watershed project, is to provide productive livelihood opportunities to poor ethnic groups, thereby, ensuring long term sustainability of the sub-watershed.

The proposed activities include as follow: (i) capacity building, (ii) crop productivity improvement, (iii) livestock management,(iv) forest restoration, and (v) infrastructure improvement.

Watershed management is the process of formulating and carrying out a course of action involving manipulation of the natural system of a watershed to achieve specific objectives.

- Poverty alleviation and improved standard of living, through the maintenance and enhancement of existing, and development of new, sustainable livelihood opportunities for those individual households and communities.
- Improved conservation and protection of forest areas that is important for the preservation of biodiversity and for protecting water resources.
- Improved conservation and management of the natural resources within individual watershed/river basin areas thereby enabling them to be used for economically productive purposes (water, forestry, agriculture, tourism, power generation etc.).
- Improved water resource management (rainwater and ground water) management within individual watershed/river basin areas to:
    - Provide water of the quality and quality and quantity required, and at the time wanted, to meet the needs of different water users within, and downstream of the watershed;
    - Provide human settlements, lowland farmland/irrigation systems, power generation and transport infrastructure, fish ponds downstream of the watershed, with increased protection from damage by floods and sedimentation.
- Increasing the marginal productivity values (MPV) of natural resources (land, water, and forests).

1.3 Legal, Institutional and Policy Framework

The law governing the protection of the environment, including the assessment and management of projects, is the Environmental Protection Law (EPL), 1999. An update was prepared and released in 2013, reflecting rapid economic growth and socioeconomic development and the need to address increasing conflict and social impacts as well as pollution issues with some larger projects, increasing foreign investment, and climate change. Responsibilities and procedures for Environmental Assessment, together with requirements for environmental monitoring of projects, have been revised and are set out in a new Decree on Environmental Impact Assessment (EIA decree), dated April 2010. The EIA decree states

that all investment projects that may create adverse environmental and social impacts, are to be designed with the correct and appropriate environmental and social impact prevention and mitigation measures or environmental management and monitoring plans (EMMP) and social management and monitoring plans (SMMP) (Article 1). According to the decree, primary responsibility for undertaking environmental assessment of projects is with the Office of the National Project Management (ONPM), which for this project is the Ministry of Agriculture and Forestry (MAF). The Ministry of Environment and Natural Resources (MoNRE), acting through the provincial Department of Environment and Natural Resources (DoNRE) is responsible for review and approval of environmental assessment reports, co-ordination of monitoring and evaluation, and issuance of compliance certificates. Public participation and discussion with local administrations is required throughout the environmental assessment process.

Investment projects are categorized according to a schedule to the EIA decree into category 1 –small scale, requiring an initial environmental examination (IEE) or category 2 – large scale, requiring an environmental impact assessment (EIA). The schedule lists irrigation scheme, access road improvement, and water supply (item 2.3, 4.14, 3.52, respectively) as category 1.

1.4 Methodologies

Although watershed degradation is prevalent in most upland areas of the entire Nam Ngum Watershed area the study has assessed environmental/watershed issues in Nam Lik sub-watershed only. Field survey has conducted in mid of May 2005, about seven days (one week). The study team was composed of a socio-economist and a gender/team leader, environmental/watershed management specialist, and a forestry expert.

- Take part in a minute meeting with the provincial authorities (Provincial Agriculture and Forestry Division) to discuss in the detail on environmental issues/watershed management, soci-economic and biophysical conditions within Nam Lik sub-watershed and make an interview.
- Visit relevant authorities and staffs of DAFO in Kasy District to collect data on the regulatory framework of the sub-watershed and existing knowledge of the socio-economic, agricultural productions, livestock raising and the land/forest allocation activities.
- Visit some key villages in Nam Lik sub-watershed to overview with village land being assigned to communal use (Land/forest land allocation).

2. Strengthen the Capacity of the IWMU of MAF its other relevant provincial and district department

These activities will strengthen the capacity of counterpart staffs in the provincial and district departments as train the potential beneficiaries. No direct adverse environmental impacts are expected from this component.

The strategic targets of the Nam Ngum Watershed (NNWS) management and development (MAF, 1999) sets forth action items related to basin and to watershed management as follows:

- Upgrade rural living standards by developing diversified, sedentary agricultural systems in income generating opportunities that significantly improve socio-economic conditions and villages.
- Preserve and accelerate the issuance of land allocation and biodiversity conservation and improve land use regimes.
- Improvement of social and economic infrastructure and services.
- Institutional strengthening and development of key watershed management local agencies. Upgrade and strength the deputy governor's offices as point of provincial level watershed management activities.
- Provide financial assistance to the poorest segment of the NNWS population (the 11 percent of households practicing exclusive shifting cultivation) by hiring household members to perform essential conservation and environmental management services and the village level.
- Technical, environmental and social mitigation.

2.1 Increase Crop Productivity and Irrigation Efficiency

Crop productivity is low due to farmers lacking of access to modern technological package and their inefficient farm practices. This activity will target degraded parts of the subproject and these with special environmental concerns for the water sector. Outputs will include (i) more productive and stable farming systems, and (ii) improved food security. As a result shifting cultivation will reduce considerably.

2.2 Improve Livestock and Fishery Management

These activities will improve livestock management practices by (i) utilizing improved forage technologies, (ii) modifying grazing practice to emphasize managed rather than free-range grazing of cattle, (iii) identifying major livestock diseases and their appropriate treatment and (iv) developinga farmers centered extension system at the village level. Interventions in the fishery sub-sector will extend fish technology to the village level.

2.3 Preserve and Restore Forest Resources

These activities use framework species technology for restoring degraded natural forest area with crown cover ranging between 20-40%. Using agro-forestry technologies, the project will improve forest condition and production of timber and non- timber forest products (NTFPs) over state and commune forest lands. Individual and/or groups of households will be involved in this activity.

3. Description of the Environment

NNRB in north-central Lao PDR, covers an area of approximately 16,906 square kilometers (Km^2). The upper basin, that covers about 8,297 Km^2, is the catchment area for NumNgum 1 reservoir. NNRB extends northeast from the Vientiane waterfront about 400 km to Xiengkhouang Province and is equivalent to about 2.73% of the entire lower Mekong Basin. The catchment outlet is 157metres (m) above sea level and the highest point is 2,682 m above sea level. Less than one third lies below 300m above sea level.

3.1 Bio-Physical Condition

Topography:

The Land area of Kasy District is 400,000ha and comprised 59villages[1]in 2004. Currently (2012), it comprises 51villages in 6 village clusters.Kasy District is joining boundary with 10 districts such as Nan, XiangNgeun, Phoukhoun (Luangprabang) and Paklai and Saignabouri (Xayabury Province), the boundary of Kasy district is shown in Figure 1. Almost of the village area lies at elevation of 400 m to 800 m above sea level, however the Kasy district is also located adjacent to Road N0.13 Northand the Landform quite plain and mountain from 400 to 1892 m elevation. Figure 2 shows its geographic map

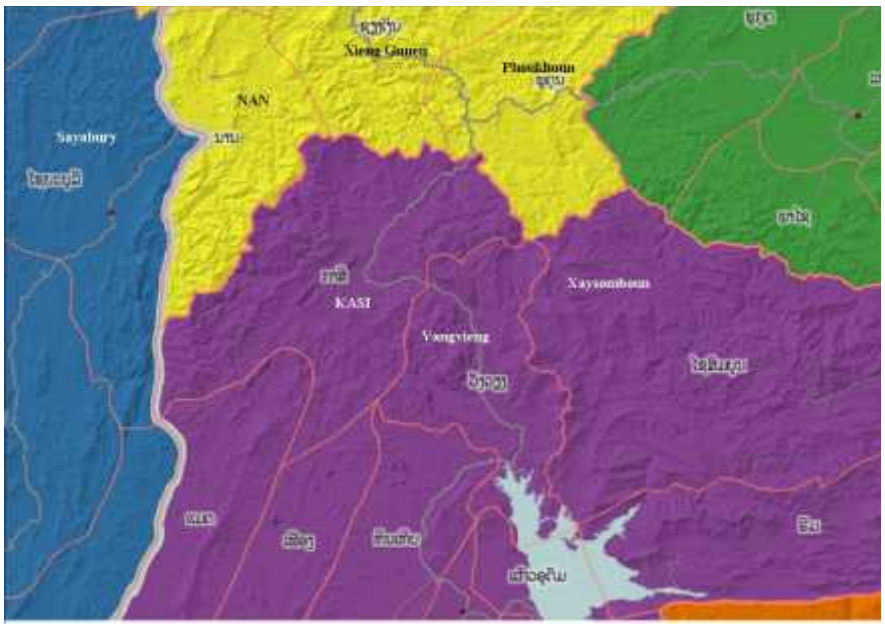

Figure 1 Kasydistrict boundary map

Figure 2. Kasy topographic characteristic map

[1]Political Draff Report to the IV conference of Kasy District 2004

The Nam Lik sub-watershed area is 600,000 ha, of which covering some part of Xiang-Ngeun and Phoukhoun districts, its boundary isshown in Figure 3.

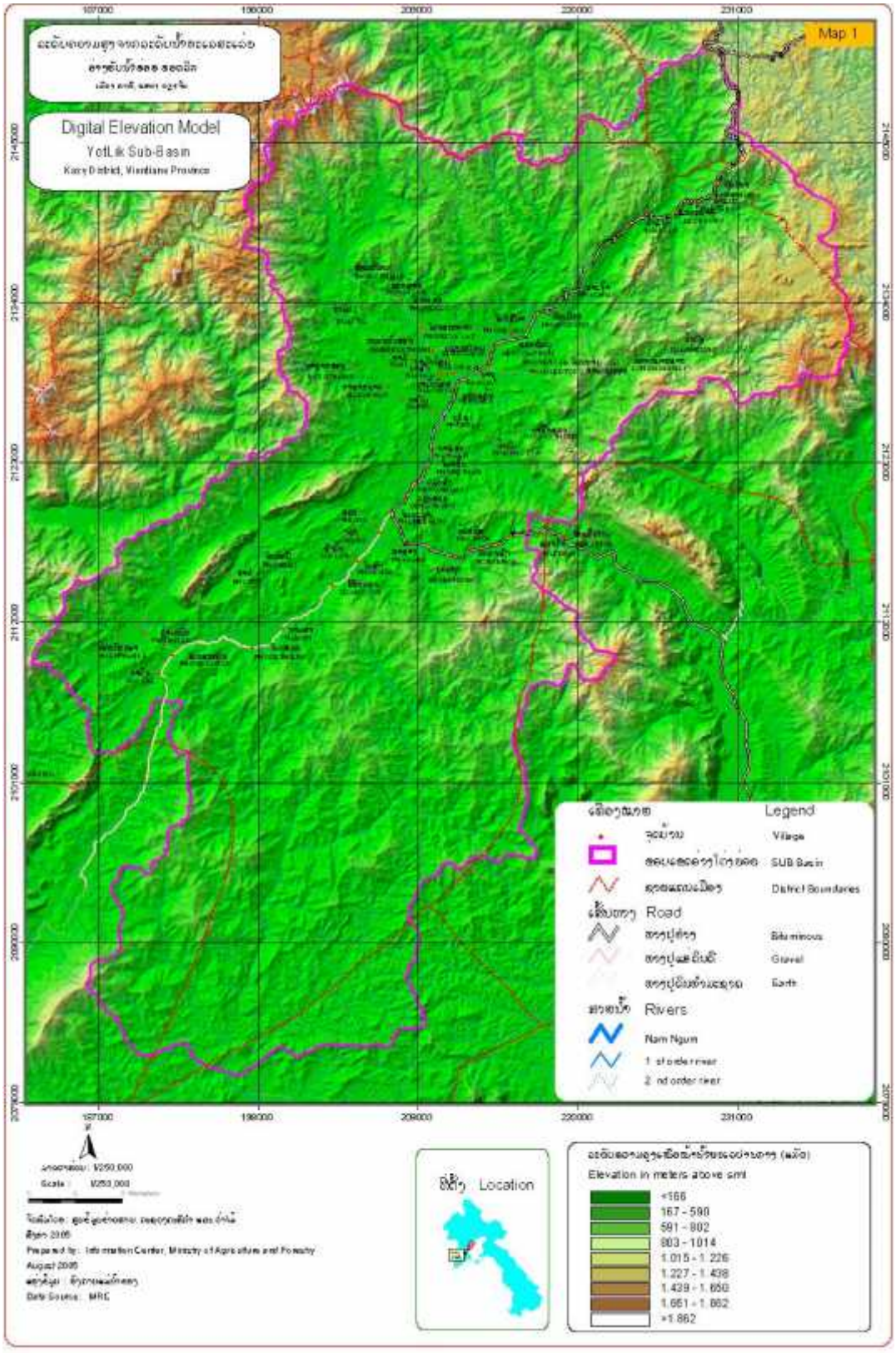

Figure 3. Nam Lik sub-watershed area map

3.1.1 Climate

Kasy district has a tropical monsoon climate, with two seasons, dry season from October to March and a wet season from April to September. The average rainfall of Vientiane province in the year 2002 is 2,511 mm and 1,770mm in 2003. Temperature, relative humidity and wind data are not directly available for Kasy district during preparation of IEE. However, the temperature of Vientiane province[2] minimum 22°C and Maximum 31°C, humidity minimum 55% and Maximum 94%. Table 3 shows information of temperature and rain fall of Kasy district from 2003 up to 2011.

