Rural Development Project Dak Lak (RDDL) Vietnam

Concept for Sustainable Upland Farming in Dak Lak Province

Maurice Gallen

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
November 2004
A Concept on Development and Improvement of Upland Farming Systems

TABLE of CONTENTS

EXECUTIVE SUMMARY

1. INTRODUCTION
   1.1 Rationale for Project Intervention
   1.2 Project Objectives and Results
   1.3 Anticipated Outcomes

2. CONTEXT for DEVELOPMENT AND EXTENSION OF SUSTAINABLE UPLAND FARMING SYSTEMS
   2.1 Existing Upland Farming Systems and Shifting Cultivation
   2.2 Reduction in Access to Forest Land
   2.3 The Socioeconomic and Cultural Environment.
   2.4 General Strategies for Improving Farm Livelihoods

3. PTD - THE CONCEPT
   3.1 Definition and Description of the PTD Process
   3.2 PD - Participatory Diagnosis
   3.3 PAEM – farmer designed trials
   3.4 Extension of Successful Technologies

4. PROPOSED PILOT IMPLEMENTATION of PTD in DAK LAK
   4.1 Steps in Introducing the Upland Farming Concept & PTD to the AEC
   4.2 Broad Implementation Strategy for Result 2 in Phase 1.
ANNEXES:
1. Soil Fertility, the Forest Fallow & the Nutrient Cycle.
2. Provincial Institutions and Organisations associated with the development and extension of sustainable upland farming systems;
4. Sustainable Agriculture and Conservation Agriculture.
5. Notes on Village, Farmer, Field Selection and M & E in PTD
7. Participatory Technology Development.

TABLES:
1. Household in target communes dependent on Upland farms and livestock.
2. Farming Groups and Current Dynamics in Dak Lak Farming systems.
3. Conventional versus Participatory approach to Farming Technology Development.
4. Steps in the introduction of the Upland farming Concept and PTD to the AEC.
List of Acronyms used in the Paper.

ACO Agriculture and Cadastral Office at the District
AEC Agriculture Extension Centre at the Province
CA Conservation Agriculture
CBFM Community Based Forest Management
CBN RD Community Based Natural Resource Development
CDP Community Development Plan
CEW Community Extension Worker
CIG Common Interest Group
DARD Department of Agriculture and Rural Development
DPI Department of Planning and Investment
DES District Extension Service
ETSP Extension Training Support Project
GTZ German Agency for Technical Cooperation
IF Implementing Farmer
LUP/LA Land Use Planning and Land Allocation
M&E Monitoring and Evaluation
NRM Natural Resource Management
PAEM Participatory Agriculture Experiment Management
PD Participatory Diagnosis
PPM Project Planning Matrix
PRD Participatory Resource Development
RDDL Rural Development Dak Lak
SFDP Social Forestry Development Project (Son La)
SFSP Social Forestry Support Project
VDP Village Development Plan
EXECUTIVE SUMMARY.

This paper outlines an approach by the Dak Lak Rural Development Project (RDDL) to the development and improvement of upland farming systems in Dak Lak in general and to 4 target communes in the districts of Ea H’leo and Lak in particular. This suggested approach to Result No.2 in the Project is consistent with the other activities which promote the overall Project objectives of encouraging participatory planning procedures which enable community and social organisations as well as government institutions to identify and thereafter support sustainable natural resource management processes. The Project is expected to run until the end of 2009.

The Project initially seeks endorsement of the Project approach from its obvious collaborator in this initiative namely the Province Agriculture Extension Centre (AEC). Through this liaison the Project seeks to maximize its impact and strives to assist in the development of the Agriculture extension services to the rural population.

The prevailing farming systems of the poor minority groups in the target area do not have the benefit of irrigation. Traditionally these groups farm the slopes in a crop/fallow rotation commonly know as shifting cultivation. Livestock is incorporated to varying degrees and the system overall is therefore referred to as a rainfed integrated farming system. Slash and burn at the end of the dry season is followed by cultivation, sowing and harvesting through the wet season are the major farming activities.

The slash and burn process has many inherent bad soil management practices which makes the farming sites very prone to erosion, loss of topsoil, reduced fertility and water holding characteristics and consequent falling crop productivity.

While land was abundant the shifting cultivation cycle included sufficient time for each site to recuperate in term of soil fertility and productivity potential before they were reused. Discussions with farmers, organisations and institutions involved with rural development and sustainable natural resource management have confirmed that many of the poorest farmers are being forced to shorten the fallow period in their slash and burn cultivation cycle. This situation is a consequence of an increased population caused by a large in-migration over the last 15 years (both programmed and ad hoc), the recent dominance of perennial crops compared to subsistence farming in the rural economy, and the introduction of land laws that restrict the traditional use of the forest resources by the customary landholders.

Therefore, with traditional farming practise s that are not environmentally sound and with reduced access to the amount of land needed to support these traditional crop/fallow rotations, the poor subsistence farmer’s situation becomes desperate as productivity from gardens on sloping land falls and his household encounters food shortages. The outcome often is that the household has no option but to encroach illegally on state controlled land.

There are two main household level strategies that have the potential to improve these agriculture based family livelihoods dependent on farming on sloping land. They are:

- Intensification of existing production patterns (improved varieties and breeds and better farm management)
- Diversification of production and processing (more alternatives and spreading risk)

The Government at the various levels supports these strategies by funding research and extension organisations to develop, introduce, test and disseminate new and more productive varieties of crops and livestock. However, little success has been achieved to date with attempts to change inefficient traditional farming methods on these sloping sites.

