

Appendix 5
Land and Forest Resources

**MASTER PLAN STUDY
ON
INTEGRATED AGRICULTURAL DEVELOPMENT
IN
LAO PEOPLE’S DEMOCRATIC REPUBLIC**

VOLUME III

APPENDIX-5

LAND AND FOREST RESOURCES

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CHAPTER 1 LAND AND LAND USE

1.1 Land Area and Land Resource

Lao PDR covers an area of 23.68 million hectares of which forests occupy about 45%, potential forests and other wooded areas (including recovering shifting cultivation areas of about 2 million ha.) 41%, permanent and temporary arable agriculture, 8%, grass and pasture lands 4% and the remaining areas 2%. The estimated land use for three time periods is given in Table below.

Land use for 1982 & 1989, with estimates for 2000

Land use groups/land /use and vegetation types	Area (000 ha.)		
	1982	1989	2000
Year	1982	1989	2000
Forest	11,636.8	11,167.7	10,700
Dry dipterocarp	1,235.1	1,206.5	1,155
Lower dry evergreen	88.6	85.5	82
Lower mixed deciduous	893.0	866.0	830
Upper dry evergreen	1,105.9	1,061.0	1,017
Upper mixed deciduous	7,492.4	7,448.4	7,136
Gallery forest	90.7	87.5	84
Coniferous	138.3	132.3	127
Mixed coniferous/broadleaves	293.2	280.5	269
Potential forest	7,956.7	8,323.3	8,530
Bamboo	1,457.0	1,531.9	1,260
Poorly stocked, including recovering shifting cultivation areas	6,499.7	6,791.4	7,270
Other wooded areas	1,545.4	1,444.4	1,300
Savannah/Open woodlands	974.0	912.5	820
Heath and scrub forest	571.6	531.7	480
Arable agriculture	1,306.1	1,475.1	1,810
Sedentary agriculture	708.7	849.5	1,130
Shifting cultivation and other upland systems	597.4	625.6	680
Grasslands	804.4	822.8	860
Other land areas	430.6	446.7	480
Barren land/rock	109.9	116.1	116
Urban	82.2	84.2	113
Swamps	34.1	35.4	35
Water	204.4	210.9	216
TOTAL	23,680.0	23,680.0	23,680

(to be continued)

(Continuation)

Land use groups/land /use and vegetation types	Area (000 ha.)		
	1982	1989	2000
Population (000)	3,346	3,977	5,234
Forest land per person (ha.)	3.48	2.81	2.04
Potential forest & other wooded area per person (ha.)	2.83	2.46	1.88
Arable agricultural land per person (ha.)	0.39	0.37	0.35

Note: The estimates for 2000 were derived from the increase in population in the three time periods and the land use trends for 1982 & 1989 and trends in Khammouan and Savannakhet for 1982, 1989 and 2000 (Appendix 10). The "official" area of arable land in 2000, is 871,000 ha. (Agricultural Statistics) and the estimate from the 1999 agricultural census is 959,000 including 112,000 ha. of fallow land. The statistics states that there are 105,000 ha of vegetables, whereas the census gives a figure of 12,500 ha. The average farm holding is given as 1 ha. for upland areas (including fallow) and 1.5 ha. in lowland areas, yet lowland cereal production is about twice as productive as uplands!

Source: DOF 1992. Forest cover and land use in Lao PDR. Report No. 5 1992. MOAF. NAFRI 2000. Land use in Khammouan and Savannakhet derived from satellite imagery. SIDA/JICA. & NAFRI, MOAF. Team estimates.

1.2 Land Suitability

There is considerable information on the soils and land conditions in the country. The Soil Survey and Land Classification Center (SSLCC) of The National Agricultural and Forestry Institute (NAFRI) is responsible for soil surveys as well as agricultural and forest land classification, research on the management of agricultural land and fertilizer application. Soil maps and land suitability maps have been produced for the main agricultural areas in the country and for the remaining areas data are now being produced.

In order to conserve and sustainably manage the land and soil, it is important to have information on slope, elevation, soil and existing land use. Knowing these factors, land use planning can be undertaken and an orderly switch from one form of land-use to another appropriate form can occur. Information exists on slope, topography and altitude classes as well as the existing land-use. Table below gives data on land use by slope classes. This is taken from a nationwide reconnaissance survey of land use in Laos in 1989 and has been up-dated to 2000, but the information on slope will not change over time, only the land use.

Lao PDR 2000; Estimated Land Use by Slope Class

unit: 000 ha.

Land Use	Slope Classes (%)					Total Area
	0 - 5	6 - 19	20 - 30	31 - 59	60+	
Forest	2,335	642	3,731	3,030	962	10,700 (45%)
Degraded forest, bamboo and other wooded areas	1,548	593	4046	2955	688	9,830 (41%)
Shifting cultivation	139	65	313	138	25	680 (3%)
Permanent agriculture	1,100	26	4	0	0	1,130 (5%)
Grassland	126	27	332	297	78	860 (4%)
Other land	319	29	47	38	47	480(2%)
Total	5,567	1,382	8,473	6,458	1,800	23,680
Percentage	24%	6%	36%	27%	7%	100%

Note: A slope of 100% is equivalent to 45 degrees.

Source: Nationwide Reconnaissance Survey: Report 5, 1992. MAF (DoF), modified to 2000 land-use data.

Nearly all permanent agricultural land is on areas with slopes less than 5%, whereas 70% of shifting cultivation land is on areas greater than 20% slope. This is one of the main reasons why the government has decided to try to stabilize shifting cultivation by 2010 and to demonstrate more sustainable land-use alternatives. Also, in many upland areas, the soil is unsuitable for annual crops. Land with a slope of more than about 20% should not be farmed without measures to counter erosion such as contour ploughing, strips of grass and/or trees along the contours at appropriate intervals, terracing and micro catchments etc. Better still if such areas are put under permanent crops. This may be the best way to protect lowland agricultural land from inundation with coarse materials and flash flooding.

The above information can be used to estimate the potential available area for permanent agricultural land. Table 9 of the Vision for Agriculture to 2020, (MAF 1999) estimates that between 3.6 and 7.6 million hectares are available for agriculture, but the Asian Development Bank's Environmental Profile (ADB 1997) estimates that only between 2.0 and 2.3 million ha. are available. Examining the above table, it would seem that less than 3.5 million ha. are available for arable agriculture in the light of competing demands for land, especially pastoral agriculture, and the government's policy of restoring the forest area to 60% land cover by the year 2020.

In fact, the National Environmental Action Plan, (STEA 2000 Table 10) estimates that only about 2.4 million hectares of land are suitable for arable agriculture, of which less than 260,000 ha. are appropriate for irrigation. This is about the same area that is irrigated today, although some of this land has been abandoned for various reasons including soil salination. On the other hand, the Irrigation Department of MAF has a goal to bring 800,000 ha. under irrigation. Clearly, there is need to undertake more work on land suitability classification and to judge scientifically the competing claims for land with the costs and benefits of the various alternatives.

Land conservation techniques are well known, such as appropriate land preparation and tending practices, including minimum tillage, contour ploughing, terracing, green manuring; agro-forestry; integrated pest management; planting of permanent crops on sloping land; and proper use of irrigation water to prevent salination etc. But today, the application of these techniques is only moderate to poor. Therefore, while the best land conservation practices are known and while the land-uses for land in different slope, topography and altitude classes is well established, there is still a considerable effort to be made in converting theory into practice.

1.3 Soils

Most soils in Laos are acidic and poor in minerals and organic matter. On land below 30% slope, - two-thirds of the country – the dominant soil types are acidic alisols, acrosols and ferralsols. These cover about 54% of the soil types (8.4 million ha.) with alisols contributing 7 million ha. of this total. These soils have undergone intense weathering and as a result, the soils consist of low activity clays and have a comparatively low cation exchange capacity (CEC), with pH values 4.0 or less. Therefore, they have low levels of available nutrients and are unstable and susceptible to erosion. Liming is necessary to increase the pH and to decrease the level of free aluminium and increase the soil fauna activity. Such soils are not very productive and perform best under acid-tolerant crops such as pineapple, cashew and mango as well as indigenous tree species.

The soils that are appropriate for agriculture are the luvisols (15%), cambisols (14%) and fluvisols (2%). Together, these soils cover about 4.8 million ha. of land with a slope less than 30%. They are found in alluvial and depression areas along the Mekong river and other river basins to which rich soil materials have been transported. The soils are neutral to alkaline and have a high CEC and a good organic matter content. Luvisols are formed from alluvial and colluvial deposits in flat or gently sloping land under deciduous forests or grasslands. These soils are good for a wide range of agricultural uses, including rice in poorly drained areas. Cambisols have a relatively high concentration of iron and are neutral to slightly acid, but also very suitable for arable agriculture. The remaining 10% of the soils in areas with slopes below 30% are leptosols (5%) and eight others including lixisols (1%), gleysols (1%), and nitisols (0.5%). Most, if not all, are acid soils with fairly low levels of minerals and low CEC. Generally these soils are not suitable for arable agriculture. Thus, from a perspective of suitable soils, the maximum area available for arable agriculture is about 4.8 million ha., but in practical terms a figure of about 3.5 million ha. seems to be the upper limit. The Soil Survey of NAFRI has information on all the soils in lowland areas and has crop suitability maps for most of these areas.

1.4 Sustainable Use of Forest and Natural Resources

The sustainable development of natural resources is not only of national importance, but it is also significant from a regional and global perspective. Laos is rich in bio-diversity and has considerable areas of pristine forests: these are important globally. The forests are a source of many timber and non-timber forest products, including wild animals on land and in water. These are important to rural communities for subsistence and income generation. The forests are also important cattle grazing areas. There are 64 watersheds in the country and 55 of these rivers systems contribute about 35% of the water to the lower Mekong river system with the remaining 9 flowing directly into Vietnam on the northeastern

border. The protection of these watersheds is of regional as well as national importance, particularly for lowland agriculture and fishing. Many of these watersheds are rich in biodiversity. The government has recognized their global importance and created 20 National Biodiversity Conservation Areas and two corridors connecting three of these areas covering 3.4 million hectares. These contain rare and newly discovered plants and animals and are the last remnants of large areas of unique forest types. Most of these NBCAs have populations living in them practicing shifting cultivation. Stabilization of this land-use system is, therefore, of paramount importance.

Over the past 20 years about half a million hectares of forests have been cleared and some wetlands drained for agricultural expansion. Some of this land was unsuitable for agriculture or should have been maintained in its original state. Thus, considerable pressure is being placed on natural resources and forest land to meet the increasing needs of an expanding population and in order to satisfy the government's policy of improving living standards. The major objective of government is to properly manage both renewable and non-renewable natural resources so as to help meet their goals. However, especially in the agricultural sector, this has to be done in a sustainable and environmentally friendly way. Having a large forest area and a relatively low population density there is a considerable quantity of wood available to the population, especially small diameter wood. An estimate of the total above ground woody growing stock, including dead wood, stems, branches, twigs and shrubs is given in the following Table.

Land Use 1990 & 2000 and estimated 2000 Woody Growing Stock and Yield

Land-use type	Area 1990	Area 2000	Change 90-00	Growing stock	Annual yield	per ha stock & % yield
units	000 hectares			million tonnes (dry)		tonnes
Forest area. Of which proposed or actual conservation areas	11,168	10,700 (3,394)	-468	2,065 (815)	51.6 (20.4)	193 2.5% 240 2.5%
[Forest area, excluding conservation areas]		[7,306]	[-468]	[1,250]	[31.2]	171 2.5%
Potential forest (poorly-stocked, bamboo)	8,323	8,530	+207	213	42.6	25 20%
Other wooded areas	1,444	1,300	-144	32	3.2	25 10%
Shifting cultivation	626	680	+54	7	1.4	10 20%
Arable agriculture	850	1,130	+280	11	2.3	10 20%
Grasslands	823	860	+37	4	0.4	5 10%
Urban	84	113	+29	1	0.1	5 10%
Sub-total	23,318	23,313	- 5	2,303	101.6	
Water, swamps, rocks etc.	362	367	+5	0	0.0	0 0%
Total, land area excluding conservation areas and water etc.		19,919		1,455	81.2	
Population (million)	4.08	5.23	+ 1.15	278t/c.	16 t/c	

Note: The change in land use is based on the increase in population between 1990 and 2000, an estimated 1.15 million, from 4.08 million to 5.23 million. Increase in agricultural productivity was also taken into consideration. It is assumed that all the conservation areas are covered in forests, but in fact there are areas of shifting cultivation, potential forests, wetlands and rocks. Therefore, the actual area of forests outside NBCAs is greater than stated. The per-hectare above-ground stock for forest areas was based on FAO Forestry Paper 112 Forest Resources Assessment 1990. The other per-hectare stocks are based on best estimates from measurements in similar land-use types. It is total above-ground

woody biomass including small stems, branches, twigs and shrubs and dead wood. The yield is based on the following assumed rotations. Forest – 80 years. Potential forest and arable agriculture –10 years. Other areas – 20 years. It is further assumed that the stated stock is the average growing stock and represents the sum of trees in different age classes, not the stock of only mature trees. This latter is assumed to be twice the average growing stock. Thus yield = 2 x growing stock/ rotation or % yield = 200 x GS/R. Estimated demand for industrial wood under current practices is between 2.8 and 4.0 million m³. The estimated demand for small diameter wood, including sawmill off-cuts is between 9 and 10 million m³. This latter figure is at least 5 times sustainable supply.

Source: FAO 1993. Forest Paper 112, Western et al 1982. (Net Primary Production Figures) & JICA team estimates.

The estimated stock of total above ground woody biomass including bamboo and shrubs and stems, branches and twigs is over 2.3 billion tonnes of dry wood, or more than 3 billion m³. Excluding the wood growing on actual or potential conservation areas, there is still an estimated 1.5 billion tonnes of wood or more than 2 billion m³. This is equivalent to nearly 440 tonnes of wood per-capita (278 t./c if conservation areas are excluded). The estimated annual yield from this growing stock is 102 million t. for all areas, or 81 million tonnes excluding conservation areas. This is equivalent to 19 t./c from all areas, or 16 t./c from non-conservation areas. This is a large potential resource especially of small diameter wood and if it is not used, most will decay or be burnt in annual fires. However, because of poor logging practices, commercial trees in the most accessible areas are being over-exploited in many areas. The official export of logs, sawn-wood and plywood (in round wood equivalent terms) is 620,000 m³, some of this wood is under-measured, so the actual 'official' export may be about 900,000 m³. In addition, there may be unrecorded export of up to 300,000 m³ bring total exports in round wood equivalent terms to an estimates 1.2 million m³. Logging companies only pay for what they remove and not for what they fell. It is estimated that between 50% and 67% of the felled wood is left behind in the forest. Therefore, the actual volume of stem wood (over 30 cm. in diameter) that is felled for export could be between 2.4 and 3.6 million m³ per year. Domestic consumption of saw logs for sawn wood etc. is about 0.5 million m³, but some of this will have come from discarded/rejected 'export' logs. Thus, the annual felling of 'commercial' stem wood for so-called industrial wood products could be between 2.8 and 4.0 million m³.

The FAO Global Fiber Supply Model [GFSM] (FAO 1999) estimated that there are only 2.5 million ha. of forest land that is commercially exploitable containing about 249 million m³ of commercial stem wood (> 10 cm. diameter at breast height). If the rotation age is fixed at between 80 and 100 years, the annual yield from this commercial stem wood should be between, 4.5 and 5.7 million m³. But the Global Fiber Supply model estimates the annual yield at only 1.05 million m³. This would give a nominal rotation of 467 years, which is much too long. If the GFSM yield figure of just over 1 million m³ is near the truth, then clearly annual felling of commercial stem wood is much greater than sustainable yield. However, if rotations of between 80 & 100 years are taken as the time needed to reach about 60 cm. diameter, then there should be sufficient stem wood to meet industrial

demand if the resources are managed properly. Also, if loggers had to pay for what was felled, rather than what is removed, then this should increase the log utilization rate and reduce the actual felling volume.

While there may be shortages of certain species of wood for industrial purposes, there is little if any shortage of small diameter wood for fuel wood, charcoal and poles. In fact the overall sustainable supply of small diameter wood is at least 5 times demand (Table AP 5-3). The use of this category of wood could be expanded considerably and be used as an energy source for many cottage industries such as brick, tile and lime burning, crop drying, fish smoking etc.

1.5 Trees and their Importance to Farmers

Trees and forests are important components of the farming system and are essential for shifting cultivation. They supply fuel, building materials, food, fiber, medicines and many other NTFPs. They also contribute the bulk of grazing and browse to farm animals and are a significant source of non-farm income for rural people. While forest trees supply most of the products that farmers require, trees outside the forest, especially trees on farm, are becoming more important especially as a way to generate income and as an input to sustainable agricultural development. Most arable and pastoral farming systems have trees as an integral component, the exception being lowland paddy production. But even here, farmers plant trees/bamboo in some areas to at least provide shade, but usually to provide food, fiber and fuel.

Without products from the forests, most, if not all, upland farmers could not survive. Production of upland rice is usually insufficient to meet the requirements for food; bamboo shoots plus rice bought with income from NTPF make up some or all the deficit. There are several examples of where managing forest products can be profitable. These include, bamboo shoots, bamboo/rattan, cardamom (*Amomum spp.*), paper mulberry (*Broussonetia papyrifera*), kisi [damar] resin (*Shorea and Parashorea spp.*) and yang oil (*Dipterocarpus spp.*). All these products are exported and in 1996 were valued at over US\$ 4 million, but most NTFP are used for subsistence.

The present stock of cattle, buffalo and goats/sheep, in cattle equivalent terms is about 3.3 million. The carrying capacity of existing grassland and forestland such as dry dipterocarp forest is about one cow per four hectares. Of course these ruminants eat the rice straw and other crop residues after harvest, but their main food source is from the forest. About 12 million ha. of land are required to feed these animals and as there are only about 860,000 ha. of grasslands, and just over 1.5 million hectares of arable land, forest land must provide most of the fodder and browse for these animals. And of course many wild animals, including insects, fish and amphibian, caught for food obtain their food directly or indirectly from the forest.

There are also an estimated 2 million pigs and poultry in pig equivalent terms. While most of the food for these animals will come from areas surrounding the farm, including prepared food from residues, pigs and poultry obtain some of their food from farm trees and the surrounding forest areas.

Because of population pressures and traditional farming practices, some of the forests are being over-exploited for specific products such as bamboo and rattan. Or the trees are being felled for quick profit, such as from the sale of dipterocarpus wood, rather than for long term benefit from the production of yang oil from dipterocarp trees. Again, to get rid of old grass and to destroy parasites such as ticks, fires are set in forests; in many instances these destroy young regeneration and keep many areas in a degraded state. Therefore, much could be done to improve the management of the forest areas. This should not only increase the stock of trees, but also increase their productive capacity for timber and NTFPs.

Through the efforts of the Shifting Cultivation/Agro-forestry Research Program, the NTFP project, the EU micro-projects, the Lao-Swedish Forest Program and several other private and public initiatives, planting trees on farm has increased. Agro-forestry initiatives and NTFPs are dealt with elsewhere in this report, but the planting of trees, bamboo and bushes for food, fruit, nuts, raw silk, paper bark, poles and timber is gaining momentum, especially where there is a developed market for these products.

1.6 Forest Rules and Regulations

On the one hand government and donors are encouraging tree planting. In the Forest Laws (Article 34 – The Promotion of Tree Planting), tree planting is promoted through various incentives, subsidies and regulations, including credit and tax incentives and the provision of planting material usually from improved stock. There is also a National Tree Planting Day on the first of June every year, when tree planting is encouraged by all the population, (Article 46 of the Forest Laws). Article 47 of the Forest Law specifies the establishment of a forest and forest resource development fund to promote amongst other things tree planting. However, up to the present, this fund has not been established, but through the Lao/ADB Plantation Program, money can be borrowed to invest in planting.

On the other hand, there are regulations in the Forest Laws, which could inhibit the planting of trees. Article 25 specifies that the harvesting of shoots, leaves and bark must be carried out in accordance with specific regulations issued by concerned agencies. This could adversely affect the growing of bamboo for food, mulberry leaves for silk production, and bark from the paper mulberry tree if farmers have to follow rules and regulations that may be inappropriate for their products. Article 26 specifies that the transport of timber and other forest products must be conducted in accordance with the regulations, including the payment of a

resource tax, the marking and stamping of each log, the completion of transport documents, the transport over authorized routes and declaration at all check points.

Finally, Article 27 states that the cutting of trees planted by a family for household use should be reported to the village administration so it can be checked. If this law is carried out to the letter, it will mean all trees planted in agro-forestry formations such as allies and felled every two to three years, with the wood used for poles and fuel, will have to be inspected. Similarly, the same article states that when timber from farm trees is transported to another district it must be reported to the District Agricultural and Forest Office for checking. Finally, this article states that cutting planted timber for sale requires permission of the province or Prefecture Agriculture and Forest Service, obtained through the District Agricultural and Forestry Office.

The government wants to encourage the planting of the equivalent of 0.5 million hectares by 2020. Some of the above laws are not conducive to tree planting especially by private individuals and in particular to farm tree planting. The laws should be amended to make the growing of trees and the yield of tree products from farm trees free of bureaucratic procedures that may inhibit rather than encourage tree planting.

CHAPTER 2 LAND USE PLANNING AND LAND ALLOCATION

2.1 Introduction

In rural Laos, land ownership has long been often not a matter of registered title and fences, but of the memory of local elders, and the identification of particular trees, rocks, river-beds and other features of the terrain as boundary markers. Due to recent population pressure and other socio-economic changes, however, the government has placed a priority on providing secure agricultural land use rights and access to forest products for village and villagers since early 1990s. Some of the direct causes and the underlying effects resulting from general lack of land resource management system at the village level are shown in the table below.

Examples of Direct and Underlying Effects of the Lack of Land Use Planning

Direct Causes	Underlying Effects
<p><Environmental Aspects></p> <ul style="list-style-type: none"> ? Unsuitable shifting cultivation practices; ? Inadequate agricultural activities; ? Inadequate forest resource management; ? Irregular land use conversion; ? Deforestation and removal of natural vegetation. 	<ul style="list-style-type: none"> ? Land tenure is not clear; ? Population growth in the uplands; ? Conversion technologies are not developed; ? Government support is limited.
<p><Socio-economic Aspects></p> <ul style="list-style-type: none"> ? Conflicts among villages and villagers over boundaries and resource use; ? The transition toward sedentary farming is very gradual. 	<ul style="list-style-type: none"> ? Unclear land tenure; ? Village development plans are not prepared; ? Market access is limited; ? Follow-up extension activities are being neglected.

2.2 The Objectives of Land Use Planning and Land Allocation

The government has been showing its commitment to stabilize shifting cultivation by the year 2010. This is closely connected to village land use planning (LUP) and individual land allocation (LA). The major objectives of LUP are effective and sustainable management of land, forest and watershed resources, including maintenance of existing forested land and gradual expansion of forested area, and reduction of shifting cultivation and its eventual stabilization by delineating village boundaries, village forestland use zones, and agricultural zones. The LA is being implemented for the purpose of entitling individual households with Temporary Land Use Certificate (TLUC) within the agricultural zone based on the village LUP.

Both LUP and LA are expected to execute nationwide, and its ultimate purpose is not in the issuing the official document to village and individual farmers. Rather, it is aimed at realizing sustainable land use by securing forest and land use right, based on the dialogue over villagers' conventional land and natural resource use. In this context, it is important to understand that undertaking of LUP and LA

requires a long process that involves the planning and implementation of both technical and socio-economic initiatives to realize natural and human resource of land to contribute to livelihood development of the rural population.

The overriding conclusion is that the lack of appropriate land use planning affects many sectors, and issues concerning land resource management can only be addressed through cross-sectoral collaboration and, more importantly, through direct participation of local communities in LUP and LA.

2.3 Relevant Ongoing Activities

There are several development projects concerning land management. Especially, with respect to rural development many donor and NGOs are assisting district staff and villagers to enhance village level land zoning and LUP all over the country¹. Often, LUP is one of the projects components, and various planning and allocation solutions are tested. The following two projects are considered to have large impacts on other similar activities in the light of its project scale and its replicability.

Lao-Swedish Forestry Project (LSFP)

LSFP has provided support with the development of LUP/LA procedures, participatory methods and practices. The Land Use Planning sub-program has focused on *model development and competence development* based on field activities targeting four provinces, namely, Louangphrabang, Xaignabouri, Savannakhet, and Saravan. Their 8-step methodology was introduced in 1997 and adopted by the GOL in 1998, which was later modified to 10-step procedure emphasizing LUP/LA information storage and land use planning at the village level. At the earlier stage of the Project, there was no provision in the procedure to prepare forest and agricultural land use plans with farmers. Thus, procedures to demonstrate land use plans in the agricultural use zone were also tested. After reviewing LUP/LA activities and elaborating basic procedures, the LUP/LA procedures were improved and developed for other situations including NBCAs.

Land Titling Project

Department of Lands of the Ministry of Finance is undertaking Land Titling Project supported by the World Bank/AusAid since 1997. This is aimed at fostering the development of efficient land markets and to facilitate domestic resource mobilization by providing a system of clear and enforceable land use

¹ Examples are EU Micro Project in Louangphrabang and ADB Nam Ngum Watershed Management Project. Also, JVC (Japan Volunteer Center) is one of the pioneering NGOs which has been initiating Village Land Zoning since early 1990s. In their project in six districts in Khammouan, villagers acquired legal forest management right and formulated forest management plan at villagers' initiative. Focusing on land use zoning and the preparation of village forest and agricultural land management agreement, village forest management committees were also created. Their activities were introduced and further applied by government and other NGOs, too.

ownership rights and by developing a land valuation capacity. This activity has started in urban and peri-urban areas of five provinces with Vientiane Municipality, which are regarded as economic priority focus, with respect to increased land tax revenue by accelerating base mapping and systematic adjudication with registration (issuing title documents) and by developing land valuation functions.

The MAF is responsible for temporary land allocation and issuing TLUC, valid for three years, for agricultural and forest areas while the Land Title, which is valid for permanent use practically, will be provided successively. The Land Titling Project is expected to continue to cover all lands in the form of parcel-based land registration. In this connection, agricultural and forest lands are expected to be zoned at the village level and allocated at the household level before the titling and registration. If and when all lands are titled and registered, it is expected that the land tax revenue would be assured which is vital to contribute to the development of entire nation. (Land tax rate is given in Table 2.3 1.)

2.4 The Constraints to Overcome²

The major government agencies concerning agricultural land management are summarized below. Overall division of roles is that the National Shifting Cultivation Stabilization Program is responsible for administration issues while Forestry Inventory Planning Center's mandate is in technical aspects. LUP/LA procedures are still evolving and need to be improved and upgraded.

Major Government Agencies Related to Land Management

Agency	Roles and Functions
National Shifting Cultivation Stabilization Program, DOF	? Overall management and work plans
	? Formulation of plan at national level and its implementation
	? Monitoring and evaluation of the plan
Forestry Inventory Planning Center (FIPC), NAFRI	? Methodology development based on farming systems
	? Training of provincial and district staff for LUP/LA
Department of Lands, MOF	? Issuance of permanent LUC and Land Title
	? Land tax regularization

Presently, there exist several planning & institutional and socio-economic issues to be addressed for the implementation of LUP/LA as the following.

² This section relies on the documents produced in LSFP project including Peter Jones (1998) *Options for Forest-land Use Planning and Land Allocation* (A Discussion Paper 2); *Issues in Forest-land Use Planning and Land Allocation* (A Discussion Paper 3); Peter Jones (2000) *Land Use Planning and Land Allocation Experiences, Lessons, and Issues from the LSFP Phase 4* (Paper presented at the NAFRI Research Strategy Development Workshop May 2000).

(1) Planning and Institutional Issues

Lack of Implementation Plan and Reliable Data

As mentioned above, one of the government's objectives of LUP/LA is in the stabilization of shifting cultivation. Thus, it is supposed that the northern area of the country would be prioritized for the implementation of LUP/LA while there is no signs of doing so. In the government plan, while LUP/LA is expected to complete by the year 2010, there are only general targets by province and by district. Also, the data collected at the central level is not sufficiently accurate. The following table shows the official statistics regarding the number of villages where LUP/LA is completed.

The Number of Villages with LUP/LA by Province 1990-2000

Region/Province	Village completed	Total Number of Rural Village *
Vientiane Municipality	297	259
Northern Region	4,070	4,159
Phongsali	214	562
Louangnamtha	230	382
Oudomxai	305	677
Bokeo	449	346
Louangphrabang	1,296	895
Houaphan	202	817
Xaignabouri	1,374	480
Central Region	1,297	3,579
Xiangkhouang	117	482
Vientiane Province	304	546
Borikhamxai	290	305
Khammouan	188	740
Savannakhet	249	1,423
Xaisomboun-SR	149	83
Southern Region	1,200	1,956
Saravan	147	695
Xekong	105	245
Champasak	728	822
Attapu	220	194
All Laos	6,864	9,953

Notes: There are various data on total number of rural villages. The figures (*) are based on the National Statistical Center 2000.

Source: Shifting Cultivation Stabilization Program, DOF

There are three major problems in this figure. The first one is that the number of villages where LUP/LA completed are sometimes exceeding the number of total rural villages (e. g. Vientiane Municipality, Bokeo, Louangphrabang, etc). This is partly explained by the fact the *Land Use Planning and Land Allocation are mixed up*. Like in Louangphrabang case, first LUP was initiated, then, LA was mandated additionally, it is suspected that the district or provincial staff double counted the village number. The second problem is the striking gaps on data between national and provincial level. The Louangphrabang case again, the numbers of village declared as LUP/LA completed by the province are always below the national data. Lastly, even if one village is reported as LUP/LA *completed*, the degree of completion is variant. As described above, since the LUP/LA is a long process

involving all villagers, it is justified that not all LUP/LA components are completed in one time, or within a limited period of time, but it should be repeated. The activities are phased to allow time for villagers and staff for understanding the methods and activities and LUP/LA steps should be undertaken when they are needed within the context of a village development program. However, as the monitoring system is not sufficiently established or introduced, after one visit by the district staff in the village, there are cases where LUP/LA activities are suspended unsatisfactorily.

Under these conditions, at present, it is extremely difficult to formulate a realistic implementation plan based on past achievement both at the central and the provincial levels. For prioritization, there is a need to make a criteria balancing between achieving provincial or district LUP/LA target and integration of LA, extension, and rural development activity in the annual work plan, based on long term planning. Likewise, through various government agencies and donors, a large number of data relevant to LUP/LA activities have been generated and these data should be kept in the form of sketch maps and data sheets by provincial and district offices. These information should be fully used for the purpose of long term development planning.

Needs for Capacity Building

This is related to the planning and implementation capacity. Since the attributes of LUP/LA procedure developed to date are in its participatory and empowering aspects, those who implement LUP/LA at the field level need a consistent training. LUP/LA involves villagers in every step of the process, encourages them to involve in forest and agricultural land use decisions and agreements on forest and agricultural land management, and aims to strengthen community organization and capability and help provide villagers with the skills and tools to solve their own land use problems. In this connection, the series of LUP/LA are rather dynamic process and require flexibility, and the field staff are required to have both knowledge on the LUP/LA and practical skills by using the method to perform the tasks required.

One of the roles of executing agency at the central level is to assess the training needs of provincial and districts staff and to provide the occasions for that purpose both from technical and social viewpoint. Currently, the FIPC of NAFRI is implementing the training for provincial and districts staff while general planning for staff training and staff allocation is yet to be prepared.

Irregular Budget Disbursement

It is more preferable for the staff to implement LUP/LA exercises during the dry season since rural villages turn inaccessible in rainy season. As LUP/LA takes a series of field activities including transects, mapping, and measurement, it is more efficient to do them in dry season. But the budget disbursement for the implementation is sometimes unpredictable, thus, the staff have to work even in

rainy season, which is considered rather ineffective. Also, as mentioned already, the budget allocation is rather across-the-board; the budget is uniformly 1.5 million kips per village, which is not much realistic.

Lack of Information Storage System

The LUP/LA approach used involves implementing an 8-step procedure, starting from *preparation* through to the *allocation of agricultural land* to households. Implementing teams of 5 to 15 people from DAFO undertake this exercise over one period of two to three weeks depending on the village size. The exercise costs ranging from Kip 200,000 to 1,000,000 also depending on village size.

However, even if all these efforts are made, the information produced in LUP/LA is not always secured and stored at the district or the village level. The important TLUCs are often misplaced and damaged, which might lead the families to be disadvantaged when wishing to secure permanent land use certificates. Thus, information storage was added in the newly proposed procedure, which is to be adopted by the government by the end of 2001 . Also, other than the copies of TLUCs, there is no official record of LA held at the district level. As the district does not have the detailed information as a central system, it might cause confusion among staff and land owners in managing changes in land ownership. Both information storage and record keeping are required to regularize in LUP/LA activities.

In the newly proposed LUP/LA procedure under LFSP project, this problem is also touched upon to improve the procedure in order to assure the transition of TLUC to permanent one, or land title.

(2) Socio-economic Issues

Needs for Succeeding Livelihood Development

As mentioned earlier, the ultimate objective of LUP/LA is not issuing the land document but securing rural livelihood through the sustainable land use and resource management. In this context, at the village level, one of the major issues is how to build up capacity to receive and sustain extension activities rather than having a system relying on the few DAFO staff available.

However, at present, as the village development plans are not prepared, the important follow-up extension activities are being neglected. Farmers' knowledge of permanent farming system is limited especially in upland area, and extension services are limited in those areas. Opportunities for economic cash cropping and markets are limited again, thus the transition towards sedentary farming is very gradual. Follow-up activities should not bias on controls over land use, but village management of forest and land resources should be encouraged and enhanced.

Needs for Succeeding Livelihood Development

It is reported that in the large shifting cultivation areas if only a small amount of land is allocated to individual households, they can not continue shifting cultivation within the allocated land, due to soil degradation. After allocation, the number of available plot is reduced and farmers are aware that they can not have unlimited land anymore but say that rice productivity goes down rapidly since they can not maintain a reasonable field rotation.