Table 1 Temperature and rainfall data

Year	Temperature (°C)		Rainfall (mm)
	Lowest	Highest	Max
2003	-	-	755.3
2004	-	-	1055.7
2005	7	37	1072.8
2005	6	37.5	2600.0
2007	5	37.8	2569.6
2008	14	29.5	3421.1
2009	19	29	2317.9
2010	13	35	2977.2
2011	19	31	2248.2

Source: Meteorology and Hydrology Office, 2012

3.1.2 Soil

According to the soil survey conducted by soil survey and land classification center in 1994, the area was identified into major soil types. One is a steep slope complex (STP) where the topography is very steep, the slope is more than 55%, soil is relatively fragile and easy to erode. The second type is humid ACRISOLS (ACu) which consists of fragile organic matter, soil depth ranges between 30 to 100 centimeters and slope ranges from moderately steep 16-30% to steep slope (30-55%). For details of soil data see appendix 1.

Soil type within Nam Lik sub-watershed is quite plain and the sloping land, the characteristic of soil is mainly poor, re-yellow, podzolic, and reddish brown lateritic, with low water holding capacity. Upland rice soils have low N supply capacity and that most are deficient in P (Gupt and O'Toole, 1986). Slash and burn systems, the accumulation of soil organic matter during the fallow period and ash deposits from the burned biomass are major factors contributing to increased soil fertility at the end of fallow period (IRRI, 2001). Mineralization of soil organic matter after burning is an important source of N for cultivated crops.

3.1.3 Land use pattern

[2]Department of Meteorology and hydrology 2003

Land resources as other natural resources, play a significant role in the livelihood and welfare of Lao people. Meanwhile, the country's topographic pattern is subject to a fragile environment and susceptibility to soil erosion due to its shallow infertile soil condition and the steep slopes, shifting cultivation is considered as a major land use practice in upland and high land areas where the minority ethnic groups scattering settle.

Most villages have well established access and use the right to forest and agricultural land within areas under their traditional control. Villages enjoy traditional and customary rights to land, heritable by the family and transferable to third parties, and access to large varieties of non-timber forest products for domestic consumption and sale, and wood consumption.

Since the land use is varied so that reduce the conflict of the use of land in sustainable way, it needed to have land use planning that a means of helping decision makers to decide how to use land in sustainable way.

- **Rain-fed Lowland Rice Agriculture**

The majority of rice production in Kasy district comes from lowland wet rice fields. These are located on alluvial plain beside the major rivers; Key areas are the lower and upper Nam Kay plain, the Nam Khong plain, the Nam Ken plain, the Huay Hong and the HuayPhouk. These plains aredemonstratedin Figure 4. Table 4presents the areas of rice paddy fields and their yield capacity in the year 2011-2012.

Table 2. Productive area and capacity

No	Type of production	Areas (ha)	Yield (ton)	Capacity (t/ha)
1	Rice harvest	3,648	-	-
2	Rainy season	3,494	15,723	4.5
3	Dry season	154	539	4.30

Source: District Agriculture and Forestry Office, 2012

- **Upland Rice culture-Sweden agriculture**

In many part of the Nam Lik sub-watershed, forest encroachment follows logging are burned and forest or scrum bush land is converted to agricultural land use, generally planting of unimproved varieties of upland rice, cassava, corn, banana, etc. Crop yield are satisfactory during the first few years, due to nutrients by burning or decomposition of forest cover, the crop sharply. Upland rice field has mostly been abandoned for two or three years for natural covering and nutrient restoring. Some upland fields have been sequentially cropped in the year after if the yield is satisfaction. The intensity of farming practices is shown in table 5 below.

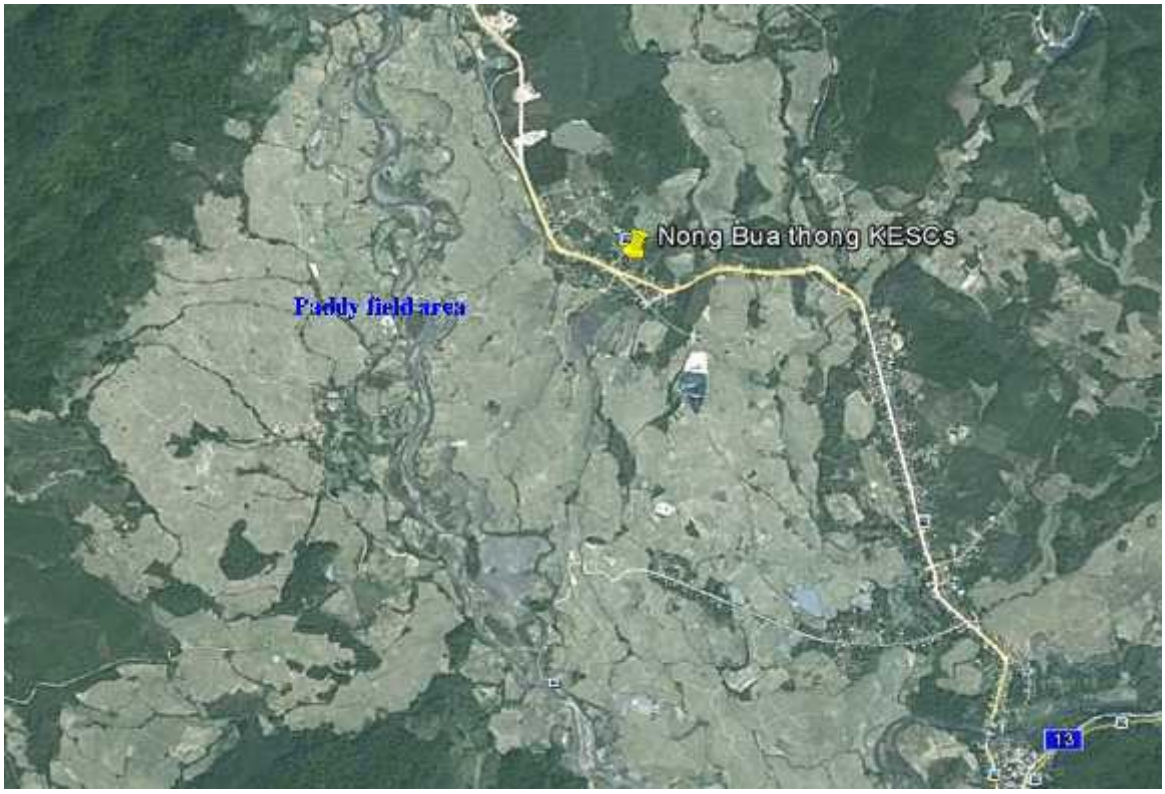

Figure 4 Rain fed lowland paddy field area map

Table 3. Cropping calendar for upland farming

Activities	Time (Month)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Au	Sep	Oct	Nov	Dec
Site selection												
Preparation of farm tools												
Land preparation												
Clearing bushes												
Burning												
Re-clearing												
Seeding												
Weeding												
Harvesting												
Threshing												
Storing												

3.1.4 Land/forest allocation

The land and forest allocation policy was formally introduced by Prime Minister (PM) Decree No.186 in 1994 and implementation was accelerated after ministry of agriculture and forestry (MAF) instruction No. 822 in 1996 was issued. The objectives of the program are:

- To promote crop production and to stabilize shifting cultivation,
- To protect natural resources environment.

Kasy district is implementing Land allocation program and success 53 villages of total of 59 village equivalent 89.83 percent and will be complete in 100% of this activity in 2005.

Land and forest land allocation which aims to introduce crop production and as well as to solve the problems slash and burn of shifting cultivation and poverty in order to encourage the villagers to engage in sedentary agriculture and livelihoods. Table 6illustrates land and forest matrix.

Table 4. Land and Forest Land Matrix

Agriculture policy objective and strategies	Measures	Targets/subsector goals	Actions/programs (Numbers correspond to MAF JICA master plan	Responsible agency
1. Forestry development 1.1 identification, delineation, demarcation and initial management of the national production forest area	I Revise the system for harvest determination to shift from a focus on industrial demand to one on sustainable supply. ii. Promote tree planting and participatory management to strength the wood supply base with clearly targeted owners, markets and investment schemes based on experience from existing plantation management and promotion methods.	i. restructure the wood industry in Lao PDR to bring processing capacity into closer accord with the sustainably raw material supply; ii. control unsustainable harvest and export of NTFPs by unregulated traders and promote sustainable participatory management and processing of NTFPs; iii. Prevent encroach, illegal activities and biodiversity degradation in NBCAs by law enforcement, capacity building and assisted participation of villagers in conservation activities.	Sustainable forestry and rural development project[+]	MAF, DOF, NAFES
			Industrial Tree Plantations Project[+]	DOF
			National Forest Rehabilitation Project[+]	NAFRI
1.2 Land resource management	i. establish land resources dabasse and mapping. ii. consolidate all natural resource planning and management functions at the national level. iv. strength natural resources management systems at the national and village/community levels v. develop agro-zoning classification maps	i. establish environmentally sustainable watershed management systems. ii. implement proper land resource management for sustainable agriculture	LW-3 watershed management program[*] LW-4 agro-zone classification, land management, and farming system development	NAFRI,STEA
1.3 tree plantation for livelihood improvement	i. agriculture promotion bank provides credit in support of establishing smallholder tree plantations.	i. Farmers accept tree plantations as sustainable on-farm livelihood alternative.	Tree plantation for livelihood improvement project[+]	NAFES, NAFRI, DOF, STEA, Agriculture Promotion Bank, CPC