Intensification includes improved farming practices and especially better soil management practices like those contained in an approach to sustainable upland farming called Conservation Agriculture. The 3 basic principles of CA are:

- Keeping the soil covered as much as possible including minimizing cultivation
• Maximizing the incorporation of organic matter into the soil
• Rotating the crops.

International experience has shown that if new technologies are to be accepted by farming communities they must have participation in the design and development of the technologies.

The general approach proposed by the Project is a two-fold one through an alliance with the Province Agriculture and Extension Centre (AEC) and through partnerships with the farmers. The AEC already has a mandate to assist in raising livelihoods and contribute to sustainable development of natural resources, and has the benefit of a network stretching down to village level.

The Project will support the AEC in encouraging farmers to:

A. Use Participatory Technology Development (PTD) to

• Identify their farming problems – PD (Participatory Diagnosis) at the Village and also through the Commune PTD Working Group.
• Design and implement appropriate farm based agriculture experiments aimed at finding solutions to the problems – PAEM (Participatory Agriculture Experiment Methodology)
• Evaluate the trials with their peers.
• Support dissemination of the new practices as appropriate.

B. Gain better access to those improved farming technologies, practices and teaching aids that the Agriculture Extension Centre and associated organisations (eg Farmer’s Union and Women’s Union) already possess. Through the Project training programme build the capacity of AEC and these social organizations to manage and deliver appropriate agriculture extension services to the rural community.

This PTD process is a progression of activities which follows the Commune Development Planning (CDP) process which starts at the village with VDP identifying amongst other things their general agriculture related problems. The follow-up PTD process then gives an opportunity for the village farmers through PD to more clearly define their particular farming problems and to pursue their own solutions within a partnership with the AEC.

The final step in the process would be the transfer and replication of successful technologies to other communities with similar farming practices.

At the same time Social Organisations with the role of assisting the farmers in planning for and achieving sustainable natural resources management would have the opportunity to be trained in those disciplines and topics identified through specific training needs assessment and the CDP process.
1. INTRODUCTION

The project on Rural Development Dak Lak (RDDL) is being implemented by the Department of Planning and Investment (DPI) of Dak Lak Province with support from the German Agency for Technical Cooperation (GTZ). The Project started in January 2003 and the first phase will run until December 2005 with probable extension through 2 more phases until the end of 2009, a possible total of 7 years.

1.1 Rationale for Project Intervention

Traditional farming systems in the Central Highlands are still based on shifting cultivation. This system of slash and burn met the requirements of a subsistence based economy which consisted of few people spread over a large well forested area. It contains some inherent bad farming practices which however had minimal adverse impacts while farming sites were plentiful. Burning removes organic matter and kills soil micorganisms and together with ploughing (hoeing) exposes the surface to erosion. The top soil is lost via the impact and run-off from wet season storms and site fertility and productivity is quickly reduced. As productivity at a particular location drops below breakeven, the farmer moves on to a new site and the cycle continues. (See Annex 1 – Shifting cultivation, Soil fertility, the Forest fallow & the nutrient Cycle.

When the availability of alternative new farming sites was unrestricted, this system at least produced enough food for individual families. Households were also able to supplement seasonal shortages through the hunting and gathering of forest products via access to abundant forest resources.

At present however, with a large influx of land seeking migrants in the 80s and 90s swelling the population and the government alienating much of the forest land under state farms and protected and special use forest classification, the traditional land users have been forced into a more sedentary life-style. Access to a necessary wide selection of farming sites, as short term stages in a cycle of cultivation followed by a long site recuperating fallow, has decreased significantly. Government regulations now condemn the shifting cultivation cycle as contributing to forest destruction. The fallow period on available land is not long enough for sites to regain their fertility and hence production from this customary farming system can no longer provide the average household’s food requirements.

1.2 Project Objectives and Results.

Since there is no more or very little land available for distribution, it was therefore decided in the Project design phase to support the effort of finding alternatives to this dependency on gardening on sloping land or at least to making the cultivation practices used on these slopes more sustainable.

This is obviously in accord with the Project’s Overall Goal which is to contribute to increased livelihoods through sustainable and participatory Natural Resource Management and the Project Development Goal which is:

“that villages in selected areas increasingly improve their quality of life particularly by practicing sustainable (economically, socially, and environmentally sound) natural resource management.”

The Project Planning Matrix (PPM) also states that the Project should focus on strengthening the capacity of organisations and institutions which have the role of providing rural services and which contribute to participatory natural resource planning and development. In summary those services include:
1. Facilitation of active participation of villagers in development planning and implementation of respective measures at village and commune level by government and social organisations

2. Facilitation of participatory identification and introduction of sustainable upland farming options by agriculture extension service (NRM planning)

3. Facilitation of participatory LUP/LA and CBFM planning by government and relevant social organisations (NRM planning)

4. Establishment of commune nurseries

5. Support of services to supply adequate farm inputs, e.g. seed/planting material, fertilizers, chemicals, vaccines and drugs for animal husbandry, extension of information on cropping and animal husbandry, agriculture and price information, agriculture tools and machinery, etc

6. Support of small credit groups by the Women’s Union in respect to facilitation of credit access and credit management at commune and village level.