Likewise, socio-economic impacts and changes resulted from LUP/LA should be monitored and evaluated in order to secure farmers' livelihood in a participatory manner aiming at identifying problems and supporting to solve identified problems, rather than inspecting or controlling land use as specified in land documents. Also needed are the evaluation exercises of the impacts of LUP/LA on stabilization of shifting cultivation, including the LUP/LA impacts on land use sustainability in upland areas.

Table

Table 2.3.1 Land Tax Rate (Collected in kg of rice per ha and in Kip per ha)

Items	Lowland Agriculture & Forestry Land			Upland Agriculture & Forestry Land			Highland Agriculture & Forestry Land		
	Urban areas	Special Economic Zones	Rural areas	Urban areas	Special Economic Zones	Rural areas	Urban areas	Special Economic Zones	Rural areas
I. Rice Fields Area: (kg/ha)									
1. Rice fields	25kg	22kg	20kg	22kg	20kg	18kg	20kg	18kg	16kg
2. Rice fields sustaining less than 70% of damage from natural disasters	10kg	7kg	5kg	9kg	6kg	5kg	7kg	5kg	4kg
3. Fallow rice fields (K/ha)	20,000K	20,000K	20,000K	15,000K	15,000K	15,000K	10,000K	10,000K	10,000K
II. Highland Rice Fields: (kg/ha)									
1. Sedentary rice fields	17kg	16kg	15kg	16kg	15kg	14kg	14kg	13kg	12kg
2. Rotating rice fields	20kg	18kg	17kg	19kg	17kg	15kg	15kg	17kg	14kg
III. Orchard: (K/ha)									
1. Horticulture	12,000K	10,000K	9,000K	11,000K	8,000K	7,000K	8,000K	7,000K	6,000K
2. Fruits tree plantation	9,000K	8,000K	7,000K	10,000K	9,000K	8,000K	7,000K	6,000K	5,000K
3. Industrial crops	13,000K	12,000K	11,000K	12,000K	10,000K	9,000K	10,000K	8,000K	7,000K
4. Medicinal plants	8,000K	7,000K	6,000K	7,000K	6,000K	5,000K	6,000K	5,000K	4,000K
5. All types of vegetables	10,000K	9,000K	8,000K	9,000K	8,000K	7,000K	6,000K	5,000K	4,000K
6. Trees and crops	10,000K	9,000K	8,000K	9,000K	8,000K	7,000K	8,000K	7,000K	6,000K
IV. Livestock Rearing Land: (K/ha)									
1. Natural grassland	18,000K	15,000K	10,000K	15,000K	10,000K	8,000K	12,000K	8,000K	6,000K
2. Cleared grassland	15,000K	10,000K	5,000K	13,000K	8,000K	4,000K	8,000K	5,000K	3,000K
3. Livestock farm	24,000K	20,000K	18,000K	20,000K	17,000K	15,000K	16,000K	14,000K	12,000K
4. Aquatic life rearing ponds	20,000K	17,000K	16,000K	17,000K	16,000K	14,000K	16,000K	14,000K	12,000K
V. Other: (K/ha)									
1. Grassland without livestock	21,000K	18,000K	17,000K	18,000K	17,000K	16,000K	15,000K	12,000K	10,000K
2. Other agriculture & forestry land	20,000K	17,000K	16,000K	18,000K	16,000K	14,000K	16,000K	14,000K	12,000K

Notes: *Special Economic Zone* has yet to be established as of August 2001. Tax rate indicated in the unit of kg is being paid in equivalent cash.

Source: Decree on the Implementation of the Presidential Decree on Land Tax, dated 22 October 2000 (English Translation)

Appendix 6
Field Crops

**MASTER PLAN STUDY
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FIELD CROPS

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FIELD CROPS**

CHAPTER 1 PRESENT CONDITION OF FIELD CROP PRODUCTION

1.1 Physical Conditions

1.1.1 Agro-Ecological Zones

Six agro-ecological zones (AEZ) are defined in Lao PDR based on the agro-climatic data. The characteristics of each AEZ are summarized below:

Summary of AEZ in LAO PDR

AEZ		Climatic Zone	Topographic Condition	Altitude	Dominant Agricultural Type
AEZ 1	Southern Lowland Plain and Terrace	Tropical wet and dry zone	Flat to undulating	100-200 m	Rainfed lowland rice, gardening and livestock
AEZ 2	Foothills	Tropical wet and dry zone	Undulating to rolling	200-500 m	Shifting cultivation of upland rice and livestock raising
AEZ 3	Foothills and Lower Mountains	Tropical monsoon zone	Rolling	500-1,000 m	Shifting cultivation of upland rice and livestock raising
AEZ 4	Plateau	Tropical monsoon zone	Undulating	500-1,500 m	Tree crops, some shifting cultivation of upland rice and livestock raising
AEZ 5	Central Northern Upland	Tropical wet and dry zone	Mountainous	500-1,500 m	Shifting cultivation, livestock grazing
AEZ 6	Highland Mountain Zone	Sub-tropical wet and dry zone	Mountainous	1,500-2,500 m	Shifting cultivation, livestock grazing

Source: Promotion of Sustainable Development, FAO, 1999

As shown above, the agro-ecological zone is closely related to altitude and topographic conditions.

1.1.2 Soils

Most soils in Lao PDR are acidic and poor in minerals and organic matter. A soil classification map based on the FAO-UNESCO system is available covering the whole country at reconnaissance level. In total, 38 soil units are identified. Out of 38 soil units, five major soil types occupy about 74% of the land, i.e. Ferric Acrisols (28%), Humic Acrisols (20%), Ferric Alisols (11%), Humic Alisols (7%) and Ferric Lixisols (8%). In general, these major soils are acidic, with pH values 4.0 or less, have a comparatively less cation exchange capacity (CEC) and have a

shallow layer suitable soil for agriculture use. The soils that are appropriate for agricultural use are Luvisols (10%), Dystric cambisols (5.0%), Eutric cambisols (4.2%), Leptosols (1.9%), Fluvisols (1.3%) and Gleysols (0.5%). Together these soils cover about 4.8 million ha with slopes less than 30%. They are found in alluvial and depression areas along the Mekong river, and other river basins. The soils are neutral to alkaline and have a good CEC with a favorable organic matter content.

1.1.3 Agriculture Land Use

According to Agricultural Statistics of MAF, the area of agriculture land is summarized below:

Area Holdings by Land Use

(Unit: 1000 ha)

Region	Rice	Other Annual Crops	Fallow Land	Permanent Crops	Grazing Land	Other Land	Total
- North	205.3	40.7	50.4	11.9	0.8	15.0	324.4
- Central	308.6	34.1	39.4	14.8	15.0	43.3	455.2
- South	165.7	10.6	22.4	54.5	1.5	13.3	268.2
Total	679.6	85.4	112.3	81.3	17.6	71.6	1,047.7

Source: Lao Agricultural Statistics, 1975-2000, MAF

The total area of holdings for agriculture use is about 1.0 million ha including fallow land. However, from satellite imagery interpretation, the areas of agricultural land, excluding grassland, is as and estimated 1.8 million ha. Rice is the dominant crop, and it alone occupies 68% of the total area. Other annual crops and permanent crops account for only 9% and 8%, respectively. The proportion of grazing land is very small at only fraction of the more than 2 million re 2% of the total area of holdings. It is only able to support a small fraction of the more than 2 million ruminants.

1.2 Farming System in Lao PDR

In Lao PDR, major farming systems are identified as: i) lowland rainfed, ii) lowland irrigated, iii) upland and mountain, and iv) plateau. The lowland rainfed and irrigated farming systems are located mainly in AEZ 1. Upland and mountain farming systems are observed in AEZ 2, AEZ 3, AEZ 5 and AEZ 6. The plateau farming system is found in AEZ 4.

The lowland rainfed and irrigated farming systems are found in five plain areas, i.e. the Vientiane plain (58,000 ha), the Pecan plain (12,000 ha), the Xebang Fai plain (49,000 ha), the Xebang Hekh plain (83,800 ha) and the Xedong plain (42,500 ha). In the plains, all cultivated land is used for lowland rice production in the wet season and for livestock grazing in the dry season. On the other hand,

for irrigated farming, a two-crop system is developed, and many farmers grown irrigated rice in the wet season and irrigated rice or other crops in the dry season.

The upland and mountain farming systems are dominated by single wet season crop production in hilly or mountainous areas. The most important crop is upland paddy which is produced mostly in shifting cultivation area. Other important annual crops include maize, sweet potato, cassava, ginger, groundnut, soybean, cotton and sugarcane. In this farming system, small irrigation area is developed in valley bottoms for the production of lowland rice. Perennial crops are also grown in the field, usually in scattered formations.

In the plateau farming system, commercial crops are increasingly produced, and shifting cultivation area have been reduced. The major commercial crops including coffee, tea, cardamom, fruit and vegetables are cultivated under rainfed conditions. The farming system is being developed using various topographic and climatic conditions. Soil fertility there is also better than that in other areas of the country.

1.3 Performance of Crop Sub-Sector

The following table shows the performance of agriculture sub-sectors during 1994-99.

Agriculture Sub-Sector Growth Rates – 1994-99 in 1999 Prices

	1995	1996	1997	1998	1999	Average
Paddy	0.1	0.3	16.2	1.3	15.1	6.4
Commercial Crops	6.0	10.1	9.8	17.9	15.8	9.5
Livestock	3.7	2.8	2.4	2.5	1.7	1.5
Fishery	3.0	5.3	5.0	5.0	5.0	5.5
Total Agriculture	3.1	2.8	7.0	3.1	8.2	4.8

Rice production registered declines in the period from 1990-96 but has since registered strong growth, partly due to the substantial investments in installation of water pumps made in recent years and favorable weather. This trend could continue over the next few years if weather conditions are favorable.

The commercial crops, mainly coffee, sugar cane, tobacco, peanuts and cotton have shown a steadily increasing trend both in terms of yields as well as areas planted and overall have shown a rapid growth in value added over the past five years of around 10 % per annum. Prospects for further increase in yields are favorable.

1.4 Overview of Crop Production

The harvested area, yield and production of major crops from 1996 to 2000 are shown in Table 1 and each crop production is described hereinafter.

1.4.1 Rice

The harvested area, yield and production of rice from 1996 to 2000 are summarized below:

Harvested Area, Yield and Production of Rice on Average from 1996 to 2000

Crops	Harvested Area		Yield		Production	
	Average	Annual Growth	Average	Annual Growth	Average	Annual Growth
	('000 ha)	(%)	(ton/ha)	(%)	('000 ton)	(%)
Rice	641.9	5.1	2.8	3.8	1,810.5	9.2
-Lowland Rice (Wet Season)	433.4	5.3	3.1	2.3	1,335.8	7.7
-Lowland Rice (Dry Season)	55.3	46.5	4.1	2.8	228.2	50.6
-Upland Rice	153.1	-3.2	1.6	0.6	246.4	-2.7

Source: Agriculture Statistics, 2000, DOP, MAF

Rice is the dominant crop in Lao PDR. It is cultivated on the lowland plains along the Mekong River and its tributaries. The annual production of rice is 1.8 million tons on average from 1996 to 2000. The production increased by 9.2% annually through the expansion of the doubled-cropped area but also and increase in yield. On the other hand, the official production of upland rice decreased by 2.7% p.a. caused by reduction of the shifting cultivation. The upland rice is cultivated mainly under the shifting cultivation that is commonly practiced in upland and mountain farming system.

In the plain area of Borikhamxai, Khammouan, Savannakhet, Saravan, and Champasak Provinces (major part of Mekong Corridor in Lao PDR), irrigation system is developed to and irrigation system is used mainly for paddy production in both wet and dry season. Those five provinces occupy 56% of total dry season paddy in Lao PDR (56,000 ha). Dry season paddy is expanded at around 90% p.a. during period of 1996-2000, because irrigation pump has been installed under National Pump Irrigation and Management Project (NPIMP). Therefore, the most of irrigation area developed newly under the NPIMP is supposed to be used as paddy field.

1.4.2 Upland Crops

The harvested area, yield and production of major upland crops from 1996 to 2000 are summarized in the table below:

Harvested Area, Yield and Production of Major Upland Crops on Average from 1996 to 2000

Crops	Harvested Area		Yield		Production	
	Average	Annual Growth	Average	Annual Growth	Average	Annual Growth
	('000 ha)	(%)	(ton/ha)	(%)	('000 ton)	(%)
Maize	42.3	11.0	2.3	6.7	95.8	18.4
Root crops	17.7	6.7	5.7	-3.0	98.5	3.4
Mungbean	1.8	-17.1	0.8	4.1	1.4	-13.7
Soybean	5.1	2.0	0.8	0.3	4.2	2.2
Peanut	12.8	9.2	1.0	0.2	13.0	9.4

Source: Agriculture Statistics, 2000, DOP, MAF

Amongst upland crops, the annual production of maize increased considerably by 18.4% p.a., followed by peanut (9.4% p.a.) due to expansion of harvested area and improvement of unit yield. On the other hand, annual production of mungbean declined by 13.7% p.a., since the harvested area decreased due to low prices and a limited market of mungbean. Maize is produced mainly in northern region, while peanut is grown in many provinces.

1.4.3 Industrial Crops

The harvested area, yield and production of major industrial crops from 1996 to 2000 are summarized in the table below:

Harvested Area, Yield and Production of Major Upland Crops on Average from 1996 to 2000

Crops	Harvested Area		Yield		Production	
	Average	Annual Growth	Average	Annual Growth	Average	Annual Growth
	('000 ha)	(%)	(ton/ha)	(%)	('000 ton)	(%)
Coffee	26.8	7.8	0.6	13.4	16.1	22.3
Tobacco	6.5	-2.0	4.3	6.8	27.3	4.6
Cotton	6.5	-13.4	0.9	1.4	6.0	-12.2
Sugarcane	5.1	25.6	31.0	8.8	164.6	36.7

Source: Agriculture Statistics, 2000, DOP, MAF

Amongst upland crops, the annual production of sugarcane increased considerably by 36.7% p.a., followed by coffee (22.3% p.a.) due to expansion of harvested area and improvement of unit yield. On the other hand, annual production of tea declined by 23.5% p.a., followed by cotton (12.2% p.a.), since the harvested area decreased due to low prices and a limited market.

Coffee is major export crop in Lao PDR. Assistance provided by Groupe Agence Francaise de Development (AFD) has caused these improvements of coffee cultivation in Bolovens plateau. Out of 15,000 tons of total produced coffee in Champasak province, 14,300 tons of coffee was exported to the European and Singapore markets in 1999. However, the coffee cultivation in Bolovens plateau faces the following constraints for the further expansion.

- (1) The export price of Boloven coffee is 10 % lower than the international market price due to poor quality. Low quality is mainly caused by poor husbandry, early harvesting and manual harvest processing from screening to drying. One of the important reasons for poor quality is that most of farmers and middlemen have limited concern to quality improvement, since there is no price system based on quality. The price is fixed on the basis of weight only.
- (2) The coffee farms are very sensitive to market price fluctuations since coffee is cultivated in the form of mono-culture. Therefore, the recent low price of international market price directly affect to coffee farm economy.

1.4.4 Vegetables

Vegetables are cultivated mainly proximity to large urban centers on commercial basis. In addition, Xaignabouri and Champasak provinces produce vegetables for export to Thailand. In the other rural area, vegetable production is cultivated mainly in home gardens for consumption. The harvested area, yield and production of vegetables from 1996 to 2000 are summarized in the table below:

Harvested Area, Yield and Production of Vegetables on Average from 1996 to 2000

Crops	Harvested Area		Yield		Production	
	Average	Annual Growth	Average	Annual Growth	Average	Annual Growth
	('000 ha)	(%)	(ton/ha)	(%)	('000 ton)	(%)
Vegetables	43.5	61.7	5.1	-1.4	235.6	59.4

Source: Agriculture Statistics, 2000, DOP, MAF

The annual production of vegetables increased rapidly by 59.4% p.a. due to expansion of harvested area. On the other hand, average yield has declined slightly by 1.4%. Though commercial vegetable production has exported shortly, the research activity in vegetable is relatively weak and has logged behind due to limited technical or financial resources.

1.4.5 Fruits

Agriculture statistics do not provide any data on fruits production. In fact, Lao PDR allows the cultivation of various varieties for tropical, sub-tropical and temperate fruits and accordingly many kinds of fruits is produced, namely; mango, banana, durian, longan, lychee, mandarin, mangosteen, orange, pummelo, rambutan etc.

1.4.6 Sericulture

There is no officially available data relating to silk production on a national basis. In fact, most rural households have carried out weaving activities on subsistence basis rather than commercial basis. From the late 1980s, weaving workshops have been established in the rural area and their products have been sold to urban markets or sometimes international markets. In silk weaving, most silk yarns as the materials of silk weaving are imported from other countries; i.e. China, Thailand and Vietnam, though sericulture is traditional industry of Lao PDR. This is due to low quality and limited quantity of domestic production of silk yarn, since sericulture activities have been made based on local variety of silkworm, traditional rearing, and non-modernized reeling.

Through field observation and interviews to officers concerned to sericulture, 11 provinces and 164 villages are currently engaged in sericulture as shown below:

Present Sericulture Activity in Lao PDR

Municipality/Province	No of Sericulture Village (Estimation)	Remarks
1. Vientiane Municipality	2	These villages start sericulture 3 years ago
2. Vientiane Province	1	Two private companies carry out.
3. Luangnamtha Province	30	-
4. Oudomxay Province	5	Not active
5. Xayabury Province	10	-
6. Luangprabang Province	1	Not active
7. Houaphan Province	20	-
8. Xiengkhuang Province	40	One private company carries out sericulture
9. Borikhamxai Province	20	Sericulture is made mainly in Lak Sao district.
10. Savannakhet Province	30	-
11. Champasack Province	5	Not active
Total	164	

Source: Village number is estimated based on interviews to officers concerned to sericulture.

1.5 Farming Practices

1.5.1 Improved Seeds

(1) Rice seeds

At present, the annual production of improved rice seeds through public seed multiplication system is summarized as follows:

Annual Production of Improved Rice Seeds

Name of Center	Location	Annual Production of Improved Rice Seeds (ton)
1. Napok Seed Multiplication Center	Vientiane Municipality	110
2. Thasano Rice Research and Seed Multiplication Center	Savannakhet Province	110
3. Phone Ngam Rice Research and Seed Multiplication Center	Champasak Province	90
4. Pakchaeng Research Station	Vientiane Province	40
5. KM 6	Vientiane Municipality	50
6. Agriculture Extension Agency (AEA)	Vientiane Municipality	40
7. Saravan	Saravan Province	50
Total		490

Source: Napok Seed Multiplication Center

According to available data of MAF, 60-70% of rice farms use improved variety seeds in the wet season, while 100 % of rice farms use improved variety seeds in the dry season. Research conducted by Lao-IRRI project in farmers field indicates that there is a 10-15% increase in yield with use of improved seed only. The above table shows that the annual supply of improved seed varieties is about 490 tons through public seed multiplication system. This amount will only cultivate about 7,000 ha with a seed rate of 70 kg/ha. If it is necessary to renew the seed stock every five years, continuous annual supply of 490 tons can only cover 35,000 ha or about 6% of the lowland paddy area including both wet and dry season cultivated area. It is therefore judged that most of farmers use the improved seed for long period continuously without renewal, though Lao-IRRI project

recommend three years renewal of seeds. In addition, the following constraints are observed in the present seed multiplication system.

- (1) Due to lack of extension system, farmers cannot understand the production effect of improved seeds. In this situation, farmers are reluctant to pay a high price for improved seeds. In addition, farmers who live in remote area pay higher transportation cost of seeds.
- (2) The present production of seed multiplication centers are much lower than designed capacity due to shortage of operation budget, risk of oversupply against farmers demand, incomplete seed processing facilities, low technical level of staff. Risk of oversupply appears to be the largest problem in the seed multiplication system.
- (3) It is pointed out that the quality of rice seeds is not so high and its germination rate is around 85% due to insufficient quality control and incomplete processing facilities. This low quality may be one of the reasons that farmers show little interest in use of improved seeds.
- (4) All the seed multiplication centers are located in the central or south region. There is no public seed multiplication system in northern region. To settle this problem, rice research center/station located in Xaignabouri and Oudomxai provinces produce rice seeds using foundation seeds produced by Napok Seed Multiplication Center. However, those center/station has no seed processing facilities.

(2) Seeds of Other Crops

At present, the basic seed production system has been not developed yet except rice seeds in Lao PDR. For crops other than rice, the supply of improved variety seeds is very limited with the exception of imported vegetable seeds which are mostly handled by the private sector. This is one of the bottleneck to promote crop diversification in present mono-paddy based cultivation.

1.5.2 Fertilizer, Agro-chemicals and Agricultural Machinery

Based on the data from Agriculture Census in 1998/99, the percentage of farm households using fertilizer, pesticides, and machinery are calculated. The results are presented in the table below.

Percentage of Farm Households Using Fertilizer, Pesticides, and Machinery

	Not Used	Used	-	-	Total
Pesticides	89.4	10.6	-	-	100.0

	Not Used	Organic Fertilizer Only	Chemical Fertilizer Only	Both Organic and Chemical Fertilizer	Total
Fertilizer	57.0	14.8	9.9	18.3	100.0

	Use of Draught Animals	Use of Tractor	Unknown	-	Total
Agriculture Machinery	39.4	20.6	40.0	-	100.0

Source: Lao Agriculture Census, 1998/99, MAF

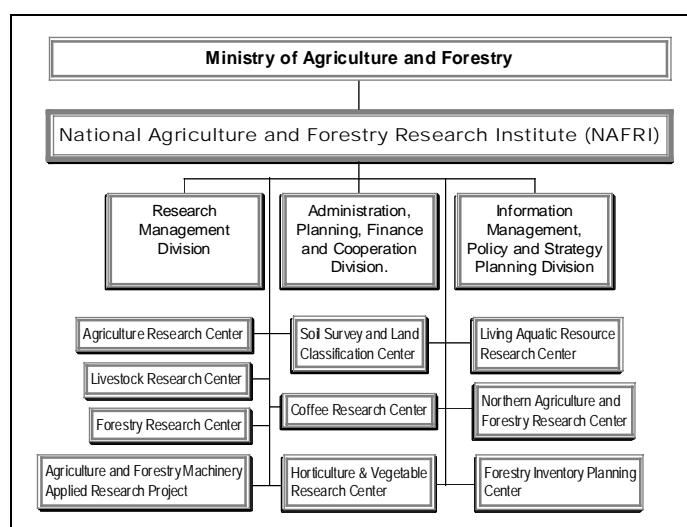
The above table shows that most farm households carry out crop cultivation in the traditional way, without using modern farming practices. All chemical fertilizers and agro-chemicals are imported, and only 28% and 11% of farmer use them, respectively. Regarding agriculture machinery, an estimated 21% of farmers use tractor and 39% use draft animals. The remaining farm households (40% of the total) don't plow the land. Most of them probably practice shifting cultivation in which most work is carried out manually.

1.6 Agriculture Support Service

1.6.1 Agriculture Research

The National Agriculture and Forestry Research Institute (NAFRI) was established in June 1999 in order to concentrate the limited physical, human and financial resources. Prior to its establishment, various departments of MAF were conducting agriculture research work separately. The coordination between NAFRI and MAF line departments is undertaken by the Council of Science and Technology (CST) chaired by the Minister. The Council consists of the Director of Generals (DG) of all the departments including NAFRI.

The role of NAFRI is to implement technical research works on agriculture, forestry, meteorology and hydrology. NAFRI has three divisions, nine centers and one project unit (agriculture and forestry machinery) as illustrated in right figure. It focuses mainly on rice and forest research



NAFRI Organization Chart

through various donor assistance. The research work in other fields like horticulture, livestock and fishery are relatively weak. The research facilities and skills are also limited in these fields. The current number of staff in NAFRI is 356, including 8 Ph.D's. However, the majority are technical or vocational graduates. An increase of postgraduate qualification staff and upgrading of skills are needed to develop the adaptive technology for many sub-sectors.

1.6.2 Agriculture Extension Service

The agriculture extension system was proposed in “The Government’s Strategic Vision for Agriculture Sector” as a new agriculture support system. In consequence, the Agriculture Extension Agency was established under the Department of Agriculture (DOA) in 2000. At present, however, the agriculture extension agency is not established completely, and is not functional in many places.

According to the proposed system, the AEA will take the lead in farming systems extension and will draw upon the technical staff of line departments and support the Subject Matter Specialists (SMSs) at the provincial level, and Farmer Systems Extension Workers (FSEWs) at the district level for extension activities. AEA has appointed limited number of staff from the DOA and no staff from other departments. As a result, AEA cannot perform extension activities for livestock, fishery, forestry and irrigation due to a lack of technical staff.

The proposed system is intended to be based on farming group training and on-farm demonstration activities through participatory planning with regular visits to villages by FSEWs and SMSs. It is, however, reported that the FSEWs and SMSs carry out only administrative works, since the extension system has just been introduced. Moreover, there is a serious shortage of operation funds, equipment and qualified staff.

1.6.3 Agricultural Statistics

Agriculture statistics are published annually by MAF. The statistics includes various data such as crops, livestock, forestry, meteorology and hydrology, irrigation, GDP, prices, exports and imports, public and foreign investment. However, available data is still limited, for example, the data on horticulture crops are not included except as an aggregated vegetable data. Various donor-assisted studies reported that there are considerable discrepancies between the actual survey results and the statistics data. For proper agriculture development planning, the supply of accurate data covering wider fields is prerequisite.

1.7 Past and On-going Agriculture Development Projects Relating to Crop Production

1.7.1 General

MAF prepared a list of agricultural development projects as of fiscal year 1998/99. Based on this list, nearly 90% of the total investment and 60% of the projects were undertaken in the forestry and irrigation sub-sectors. On the other hand, only 6% of the total investment and 10% of the projects were allocated to the crop sub-sectors. The followings are major projects relating to crop sub-sector, namely: i) Lao-IRRI Rice Research and Training Project, ii) Xiangkhouang Agriculture Development Project, iii) National Integrated Pest management (IPM), iv) Rural Development Project in Boloven Plateau, and v) Pilot Extension Project.

1.7.2 Lao-IRRI Rice Research and Training Project

The objective of the project is to increase production and sustainability of rice and rice-based farming systems in Lao PDR through (a) improving the technical expertise of scientists and technicians in research, training and extension, (b) strengthening the quality and increasing the quantity of rice research in Lao PDR, and (c) assisting in the development of research and training infrastructure at strategic locations. The project has been implemented at four phases, namely; Phase 1 for 1990-1993, Phase 2 for 1993-1996, Phase 3 for 1996-1999, and Phase 4 for 2000-2003 (on-going), under the financial assistance of Swiss Agency for Development and Cooperation (SDC) and technical assistance of International Rice Research Institute (IRRI).

The project has been the principal source of capacity building and technological developments in the rice sector in Lao PDR. In order to achieve sustainability of the Lao National Rice Research Program (NRRP), the SDC expects greater national capacity to independently plan and implement research and development and thereby reduce its dependence on external experts. From a very low base in 1990, the project has developed a functional National Rice Research System involving more than 120 government officials and technicians. In addition, a network of research station involving all 17 provinces of the country as well as comprehensive training facilities have been established. The project has also been instrumental in catalyzing a number of complementary collaborative research programs on rice research involving both the government and private sectors. Since diversification of financial support to include a role of the Lao government and other donors is essential, Phase 4 increasingly emphasizes the need for additional resources from other donor organizations for specific research and training activities.

1.7.3 Xiangkhouang Agriculture Development Project

The objective of the project is to: i) ensure food security for poor households, ii) increase agricultural productivity, iii) eliminate opium production, with major emphasis on sustainability and stabilizing shifting cultivation. The project has been implemented at two phases, namely; Phase 1 for 1991-1998, and Phase 2 for 1999-2005 (on-going), under the financial assistance of International Fund for Agricultural Development (IFAD) and technical assistance of UN Drug Control Program (UNDCP).

The major components of the project for phase I are: i) production increase and creation of sense of ownership through irrigation revolving fund, including formation of water users groups, ii) cattle bank, iii) credit, iv) fruit tree in village nursery on a revolving basis, v) access road development (49.5 km length), and vi) training village extension workers. The major components of the project for phase II are: i) income diversification; credit (handicrafts, marketing, fishery, horticulture, dry season crops, sericulture, buffaloes rearing etc.), community mobilization & group formation, ii) agriculture development; crops, livestock & fisheries, irrigation, and iii) rural infrastructure development; rural water supply, rural access road.

1.7.4 National Integrated Pest management (IPM)

The objective of the project is to extend the Integrated Pest Management (IPM) in rice and vegetable production through training program. The project has been implemented at two programs, FAO Vegetable IPM program for 1996-2000 under the financial assistance of Netherlands and technical assistance of FAO, and FAO Community IPM program for 1999-20002 under the financial assistance of Norway and technical assistance of FAO.

The program includes the three core activities; i) training of trainers (TOT) courses, ii) organizing farmers field school (FFS), and iii) supporting participatory field study. TOTs are intensive field training for agriculture extension workers about IPM and production technology for paddy and vegetables. FFS is a field based school for farmers and carries out short term training about IPM at the village. The participatory field study will be made by farmers, extension workers and researchers to identify the constraints and formulate solutions.

1.7.5 Rural Development Project in Boloven Plateau

The objective of the project is: (i) to evaluate the agriculture capacity of the plateau, (ii) to develop and grow other crops (coffee plus) to prevent from disaster and to increase income of farmers, (iii) to reinforce crops husbandry techniques to grow other crops and to attain high quality of product, (iv) to protect the natural resources and manage soil fertility, (v) to raise animals to establish a production

system and (vi) to organize farmers for facilitating technical extension, marketing, and for attaining the sustainable development. The project will be implemented during the period of November 1997 - November 2001 under the technical and financial assistance of Agence France Pour le Development (AFD). Major project components are composed of support and technical assistance programs of coffee, agronomy, animal husbandry, formulation of farmers organizations, and infrastructures development.

1.7.6 Pilot Extension Project

The objective of the project is to develop the agricultural extension system at the district level. The project has been implemented during the period of 1996 - 1998 under the financial assistance of Swiss Development Agency (SDC) and technical assistance of Novartis Foundation for Sustainable Development. The project focuses on technical issues to enable the DAFO to function as an extension unit through the work in the field and the development of working models (extension methodology, DAFO structure adjusted for extension, extension management system), and program to develop staff capacity to work according to the model. DAFO staff was working as generalist. The application of the extension methodology had encouraged 40% of all families in 46 pilot villages to use improved technologies for rice over 20% of their paddy, with an average increase of about 50%.

1.8 Major Constraints and Development Potentials

1.8.1 Constraints to Rice Production

Lowland Area

- The number of farmers using improved variety seeds of rice is limited.
- Lack of knowledge of improved technology including crop maintenance, pests control, irrigation water management, this is because the extension service is the process of developing.
- Flood and inundation damage during wet season in low land areas.
- Lack of access to credit for new investment and to purchase farm inputs.
- Predominance of labor intensive farm operation in which return per unit of labor is quite small.

Upland and Mountain Area

- Insufficient distribution of credit and fertilizer, especially in the remote areas.
- Poor access road for purchasing inputs and selling produce.
- Low soil fertility in terms of physical and chemical aspects.
- Lack of technology for cultivation of upland rice or alternative crops including land preparation, crop maintenance, pests, and weed control; this is because the extension service is the process of developing or is undeveloped.
- Limited development of adaptive research for upland and mountain areas.

- Lower productivity of upland rice under shifting cultivation leading deterioration of the forest environment.
- Declining soil fertility and increasing water runoff, soil erosion under shifting cultivation.
- Large labor inputs due to manual practices in shifting cultivation.

1.8.2 Major Constraints of Commercial Crop Production

- Insufficient quality control and lack of grading and classification system for commercial crop production.
- Non-availability of improved varieties/hybrid seeds and plant materials.
- Lack of knowledge of improved technology including crop maintenance, insect and pest control, irrigation water management; this is because the extension service is the process of developing.
- Limited development of adaptive research for integrated agriculture related to horticulture, livestock and fishery.
- Lack of access to credit and to new investment.
- Reluctance of farmers to use fertilizer and agro-chemicals due to high cost compared to crop income.
- Limited market channels and market information.
- Decreasing price incentive for commercial crop cultivation due to oversupply in the domestic market and low international prices.
- Limited or insufficient post harvest and agro-processing facilities for commercial crops.
- Limited availability of manpower or agriculture machinery in intensive agriculture.
- Limited information on suitable crops to be introduced based on area-specific natural conditions.

1.8.3 Development Potential of Rice Production

- Improved varieties of rice have been developed by the Lao-IRRI project.
- Agriculture potential analysis shows that further expansion of lowland paddy is possible up to about another about 1.0 million ha.

1.8.4 Development Potential of Commercial Crop Production

- Natural conditions including soil & climate conditions are favorable to various commercial crops under rainfed condition.
- The private sector investment in agro-processing and marketing activities have been increasing gradually.
- A further expansion of the cultivated area of crops under irrigated land is possible.
- It is widely observed that many farmers are becoming market oriented as the market intelligence filtrates into rural areas.

CHAPTER 2 DEVELOPMENT PLAN OF FIELD CROP PRODUCTION

2.1 Development Opportunities

2.1.1 Food Security and Rice Output

A preliminary projection on paddy/rice food balance is made for the year 2010 and 2020 based on official data from the relevant agencies and assumptions set by the JICA Study Team. The important assumptions involved in the projection are as follows (see Table 2.1.1):

(1) Harvested Area

- Lowland paddy; There would be no increase and decrease of the harvested area in the future, and present harvested area of 475,500 ha in 2000 would continue for the next 20 years from 2001 to 2020.
- Upland paddy; past declining trend (2.28% p.a. during 1990-2000) would continue to 2010. After 2011, utilization of decreased size of the area would be stabilized.
- Dry season paddy; A very small area expansion (10% in every ten years) would be performed through improvement and better management of irrigation systems.

(2) Unit Yields

- Lowland paddy; It would be increased with a growth rate of 2.28% p.a. (past trend during 1990-2000) till its assumed maximum of 4.5 tons/ha.
- Upland paddy; It is just assumed that the yield in 2010 would be the same with that at present (1.7 ton/ha), and 2.0 tons/ha in 2020.
- Dry season paddy; It would be increased with a growth rate of 2.26% p.a. (past trend during 1990-2000) till its assumed maximum of 6.0 tons/ha.