Agriculture policy objective and strategies	Measures	Targets/subsector goals	Actions/programs (Numbers correspond to MAF JICA master plan	Responsible agency
	ii. CPC &FIMC streamline procedures and facilitate foreign direct investment in commercial tree plantations. iii. MAF/DOF, NAFRI, and STEA collaborate to formulate procedures and regulations for carbon offet projects per the Kyoto protocol.	ii. rural credit is available and appropriate private sector financing models are developed for promoting tree plantations. iii. both indigenous and exotic species are promoted in tree plantations. iv. the export of timber and wood products from certified sustainably managed tree plantations are making a significant contribution to export earnings. v. foreign direct investment is facilitated by the GOL for establishment of commercial tree plantations		foreign investment management committee
			Integrated agro-forestry Research project+	NAFRI
			National tree seed project+	NAFRI
			Forest fire prevention project in Xayaboury province+	DOF
			Forest management and reforestation project, Vanvieng+	DOF
1.4 participatory land allocation and land use planning with regard to stabilization of shifting cultivation	i. develop provincial and district land allocation capacity within area-based development programs. ii. Develop procedures for periodic reviews of allocation procedures and guideline for inside and outside NBCAs. iii. Technical assistance for further development of land allocation processes and to inform and increase family considerations to address land allocation. iv. Develop procedures and capabilities for participatory land-use planning incorporated within area-based programs and projects	Stabilize shifting cultivation though and allocation and sustainable land use.	LW-1 strengthening Land use planning and land allocation and land titling in rural areas SC-1.1 stabilization of shifting cultivation in in the Southern region.	CCLM, MAF/DOF, NAFRI, NAVES
			SC-1.2 Stabilization of shifting cultivation in the Northern region.	
			SC-2 Stabilization of shifting cultivation in NBCAs	

Agriculture policy objective and strategies	Measures	Targets/subsector goals	Actions/programs (Numbers correspond to MAF JICA master plan	Responsible agency
1.5 adaptive research for sustainable land-use through soil and water conservation and agroforestry systems for sloping land	i. develop institutional linkages between FSEWs/SMS with NAFRI for on farm adaptive farming systems research and demonstration including livestock and fisheries. ii. Identification and evaluation of potential farming system models for agro-climate zones. iii. Technical assistance and support for field crop, tree, livestock, and fishery programs.	Develop adaptive research systems for sustainable land-use through soil and water conservation and agroforestry for slopping lands.	LW-1 Strengthening Land use planning and land allocation and land titling in rural areas	
			SC-1.1 Stabilization of shifting cultivation in the Southern region.	
			SC-1.2 Stabilization of shifting cultivation in the Northern region.	
			SC-1.3 upland development and poverty alleviation program.	
			SC-2 stabilization of shifting cultivation in NBCAs	
1.6 adaptive research for sustainable land use through soil and water conservation and agroforestry systems for sloping land	i. Develop institutional linkages between FSEWs/SMS with NAFRI for on-farm adaptive farming systems research and demonstration including livestock and fisheries. ii. Identification and evaluation of potential farming system models for agro-climate zones. iii. Technical assistance and support for field crop, tree, livestock, and fishery programs.	Develop adaptive research systems for sustainable land-use through soil and water conservation and agroforestry for slopping lands.	SC-3 On-farm agroforestry research for sustainable upland farming systems. SC-6 agroforestry and sustainable land use demonstration.	
			SC-1 & SC-2 stabilization of shifting cultivate in the Southern Regions+	
2. stabilization of shifting agriculture 2.1 Employment opportunities 2.2 capacity building of village authority and farmer organizations	i. Introduce off-farm income opportunities: sericulture weaving, and papermaking. ii. Operation of agroforest programs iii. Operation of NTGP programs. iv. Research and agroforestries. v. Enhance the capacity of village authorities and communal organization of development projects	i. Creation of economic opportunities. ii. Strengthening of communities. iii. Improved village and community management and planning. iv. Farmers' organizations strengthened. v. Training program for farmer's organization developed.	HR-1 strengthening agriculture and forestry extension services	MAF/DOP department of personnel, DOA, NAFES, agriculture and Forestry training centers/farmer vocational
			HR-2 development of district in-service training and farmer training in agriculture and forestry, phase 2.	

Agriculture policy objective and strategies	Measures	Targets/subsector goals	Actions/programs (Numbers correspond to MAF JICA master plan	Responsible agency
	based on experiences vi. Development and strengthening of farmers' organization in management, technical knowledge, and skills vii. develop training programs for village and communal organization based on a training needs assessment and on specific village development matrixt	vi. introduction of diversified agricultural based on traditional knowledge and resources.	Lao-Cambodia-Australian Increasing indigenous rice and crop production project+	
2.3 stabilization of shifting agriculture in Northern upland and highland areas 2.3.1 shift to areabased and decentralized development, centered on integrated watershed/river basins. 2.3.2 poverty alleviation. 2.3.3 shifting cultivation stabilization	i. Development of alternative production systems (diversified agricultural development). ii. Strengthening the livestock sector by: • Supplying feed crop production. • provide micro-finance to support procurement of production inputs. iii. expand and strengthen MAF's approach to reduce shifting agriculture and to achieve land tenure through participatory planning. iv. Land-use planning based on bio-physical and socioeconomic parameters. v. participatory land allocation and land use occupancy entitlement. vi. promotion of community management of natural resources. vii. diversification of farming systems and agroforestry development through adaptive research, trials, and demonstrations on farmers' fields.	Fundamental/Long term: i. Strengthening of research and extension efforts. ii. Development of an adequate road network in shifting cultivation areas to improve accessibility and increase to improve accessibility and increase the sale of agricultural produce.	SC-1&SC-2 Stabilization of shifting cultivation in the Southern and Northern Regions and in NBCAs+	MAF/DOF, NAFRI, NAFES
			-5 Non[Timber Forest Products (NTFPs) Management and utilization of NTFPs	
			SC-4 research on sustainable management and utilization of NTFPs	
			MR-8 Processing and marketing study of NTFPs	NAFRI

Agriculture policy objective and strategies	Measures	Targets/subsector goals	Actions/programs (Numbers correspond to MAF JICA master plan	Responsible agency
	viii. expansion of community managed irrigation systems, ix. Sustainable land use management with soil erosion control, afforestation and conservation management. x. Rural saving mobilization and credit extension. xi. rural finance development based on market determined interest rates and open competition to accelerate and cushion the risks of farming systems diversification among the poorest social strata. xii. opening community market access through feeder road upgrading and expansion and market delivery system			
			Lao-Swedish upland agriculture and forestry research project +	

3.1.5 Water

High precipitation in Kasydistrict provides water to the rivers, streams as well as living life consumption. According to topography and field surveyed, Nam Lik sub-watershed is an abundant of surface water and the main important of Nam Lik's tributaries are Nam Ken; Nam Khat; Nam Xu-Noy; H.Phouk; Nam Khong; Nam Kay; and H. Hong as well as several small streams. The quality of this surface water is not pollute and quite good. The consumption of surface water in this district is mainly for household and small and medium irrigations. Kasy district, in 2005, has 12 irrigation systems, 12 gravity and 10 concrete which can supply water to irrigated area 1,200 hectares. According to updated report in 2012, the number of irrigationsystems has been increased comprising earth dams; reinforce concrete weirs, and wooden weirs. Table 7 presents a number of irrigation head works and their irrigated areas.

Table 5 Irrigation scheme and area

No	Type of head work	Number	Wet season irrigated (ha)		Dry season irrigated (ha)	
			Plan	Completed	Plan	Completed
1	Earth dam	2	116	116	80	30
2	Reinforce concrete weir	30	1,487	1,487	1,000	800
3	Wood weir	151	1,454	1,454	-	-
4	No irrigation scheme	-	394	-	-	-

Source: District Agricultural and Forestry Office, 2012

3.1.6 Forest

Kasy district has 5 nurseries and supporting 34,340 plants per year, presently, it has been 5,000 hectares planted of tree. Forest cover is somewhat sparse in the Nam Lik sub-watershed and land use shows a mixture of forested areas (mixed deciduous and dry dipterocarp), bamboo and ray forested areas, scrum, and wet rice cultivation on land under agricultural use. See Figure 5

Figure 5 Forest area

Forest types have been classified into protected forest area, conservation forest area, and reforest areasin order to manage and protect natural resource and surface water resources.According to the data collected by DAFO in 2012, protected forest area is about 618 ha, conservation forest area is 921ha, and productive forest area is 228 ha.

Forest restoration, restoring previously forested areas has only positive impacts. Certain concerns, however, include the selection of species to be introduced (e.g., fruit trees, eucalyptus, teak) and how the activity will affect the overall farming system. The government policy is to avoid growing eucalyptus in upper basin as it damages soil structure. Teak is a positive commercial species, but its plantations have to be accessible to transport and other infrastructure. Orchards are good in principle, but their impacts on the general environment require a view and preparation of possible mitigation measure as the project progresses.

3.1.7 Biodiversity

National Biodiversity Conservation Areas (NBCAs) are managed by the Ministry of Agriculture and Forestry. According to the World Conservation Union (IUCN), protected a area is an area dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effect means.

The NBCAs system for Lao PDR was legally established in 1993 through the Prime Minister's Decree No 164. Two more NPAs have been established since then, which NBCAs now totaling 20, while others have been expanded. In the end of year 2000, the PM Decree No 193 established the contiguous areas between three NPAs as corridors, i.e:

- The corridor between Nakai Nam Teun NPA and PhouHinpoun NPA
- The corridor between Nakai Nam Teun NPA and Hin Nam Nor NPA

Now, the total area within the national system is about 33,907km^2, or about 14.2% of the country's land area. However, this area is not covering by NBCA, there are no known endangered varieties of flora or fauna in the sub-watershed areas to be affected by the development activities of this watershed, as most of the land areas have been previous by the development activities of this sub watershed, as most of the land areas have been previously developed.Habitat Composition of Existing NBCAs, 1997

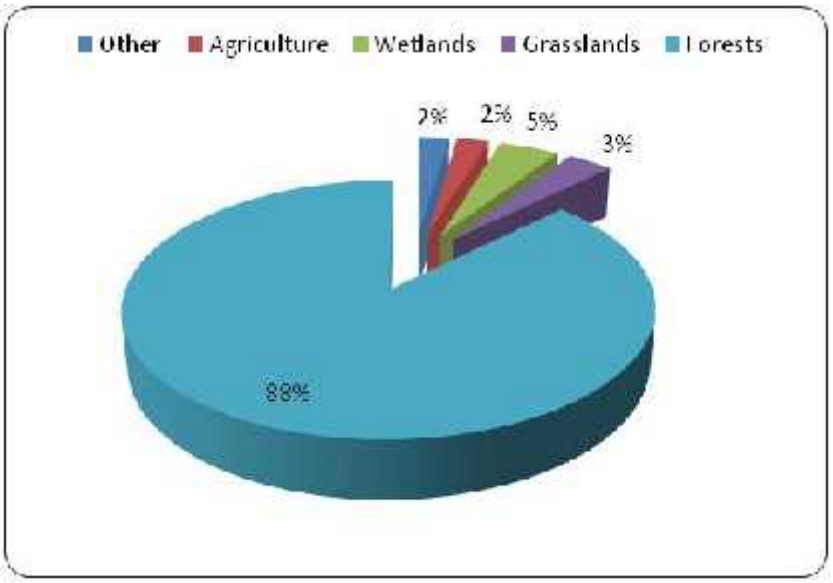

Figure 6 Biodiversity in Laos

3.2 Socio-economic development

Kasydistrict, statistic of 2005s, has an area of about 400, 000ha, comprising 59 villages with population 27,588 persons. This population density is 13persons/Km^2. The principal ethnic group is the laoLoum with 50%, with minorities of the Khmou with 45, 55% and Hmong with 4, 45%. The various ethnic households appear well assimilated.

The statistic of year 2012, the population of Kasy district is 36,521persons, female is 18,220persons. The detail of this information presents in table 8.