7. Marketing of agriculture and non-timber forest products

8. Skills development for rural women in traditional crafts in support of income earning activities.

In particular in the context of the formulation of this Concept, Result 2 in the Project Planning Matrix (PPM) states that Upland farming systems are developed and improved.

The related activities are:

1. a concept for upland farming systems should be drafted and reconciled through a participatory approach and drawing on relevant experiences from farmers and elsewhere.

2. formulate criteria for model area selection focusing on critical ethnic minority areas (poverty) and agro-forestry.

3. conduct field survey focusing on crop, animal husbandry, markets, existing farming technology of farmers, diversifications and economic returns to farm households.

4. select model farms and identify the size, establish demonstration plots in relation to required inputs (seed, livestock, pesticides, tools) budget and manpower.

5. jointly prepare management plans for those models with selected households and start implementation

6. improve capacities for households and organizations in relation to training

7. establish monitoring and evaluation (M&E) systems for farming systems based on household/community.

8. start dissemination & replication in other areas.

1.3 Anticipated Outcomes.

For these activities to be successfully implemented it is anticipated in the PPM that the following outputs will need to be realized:

- At commune level a Working Group with representatives from all target villages will be established. It will have the role of facilitating the implementation and monitoring of project activities especially those relating to support to agriculture production. It will also create a forum where project performance can be evaluated. This working group should be established by 12/2003.
• By 5/2004 a concept and criteria of upland farming models based on knowledge/needs and experience of farmers are developed. This concept will take into account the information received from farmer surveys identifying existing agriculture outputs from farming systems, existing farming technologies, present returns from farming endeavours and the perceived opportunities for diversification.

• By the beginning of the wet season (July/2005) at least one demonstration plot which particularly considers women farmers’ needs will be established for each commune. Natural conditions, diversification possibilities, potential returns and the prevailing market environment will be taken into account in the design of demonstrations aimed at finding long-term sustainable solutions to farmer identified problems in existing farming systems.

• By the middle of July 2005, 30% of interested farming households will have received the opportunity to participate in training in upland farming technologies.

This concept presents an approach to achieving these outputs based on discussions with farmers in the target communes and with Institutions and Departmental sections associated with developing and proliferating sustainable farming systems in the agricultural community. (See Annex 2 for a description of these Organisations)

Chapter 2 outlines and analyses the characteristics of the prevailing farming systems in Dak Lak and looks at its obvious weaknesses and its inherent negative impact on the environment and its lack of sustainability. It also considers the socio-economic conditions which have influenced the direction of the development of upland farming systems.

Chapter 3 describes the process and the main players in PTD – a process which includes the farmer in the identification of his problems and the process of finding an appropriate solution.

Chapter 4 sets out the approach of the Project in supporting the participatory identification and development of sustainable farming practices within upland farming systems.

2. CONTEXT FOR DEVELOPMENT AND EXTENSION OF SUSTAINABLE UPLAND FARMING SYSTEMS.

2.1 Existing Upland Farming Systems and Shifting Cultivation

An assessment of farming systems in the target districts has illustrated that many of the traditional inhabitants of the localities are by default or choice farming on sloping land. (See Table 1 in Annexes).

Traditionally without elaborate irrigation systems and experiencing a distinct wet and dry season of about equal duration, ethnic farmers in the Central Highlands have traditionally been exponents of shifting cultivation practices on sloping land. They have as their staples, upland rice, varieties of local maize, cassava and various varieties of beans.

Their system can be classified as a rainfed, integrated rice-based system where upland rice is grown in rotation with a range of annual crops in non-permanent sloping fields. It is characterised by subsistence farming, high demand for arable sites and limited market access. This is a common situation in the poorer areas of Dak Lak. (See Annex 3 for more information on Farming Systems)

Shifting cultivation consists of several distinct actions which may vary in timing and intensity from commune to commune but generally follow the following steps:

• All vegetation on the site is slashed in the later part of the dry season. (April in Dak Lak) On occasions some trees valued for their medicinal or spiritual value are kept but these trees are rare and do not have a significant impact on site stability.
Once the cut vegetation is dry the site is burned. Any unburnt material is then raked into heaps and fired again.

The site is then completely hoed to approximately 15cm with the ash being incorporated into the cultivated layer.

Once the wet season has commenced and the site contains enough moisture to carry the seedling beyond initial germination, sowing of the crop commences. This is usually hill rice, native or hybrid maize, a bean crop or cassava.

Weeding is carried out as required to prevent competition by non-useful species for moisture, nutrients and light.

The crop is harvested as it matures with most trash being left in the field although in some instances it is taken back to the home and used for fuel or occasionally fodder for livestock.

The cycle is repeated until the site no longer gives a return commensurate with the required inputs of labour and materials. The farmer then repeats the process at a new location giving the old site an opportunity to revegetate and regain some of the lost fertility. This period of recuperation is called “the fallow”.

The process is labour intensive but requires little capital investment apart from the seed although in a lot of instances this is carried over from the previous harvest.

This dependence on the forest fallow as a source of nutrient build up for the next crop is the central principle of shifting cultivation. Sufficient time is required for the forest to regenerate and replenish the nutrients in the soil if the next cropping cycle is to be successful. (See the Forest Fallow and the Nutrient Cycle in Annex 1)

This shifting cultivation system of slash, burn, crop and fallow, despite traditionally and historically meeting community food requirements, is in reality not a very efficient system especially with regard to issues of sustainable soil management and maintaining site productivity. It is wasteful of resources, is labour intensive and has many components which are not good soil management practise.