On the other hand, the projection on paddy/rice consumption for the year 2010 and 2020 is made by applying the annual per capita consumption of 180 kg rice (see Table 2.1.1).

In the above projection, reliability of individual figures on harvested area and yield may not be very high as several donors indicate it. On the other hand, similar source of information reports that the self-sufficiency of paddy/rice in Lao PDR is almost achieved. The above projection is thus carried out based on the latter information in order to know the direction of Lao PDR keeping the present level of self-sufficiency in paddy/rice.

2.1.2 Development Potential of Commercial Crops

As mentioned in Government's Strategic Vision for the Agriculture Sector, the approach to commercial agriculture in flatland is to improve and diversify farming systems with increased and intensified cash crops, livestock and fishery production. In the sloping land, on the other hand, farming systems diversification and agro-forestry should be developed through adaptive research, trials and demonstrations on farmers' field. It is, therefore, understood that the most important step for commercial agriculture is to promote crop diversification in both flatland and sloping land. The main potential crops for diversification are as follows:

Upland Crop

Taking into consideration of growth rate of the production for recent five years, maize, peanut, soybean and some root crops are strong candidates for diversification. In addition, it is reported that sesame, soybean, sunflower, sorghum and safflower have a comparative advantage (FAO, 1998). It is noted that some field crops are used as not only as food crops but also as supplemental feed for livestock since number of livestock is increasing considerably.

Fruit

A previous study pointed out that 50 fruit species can grow in Lao PDR taking into consideration the agro-climatic conditions (SIDA, 1998). Out of these potential crops, Lao PDR frequently imports some fruit, namely: grape, mandarin, apple, sapodilla, orange, durian, pummelo, lechee, rambutan, mangosteen, jujube, cashew, longan, and tamarind. These imported crops can produce in Lao PDR except apple and should have a comparative advantage. In addition, mango also is one crop with a comparative advantage, and DOA intends to promote it for export.

Vegetables

The vegetable production has increased rapidly and is cultivated mainly near large cities. However, over supply and hence low market prices are widely observed in the dry season since many farmers cultivate vegetables using home gardens, the river side and in irrigated areas, while the domestic market is small. Therefore, the introduction of new techniques, especially the adjustment of the cropping pattern is necessary to stabilize the supply of vegetables in a year-round.

Industrial Crops

Taking into consideration their growth rates, coffee and sugar cane have a comparative advantage on the export market. However, both crops face serious problems for the further expansion. The coffee farms are very sensitive to market price fluctuations since coffee is cultivated by itself. Also, sugarcane is cultivated without proper consideration of the sustainable use of land. These problems should be settled through crop diversification and introduction of improved husbandry. Cotton production and sericulture using mulberry leaves should also

be promoted, since at present most raw materials are imported to Lao PDR for the handloom industry. It is noted that paper produced from paper mulberry could be an important crop on the experience of the JICA Forest Conservation and Afforestation Project. These industry crops should not only have advantage for import substitution, but also for export preferably as finished products.

2.2 Development Plan of Crop Production

2.2.1 Development objective

For the development of crop sub-sector, development objectives are established for respective two different agricultural settings in Lao PDR. One is for flatland and the other is for sloping areas, based on the Government's Strategic Vision for the Agriculture Sector.

Flatland Area

- To maintain or accelerate the pace of market-driven changes in agriculture sector of the Mekong corridor through (i) introduction and expansion of crop diversification including cash crops, (ii) introduction and expansion of intensive farming with livestock and inland fishery and (iii) enhancement of crop yield.
- To ensure food security to meet the demand of increasing national population as well as increasing urban population caused by migration from rural area. This has to be performed mainly through the improvement of unit yield of paddy and expansion of cultivation area in dry season paddy.
- To improve crop husbandry for enhancing and stabilizing farm income by providing adaptive research result, demonstration on farmer field, reliable market information through appropriate extension system and training.

Sloping Land

- To accelerate the integration of sloping area into market economy through (i) improvement of farm to market roads, (ii) acceleration of participatory land allocation, (iii) implementation of farmer demand driven extension including adaptive research, trials and demonstrations on farmers' fields, (iv) introduction and expansion of rural finance, and (v) market information delivery.
- To diversify income source and enhance farm income through (i) farming diversification, (ii) agro-forestry development, (iii) introduction and expansion of non-timber forest products (NTFP), and (iv) introduction and expansion of combining farming with livestock and inland fishery.
- To promote environmentally sound and sustainable use of natural resources through (i) implementation of participatory and sustainable land use management, (ii) stabilizing shifting cultivation, (iii) stabilizing upland paddy cultivation area, and (iv) introduction of communal management of natural resources.

2.2.2 Development strategy

Based on the above development objectives, the development strategy for crop agriculture development is set for each development field, i.e. food security in flatland, commercial agriculture in flatland, crop agriculture in sloping area and others. The strategy of each field is described below:

(1) Flatland

(a) Food Security (Paddy/Rice)

For ensuring food security, the following strategies are applied to the flatland.

- There would be little need for the development of new paddy fields (including irrigated paddy field) particularly over the next 10 years. The increase of paddy/rice consumption, which is coupled to population growth, could be met by increased unit yield. Measures to be taken for increasing unit yield include; i) identification and distribution of improved varieties of rice seed suitable for the area specific conditions; ii) strengthening extension services to improve farmers' cultivation and water management technology; and iii) supply of more credit for purchasing farm inputs.
- On the other hand, expansion of dry season paddy area is expected at a rate of 10% during 2000-2010 and 2011-2020 periods, respectively. The present size of dry season paddy area (about 91,800 ha) would therefore increase about 20% to 112,000 ha in 2020. This is still smaller than the present dry season irrigable area (about 197,000 ha) which is under existing irrigation facilities. It is therefore judged that sufficient irrigable area for dry season paddy is available, and its expansion should be promoted through rehabilitation of existing irrigation systems and introduction of proper irrigation water management.
- For ensuring food security from the above viewpoints, DOA should implement "Rice Seed Multiplication Systems Improvement" and NAFRI should implement "National Rice Research Program". Other measures that should be taken for the matter of food security by other sub-sectors are described in other sub-sections, i.e. organization and institution, human resource development, irrigation, rural finance.

(b) Commercial agriculture

For acceleration of commercial agriculture in flatland, the following strategies are applicable.

- Most farmers show a higher concern for food security rather than the introduction of new crops evenly in flat lowland area. As a practical matter, new generation farmers who require the land for their food production would expand the paddy land. Moreover, the farmers have limited experience on cultivation of crops other than paddy and

accordingly, feel risk averse. In such cases, over production of rice would possibly occur. In order to avoid such a situation as well as enhance farm income, crop diversification should be promoted particularly in the flat paddy areas.

- As mention in the above food security paragraph, the difference between paddy area and total irrigation area in the dry season is still 105,000 ha at present and is projected to be 95,000 ha in 2010 and 85,000 ha in 2020, if new irrigation development is not made. The areas not used for paddy should be utilized as possible area for diversification. Therefore, the target area of crop diversification is around 80,000 ha. The potential crops of field crops, fruit, vegetables, industrial crops for crop diversification are proposed in Sub-section 2.1.2.
- Previous research work on horticulture and industrial crops is very limited with the exception of that for coffee. Therefore, research outputs from the trials of new crops/varieties and the development of applicable technology on crop diversification are in rather short supply at present. For realizing crop diversification, the development of adaptive technology is essential and urgently needed, and NAFRI should carry out various research programs. Considering potential crops for diversification as mentioned in Section 2.1.2, the proposed programs include “Coffee Cultivation Technology Research Program”, “Vegetable Cultivation Technology Research Program”, “Fruit Cultivation Technology Research Program”, and “Upland Crop Cultivation Technology Research Program”.
- In parallel with the technology development to be carried out by NAFRI, manageable and small demonstration plots using trial species and/or adaptive technology on crop diversification should be established under the full management or guidance of extension staff of the government. Of course, trial species and/or adaptive technology developed by NAFRI or other neighboring countries should be applied. The farmers could then see at first hand the technical possibilities and financial attractiveness of diversification. As a result, farmers will gradually lose their risk aversion through observation of demonstration plots. Accordingly, some farmers will start crop diversification practice on the basis of visual knowledge in the demonstration plots. For enhance technical level, it is recommended that these demonstration plots could be used for training local extension staff and farmers on the basis of “Teach by Showing” or “Learning by Doing”.
- The establishment of demonstration plots and training is the most important component of commercial crop promotion projects. DEA, PAFS and DAFO will implement the commercial crop production projects including “Pilot Integrated Agriculture Promotion Project in Plateau Area”, “Crop Diversification Program”, “Outer City Horticulture

Promotion Program”, “Sustainable Sugarcane Production Promotion Program”, “Export Oriented Crop Promotion Program” and “Fruits Crop Promotion Program”. In addition, sericulture using mulberry leaves is also promoted as “Sericulture Development”, and “Private Sector Assisting Project for Silk Production (Large Scale)”, since most raw materials for the handloom industry are imported to Lao PDR.

- It is also reported that there are shortages of improved seeds and planting materials for promoting crop diversification. This is caused by the absence of private seed companies and the high price of imported seeds. To resolve this seed constraint, the Government may need to take responsibility for developing and supplying foundation seeds for some crops. Private seed farms should implement multiplication of these foundation seeds to minimize government interference in the market economy. In this connection, DOA and NAFRI will implement the project on “Basic Seed Technology Development”.
- The above crop diversification and combined agriculture with livestock and fishery need more manpower to maintain the field properly. In future, on the other hand, more integrated agriculture at a larger scale will be introduced to enhance and stabilize farm income. In this situation, mechanized farming will be required in order to decrease production cost and increase work efficiency. For introduction of mechanized farming, NAFRI should implement “Mechanized Farming System Research Program” and “Agriculture Machinery Performance Test Criteria”. “Integrated Farming Technology Research Program” is also required to promote integrated agriculture at a larger scale.

(2) Sloping land

For applying the market economy to sloping land, the following strategies will be applied.

- Most of upland paddy production is carried out under shifting cultivation. To stop it spreading including increasing the unit yield of upland paddy and promotion of other farm income source is one of the most important issues in Lao PDR. For this matter, NAFRI should implement “National Rice Research Program”. In general, the sloping area imports paddy from flat lowland area due to low productivity of upland rice. The emergency shortage of paddy may occur in sloping area and food security is a more important issue than flatland. Therefore, “Rice Storage for Emergency Purpose” will be proposed in remote sloping area.
- Stabilization of shifting cultivation would be not achieved by only taking measures to increase unit yield of upland paddy. Important measures would include research and extension activities to convert shifting cultivation areas into permanent farmland. From this point of view, research work should be strengthened so as to identify cropping patterns

and cultivation technologies that are applicable to the major shifting cultivation regions. The research work should be comprehensive covering wide range of products in addition to upland rice, e.g. other annual crops, tree crops (including fruit trees) and several kinds of livestock. Priority should be given to increasing farm income. For this matter, NAFRI should implement “Integrated Upland Agricultural Research Project (IUARP)”.

- In addition to the above research work, strengthening of extension and credit services are needed to stabilize shifting cultivation in an integrated manner. With the former service, dissemination of technologies that have already been developed by past research activities would have priority. The crop promotion program of various crops is also highly applicable to sloping area, especially, upland crop, fruit, and sericulture.
- Although this is not critical from the national food security viewpoint, new irrigation area development in sloping area regions would have a high priority for shifting cultivation stabilization. This would be promoted, but only after taking its economic feasibility into account. This will be mentioned in irrigation development sub-sector.

(3) Others

The extension system is a foundation for implementing crop programs as mentioned above. The institutional and human resource aspects related to extension service is described in Appendix 3, 9 and 10. The extension materials are also important and DOA has already prepared such extension materials. However, improvement is required in future, since adaptive research and demonstration results would be available after the implementation of various projects. Therefore, it is proposed that DOA and NAFRI should implement the project on “Farming Technology Dissemination Project” to enhance efficiency of extension service. After the implementation of various projects related to crop agriculture, the opportunities of contract farming with agro-processing factory or middlemen might be expanded. If so, “Contract Farming in Intensive Area” will be made to expand market channels for commercial crops as well as to stabilize farm income.

2.2.3 Proposed projects and programs

(1) Rice Seed Multiplication System Improvement Project

The objective of the project is to increase the unit yield of rice production through increase of certified rice seed production and expansion of use of improved rice seeds at farmer level.

The project will address all the above constraints for rice seed multiplication through confirmation of farmers needs, rehabilitation of existing facilities,

technical upgrading, restructure of seed distribution system in cooperation with extension system. In addition, the contract farmers system for production of registered seeds should be expanded, since intervention of public sector and public investment should be minimized. The project will cover in the whole country, thus step-wised development is required. Proposed phase of the project will be as follows:

Phase I: Technical assistance on future seed multiplication plan and rehabilitation plan, rehabilitation of Napok Seed Multiplication Center and Thasano Rice Research and Seed Multiplication Center as well as technical cooperation in those centers including implementation of training program.

Phase II: Rehabilitation of other Seed Multiplication Centers and upgrading of rice research stations as well as implementation of technical training program.

Phase III: Construction of new seed multiplication centers, if required.

(2) Integrated Upland Agricultural Research Project (IUARP)

The objective of the project is: i) to develop, test and refine the methodology for integrated upland agricultural research, ii) to develop sustainable livelihood systems as alternatives to slash and burn, iii) to upgrade current staff capacity in integrated upland agricultural research within NAFRI, PAFO and DAFO, and iv) to enhance community development, decision making and leadership capacity within the target communities.

This project was formulated primarily for the stabilization of shifting cultivation through the development of integrated agriculture in the upland environment. In general in the upland environment, population pressure is increasing, alternative land use is lacking, land availability is limited, and fertility decline and cumulative soil erosion combine to make the farming systems unsustainable. Currently farmers in much of the uplands are unable to produce sufficient rice to feed their families.

Recognizing the above nature in the upland environment, IUARP is currently implemented giving a priority to the following fields:

- 1) Rice Based Cropping Systems; rice variety improvement, vegetative contours, weed management, nutrient management, rodent control and fallow management,
- 2) Crop Diversification; perennial crops (fruit and agro-forestry), forestry, annual crops,
- 3) Livestock; forage evaluation, husbandry and management.

IUARP is now under implementation with financial and technical assistance from many donors including Lao-IRRI (SDC), IRS (International Research Scientist), ICRAF (International Center for Research in Agroforestry) and others.

(3) Crop Diversification Program

The objective of the project is to enhance farm income through expansion of crop diversification for second crop season in irrigation area. The project will expand crop diversification in the irrigation area through extension service including preparation of crop management calendar, and demonstration plots and associated farmer training. The project will be carried out mainly by DAFO staff in the districts concerned with the full technical and administrative support of PAFS and DOA. The training program of DAFO and PAFS staff is important component of the project. The staff training will be made in the form of on-job training, and study tour in other countries.

In the project, crop management calendar will be prepared and the calendar would include necessary operations in the field from land preparation to post harvest management. The calendar would fit in with farmers capability and existing agricultural conditions. Moreover, the calendar will be modified from time to time on the basis of field demonstration result. Small and manageable demonstration plots using trial species and/or adaptive technology on crop diversification will be established under the full management or guidance of extension staff of DAFO. The demonstration plot would be located in the place where farmers pass frequently and trial species and/or adaptive technology developed by NAFRI or in other neighboring countries will be applied. The farmers could then experience the technical possibilities and financial attractiveness of diversification. For propagation of demonstration plots, training for local extension staff and farmers will be implemented on the basis of “Teach by Showing”.

(4) Outer City Horticulture Promotion Program

The objective of the project is to enhance farm income through expansion of horticulture production in outer city area. The project will expand value added crops including vegetables, fruits and fodder crops (maize etc.) through extension service including preparation of crop management calendar, and demonstration plots and associated farmer training as explained in “Crop Diversification Program”.

(5) Export Oriented Crop Promotion Program

The objective of the project is to expand export oriented crop production including agro-processed products in border provinces. The project will expand crop and agro-processed production in the border provinces through extension service including preparation of crop management calendar, and demonstration plots and associated farmer training as explained in “Crop Diversification Program”. However, the present conditions as well as potential crops are not clear in terms of exports of crop production. It is therefore proposed that the study should be carried out to clarify the present export condition, selection of potential crops and its development plan including agro-processing.

The agro-processing activities are also important component in the program to add more value. The public orientation program will be made to explain how to participate the community managed agro-processing unit (CMAU). The initial inputs including equipment and materials will be provided to community. The cost of those inputs will be subsidized to some extent. However, the scale of subsidy will be examined carefully considering government policy and subsidy condition of other projects.

(6) Fruits Crop Promotion Program

The objective of the project is to generate additional farm income through introduction or expansion of fruit cultivation in upland and mountainous areas. The project will expand fruit crop cultivation in the upland and mountainous area through extension service including preparation of crop management calendar, and demonstration plots and associated farmer training as explained in “Crop Diversification Program”.

The nursery preparation of fruit crops is also important component in the program. The public orientation program will be made to explain how to participate the community managed nursery preparation (CMNP). The initial inputs including seeds/plant materials and fertilizer will be provided to community. The cost of those inputs will be subsidized to some extent. However, the scale of subsidy will be examined carefully considering government policy and subsidy condition of other projects.

(7) Sericulture Development Project

The objective of the project is to generate additional income in rural area through expansion of production of qualified cocoon and raw silk materials. The project will expand both cocoon and silk yarn production through supply of qualified silkworm eggs and extension service for introduction of modernized rearing and reeling technologies. The project will be carried out mainly in existing Sericulture Research and Extension Center (SREC), located in Vientiane Municipality, under municipal government. In the initial stage of project, grainage, rearing facility and dormitory for trainees will be rehabilitated in SREC compound.

The training program of SREC staff and farmers is also important component of the project. The staff training will be made in the form of on-job training, study tour, and scholarship to universities or research institutes in other countries. Training to farmers will also be made in the form of training program in SREC, study tour, and field guidance made by SREC staff.

For implementation of the project at farmers' level, the selection of priority sericulture promotion area will be made on village basis using appropriate criteria; i.e. present sericulture activity, land availability, willingness of village people, access to market etc. Awareness campaign and public orientation should be considered to motivate community participation to the project.

For sericulture activities, framers require initial and operation funds including construction of mulberry plantation and rearing house, rearing and reeling equipment, consumables and silkworm eggs. Therefore, village revolving funds should be established under the full assistance of local NGOs to the project. Project will create those funds at village level. And then, NGOs under the project will train beneficiaries how to maintain those funds. NGOs will also carry out monitoring activities of village revolving funds. In addition to those funds, farmers will form groups under the technical assistance of NGOs. The groups are expected to carry out cooperative works on maintenance of mulberry plantation, silkworm rearing and marketing to enhance sustainability of project activity. In parallel with fund creation and group formulation, the technical guidance will be made step by step; i.e. i) establishment of mulberry plantation and silkworm rearing house, ii) maintenance of those facilities, iii) silkworm rearing, iv) post cocoon activities including reeling and marketing.

(8) Farming Technology Dissemination Project

The objective of the project is to provide farmers and extension workers with improved farming technology information through radio and TV programs. The project will collect all existing relevant information, both from within the country and from the SE Asia region, and this information will be examined under the technical assistance of experienced experts for farming system or in various agricultural specialties. Field tests could be carried out under the research centers connected to NAFRI, if necessary. The project will compile a series of extension materials detailing locally adaptive, economically justifiable, and environmentally friendly farming practices for different farming systems in the various agro-climatic zones. The project will continually update information and provide revised and new data in a timely fashion.

Radio and television program are effective means for providing information, since the adult literacy rate is still high and accessibility of village is very low in Lao PDR. All the extension materials would be processed for the broadcast media. Based on the processed materials, the project will develop radio and television program for broadcasting technical information on farming system. The above materials will be published in various forms too, including leaflets, posters, newsletter, or newspaper, and made available to all interested parties, especially farmers, extension workers and subject matter specialists.

(9) Coffee Cultivation Technology Research Program

The objective of the project is to develop modern technology for coffee cultivation to contribute to exports. The project will develop adaptive research technology at the field level, especially for quality improvement and crop diversification. The main feature of the proposed project is envisaged as follows:

- 1) The draft quality standard of coffee products will be established and applied in Bolovens plateau. For the establishment of the quality standard, international standard for trade, examples of other countries and real situation of Bolovens plateau will be examined, since grade system is quite new approach in Lao PDR. The Lao government intends to expand organic cultivation, since natural coffee under organic cultivation get more value in European countries. The factor of organic cultivation will be considered in the quality standard.
- 2) The project will develop adaptive research technology of the field level, especially for quality improvement and crop diversification as well as mix culture with livestock and inland fishery. These recommended technologies would be tested in the field carefully from technical and economical viewpoints and then, would be provided as technical packages through extension service.
- 3) A quality testing unit will be set up in Ban Itou Coffee Research Center (CRC). Most of the staff has very limited knowledge and experience and accordingly, the training program for staff in the unit is very important component in the project. The training will be made in the form of on-job training, study tour, and overseas training. In addition to these human resource developments, installation of quality testing equipment should be made in the quality testing unit.
- 4) The training program of extension staff of PAFS and DAFO as well as model coffee farmers will be implemented in Ban Itou Coffee Research Center. The training program includes; i) importance of quality control of coffee, ii) improved coffee cultivation technology including post-harvest activities for quality improvement, and iii) crop diversification technology. After the training program, the campaign on quality improvement and crop diversification of coffee to farmers and middlemen will be made in the full cooperation of extension staff of PAFS and DAFO. In parallel, the demonstration plots will be established amongst existing farms to demonstrate improvement of the coffee quality and farm income.
- 5) The coffee market information including grade and quality, seasonal price trends by major production areas, price trends in major markets and at borders, export volume trend will be monitored and analyzed. The analyzed result will be feedback for further improvement of grade system and cultivation technology of coffee. The project will collect all existing relevant information, both from within the country and from the SE Asia region, and this information will be examined under the technical assistance of experienced experts for farming system or in various agricultural specialties. Field tests could be carried out under the research centers connected to NAFRI, if necessary. The project will compile a series of extension materials detailing locally adaptive, economically

justifiable, and environmentally friendly farming practices for different farming systems in the various agro-climatic zones. The project will continually update information and provide revised and new data in a timely fashion.

(10) Vegetable Cultivation Technology Research Program

The objective of the project is to select new improved varieties and develop adaptive technologies at field level for vegetable cultivation. The project will select recommended varieties and develop adaptive research technology at the field level. These recommended varieties and technology would be provided as technical packages through extension service on an area basis. The project will be carried out in Horticulture and Vegetable Research Center (HVRC), located in Vientiane Municipality, under National Agriculture and Forest Research Institute (NAFRI). In addition to HVRC, it is required to implement trial experiment in provincial stations or farmers field to develop adaptive research technology at area basis. Adaptive research trials using method from neighboring countries with similar agronomic condition would also be tested.

The training program of staff in HVRC and other staff in the province are also important subject in the project. The training will be made in the form of on-job training, study tour, and scholarship to universities or research institutes in other countries. In addition to these human resource developments, improvement of facilities and equipment should be made in HVRC. Necessary arrangement for research stations and experiment field should be also considered in the proposed project.

(11) Fruits Cultivation Technology Research Program

The objective of the project is to select new improved varieties and develop adaptive technologies at field level for fruit cultivation. The project will be carried out in Horticulture and Vegetable Research Center (HVRC), located in Vientiane Municipality, under National Agriculture and Forest Research Institute (NAFRI). The project will select recommended varieties and develop adaptive research technology at the field level as mentioned in “Vegetable Cultivation Technology Research Program”.

(12) Upland Crop Cultivation Technology Research Program

The objective of the project is to select new improved varieties and develop adaptive technologies at field level for fruit cultivation. The project should select recommended varieties and develop adaptive research technology of the field level. These recommended varieties and technology would be provided as technical packages through extension service on an area basis. The project will be carried out in Agriculture Research Center (ARC), located in Vientiane Municipality, under National Agriculture and Forest Research Institute (NAFRI).

In addition to ARC, it is required to implement trial experiment in provincial stations or farmers field to develop adaptive research technology at area basis. Adaptive research trials using method from neighboring countries with similar agronomic condition would also be tested.

The training program of staff in ARC and other staff in the province are also important subject in the project. The training will be made in the form of on-job training, study tour, and scholarship to universities or research institutes in other countries. In addition to these human resource developments, installation or upgrading of some equipment should be made in ARC. Necessary arrangement for research stations and experiment field should be also considered in the proposed project.

(13) Basic Seed Production Technology Development Project

The objective of the project is to select new improved varieties and develop adaptive technologies at field level for fruit cultivation. The project will include breeding and variety evaluation, seed certification, development of breeders' seeds, production of foundation seeds. In addition to basic (breeders' and foundation seed) seed development, the contract farmers system for production of registered seeds will be expanded in subsequent phase, since intervention of public sector and public investment should be minimized. Considering farmers' needs and technical aspects, candidate crops for the proposed project will be selected.

The project will implement in Agriculture Research Center (ARC), which is belong to National Agriculture and Forest Research Institute (NAFRI), for breeding & variety evaluation and development of breeders' seeds. It is also proposed to implement foundation seed production on a trial basis for technical improvement of staff in Napok Seed Multiplication Center under Department of Agriculture (DOA).

In succession to the above developments in the seed technology, the production system of certified seeds will be established in phase II, subject to the success implementation of the phase I. The main function of certified seeds production will be made on the contract basis with farmers.

The training program of staff in ARC and Napok Seed Multiplication Center under Department of Agriculture is also important component in the project. The training will be made in the form of on-job training, study tour, and scholarship to universities or research institutes in other countries. In addition to these human resource developments, installation or upgrading of some equipment should be made in ARC and Napok Seed Multiplication Center in the initial stage of the project.

2.2.4 Implementation plan

In total, 22 projects are proposed for crop sub-sector development. The implementation plan of the proposed projects, including sequence of activities during 2001-2020 period, should be formulated by phase. The implementation plan is divided into three phases, short, middle and long terms.

As the short-term strategy, the existing systems of crop agriculture should be improved through continuation of on-going or past efforts. These are related to rice production including “Rice Seed Multiplication Systems Improvement”, “National Rice Research Program” and “Integrated Upland Agricultural Research Project”. Other than rice production, “Sericulture Development Project” and “Pilot Agriculture Promotion Project” are also considered as projects for expansion of past effort.

Foundation approach to develop commercial agriculture in flatland should also be commenced in this Phase. From this point of view, most research programs related to crop diversification are a foundation requirement, since the demonstration can not be implemented without any adaptive research results. Therefore, “Coffee Cultivation Technology Research Program”, “Vegetable Cultivation Technology Research Program”, “Fruit Cultivation Technology Research Program”, “Upland Crop Cultivation Technology Research Program” will be implemented in this Phase. In parallel with these research programs, institutional strengthening programs of NAFRI should be implemented to increase research efficiency and quality. It is also proposed that the project on “Basic Seed Technology Development” will be implemented at initial stage, because shortage of improved seeds is one of the key issues for promoting crop diversification, and it will take time for the development of foundation seeds.

As the middle-term strategy, research results developed in the Phase I should be applied to field level for demonstration to farmers. In this connection, various promotion programs should be implemented, namely: “Crop Diversification Program”, “Outer City Horticulture Promotion Program”, “Export Oriented Crop Promotion Program” and “Fruits Crop Promotion Program”. For implementation of the above projects/programs, a sound extension structure from central to field levels will be essential. It is also noted that irrigation water management and supply of more credit for purchasing farm inputs are important. Therefore, the concerned projects should be commenced before year 2005 and various promotion programs will be commenced depending on their progress. For enhancing the efficiency of extension services, “Farming Technology Dissemination Project” will be commenced in this Phase.

Most basic projects for food security and crop diversification will be commenced as the short and middle term strategy. The long-term strategy focuses on stabilizing food security and expands advanced commercialized agriculture through mechanized farming and contract farming. “Private Sector Assisting

Project for Silk Production (Large Scale)”, “Mechanized Farming System Research Program”, “Agriculture Machinery Performance Test Criteria”, “Integrated Farming Technology Research Program”, “Contract farming in intensive area” will be implemented as long term strategy.

2.2.5 Expected result

The following results will be expected through crop agriculture development.

Flatland Area

- Rice seed multiplication system will be completed by the year 2010 and 100% of farmers will use improved rice seeds by the year 2020,
- Target on access to extension service and rural finance as well as enhancement of irrigation efficiency will be mentioned in other sub-sectors,
- The following area, yield and production targets for lowland and dry season paddy will be achieved by the year 2010 and 2020,

Target Area, Yield and Production of Lowland and Dry Season Paddy

Item		Yr. 2000	Yr. 2010	Yr. 2020
Lowland paddy	Area (ha)	475,500	475,500	475,500
	Yield (ton)	3.27	4.30	4.50
	Production (ton)	1,552,800	2,046,655	2,139,750
Dry season paddy	Area (ha)	91,800	101,800	111,980
	Yield (ton)	4.25	5.49	6.00
	Production (ton)	390,150	559,256	671,880

- Cultivated area other than paddy in dry season will be 20% (40,000 ha) of irrigation area in year 2010 and 40% (80,000 ha) in year 2020,
- More than 70% of total coffee production will be of an internationally acceptable quality in year 2010,
- 100% of farmers, who access to sericulture training center, will use improved variety of silkworm, get technical training and use improved cottage basin in 2020.

Sloping Land

- Improved seeds and adaptive research result will be developed for upland rice,
- Target on access to extension service, rural finance and market will be explained in other sub-sectors,
- The following area, yield and production of upland paddy will be achieved by the years 2010 and 2020,

Target Area, Yield and Production of Upland Paddy

Item		Yr. 2000	Yr. 2010	Yr. 2020	
Upland paddy	Area	(ha)	152,100	110,000	110,000
	Yield	(ton)	1.70	1.70	2.00
	Production	(ton)	258,750	187,000	220,000

- Income source will be diversified through farming diversification including fruit, vegetable and upland crop production, and
- Other income sources including NTFP and agro-forestry on sloping land will be explained in sub-sector of “Stabilization of Shifting Cultivation”.

Table

Table 1.4.1 Harvest Area, Production and Unit Yield of Major Crops

1. Harvest Area

(Unit: ha)

	1995	1996	1997	1998	1999	2000	Average	Annual Growth (%)
Rice	559,900	553,700	601,300	617,500	717,600	719,400	628,200	5.1
-Lowland Rice (Wet Season)	367,300	363,100	421,100	430,200	477,200	475,500	422,400	5.3
-Lowland Rice (Dry Season)	13,600	18,000	26,600	53,100	87,000	91,800	48,400	46.5
-Upland Rice	179,000	172,600	153,600	134,200	153,400	152,100	157,500	-3.2
Maize	29,100	37,400	38,000	46,400	40,700	49,000	40,100	11
Root crops	14,000	14,600	19,400	21,700	13,100	19,400	17,000	6.7
Mungbean	3,300	1,700	2,000	2,100	1,700	1,300	2,000	-17.1
Soybean	5,800	3,600	3,100	5,900	6,800	6,400	5,300	2
Peanut	8,300	9,400	14,000	14,900	12,900	12,800	12,100	9.2
Tobacco	7,400	7,200	7,500	6,600	4,300	6,700	6,600	-2
Cotton	9,600	9,100	7,200	7,200	4,400	4,700	7,000	-13.4
Sugarcane	2,700	3,400	3,700	5,400	4,700	8,400	4,700	25.6
Coffee	20,200	23,100	23,300	28,600	29,300	29,400	25,700	7.8
Tea	570	400	400	910	930	560	600	-0.5
Vegetables	9,500	14,600	25,500	30,900	41,100	104,700	37,700	61.7

2. Production

(Unit: ton)

	1995	1996	1997	1998	1999	2000	Average	Annual Growth (%)
Rice	1,417,800	1,413,500	1,660,000	1,674,500	2,102,800	2,201,800	1,745,100	9.2
-Lowland Rice (Wet Season)	1,071,300	1,076,000	1,299,500	1,248,900	1,502,000	1,552,800	1,291,800	7.7
-Lowland Rice (Dry Season)	50,400	71,500	113,500	212,100	354,000	390,200	198,600	50.6
-Upland Rice	296,100	266,000	247,000	213,500	246,800	258,800	254,700	-2.7
Maize	50,400	78,100	78,300	109,900	96,100	117,000	88,300	18.4
Root crops	99,200	92,500	94,000	107,900	80,600	117,500	98,600	3.4
Mungbean	2,300	1,200	1,500	1,700	1,500	1,100	1,600	-13.7
Soybean	4,800	3,200	2,300	4,300	5,900	5,400	4,300	2.2
Peanut	8,400	11,900	12,000	15,000	13,000	13,200	12,300	9.4
Tobacco	26,600	26,000	28,000	25,600	23,400	33,400	27,200	4.6
Cotton	8,800	6,800	7,000	7,500	4,300	4,600	6,500	-12.2
Sugarcane	62,300	87,100	95,000	170,200	173,600	297,000	147,500	36.7
Coffee	8,600	10,000	12,300	17,000	17,500	23,500	14,800	22.3
Tea	760	100	110	260	350	200	300	-23.5
Vegetables	61,700	88,900	100,000	117,300	236,000	636,000	206,700	59.4

3. Yield

(Unit: ton/ha)

	1995	1996	1997	1998	1999	2000	Average	Annual Growth (%)
Rice	2.5	2.6	2.8	2.7	2.9	3.1	2.8	3.8
-Lowland Rice (Wet Season)	2.9	3.0	3.1	2.9	3.1	3.3	3.0	2.3
-Lowland Rice (Dry Season)	3.7	4.0	4.3	4.0	4.1	4.3	4.0	2.8
-Upland Rice	1.7	1.5	1.6	1.6	1.6	1.7	1.6	0.6
Maize	1.7	2.1	2.1	2.4	2.4	2.4	2.2	6.7
Root crops	7.1	6.3	4.8	5.0	6.2	6.1	5.9	-3
Mungbean	0.7	0.7	0.8	0.8	0.9	0.8	0.8	4.1
Soybean	0.8	0.9	0.7	0.7	0.9	0.8	0.8	0.3
Peanut	1.0	1.3	0.9	1.0	1.0	1.0	1.0	0.2
Tobacco	3.6	3.6	3.7	3.9	5.4	5.0	4.2	6.8
Cotton	0.9	0.7	1.0	1.0	1.0	1.0	0.9	1.4
Sugarcane	23.1	25.6	25.7	31.5	36.9	35.4	29.7	8.8
Coffee	0.4	0.4	0.5	0.6	0.6	0.8	0.6	13.4
Tea	1.3	0.3	0.3	0.3	0.4	0.4	0.5	-23.1
Vegetables	6.5	6.1	3.9	3.8	5.7	6.1	5.4	-1.4

Source: DOP, MAF

Table 2.2.1 Preliminary Projection on Paddy/Rice Balance for 2010 and 2020

PRODUCTION

Item		Yr. 2000 a/	Yr. 2010	Yr. 2020	Remarks
Lowland paddy	Area (ha)	475,500	475,500	475,500	No expansion of harvested area is assumed for 2000-20 period.
	Yield (ton)	3.27	4.30	4.50	Increase rate of 2.28% p.a (past trend of 1990-2000) is applied to 2000-20 period till its assumed maximum of 4.5 ton/ha.
	Production (ton)	1,552,800	2,046,655	2,139,750	
Upland paddy	Area (ha)	152,100	110,000	110,000	3.21% p.a decrease of past trend (1996-2000) is applied to 2000-2010 period. It is also assumed that use of upland paddy area would be stabilized in 2010.
	Yield (ton)	1.70	1.70	2.00	Assumed yields
	Production (ton)	258,750	187,000	220,000	
Dry season paddy	Area (ha)	91,800	101,800	111,980	10% of area increase is assumed to be performed during 2000-2010 and 2011-2020 periods, respectively.
	Yield (ton)	4.25	5.49	6.00	Increase rate of 2.26% p.a (past trend of 1990-2000) is applied to 2000-20 period till its assumed maximum of 6.0 ton/ha.
	Production (ton)	390,150	559,256	671,880	
Total paddy	Area (ha)	719,400	687,300	697,480	
	Yield (ton)				
	Production (ton)	2,201,700	2,792,911	3,031,630	
Projected production increase rate		(1990-00 period) 3.97% p.a	(2000-10 period) 2.41% p.a	(2010-20 period) 0.62% p.a	

CONSUMPTION

Production (tons)	2,201,700	2,792,911	3,031,630	
Seed and post-harvest losses, 16% b/	352,272	446,866	485,061	
Net paddy milled (tons)	1,849,428	2,346,045	2,546,569	
Milled rice (62% recovery) b/	1,146,645	1,454,548	1,578,873	
Rice for other uses, 2% b/	22,933	29,091	31,577	
Net milled rice available (tons)	1,123,712	1,425,457	1,547,295	
Rice requirement (kg per capita) b/	180	180	180	Assumed that the present consumption level estimated by the Government's Strategic Vision (1999) would continue until 2020.
Population c/	5,234,000	6,650,000	8,207,000	
Total rice requirement (tons)	942,120	1,197,000	1,477,260	
Rice balance	181,592	228,457	70,035	

Source: a/; Agricultural Statistics, 25 years, 1995-2000, MAF

b/; These figures are obtained from "the Government's Strategic Vision for the Agriculture, 1999".

c/; Results from the Population Census 1995, State Planning Committee, National Statistical Center

Assumption for Projection

(1) Harvested Area

- Lowland paddy; There would be no increase and decrease of the harvested area in the future, and present harvested area of 475,500 ha in 2000 would continue for the next 20 years from 2001 to 2020.