Table 6 Statistic of population in 2012

No	Name of Village Cluster	Population				lao Loum			Khmou			Hmong			Oiewmien			Famaly		
		House	Family	Total	Female	Total	percentage	Female	Total	%	Female	Total	%	Female	Total	%	Female	Total	%	Female
1	Phachao	1,286	1,479	7,433	3,873	1,318		757	4,210		2,227	1,905		889	-		-	169		
2	Phoukham	1,583	1,941	9,023	4,430	4,532		2,219	3,050		1,502	936		469	500		236	23		
3	Na Moon	1,311	1,508	7,128	3,694	3,195		1,697	3,543		1,786	185		98	205		113	73		
4	Nong Kham	492	561	2,832	1,336	932		400	1,900		936	-		-	-		-	39		
5	Ban Jieng	955	1,129	5,316	2,529	4,277		2,025	1,044		518	-		-	-		-	55		
6	Phunglak	844	973	4789	2358	899		438	2830		1335	1060		585	0		0	306		
	ລວມທັງໝົດ	**6,471**	**7,591**	**36,521**	**18,220**	**15,153**		**7,536**	**16,577**		**8,304**	**4,086**		**2,041**	**705**		**349**	**665**		

Source: Governor Office, 2012

3.2.1 Education

The education and technical support to each sector development is a very significant to assist the villages development strategic and action plan of Nam Lik sub-watershed. There are 3 kinder schools, 53 primary schools, and 5 secondary schools, 284 teachers and 825 students in the in the Kasy district.

Table 7 Education statistic 2012

No	Description	2005				2012			
		No. of school	No. of Room	No. of student	Average per room	No. of school	No. of Room	No. of student	Average per room
1	Kindergarten	3	9	165	18	3	9	131	14.5
2	Primary school	53	169	4,651	27.5	46	207	5,893	28.46
3	Secondary school	4	39	1,365	35	4	53	2,554	48
4	High school	1	12	719	59.9	3	19	974	51

Source: District Education and Sport office, 2012

3.2.2 Health

In 2005, there are 1hospital, 2 dispensaries, 39 nurses of which 4 medical doctors, 8 technicians, 27 elementary, and average 710 patients per one medical doctor. There is a high incidence of water related diseases such as malaria, dysentery and diarrhea and other indications of low hygiene levels. Approximately 43.49% of households have toilet facilities, and about 62.25% have access to save water[3].

The data of year 2012 presented here there are 1 hospital with 20 rooms, and 5 dispensaries where located different places such as B.Jieng Dispensary with 5 rooms, B. Phachao with 4 rooms, B.Phontheing with 12 rooms, B.Phunglak with 7 rooms, B.Thongsan with 7 rooms.

3.2.3 Transport and communication

There are main paved roads in 2012, one is road No.13-North through Kasy district from South to North parts and one other is Kasy-Nan Road, this road is conjunction with Road No. 13 at B.Viengkeo to B.Thongmued directing to Nan District of Luangprabang Province.

Table 8. Road and access road

No	Road and access road	Length (Km)	From	To	Remark
1	Road No. 13 North	59	Phouhinlekfai	HinNgoun	Asphalt
2	Kasy-Nan	40	Viengkeo	Thongmued	Asphalt
3	Nasou-Longmarkkai	40	Nasou	Longmarkkai	Gravel
4	B.Jieng-Muengmad	25.4	Phonbeng	Keokadath	Clay
5	Viengkeo-Hauyphanla	32	Viengkeo	H.Phanla	Clay
6	Viengkeo-Nam Fot	9	Viengkeo	Nam.Fot	Clay

Source: District Civil work and Transport Office, 2012

The communication is also available to communicate by telephone and mobile.

3.2.4 Agriculture

Agriculture system in the Kasy district detail is in table 11 below with average yield ranges from 4.35 ton/ha for rained paddy rice, 3.33 ton/ha for irrigated paddy and 1.3 ton/has for upland field yield.

[3] Political Draft Report to the IV conference of Kasi District 2004

A total of 1,624 ha of land for other crops planting during dry season in Kasy district such as Maize, starchy roots, sesame, vegetable and bean, mungbeans, soybean, peanut, tobacco, cotto, sugarcane, lemons, orange, cucumbers, water melons, papayas, pineapple, garlic, onion, carrot, aubergine, cabbage, cauliflower and potato. The area cultivated for rice production detail in table below.

Kasy district has many families who have become ideal model for agriculture, e.gKhoun's family, Namone village whose rice harvest has reached 5 ton/ha. Khamsone's family, Viengsamay village planted chili and had harvest of 5 tone/ha to generate an income of more than 20 million Kip.

Table 9. Agricultural areas

District name	Rain fed paddy (ha)	Irrigated paddy (ha)	Upland fields (ha)	Others (ha)
Kasi	2,284	754	-	-

Source: District Agriculture and Forestry Office, 2012

The National Growth and poverty eradication strategy (NGPES) is central to the national development agenda. Form a poverty eradication perspective, the most important policy-related objective regarding agriculture/forestry development is improvement of household food security, contributing to this objective, and improved living standards more generally, market-based farming will be enhanced, disparities between lowland and sloping land farming reduced, and sustainable forest and watershed management enforced.

Table 10. Agriculture matrix

Agriculture Policies objectives &strategies	Measure	Targets/subsector goal	Actions/programs (Numbers correspond to MAF-JICA Master Plan)	Responsible agency
i. Poverty alleviation/poverty eradication through sustainable economic growth 1.1 food security and self-sufficiency in food production program 1.2 Provide an enabling environment for agricultural development	i. Distribution of improved paddy seed. ii. Improvement of cultivation technologies. iii. Effective use of existing irrigation systems. iv. Identification of remote low-income villages based on selection criteria to be established (or revised) in each province. v. Training of ROD and relevant department staff for participatory survey and project planning.	i. at the 1996 world food summit GOL pledged to achieve a measurable and monitor goal "..to eradicate hunger in all countries, with an immediate view to reducing the number of undernourished people to half their present level no later 2015"	Food production program: AC-1 rice seed multiplication systems improvement project*	MAF
			AC-2 Rice storage for emergency Purpose*	NAFES
			AC-3 integrated agricultural research project*	Rural Development office (RDO)
			Remote area agriculture development approach RD-1 village-led agriculture development initiative in remote Areas, phase I*	MAF, PAFOs, NAFES
			RD-2 village-led agriculture development initiative in remote areas, phase I*	
			RD-3 integrated agricultural and rural development on the Bolivens Plateau*	
			Smallholder development project+	DOA
			Special program for food security+	NAFES

Agriculture Policies objectives &strategies	Measure	Targets/subsector goal	Actions/programs (Numbers correspond to MAF-JICA Master Plan)	Responsible agency
	vi. Conduct participatory surveys in selected villages and clarify local needs and potentials vii. Formulation of plans for rural infrastructure improvement and/or development where beneficiaries are involved. viii. Formulation of operation and maintenance plans involving beneficiaries. ix. Construction of rural infrastructure based on the plans with beneficiary participation.	Food production: ii. 3 million tons; 2,7 million tons of rice and 200,000 tons of meat, fish, eggs, and milk.	Special program for food security and south-south+	NAFES
	x. establishment of a mornitoring and evaluation plan. xi. training of providing and district NAFRES staff for extension activities. xii. operation of field demonstration plots. xiii. micro-credit introduction and operation xiv. construction of marketing facilities.	i. To alleviate rural poverty and improve the livelihood of the rural population through improvement/development of rural infrastructure facilities.	RD-4 Area-Based integrated rural development program phase I*	Rural development office in each province
			RD-5 area-based integrated rural development program phase II*	
			Livelihood improvement project+	NAFES
			Agricultural research institutional development project+	NAFRI

Agriculture Policies objectives &strategies	Measure	Targets/subsector goal	Actions/programs (Numbers correspond to MAF-JICA Master Plan)	Responsible agency
			Integrated rice paddy development	NAFRI
1.3 minimum target: the production of paddy for food security through the food production program	i. improve rice multiplication system. ii. Establish and strengthen the integrated and participatory agricultural extension system including adaptive research trial and demonstration. Improve extension guidelines and materials. iii. Improve extension guideline and materials. iv. Facilitate post-harvest handing in rice milling storage in the private sector. v. technology improvement in irrigation water management. vi. further develop applicable technology for rice varieties and cultivation. vii. improve rural access road. viii. improve access to rural credit for purchasing inputs. Develop proper areas specific technology for production of upland rice and other food crops.	i. Distribution of improved paddy seed. ii. improvement of cultivation technologies. iii. effective use of existing irrigation systems. iv. farm to market roads are improved. v. Access road to credit is improved in rural areas. vi. Millennium declaration vii. Goal 4: Reduce child mortality by two thirds between 1990 and 2015, the under five mortality rate. viii. Goal 1: Eradicate extreme poverty and hunger: Halve, between 1990 and 2015, the proportion of people whose income is less than one dollar a day.	AC-17 integrated farming technology research program*	MAF, DLF, NAFRI, NAFES
			AC-18 lao-IRRI rice research and training program phase 4+	
			AC-19 mechanized farming system research program	
			AC-20 agriculture machinery performance test criteria	
			AC-21 basic seed production technology research program	
			AC-22 upland crop cultivation technology development project	
			RD-4 Area-based integrated rural development program phase I	Rural development office each province
			RD-5 area-based integrated rural development program phase II	

Agriculture Policies objectives &strategies	Measure	Targets/subsector goal	Actions/programs (Numbers correspond to MAF-JICA Master Plan)	Responsible agency
1.4 community production program: agricultural commodities support will be promoted.	x. develop mechanized farming systems		PhongSaly rural development project 2+	NAFES
			Self-sufficiency rural development project, MouangPhin, Savannakhet+	NAFES

Source: LaoPDR-NGPESs annex 3.

3.2.5 Livestock and Fishery

Livestock is an important activity for all rural communities. Animal husbandry provides the income needed to cover the rice deficiency and the purchase of market goods as well as enabling families to participate fully in tradition all ceremonies and feasts such as festivals, weddings and funerals. The most important animalraises within district are in the table 13.

Table 11livestock statistic

Buffalo	Cattle	Goal	Pigs	Poultry
2,210	7,595	1,225	4,900	113,500

Source: District Agriculture and Forestry Office, 2012

Kasydistrict has many families which have become ideal model for livestock; e.gKhammao's family has 150 cattle's, 20 buffalos, and more than 100poutry which generates an earning of 20millions Kip per year. Sitha's family has chicken farm with 2,265 heads, and able to collect more than 1000eggs per day which generates an income of 40million Kip per year.

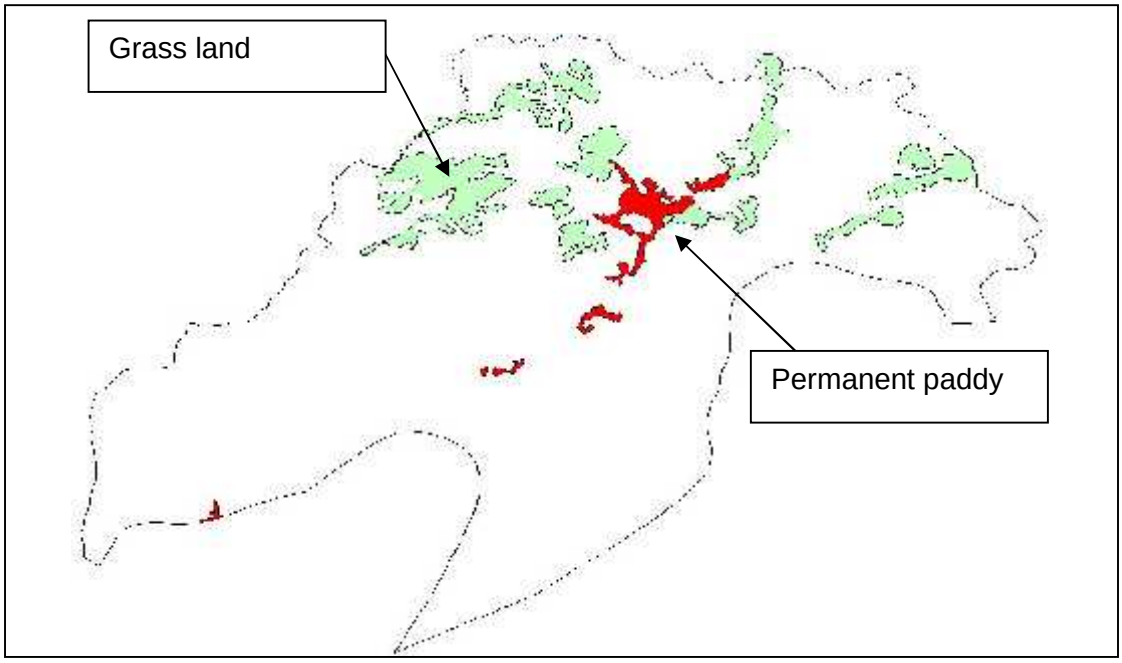

Figure 7 Paddy field area

The Lao expenditure and consumption survey, 1997/98 and the agricultural census 1998/99 both indicate that fishing and collection of aquatic animals are very important for subsistence and integral parts of all aspects of people's livelihood strategies.