The obvious shortcomings are;

- The burning process associated with the system may make nutrients available short term through the mineralization of organic matter but it creates a situation where this now exposed nutrient bank can be quickly washed away and lost from the system.

- The heat from the burning of trash kills many of the microrganisms in the top layer of soil which are so essential to producing and maintaining good healthy soils.

- The soils are left exposed and prone to erosion especially following the hoeing of the site after burning. Storms wash away the nutrient rich top soil and the less fertile and poorly structured B horizon is left as the sole source of nutrients for the crop.

- Water absorption into the soil profile falls dramatically as the more friable and porous top soil is lost. Water rushes off the site carrying the top soil away before it has time to soak down into the soil profile. Crops become more susceptible to moisture stress, and the potential growing season is shortened.

The direct outcome is soil conditions which provide less than optimum growing conditions for the farmer’s cropping efforts. The farmer lacks the capital to provide the necessary inorganic fertilizers to sustain productivity and in any case any applied fertilizer is often leached down through the soil profile or off the site to the detriment of adjoining waterways.

2.2 Reduction in access to Forest Land.
Statistics show that in Dak Lak there has been an overall increase in population of 300% over the last 15 years. As the Province was opened to development after Liberation in 1975 much of the flat forest land was seconded by the government and vested in State Agriculture and Forestry Enterprises specializing in perennial crops such as rubber, coffee and timber. The Government has also implemented re-settlement programmes aimed at relocating landless households from the heavily populated Red river delta in particular. Other land was alienated from customary use as it was gazetted as Special Use Forest Land or National Parks. In addition the government has introduced forest protection regulations which restrict customary use of forest land by the traditional occupants.

The coffee boom of the late 80s and early 90s also fostered a land rush by unauthorised and uncontrolled immigrants who became squatters on fertile forest land. Traditional occupants with less experience and not fully aware of the consequences perhaps “sold” their more fertile and flat land to these more aggressive newcomers for short term gains.

Thus many ethnic farmers in the project area do not have access to enough land to allow the completion of their customary crop/fallow farming cycle. They are now trying to feed their families from less per capita available land compared to 15 years ago. There is not sufficient time for their upland farming sites to recover their fertility as the land available for completion of the total cycle has been restricted and thus the period available for fallow has been reduced significantly. Sites that have lost their capacity to give an economical return and are left to fallow do not have sufficient time to recover their nutrient levels before the demand to reuse them returns and the vegetation is cleared and burnt again.

Relative fertility and productivity is reduced as a consequence and a vicious cycle commences – the site is farmed for a maximum of 2 years not 3 or 4, the next site in the rotation has not had sufficient time to recover its fertility, and so on until the only solution is to find a new location outside the cycle. This usually means illegal incursion (without tenure) on to land classified as forest land not agriculture land and conflict with the authorities or other villagers.

2.3 The Socioeconomic and Cultural Environment.

As well as the problem of bad farming practices and the lack of land to allow sufficient fallow time, certain other factors and conditions prevail in the present rural community which contribute to the poor farmer being locked into this unsustainable cultivation system. They include:

- The lack of tenure or having no legal right to his traditional farming sites. This becomes a psychological barrier to any long term approaches to better land management especially on those sites requiring investment by the household in either capital or labour. With the development of the country’s land laws has come a need to have land use certificates to show “ownership”. The traditional household is no longer confident that unwritten permission from the commune or “a white book” is sufficient security when land use certificates can be bought by settlers from outside and supersedes traditional land use rights.

- Many financially poor farmers and women are also poorly educated and therefore lack the language and literacy skills and knowledge to improve their situation through using available services which could provide access to better farming technologies. As well it is difficult to replace old habits with new largely untried technologies with uncertain outcomes.

- These two issues above also limit the minority farmer’s ability to access development capital through available credit facilities.

- Capital investment required for example to initiate or improve irrigation systems, which could lessen some farmers dependency on sloping land farming, is often not available.
Perennial cash crops have become more significant in regional economies. Good access to markets becomes important. Poor farmers forced to farm land in isolated localities often have inadequate infrastructure (communication, transport, irrigation) when it comes to growing perennials and are forced to continue as subsistence farmers.

There is no adequate process existing through which the particular problems of small farmers relying on sloping land crop production can be addressed. Government service organisations and research institutions tend to concentrate on the higher yielding perennial crops and on improving farming practices associated with intensive agriculture. Few if any trials have targeted the problems of sloping land farmers and appropriate models for farmer evaluation and consideration in this field are not readily available.

More restricted access to native forest resources limits the opportunities for families to supplement their farm production by hunting and gathering products from the forest.

There are few alternatives to farming as a livelihood. Vietnam has an agriculture based economy and industrialization is limited to the metropolitan areas. Therefore off-farm opportunities to earn an income are extremely limited for the poor farmer.

(See Table 2 for Farming Groups and Current Dynamics in Dak Lak Farming systems)

2.4 General Strategy for Improving Farm Livelihoods.

Studies have shown (ACIAR Proceedings No 33 – Technologies for Sustainable Agriculture on Marginal Uplands in SE Asia) that in broad terms there are 5 main household strategies to improve livelihoods and these can be summarised as follows:

- intensification of existing production patterns,
- diversification of production and processing,
- expanded farm or herd size,
- increase of off-farm income, both agricultural and non-agricultural, and
- a complete exit from a particular farming system within the agriculture sector.