- Upland paddy; past declining trend (2.28% p.a. during 1990-2000) would continue to 2010. After 2011, utilization of decreased size of the area would be stabilized.

- Dry season paddy; A very small area expansion (10% in every ten years) would be performed through improvement and better management of irrigation systems.

(2) Unit Yields

- Lowland paddy; It would be increased with a growth rate of 2.28% p.a. (past trend during 1990-2000) till its assumed maximum of 4.5 tons/ha.

- Upland paddy; It is just assumed that the yield in 2010 would be the same with that at present (1.7 ton/ha), and 2.0 tons/ha in 2020.

- Dry season paddy; It would be increased with a growth rate of 2.26% p.a. (past trend during 1990-2000) till its assumed maximum of 6.0 tons/ha.

(3) Per capita consumption

Per capita consumption for the year 2010 and 2020 is assumed to be 180 kg rice.

In this projection, reliability of individual figures on harvested area and yield may not be very high as several donors have indicated. On the other hand, similar source of information reports that the self-sufficiency of paddy/rice in Lao PDR is almost achieved. The above projection is thus carried out based on the latter information in order to know the direction of Lao PDR keeping the present level of self-sufficiency in paddy/rice.

Appendix 7
Livestock and Fisheries

**MASTER PLAN STUDY
ON
INTEGRATED AGRICULTURAL DEVELOPMENT
IN
LAO PEOPLE'S DEMOCRATIC REPUBLIC**

VOLUME III

APPENDIX-7

LIVESTOCK AND FISHERIES

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**MASTER PLAN STUDY
ON
INTEGRATED AGRICULTURAL DEVELOPMENT
IN
LAO PEOPLE'S DEMOCRATIC REPUBLIC**

**VOLUME III
APPENDIX-7
LIVESTOCK AND FISHERIES**

CHAPTER 1 LIVESTOCK

1.1 Present Condition of Livestock

1.1.1 Organizations of Department of Livestock and Fisheries (DLF)

The organizations of Department of Livestock and Fisheries (DLF) are shown in Figure 1.1.1. The DLF governs all the livestock administration related to livestock hygiene and production. Under the DLF, there are Administration, Technical, and Planning Divisions (Sections) which have altogether 19 staffs. The Technical Division is divided into the Livestock and Fisheries Development Division and the Animal Health Division, both of which implement their own operations. The Livestock and Fisheries Development Division has 44 staffs and has the following sub-organizations.

- Nongteng Fishery Station
- Nongteng Pig Farm Station
- Nongteng Poultry Station
- Animal Feed Laboratory

The Animal Health Division has 50 staffs and has the following sub-organizations.

- Vaccine Production Institute
- Animal Disease Diagnostic Laboratory
- Veterinary Extension Unit
- Meat Inspection and Check Point Unit

The above mentioned organizations and sub-organizations are positioned at the central level, under which there are Provincial Livestock and Fisheries Offices (PLFO) in 18 provinces and the District Livestock and Fisheries Offices (DLFO) in 142 districts, each has 258 and 498 livestock-related staffs respectively. There are 5,000 village veterinary workers (VVWs) related to the vaccination at village level in approximately 11,000 villages in the country.

1.1.2 Organization of Research

(1) National Agriculture and Forestry Research Institute

The National Agriculture and Forestry Research Institute (NAFRI) is directly placed under the Ministry of Agriculture and Forestry (MAF) and divided into 10 departments for each field. The major activities of the Livestock Research Center for livestock field are shown below.

1) Animal Breeding Section

7 staffs are mainly engaging in the selection breeding of yellow cattle and the improvement of local chickens.

2) Farming System Section

5 staffs are mainly engaging in the research on the Integrated Farming System combining the livestock, fish culture, farm production (paddy rice, upland crops), and forestry improve the labor productivity of farmers.

3) Animal Nutrition Section

5 staffs are implementing the adaptive test of grass, cassava, and maize imported from Australia and Thailand. This facility was constructed under the support of Australia in 1982. It is a large-scale facility build on a lot of 150 ha and includes an office, a training center, and accommodation facilities. However, the laboratory and the equipment are not prepared yet, which is the basic facility needed for a research center. Concerning the livestock, it has 100 cattle and 150 chickens, but no active research is conducted at present.

At present, an Australian Project, Forages and Livestock Project (SLP) is being implemented from 2000 to 2005, in which the NAFRI is the executing agency. However as the project sites are located in the northern part of Laos, that is, in Louangphrabang and Xiangkhouang provinces, the NAFRI is rarely involved because of lack of staff members and remote areas.

(2) Organizations under the DLF

1) The Animal Feed Laboratory belonging to the Livestock and Fishery Development Division was established in 1982 with the support of the FAO. It has 6 staffs and analyses the feed ingredients as its main activity. The equipment made in the Czech in the laboratory is old. Almost all the instruments are manual analyzers and some of them are out of order. From the seditious of the inside of the laboratory, no active analytical activity is assumed to be conducted. Animal feed is a most important item for the livestock production just like the livestock hygiene. However, the Lao People's Democratic Republic (Lao PDR) has no integrated laboratory related to the animal feed at present. It is

necessary to reconstruct the Animal Feed Laboratory that can implement technological development of the entire animal feeds and animal husbandry by improving the facility in the future. The DLF is already planning the improvement of this laboratory.

2) Animal Disease Diagnostic Laboratory belonging to the Animal Health Division was established in 1965 with the support of France. It is an important laboratory for the animal disease diagnosis, treatment, and prevention. At present, 13 staffs are doing the research activities in the following 7 units.

- i) Epidemiology Unit
- ii) Bacteriology Unit
- iii) Virology Unit
- iv) Parasitology Unit
- v) Pathology Unit
- vi) Toxicology Unit
- vii) Rabies Diagnostic Unit

As the facility and the equipment of this laboratory had been extremely damaged, part of the facilities were rehabilitated and the equipment was supplied by the EU Project called the "Strengthening of Livestock Service and Extension Activities" at the end of 2000. This is a laboratory having the equipment of the latest model in the Lao PDR. The activities of this laboratory are also active and the laboratory has a training facility near the building. However, the floor space of the facility is small and sufficient activities cannot be conducted.

This laboratory is considered to play a core role in the entire animal health field at the central level in the Lao PDR in the future. Under the Animal Health Division, the Field Diagnostic Laboratories established around 1995 are located in 4 provinces of Louangphrabang, Xiangkhouang, Savannakhet, and Champasak. Each facility has 2 staffs and has a network with the laboratory of central level. However there is no field laboratory in the northern area. With the support of the above mentioned EU Project, the equipment was supplied to the 2 existing field laboratories in Louangphrabang and Champasak and their diagnostic abilities will be improved.

The DLF is planning to rehabilitate the laboratory of central level by positioning it as the National Animal Health Center. It also plans to build field laboratories in 4 northern provinces where there is no field laboratory at present.

3) National Vaccine Production Institute

The National Vaccine Production Institute was established in 1978 with the support of the United Nations Development Program (UNDP). It manufactured 11 types of vaccines. However, at present, the vaccines not demanded much are imported, and the Institute is manufacturing 8 types of vaccines. The production reached the peak in 1995 when the Institute manufactured 6.4 million doses. However with the deterioration of facility and equipment, the production was reduced and dropped to 4.8 million doses in 2000. (Refer to the transition of production quantity.) In order to improve the deteriorated conditions of the equipment and facility, main equipment was supplied with the support of EU Project and some are already being used at present. The vaccine production ability when this Project is completed will be 15.0 million doses, which is 3 times more than now. The National Vaccine Production Institute is formulating a vaccine production plan targeting for 2020. By considering the increase of livestock number and immunization rate of vaccines, the plan assumes that the necessary quantity of vaccines will be 32 million doses in 2005, 37 million doses in 2010, and 75 million doses in 2020. The rehabilitation plan of the facility is already formulated. The present facility was build more than 20 years ago and each room is divided into small sections, which is not proper for mass production. Therefore, prompt rehabilitation of the facility is necessary for achieving the said plan. The vaccines having small demand are imported.

1.1.3 Kinds of Livestock

(1) Cattle

As for the breed of feeding livestock, Yarrow Cattle is the subject. This breed is called Chinese Yarrow with a good characteristic for the draft and meat production purpose from China. Yarrow cattle is hardy with ability to withstand heat, stands up to poor feed. And this breed has power of resistance against the tropical endemic. Though a physique varies by the areas, generally the breed is small with mature weights of from 300 to 350 kg for bulls and 200 to 250 kg for cows. Dressing rate of about 50%, similar to buffalo. The meat production of this breed is small, but the quality is good. Beside Yarrow, Sahiwal and Holstein breeds are partly raised in the country.

(2) Buffalo

Buffaloes are of larger size compared with cattle: mature males reach of from 400 to 450 kg and females of from 300 to 350 kg. The first parturition is reported at four (4) years and calving interval is about every 27 months.

(3) Pigs

As for the breed of the pig in the Lao PDR, a black pig from China is the subject. They are prolific and hardy with ability to withstand heat. But, because improvement of breed has not proceeded, the body fat is thick, and it is not suitable for processing of raw material. Recently, large-scale pig farms have been facilitated in the suburbs of the city. Here, the kinds such as Landrace and Duroc are bred, and, in addition, interbreed crossing between these kinds is done.

(4) Sheep and Goats

Sheep and goats are not many in number compared with other animals. The breeds are indigenous, and they are used for the meat. Feeding method is only grazed extensively without other feed. Overgrazing, which so far has not existed would become a problem if the grazing intensity would be controlled.

(5) Poultry (Chicken, Duck and Turkey)

Poultry are indigenous breeds, and they are used for egg and meat purpose, mainly for the self-consumption of the farmers. These animals are fed with residuals of after crop harvest, home trash, and grass around the residence. Recently, large-scale chicken farms just like the pig farm have been established in the suburbs of the city. Two kinds of chickens are bred here. One is Yarrow Breed, which is introduced from Vietnam, for egg and chicken. The other is Bovanera breed, which is introduced from Netherlands.

1.1.4 Livestock Population

As for the livestock, as shown in table below, approximately one (1) million buffaloes, 1.1 million cattle, 1.4 million pigs, and 13.1 million poultry were raised in 2000. With regard to the average increase rate in the past five years, the livestock excluding poultry decreased, which was considered to have been caused by the increase of number of exported cattle because of the rapid increase of export price of cattle to Thailand due to depreciation of the actual currency rate against Baht by economic crisis in Asia. However, it was a temporary decrease and the number changed to increase in 2000.

Livestock Population in Lao PDR in 1996 - 2000

(Unit: 1,000 head)

Description	1996	1997	1998	1999	2000	Growth Rate
Northern						
Buffalo	330.80	337.30	314.40	301.00	311.40	-0.03
Cattle	239.30	252.00	228.48	210.00	233.80	0.37
Pigs	906.50	922.50	628.18	647.00	625.70	-5.27
Goat/Sheep	88.20	98.00	59.51	60.11	59.80	-7.19
Poultry	4,238.00	4,205.00	3,983.58	4,356.00	4,214.10	0.01
Central						
Buffalo	598.00	596.00	552.80	464.00	476.70	-4.44
Cattle	669.00	684.00	656.42	579.00	641.30	-0.15
Pigs	515.50	528.50	508.50	505.00	598.20	0.87
Goat/Sheep	55.00	56.50	50.89	43.13	53.80	0.10
Poultry	4,191.00	4,633.00	5,299.47	5,846.00	6,449.70	10.17
Southern						
Buffalo	282.90	290.50	225.54	243.00	239.90	-3.14
Cattle	277.70	291.50	241.70	211.00	224.90	-3.61
Pigs	350.00	362.00	327.74	168.00	201.10	-9.33
Goat/Sheep	15.80	10.50	11.77	9.17	7.80	-9.13
Poultry	3,227.00	3,108.50	2,827.81	2,151.00	2,430.40	-15.81
Lao PDR						
Buffalo	1,211.70	1,223.80	1,092.74	1,008.00	1,028.00	-2.91
Cattle	1,186.00	1,227.50	1,126.60	1,000.00	1,100.00	-0.81
Pigs	1,772.00	1,813.00	1,464.42	1,320.00	1,425.00	-3.73
Goat/Sheep	159.00	165.00	122.17	112.41	121.40	-4.51
Poultry	11,656.00	11,945.50	12,110.85	12,353.00	13,094.20	2.92

Source: DOLF/MAF. Details are shown in the Table 1.1.2 (1)-(3), 1.1.3

As seen by the regions, there are a lot of breeding numbers of the buffalo and cow in the Central part, and they are few in the Northern and Southern parts. The feeding numbers in the entire region and per household are small in the Northern part because a natural condition in the Northern part is severe for animal feeding. The entire feeding number in the Southern part is smaller than in the Central and Northern parts, because both regional areas and the numbers of farmers are the least among three regions. The pig, goat, and sheep are domestic animals of the character to endure well also against a severe natural condition, so those feeding numbers are similar to those of the Central part.

1.1.5 Livestock Management

The methods of animal feeding are traditional feeding in all practices excluding the large-scale livestock farms in the suburbs of city. Large animals such as cattle and buffalo are mainly pastured on a natural meadow and the vacant lots. In the paddy producing zone, cattle and buffalo are mainly pastured in paddy fields after harvesting in the dry season, the cattle and buffalo graze remaining rice straw, gleanings and weed. Usually, the animals are released for grazing in the morning and accommodated in simple animal barn near the farmer's house in the evening. There are a lot of grasses on a natural meadow and vacant lots, and fodder is not in short in the rainy season. However, the fodder is insufficient from the middle of the dry season, the nourishment condition gets worse, weight decreases and

physical strength gets exhausted. As the results, the resistance to the disease decreases, and they become subject to the epidemic. Especially, for infant and aged domestic animals, the influence of this fodder shortage is large.

The poultry and the pig are bred nearly under wild conditions, and are fed with agricultural by-products and kitchen wastes from time to time. The purpose of raising of the poultry and pig is for self-consumption for the farmers. Therefore, the purpose is attained even by such feeding method. Pasturing is basically done also in a natural meadow by the ravine zone. However, the fodder resource might be limited and the feeding number is little. The feeding methods such as pasturing natural meadow and pasturing to farmland after harvesting are the same as plain area. Fodder shortage in the dry season is also similar.

1.1.6 Animal Health

Though there is no information on infection rate by domestic animal disease in Lao PDR, the damage is considerably large. Especially, it is reported that damage to the infant and aged animals whose resistance is low is quite large. This is a big problem prior to the improvement of productivity of the domestic animal.

Animal health services are executed through the system shown in the following in the country now. However, the efficiency of the animal health measures does not go up so much due to the following reasons. They are; i) system of the basic law concerning the animal health including animal food inspection system is insufficient, ii) lack of trained technicians related to veterinary, the medicine, medical equipment and movable car, and iii) low knowledge of the farmers on domestic animal health.

Basic and important matters such as exchange of the injection needle by animal, confirmation of the vaccination, are not practiced on the site of the vaccination of the HS(hemorrhagic septicemia). The situation of the inspected site was that about 50 cattle were driven into a wide paddock, then two VVWs vaccinated animals vagrantly. Therefore, the confirmation of the vaccination was in fact impossible. These facts explain the low level of awareness to terminate the epidemic. Moreover, technical guidance even concerning feeding and management has not yet been conducted properly.

1.1.7 Livestock Hygiene Legislation

The system of the law concerning the domestic animal health, quarantine of importing and exporting domestic animal, meat inspection, is insufficient in Lao PDR now. Therefore, the vaccination, quarantine, and the meat inspection don't completely put into operation. This will bring a big trouble for expansion of the livestock sub-sector in the future. It is a crucial to be solved immediately. About maintenance of laws and technological improvement concerning the domestic

animal health, it is considered that significant improvement in the domestic animal health would be achieved by an on-going project, namely, “The Strengthening of Livestock Services and Extension Activities” by EU whose target year is set at the year 2004.

1.1.8 Production of the Livestock Products

Trend of livestock production is not known due to lack of statistical data on the livestock production. Therefore, the current production is assumed from the projected production by the DOLF plan whose target year is 2005. According to such estimation, the production of pork accounts for 36% of the meat production. The second is fowl meat having a share of 24%. The buffalo and the cow have the shares of 20%, respectively.

The Estimation of Meat Productivity Capacity (weight in live animal)

(Unit: tons)

Animals description	2000	2001	2002	2003	2004	2005
Meat						
Buffalo meat	19,700	20,100	20,500	20,900	21,300	21,700
Cattle meat	20,200	21,400	22,700	24,000	25,500	27,000
Pork meat	49,000	52,200	54,300	56,400	58,700	60,900
G/S. meat */	400	450	460	470	480	490
Poultry meat	16,800	17,940	19,510	20,610	21,680	22,900
Total weight	106,100	112,090	117,470	122,380	127,660	123,990
Eggs total	10,000	10,200	10,900	11,600	12,400	13,200
Milk total	270	300	350	400	450	500

Source: Department of livestock and Fisheries

Note: */ G/S. Goat and Sheep

As mentioned above, the feeding scale of a current livestock sub-sector is small, and productivity is low. However, the livestock sub-sector in Loa PDR is regarded as a growing sector of the future, expecting a great growth rate until 2020. The target values in 2020, which DOLF set are shown below.

Livestock Development Target in 2020

Livestock	Year 2000		Year 2020	
	Population (nos.)	Production (tons)	Population (nos.)	Production (tons)
Buffalo	1,028,000	16,600	1,527,000	24,705
Cattle	1,100,000	16,400	3,672,000	52,700
Pigs	1,425,000	27,650	2,393,000	51,406
Total Poultry	13,094,200	18,340	52,829,000	78,167
Meat Total		76,990		204,958
Eggs		10,000		40,793
Milk		270		1,202

Source: DOLF/MAF

According to the above table, the plan expects a great increase to about three times in the domestic animal feeding number of cattle and poultry. The production

of meat is also expected to increase drastically as the animal feeding number increases. Meat production in 2020 is expected to be about three times in 2000. The plan will achieve the reinforcement of the production by the expansion of feeding number at levels of the farmers and the large-scale livestock farms, which will be established in the future.

1.2 Livestock Development

1.2.1 Formulation of Livestock Development Plans

(1) Outline of livestock development

In livestock development of Laos, the income increase of farmers through animal breeding, effective use of the unused land resources by livestock development, and increase of the livestock production are expected.

The increase of livestock production will contribute to supply of the animal protein to urban residents and to stabilization of national economy through the increase of export of livestock products.

Approximately 90% of the present animals are raised by small-holder-farmers. These farmers are not full time livestock farmers, but operate jointly the animal feeding and agricultural production such as paddy. They feed animals extensively and cannot secure sufficient feeds during the dry season. Therefore, productivity remains low under the present feeding system. Though number of animals is small, livestock is an important source of cash income for the farmers. The production of these farmers occupies large portion of the total. From these facts, the livestock population and the production shall be increased and productivity shall be improved using the following measures.

- improvement of the animal health
- improvement of the traditional feeding and management system
- effective use of lands
- introduction of fodder crops
- securing of feeds in the dry season
- effective use of the by-products of agricultural products
- improvement of the management of natural pasture lands that are being used
- improvement of animal breed

On the other hand, in Laos, there are still many unused land resources (natural pasture land) available for the livestock development. Thus the possibility of future livestock development is high. In order to use these land resources effectively, it is suitable to conduct exclusive livestock production (beef cattle and dairy cattle production) with the large-scale modern technologies for livestock management and feed production, and storage with low investment. Then the production with low cost might be realized. The measures for this purpose are similar to those for the small-scale breeding farmers. However, as the exclusive

livestock management raises large livestock population, extension of the hygienic knowledge on group animals is especially important. For the future livestock development of large animals in Lao PDR, it is important to increase the production by both strengthening of the small-scale animal feeding farmers and establishing of the large-scale exclusive livestock business.

The pigs and poultry (especially chickens) for the self-consumption and supply to local city residents would be produced by the traditional animal feeding farmers through increase of feeding scale and improvement of productivity as far as possible. In this case, it is necessary to introduce improved hygienic treatment along with highly productive varieties even under the raising environment of the small-scale farmers. It is desirable that pigs, poultry, and eggs supplied to the central city residents are provided by the exclusive suburban-type farming production with high productivity, which are recently observed mainly in Vientiane Municipality. This kind of production mostly depends on the grain feeds from outside. Thus the production and supply of livestock feeds which meet the demand are required. In this case, it is also important to secure quality and safeness of the feed. Furthermore, mass hygienic management of the livestock is especially important, and due consideration should be paid on preventive measures against diseases as well as special care when renewal of animals, and/or improvement related to the scale and layout of livestock sheds are undertaken.

(2) Proposed targets

The targets proposed by the Department of Livestock and Fisheries (DOLF) based on the Vision 2000 are shown in the table below.

Livestock Development Target in 2020

Livestock	Year 2000		Year 2020	
	Population (nos.)	Production (tons)	Population (nos.)	Production (tons)
Buffalo	1,028,000	16,600	1,527,000	24,705
Cattle	1,100,000	16,400	3,672,000	52,700
Pigs	1,425,000	27,650	2,393,000	51,406
Total Poultry	13,094,000	18,340	52,829,000	78,167
Meat Total		76,990		204,958
Eggs		10,000		40,793
Milk		270		1,202

Source: DOFL/MAF Details are shown in the Table 1.2.1 (1)-(2)

The targets were set up as practical ones based on the estimated livestock population and the average annual increase rate for each animal as follows.

Buffalo: 2.0%, Cattle: 6.0%, Pigs: 3.0%, Poultry: 6.0%

The target values of Vision 2020 are calculated by multiplying the assumed per capita consumption of animal protein of 60 kg/year by the projected population for each animal. These values are evaluated as practicable even though they are lower than the planned values of Vision 2020 except for buffalo and beef cattle..

The beef cattle has high potential for development in the future. A significant increase of the beef cattle population is planned. Thus, the domestic demand would be satisfied, and some surplus is projected for export. Approximately 61,000 buffaloes and 189,000 beef cattle, totally 250,000 will be able to be exported in a year.

The increase rates of the planned livestock population and production against the present are shown in the table below.

Increase Rate of Livestock Population and the Amount of Production

(Unit: %)

Animals	Present Livestock Population (2000)	Present Livestock Production (2000)	Target Livestock Population (2020)	Target Livestock Production (2020)
Buffalo	100	100	149	146
Cattle	100	100	334	303
Pigs	100	100	168	175
Total Poultry	100	100	403	426
Total		100		277
Eggs		100		408
Milk		100		445

CHAPTER 2 FISHERIES

2.1 Present Condition of Fisheries

2.1.1 Fish Cultural Management

Basically, there is no specialized or professional fish cultivators at present in Lao PDR and most of the cultivators are involved in rice crop and/or upland crop cultivation. Around Namngum Lake and the Mekong River, especially in Khog District of Chanpasak Province, the side-work farmers cultivate the fish to sell and earn cash income. The part-time fishermen working at mountainous or highland provinces, and most of inland areas, operate so called “subsistence fisheries” mainly for their self-consumption.. Most of the part-time fishermen belong to the latter as a whole. Fish culture in Lao PDR is classified in the following three (3) types;

- i) Extensive farming with low fish density without feeding
- ii) Semi-intensive farming with small amount feeding; and
- iii) Intensive farming with high fish density with feeding

Density of fish ranges from 0.5 to 1.0 fish/m² for the semi-intensive cultivation, while for the intensive, over 5.0 fish/m². Ninety percent (90%) of the aquaculture in Lao PDR is categorized into semi-intensive or extensive. In Vientiane Mun, where small-scale aquaculture has mostly been operated, some entrepreneurs have started commercialized aquaculture and produce 10 to 20 tons of fish per year.

Eight (8) kinds of fish are mainly cultivated; namely, Nile Tilapia, Common Carp, Puntius, Chinese Carp (Silver Carp, Big head, Grass Carp), Indian Carp. Besides, Clarias and Pangasius are cultivated to some extent. In the northern mountain region, the aquaculture is being conducted extensively even in small scale of 500 m² or less mostly for self-consumption. Even in such mountainous region, some areas near mountain streams can extract water for the aquaculture even in the dry season, having good forest in the watershed.

In the suburbs, where irrigation system has been developed, and also unit price (per weight) of fish is more than that of paddy rice, some farmers have started to convert their paddy fields into fish ponds. It may be inferred that those farmers would be divided into; i) commercial-based cultivators, who utilize un-used water bodies for the aquaculture with floating net cages, and ii) farmer-cultivators aiming for self-consumption.

However, technology of the aquaculture of Lao PDR remains at low level both in terms of intensive and extensive cultivations, which well explains their low productivity.

2.1.2 Extension Services

There are 22 national hatcheries in the country¹. Out of these, DOLF assigns a role of “Central Fish Breeding Farm” to Nonteng Fish Breeding Farm which is located in the outskirts of Vientiane Mun. The Farm was constructed by USAID in 1962, and had been rehabilitated for five years from 1992 to 1996 under an FAO project.

In the Farm, production and distribution of fish fry, training for farmers, private sector, students and officials of provinces and districts are conducted (three to four times a year). Five to ten trainees are selected for subjects of; raising of parent fish and fry, management, construction of fish pond, distribution of the fish fry, etc. Technical guidance on the aquaculture is conducted by the officials of District Livestock and Fisheries Office (DLFO) trained here, but it is not sufficient due to shortage of the extension workers and their proficiency on the aquacultural technology.

According to Naluang Fisheries Station in Louangphrabang Province, farmers are eager to learn the technology on the aquaculture, but the technical level of the district staff is not high enough to improve the aquacultural techniques of farmers, who do not even have fundamental knowledge on the aquaculture such as proper feeding, density of fish in a pond, etc.

2.1.3 Production of Fingerling

In the year 1996, in which more statistical data are available, the demand for fingerlings in the country was 52 million. However, regarding the amount of fingerling production, the number of fingerlings produced at 14 provincial hatcheries and private ones were 16 million, which accounted for only 30% of the demand for fingerlings. Thus, the deficit was compensated by import from Vietnam, China and Thailand. Because of the poor fingerling production technology, the survival rate from fries to fingerlings is low of 30%. Furthermore, the survival rate during transportation is 50%. Thus the fish that reached fish ponds accounted for only 15% of the hatched ones. According to Mr. Morimoto, JICA expert, 90% of required fingerling can be afforded with the existing public and private hatcheries, if the technology is improved. In February this year, a project for improvement of fingerlings culture was started. The project will contribute to increase domestic supply of the fingerling and to enhance the fish-culture production.

2.1.4 Fish Production

Domestic catch of fish slightly decreases as shown in the table below, even the catch of subsistence fisheries is not included in the figure. Taking into account that

¹ As of the year 2000. Planned to be 30 in 2001.

eighty percent of the population of the Lao PDR reside in the rural area and most of them are engaged in the subsistence fisheries, these figures are assumed to lie on rather low side of the range. Furthermore, high-value wild fish of the Mekong River, which are likely unloaded for smuggling at Thai side at an estimated rate of 59% of the total catch are not included or clearly grasped in the figures.

Lao PDR : Estimated Fish Production in 1996 - 1998

(Unit: ton)

Description	1996	1997	1998
Fish Production	38,000	40,000	46,000

Source: Mr. Morimoto (JICA Expert in Vientiane 2000)

Recent statistics show a conspicuous tendency on the fisheries, i.e., “increase in production by the aquaculture”. Such increase explains its significant role, namely that it occupied only five (5) percent of the total catch in 1990, whereas it has grown to 40% or 18,000 tons in 1998.

In the future, the aquaculture of Laos has an important role to supply animal foods to the people. According to the National Plan of Laos, it is projected that the per capita fish consumption should increase from the present value of 8-10 kg to 24 kg by 2020. This amount requires approximately 200,000 tons taking into account the population. The table below shows the amount of fish production that the DOLF projected for the target year of 2020. The projection assumes the gross production of fishery as 3.6 times the present one. Assumed that the amount of the production of natural fish remains unchanged, certain part of the increased demand should be covered by the aquaculture. The production is expected to be seven (7) times of the present one. The production of the fingerlings will also increase to 800 million that are 6 times of the present production of 140 million.

Fish Production and Rate of Increase

Description	2000	2020	Growth Rate (%)
Fingerling Production (million nos.)	140	800	571
(State owned)	(42)	(70)	167
(Private owned)	(98)	(730)	745
Fish production ('000 tons)	52	189	363
(Natural fish)	(28)	(28)	100
(Culture fish)	(24)	(161)	671

Source: DOLF/MAF

2.2 Fisheries Development

2.2.1 Formulation of Fisheries Development Plans

(1) Outline of livestock development

The amount of fish catch in the Mekong River and its tributaries has decreased year after year. In order to respond to the increase of the domestic consumption in the future, promotion of aquaculture will be an important subject. At present, 90%

of the aquaculture in Laos consists of the production by the small-scale farmers for self-consumption and its productivity is low. On the other hand, business-oriented aquaculture supplies the products to the outskirts of the cities. However, both types of the aquaculture have development constraints of low productivity and technology.

The future aquaculture in Laos would have objectives to increase the income by selling the excess products which would be realized by the improvement of culture technology of the small-scale farmers and rehabilitation of facilities. The large-scale and business-oriented aquaculture would supply the animal foods to the urban residents by rationalizing their production and marketing systems. The production in this sector would be increased as productivity is improved through the measures shown below.

- Improvement of the survival rate through the improvement of technical levels of fingerling production and transportation
- Use of proper water body and proper culture density
- Rehabilitation of fish ponds and use of proper water depth
- Proper supply of feeds
- Rationalization through the combined business of pig and poultry breeding at the small-scale breeding (increase of underwater plankton by use of livestock excretion)
- Securing of the sources of water and promotion of dry season breeding

(2) Proposed targets

The targets would conform to the plan of the DOLF based on Vision 2020. The targets were set up based on the amounts of aquaculture production and seedling production in 1999. The targets of Vision 2020 were set by assuming the per capita annual intake of animal protein at 60 kg, in which the intake of fish is assumed at 28 kg. The targets were obtained by multiplying the target population by the target production. The value, 197,000 tons, is not much different from the one planned by DOLF. Thus, the target values planned by the DOLF shown below would also be used as the targets of the plan.

Fish Production and Rate of Increase

Description	2000	2020	Growth Rate (%)
Fingerling Production (million nos.)	140	800	571
(State owned)	(42)	(70)	167
(Private owned)	(98)	(730)	745
Fish production ('000 tons)	52	189	363
(Natural fish)	(28)	(28)	100
(Culture fish)	(24)	(161)	671

Source: DOLF/MAF Details are shown in the table 7-1-4 (1)-(2)

(3) Fish culture production system

The future fish culture would consist of two types, namely, intensive culture as the “urban type” and the small-scale culture by the farmers. The target production of 161,000 tons would be shared by these types. In proportion with the population in rural areas (80%) and the urban area (20%), 128,000 tons would be produced by the farmers’ aquaculture as “village-type”, and 33,000 tons would be produced by the “urban-type”. The village- would be mainly for self-consumption, and some surplus would be shipped to the near-by markets for sale. The urban-type aquaculture would supply the products for the urban residents.