Since the number of population and fishermen increased and the number of fish are gradually decreased due to over exploitation, in case of fishing communities in Nam Ngum Reservoir indicated the decreasing of fish population, due to over fishing and use inappropriate fishing gears (Mekong Secretariat, 1992).

Official MAF statistics (2002) mention an annual fish production in the range of 83,500 tons (NBSAP, 2004) of which 55,500 tons derive from fish culture with the remainder originating from natural sources such as rivers, reservoirs, swamps.

TheGovernmentofLaoPDRhasrecognizedthatthefisheriessub-sectoristheintegralcomponentofthefisheriessocio-economicandprice,since1995to2004.Theannualfishproductionalmostfishingfrom MekongRiversBasinandits14tributaries,largereservoirs,sallowirrigationandweirs,wetlandandswamps,naturalpondsandoxbows,rain-fedricepaddyfield,fishpond,ricecumfishcultureandcage cultureincludingtotalareas 960,416hayear2004.

The existing fish pond of Kasy district[4]is51.83hectares. Mostly, the fishery in Kasidistrit is tilapia common carp, grass carp, siver carp, big head carp, clariasbatrachus and others carps.

Table 12. Fish production in Laos

year	Amount (ton)	Remark
2004	94,710	
2003	93,165	
2002	83,455	
2001	73,855	
2000	71,316	
1999	60,403	
1998	42,000	
1997	41,000	
1996	40,200	
1995	40,000	

[4] Political Draft Report to IV conference of Kasi District 2004

Table 13. Livestock and fishery Matrix

AgriculturePolicy Objectives& Strategies	**Measures**	**Targets / Subsector Goals**	**Actions/Programs** (*Numbers correspond toMAF-JICAMasterPlan*)	**Responsible Agency**
1.Livestock Development	i)Develop suitable technologies for overall improvement in livestock production. ii) Strengthen the nimal health control system through the productionand distribution of vaccines. iii)Strengthen the livestock extension system by adaptive research trialsand demonstrations. iv)Rehabilitatethe existing research centers and stations. v) Strengthen information networks on productivity, disease, and markets. vi)Introduce ameat inspection Systemwiththe installation of facilities. vii) Technical assistance for animal improvement andbreeding for the private sector. viii)Improveaccess roads and accesstocreditfor livestock production ix)Introduce a veterinary education and certification system.	i)To achieve sustainable development in the livestocksectorin an environmentally friendlymanner. ii)To reduce the lossoflivestock. iii)To increase household income through livestock production. iv)To contribute to nutritional improvement through increased protein supply. v)To enhance foreign exchange earnings through the exportof livestock and livestock byproducts.	LF-1LivestockServices andExtension ActivitiesStrengthening+	Departmentof Livestock& Fisheries, NAFRI, NAFES
			LF-2Animal Health Improvement+	
			LF-3Animal Improvement and Breeding System	
			LF-4Introduction of AnimalInsurance System	
			LF-5Livestock Productivity Enhancement	
			LF-6NationalAnimal Health Center Improvement+	
			LF-8ResearchProgram of Fodder Crop Production and Sustainable Use of PastureLand	DOLF
			LF-9Animal Disease Control Promotion Projectin Indochina+	DOLF
			Strengtheningof LivestockService & ExtensionActivities+	DOLF
			StrengtheningCross BorderAnimalDisease Surveillance& Coordination between China, Laos,Thailand& Viet Nam+	DOLF

AgriculturePolicy Objectives& Strategies	**Measures**	**Targets / Subsector Goals**	**Actions/Programs** (*Numbers correspond toMAF-JICAMasterPlan*)	**Responsible Agency**
Fisheries Development	i) Development of applicable technology for inland fisheries, including pond management and feeding. ii)Developmentof technologyonfish feed usinglocally available aterials. iii) Establishment and strengthening integrated and participatory extension systems including adaptive research trials and demonstrations. iv) Rehabilitation and establishment of research centersor stations related to fisheries production. v) Development of improved varieties of inland fish. vi) Identification and conservation of local aquatic resources. vii) Technical assistance to fish fry productionon a communal basis.	i) To achieve sustainable fisheries development in an environmentally friendly Manner. ii) To increase income at the household level through fish roduction. iii) To contribute to nutritional improvement through increased protein supply.		

Source: Lao PDR-NGPES. Annex 3

3.2.6 Non-Timber Forest Products (NTFPs)

Throughout the Nam Liksub-watershed, Non-Timber Forest Products fulfill villagers' needs for subsistenceandeconomicdevelopment.HowevertheuseofNTFPsiscommoninmanyaspectsoflife, and unlike timber,mostNTFPs-rattan,bamboo,honey,rasins,herbs,etc.canbecollectedandsold legallyascashcrops.Deforestationhasreducedtheresourcebase ofNTFP.Thereisaneed toconservetheforestresourcebase,whiledevelopingharvesting,marketing,andlocalprocessingofn on-
timberforestproducts.Ifnoactiontaken,thewayoflifeoftraditionalforestdwellerswillbelost,alongwitht heirknowledgeoftheuseandsustainablemanagementofNTFPs.Collaborativeeffortsareneededinth efieldofmedicine,agricultureandforestrytoimprove dataonhabitats,sustainable harvestlevels,taxonomy,propagation,processingandcommercializationofNTFPs.

3.2.7 Industry and Handicraft

Kasydistricthas559Industry-Handicraftunitescomparedwiththeyear1997increased198, 45%.44 Villageshaveelectricityconsumptionequivalents74,57%oftotalvillage,75familiesinremoteareause smallhydropowerand6villageusesolarenergy.Villagersintheareahavetraditionallyproducedhandic raftssuchasweaving;sericulture,knitting, and bambooweaving,whichhaveprovidedadditionalincome fortheirfamilies.In general,mosthandicraftproductionisstillbasedontraditionalpracticesandmain obstacleforincomegenerationis thattheproductsmostofteninsufficientquality.

- Energy and Mining Development

The survey and exploration of energy and mining are overwhelming every corner of the country. Kasy district has potential resource to develop such kind of developments. In 2012s, there are 2 hydropower dams were being built. 51 villages have accessed and used electricity. While mining development has also surveyed and explored in Kasy district. Mineral ores explored in 2010 presented in Table 16 below.

Table 14 Mining exploration

No	Exploration Activities	Investor (company name)	Investment cost (1000,000 kip)
1	Zinc ore explorations (2010)	Skye	452,32
2	Zinc ore explorations (2007)	Fedy	2,100
3	Zinc ore explorations (2010)	Phadeng	500
4	Copper ore exploration 1 (2010)	Jackapath	438,614
5	Copper ore exploration 2 (2010)	Jackapath	850
6	Copper ore exploration (2010)	Phatheam	1,600
7	Mineral ore exploration	Vangvieng mineral	

Source: District Energy and Mining Office, 2012

3.2.8 Tourism

Kasydistricthas ThumPha;ThumKhounlang;Thumphaboun and NamKen'sHot spring. Referred to survey data collected in 2012, the number of tourists has been increased since the

establishment of district information, culture and tourism office in 2009. The number of tourist visited Kasy district shows in table 17.

Table 15 tourist information

No	Themes	Amount/year			
		2009	2010	2011	2012
1	All number of tourists	8,140	10,190	16,370	11,997
2	Foreigners	316	954	3,888	1,709
3	Restaurants	9	11	16	17
4	Quest houses	5	6	8	11

Source: District Information, culture and Tourism Office, 2012

3.2.9 Income generation

MainincomeforallKasyDistrictisderivedmostlyfrom(i)agriculturalactivities,(ii)trade,(iii)services,and (iv) Governmentservice.Sourcesincomegenerationbyhouseholdsare90%fromagricultureandderivedfromhandicraftandlivestockselling.Fishingisstillbeinganimportantactivityforthevillagersforfoodandtoearnincomeforthefamily.Incomegeneratedfromvegetableandfruitselling,ricebutthisproportionisrelativelysmall. Farmerswillsell ricewhenthereisnooptiontoearnmoney.

3.2.10 Rural development and poverty eradication

TheGovernmenthasputemphasisontheconstructionofexistingbasicinfrastructuresinordertoincrease commodity production; mobilization of development funds for villages by providing asupportingbudgetof25billionkipsfor47ofthepoorestdistrictsnationwide(National SocioEconomicDevelopment Plan,2004-2005).Although,Kasydistrictisnotapoordistrictbynationalcategories,Kasydistrictmobilizesdevelopmentfundsforvillagesforagriculture,livestock,handicrafttogeneratefoodproductionamountingto239millionKIP, generatesafewateramountingto187millionKIP.Togetherwithlocalpeopleoftargetvillages, it establishedVillageOwnDevelopmentFund(VODF)of14millionKIP.

4. Environmental Effects

The intention of the initial environment examination (IEE) was focused on the socio-economic development,naturalresourcesandwatershedmanagement,includingthemitigationimpactwhichmay arise duringtheprojectimplementation.However,theenvironmentinLaoPDRisstilldeteriorating:Biodiversityisdeclining,forestcoverdecreasing,deterioratinginwaterandsoilqualityerosionremainsaseriousproblem,andurbanenvironmentalproblems(suchaswaste,toxicandhazardousmaterialetc) stillgraduallyincreasing(SoE, 2001).

ThefirstNationalForestryConferenceheldin1989,thegovernmentreviseditsnaturalresources managementpolicies,basedonconcernsaboutdegradationofnaturalresources,especiallylostofforestcover,soildegradation,andcleanwatersupply,whichwereseentobebasedondirect,causallink betweenforestlossandwidespreadshiftingcultivationofsubsistenceuplandriceproduction.

Population pressureduetothelimitationofagriculturelandisconsideredasamajorcauseofforest encroachment.Uplandfarmers,whomostlyengageintraditionalslashandburnshiftingcultivation,havebeenclaimedtobethecauseofenvironmentaldegradation.Forestfirehasbeenameansoflandcleari

ngsincelong.Shiftingcultivationisafarmingsystemthatreliesonfireforclearingthelandofslashedtrees,shrubsandgrasses.Beinguncontrolled,thefirespreadsintoforest nearbyanddestroysyoungtreesandseedling.Everyyear,uncontrolledforestfirehasbeenreported,butthesourceoffireis unknown.

- **Potential Positive Effect (PPE)**

CommunityEnvironmentalImprovements(CVI)willprovidefundsandtechnicalassistancefor small-scaleimprovementsincorevillageresidentialareas.Itwillincludesuchas:(i)community environmental improvements;and(ii)sanitationimprovementforpoorhouseholds. TheGovernmentofLaoPDRhasembarkedonanambitiousNationalProgramofLandandForestAllocationinseveralprovincesandintendstofurtherexpandtheimplementationoftheseactivities.The programhas alsotwocomponentssuchas:

a) Allocationofdegradedlandtohouseholds(witha3yeartemporarylandusecertificate)for cropcultivation,treeplantingorgrazing;satisfactoryperformanceleadstohouseholdgainland title.
b) Afterlandallocation,villageforestlandisclassified(use,protection,rehabilitation,etc.)and agreements onrulesgoverningeachforesttypearesigned.
c) Civil work improvement, small water supply, will help village residents to access safety water and to reduce time to get water from rivers or streams.