These strategic options are not mutually exclusive and even at the household level any particular household will often pursue a mixed set of strategies.

Considering local and national circumstances, the most relevant and obvious way in which farmers in the target areas are going to increase livelihoods is through Intensification and Diversification of their agricultural production. Therefore given the mandate of the Provincial AEC and the resources that the Project has to address this result, the following broad topics become possibilities for a joint approach with the AEC to intervention and involvement:

A) **Intensification** which is defined as increased physical or financial productivity of existing patterns of production; including food and cash crops, livestock and other productive activities. Although intensification frequently increases yields through greater use of external inputs, it may also involve improved varieties and breeds, utilisation of unused resources, improved labour productivity, and **better farm management** – for example improved irrigation facilities, erosion control strategies or better control of pathogens.

**Improved varieties and breeds.**

The Agriculture Extension Centre is responsible for the introduction and testing of new breeds and varieties which could help farm level production. Wherever applicable and within its resources the Project will support these activities through assistance with training and demonstrations. An example of opportunities in this field would be helping to make grafted...
hybrid cashew seedlings more available to isolated and poor farmers. Similarly the introduction of the most appropriate breed of livestock for the circumstances should be supported.

**Better Farm Management**

_conservation agriculture_ would give more sustainability to farming practices in general and to shifting cultivation on sloping land in particular. This practice advocates the use of direct seeding into live or dead mulches using minimum tillage. The principle is to copy a forest ecosystem and to maintaining the natural nutrient cycle thus reducing the rate of fertility loss.

One critical factor is to have suitable plants that can be used in intercropping or relay cropping systems that have strong deep tap roots which can recycle nutrients for the main crop. They should also have the ability to produce large amounts of biomass quickly and be able to grow in adverse conditions such as during the dry season or under high weed pressure. Disturbance to the soil structure where there is a fine balance between micro-organisms and the nutrition recycling process is minimized. This approach also address the wide spread erosion problem associated with farming on sloping land and aims to extend the growing season through better soil water management.

**Animal husbandry** – the rearing of livestock is a major contributor to many household economies. Naturally the return on investments is closely linked with best practice animal husbandry including adequate nutrition which leads to better animal health. On the other hand as an example, no amount of nutritious fodder will make an animal healthy if it is suffering from internal parasite infestation. At the moment farmers with cattle and buffalo struggle to find sufficient fodder to allow their herds to achieve their maximum potential – there is competition for grazing space from cropping in the wet season and in the dry season many native grasses die off. Establishing improved pasture at household level may help alleviate this problem.

**B) Diversification** is defined as adjustment to the farm enterprise pattern in order to increase farm income, or reduce income variability. It exploits new market opportunities or existing market niches or demands. Diversification may take the form of completely new enterprises or may simply involve the expansion or adjustment of existing profitable activities.

Monocultures can expose the farmer to risks associated with fluctuating produce prices at local, national and international levels. Extraordinary environmental or other climate related occurrences can also impact household incomes dependent on a single product. Not having all the eggs in one basket can help reduce the impact of price and yield fluctuations.

Diversification into new crops such as cocoa, cotton or tobacco have been supported by various programmes. The Government is constantly supporting the identification and exploitation through applied research of better varieties and improved farming practices for these alternative crop possibilities. Hybrid cashews, hybrid maize, improved hill rice varieties and the direct sowing of paddy rice are good examples of this. Support to these Government strategies have already been highlighted in the project design and are identified for direct support especially through the various training programmes.

The Project will support the Government to help farmers achieve greater security and reduce risks associated with such mono-crop systems. Coffee production is an important contributor to household economies in the target area, but is not without its risk as international prices fluctuate considerably. Therefore the Province has encouraged farmers to consider Cocoa as an alternative to Coffee especially in marginal areas. Cocoa is not so demanding in its soil requirements and once established still produces adequately without irrigation.

Mixed farming, crop rotation and intercropping, including livestock with crops, root crops following grains, and beans intercropped with maize either in parallel or in relays is good soil management practice as well as spreading the risk.

Many farmers now realize the benefits of investing in livestock and have changed from a pure cropping farming system to mixed farming. The Project has responded to requests from
farmers and social organisation in this issue of improving the sustainability of cattle production.

**Agroforestry systems** incorporating trees, crops and livestock, allow for diversification of production and help stabilize farming sites. Several multi-purpose trees such as Leucaena and Glyricidia which are great biomass producers and can be fed to livestock as well as provide shade and firewood, grow well in the area but are seldom utilised by farmers. As well, agroforestry as opposed to straight cropping is accepted by the Government as an acceptable use of designated forest land. Those farmers fortunate enough to receive forest land use certificates can legitimately develop that land under agroforestry systems.

**C) Improved Access to Services.**

If Extension services and organisations responsible for supporting farmers to achieve sustainable and efficient natural resource management are efficient, competent and accessible, the farmer has a better opportunity to be exposed to and possible adopt new technologies and thus improve his livelihood.

Similarly if marketing opportunities are improved the farmer is faced with a wider selection in his choice of crops and greater confidence to diversify, increase his production and reduce his risk.

Efficient farm production also depends on supply of quality agriculture inputs including access to good quality seeds and seedlings.

**2.5 The Project Focus**

It is the previously detailed problems associated with reduced access to good farm land and the resultant inability to use their traditional farming practices that the Project has identified as having the potential if addressed to have the most impact with respect to support to the development and improvement of upland farming systems.