(4) Production of Commercial Fingerling

Production of commercial fingerlings would be increased from the present amount of 140 million to 800 million by 2020, which is about six times that of the present one, as planned by the DOLF. During the same period, the previous survival rate of commercial fingerlings of 15% (including the loss during transportation) would be increased to 40 to 50% through the improvement of production technology. Among the above mentioned production amount, 70 million fingerlings would be produced at the 30 national hatcheries and 73 million would be produced by the private culture businesses to achieve the demand for commercial fingerlings.

Table

Table 1.1.1 Production and Supply of Vaccine in 1990-1998

Unit: Doses

No.	VACCINE	1990		1991		1992	
		Production	Supply	Production	Supply	Production	Supply
1	Haemorrhagic septicemia	727,310	724,140	1,096,035	1,092,585	389,425	362,859
2	Blackleg	1,043,350	825,390	370,664	360,317	565,490	564,590
3	Fowl cholera	274,100	259,460	320,080	319,740	549,210	549,210
4	Anthrax	46,850	45,550	57,700	57,700	76,970	76,970
5	Newcastle F	534,000	520,000	731,900	695,000	1,507,300	1,473,100
6	Newcastle M	383,650	360,750	920,800	628,600	906,250	901,550
7	Infectious bronchitis	44,400	42,100	82,400	54,350	102,000	87,850
8	Swine fever	87,970	71,960	103,990	71,540	57,740	56,100
9	Duck plague	76,400	60,350	87,750	43,850	188,700	162,350
10	Fowl pox	146,000	131,400	161,700	94,400	207,100	204,300
11	Rabies	3,970	3,900	4,981	3,918	7,815	7,121
	Total	3,368,000	3,045,000	3,938,000	3,422,000	4,558,000	4,446,000

No.	VACCINE	1993		1994		1995	
		Production	Supply	Production	Supply	Production	Supply
1	Haemorrhagic septicemia	378,952	363,672	580,000	425,640	588,500	483,960
2	Blackleg	81,900	63,000	70,000	60,750	54,810	49,560
3	Fowl cholera	1,072,006	1,032,936	998,200	912,000	706,250	696,700
4	Anthrax	33,400	33,400	17,500	13,900	4,270	3,680
5	Newcastle F	2,135,560	1,550,360	2,168,900	1,889,900	2,371,000	2,088,600
6	Newcastle M	1,665,582	1,181,482	1,620,000	1,423,100	1,829,800	1,612,100
7	Infectious bronchitis	209,550	189,850	302,100	155,250	296,450	151,550
8	Swine fever	54,841	54,841	66,370	57,730	66,210	59,060
9	Duck plague	306,522	237,772	239,450	183,150	185,800	91,190
10	Fowl pox	328,982	245,982	319,493	139,400	282,300	49,500
11	Rabies	11,705	11,705	16,387	12,180	14,610	14,100
	Total	6,279,000	4,965,000	6,398,400	5,273,000	6,400,000	5,300,000

No.	VACCINE	1996		1997		1998	
		Production	Supply	Production	Supply	Production	Supply
1	Haemorrhagic septicemia	456,240	453,900	561,300	492,480	888,470	360,030
2	Blackleg	55,800	51,150	44,613	25,350	15,660	15,150
3	Fowl cholera	578,600	578,400	821,500	574,150	540,050	499,550
4	Anthrax	8,920	2,000	6,920	720		
5	Newcastle F	1,318,300	1,226,500	1,433,000	1,243,700	1,520,400	1,161,400
6	Newcastle M	1,016,800	1,003,200	1,290,000	1,092,300	1,740,900	1,235,900
7	Infectious bronchitis	143,700	132,350	173,450	106,300	62,500	54,900
8	Swine fever	80,360	80,360	132,570	98,830	67,660	67,640
9	Duck plague	100,000	99,700	135,600	81,800	151,300	78,950
10	Fowl pox	140,800	50,300	288,900	103,200	82,000	43,000
11	Rabies	16,447	15,794	12,087	11,911	12,586	12,586
	Total	3,915,967	3,693,654	4,899,940	3,830,741	3,637,346	2,654,376

Source : National Vaccine Production Institute

The amount of total vaccine production in 2000 was **4,784,568** Doses.

Table 1.1.2 (1) Buffalo population 1976 - 2000

(Unit : Th.heads)

Code	Name of province	Year									
		1976	1980	1985	1990	1995	1996	1997	1998	1999	2000
Northern Region		194.71	242.23	243.40	295.21	311.88	330.80	337.30	314.4	301.00	311.40
1	Phongsali	21.07	26.94	25.81	25.24	29.41	36.80	38.00	39.92	29.00	31.40
2	Louangnamtha	14.12	21.49	17.14	20.61	19.51	23.2	23.30	20.32	21.00	20.80
3	Oudomxay	27.84	40.62	35.58	75.42	41.50	44.9	47.00	47.97	44.00	45.30
4	Bokeo	7.87	11.48	12.29	14.40	28.46	27.3	29.00	23.92	22.00	22.30
5	Loungphrabang	27.19	30.49	39.30	51.46	64.16	65.7	66.00	57.13	56.00	61.40
6	Houaphan	58.3	55.29	55.60	55.65	55.58	61.3	58.00	53.21	62.00	63.30
7	Xaignabouri	38.32	55.92	57.68	52.43	73.26	71.60	76.00	71.93	67.00	66.90
Centra Region		293.79	435.25	475.06	533.48	598.10	598.00	596.00	552.80	464.00	476.70
1	Vientiane Mun.	26.33	33.87	59.36	63.60	63.04	55.50	42.50	30.65	33.00	31.90
2	Xiangkhouang	9.17	15.27	23.49	37.76	54.02	48.50	50.00	47.70	46.00	46.90
3	Vientiane	33.34	42.88	79.34	92.11	106.11	95.50	97.50	70.22	59.00	60.20
4	Borikhamxai	20.85	26.81	47.03	44.89	50.98	52.00	53.00	41.50	35.00	35.90
5	Khammouan	79.60	94.6	72.25	86.70	90.72	91.60	94.00	90.82	85.00	83.20
6	Savannakhet	124.50	221.82	193.59	208.42	233.23	240.50	243.00	255.85	186.00	198.20
7	Xaisomboun	-	-	-	-	-	14.40	16.00	16.06	20.00	20.40
Southern Region		152.89	175.81	220.95	243.06	281.43	282.90	290.50	225.55	243.00	239.90
1	Saravan	47.13	52.26	66.18	63.78	72.44	72.50	75.00	71.35	70.00	68.70
2	Xekong	9.99	11.07	12.57	20.24	23.03	23.40	24.00	20.06	17.00	17.30
3	Champasack	73.37	81.36	108.01	119.01	139.73	140.50	143.50	82.81	116.00	114.40
4	Attapu	22.40	31.12	34.19	40.03	46.23	46.50	48.00	51.33	40.00	39.50
Total:		641.39	853.29	939.41	1071.75	1191.41	1211.70	1223.80	1092.75	1008.00	1028.00

Source: Department of Livestock and Fisheries, MAF,2000.

Table 1.1.2 (2) Cattle Population 1976 - 2000

(Unit : Th.heads)

Code	Name of province	Year									
		1976	1980	1985	1990	1995	1996	1997	1998	1999	2000
Northern Region		60.24	81.77	94.53	154.84	229.5	239.3	252	228.48	210.00	233.80
1	Phongsali	9.84	11.65	13.12	9.73	17.29	18.60	20.00	20.83	15.00	15.60
2	Louangnamtha	5.70	20.85	6.53	13.34	21.23	23.00	24.00	17.45	15.00	19.10
3	Oudomxay	8.18	9.28	17.58	47.02	41.57	40.00	42.00	34.44	32.00	31.50
4	Bokeo	7.02	7.96	7.79	10.8	27.76	26.50	28.00	22.69	17.00	18.50
5	Loungphrabang	5.17	8.34	13.79	22.67	34.07	36.00	38.00	34.97	39.00	42.10
6	Houaphan	16.87	15.23	21.35	21.17	29.96	34.50	36.00	35.47	41.00	44.00
7	Xaignabouri	7.46	8.46	14.37	30.11	57.62	60.70	64.00	62.63	51.00	63.00
Centra Region		190.06	277.95	384.73	487.36	646.13	669.00	684.00	656.42	579.00	641.30
1	Vientiane Mun.	17.03	20.46	40.32	52.81	70.79	66.80	57.00	43.39	51.00	54.10
2	Xiangkhouang	9.12	12.3	24.28	48.20	74.86	75.60	79.00	79.26	100.00	119.00
3	Vientiane	23.64	28.4	68.5	88.18	117.98	112.00	116.00	85.95	97.00	107.50
4	Borikhamxai	7.56	9.09	21.93	30.58	34.85	38.50	40.00	40.39	36.00	38.20
5	Khammouan	26.31	32.4	32.76	36.5	46.52	51.50	53.50	48.45	52.00	56.20
6	Savannakhet	106.40	175.30	196.94	231.09	301.13	304.60	317.00	336.88	218.00	239.80
7	Xaisomboun	-	-	-	-	-	20.00	21.50	22.10	25.00	26.50
Southern Region		75.75	87.24	147.24	199.70	270.24	277.70	291.50	241.69	211.00	224.90
1	Saravan	29.88	34.14	56.68	76.78	102.25	105.00	111.50	96.5	71.00	76.30
2	Xekong	2.21	2.53	4.09	12.32	16.29	16.50	18.00	12.17	9.00	9.80
3	Champasack	41.66	47.60	83.77	106.05	145.94	150.00	155.50	125.38	122.00	129.30
4	Attapu	2.00	2.97	2.70	4.55	5.76	6.20	6.50	7.64	9.00	9.50
Total:		326.05	446.96	626.50	841.90	1 145.87	1 186.00	1 227.50	1 126.59	1 000.00	1 100.00

Source: Department of Livestock and Fisheries, MAF,2000.

Table 1.1.2 (3) Pigs Population 1976 - 2000

(Unit : Th.heads)

Code	Name of province	Year									
		1976	1980	1985	1990	1995	1996	1997	1998	1999	2000
	Northern Region	442.05	575.60	454.32	665.25	820.08	906.50	922.50	628.18	647.00	625.70
1	Phongsali	33.55	51.14	58.73	32.57	68.96	71.10	74.00	78.88	54.00	50.80
2	Louangnamtha	39.76	125.50	31.00	52.28	73.57	78.60	78.00	64.92	44.00	77.80
3	Oudomxay	75.52	99.75	47.99	165.80	159.14	95.50	98.50	76.29	93.00	82.20
4	Bokeo	12.12	16.01	19.84	74.40	94.51	52.00	53.00	60.15	39.00	32.90
5	Loungphrabang	58.61	86.99	102.18	116.42	156.43	178.50	177.50	136.51	132.00	126.20
6	Houaphan	176.70	135.73	130.00	146.08	160.70	334.80	341.50	111.11	152.00	155.50
7	Xaignabouri	45.79	60.48	64.58	77.70	106.77	96.00	100.00	100.32	133.00	100.30
	Centra Region	239.68	421.66	513.97	481.57	575.42	515.50	528.50	508.50	505.00	598.20
1	Vientiane Mun.	14.60	49.01	34.55	2.28	42.44	32.00	27.00	30.79	117.00	102.00
2	Xiangkhouang	29.17	40.61	68.10	70.33	83.66	65.50	72.00	75.46	82.00	69.50
3	Vientiane	21.08	70.78	106.79	115.31	133.67	95.50	98.50	80.40	78.00	78.40
4	Borikhamxai	8.43	28.29	67.79	81.99	53.32	55.00	57.00	41.28	40.00	40.10
5	Khammouan	58.10	85.00	80.20	87.50	123.35	86.00	88.00	66.84	48.00	69.00
6	Savannakhet	108.30	147.97	156.54	124.16	138.98	158.50	162.00	187.40	118.00	212.70
7	Xaisomboun	-	-	-	-	-	23.00	24.00	26.33	22.00	26.50
	Southern Region	82.50	113.83	221.56	224.72	328.09	350.00	362.00	327.74	168.00	201.10
1	Saravan	34.01	45.90	52.01	69.14	125.11	125.50	133.00	156.96	68.00	93.90
2	Xekong	6.95	9.37	50.19	26.60	36.92	57.00	58.00	38.72	25.00	23.30
3	Champasack	30.11	40.64	86.29	104.22	130.49	131.00	133.00	96.85	60.00	69.50
4	Attapu	11.43	17.92	33.07	24.76	35.57	36.50	38.00	35.21	15.00	14.40
	Total:	764.23	1111.09	1189.85	1371.54	1723.59	1772.00	1813.00	1464.42	1320.00	1425.00

Source: Department of Livestock and Fisheries, MAF,2000.

Table 1.1.2 (4) Goat& Sheep Production 1976-2000

(Unit : Th.heads)

Code	Name of province	Year									
		1976	1980	1985	1990	1995	1996	1997	1998	1999	2000
	Northern Region	23.02	37.13	49.38	65.62	86.82	88.20	98.00	59.50	60.11	59.80
1	Phongsali	0.20	0.29	0.47	0.37	1.44	2.70	3.00	3.51	1.20	1.30
2	Louangnamtha	2.30	5.13	11.19	8.40	6.17	6.00	6.00	2.54	2.62	4.80
3	Oudomxay	2.54	4.27	7.92	16.00	26.85	26.00	31.00	11.67	19.75	12.00
4	Bokeo	0.45	0.76	1.35	5.50	6.10	6.00	7.00	4.57	2.38	3.30
5	Loungphrabang	4.01	4.90	8.31	16.55	22.67	24.50	25.50	21.22	16.90	21.40
6	Houaphan	12.13	19.44	15.78	16.48	18.60	18.00	19.00	10.64	12.97	13.00
7	Xaignabouri	1.39	2.34	4.36	2.32	4.99	5.00	6.50	5.35	4.29	4.00
	Centra Region	6.47	10.07	28.60	67.42	53.52	55.00	56.50	50.90	43.13	53.80
1	Vientiane Mun.	0.80	0.61	2.00	33.72	4.32	3.90	2.50	2.83	2.05	3.30
2	Xiangkhouang	4.10	7.77	15.90	10.83	15.35	15.00	15.50	5.88	8.45	5.60
3	Vientiane	1.00	0.76	4.41	5.93	9.71	9.50	7.00	5.37	2.62	2.90
4	Borikhamxai	0.06	0.05	0.09	0.33	2.27	2.50	2.00	1.85	2.05	1.70
5	Khammouan	0.06	0.06	0.65	0.42	0.65	1.50	2.00	3.31	2.97	3.40
6	Savannakhet	0.45	0.82	5.55	16.19	21.22	21.00	25.00	29.91	23.20	34.80
7	Xaisomboun	-	-	-	-	-	1.60	2.50	1.75	1.79	2.10
	Southern Region	1.40	1.40	3.58	6.37	12.59	15.80	10.50	11.78	9.17	7.80
1	Saravan	0.77	0.71	0.97	2.73	4.44	5.70	2.00	4.33	3.81	3.90
2	Xekong	0.53	0.49	2.30	2.60	6.65	7.50	5.00	4.23	2.03	1.80
3	Champasack	0.08	0.07	0.17	0.54	0.66	1.20	2.00	1.36	2.26	1.20
4	Attapu	0.02	0.13	0.14	0.50	0.84	1.40	1.50	1.86	1.07	0.90
	Total:	30.89	48.60	81.56	139.41	152.93	159.00	165.00	122.18	112.41	121.40

Source: Department of Livestock and Fisheries, MAF,2000.

Table 1.1.2 (5) Poultry Population 1976 - 2000

(Unit : Th.heads)

Code	Name of province	Year									
		1976	1980	1985	1990	1995	1996	1997	1998	1999	2000
Northern Region		1707.70	2049.60	2644.00	2896.20	4212.03	4238.00	4205.00	3983.58	4356.00	4214.10
1	Phongsali	161.40	94.20	184.40	149.20	291.80	278.50	288.00	285.60	268.00	309.50
2	Louangnamtha	287.20	440.20	265.90	159.80	213.48	203.00	208.00	211.95	55.00	260.40
3	Oudomxay	274.09	311.05	275.80	600.00	537.08	538.00	552.00	403.87	605.00	471.60
4	Bokeo	82.81	93.97	58.50	250.80	303.93	290.00	312.00	411.30	332.00	62.80
5	Loungphrabang	239.70	192.50	397.80	689.30	964.05	1015.30	1000.00	842.74	993.00	938.20
6	Houaphan	360.80	575.30	861.90	436.10	872.25	828.00	745.00	621.26	845.00	864.40
7	Xaignabouri	301.70	342.38	599.70	611.00	1029.44	1085.20	1100.00	1206.86	1258.00	1307.20
Centra Region		1439.71	1813.90	2589.20	2740.90	3973.38	4191.00	4633.00	5299.47	5846.00	6449.70
1	Vientiane Mun.	316.74	448.85	353.10	663.10	1169.89	1240.00	1271.00	1308.49	1643.00	2126.20
2	Xiangkhouang	181.80	131.30	314.20	370.70	518.54	508.00	520.00	517.61	672.00	542.20
3	Vientiane	195.41	276.91	501.30	616.40	824.72	812.00	927.00	1004.93	1041.00	1079.10
4	Borikhamxai	56.06	79.44	147.20	342.00	250.22	289.50	405.00	437.68	510.00	540.90
5	Khammouan	254.60	244.40	504.20	302.50	404.50	408.50	455.00	455.77	419.00	533.90
6	Savannakhet	435.10	633.00	769.20	446.20	805.51	824.00	942.00	1444.16	1389.00	1581.30
7	Xaisomboun	-	-	-	-	-	109.00	113.00	130.83	172.00	46.10
Southern Region		928.51	757.09	1237.60	2247.40	3152.94	3227.00	3108.50	2827.82	2151.00	2430.40
1	Saravan	115.36	117.84	117.40	441.30	732.02	740.00	729.00	1058.26	598.00	638.30
2	Xekong	29.39	30.02	79.20	95.70	128.09	129.50	133.00	68.92	26.00	194.90
3	Champasack	522.66	533.93	755.40	1520.00	2037.77	2100.00	1965.50	1480.54	1346.00	1430.30
4	Attapu	261.10	75.30	285.60	190.40	255.06	257.50	281.00	220.10	181.00	166.90
Total:		4075.92	4620.59	6470.80	7884.50	11338.35	11656.00	11946.50	12110.87	12353.00	13094.20

Source: Department of Livestock and Fisheries, MAF, 2000.

Table 1.1.3 Average Animals Feeding Number per Household in 2000 (1/2)

(Unit : Number, %)

Provinces	No. of Farm Household	No. of holdings with cattle	No. of cattle	Ratio of holdings with cattle	Ave. cattle per holdings	No. of holdings with buffalo	No. of buffalo	Ratio of holdings with buffalo	Ave. buffalo per holdings	No. of holdings with pigs	No. of pigs	Ratio of holdings with pigs	Ave. pigs per holdings
Phonsali	24 395	5 519	15 000	22.62	2.72	11 619	29 000	47.63	2.50	15 624	54 000	64.05	3.46
Louangnamtha	19 776	5 014	15 000	25.35	2.99	8 437	21 000	42.66	2.49	12 687	44 000	64.15	3.47
Oudomxai	33 364	8 685	32 000	26.03	3.68	14 697	44 000	44.05	2.99	22 483	93 000	67.39	4.14
Bokeo	18 844	4 060	17 000	21.55	4.19	7 159	22 000	37.99	3.07	11 842	39 000	62.84	3.29
Louangphrabang	55 718	10 863	39 000	19.50	3.59	19 053	56 000	34.20	2.94	29 841	132 000	53.56	4.42
Houaphan	36 942	10 680	41 000	28.91	3.84	19 919	62 000	53.92	3.11	30 393	152 000	82.27	5.00
Xiangkhouang	49 402	11 300	51 000	22.87	4.51	19 866	67 000	40.21	3.37	28 532	133 000	57.75	4.66
All Northern Region	238 441	56 121	210 000	23.54	3.74	100 750	301 000	42.25	2.99	151 402	647 000	63.50	4.27
Vientiane Mun.	48 581	9 244	51 000	19.03	5.52	8 920	33 000	18.36	3.70	4 781	117 000	9.84	24.47
Xiangkhouang	28 081	16 509	100 000	58.79	6.06	15 362	46 000	54.71	2.99	21 767	82 000	77.52	3.77
Vientiane	43 675	15 060	97 000	34.48	6.44	14 522	59 000	33.25	4.06	17 715	78 000	40.56	4.40
Borikhamxai	26 513	7 071	36 000	26.67	5.09	8 861	35 000	33.42	3.95	11 563	40 000	43.61	3.46
Khammouan	43 619	12 667	52 000	29.04	4.11	24 437	85 000	56.02	3.48	10 239	48 000	23.47	4.69
Savannakhet	95 443	46 542	218 000	48.76	4.68	64 738	186 000	67.83	2.87	40 684	118 000	42.63	2.90
Xaisomboun	7 618	4 114	25 000	54.00	6.08	4 817	22 000	63.23	4.57	5 318	22 000	69.81	4.14
All Central Region	293 530	111 207	579 000	37.89	5.21	141 657	466 000	48.26	3.29	112 067	505 000	38.18	4.51
Saravab	41 320	16 127	71 000	39.03	4.40	24 812	70 000	60.05	2.82	22 446	68 000	54.32	3.03
Xekong	9 721	2 023	9 000	20.81	4.45	4 461	17 000	45.89	3.81	6 144	25 000	63.20	4.07
Chapasak	70 234	21 227	122 000	30.22	5.75	42 284	116 000	60.20	2.74	31 301	60 000	44.57	1.92
Attapu	14 757	1 429	9 000	9.68	6.30	8 178	40 000	55.42	4.89	4 137	15 000	28.03	3.63
All Southern Region	136 032	40 806	211 000	30.00	5.17	79 735	243 000	58.61	3.05	64 028	168 000	47.07	2.62
All Raos	668 003	208 134	1 000 000	31.16	4.80	322 142	1 010 000	48.22	3.14	327 497	1 320 000	49.03	4.03

Table 1.1.3 Average Animals Feeding Number per Household in 2000 (2/2)

(Unit : Number, %)

Provinces	No. of Farm Household	No. of holdings with poultry	No. of poultry	Ratio of holdings with poultry	Ave. poultry pre holdings	No. of holdings with goats & sheep	No. of goats & sheep	Ratio of holdings with goats & sheep	Ave. goats & sheep pre holdings				
Phonsali	24 395	19 045	228 248	78.07	11.98	451	2 340	1.85	5.19				
Louangnamtha	19 776	14 639	191 980	74.02	13.11	815	4 390	4.12	5.39				
Oudomxai	33 364	26 921	506 073	80.69	18.80	4 880	20 080	14.63	4.11				
Bokeo	18 844	16 420	274 124	87.14	16.69	698	4 650	3.70	6.66				
Louangphrabang	55 718	43 582	809 351	78.22	18.57	4 297	21 900	7.71	5.10				
Houaphan	36 942	31 322	713 841	84.79	22.79	3 453	14 720	9.35	4.26				
Xiangkhouang	49 402	41 160	1 036 273	83.32	25.18	790	5 030	1.60	6.37				
All Northern Region	238 441	193 089	3 759 890	80.98	19.47	15384	73 110	6.45	4.75				
Vientiane Mun.	48 581	32 157	693 535	66.19	21.57	275	2 920	0.57	10.62				
Xiangkhouang	28 081	25 034	506 360	89.15	20.23	2 164	10 090	7.71	4.66				
Vientiane	43 675	33 731	711 060	77.23	21.08	601	5 482	1.38	9.12				
Borikhamxai	26 513	22 716	414 776	85.68	18.26	324	2 020	1.22	6.23				
Khammouan	43 619	20 326	321 961	46.60	15.84	438	2 640	1.00	6.03				
Savannakhet	95 443	72 219	1 101 669	75.67	15.25	4 029	26 780	4.22	6.65				
Xaisomboun	7 618	6 682	131 678	87.71	19.71	474	1 950	6.22	4.11				
All Central Region	293 530	212 865	3 881 039	72.52	18.23	8305	51 882	2.83	6.25				
Saravab	41 320	33 184	474 452	80.31	14.30	875	3 950	2.12	4.51				
Xekong	9 721	7 794	114 966	80.18	14.75	471	4 110	4.85	8.73				
Chapasak	70 234	54 032	997 168	76.93	18.46	496	1 600	0.71	3.23				
Attapu	14 757	6 990	151 511	47.37	21.68	202	1 350	1.37	6.68				
All Southern Region	136 032	102 000	1 738 097	74.98	17.04	2044	11 010	1.50	5.39				
All Raos	668 003	507 954	9 379 026	76.04	18.46	25 733	136 002	3.85	5.29				

Table 1.2.1 (1) Plan of Livestock and Fish Development (Feeding Number)

No.	Items	1999	2000	2001	2002	2003	2004	2005	2010	2015	2020
I. Indegenious species											
1	Buffalo	1 008 000	1 028 000	1 049 000	1 070 000	1 092 000	1 114 000	1 135 000	1 253 000	1 383 000	1 527 000
2	Cattle	1 080 000	1 145 000	1 214 212	1 287 000	1 365 000	1 447 000	1 534 000	2 050 000	2 744 000	3 672 000
3	Pig	1 250 000	1 325 000	1 365 000	1 406 000	1 448 000	1 491 000	1 536 000	1 981 000	2 064 000	2 393 000
4	Sheep and goat	112 000	121 000	123 592	126 000	129 100	132 000	135 000	148 000	163 000	180 000
5	Poultry	12 353 000	13 094 000	13 879 788	14 713 100	15 596 000	16 532 000	17 524 000	2 350 000	31 381 000	41 995 000
II. Industrial species											
1	Chicken egg species	280 000	350 000	350 000	385 000	424 000	466 000	513 000	826 000	1 330 000	2 141 000
2	Broiler chicken	900 000	500 000	700 000	1 200 000	1 300 000	1 400 000	1 500 000	2 416 000	3 891 000	6 266 000
3	Duck	1 400 000	1 450 000	1 450 000	1 450 000	1 450 000	1 450 000	1 450 000	1 600 000	1 700 000	1 800 000
4	Broiler Pig	70 000	100 000	110 000	120 000	130 000	140 000	150 000	242 000	389 000	627 000
III. Small fish breed*/1											
1	Total production	80 000 000	140 000 000	154 000 000	169 000 000	186 000 000	205 000 000	225 000 000	300 000 000	500 000 000	800 000 000
2	Stat owner	16 000 000	42 000 000	43 000 000	44 000 000	45 000 000	46 000 000	47 000 000	52 000 000	60 000 000	70 000 000
3	Private owner	64 000 000	98 000 000	111 000 000	125 000 000	141 000 000	159 000 000	178 000 000	248 000 000	440 000 000	730 000 000

Noate:*/1=Fingerling Production

Source: Department of Livestock and Fisheries, MAF, 2000

Table 1.2.1 (2) Plan of Livestock and Fish Development (Production)

No.	Items	2 000	2 001	2 002	2 003	2 004	2 005	2 010	2 015	2 020
I. Indegenious species										
1	Buffalo meat	16 600	16 950	17 309	17 610	18 021	18 381	20 267	22 376	24 705
2	Cattle meat	16 400	17 500	18 500	19 600	20 800	22 000	29 400	39 400	52 700
3	Pork meat	27 650	29 300	30 205	31 107	32 002	32 993	38 254	44 345	51 406
4	Sheep and goat meat	430	458	469	478	501	512	562	619	682
5	Poultry meat	9 700	10 300	10 900	11 600	12 300	13 014	17 415	23 305	31 187
II. Industrial species										
1	Chicken egg species meat	560	560	600	700	750	821	6 024	2 127	3 426
2	Broiler chicken meat	480	700	1 100	1 200	1 300	1 400	10 492	3 659	5 975
3	Duck meat	2 000	2 000	2 000	2 000	2 000	2 000	2 400	2 350	2 490
4	Broiler pig meat	5 600	6 160	6 720	7 280	7 840	8 400	18 916	21 787	35 089
Total meat		79 420	83 928	87 803	91 575	95 514	99 521	143 730	159 968	207 660
III. Eggs and milks										
1	Poultry eggs	3 400	3 500	3 800	4 000	4 200	4 500	598	8 063	10 793
2	Chicken eggs	4 400	4 500	4 900	5 400	6 000	6 500	10 498	16 931	27 301
3	Duck eggs	2 200	2 200	2 200	2 200	2 200	2 200	2 400	2 550	2 700
Total eggs		10 000	10 200	10 900	11 600	12 400	13 200	13 496	27 544	40 794
Milks		270	300	350	400	450	500	546	968	1 202
IV. Fish capture										
1	Natural fish	28 000	28 000	28 000	28 000	28 000	28 000	28 000	28 000	28 000
2	Fish pond	24 000	26 400	29 000	31 900	35 000	38 500	42 350	99 859	160 824
Total fish		52 000	54 400	57 000	59 900	63 000	66 500	70 350	127 859	188 824
ALL TOTAL		141 690	148 828	156 053	163 475	171 364	179 721	228 122	316 339	438 480

Source: Department of Livestock and Fisheries, MAF, 2000

Figure

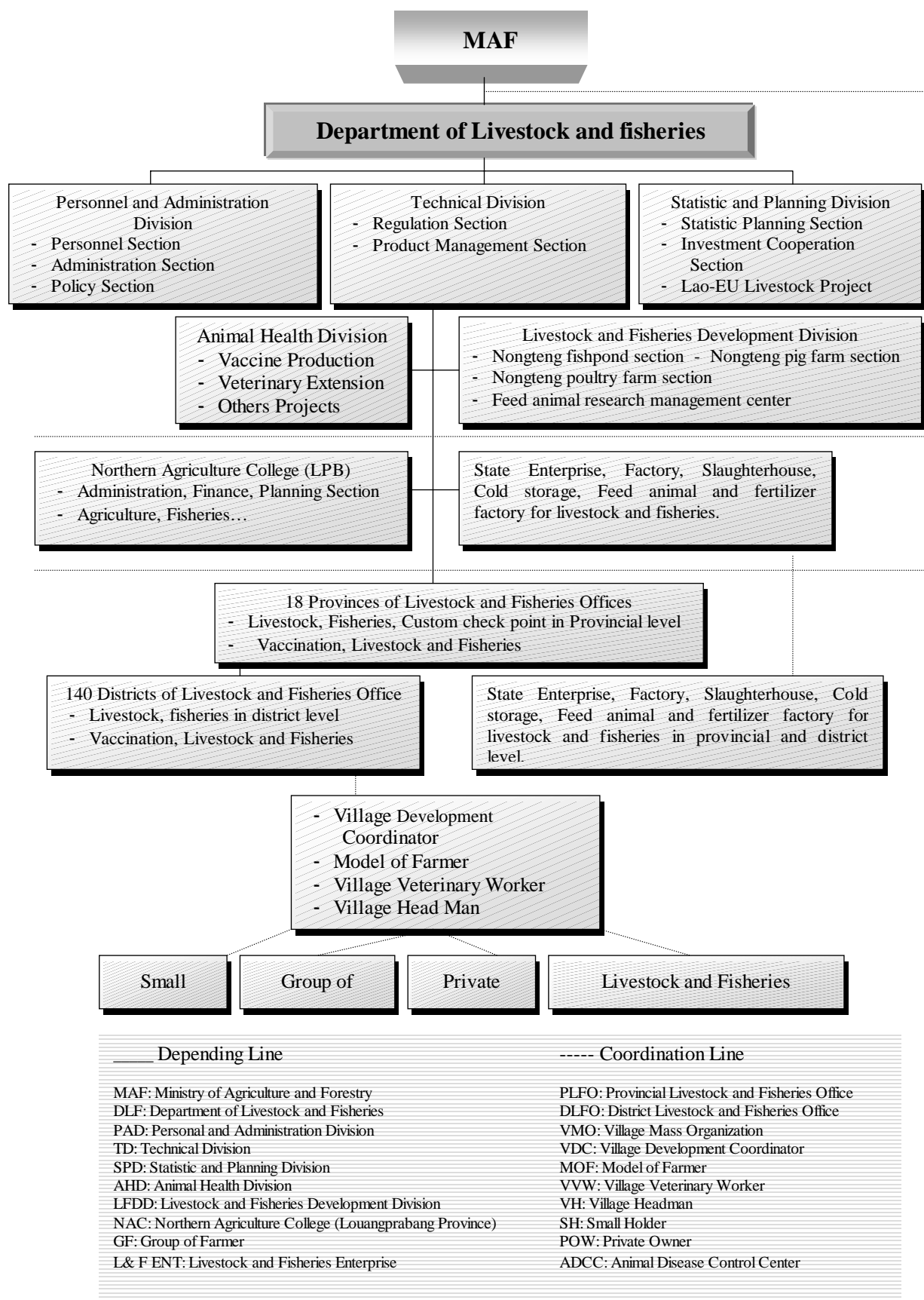


Figure 1.1.1 DEPARTMENT OF LIVESTOCK AND FISHERIES CHART

Appendix 8
Shifting Cultivation, Agro-forestry, NTFPs
and
Related Livelihood Activities

**MASTER PLAN STUDY
ON
INTEGRATED AGRICULTURAL DEVELOPMENT
IN
LAO PEOPLE’S DEMOCRATIC REPUBLIC**

VOLUME III

APPENDIX-8

**SHIFTING CULTIVATION, AGROFORESTRY, NTFPs AND RELATED
LIVELIHOOD ACTIVITIES**

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**MASTER PLAN STUDY
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**VOLUME III
APPENDIX-8
SHIFTING CULTIVATION, AGROFORESTRY, NTFPs AND
RELATED LIVELIHOOD ACTIVITIES**

CHAPTER 1 SHIFTING CULTIVATION

1.1 Current Conditions

Shifting cultivation is a traditional upland cropping system whereby a piece of primary or secondary forest, bamboo or bush is cleared and farmed until the soil fertility is depleted, reducing labor productivity below a worthwhile level. The land is then rested to fully or partially regenerate to the original and/or new cover species. In traditional forms this resting or fallow period is very long, with the fallow land reverting fully to secondary forest. This enables soil amelioration and the return of high fertility, organic matter and physical structure. Twenty years ago, fallow periods of about 20 years were possible under conditions of low population pressure and unrestricted access to land. This situation has progressively changed in Lao PDR and currently three types of shifting cultivation can be identified.