- **Potential Negative Impact (PNI)**

Issuesconcerningthenegativeimpactshavebeenidentifiedformakingrecommendationonthe degradationofenvironment.Owingtothesettlementpatternswayoflivingoflocalpeople,shiftingcultivationbecameaprobleminagriculturalproduction.Sincethen,thegovernmentrealizedthatthecountry'sforestcoverhaddecreasedeveryyearbythefarmingactivitiesanditcreatedimpactsonthenaturalresourcesandenvironment. Sothe governmentattemptedtostopthesenegativeresourcesutilizationbylayingouttheresettlementprogrammed in1982.Thisprogramwastopromotemountainousanduplandpeopletocome tosettle inlowlandareaswhere itwas expectedthattheycould developpermanentagriculturallands.

Deforestationiscausingdownstreamenvironmentalimpactsuchaswatershortageforagriculturedurin g dry season in many locations,increasing water runoff, soil erosion, siltation in rivers,wetlandsanddams,increasingratesofoccurrenceandseverityoffloods,landslidesanddroughts,waterpollution,lossofbiodiversity,depletionofaquaticresources,reducedlife-spanofdamsanddamage toagriculturaland irrigationsystem.

Herbicides used in Yotlik sub-watershed is common practices recent year.There practices apply infarmsof maize, vegetable, and rubber tree plantation. Nowadays, there is no law to control importers and suppliers in Lao PDR.Thus, the increase use of herbicide is great concern to environment in YotLik sub-watershed.

Some small scale civil works may involve minor negative environmental impacts due to construction activities such as small water supply and access road improvement. During the construction of these activities generates soil suspension to water body and increase sedimentation in river bed.

4.1 Capacity building at district level

NumberofstaffatDistrictAgricultureandForestryOffice(DAFO)areconsiderablyinsufficientin comparisontothetaskforceoftheoffice.Therearefewstaffsincludingheadof DAFOworkingbothinthe

office
andinthefieldhavingtheirtaskcoveringagriculture,forestry,irrigation,livestock,ruraldevelopment sectors
andcoordinationwithotherdevelopmentsinthedistrict.BudgettotheDAFOisalsolimited.Plansarepre paredfortheirtaskforcebutbudgetnotavailable,sothatthefieldworksurveyandotherrelevantactivities arenotcarriedoutasplanprepared.Asaresult,the problems occurredinthevillagesmaynotbe knownandsolveastheyshouldbe.

4.2 Crop Productivity Improvement

Currentlyyieldperunitareaatthisprojectsitesareconsiderablylow,meanwhilethedemandforstaplefo odgrainisincreasing,tomeetthis demandthe productionhasbeenincreased through the expansionofagriculturalareaswhichtheadditionalareacomesfromencroachmentonnaturalforestre sources.Populationincreasedduetothelimitationofarablelandforpermanentagricultureisamajorcau seofforestencroachment.Uplandfarmerswhoaremostlyengagedintraditionalslashandburncultivati onis leadedacauseofforestdestructionandlanddegradation.

Villagersonmostareashavepracticedformsofshiftingcultivationusingacroprotationalsystemoffieldc ultivationtomaintainproductivitylevels.Todothiseachfamilyhasusedaboutsixormoreplotsoflandan dsomehaveusedmorethan10plotsinthepast.Someethnicgroupsarelessconsciousaboutconservin gnaturalresources thanothersandhavecauseddepletionofforestandsoilfertilitybycultivating land twoandthree timesinsuccessiontoproducefoodcropsandhighvaluecrops.

Agriculturaldevelopmentinthesepilotareasfaceswithmanydifficultiesinaccordancewithpresent technologyandfarmingpractices.Itwasnotclearlydefinedbetweenagriculturelandandforestlandwhi chsomehowcreatesomeproblemforthevillagerstoclassifylanduseandlandresourcesatthelocalleve ls.Itseemthatthelimitationisalessononhowtomanagetheirfarmingsystemespeciallylivestock husbandry,in caseofpestanddiseasesmanagement.

Riceproductionisstillamajorfarmingpracticeofvillagers.Bothpaddyfieldanduplandfieldaresubjectto nutrient lost,becauseof thelackofsoilimprovementbyanymeans.Naturalimprovementwillnotableto maintaintheproductionin thelongrun.In tradition,growingriceseemsto makefarmersfeelmoresecurethangrowingothercropspecies,asriceisnotonlyastaplefoodgrainbutit canbesoldany time.

4.3 Livestock Management

Livestockmanagementhasanadditionalbenefittoagricultureintermsofmaintainingsoilfertilityforcro pproduction.Thereisnouseofchemicalinputsinmostagriculturalsystemsinthisprojectsites.Cattlean dbuffalo,grazedonharvestedorfallowfields,providemanure,whichsupplementssoilnutrientsandma intainssoilfertility.Referred to*EmertonandAsrat1998*,thelocalbreedsofcattleandbuffalo produce an average of 0.7 tones of dung per year, containing 1.4% nitrogenand 1.3%phosphorus,whichisequivalent to9.8kgofcombinednutrients.The animal husbandry of the project sites is based on traditional practices because of natural environmentfeeding.Animalraisingismainlyundertakeninsmallscaleandmostanimalsarenotimpro ved breeds.Thevaccinationcampaignwasnotactiveinthissub-watershed.Also,ingenerallivestock stillwithout
theshed.Livestockraisingisthemajorincomeearningforthevillagersintheprojectpilotvillages.Atthes ametime grazinglandislimitedanditsavailableforthewetseasononly.

4.4 Forest Restoration

TheGovernmentoftheLaoPDRdevelopedthenationalprotectedareasystemforseveralyears;

Government is responsible for administration and allocation of natural forests and forest lands.Approval fromauthorizedagencyisrequiredforindividualsandorganizationstopossessandusenatural forests.Individualsandorganizationshaveobligationtopreserveforestresourcesincludingwatersources,aquatic animalsandwildlife.ForestRestoration,restoringpreviouslyforestedareashasonlypositiveimpacts. Certainconcerns,however,includetheselectionofspeciestobeintroduced(e.g.,fruittrees,eucalyptus,teak)andhowtheactivitywillaffecttheoverallfarmingsystem. Thegovernmentpolicyistoavoidgrowingeucalyptusinupperbasinasitdamagessoilstructure.Teakis apositivecommercialspecies,butitsplantationshavetobeaccessibleto transportandotherinfrastructure.Orchardsaregoodinprinciple,buttheirimpactonthegeneralenvironmentrequiresaviewandpreparationofpossiblemitigationmeasureastheprojectprogresses.AccordingtoMAFregulationonforestmanagementissuedinJune2001consolidatesprovisionsrelated tovillage forests, and recognizes collection of NTFPsfor sale if managementplans areformulated and improved. A high-level decree providing for delineation of production forest alsomandatesparticipationofvillagesinallaspectsofproductionforestmanagement,includingplanningandbenefitsharingin accordance withcontractsbetweenvillagesanddistrictauthorities (NAFRI, 2003.Upland AgriculturalDevelopment).*ForestandLandAllocation*:LandUsePlanningandLandAllocationprocessisasystematicanditerativeprocedurecarriedoutinordertocreateanenablingenvironmentforsustainabledevelopmentoflandresourceswhichmeetspeople'sneedsanddemands.Itassessesthe physical,socio-economic,institutionalandlegalpotentialsandconstraintswithrespecttoanoptimalandsustainableuseoflandresources,andempowerspeopleto makedecisionabouthowtoallocate thoseresources.Theultimatetarget of land use planning and land allocation process is to improve of the capabilities in theparticipatory managementofnaturalresources atvillage,districtandprovinciallevel.

Assistancetodistrictandprovincelevellanduseplanningauthoritiesconcerningparticipatoryand sustainablenaturalresourcesmanagement.Reducedtheconflictoftheuseoflandandtousethelandin sustainablewayitneededtohavelanduseplanningthatameansofhelpingdecisionmakerstodecide howto useland. *IntegratedWatershedManagement(NAFRI,2003.UplandagriculturalDevelopment)*:Allprovincesaretodevelopoverallstrategiesandprioritiesforsub-watershedscoveredbyprovince,andalldistrictsaretodevelopwatershedplanseitherbythemselvesortogetherwithneighboringdistricts,dependingonthebiophysicalboundariesofthewatershed.The7-stepIWMplanningprocessdistinguishesbetweentheprovinciallevel,whererangingofsub-watershedsandstrategicoptionsforalargewatershedshouldbeidentified,andthe districtlevelwherewatershedzonation,morespecificinterventionsindevelopment, bufferzoneand conservationareasshouldbediscussedandagreeduponbydistrictsub-sectors.

4.5 Mitigation Measures

Governmentpoliciesonresettlementprogrammeandself-subsistencefoodproductionandshiftingcultivationeradicationareconsideredasthegovernmentintervention thatresultsinthemovementandimmigration ofupland farmers.Sincethegovernmenthasannouncedapolicytodiminishandbanfortheencroachmentofnaturalforest.Somerestrictruleshavebeensetbasedontheregulationofforestmanagementandutilization authorizedbythelocalgovernment(districtlevel),onewhobreaktheruletoencroachorclearnaturalforestwillbefinedinaccordancewiththenumberoftreescutandthesizeofthelandtobecleared.Although,in eachvillage,one personhasbeenassignedtoberesponsiblefornaturalresourcesconservation(villageforester),butthispersonisnotabletopatrolalltheterritorythatunderthevillageboundary.Sothattheenforcementofregulationandlegislationintheseaspectsneedtheparticipation

ofpeopleinthewholecommunityandothernearbycommunitieswhohavebeensharingthebenefitsfrom theprotectionandconservationofexistingresources.

TheGovernmentiscommittedtohelpingfarmerstomoverapidlytowardagriculturaldiversificationinfield and horticulturalcashcropsandimprovingthelivestockandfisheriessectorsoftheLaoPDRfarming systems (Government'sStrategicVisionfortheAgriculturalSector,1999).
Thestrategicforpromoting upland farming systemsdiversificationwillproceedfromasystematicsetof interventionstargetedonparticipatorylanduseandlandallocationandentitlementandadaptiveresearchandtrialsonfarmersfields ofpromisinguplandagriculture,agro-forestryandnaturalresourcemanagement technologies.Theapproachwillbefurtherstrengthenedbydevelopingandexpandingmicro finance systems at the village level, intensification and further replication of small-scalecommunitymanagedirrigationsystemsandanextensiveprogramofmarketinformationsystems andfeederroadupgradinganddevelopment tohelpforgecommerciallinkagesbetweenisolateduplandcommunities andlocalandregionalmarket.

AProvincial ProjectSteeringCommittee(PPSC)willbeestablishedintheprovince toprovidedirectionandguidanceforthesubprojectswithintheprovinceandcoordinateprovincialanddistrictagencies.It willbechaired byaviceprovincialgovernorandcomprisesubprojectdistrictagencies.

AProjectImplementation Unit (PIU) will be established in the project sub-watershed area. The major responsibilitiesofPIUwillbeincluded:(i)participatinginprojectplanning,feasibilitystudies,design,and procurementactivitiesfortheprovincesub-watershed;(ii)coordinatingtheactivitiesofconsultantsand contractorsintheprovince;(iii)overseeingconstructionactivities;(iv)coordinatingresettlementandassistingtheresettlementcommittee;(v)implementingthegenderstrategyandtheethnicminoritydevelopment framework; (vi)supervisingcapacitybuildingactivitiesatlocal level.