Assessment of information from preliminary studies, discussions with farmers and service providers like the AES have lead to a crystallization of the upland farming system problems as follows:

1. Traditionally there was sufficient land for the shifting cultivation system to be functional if not necessarily efficient. This is no longer the case as farmers have for various reasons restricted access to sufficient land for a full slash and burn farming cycle. As a farming practise, the slash and burn process contains activities which are not conducive to sustainable soil management.

2. The outcome is a farming system crisis with the two following problems:
   - No time for the site to recover,
   - Farming practices inherently bad

Both problems need to be addressed by the Farmer and the Government with Project support:

- Indirectly by improving the fallow and therefore shortening the cycle
- Directly by better soil management practices on the sloping sites.

To give support to finding solutions to these 2 major problems the Project will focus on developing with the farmer, technologies currently described as Conservation Agriculture which specifically promote the use of soil erosion, minimum tillage and crop rotation
techniques to promote site stability and maintain productivity. (See Annex 4 for more details of CA)

Specifically the Project will introduce a participatory approach to identifying and supporting the developing of improved farming practices that will assist towards sustainable crop production by poor farmers who by default and from tradition farm on sloping upland sites.

3. PTD - The CONCEPT.

It is the responsibility of the Government and the role of the Project to help the farmer develop these urgently required technologies. The Project is confident the technical solutions to most of the upland farmers current problems are contained within the principles of CA as mentioned above.

However, internationally, there is a growing recognition that including the participation of communities and individual farmers in the search for new technologies often leads to a better outcome. Solutions to problems are usually more appropriate and more likely to be accepted if the farmer has a leading contribution in the diagnosis of the problem and his opinions and experiences are included in the process of finding a satisfactory alternative. The experience is that a farmer will not change his farming habits unless he has a sense of ownership in the development of new farming practices, and participates in all steps of technology development including the identification of his needs and the appraisal of any outcomes. If he contributes the opportunity cost of his land and his labour he becomes an active stakeholder in the process.

As outlined in Annex 2 the Provincial Department of Agriculture and Rural Development (DARD) has the mandate to improve and maintain agriculture productivity in a sustainable manner and to contribute to the improvement of rural livelihoods. DARD manages the Agriculture Extension Centre (AEC) whose responsibilities include the introduction and evaluation of new species, improved varieties of plants and livestock and new farming technologies.

Therefore the Project proposes support to the AEC in developing a process and exemplarily testing some demonstrations in the target communes for a participatory approach by farmers, extensionists and specialists towards the development of sustainable agriculture in the uplands.

Such a process is PTD or Participatory Technology Development.

3.1 PTD - Definition and Description.

As the name implies, PTD or Participatory Technology Development, is a participatory approach in which farmers, extensionists and specialists work together in a partnership to find solutions to farming problems identified by the farmer in his farming system.

The approach has been developed and exemplarily tested in several Provinces by various projects including SFDP (the GTZ funded project in Son La) and by the SDC sponsored SFSP and ETSP run by Helvetas.

PTD is based on the approach that a farmer learns best if he contributes to the identification of the solution and by his own hands-on experience.

PTD strives to:

- enable farmers to make decisions by themselves as to what in their situation is the best solution.
- facilitate farmers in continuously building up new knowledge by setting up, monitoring, and evaluating trials on their own fields.
- enable extension workers to support farmers during implementation of extension activities in accordance with the farmers’ requirements.
• build up the capacities of the extension service to manage and to monitor agricultural extension activities.

**See Table 3 for Conventional vs Participatory approach to farming technology development.**

In the overall context of community based natural resource development (CBNRD), PTD complements the planning processes of participatory rural development (PRD) that the Project has formulated as its major outcome. Village Development Planning (VDP) is the corner stone of CBNRD. As a necessary process for future District and Provincial planning procedures, it highlights amongst other things through a participatory process, problems in agriculture production generally. The PTD which can follow then provides a process where the AES can help the farmer identify specific farming problems and work towards collaboratively finding an appropriate solution. Thus the PTD process is easier and more effective if it can follow and be linked with the VDP process.

**PTD consists of 3 main components once a village has been selected:**

A) **PD or Participatory Diagnosis**

A group of farmers facilitated by an extensionist assess their farming situation, identify their farming problems, discuss what are the causes and suggest what could be within their farming experiences, possible solutions.

B) **PAEM or Participatory Agriculture Experiment Methodologies.**

A group of farmers (CIG or Common Interest Group), an extensionist and a specialist if required, work together to design and implement an on-farm experiment or trial that tests some solutions suggested in the PD process.

An implementing farmer (IF) with an appropriate farm site on which to implement the experiment is selected. A work plan is formulated, and the extensionist facilitates the implementation of the experiment with regular supervision and monitoring.

C) **Evaluation and Dissemination.**

The CIG and the IF’s peers evaluate the trial at its conclusion and determine if it is worth incorporating into their routine farming system. If the outcome is positive the technology can be spread across village and commune boundaries by farmer field days and the AES network.

*(See Annex 5 for notes on Village, Farmer, Site Selection and on M&E)*

The leading stakeholders in the PTD implementation are:

• The AEC for overall policy direction and to provide the specialist if required.

• The DES and CEW for facilitation of PD, experiment design, field implementation, supervision, monitoring and evaluation.

• The Farmers (CIG and IF) as the client/owner, the joint trial designer, the implementer of the trial and the evaluator.