1.1.1 Types of Shifting Cultivation

(1) Traditional Swidden Rotational System:

In this system, the cycle ranges from about fifteen to twenty years. The cleared upland sloping area is farmed for about two years, either under rice or rice and maize etc. This system is found at low population densities and provides sufficient time for the bush fallow to ameliorate soil fertility depleted in the cropping phase.

(2) Pioneering Shifting Cultivation

This is an exploitive form of shifting cultivation often practised in opium poppy cultivation areas. In these areas, the cleared land is continuously cropped until severely degraded, after which it is abandoned. The cultivators then move to a completely new forest area to continue the cropping cycle. When abandoned, imperata and other aggressive weeds and grasses invade the areas. The land generally remains under these species without the usual succession to bamboo, bush and then trees.

(3) Transitional Swidden Rotational System

This is a transition system towards continuous annual cropping. In many areas because of land allocation, tax and the delineation of forest boundaries with village agreements, the swidden cycle has been truncated to between four and six years. Thus, the land is cleared after only a three to five year's rest between successive cropping phases. Productivity is declining in these areas through soil degradation and erosion. Unless steps are taken, productivity will continue to decline presenting serious livelihood problems for the communities in these areas.

Changes that are bringing about the transition to shorter rotations are:

- Increasing population pressure.
- Establishment of National Biodiversity Conservation Areas.
- Progressive land allocation and village agreements on land use, forest boundaries and forest conservation and management.

Of primary significance is a need for control and containment of agricultural land to enable re-forestation targets to be met and the country's 'high-forest' cover increased from the current 45% to 60-70% by 2020.

1.1.2 Upland Cropping and Shifting Cultivation Area

A Department of Forestry National Reconnaissance Survey made in 1992 indicated the area under upland crops was 626,000 hectares in 1989. This is consistent with an estimate of 598,000 hectares in 1982. Based on this, and the projected influence of population increase, it is considered that in the year 2000 about 330,000 families cropped 680,000 hectares. This is about 3% of the country area - See the table below.

Land Use by Region

1982 Land Use by Region (000 ha.)				
	Northern	Central	Southern	Country
Forest, potential forest & other wooded areas	8,995	6,298	5,846	21,139
<i>Shifting cultivation</i>	353	144	101	598
<i>Permanent agriculture</i>	51	234	423	708
Total agriculture	404	378	524	1,306
Grassland	368	311	125	804
Other areas	54	242	135	431
Total area	9,821	7,229	6,630	23,680
Population (000)	1,113	1,570	663	3,346
Cropland per capita (ha.)	0.36	0.24	0.79	0.39

(to be continued)

(continuation)

1989 Land Use by Region (000 ha.)				
	Northern	Central	Southern	Country
Forest, potential forest & other wooded areas	8,980	6,189	5,767	20,936
<i>Shifting cultivation</i>	365	155	106	626
<i>Permanent agriculture</i>	57	296	496	849
Total agriculture	422	451	602	1,475
Grassland	365	332	126	823
Other areas	54	257	135	446
Total area	9,821	7,229	6,630	23,680
Population (000)	1,296	1,899	782	3,977
Cropland per capita (ha.)	0.33	0.24	0.77	0.37
2000 Estimated Land Use by Region (000 ha.)				
	Northern	Central	Southern	Country
Forest, potential forest & other wooded areas	8,871	6,054	5,605	20,530
<i>Shifting cultivation</i>	380	185	115	680
<i>Permanent agriculture</i>	125	370	635	1,130
Total agriculture	505	555	750	1,810
Grassland	380	350	130	860
Other areas	65	270	145	480
Total area	9,821	7,229	6,630	23,680
Population (000)	1,708	2,486	1,040	5,234
Cropland per capita (ha.)	0.30	0.22	0.72	0.35

Note: Some cropland may include abandoned and one-year old fallow land.

Source: 1. Forest Cover and Land Use in Lao P.D.R., DoF Report No. 5, 1992 for 1982 & 1989.

2. Year 2000 figures are based on this earlier data and estimated influence of population.

The majority of the shifting cultivation areas, as classified in these studies, are in the transitional short rotational form of upland cropping. These areas do not include the majority of fallow scrub and bush land within the shifting cultivation cycle. This could amount to an additional area of about 2.5 million hectares. Thus, the total area being utilised for all forms of shifting cultivation is about 3.2 million hectares or 13% of the land area.

From the above table, it can be seen that annually cropped land per capita is relatively constant in each region, with a slight decline over time.

Based on government statistics, in 1995 there were 198,868 families practising shifting cultivation with an annual area cropped of 192,258 hectares. By 1998 the number had fallen to 156,720 with 148,000 hectares under annual crops. By the year 2000, the area recorded for shifting cultivation had fallen further to 118,999 hectares. The reduction in traditional long rotation shifting cultivation is occurring as families adjust to shorter fallow rotations on reduced areas. The current government target, for shifting cultivation, is for further reduction to 29,400 hectares by the year 2005 and to zero by the year 2010. Table below sets out the current plan for reduction of shifting cultivation on a provincial basis.

Plan for the Reduction of Shifting Cultivation Area 2001 - 2010

PROVINCE	AREA REMAINING BY YEAR – HECTARES						
	2000	2001	2002	2003	2004	2005	2010
Phongsali	14,200	11,200	9,000	6,000	5,000	4,300	0
Louang Namtha	10,300	7,800	7,000	7,000	4,000	3,100	0
Oudomxai	19,400	16,200	12,000	10,000	8,000	5,800	0
Bokeo	1,600	1,300	1,000	800	600	0	0
Luang Prabang	30,900	25,100	20,000	18,000	12,000	9,300	0
Houaphan	14,200	11,000	9,000	7,000	5,000	4,300	0
Xaibouri	0	0	0	0	0	0	
NORTH	90,600	72,600	58,000	48,800	34,600	26,800	0
Vientiane M.	0	0	0	0	0	0	0
Xieng Khouang	8,700	7,000	5,600	4,000	3,500	2,600	0
Vientiane P.	2,200	1,300	1,000	800	500	0	0
Borikhamxai	3,600	2,900	2,000	1,500	1,000	0	0
Khammouan	1,400	1,000	800	600	200	0	0
Savannakhet	3,800	2,100	1,800	1,200	800	0	0
Xaisomboun	2,000	1,600	1,200	800	500	0	0
CENTRE	12,700	15,900	12,400	8,900	6,500	2,600	0
Saravan	2,200	1,800	1,200	800	500	0	0
Sekong	2,200	1,800	1,200	800	500	0	0
Champasak	0	0	0	0	0	0	0
Attapu	2,200	1,800	1,200	800	500	0	0
SOUTH	6,600	5,400	3,600	2,400	1,500	0	0
TOTAL	118,900	93,900	74,000	60,100	42,600	29,400	0
ANNUAL REDUCTION		25,000	19,900	13,900	17,500	13,200	0

Source: Shifting Cultivation Stabilisation Programme, Department of Forestry, July 2001.

The differences in figures for shifting cultivation areas and upland cropping areas are explained by the classification of shifting cultivation types. In the past, upland cropping was mostly in a long (15-20 year) swidden / bush fallow rotation. Under this fallow regime, areas regenerated fully to secondary forest before the next cropping phase. As explained above, fallow periods have now been drastically shortened to 3-5 years. Thus, areas of upland under these transitional rotation systems now constitute the majority of *upland cropping* and are increasing, with traditional shifting cultivation declining.

Whilst the majority of upland families now have been allocated land, they have been unable to adapt their farming systems as rapidly as their access to land has decreased. As a result they have not maintained productivity and living standards under the shortened fallow regimes. It is evident that many upland farmers are now caught in this vicious cycle of decreasing production and increasing poverty. Therefore, many families are forced to continue swidden rotations on un-recorded greater areas than they are allocated.

Unless steps are taken, productivity will continue to decline presenting serious livelihood problems to such communities. The surrounding forest areas will come under increasing pressure to supply more products and farmland.

1.1.3 Plan for Shifting Cultivation Stabilisation

The majority of shifting cultivation areas are in the northern and upper central provinces and in the eastern parts of southern provinces against the Vietnamese border.

The government has recognized the major impact that the above changes are having on upland livelihood systems. In response it has established strategies as outlined in the Strategic Vision for the Agricultural Sector. These are designed to facilitate *stabilization* in shifting cultivation areas. The government's goal is to facilitate transformation from shifting cultivation to sedentary farming systems that are capable of sustainability, whilst improving living standards. The strategic vision recognizes that traditional upland livelihood systems are very diverse and will remain so. Thus, the program for stabilization in shifting cultivation areas needs to address these inter-related and complementary activities. Besides upland cropping, upland communities rely heavily on a range of other pursuits, including the gathering of a diverse range of non-timber forest products (NTFPs) for domestic use and sale and also cottage industries based on NTFPs plus other activities.

1.1.4 National Biodiversity Conservation Areas (NBCAs)

As indicated, shifting cultivation is mainly found throughout upland areas. Communities have accessed these areas for centuries. Since the early 1990's, government policy has emphasised participatory action with villagers in developing sustainable livelihood and conservation strategies through a local partnership approach. This strongly advocates people's involvement in natural resources management and protection. In 1993 the government instituted a protected area system which currently comprises 20 National Biodiversity Conservation Areas (NBCAs). These NBCAs cover a total area of 3.4 million hectares i.e. about 14% of the country.

Establishment of this protected area system was the start of a long-term process of developing a management system capable of protecting, enhancing and managing these valuable resources on a sustainable basis, for the good of the entire nation.

The Forestry Law reconfirms Government's commitment to participatory management by creating a framework for zoning NBCAs into totally protected (TPZ) and controlled use (CUZ) zones. This is further elaborated by Article 42 which specifies the rights of villagers to utilise the CUZ for a variety of livelihood purposes. Article 63 further provides for the development of local regulations for

the management and care of forests, watersheds, wildlife and the natural environment by village authorities. Although not specifically stated, there is the implication that CUZs are to be jointly managed by villagers with support from the government, while TPZs remain the direct responsibility of NBCA authorities. Stabilisation of shifting cultivation within NBCAs is thus a matter of high priority. Strategies and approaches to these areas follow similar participatory livelihood development approaches as in the general upland areas, but against a more intensified conservation background. This has been described as an integrated conservation and development approach (ICAD).

1.1.5 Past and On-going Project Interventions

Adaptation of upland farming and livelihood systems in all areas is complex and requires time. As rice productivity declines, rice security is further eroded for which families compensate by increasing access and gathering of NTFPs. Many NTFPs are now being over exploited. Thus programs need to address this complex area, as well as developing other alternative income potentials.

A goal of shifting cultivation stabilization should not imply that upland rice production will be reduced to zero. In remote mountainous/upland areas, rice production will always have priority. Farming systems development seeks to enable environmentally non-hazardous production through the integration of a range of measures as discussed below. Depending upon soil suitability and slope, rice can still be incorporated into cropping systems. The value of rice supplied in highland areas is greater than its farm gate or market price in lowland areas, due to transportation difficulties and availability.

A number of past and on-going projects and programs have been implemented to facilitate shifting cultivation stabilization in target areas. These have been implemented both within, and specifically for NBCAs, and general for upland areas outside the NBCAs. The approach adopted has been for participatory development of locally appropriate land-use systems incorporating a variety of agro-forestry systems and conservation measures. Program interventions include a range of strategies from land allocation and land-use planning and farming systems, to cottage industry development, plus socio-economic development such as improved infrastructure and better schools, health and family planning services.

Development projects have employed a range of interventions in order to facilitate the transition to sedentary upland farming and the development of other components of diverse livelihood systems. Interventions include:

- Land Use planning and Land allocation.
- Improved cropping practices – varieties, fertilisers & husbandry.
- Improved livestock practices – feed, grazing, animal health & housing.
- Introduction of permanent tree crops.
- Small supplementary irrigation schemes.

- Land-use systems approaches including conservation measures, integrated farming & cropping systems and agroforestry.
- Introduction of fish paddy & pond farming.
- Improved management of existing forest resources.
- NTFP development, cottage industries & other off-farm income alternatives.
- Market knowledge & improved access.
- Village finance development – VRFs, VSCGs, APB cooperation.
- Improved social services.

Almost all introduced technologies and developments need local adaptation work and testing prior to promotion to the communities in general.

The government's strategy calls for elimination of shifting cultivation by 2010 and elimination of opium poppy cultivation by 2006. Recognising that strategies for stabilization of shifting cultivation and elimination of opium poppy call for common interventions the government, in its 5-year Socio-Economic Plan, has provided for these two goals to be pursued in parallel.

Under the umbrella of the UNDCP/LCDCs' program "*A Balanced Approach to the Elimination of Opium Poppy Cultivation*" pipeline '*Alternative Development Projects*' are implemented. There are currently 4 such projects ongoing in Luang Namtha, Oudomxai, Xieng Khouang and Houaphan and 6 new ones commencing or proposed for Louang Namtha, Louang Prabang, Phongsali, North Phongsali and Oudomxai.

It is in the areas of physical and social infrastructure, food security and income generation where there is a commonality of interventions to achieve the goals of shifting cultivation stabilization and opium poppy cultivation elimination. Here a combination of development efforts including, improved access, health and education, sustainable farming systems with alternate cash crops and other income generating activities, provide for development of sustainable sedentary farming and other livelihood pursuits.

The required changes to traditional swidden farming systems to achieve sustainability under shortened fallow periods are significant. Proper land-use planning is required to determine suitable and environmentally acceptable land uses, which are capable of providing for family subsistence and income needs. Land capability is a function of soils, slope, rainfall, altitude & climate.

CHAPTER 2 AGROFORESTRY LAND-USES OR SYSTEMS

With declining upland productivity under shortened fallows (non-existent in some situations), there has been increasing interest in developing agroforestry systems. These accelerate soil fertility recovery and enable the shortening or elimination of the fallow period. In areas where fertility is severely depleted, longer term agroforestry practices, with high capability of ameliorating soil fertility, are required to return arable crop productivity to satisfactory levels.

Agroforestry techniques have been employed in Laos throughout a range of situations in both the traditional and later developed farming systems.

2.1 Types of Agroforestry Systems

2.1.1 Arable Systems - Woody perennial / Annual crop associations

The swidden rotational shifting cultivation, as described earlier, is a form of this *agroforestry* type. Crops (predominately rice) are planted in rotation, over time, with bush fallow periods of varying lengths.

Improved fallow and/or alley cropping systems provide the potential to accelerate soil amelioration benefits under shortened fallow regimes. Examples are demonstrated at the Agroforestry Research Station at Tong Khang, Luang Prabang. These include cover crops of legumes after rice, alley cropping within tree legumes along contours to control erosion and provide mulching material to improve the soil. Without such systems, progression to a non-legume mono cropping regime is not sustainable.

2.1.2 Taunga Systems - Tree crop / annual crop associations

These are permanent agricultural systems and capable of stabilising steeper slopes in shifting cultivation areas and also have potential to provide opportunities in other agro-ecological areas. There are now many examples of these agroforestry associations particularly in the northern uplands.

- Rice or maize / Paper mulberry and rattan
- Rice or maize / Bamboo
- Rice or maize / Styra for resin & wood production
- Rice or maize / Teak
- Pineapple / Teak or fruit trees

Within these systems there are many variations on the form of associations. Some strategies seek to maintain the association continuously over time with widely spaced rows or clumps of the woody species. Other systems, through optimal planting of the woody species may only enable annual cropping for a limited

period as crop yields decline over time, as result of root competition and canopy shading.

Styrax and Paper Mulberry / Crop associations in Houaphan and elsewhere are established by encouraging the paper mulberry or styrax trees which regenerate naturally in fallow land. This is simply achieved by not cutting and burning such species during land preparation for rice or other crops.

2.1.3 Pastoral systems

Transformation in shifting cultivation areas also involves improving livestock forage and feed supply systems. Increasing farm animal population as a result of the expanding demand for animal proteins is increasing the demand for feed grains and fodder crops. To improve animal production, ruminants require improved forages and some supplemented feed and non-ruminants require more maize and other feeds. Thus, to provide sufficient nutrition in future, forage and feed systems also need to be developed.

Pastoral agroforestry systems provide benefits through increasing the production and nutritional value of forages for ruminants and some feed for non-ruminants. This improves the foraging capacity that can be sustained in grazing areas – forest and fallow lands. Pasture legumes of stylo and centrocaema can be seeded into grassland and bush lands along with the introduction of bushy forage feed species such as *gliricidia*, *leucaena* and *calliandra*.

2.2 Current Development and Adoption of Agroforestry Systems

Currently, transformations through development and adoption of agroforestry solutions are not widespread. However, various government and donor programs have through participatory research-extension linkages, developed and demonstrated approaches for a number of agroforestry and land-use systems.

Measures tested and introduced have included domestication of some NTFPs (styrax and paper mulberry) in regenerating fallows, the introduction of crop rotations, the planting of leguminous shrubs and soil conservation measures. Where land is not capable of supporting annual crops, (due to soils or slope) then other options include development of more permanent agroforestry systems, permanent tree crops, industrial trees or forest tree species suitable to the location and situation.

2.2.1 Characteristics of Appropriate Systems Development

There is no collated information available on the adoption scale of agroforestry systems by farm families. However, anecdotal and project reports indicate adoption is occurring and is influenced by a range of considerations. Agroforestry

systems that are seen as appropriate for adoption by upland farming communities display a number of characteristics, including:

- An improvement of existing systems to solve community identified problems.
- They are technically feasible and have been demonstrated in particular situations.
- They are not labour intensive.
- They provide locally useful and/or marketable produce/products.

When developed, agroforestry systems need some of the following attributes: -

- Minimise soil erosion and runoff in sloping land situations
- Enable sustainable production of hill rice
- Provide other products and benefits such as:-
 - Fodder for livestock.
 - Timber, bamboo, fruits, nuts and other commodities for local use.
 - Marketable commodities - bamboo, paper from paper mulberry, silk, styrax resin, fuelwood and small timber from teak and fast growing (exotic) species.
 - Living fences for improved grazing control.

Very importantly the enterprises or activities within agroforestry systems may have site-specific technical problems or special requirements for successful uptake and adoption by farming communities. These should be addressed by joint and participatory endeavours between: research, extension & farming communities.

A striking observation is that, whilst there is a growing body of information and project experience now available, there is little routine district village expansion of extension efforts to other villages and districts. This is due to an extremely low capacity and development in district extension services and lack of provincial subject matter support.

CHAPTER 3 NON-TIMBER FOREST PRODUCTS (NTFPS)

3.1 Background

Agroforestry should not be viewed as a *one and only* solution or method for intensification and stabilization of agricultural systems. It is one technique amongst a number of solutions to sustainable food production. In relation to shifting cultivation stabilization, opportunities also exist through reorientation by developing sustainable management systems for NTFPs and other off-farm income generating activities. This approach in some situations may generate enough income to purchase food and other goods, but the distribution systems for products and food has to be improved to facilitate such initiatives.

In addition to timber, forests yield many biological products of value. Commonly these products are called non-timber forest products (NTFP). In Lao PDR, a country rich in biodiversity, NTFPs are very important to the national and local economy for subsistence and trade. Sometimes NTFPs together constitute a higher value than timber. About half the cash income of rural households is derived from NTFPs. Generally in the past, the government's focus has been on timber production and NTFPs have received little attention in national forest policy. They have been neglected, probably due to their diverse and complex nature and their position outside mainstream economic development.

3.2 Government Policy

Currently, the government is revising former policies, working out strategies and formulating socio-economic development programmes. The Strategy Proposal for the Forestry Sector 1995-2000 highlighted the following seven priority areas:

1. Develop viable alternatives to shifting cultivation and gradually decrease unsustainable upland farming.
2. Allocate land to rural families and enterprises and encourage afforestation.
3. Assess the national forest resource and set up appropriate systems for forest management.
4. Implement biodiversity conservation areas management and protect priority watersheds.
5. Develop an appropriate and competitive forest industry.
6. Improve human resource development, and
7. Improve the forestry research strategy.

NTFPs play an important role in all these priority areas. The IUCN/NTFP Project (1995-2001), with field activities in Oudomxai, Saravan and Champasak provinces was the first major project to work on NTFP development. The following information and lessons learnt are mainly extracted from this project.

3.3 Main NTFPs Collected for Use and Sale

Villagers in the IUCN/NTFP Project areas collect more than 700 NTFPs. At the national level the number may be 3-4 times higher. The largest diversity is found among plant and animal food products and ornamental plants (mainly orchids). Some key species are briefly presented below.

3.3.1 NTFPs for Local Use:

Bamboo and rattan shoots, cooked or eaten raw, are the most important side dish to rice on the daily menu. Common bamboo species for food are *Gigantochloa albociliana*, *Bambusa arundianaria*, *nana* and *tulda*. Two common rattan species for shoots are *Daemonorops schmidtiana* and *Rhapis spp.*

Fish and other water animals like frogs, shrimps, soft-shelled turtles, crabs and molluscs are a major source of protein rural community in their diets.

Wildlife is a more important source of protein than livestock for most rural people. Some 31 mammals, 24 birds and 13 reptile species were recorded by the IUCN/NTFP Project as regularly eaten.

Vegetables: Some 40 types of leaves from trees, shrubs and herbs are eaten fresh or cooked. **Tubers** (*Dioscorea sp.*) are eaten as a rice substitute in times of rice shortage. **Mushrooms** are important in the rainy season. Various **flowers** and **forest fruits** are also gathered and eaten.

Bamboo and rattan are widely used for house construction and to produce fishing gear and baskets. Most commonly used bamboo species are *Cephalostachyum virgatum*, *Oxythenanthera parvifolia*, *Bambusa tulda*, *blumeana*, and *Neohouzea mekhongensis*. Among rattans, *Calamus javanensis* and *Daemonorops schmidtiana* are the most commonly mentioned. While internationally, rattan is used as material for furniture etc., in Laos it is collected mainly for food.

Pandan (*Pandanus sp.*) is commonly used to make mats. Various **vines** are used to make ropes.

Fuelwood is an NTFP. 82 % of the country's total energy consumption is derived from wood (including charcoal). It is the principal household cooking and heating fuel. Many rural industries and the service sector also use wood and other residues.

3.3.2 NTFPs for Sale:

Some of the subsistence products mentioned above also provide an important income source, e.g. fish, wildlife bamboo shoots. Some other products are mainly collected for sale. These fall into four categories: plant exudates, medical plants, spices/condiments and tree bark. The prices given generally refer to 1996.

Wild **cardamom** (*Amomum sp.*) grows abundantly in disturbed forest at wetter locations. It is also planted in Champasak, Salavan and Luang Namtha provinces. Its fruits, are sold mainly to China where it is used in the preparation of various medicines. The price was 3,000 Kip/kg in 1996.

Malva nut from *Scaphium macropodium*/*Sterculia lychnophora* trees is a popular medicine in China. Wild stands exist in the south but produce fruit only every 3-4 years. The price is very high, currently about 25,000 Kip/kg.

Coscinium usitatum is a **vine** that produces the medicine “berberine”, which is popular in Vietnam and Laos. The drug is effective against amoeba and various intestinal bacteria. The vines sell for 10 Kip/kg.

Helminthostachys zeylanica, the **root** of a small fern, grows in wet places near bamboo. It is a popular medicine in China. Price: 3,000 Kip/kg.

Damar (kisi) resin is produced from dipterocarp tree (*Shorea spp.* & *Pamshorea spp.*). It is collected from the forest floor after it has fallen from the tree. This product is exported mainly to Vietnam and Thailand. **Yang oil**, a oleoresin from *Dipterocarpus alatus* is a liquid resin, used as an ingredient for high quality varnishes and as a non-alcohol base in perfume production. Almost all of it is exported to India through Thailand. **Benzoin**, an exudate from *Styrax tonkinensis*, is mainly exported to France and is used as a base in manufacturing of perfume.

Eagle wood is a rare, scented wood produced in small quantities in the heartwood of *Aquilaria crassna* after incisive damage by insects, bullets etc. Only a small percentage of the wood of this species contains these intrusions. It is a very appreciated product in Arab countries, as well as China and Japan. The price is high, 7,000-16,000 Kip/kg on the Nakai plateau.

Nong bark from *Notaphoebe crassna* trees is collected and sold to Thailand where it is used to make joss sticks and incense. Current harvesting pressure is rapidly depleting present stands. The price is 60-100 Kip/kg. **Saphan bark** from *Debregeasia hypoleuca* trees contains a gum, which is used in China to produce glue. The bark of *Cinnamomum spp.*, known as “false” cinnamomum, is collected and used as a spice. Price 60 Kip/kg. The **rootstock** of wild *Alpinia spp.* is used as common spice throughout Southeast Asia. The price is 400 Kip/kg.

Thysanolaema maxima is a **grass** used to make brooms. Large quantities are exported to Thailand. **Paper mulberry**, *Broussonetia papyrifera*, is a small tree used for producing paper in China, Japan, Thailand and Laos. The price is 150 Kip/kg.

Charcoal is a common urban household and restaurant fuel. It is generally made from denser tree species. The current selling price in the market is 1,000 kip/kg.

3.4 Role and Importance of NTFPs

The importance of NTFPs for the family economy has been assessed by the IUCN/NTFP Project in 28 villages in three provinces. When ranking the NTFPs, bamboo shoots stand out as the single most important product, see Table below.

Villagers' ranking of 50 most important NTFPs

Ranking	Product	Ranking, %		
		Men	Women	Combined
1	Bamboo shoots	13	17	13
2	Fish	13	7	10
3	Vegetables	11	11	9
4	Wildlife	11	6	8
5	Cardamom	7	7	7
6	Rattan canes	6	6	6
7	Damar resin	2	4	5
8	Frogs	5	5	5
9	Mushrooms	3	6	4
10	Yang oil	4	4	4
Total top 10 products		74	74	71
Other 40 products		26	26	29
Total 50 products		100	100	100

Source: The Use of NTFPs in Lao PDR, DoF/IUCN Vientiane, Foppes J., Khetphanh S. Nov. 1997.

Women attach more importance to products such as vegetables and bamboo shoots, while men prefer products such as wildlife and fish. Both men and women collect other products. Fuelwood ranked 38th although the average per-capita consumption has been assessed at 2.4 m³ (STEA 2000), of which two thirds is collected outside the forest. A similar ranking was carried out for sources of income. See Table below.

Villagers' ranking of income sources (1996)

Income Source	Ranking, %	
	NTFP	Total
NTFP:		55
Cardamom	9.5	
Fish	7.0	
Wildlife	5.8	
Damar resin	5.6	
Bamboo shoots	3.0	
Rattan canes	2.6	
Saphan bark	2.5	
Bong bark	2.0	
Rattan shoots	1.8	
Yang oil	1.8	
Others	13.6	
Livestock		24
Rice		9
Other crops		8
Labour		1
Off-farm income		2
Total		100

Source: The Use of NTFPs in Lao PDR, DoF/IUCN Vientiane, Foppes J., Khetphanh S. Nov. 1997.

On average, 55% of family income was considered to be from NTFPs. Cardamom was top, followed by fish, wildlife, damar resin and bamboo shoots. Besides NTFPs the other main source of income is livestock. Rice ranks low as an income source because of low surplus levels and frequent shortages.

The general wealth of the household effects their dependence on NTFPs. Poor households are much more dependent. Following Table sets out the results from interviews with 191 families in 5 villages on the Nakai plateau.

Annual income in different family wealth categories (1996)

Source of Income	Annual Income, Kip/Household				
	Richest	Medium	Poor	Poorest	Average
NTFP	99,740	107,550	60,460	70,490	82,930
<i>% of gross value</i>	24%	62%	35%	90%	41%
Livestock	152,220	41,500	73,460	3,900	64,910
Off-farm	164,000	23,670	37,670	4,000	56,200
Gross Value	415,960	172,720	171,590	78,390	204,040
Rice*	-10,940	-30,940	-232,710	-294,630	-133,520
Net Value	405,020	141,780	-61,120	-216,440	70,520

*Amount of money needed to buy rice (negative value) or surplus of rice sold (positive value), based on a calculation of deficits/surplus after family paddy consumption calculated as 300 kg/capita/year.

Source: The Use of NTFPs on the Nakai Plateau. DoF/IUCN Vientiane, Foppes J. et al 1997.

As can be seen in Table 3.4.3, the average annual income from NTFP accounts for about 40% of total household income. However, this income makes up 90 % of the total income for the “Poorest” group. It accounts for only 24 % in the “Richest” group, where off-farm activities and livestock provide the bulk of income. On average livestock account for 32% of gross income and off-farm 28% (labour & other activities etc.) which is much higher than indicated in the study results presented in Table 8.4. The indication of negative income (by calculation) for the “poor” and “poorest” groups is in fact not possible. In these situations of rice insufficiency, the poor increase consumption of NTFP foods as substitutes for rice.

Cash income earned by rural villagers from NTFP sales could amount to US\$ 26 million per year. This is an estimated US\$ 39 (55%) out of a total family income of US\$ 70 for the nations 660,000 rural families. Exports of NTFPs for the year 1995/1996 are shown in Table below.

Export of NTFPs (1995/1996)

Rank	Product	Unit	Quantity	Value (US\$)
1	Cardamom	kg	461,337	2,232,276
2	Damar resin	kg	3,098,192	533,022
3	Sugar palm fruit	kg	865,109	465,112
4	Bong bark	kg	1,236,675	172,869
5	Broom grass	kg	502,266	135,018
6	Orchid stems	kg	49,000	105,376
7	Rattan (big diameter)	Stems	246,366	98,546
8	Paper mulberry bark	kg	563,402	90,871
9	Dried lizards	Skins	7,237	86,696
10	Yang oil	Litres	185,240	67,125
11	Eagle wood	kg	3,327	35,774
12	Bamboo shoots	kg	165,000	35,484
13	“Hak tin hung” fern	kg	10,160	35,309
14	Benzoin	kg	15,866	34,120
15	Bamboo canes	Stems	141,655	30,463
16	Draceana plants	kg	103,261	27,203
17	Rattan fruit	kg	41,288	22,198
18	Saphan bark	kg	107,500	21,640
19	Malva nuts	kg	17,230	10,338
20	“Si siet” bark	kg	5,000	8,065
21	Rattan (small diameter)	Stems	37,398	6,032
22	Vomica nuts	kg	23,632	3,405
23	“Keua hem”	kg	58,900	633
24	Sticklack	kg	2,200	355
25	Charcoal	kg	234,500	25,215
26	Incense powder	kg	100	?
27	“Man on ling”	kg	3,355	?
28	“Kheua tip ti”	kg	22,000	?
Total				4,283,146

Source: The Use of NTFPs in Lao PDR, DoF/IUCN Vientiane, Foppes J., Khetphanh S. Nov.1997

The quantities come from MAF statistics and the value from market research carried out by the IUCN/NTFP Project.

Cardamom is by far the most important export NTFP, accounting for 52 % of total 1996 NTFP export value. Most NTFPs leave the country in a raw state because there is little capacity for processing. There is a great potential for improved marketing/processing of NTFPs. The total export value of US\$ 4.3 million from NTFP represents 2.5 % of total export value (US\$168.3 million) in 1996.

In addition there is unrecorded trade, which is not taken into account in the above official figures. A good example is the lively trade in orchids and other ornamentals along the Lao-Thai border. A survey by the IUCN/NTFP Project identified some 90 species of ornamentals being exported, of which 56 species are wild orchids. On average 5,000-7,000 plants are sold per month. This could lead to the extinction of rare orchids. The Lao government signed the Convention on Conservation of Biodiversity in 1996, but has not yet signed the Convention of Trade of Endangered Species (CITES).

An issue with the export of NTFP is the large price increase accrued along the market chain. An example of this can be seen in the sale of yang oil, the oleoresin of *Dipterocarpus alatus*, from a timber tree common in Laos. The villagers collect and sell the oil for US\$ 0.16/kg, and the final Bangkok buying price is at least US\$ 1.20/kg, i.e. eight times higher. The reason is the many middlemen involved along the market chain, plus some transport and other costs.

Semi-domestication of wild NTFPs is occurring in many provinces. For example, planting and tending of cardamom and rattan seedlings under trees in natural forest or under coffee. An interesting side effect is that the villagers stop burning these forests. There are also examples of villagers growing broom grass, tannin bark trees, paper mulberry and bamboo in home gardens for NTFP production.

3.5 Structure of the NTFP Sub-Sector

NTFP issues are formally handled by MAF/DoF at the central level, PAFO at the provincial level and DAFO at district level. However, staff numbers and organisational structure dealing specifically with NTFPs are limited. There is a new NTFP Research Division in the Forestry Research Centre (FRC) within NAFRI. It includes the project office of the IUCN/NTFP Project, a rattan research project (Darwin Initiative) and a NTFP database. The IUCN/NTFP Project established NTFP Development Support Units in three provinces with NTFP Field Teams operating at the district and village levels. These are important first steps in building the NTFP sub-sector structure and capacity within the agriculture/forestry sector.

The Forest Law (1996) provides a legal framework for the NTFP sub-sector.

Article 25 states: “*the harvesting of timber and other forest produce can proceed only in surveyed and inventoried production forest areas for which there is a forest management plan*”, and, “*the harvesting of other forest products such as mushrooms, roots, tubers, shoots, leaves, flowers, bark, resins, gums must be carried out according to specific regulations issued by concerned agencies*”.

Villagers generally believe that they have traditional rights to collect NTFPs in the forest and do so without seeking permits, often because they simply have little other choice for food or cash. This means that most NTFP collection is “illegal”. Realistic regulations and procedures are needed to clarify rights.

The availability of markets is a pre-requisite for commercial collection and trade in NTFPs. In addition to local and national markets, there are strong external NTFP markets in neighbouring China, Thailand and Vietnam. These markets could be further developed and villagers and traders assisted to gain access to them. To some extent the government controls the market, and indirectly controls NTFP collection, through quotas for certain products.

There is an interesting case with yang oil in the south. In 1995 the provincial governments stopped issuing quota for export of yang oil, saying that its harvesting often causes forest fires and increases death of young *Dipterocarpus alatus* (DA) trees. This has led to decreased cash income for thousands of farmers involved in yang oil tapping. There is a conflict of interest between the government wanting the DA trees for timber and the villagers wanting them for yang oil tapping. According to the villagers and others, the DA trees can be tapped for up to 30-50 years and then be cut for timber without too much loss in timber value. This case underlines the need to carry out research on NTFP production to develop sustainable forest management systems that include both timber and NTFP production and considers ecological, economic as well as social aspects.