5. Screening of potential impacts and mitigation measures

Theproposedsubprojectactivitieswillleadtomoreefficientmanagementofthewatershed,whichwill improvewaterconservation,providesustainablelivelihoods,andrestoreforests.ASaresult,human pressureontheenvironmentwilldecrease:

1. Improvecropyieldseitherfromirrigatedornon-irrigatedagriculture,combinedwithcrop diversification (e.g.tofruittrees),willreduceswiddenagriculture;
2. Reducedgrazingpressureonforestswillallowgreaterregenerationofwoodyspecies, increasingdiversityandabundance;and
3. SelectionandpropagationoflocalNTFPswillincreasetheintra-specificdiversityofselectedspecies.

Ingeneral,mostnegativeenvironmentalprojectimpactswillresultfromthreephysicalinvestmentacti vities,butmostwillbeminorandconfinedto(i)inappropriateselectionoflocationforinterventions;(ii)in appropriateselectionoftreespeciesorvarieties;(iii)indiscriminateuseofagrochemicals;and(iv)heal thandsafetyissuesofsmall-scaleconstruction(e.g.weirs).Potentialimpactsforeachphysicalinvestment activityareasfollows:

5.1 Crop Productivity

- **Positive Effect**

TheagriculturesystemintheKasyDistrictindicatedthatanaverageyieldrangesfrom4,35ton/haforR ainedpaddyrice,3,33ton/haforIrrigatedpaddyand1,3ton/haforUplandfieldyield.The majority of people are engaged in agriculture in which land use and farming system are considerablyundeveloped.NamLiksub-watershedneedstoimprovecropproductivitybutwithlittleorno useoffertilizers and pesticides. The Lao-International Rice Research Institute's high yieldingvarieties,suitedforupperbasin,donotrequireuseofsupplementinputs.Besides,thistechnol ogicalpackage encourages integratedpestandnutrientmanagement.

Theprojectwillhavepaidmoreattentiontodevelopproperpermethodology ofagriculturesystemsuchassoilnutrientimprovementbyusingofgreenmanure,compostandanimal manureisencouragedundera closefollow upbytheproject.

Toavoidriskfromnaturaldisastroussuchasdrought,pest,andinsect,farmershaveselecteddifferent kindofricevarietiestogrowthinthefield.Croppingcalendarshouldbemonitorduetosomevarietiesca nbemature andharvestedinearlierstage(shortdurationwithinthreemonthperiod),butthesevarietiesproducelo wyieldwhencomparedtothelongdurationvarietieswhichwilltakeaboutfourtofivemonthsformaturin g.Thelongdurationvarietyofpaddyprovideabout3-4tonperhectare,butit dependspartlyonwaterandnaturalcondition.

Fallowlandhasbeenconsideredasasuitablesiteforuplandcultivationbasedonthewoodyspeciesth atgrowintheareas.Certainspecies areusedtobetheindicatorsforsoilimprovementthatreadyforclearingandcultivationofrice.Thefallo wsystemallowstheforestregeneration.Itisaccompaniedbythereconstitutionofthesoilstructure,ofh umusandbiologicallife.Afallowsufficientlyandregularlylongprovidesanarborescentorbushplantc overwhichlimitstheherbaceousstorey,synonymousofconstrainingweedingforthefamily (STENO,1996).

- Negative impact

Comparisonbetween4,35ton/haforRainedpaddyriceand3,33ton/haforIrrigatedpaddyinKasy district theproductionofirrigatedpaddyislow.Toincreaseproductionit willmeetasfollowing:

- Supplementaryinput(Fertilizer,pesticide,insecticide);
- Lowcostbenefitduetomorecapitalcostinvestment;
- Expansionofagriculturalareasbyencroachesofforestland;
- Waterrequirement(irrigationsystems);
- Uplandfarmerswhoaremostlyengagedintraditionalslashandburncultivationisleadeda cause of forestdestructionandlanddegradation.

5.2 Fertilizer use

Implementationofagricultureactivities(cropdevelopment)intheNamLiksub-watershedareasareneeded toprovideappropriatetrainingand explanationon improvedplantationmanagementandharvestmethodsusingfertilizer,intheupperbasinisnegligible becauseofweakinputmarkets,andgenerallyfarmerscannot affordcashinputs.Farmersconsiderthatuplandriceprovideadditionalproduction becausepaddy field production is not enoughto ensure foodsecurity,whichis true.However,someactivefarmersare developingnewricefieldswithintheprojectareasandintendtoreduce uplandcroppinginthefuture.

FertilizerisstillsoldthroughtheAgriculturalPromotionBank,andmostlyhandledbyprivatedealers,s uchasCPThailand.In the pastthere has beenagenerallackofavailabilityoffertilizer and ashortageofcapitalamongfarmers,butthereisevidencethissituationischanging.Atotalof35,000me trictonsof fertilizerwasimported duringthefirstpartof2001,asshowninTablebelow

Table 16 Fertilizer Import for 2001

Types of fertilizer	Formula			
	Kg			
	N	P	K	MT
Urea	2,396,600			5,210
NPK 16-16-8	53,600	53,600		335
NPK 16-8-8	71,520	35,760		447
NPK 15-15-15	1,896,750	1,896,750	1,896,750	12,645
NPK 13-13-21	1,300	1,300	2,100	10
NPK 12-3-3	600	150	150	5
DiammoniumPhosphate 18-46-0	36,000	92,000		200
OtherNP compounds 16-20-0	2,550,080	3,187,600		15,938
Superphosphate		450,800		980
Kg Total	7,006,450	5,717,960	1,899,000	
MT Total	7,006	5,718	1,899	35,770

Source: DOAE, 2001

5.3 Livestock Improvement

Since1997,Kasydistrict'slivestockproductionincreasingof4,6%buffaloes,6,8%cattle,16,9% pigs,7,41%poultry,and18,4%goats,alsocontributesappreciablytotheeconomy.

- **Positive Effect**

Threetypesoflivestockproductionisenvisionedinthesub-watershedareas,withincreasesineachtypeinthenextfewyears:(i)uplandormountainousareagrazi nginvolvingcow,buffaloandgoat;
(ii)lowlandforagingamongdrydeciduousforestthathasbeenpartiallyconvertedtoimprovedpasture

,againforcow,buffaloandgoat;and(iii)animalpropagationnear villagethataimatsmall livestock(pigs,chickens,ducksandgoats).

- provide food self-sufficiency
- Income generation
- Provide transportation where cars difficult to access

- **Negative impact**

Grazingwillbeimpactsonindividualplantsorspecies,plantcommunities,soilcompactandsoil erosion,indigenousanimalspeciesandwildlife.Overgrazingfrequentlychangesthecomposition oftheplantandanimalpopulation.Accordingly,theNamLiksub-watershedinterventions need to incorporatea programto monitorimpactof livestockon variousecosystemtypesinthisarea aretominimizedetrimentalimpactswhilesupportinggoodmanagement practice.

5.4 Forest Restoration

Since1993,Governmenthasestablished20 NationalBiodiversityandConservationAreas(NBCAs) whichcoverapproximately13%ofthetotalnationalland.

Landandforestlandallocationforvillagers,whichaimstointroducecropproductioninordertosolveth eproblemsofshiftingcultivationsandpovertyandtoencouragethevillagerstoengageinsedentaryliv elihoods,shouldbelinkedwithlongtermlanduseplans,extensionandprovisionofvarious servicesfor them.
Individualsandorganizationshaveobligationtopreserveforestresourcesincludingwatersources,a quatic animalsandwildlife.
Kasydistricthas5nurseriesandsupporting34,340plantsperyear.Resently,hasbeen5000hectares plantedoftree,mostlyhavebeenplantingTeakandsomefamiliesalreadygeneratedincome fromthis activity.

- **Positive Effects**

Forest Restore, restoringpreviouslyforestedareashasonlypositiveeffect.However,selectionofspeciestobeintrodu ced(e.g.,fruittrees,eucalyptus,teak,etc…)andhowtheactivitywilleffecttheoverallfarmingsystem.
Thegovernmentpolicyistoavoidgrowingeucalyptusinupperbasinasitdamagessoil structure.Teakisapositivecommercialspecies,butitsplantationshavetobeaccessibletotransporta ndotherinfrastructure.Orchardsaregoodinprinciple,buttheirimpactonthegeneralenvironmentreq uiresa viewandpreparationofpossiblemitigationmeasureastheprojectprogresses.

- **Negative Impact**

ForestRestorationwillbeimpactstonaturalforest,forestland,biodiversityandecosystemswhich dependent communities,biodiversityconservation,anddeliveryof variousforestproductsandservicestomeetpresentandfutureneeds.Itsnegativeimpactsarealready beingfelt,especiallyinrice-deficitareas wherethepopulationsrelyheavilyonwoodandnon-woodforestproductstoaugment theirfarm production.

6. Institutional Requirements and Environmental Monitoring Plan

Inordertoensureenvironmentalactivities proceedaccordingtothegoalandobjectivesprovided inthe NationalEnvironmentalStrategy2020and2010,thefocusprogramsaredefinedasfollows:

1. Tomanageandutilizenaturalresourcesinareasonableandsustainablemannertoensurehigh benefitfromtheuseofland,water,forest,mineralresourcesandbiodiversity.
2. Topromotetheuseofenvironmentalandsocialassessment,theuseofcleantechnologyandsystematicenvironmentalinspectionforurbanandinfrastructuraldevelopmentprojects,includingindustrialmanufacturingandmediumandlargescaleprojects.
3. To strengthen and capacity build institutional frameworks and people in charge of environmental managementandmonitoring.
4. Toencourageandpromotethebusinesssector'sinvolvementinenvironmentalprotection, restorationand sustainableuseof natural resources.
5. Todevelopfinancialmechanismsinordertopromoteandenableindividualsandlegalentities tocontributetotheNationalEnvironmentalProtectionFund(NEPF).
6. Tostrengtheninternationalcooperationtheareaoftheenvironment.

6.1 Institutional Responsibilities

Thereis/arefivemaingovernmentinstitutionsresponsiblefortheimplementationoftheproposedProject.
TheDepartmentofPlanningoftheMinistryofAgricultureandForestry(MAF)istheexecutingagencyandProjectManagementUnitwillbeestablishedwithinDepartmentofPlanning.

AnintegratedProjectImplementationUnit,comprisingrepresentativesoftheOfficeForestry,Office Agriculture of Vientiane province and KasyDistrict, and other relevant provincial and districtagencies,willbeestablishedtoimplementthesub-projects
andcarryouttheoverallenvironmentalresponsibilities.
STEAhastheoverallenvironmentalreviewandapprovalresponsibilities.