• The Project as a short term supporter to coach procedures and provide training and some material inputs.

3.2 **PD – Participatory Diagnosis.**

PD is the first step in a process of engaging villagers as partners in searching for ways to improve their farming systems. It is a process in which farmers and extensionists meet to:

• identify and prioritize farming problems and their cause and effects. Suggest possible solutions to the problems.

• identify who in the village is most affected and needs the most help.
• nominate who in the village will be responsible for working within the PTD process to solve these problems. Common Interest Groups (CIG) are formed to create a more central focal point and to facilitate further implementation on behalf of the village. As well an Implementing Farmers (IF) with a suitable site is selected.

The outcome of PD is an understanding between the DES, the commune and the village on which problem to target and how to work together to find solutions.

Selecting villages

Consider which villages have the highest potential to benefit from the resources, skills, knowledge and technologies that the Project and the AEC have to offer. Select a village where the Project and the particular activity can have the most impact and where the number of beneficiaries will be maximised. Field observations, discussions with farmers and social organisations and institutions will assist with relevant background information for this selection process.

Searching for Technology Options

Farmers have an in-depth knowledge of their farming systems and are able to decide quickly which information and technologies are likely to provide substantial benefits and which they would prefer to test. Each farm and each farmer is different and no single technology will be appropriate for all situations. Therefore a broad range of options that are relevant to the issues identified in the PD, and realistic within the resources available to the village, the Extension Service and the Project must be offered. It is better to provide common interest groups with ideas and principles rather than specific recommendations.

There must be a confirmation that there are problems or opportunities that are both a high priority for the farmers and for which there are potential solutions.

Obviously the topics to be addressed should be within the mandate and resources that the AEC and the Project possess.

3.3 PAEM – farmer designed experiments, implemented and evaluated on the farm by farmers.

Testing Options

PAEM – Participatory Agriculture Experiment Methodology is a participatory approach to farmer led extension and ensures that the action of doing and hence learning takes place in the farmer’s field. It is a process which promotes the interaction between farmers and extension workers and provides a joint learning forum.

Testing new technology options (experiments) to find solutions to problems identified in the PD should start in a small way and be kept simple as this minimizes the risk to both farmer and the AEC.

A criteria for testing and evaluating has to be decided on before commencing a trial and a control representing the farmer’s current practise should always be included to assist in the evaluation. There are several essential steps in the PAEM process in which the Extensionist takes a leading role after the PD has been conducted and the village has selected those topics they would like to address in the experiment. They include:

• Meet with the CIG (Common Interest Group) and clearly define the objectives of the trial.
• Design the experiment in collaboration with the CIG.
• Formulate clearly with the CIG the criteria which would indicate a successful outcome.
• Develop a Work Plan for the experiment including inputs required, a schedule of necessary activities and a timetable for monitoring.
This step by step process also can help in identifying shortcomings in the capacity of the extension network to meet the needs of farmers.

**Evaluating and Appraisal**

CIG meetings are held at the end of the trial period and farmers are invited to discuss experiences, the pros and cons of each option tested, and discuss problems that were encountered. The rest of the village will want to know what has been learned and achieved. Some of the focal group may want to adopt the trials on a larger scale on their own farms. Other farmers in the particular village and in neighbouring villages may want to start evaluating some of the options themselves.

**3.4 Extension of Successful Technologies.**

The implementing farmer and other members of the common interest group have the main role in the evaluation of the trials.

The wider adoption of any practices depends on its positive evaluation by farmers in terms of financial returns, savings in labour and whatever other criteria for success were nominated at the start of trials.

If the particular technology has merit it will be spontaneously integrated into the farming activities by key farmers and other members of the CIG.

Innovative farmers are encouraged by the DES to become trainers and active participants in the process of replication.

Farmer field days are often the quickest way to transfer a successful activity beyond village and commune boarders and farmers in this instance make the best trainers.

Farmers have particular needs and therefore can adapt technologies to individual circumstances.

**4 PROPOSED PILOT IMPLEMENTATION of PTD IN DAK LAK.**

For PTD to have a meaningful impact on the development of sustainable upland farming systems in Dak Lak, an effective cooperation at Province level must be established to support Project credibility, assist with the identification of problems and solutions, provide information exchange and a network to assist with training, dissemination and replication. As mentioned previously the Project acknowledges the Provincial Agriculture Extension Centre as its natural partner in this endeavour.

The AEC would provide the necessary technical know-how, the farmer his experience the trial site and his labour, the Project some resources and training support. If any necessary expertise is not available within this group, then the engagement of particular skills from relevant institutions and associated specialists can be supported by the Project.

Towards achieving the desired outcome to the benefit of all stakeholders, the Project has formulated several steps to exemplarily test the introduction of the PTD process in the Project target communes.

**4.1 Process of Introducing the Upland Farming Concept & PTD to the AEC**

The Steps are outlined in Table 4 and are summarised here.

**Step 1. Round table discussions – Project, AEC, and associated Institutions.**

Invite the Provincial AEC and other Institutions who are involved in the development and dissemination of farming practices in the Province to discuss and comment on the Project approach and its potential to meet the perceived needs of the farmers and the goals of AEC. This would include the Department of Agriculture and Rural Development, the Agriculture Extension Centre at Province and District level, The Department of Science and Technology,
the Western Highlands Agro-forestry, Science and Technical Institute, the Western Highlands Soil Research Station belonging to the NISF and the Agro-forestry Faculty of Tay Nguyen University.