The government places a high priority on developing the NTFP sub-sector. The present trend to decentralise natural resources management to the provinces (strategic units), districts (planning units) and villages (implementing units) is important in this respect. The very complex and site specific nature of NTFP will allow implementation of sustainable NTFP management only at the village (or cluster of villages) level by villagers following agreed village-specific regulations, with monitoring by district and provincial authorities.

In the NAFRI Forestry Research Strategy for the period 2000-2005, NTFP research and development have been given special attention as one of four priority areas. The following NTFP research needs have been identified:

- Domestication/agroforestry systems/reforestation/forest restoration
- Sustainable harvesting regimes
- NTFP based forest management
- Ethnobotany and botanical studies
- Market analysis
- Processing feasibility studies
- Medicinal plants
- Regulatory framework
- Socio-economic research
- Research-extension linkages

NTFP research will be based mainly on on-farm trials with communities living close to the forests as a priority target. Activities will be managed through Forest Research Centre (FRC) stations and other crop research stations of NAFRI. The NTFP Development Support Units in Champasak, Saravan and Oudomxay provinces will be maintained. It is considered that a special unit should be established within FRC or inside NAFRI to provide training support and to network with other relevant organisations/institutions/projects.

3.6 Current NTFP Projects

In the past, there has been little co-ordinated support given to the development of the NTFP sub-sector. However, in the last 7-8 years six donor supported projects have been working with NTFP development. They have been addressing different issues related to the objectives of the NTFP sub-sector which in brief have been formulated as:

- Increase income from NTFP-based industry and trade through product improvement and marketing.
- Provide alternative livelihood to shifting cultivation through NTFP development.
- Provide incentives to local communities to conserve forests by increasing the social and economic benefits accrued to them from sustainable NTFP use.
- Ensure the long-term availability of NTFPs by developing systems of sustainable management and use.

The status of the six projects is described briefly below. At present it seems that only one of the projects will be operating with donor support by the end of 2001.

3.6.1 IUCN/NTFP Project

This project, which started in 1995 will end in September 2001. It is supported by the Royal Netherlands Government (US\$ 2.9 million grant) and executed by IUCN and the Department of Forestry (DoF). Following recent organisational changes it is now integrated in the NTFP Research Division of FRC/NAFRI. The project established NTFP Support Units in Oudomxai, Salavan and Champasak provinces with Field Teams operating in districts and villages with NTFP data collection, action-learning projects and training. The project had the following steps:

- Rapid rural appraisal (RRA) in villages
- Participatory planning (PRA) phase in pilot villages
- Implementing agreements with NTFP user groups in pilot villages
- Research and training
- Monitoring and evaluation
- Expansion of results

The main findings of the project are:

- NTFPs make an important but often neglected contribution to the national economy.
- NTFPs play a key role in poverty alleviation, forest conservation, land use planning and land allocation. Also as a partial substitution for shifting cultivation and for industrial development.
- The diversity of NTFPs requires multiple, locally fine-tuned solutions.

- Local people can generate solutions in a framework of participatory group strengthening.
- Such a framework requires a network of exchange and support services.

IUCN is working on a proposal for a second phase of the project that will probably need a new donor. There are tentative ideas to make a regional IUCN/NTFP project involving Laos, Vietnam and China, which will facilitate regional NTFP networking including exchange of ethno-botanical information, management experiences and market information.

3.6.2 NTFP Information Centre (NIC) Project

This project aimed at providing relevant information on NTFPs to people and organisations. It was a two-year project executed by DoF with financing (US\$ 409,000 grant) from CARE Austria/CARE International. The project started in January 1997 and ended in December 1998.

The project conducted data collection, established an NTFP database and information dissemination (newsletter, booklets, internet, workshops etc.). The project started in a temporary office at DoF. Later a centre building was established near the NAFRI headquarters through joint financing by CARE Austria and IUCN Netherlands. This building is now the NTFP Research Division office. The NIC project has been closed, but the NTFP database remains.

3.6.3 Improved Benzoin Production Project

This project started in June 1996 and ended in June 1998. It was supported by FAO (budget US\$ 305,000) in co-operation with DoF. The aim was to promote production, processing and marketing of benzoin, which is a balsamic resin produced from the *Styrax tonkinensis* tree.

The project carried out various activities on silviculture, processing and marketing related to styrax and bezoin. Trials were started in co-operation with PAFO in Louang Prabang Province. The objectives of the project were:

- Assess and improve production and processing of benzoin and determine the utilisation potential of the styrax wood.
- Study the socio-economy of minor forest products with emphasis on the role of women.
- Transfer technology to local communities and train Lao scientists and foresters in R&D and extension methods/techniques.

3.6.4 Bamboo and Rattan Project

A bamboo and rattan project was operating from 1991 to 1994 by IDRC/INBAR and DoF. The specific objectives of the project were to:

- Develop management techniques for bamboo.
- Carry out taxonomic survey of rattan and bamboo resources.
- Establish trial plantations and germplasm collections of rattan and bamboo.
- Determine growth and yield rates of natural rattan and bamboo.

The project had facilities and experimental plots located at Nam Suang Forest Research Centre (FRC) north of Vientiane. More than 60 bamboo species and 30 rattan species were identified. Manuals on bamboo and rattan, and propagation methods for rattan and bamboo were produced.

3.6.5 Orchid Research Station

An Orchid Research Station was set up with assistance from the Lao-Swedish Forestry Programme (Sida-supported) from 1991 to 1994. It continues to operate with limited funds from DoF and by running commercial activities. The aims of the station are to:

- Collect information on orchid species found in Lao PDR.
- Conduct cultivation experiments and attempts to improve the stock.
- Promote research and education in relevant subject areas from within Lao PDR and overseas.
- Promote awareness of the importance of orchids, and the need to protect its natural resource base.

The station was originally set up as a women's working group. It was transformed into a research station in 1994. More than 50 samples of orchid species have been collected from various regions of Lao PDR. 33 species have been successfully planted at the station.

3.6.6 Rattan Diversity and Sustainable Management in Lao PDR Project

This is a co-operative research project between DoF, Oxford Forestry Institute and Royal Botanic Gardens in Kew, England. The project commenced in October 1997 with a first phase completing in October 2000. A second phase is now being prepared. The first phase budget was US\$ 200,000 provided by the UK Government through the Darwin Initiative. The project supports improved management of rattan through research and capacity building. It proposes to:

- Form links between DoF and organisations abroad able to offer technical support in taxonomy and ecology.
- Determine the species present in a forest areas and produce an identification manual.
- Provide training in taxonomy for one or more Lao scientists who will then research and produce a national rattan identification manual.
- Contribute to the creation of a national rattan collection for research and education.

- Train Lao scientists in participatory and formal scientific methods for studying the ecology of commercially important species.
- Conduct ecological research that will provide guidelines for the management of rattans and possibly their domestication.

This project, which is now integrated in the NTFP Research Division office, may be the only donor supported NTFP project in Lao PDR by the end of 2001. However, the government has started discussions with several donors to obtain support for new NTFP projects and programmes, separately or as components of wider integrated rural development projects

3.7 Opportunities for Further NTFP Development

Lao PDR has about 10 million ha of natural forest, of which about 3 million ha has been set aside as national protected areas (NBCAs). The forests have very high biodiversity. Lao PDR actually ranks as one of the biologically richest countries in the region. The forest contains at least 10,000 species of mammals, reptiles, amphibians, birds, freshwater fish, swallowtail butterflies and vascular plants. This rich resource should be protected to maintain its important environmental and ecological functions, but also be used for sustainable production of timber and NTFP to the benefit of the nation and its population. As shown in Section 3.4, the poorest rural people are the ones who are most dependent on NTFPs for their survival and development. The development of the NTFP sub-sector will, therefore be an initiative action towards poverty alleviation as well as increasing the country's export earnings. There is great scope for expanding the NTFP sub-sector, but it will require a great effort to improve markets, marketing, and the development and introduction of sustainable NTFP/forest management systems.

The past NTFP development projects have created a sound basis for the development of the sub-sector. This is particularly true of the IUCN/NTFP project, which had a broad approach addressing institutional, environmental, technical, social and commercial issues. Further NTFP development should continue this broad approach. Some of the urgent development issues to be considered are briefly discussed below.

3.7.1 Legal framework and access to NTFP resources

The villagers are the main actors in the NTFP process. Their rights and responsibilities related to the forest resources are unclear. The land allocation may have clarified the situation in the villagers' individual forest lots and the common village forests, but villagers' rights of access to forests and NBCAs for NTFP collection needs to be developed and clarified.

3.7.2 NTFP institutions at central, provincial and local level

The agriculture/forestry institutions at the central, provincial and district levels need to be strengthened to provide supporting services to NTFP stakeholders involved in NTFP management, collection, processing and trade. This should include support to NTFP action research and pilot project village activities. The agriculture/forestry extension service organisation at the provincial (PAFO) and the district (DAFO) levels requires capacity building to enable them to provide NTFP extension services including market information and credit schemes. The experience of the NTFP Support Units established by the IUCN/NTFP Project in three provinces will be a valuable resource in this development.

3.7.3 Human resources development on NTFP

There should be an institutional capacity to arrange NTFP training for agriculture/forestry staff at each level and for villagers. This activity may be linked to NTFP research and extension institutions. Curricula for NTFP awareness raising should be developed and included in the regular schooling system.

3.7.4 Survey of NTFP resources

The forest inventories carried out by DoF and PAFO focus on tree species and timber volumes and do not generally contain information on specific NTFP resources. Appropriate methods for inventory/survey of NTFP resources need developing and introduced for use by forestry staff as well as special NTFP staff and villagers. The inventory system should be linked to a National Herbarium for Forest Resources, which also needs to be established.

3.7.5 NTFP market development

The development of markets and marketing facilities for NTFP will be crucial for the expansion of the NTFP sub-sector. This includes local, provincial, national as well as international markets. The development should include identification of NTFP markets, market analysis, market chain analysis, monitoring of trade volumes and prices etc. with information stored and disseminated from a NTFP market information system. The government may not be an ideal host for such a system. A national NTFP producer group/corporation could be established to run the system and provide information to its members.

3.7.6 Sustainable NTFP management

Another crucial issue for the expansion of the NTFP sub-sector is the introduction of sustainable NTFP management. Otherwise there is a considerable risk that

some NTFP resources will be over-exploited and depleted. The development of a 'sustainable-yield' NTFP management system is not an easy task considering that there are thousands of NTFPs being collected. This job is already on the agenda of the NTFP Research Division at FRC/NAFRI. This should be done in cooperation with villagers. Villagers have valuable traditional knowledge as they have been collecting NTFPs for a long time and have seen how they grow and regenerate, and have experience of community regulations aimed at sustainable harvesting of the NTFPs. There should also be the gathering of available research data from other parts of the South-Asia Region.

3.7.7 Domestication of NTFP species

Domestication will give villagers more control over supply of an NTFP. Full domestication is when wild NTFPs are grown in the home garden and semi-domestication occurs through planting NTFP seedlings in the forest to boost NTFP production. Examples of the latter method are the planting by villagers of cardamom and rattan in the forests. There is considerable scope for increased domestication of NTFP. The NTFP Research Division plans to work on this issue as an agroforestry activity in co-operation with villagers (on-farm research).

3.7.8 Forest user/NTFP producer groups

Rural NTFP producers have much to gain by organising themselves into producer groups. Advantages are: greater economies of scale in production, transport and marketing; a stronger basis for negotiating with middlemen and others in the market chain; a better basis for competing with larger-scale producers; and prospects for sustainable harvesting and more equitable sharing of benefits. Forest user/producer groups often become key actors in development and are effective in communication with government support services and networks. The IUCN/NTFP Project is promoting the establishment of NTFP producer groups in their project areas. This promotion, including the promotion of local NTFP enterprises, should be extended to the whole country.

3.7.9 Processing of NTFPs

NTFPs are mostly sold and exported in a raw/unprocessed form. Better grading and processing will increase the value and income and decrease transportation costs. Producer groups should be encouraged to increase grading and processing through better market information, training, demonstrations and credit facilities.

3.7.10 Networking

The NTFP producers are widely scattered throughout the country. They have much to gain by meeting and coordinating with other producers and exploring the possibilities of “down-stream” marketing activities. This could be done by arranging study tours, workshops and demonstrations for producer group members and through newsletter distributions etc. NTFP researchers and market promotion staff can network with the help of e-mail and the internet. The IUCN/NTFP Project has been active also in this field and has seen the benefits.

3.8 Monitoring of the NTFP sub-sector

Monitoring will be an important management tool in the very diverse and complex NTFP sub-sector. Monitoring should be done periodically of the NTFP resource base to show that the NTFP harvesting and management is done in a sustainable way. Probably this should be done with the village as the unit. Reasonable and simple survey and monitoring systems should be developed and introduced for this purpose. Provincial governments should organise and carry out the monitoring in co-operation with villager/producer groups on an annual basis.

3.9 Strategy for NTFP development

Each province should develop a strategy for the sustainable management of its natural resources (including NTFP) and issue provincial guidelines. This will require regular analysis of the natural resources situation and strategic planning activities based on national policy, annual monitoring data, results of research, socio-economic information etc., with the help of GIS technology. Development of such a system/tool for provincial natural resources management has recently started in Lao PDR by NAFRI in co-operation with pilot provinces. The system is called PRONAM. The NTFP resource management will be an important part of PRONAM.

3.9.1 New NTFP Programmes/Projects Required

The NTFP sub-sector has only recently become an organised sector. Over the last 5-10 years a few development projects have successfully helped develop this sub-sector. However, increased long-term efforts will be needed to develop it into an efficient, commercially sound and sustainable sub-sector nation-wide.

The NTFP programmes/projects should have the following overall objectives:

- Effective and sustainable use/management of the country's forest resources.
- Biodiversity conservation and participatory protected area management.
- Poverty alleviation.
- Providing acceptable alternatives to unsustainable upland farming.

- Institutional and human capacity building at provincial, district & village -levels.
- Increasing national and international trade.
- Improving national and local economy.
- Increasing industrial capacity.
- Promotion of equity (horizontal and vertical).

There is need for the following three groups of NTFP development programmes with projects, sub-projects and components.

(1) NTFP Capacity Building Programme

- NTFP legal and regulatory framework development.
- NTFP institution building (central, provincial and district levels).
- Human resources development (NTFP training of trainers).
- Promotion of NTFP producer groups/enterprises.
- Survey/monitoring of NTFP resources.
- NTFP production and consumption studies.
- Strategic NTFP planning (PRONAM).
- Studies and promotion of NTFP processing.
- NTFP extension and credit services.
- Networking.

(2) NTFP Market Development Programme

- Identification of NTFP markets (local, national and international).
- NTFP market analysis (incl. method development).
- NTFP market chain analysis (incl. method development).
- Survey/monitoring of NTFP trade volumes and prices.
- NTFP market information system (incl. NTFP market database).
- Promotion of NTFP marketing activities.
- Investigating new markets and new products.
- Networking.

(3) NTFP Research Programme

- Methods for survey/monitoring of NTFP resources.
- Methods for sustainable NTFP management (planning, harvesting, regeneration and monitoring)
- Ethnobotany and botanical studies (incl. NTFP species database)
- Bamboo use and management
- Domestication of NTFP species
- Agroforestry models including NTFP production
- NTFP extension materials
- Collection of seeds and cuttings etc.
- Networking

CHAPTER 4 TREES AND THEIR IMPORTANCE AND POTENTIALS FOR FARM FAMILIES

4.1 Forest areas

As mentioned above, trees and forests are important components of the farming system and are essential for shifting cultivation. They supply fuel, building materials, food, fibre, medicines and many other non-timber forest products (NTFP). They also contribute the bulk of grazing and browse to farm animals and are a significant source of non-farm income for rural people. Many forests are in areas of outstanding natural beauty and many rural people are living in or near these areas. There is a considerable tourist potential to develop these areas, especially the 20 National Biodiversity Conservation Areas. Also, many tourists are attracted to view at first hand rural life and rural living, especially in Laos with all its ethnic diversity. Therefore, developing a vibrant tourist industry could bring considerable income to upland villagers through servicing the industry and selling local products and dishes. This may be one of the best ways to protect the NBCA's as the local people will be involved in managing them for their own economic benefit.

4.2 Trees outside the forest

While forest trees supply most of the products that farmers require, trees outside the forest, especially trees on farm, are becoming more important especially as a way to generate income and as an input to sustainable agricultural development. Most arable and pastoral farming systems have trees as an integral component, the exception being lowland paddy production. But even here, farmers plant trees/bamboo somewhere on the farm to at least provide shade, but usually to provide food, fibre and fuel.

Through the efforts of the Agro-forestry Research Programme, the NTFP project, the EU micro-projects, the Lao-Swedish Forest Programme and several other private and public initiatives, planting trees on farm has increased. Agro-forestry initiatives are dealt with elsewhere in this report, but the planting of trees, bamboo and bushes for food, fruit, nuts, raw silk, paper bark, poles and timber is gaining momentum, especially where there is a developed market for these products.

On the one hand government and donors are encouraging tree planting. In the Forest Laws (Article 34 – The Promotion of Tree Planting), tree planting is promoted through various incentives, subsidies and regulations, including credit and tax incentives and the provision of planting material usually from improved stock. There is also a National Tree Planting Day on the first of June every year, when tree planting is encouraged by all the population, (Article 46 of the Forest Laws). Article 47 of the Forest Law specifies the establishment of a forest and

forest resource development fund to promote amongst other things tree planting. However, up to the present, this fund has not been established, but through the Lao/ADB Plantation Program, money can be borrowed to invest in planting.

4.3 Income earning opportunities

The government wants to encourage the planting of the equivalent of 0.5 million hectares by 2020. The ambitious tree-planting program offers income-earning opportunities to farmers. About 50 million seedlings will be required each year to fulfil this target. While there will be some large government nurseries, there is a considerable potential for farmers to grow tree seedlings on their own land and for villagers to undertake seed and cutting collection from valuable indigenous trees for sale or to grow in their own nursery for eventual sale.

Farm and forest trees could and should provide opportunities to establish cottage industries. Some have been mentioned already such as silk and bamboo weaving, paper making. But there are multitudes of other cottage industries that have potential. These include apiculture (honey, wax and royal jelly), wooden handicraft products, lime burning, brick/tile making, ceramic manufacture, food, fruit and fish processing etc. The potential for such small-scale industries should be investigated through marketing studies and where promising, loans and business management advice could be made available to farmers.

Thus, there is considerable potential to sustainably develop the natural forest for plant and animal NTFPs, as browse and feed for farm animals. Tree planting can also be extended and expanded to farming systems, including agro-forestry, and to home gardens. This will enable cottage industries to be based on a sustainable supply of natural resources.

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Appendix 9
Agriculture Supporting Services

**MASTER PLAN STUDY
ON
INTEGRATED AGRICULTURAL DEVELOPMENT
IN
LAO PEOPLE'S DEMOCRATIC REPUBLIC**

VOLUME III

APPENDIX-9

AGRICULTURE SUPPORTING SERVICES

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AGRICULTURE SUPPORTING SERVICES**

CHAPTER 1 AGRICULTURAL RESEARCH

1.1 General Background

The National Agriculture and Forestry Research Institute (NAFRI) was established in June 1999 in order to better use the limited physical, human and financial resources. The role of NAFRI is to implement technical research works on agriculture, forestry, fishery and livestock and others. Prior to its establishment, various departments of MAF conducted agriculture research work separately. The coordination between NAFRI and MAF line departments is undertaken by the Council of Science and Technology (CST) chaired by the Minister. The Council consists of the Director of Generals (DG) of all the departments including NAFRI.

1.2 Organization and Staffing of NAFRI

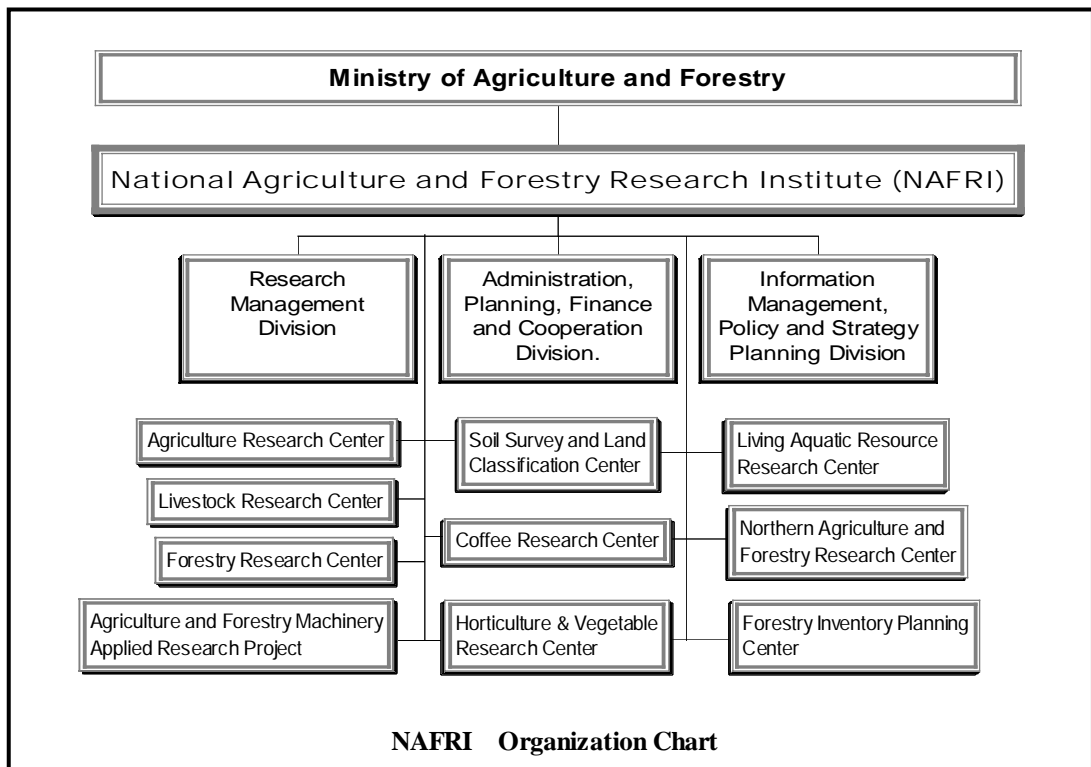
NAFRI has three divisions, nine centers and one project unit (agriculture and forestry machinery) as illustrated in next page. The number of staff with qualification in each division/center is summarized in Table below.

Present Staffing of NAFRI

Center/Division	Ph.D.	M.Sc.	B.Sc.	Diploma	Technical School	Vocational School	Total
1. DG/DGG	2	0	0	0	0	0	2
2. Administration, Planning, Finance and Cooperation Division (APFCD)	2	2	1	2	2	1	10
3. Research Management Division (RMD)	1	2	0	0	0	0	3
4. Information Management, Policy and Strategy Planning Division (IMPSPD)	0	4	1	1	2	0	8
5. Agriculture Research Center (ARC)	1	1	12	9	6	7	36
6. Soil Survey and Land Classification Center (SSLCC)	2	0	12	0	15	3	32
7. Horticulture and Vegetable Research Center (HVRC)	0	1	1	6	11	12	31
8. Livestock Research Center (LRC)	1	4	4	0	4	6	19
9. Living Aquatic Resource Research Center (LARReC)	0	9	3	7	4	4	27
10. Forestry Research Center (FRC)	0	3	6	23	30	25	87
11. Forestry Inventory and Planning Center (FIPC)	0	4	4	14	30	10	62
12. Coffee Research Center (CRC)	0	0	0	2	14	3	19
Total	<u>9</u>	<u>30</u>	<u>44</u>	<u>64</u>	<u>118</u>	<u>71</u>	<u>336</u>

Source: NAFRI

The current number of staff in NAFRI is 336, and consists of 9 Ph.D's, 30 with master degrees, 44 with bachelor degrees, and 189 who are technical or vocational graduates. It is reported that an increase of postgraduate qualification staff and upgrading of skills is needed to develop the adaptive technology for many sub-sectors. Moreover it is noted that many of existing postgraduates are appointed to administrative positions rather than research positions. The Organization Chart of NAFRI is specified in the figure as follows.



1.3 Present Research Activities of NAFRI

1.3.1 Crop Research

For research and development relating to crop production, four research centers are carrying out various research activities under NAFRI. The mandate and present activities of each research center is summarized as follows:

(1) Agriculture Research Center (ARC)

Mandate

The mandate of the ARC is to implement the national agriculture research programs on food crop (excluding vegetable and fruit trees) and industrial crops (fiber crop, sugar cane, oil crops and feed crop)

Major research activities

Under the ARC, there is one administration unit and three technical units, namely food crop unit, industrial crop unit and plant protection unit. The present research activities mainly focus on rice research through Lao-IRRI project. In this project,

variety improvement and yield maximization programs have been made continuously since 1990. Most of present facilities were rehabilitated recently under Lao-IRRI project. The research of other crops including upland crops and industrial crops is very limited. However, the research on rodent control mainly for upland area is made by the Lao-ACIAR project.

(2) Horticulture and Vegetable Research Center (HVRC)

Mandate

HVRC focuses on vegetable and fruit tree, variety trials for food processing, seed and seedling multiplication, supply good varieties and information, identify the appropriate technique from the experimental research for supporting and centralization the integrated agriculture development system based on the government policies and guideline.

Major research activities

Under the HVRC, there is one administration unit and two technical units, namely vegetable research unit and fruit tree unit. The present research activities are very limited due to lack of facility & equipment, shortage of qualified staff and shortage of operation fund. In fact, HVRC has received limited donor support, which has been carried out by NGOs, EU and SDC.

(3) Northern Agriculture and Forestry Research Center (NAFRC)

Mandate

The mandate of NAFRC is to collect technical research and experimental stations regarding agriculture, forestry, livestock and fisheries in Northern Laos.

Major research activities

Under the HVRC, there is one administration unit and two technical units, namely vegetable research unit and fruit-tree unit. The present research activities are very limited due to lack of facility and shortage of operation fund. In fact, HVRC has received limited donor support, which has been carried out by NGOs, EU and SDC.

(4) Coffee Research Center (CRC)

Mandate

The mandate of CRC is to implement the technical assistance to NAFRI on coffee research implementation, including inter-cropping system and relevant technology for high quality of coffee production.

Major research activities

Under the CRC there is one administration unit and three technical units, namely coffee research unit, fruit tree research unit and agricultural machinery unit. The present research activities focus on coffee variety trials, development of coffee seed and nursery and development of appropriate coffee cultivation technology. French government has assisted these activities. Recently, the fruits tree research

unit is established, since some developed technologies for coffee cultivation are used for fruits tree crops.

1.3.2 Livestock and Fishery Research

For research and development relating to livestock and fishery, two research centers are carrying out various research activities under NAFRI. The mandate and present activities of each research center is summarized as follows:

(1) Livestock Research Center (LRC)

Mandate

The mandate of the LRC is to implement the research for developing appropriate livestock production techniques, which aims to provide technical information, production techniques, and technologies to producers and policy makers.

Major research activities

Under the LRC, there is one administration unit and tree technical units, namely animal production system survey unit, animal breeding unit and animal feed unit. Present research. Accumulated research outputs of LRC is almost nil, since LRC was training center for cattle production under the Department of Livestock and Fishery and was transferred as research center under NAFRI in 1999. All the research units and staff has just started the research activities. At present, LRC tried to expand research field to small animals including chicken.

(2) Living Aquatic Resources Research Center (LARReC)

Mandate

The mandate of the LARReC is to undertake research on the living aquatic resource including capture and aquaculture in order to provide information on appropriate techniques and technology, and assist the government in the formulation of policies and development plans.

Major research activities

Under the LARReC, there is one administration unit and three technical units, namely fish capture unit, aquaculture unit and data and information unit. The LARReC has received substantial financial and technical assistance through National Aquatic Resource Institute Project supported by DANIDA. The project focus on the sustainable use of aquatic resources. The major components including; i) utilization and management of the aquatic fauna and flora resources ii) impact evaluation on these resources and their users of habit changes caused by environmental changes and water management projects such as hydropower dam, irrigation and flood protection.

1.3.3 Forestry Research

For research and development relating to forestry sector, two research centers are carrying out various research activities under NAFRI. The mandate and present activities of each research center is summarized as follows:

(1) Forestry Research Center (FRC)

Mandate

The mandate of the FRC is to provide efficient and cost effective research, information services and technical advisory support in forest science and technology to all those involved/concerned with conserving managing and utilizing forest and tree resources.

Major research activities

Under the FRC there is an Administration, Personnel, Planning, Finance and Cooperation Unit and 17 functional units, stations and projects covering a range of activities. These are: - Information Service Unit; Silvicultural Research Unit; Non-Timber Forest Products Unit; Agroforestry Research Unit; Tree Seed & Tree Improvement Unit (DANIDA); Support to institution Capacity Building of the National tree Seed Sector in Lao PDR (DANIDA); Supporting the Sustainable Use of NTFP (Gov. of Netherlands NC-IUCN); NTFP Information Center (Gov. of Australia through CARE International Lao PDR); Forestry Research Support for Asia and the Pacific (Gov. of Netherlands through FORSPA); Insect Resistance and Silvicultural Control of the Shoot Borer feeding on Meliaceae in SEA and Australia (Gov. of Australia through CSIRO); Botanical Surveys of Biodiversity Conservation Areas (Gov. of Netherlands through NC-IUCN); Rattan Diversity and Sustainable Management (Dawin); Domestication of *Chukrasia tabularis* (ACIAR); Teak Research Station (SIDA); Agro-Forestry Research Station (SIDA); Forestry Research Station (SIDA); Wild Flower research Station (Gov. of Lao PDR).

(2) Forest Inventory and Planning Center (FIPC)

Mandate

The FIPC has the responsibility for forest and watershed survey, formulating plans for management and use of forests and watersheds, supplying information and providing technical prescriptions and outputs for forest land surveying and planning.

Major research activities

Under the FIPC there is one Administration, Personnel, Planning, Finance and Cooperation Unit and 7 functional units and projects. These are: - Forest Inventory Unit; Watershed Management Unit; Database Management Unit; Landuse

Planning and Land Allocation Unit (SIDA); Watershed Classification Project (University of Bern-Switzerland); Forest Inventory and Management along Lao-Vietnamese Border (Governments of Lao PDR and of Vietnam) and Production Forest Survey and Management (Government of the Lao PDR).

1.3.4 Other Research

In addition to crop, livestock and fishery, and forestry researches, one research center and one project unit are carried out some research activities under NAFRI. The mandate and present activities of each research center is summarized as follows:

(1) Soil Survey and Land Classification Center (SSLCC)

Mandate

The mandate of the SSLCC is to implement soil survey, agriculture and forestry land classification, conducting the study and research on management of agriculture land and fertilizer application in Lao PDR.

Major research activities

Under the ARC, there is one administration unit and tree technical units, namely soil survey and land use planing unit, soil, plant and soil micro biology laboratory unit and soil water and nutrient management research unit. Soil survey and land classification is most important project without any donor assistance in SSLCC, since government policy eager to make production plan and target through setting of appropriate agro-zoning based on the land classification result. The progress of the project is not so good due to shortage of project fund provided from national budget.

(2) Agriculture and Forestry Machinery Applied Research Project (AFMRP)

Mandate

The mandate of the AFMRP is to carry out experimental research activities on agro-machinery in order to provide information to support the decision makers for issuing decrees and regulation to manage, utilize, design and manufacture machinery use in animal husbandry, agriculture and forestry, and agriculture products processing.

Major research activities

Under the AFMRP, there is one administration unit and two technical units, namely technical unit, and machinery utilization technology unit. The AFMRP is new created and accumulated research result is almost nil. Considering the importance of animal feed mill in Lao PDR, Small Holders Animal Feed Mill Design Project is on-going using national budget.

1.4 Donor Assisted Project Under NAFRI

In total, 32 donor-assisted projects amounted to US\$ 4.4 million are in the progress under the responsibility of NAFRI. The following table shows numbers and costs of the donor-assisted projects by research center.

Donor-Assisted Projects of NAFRI

No	Research Centers	Project Cost (\$)	Realized 1999-2000		Year Plan 2000-2001	
			(\$)	(Nos.)	2000-2001 (\$)	(Nos.)
1	ARC	3,289,456	577,795	4	1,113,049	4
2	HVRC	401,400	60,333	4	119,310	2
3	SSLCC	247,415	68,000	3	56,000	3
4	FRC	4,653,199	1,159,054	11	729,489	10
5	FSPC	143,952	81,221	1	336,386	4
6	LRC	1,644,526	6,500	1	534,968	2
7	LARRC	5,877,300	804,445	4	1,486,768	5
8	IMPSPD	375,000	76,800	2	50,000	2
Total:		16,632,248	2,834,148	30 Projects	4,425,970	32 Projects

Source: NAFRI

1.5 Future Research Plan of NAFRI

NAFRI prepared draft Agriculture and Forestry Research Strategy for 2001- 2005 and Vision to 2010. The following seven targets are specified in the Strategy for 2001- 2005 and Vision to 2010.

- (1) Genetic improvement and management of crop varieties, animal breeds and fish species with high yield and stable productivity, resistance to disease and pests, and adapted to climatic conditions,
- (2) Conservation and use of natural resources (soil, water, forests, marshlands) in a sustainable and efficient manner,
- (3) Surveying and identifying the land use patterns with the aim of protecting soil and land resources in sloping land in accord with adoption of an integrated agriculture-forestry approach to land use,
- (4) Increasing the effectiveness of the use of production inputs such as chemical fertilizer, pesticides, animal feed, minerals, medicines, and others, and appropriate use of organic fertilizer (compost, manure, crop residues) in combination with chemical fertilizer,
- (5) Improving the effectiveness and use of farm machinery in agriculture, and more specifically, on modification to machinery for different conditions, and providing technical norms for used of agriculture machinery,
- (6) Improving products and food processing techniques for agriculture and forestry, and gradually introducing bio-technology into food supply and animal feed industries, and
- (7) Strengthening the capacity for applied research in the use of advanced biotechnology techniques, physiology, and biometrics to complement other areas of research to ensure technical progress in agriculture and forestry sectors in the future.