Table 17. Institutional Responsibilities

Organization		Responsibilities
PMU	MAF	• Overallcoordination and supervision responsibilities. • Environmental responsibilities include(i) review andsubmission of IEEs for the approvalof STEA and ADB, and (ii)coordinationof subprojects and relevant national and provincial governments on the environmental matters.
PIU	DP	• Responsible for subproject implementation andcoordination with PPSC and other provincial and district agencies. Environmentalresponsibilities include (i) screeningand preparation of IEEs and SIEEs, (ii) submission of IEEs to PPSC for its approval, (iii)submission of IEESto PMU for the STEA's and ADB's approval, (iv)monitoring and reporting to PMU and PPSC, and (v) preparation ofan annual monitoring report. • Environmental mitigationmeasures and monitoring related to sub-watershed management
	OF	•As part of PIU, responsible for subproject implementation of Sub-watershed management • OF will be responsible for environmentalmitigation measures and monitoring related to sub-watershed management
PIU	OA	• As part of PIU, responsible for subproject implementation of agriculture activities and coordinationwith other villages withinkasydistrict • Environmental mitigationmeasures and monitoring related to agriculture activities, including assisting villagers to operate and maintain thevillage environmental improvements

PPSC		• Responsible for coordinating province and district agencies and makingkey decisions on behalf of the provincial government
STEA		• Responsible for (i) providing guidance on environmental issues and(ii) reviewing and approving IEE to issue environmentalcompliancecertificates

7. Environmental Monitoring and Management Plan

7.1 Environment Monitoring

TheEnvironmentalMonitoring and ManagementPlan of the proposed Project consist of thefollowing fourcomponents.AspresentedintheattachedSummaryofEnvironmentalImpacts,MitigationMeasures&MonitoringPlan,theenvironmentalmonitoringplanhasbeendevelopedtodetermine ifmitigation measuresare beingimplementedeffectivelyduringthe implementationperiods. PIUs assistedby environmental consultants are responsible for conducting periodicmonitoring.Duringtheimplementationstage,periodicmonitoringandinspectionwillbeconductedtominimizethenegativeimpactof encroachmentof forestland,wildlifehuntingandtrade,slushandburn,shifting cultivation, soil erosion, waste generation, and surface andgroundwatercontamination.

7.2 Environmental Reporting

Environmentalmonitoringresultswillberecordedinaccordancewiththedevelopedenvironmental monitoringandmanagementplantoensurethatanyindicationsofadverseimpactsaredetectedatthe earliestpossibletime.A quarterlyenvironmentalmonitoringreportformatwillbedevelopedduring implementationtocapturetheoverallmonitoringfindingsandanylessonslearnedandrecommendations toimprovethe environmentalmonitoringand managementpractices.ONPM will be responsible for preparing and submitting the reports to DoNRE and ADB.

8. Finding and Recommendations

NamLiksub-watershed isunlikelytocauseanyadverseenvironmentalimpactsbecause:(i) proposedsubprojectactivitiesaredesignedprimarilytoimprovethequalityoflifeenvironmentforthelocal communities;(ii)potentialnegativeimpactsassociatedwithsubprojectactivitieswillbetemporary,minor,andlocalizedinextentandcanbemitigatedtoacceptablelevels;(iii)subprojectactivitieswillinvolvetemporaryandrelativelyminorlossestoincomeandlivelihoodresultingfromsub-watershed management activities; (iv) all implementation activities will be monitored andreported toSTEAbythePIUinaccordancewiththeenvironmentalmonitoringandmanagementplan**.**

9. Conclusions and Recommendations

9.1 Conclusion

Theresults,mostlybasedontheeconomicconditions,gainedarelikelyreflectedthesituationoverthe countrywherethe social,economic, natural resourcesandenvironmentmanagement aredeveloped and treatedatthesamedirection.

AttheNamLiksub-watershedareas,present landuseandunclearoflanduserightandownershipresultedintheencroachmentoflocalpeopleonthenaturalforest.Peopleconsideredandtreatednaturalresourcesascommonpropertiesandsometime

san openaccess.As aresult,forest,NTFPslandandfishresourceswereexploitedinformofoverexploitationthatfollowedb ythedegradationoftheresources.Ineffectivelegalenforcement,resourcesmanagementmonitorin g andlack of local community participationonnaturalresourcesmanagementandprotectionresultedinthedecliningofresources (forest, soil,fishingground)inthearea.

Lowcapableinstitutionnetworkandlackofskilledpersonnelatalllevel(province,districtandvillagele vels),especially,atDAFO,intheimplementationandenforcementofgovernmentpolicy,decrees and regulationon the natural resourcesmanagementand monitoringresultedin thedegradationand decreasingofforestland.

Permanentpaddyfieldisthemostpreferablebythecommunities.Atthesametime,physicalstructure ofthearea,highslopelandsandwateravailability,havesomeconstraintstodevelopthehigh terracewith slopingpatterntobethepermanentagriculturalland
Livestockraisingandfishingarethemajorincomeearningforthecommunities,atthesametimegrazin glandislimitedandsimultaneouslyfishpopulationisalsodeclineingresultinhighdemandforrice cultivatedarea forhouseholdconsumption.

Thenumberofpopulationisincreasingincombinationwiththedegradationaquacultureresourcecre atehighdemandinagricultureland.Asaresult,theencroachmentonforestforpracticingshiftingcultiv ation ishardtoavoid,especiallylandforplantingricefortheirhouseholdconsumption.

9.2 Criteria cite for the recommendation

Accordingto the governmentpolicy and presentproblems and in land use management the recommendations are made. Most of the concerned recommendations are related to present government policyonlandallocation anddemarcation whichis expectedthatthispolicycanpromotetheresettlementandinvestment ofruralpeopleintheirland.Furthermorelandallocation isexpectedtostimulatelocalpeopleparticipateintheconservationandprotectionofexistingnaturalfo rest, waterandland resources.

Crop productivities:

ImplementationofLandallocationpolicy

- Totrainingin fertilizeruseandmanagement,Pesticideuseandprotectionandintegratedpest managementforfarmers
- Tosupportthefarmertouselocalknowledge andutilizeinsecticideitself
- Encouragetousenaturalorbiofertilizers(e.g)
- PromoteCommunitybasedcatchmentsmanagement
- Totraininirrigationmanagement;scheduling,seepagecontrol,operationandmaintena nce (O&M)forfarmerswithregardtoWaterResourceMasterPlan,SRIDP,FIAT etc

Rainwaterharvestandutilizationforrain-fedagricultureshouldbeintroduce
To support appropriate technology is a key consideration for sustainable agricultural practices

Livestock

Developgrazingmanagementpractices,whichwouldpromoteandbeapartytoecosystem management.

- Grazinglandmanagementtocontroldesertification.
- Livestockvaccinationmanagement
- Landforlivestockneedtobeidentifiedasplacesforpens,pasturesandforagesforfeeding livestock.
  - Needtoincorporate aprogramtomonitorimpactoflivestockonvariousecosystemtypesinthis area aretominimizedetrimentalimpactswhilesupportinggoodmanagementpractice.

Forest restoration

Improvevillagers'livingstandardsandlivelihoodsecurityin pilotareas throughvillageforestry systemsforsustainableforestmanagementandvillagedevelopmentprojects.

- Continueexpansionofreforestationeffortthroughlocalcommunityparticipation
- consultanddeveloplanduseanddevelopmentplanstoguideforestconcessionairesinlogging operations
- improvevillagers'abilitytomanageforestthroughextensivetraining
- involvelocalparticipationinongoingreforestationprograms
- enforceforestregulationtoimproveforestresourcemanagement
- Forestlandhasbeenidentifiedtosustainuseforfuelwood,housingandfencingmaterials,sourceof medicineandnon-woodforestproducts.Forestcoverplayasignificantrolestoprotectwatershed, streamsandsoilerosion,meanwhileitalsoprovideandregeneratenatural fertilizertothesoiland lowerpart(paddyfield).

Table 18. Summary of Environmental Impacts, Mitigation Measures & Monitoring Plan

ProjectActivity& Potential	Proposed Mitigation Measures
Crop productivity • Increasing demand for land resources • Fertilizer • Pesticide • insecticide	1. Land allocationpolicy 2. Farmers training in fertilizer use and management 3. encourage to use natural or bio fertilizers (e.g) 1.Farmers training in Pesticide use and protection 2.support the farmer to use local knowledge and utilize insects itself 3. Farmers training on integratedpest management (IPM).
Irrigation • high costs in system operation,particularlyfor the pumping station • high risk in the loss of waterfromcanals which couldnot meet the technical standard • theassociationof water users lack skills ineffectivemanagement, causing delays	1. Preparationof communitybased catchments management plans for prioritycatchments; 2. Farmers training in irrigation management; scheduling, seepage control, operation and maintenance (O&M)with regard to Water Resource MasterPlan,SRIDP,FIATetc 3. Farmer involving in irrigationscheme designand management, 4. Communitytraining in management and preservation of soil andwater resources 5. Rainwater harvest and utilization for rain-fedagriculture should be introduce
Livestock • Grazing • Soil Erosion • Soil compaction • Animaldiseases	1. Develop grazing management practices, which would promote and be a partyto ecosystemmanagement. 2. Grazing landmanagement tocontrol desertification. 3.Livestock vaccination
Forest restoration through community participation selection of species • selection of Location	1. Improvevillagers'livingstandardsandlivelihoodsecurityinpilotareasthrough village forestry systems for sustainable forest management and village development projects. 2. Continueexpansion of reforestation effort through local communityparticipation 3. consultanddeveloplanduseanddevelopmentplanstoguideforestconcessionairesinlogging operations 4. improve villagers' abilityto manage forest through extensivetraining 5. involve local participation in ongoing reforestation program 6. enforce forest regulation toimprove forest resource management

References

- ADB/MCTPC,2003.LaoUrbanDataBook
- CPI,2004-2005.NationalSocioEconomicDevelopmentPlan
- IRRI,2001.ImpactAssessmentofResearchandTechnologyDevelopment
- LEM,2005.FinalDraftReport
- LaoPDR,2001.StateoftheEnvironment
- LaoPDR-NGPESs.NationalGrowthandPovertyEradicationStrategy
- MAF,2003.ForestryStrategytotheyear2020(PreliminaryDraftpresentedatconsultationmeeting, 17-18July2003)
- MAF,2001.Promotion'sdecreeofnaturalfertilizerutility
- MAF,1999.TheGovernment'sStrategicVisionfortheAgricultureSector.DonorRoundTable DiscussionPaper,LaoPDR,MinistryofAgricultureandForestry.
- Mekong Secretariat, 1992. Nam NgumSocio-Economic Survey, Final Report, Burapa DevelopmentConsultantsCo.,LTD,Vientiane,LaoPDR.
- NAWACOP,2003.LandUsePlanning/LandAllocationReport.
- NAFRI,2003.UplandAgriculturalDevelopmentinthecontextofLivelihoods,Watershedsand Governanceforarea-baseddevelopmentprojectintheLaoPDR.
- NSC,2003. StatisticYearBook2003.NationalStatistic Centre.Committeeforplanningand Co-operation
- NAFRI,2000.IntegratedUplandAgricultureResearchProject.LaoPDR,MinistryofAgriculture and Forestry.
- PoliticalDraftReporttotheIV ConferenceofKasyDistrict2004.
- STEA/SIDA,2002.RegulationonEnvironmentAssessmentintheLaoPDR
- STENO,1996.EnvironmentalIssueRelatedtoShiftingCultivationintheMekongBasin:
- TheLaoExperienceinIdentifyingAlternatives,Vientiane,LaoPDR.

Appendix 1. Soil Data

Accordingtothesurvey bySoilSurveyandLandClassificationCentrein1994, isclassifiedintotwomajor soil typesasfallows:

STPsteepslopecomplexwherethetopographyisverysteep,theslopeismorethan55%soi lisrelatively fragileandeasytoerode.

HumidACRISOLS(Acu):consistsoffertileorganicmatter,AUmbricorAmolliclayerspresent;soilin0-10cmindeptisLoam(LL)andClayedLoam(CL);sloperangesfrommoderatelysteep16to 30%tosteepof30to55%.Thechemicalpropertiesofthesoilcanbeidentified intableasbelow:

Soil characteristic	**Non-erodibility**			**Un-development**	**Erodibility**		
	Avg	Max	Min	(U)	Avg	Max	Min
Dept A1 (cm)	17.50	21.00	14.00		17.57	22.00	15.00
Dept A1+B1 (cm)	37.50	42.00	33.00		38.71	65.00	31.00
%OM	3.24	4.90	1.59		5.06	5.60	4.30
P (ppm)	3.27	3.65	2.90		4.29	6.75	2.00
K_2Omg	15.60	16.60	14.60		20.44	39.20	9.00

Source: Soil Survey and Land Classification Center, 1994