CHAPTER 2 AGRICULTURAL EXTENSION

2.1 General Background

Presently there is no national agricultural extension institution in Lao PDR. At central level, The Department of Agriculture (DOA), Department of Irrigation (DOI), Department of Livestock and Fishery (DLF), the Department of Forestry (DOF) and NAFRI are separately conducting agricultural extension. The agricultural extension services of those departments and agencies are implemented through donor assistance projects and through PAFS and DAFO.

Attempts were made to organize a national extension service under MAF, but this was constrained by decentralization policies and the lack of consensus between the sub-sectors regarding the status of Agriculture Extension Agency (AEA) as the national agency to implement the function. Actually the different department and agencies carry out many “project driven” agricultural extension activities at district level. Still, there is no coordination between donor assistance projects. This situation creates confusion among the government staff as well as among the farmer community regarding different subsidy policies implemented by each project. On the other hands, no importance has been given to develop private agricultural extension especially in the progressive areas.

The lack of trainers and lack of qualified specialists and extensionists and the uneven distribution of staff hamper the agricultural extension function of PAFS and DAFO. On the other hands, very limited or no national budget is allocated to the agencies for agricultural extension in all sub-sectors. Office status and conditions varies among PAFS and DAFO offices. DAFO are generally poor in building structure, furniture supply, office appliances, transportation means and etc.

Because of the weakness of the local agencies and the absence of integrated agricultural extension system in Lao PDR, the present agricultural extension in place is other than ad hoc activities of donors’ assistance projects. Agricultural extension as a major function of MAF and its related agencies at provincial and district level has a low performance.

2.2 Present Agricultural Extension

2.2.1 Agricultural Extension by Public Initiative

There are some reminiscent extensions that are conducted by PAFS and DAFO under their own planning and budget. However, these agencies are not organized properly to conduct agricultural extension. They lack of trained extension workers, have unclear direction and have very limited funds.

There are agriculture extension and training centers that were transferred to the provinces after completion of donor assistance projects or after the re-structuration of MAF in 1996. Some of those centers are still providing extension and training with own provincial resources.

The Hinheup Upland Development Center¹ located in Vientiane Province provides training and extension services to farmers. The extension activities of the center consist of promotion of cash crops, fruit tree, and industrial tree plantation. Due to budget limitation the activity of the center is minimized and a number of trainers have been assigned to other duties by PAFS.

The Nakae Agriculture Training Center² located in Savannakhet Province is providing training to government staff and farmers in the lowland areas of Khammouane, Savannakhet, Saravane and Champassak. The center is presently under Savannakhet PAFS and is having financial difficulties due to provincial budget limitation. Therefore its activities are kept minimal. Lately, the center arranged a 9 months vocational training module for secondary school graduate.

There are also many extension (demonstration) stations that were under the EU Micro Project in Northern Laos that has been transferred to the provinces. The conditions of those stations are starting to deteriorate due to lack of provincial funds to continue the extension activities initiated by the project.

2.2.2 Donor Assisted Agricultural Extension

Agricultural extension in the uplands and lowlands is implemented by a number of Extension Training Centers and extension programs supported by donor assisted projects. The following are the major donor assistance programs in agricultural extension.

In the Crop Promotion Sub-sector, the Agriculture Extension Agency (AEA) actually conducts crop extension with training of provincial and district trainers and village extension volunteers³. The agency mandate is to develop integrated pest management (IPM) through farmers farm schools. Because of the lack of training resources and budget, the activity of AEA was concentrated in 8 provinces. The attempt to build up the national agriculture extension institution is based on the strengthening of the AEA institution and capacity. A pilot extension project (PEP)⁴ was implemented recently to establish working participatory community-based model for implementing agricultural extension and to develop extension staff capacity. The implicit of PEP program is the strengthening of the essential technical support services to farmers through in-service and farmer

¹ Established under the Upland Agriculture Development Project financed by the World Bank and AusAID.

² The Nakae Agriculture Technician School was transformed into a training center, following MAF decision in 1995.

³ Replicated from the model of the Farmer Irrigated Agriculture Training Project (FIAT) UNDP Lao/92/007.

⁴ Pilot Extension Project (1996-1999) financed by the Swiss Development Cooperation (SDC)

training, adaptive research trials and on-farm demonstrations, basic extension and other equipment, improved mobility, and other mean to support extension work.

In the Research Sub-sector, aside from its research components Lao-IRRI has established an extension network in Lao PDR by establishing a National Agricultural Training Center at Naphok, Vientiane Municipality and by annexing training facilities to all Lao-IRRI Research Stations located allover the country. However, the training facilities at the stations are under utilized and are serving a minority of government staff and farmers, who are implementing applied research for the centers. Other Centers⁵ under NAFRI are also providing training and extension to farmers.

In the forestry Sub-sector, two Agriculture and Forestry Extension Training Centers (AFETC)⁶ under the assistance of the Lao-Swedish Forestry Program are presently providing extension services to farmers in the Luangprabang area and its surrounding provinces, and in the Eastern part of Savannakhet Province. The assistance and service provided by the AFETC comprise of land use planning, village development planning, and establishment of village forest nursery, promotion of cash crops, fruit tree, coffee, industrial tree plantation, cottage industry, and small animals raising. The extension program also contains rural credit and gender development components.

Another project under the forestry sub-sector is the Forest Conservation and Afforestation Project (FORCAP) under JICA located in Vientiane Province. The project is providing extension support to farmers located in two districts. The project objective is to reduce the trend of forest degradation through administrative guidance of local government, and through voluntary participation of local people. The assistance and service provided by FORCAP comprise of village forest management planning based on land use and watershed management, provide education and local training to government staff, village volunteers and leaders, and local people involved in shifting cultivation. The project is also promoting cottage industry by training of villagers in producing and weaving paper mulberry.

A lot of training and extension initiatives in forestry were undertaken by other projects such as the NBCA projects and the FOMACOP⁷ project.

In the Irrigation Sub-sector, the Nam Tan Watershed Management Project⁸ located in Sayaboury Province supported by UNDP and UNCDF provides training and extension services to the farmers and shifting cultivators located in 18 villages

⁵ There are about 29 training centers under MAF, in which 14 are under NAFRI.

⁶ Xiang-Ngeun AFETC and Xepon AFETC.

⁷ Forest Management and Conservation Program (FOMACOP) financed by IDA, FINNIDA and the Global Environment Trust (GET). Part of the NBCAs are included in FOMACOP support.

⁸ The actual project is the extension of the Nam Tan Irrigation Perimeter Development Project funded by the Netherlands through UNDP and UNCDF.

of the Nam Tan Irrigation perimeter. The premises of Nam Tan project is used as a training center for training government staff and farmers and is also utilized by other projects. The objective of the project are to improve the capacity of the Nam Tan Water User Association (WUA) and members to productively manage irrigation, and to improve the use of upland farm and forest areas controlled by villages and the watershed as a whole. The Nam Tan project is in deed the only project dealing with the protection of watershed in the upland in order to sustain agriculture in the lowland. The extension activities of the project are developed on the basis of participatory rural appraisal for each village. Support is provided in term of rural credit and inputs through established village development committees (VDC) to activity groups of 5 to 8 families. Other extension and training model were elaborated and field-tested under the Sustainable Irrigated Agriculture Project (SIRAP), the Community Managed Irrigation Project (CMI) and the Farmer Irrigated Agriculture Training Project (FIAT)

In the Livestock and Fisheries Sub-sector, The Strengthening of Livestock Services and Extension Activities is a project executed by DOLF with technical support and financing from the European Union (EU). The objectives of the projects are to strengthen veterinary services and the extension network at all levels for an efficient and sustainable delivery of animal health and production services and thereby, and to reduce incidence of disease, improve management practice and increase livestock productivity. The extension activities of the projects are to establish a sustainable network for the delivery of animal production and health services in the field by Village Veterinary Workers (VWV). Linkages are being strengthened between farmers and government veterinary services in 30 districts of Louangnamtha and Louangprabang provinces. The project also established 2 training centers in the respective provinces.

Extension services in aquaculture were provided by the Provincial Aquaculture Development Project⁹ a project technically by FAO and financially supported by UNDP. The objective of the project in relation to extension are; to improve fish fry production in the provincial stations through training and organization strengthening; to improve fish fry production at farmers level through training and extension; and to support breeding farms and producers through supply of fish fingerlings, parent fish and materials. The project is covering 5 provinces and 14 districts.

2.2.3 Private Extension

Very little private extension services is provided to farmers aside from coffee plantations in the Boloven Plateau and tobacco plantation of the Lao Tobacco Company. Private extension deals through contract farming, actually there are no

⁹ Project Lao/97/007.

regulatory framework for agri-business and contract farming are practiced without any legal entity that is protecting both producers/sellers and buyers. There are many cases of buyers dumping prices¹⁰ or of producers/sellers selling their products to other buyers¹¹.

Most of support services¹² to the farmers by the donor assistance project are provided with subsidized price. This situation creates farmers' dependency attitude towards the government subsidies and hampers the development of private agri-business because small entrepreneurs have to compete with products produced from subsidized ground.

2.3 Future Development Strategy for Agricultural Extension

According to the government strategic vision “ the demand for agricultural extension services in Lao PDR shall be farmer-driven, and the mechanism shall be to upgrade the capacity of districts to demonstrate and share productivity enhancing technologies in farmers' fields. Through trials and demonstrations, farmers shall develop a menu of production choices in concert with market price signals”. The philosophy of agricultural extension in vision 2020 is a demand driven extension, hence it enhance the development of extension services at provincial and district level. Considering the diversity of extension model presently in practice due to the lack of integrated system the study stress the need to strengthen agricultural extension services at PAFS and DAFO level through strengthening of management and planning capacity and through the development of FSEW training at the AFETC. The present training conditions is elaborated further in the following paragraph.

There is also an urgent need to coordinate all extension activities under the current donor assistance program and to establish a national integrated agricultural extension system, which could provide direction to PAFS and DAFO and could support farmer institutions and farmers as well as private agri-business entrepreneurs.

Drawing upon the experience of past and ongoing agricultural extension projects, the following will need to be developed for strengthening the extension services. At central level, a National Agriculture and Forestry Extension Agency¹³ (NAFEA) would be established to coordinate, plan and implement all agricultural extension activities within the mandate of MAF. A Central Extension Training Unit (CETU) attached to NAFEA would be established. The CETU would coordinate the implementation of agricultural and forestry in all provinces,

¹⁰ Case of eyes drop beans in Louangprabang.

¹¹ Case of tobacco leaves in provinces bordering Thailand.

¹² in term of seed, animal breed, fertilizer, animal feed and other inputs

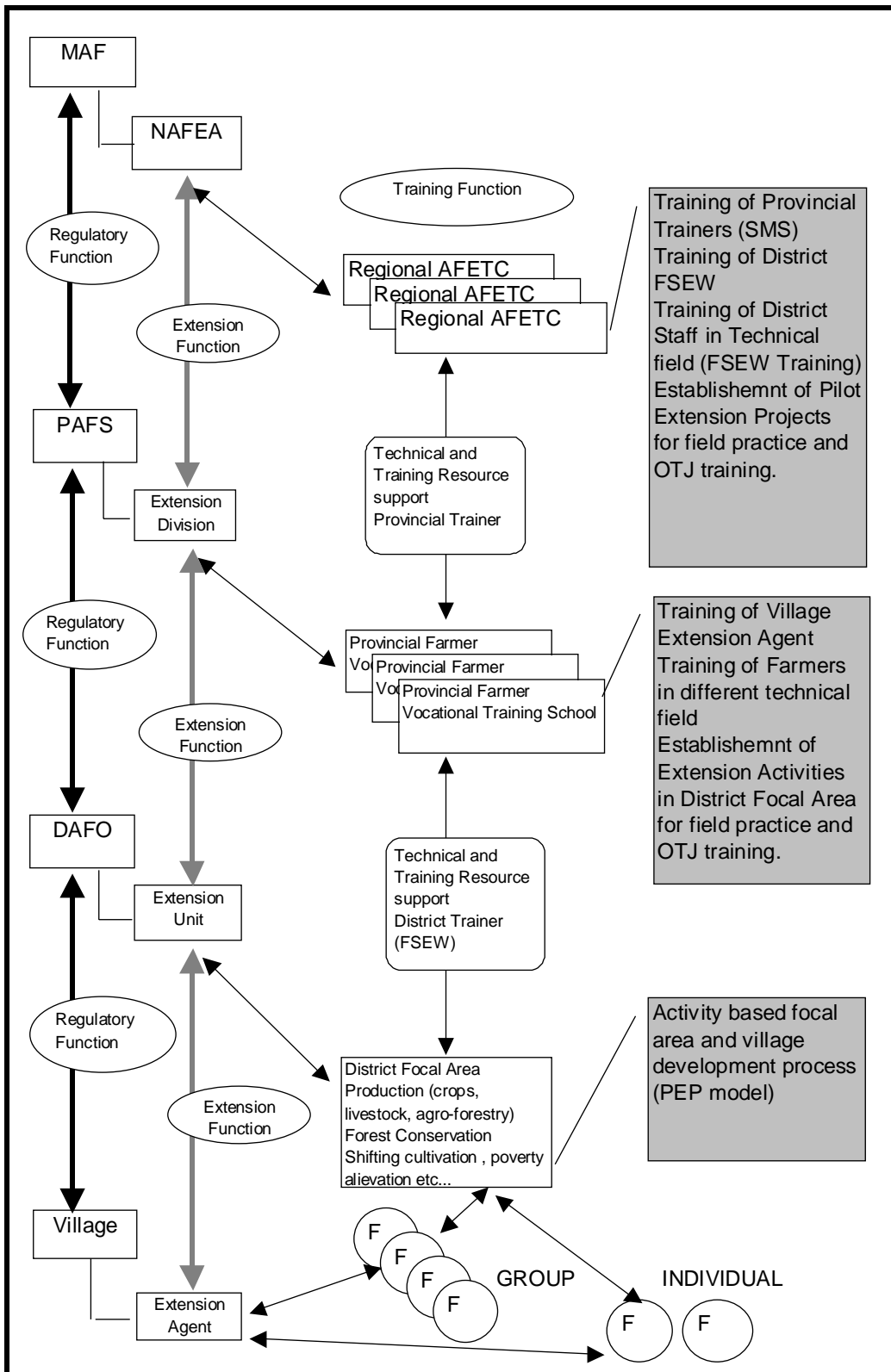
¹³ MAF Ministerial Decision No. 0306/KP.CT.2000 dated 4/4/2001 for the establishment of the National Agriculture and Forestry Extension Agency.

drawing upon experts and resource persons available in the various departments of MAF. The CETU would be responsible for preparing training and extension plans in collaboration with PAFS and Regional Agriculture and Forestry Extension Training Centers (RAFETC).

At provincial level, a Provincial Extension Training Unit (PETU) would be established within PAFS. It would comprise staff assigned from various existing sectors (crops, livestock/fisheries, forestry and irrigation). The role of the PETU would be to coordinate the extension programs of the districts within the province and to organize the training of the district staff. The PETU staff would receive training on extension from the CETU and RAFETC and would be responsible for training staff of DAFO. The PETU would also have responsibility for planning and monitoring extensions programs, coordinating input supplies with suppliers, credit institutions and markets, and diffusing information and messages through the mass media.

At district level, a training program, which aims to upgrade the technical knowledge and extension skills of DAFO technical staff would be developed. The training program would target district staff to enable them to become effective polyvalent, generalist Farming System Extension Workers (FSEW). In coordination with the RAFETC project, the FSEW would be trained in the mix of technical skills needed to support the farming systems in each area. They would be assigned responsibility for specific villages each year and would develop work programs in a participatory manner with farmers, including extension messages to be demonstrated through field plots and regular visits to the villages according to cropping calendar prepared for the season. In addition to their strictly extension role, FSEW would also be expected to act as facilitators helping villagers to identify needs and formulate proposal financing under the national rural development program or under donor assistance projects.

The Figure as follows shows the interaction between the different administrative, regulatory and extension functions at from central to village level.



Agricultural Extension and Training Function

CHAPTER 3 FARMERS ORGANIZATIONS

The government is currently implementing various policies and measures to promote and develop farmers' organizations in a view to obtain better agricultural production efficiency and to enhance the participation of the farmers in the development of their community. Taking in mind the breakdown of the "agricultural production cooperatives¹⁴" in the seventies and eighties, new directions have been given to develop service cooperative societies within the farmer community in order to build-up rural capacity.

There is no agricultural cooperative in Laos, but the basis and organizational set up of the "service cooperatives¹⁵" is found in the existing farmer organizations established under donor assistance projects, credit program, and government development initiatives. There are actually formal and non-formal farmers' organizations the most progressive organizations are the water users' organizations. Non formal organizations are called "groups" and are formed under the guidance of the village authority or under the village organization for specific income development activities.

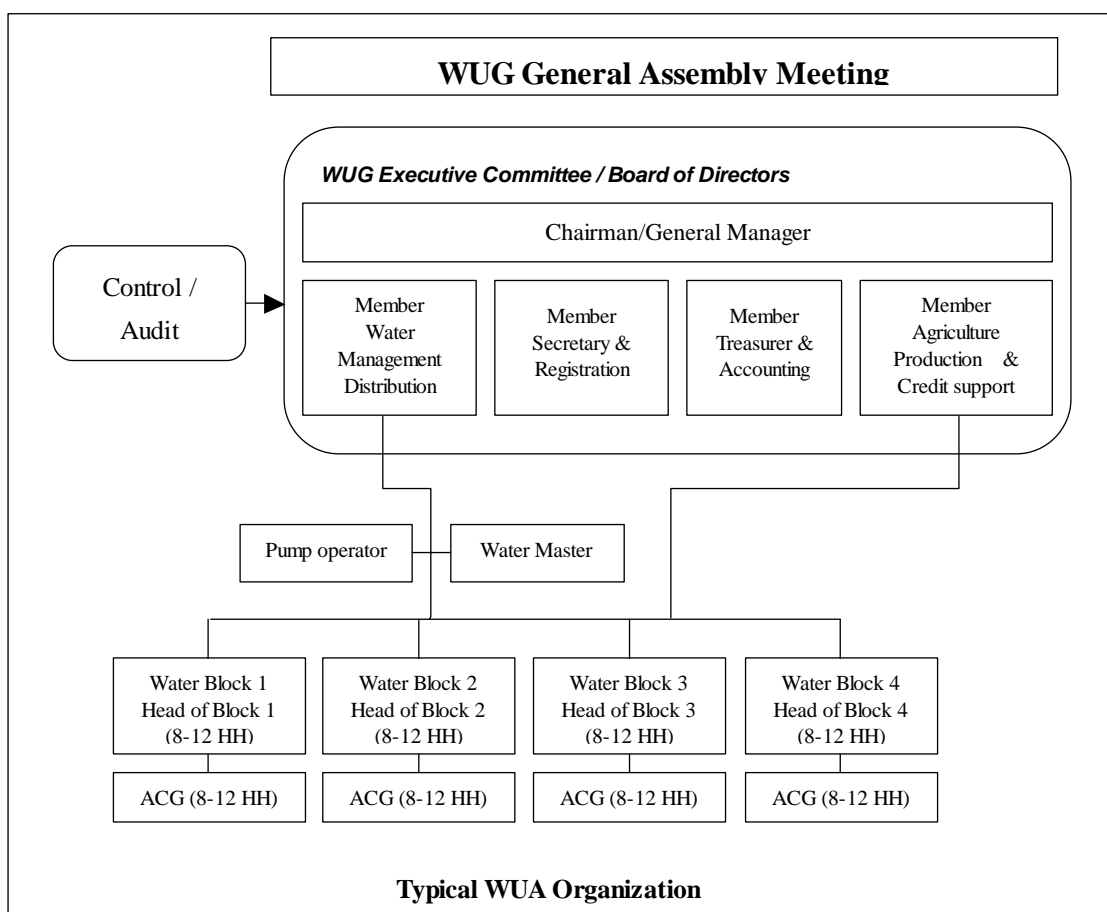
3.1 Water Users' Association (WUA)

The WUA is a formal farmer organization, which act as a juristic person. Despite their legal independent entity the WUA is also a communal organization. Therefore, it is governed by a steering committee representing the village administrative authority of all the villages located in the irrigation scheme. The WUA management committee, which is elected by the WUA's General Assembly, operates the irrigation scheme. A sample WUA organization chart is shown in the following Figure.

The WUA act as a service cooperative, it is not only responsible for the operation and maintenance of the scheme but is also responsible for the procurement of input supplies and supply credit for the agriculture production of the members and for the marketing of farm products. With their legal entity the WUAs have the right to undertake business venture with the APB/SOCB and trading companies.

¹⁴ The agricultural production cooperatives in Laos were established on the model of the "kolkhoz" of the former U.S.S.R. The individual farms are replaced by one collective organization, the input of the farmers being their labor.

¹⁵ The primary objective of the service cooperative is to render services to its members, including the supply of agricultural inputs such as seed, fertilizer and insecticides, the processing, marketing and storage of products, the provision of technical equipment (hire of agricultural machinery), and the arrangement of credit supply. The independence of the members, particularly in production process and management policy matters, remains untouched. The cooperative just tries to help them pursue their common interest.



Irrigation public assets (pump, headwork, canals and structures) were fully transferred to the associations¹⁶. The irrigation system is under the full responsibility of the WUAs. Irrigation Service Fee (ISF) system is introduced and in order to recover the cost for future investment the WUAs are in the process to increase their Irrigation Service Fee (ISF) to cover all O & M costs, and to include a Village Development Funds (VDF).

Despite the establishment of WUAs through the stepwise process developed by the government¹⁷, the associations are still young and need to be further strengthened. The balance sheet and result reports of those WUAs have not been properly audited and there has been very limited support from PAFS and DAFO. APB is also hesitating to provide medium term and long term to the associations. Firstly, due to the precarious legal entity and to the financial transparency of those organizations, and secondly, because APB is lacking credit funds.

In the Community Managed Irrigation Project (CMI)¹⁸, the establishment of WUA is one criterion required by the Asian Development Bank (ADB) for development

¹⁶ The IMT transfer was designed by the Sustainable Irrigated Agriculture Project (SIRAP) of the Mekong River Commission (MRC).

¹⁷ The process was developed by the Sustainable Irrigated Agriculture Project (SIRAP) and further replicated by the Department of Irrigation under the National Pump Installation and Management Project (NPIMP).

¹⁸ CMI area is covering provinces in northern part of and part of Bolikhamxay province.

CMI schemes. WUA registration is a task related with the community development process (CDP) developed by the project.

The CD process is a software component to initiate the development of participatory and community approach and consists of: (i) Consulting with the local farmers and site investigation, (ii) Organizing and training of Community Organizers (PAFS/DAFO Staff), (iii) Identification beneficiaries, (iv) Training farmers and organizing WUA, (v) Electing WUA boards, (vi) Making agreement with the local farmers in order to facilitate the local participation and contribution, (vii) legalizing the WUA establishment by DAFO and PAFS, (viii) Submitting request for WUA registration to District Financial Office.

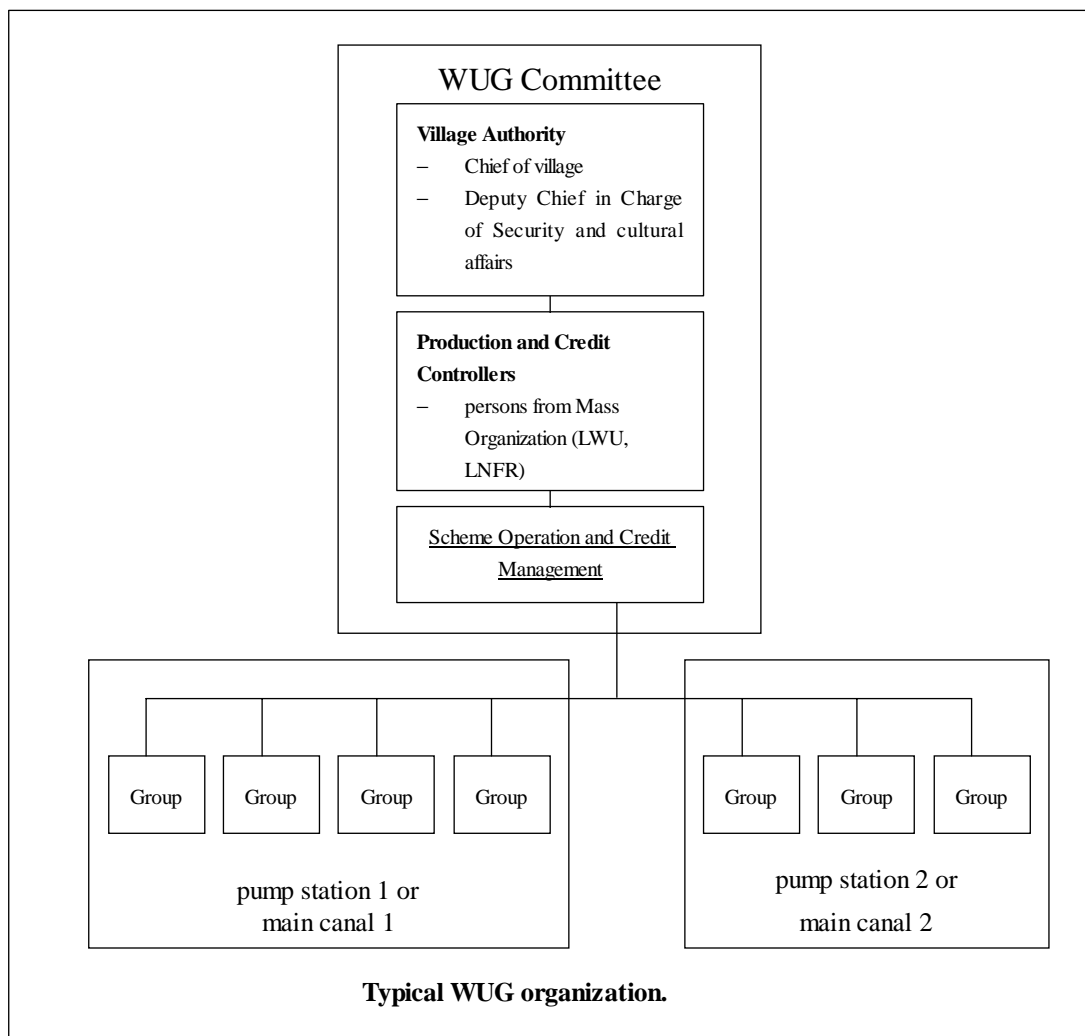
The CMI's CD process is in fact an IMT process in practice for new schemes to establish and register WUAs already at the start of the construction of new irrigation schemes. The project referred to the following policies and regulations to establish WUAs: (i) Decree No 0156 of MAF for the establishment of WUO, (ii) Guideline No 0976/DOI about "The Water User Association", and (iii) latest Notice of Prime Minister Office No 26/PM concerning the nation wide policy to transfer the operation and maintenance and the public irrigation assets to communal farmer organization.

After the completion of the SIRAP project in 1998, the CMI project is actually one of the major project in DOI, which is emphasizing the participatory approach and IMT particularly in the development of formal WUO. Since the project inception in 1996 to the present time CMI has supported the registration of 39 WUAs.

3.2 Water Users' Group (WUG)

In all the irrigation schemes constructed with the assistance of DOI and PAFS there is a water user group established by the village authority. WUGs¹⁹ are established under the directive of DOI for the operation and maintenance of the irrigation scheme. The WUG organization is a village driven organization headed by the chief or deputy chief of village. The size of the organization varies depending on the size and complexity of the irrigation scheme. In irrigation scheme covering more than one village, the WUG committee is set to include members of all villages. The village that has most land/members is taking the lead and WUG's chairman position. The by laws and article of association of the WUGs are drafted by the PAFS of each province. The organization chart of WUG is similar to the WUA but with less function depending on the size of the scheme. A model WUG organization chart is given in the figure as follows.

¹⁹ Non formal water user organization are called water user group



In the case of WUG, the responsibility for the operation and maintenance of the irrigation scheme have been transferred to the farmer organization. The WUG are operating and collecting water charges with the farmers. Water charges in most of the scheme is structured to covers electricity or fuel expenses (in case of pump scheme), cost for mechanical operation and maintenance and fee for the pump operator. In some of the scheme fee for water masters and premium for the WUG committee members are also included.

In the case of WUG the public irrigation assets still belong to the government. For major repair, WUGs get assistance from PAFS. In Savannakhet and Khammouane, WUGs took the initiative to borrow money from the bank to construct main canal and secondary canals²⁰. This proves that there is a developing sense of ownership among the farmers. The tendency of strong WUGs will be to upgrade their status to WUAs.

In the long run, WUGs that are relying on the village legal entity to manage and operate irrigation system would not be reliable to undertake any legal obligation

²⁰ Case of Lahanam and Boua Khai, in Savannakhet, and Hinkhan scheme in Khammouane.

i.e. to loan from APB as an organization. Because, the function of the village authority as a social administration will not be conform to the business status of the farmers' organization. The loan process practiced previously by the WUGs in Savannakhet and Khammouane has weak payback guaranty to the APB or SOCB that have provided medium term loan to the farmers. Nevertheless, the loans were approved based on a petition and guaranteed by the village and district authorities, this do not give any assurance on the loan payback. Hence, in the concept of the master plan, the development of the legal framework of WUG would be an important component.

3.3 Credit Groups and Credit Cooperatives

(1) APB Credit Groups

The credit policy of APB is to provide credit to group of farmers (5 to 10 families). In the study area especially in the irrigated fields there are established APB credit groups. The practice to group the farmers for the credit program is done differently in the 3 provinces. In some provinces credit are provided to the WUG's production groups ²¹(water blocks group). But in other provinces the grouping of farmers is done independently from the water user organization.

The APB credit groups are formed for seasonal loan (short term). They are heterogeneous, therefore they will not be composed of the same persons when the groups are reformed for the next season. The APB credit groups have no production function. They rule as a credit group with the sole aim to return money back to the bank at the end of each production season. After payment is made to the bank the groups disappear.

Because the only reason for the farmers to group themselves is for getting credit support (in kind as well as in cash), the credit groups have no production function. No support is provided from APB to the credit groups in term of knowledge about the utilization of the supplies (fertilizer) and equipment. On the other hand, PAFS and DAFO also provided very limited technical knowledge concerning the appropriate use of fertilizer and equipment. However, the model developed by APB to provide credit to the farmers grouped into blocks and called production group under WUG in Bolikhamxay could be a good starting point.

(2) Credit Cooperatives

Credit cooperatives were promoted during the eighties similar to the agricultural production cooperatives they all disappeared. Very little information is available concerning the operation of those cooperatives. However, it is believed that those cooperatives operated as small banks.

²¹ Case of Hadsaykhoun, Thana, Sivilay and Nongkeun in Bolikhamxay.

Under foreign assistance the Farmer Credit Cooperative of Kasi District, Vientiane province is still operating. The cooperative received funds from the CCFD²² for the development of the district. Part of the funds is utilized as revolving funds and is loaned to the members of the cooperative at very low interest rate (5%). The loan amount per family range from 3 to 10 millions Kips. The money from the loan is utilized for the production of raw materials for the fruit jam and sweet factory owned by the cooperative. The cooperative have loaned about 120 millions Kips to 96 member households.

(3) Activity Revolving Funds Groups

Many credit groups were formed under revolving funds program or credit program under donor assistance projects (IFAD, Lao-Swedish Forestry Program, SIRAP, Namtan Irrigation etc.). Most of the revolving funds and credit are targeting village income generating activities such as weaving, chicken and pig raising, and other small cottage village industry. The funds are provided to the village and are managed by a committee. Activity Revolving Funds Groups are of small size (5 to 15 families). The amount of the loan is small (50,000 to 500,000 Kips per families depending on project).

3.4 Communal Activity Groups

(1) DAFO Demonstration Groups

In some area, DAFO organized farmers into production groups for growing some particular crops or for doing irrigated agriculture practice. It is a kind of group dynamic before initiating the farmers to form WUG. It is observed that those demonstration groups are not viable and disappear as soon as the support of DAFO is stopped²³.

(2) WUG's Production Groups

In the organization of WUG the water block groups are called production groups. However, the group function is mainly for water management. The function of "production grouping" is very limited. Farmers are not shared resource to buy fertilizer and other inputs for the production and they are still selling farm products on their own.

(3) Contract Farming Groups

The only crop under contract farming activity in the study area is tobacco. The Lao Tobacco Company engaged contract with group of farmers to produce tobacco. The contract-farming group also got credit support from APB.

²² A French NGO

²³ In the case of Beungwa. Khanthabouly district, Savannakhet Province.

In the Boloven Plateau, farmers group themselves into Coffee Group. The coffee groups are engaged in contract farming with the Coffee Association, which represents state and private enterprises in the coffee business. The Coffee Groups is also borrowing money from the APB and SOCB as credit groups. This is an example progressive farmer organization. The Coffee Groups are mostly village based but in the future could be developed into producers' associations that cover wider areas.

(4) Village Forestry Groups

Under the different village forestry planning models used in Laos, there are village forestry groups that are organized to implement forestry development activities such as village nursery and plantation, village NTFP exploitation etc.

A good example of forest conservation through the development of village forestry group is given at Nam Peng Village of Oudomxay. A forest conservation project implemented through IUCN. Following the village forestry-planning model developed by the project the village was able to establish a process for the sustainable utilization of NTFP (sweet bamboo shoots and cardamom). Village Forestry Groups were formed and allocated exploitation and conservation areas. The NTFP collected are sold to Village Buying and Selling Group. A percentage of the revenue for the sale is provided to the village as village development fund. Actually, the village has accumulated enough funds to construct a new school, to construct 2 clean water tap, and to install a electrical generator that is servicing all households.

(5) Buying and Selling Group

Livestock Buying and Selling Group are established in some provinces by the district authority or by the Provincial Food Supply Company. The group is contracted by the company to buy cattle, pig and poultry at village level and to sell then to the company at specific prices. Usually, the group is formed of 3 to 5 small entrepreneurs at village level, who have also the right to borrow money from APB as a credit group. Nonetheless, APB has had few loans to the buying and selling groups.

Similar farmer organization is organized for the procurement of rice for the Provincial Food Supply Company. The difference is that the group is formed by rice-mill owner and mechanical rice threshing machine owners.