(See Annex 6 for an Outline of The Upland farming concept to be presented at a Province WS)

The Project then meets with AEC management at the Province level, ratifies the proposed objectives and the process, and discusses ways of proceeding with the implementation of the approach to maximize the utilisation of resources and achieve outcomes acceptable to both parties and of maximum benefit to the target group.

**Step 2. Planning and Training with the district AEC**

The Project and target DES develop an activity plan for approval by the AEC and which is compatible and complimentary with their existing scheduled duties and responsibilities. This should include an agreement to pursue a training needs assessment (in the context of Results 2 and 5) and to compliment and give detail to the Project training programme. The content of this training will target capacity building within the AEC network and its associates, and a better understanding of and capability of delivering PTD.

The Project will conduct ToT in PTD which will target those Government officers who can benefit from the participatory approach to technology planning in general and to DES and CE personnel who will be directly involved in implementing PTD in the target communes.

**Step 3. Identify with the Commune PTD Working Group a suitable village for PTD**

A Commune PTD Working Group has been formed at the instigation of the Project. It is chaired by the DPI counterpart in the district and it consists of some executive members from the commune including the heads of mass organisations and a representative from every village in the commune. The head of the district AEC is always included as well and other specialists can be invited to give contributions on particular topics as required. It should be kept in mind however that this WG is a creation of the Project and its continuation with its specific function could be doubtful after Project completion.

The full concept has been explained and discussed at a Commune PTD Working Group meeting and following consensus on PTD objectives and the formulation of suitable criteria, partnership villages for the pilot PTDs were selected. (See Annex 5 for Criteria for Village Selection)

**Step 4. The Village meeting and PD**

A general meeting in the selected villages will be convened at which the outline of PTD is presented and the PD process starts by forming a common interest group, selecting a key farmer, and identifying possible options as solutions to problems in the farming systems.

Once the selected village has conducted its VDP, ample primary and secondary information on problems confronting the villager will be available to assist in the PD process. The need for continued training in existing technologies, the development of demonstrations to highlight these technologies and access to new species, breeds and varieties would already have been identified in the VDP process and can serve as indicators of existing problems in the farming systems.

Since the target communes have a matriarchal land ownership system and since women are mostly involved in the physical implementation of farming activities, it is recommended by the Project that the common interest groups should be at least 40% female.

In this step the Project will not impose its views but will aim to influence the discussion of possible solutions towards those fundamentals which make up better soil management through Conservation Agriculture – that is maintaining a soil cover, minimum disturbance of the soil and crop rotation.
Step 5. PAEM

The key farmer, the common interest group, the DES network, and the Project collaborate in the experiment design, developing a work plan, implementation and monitoring of the trial. This step is elaborated on in Section 3.3.


Once completed the trial has to be assessed and a decision made as to its possible further expansion or dissemination. The implementing farmer and other members of the common interest group have the main role in the evaluation of the trials although this process will also have the input of the Commune PTD Working Group and support from the AES.

A report will be finalized by the Commune extensionist and given to the District AEC. If, in the judgement of farmers, the trial is economically and environmentally successful it will be further promoted for incorporation with possible local refinements into the everyday farming system.

The AEC and the Project can assist in fast tracking the expansion of a farmer approved new farming technology by sponsoring farmer field days. The Project should keep an accurate account of the incurred costs both fixed and variable to assist with a comprehensive evaluation of the trial.


By July 2005 a joint evaluation by DARD, the AES and the Project should be conducted to evaluate the PTD approach to helping farmers achieve more sustainable farming practices and achieve improved and more sustainable productivity from their upland farms.

4.2 Broad Implementation Strategy for Phase 1.

As discussed in detail previously, Conservation Agriculture contains the principles necessary to introduce some sustainable farming practices into the prevailing slash and burn based upland farming systems. However, even the general concepts of CA are far removed from traditional practices and new approaches will take time to be developed and considered by households.

For farmers to accept change they need to personally observe new practices in action and to talk to other farmers who are confronting and finding solutions to similar problems. Demonstrations in Conservation Agriculture that are practical and replicable will therefore be required for farmer evaluation. These will take time to establish especially in the Dak Lak environment where there is such a pronounced growing (wet) and dormant (dry) season.

More immediately, presentable field results can be obtained with topics more familiar to the farmer, with more likelihood of adoption and which can act as keys to the gradual introduction of more relevant but less digestible CA practices. Such topics include:

- the establishment of fodder gardens for dry season supplementary feeding of cattle,
- the promotion of quality grafted cashew seedlings including nursery techniques,
- maximizing potential returns from annual cash/food crops eg rice, maize.

Fodder: Most farmers with cattle are quick to realize the benefits of having a plot of grass near the house once introduced to the practice. This activity has already gathered some momentum in the Project communes and there is a lot of potential to spread the benefits more widely. Better understanding of management techniques to make best use of this
particular resource is an ongoing need as is assistance with procurement of planting material accompanied by structured training in establishment techniques.

**Cashews:** Good quality hybrid cashews seem to have the potential to give reasonable returns to farmers fairly quickly (3 years) and without the need for large investment capital or sophisticated management skills. However for best results, only grafted hybrid cashew stock should be used and at a minimum of 5,000 dong/seedling this initial investment can be beyond the reach of the poorest farmers. The Project can contribute to this crop diversification opportunity by continuing support to enhancement of community nursery skills including training in grafting techniques and the provision of quality budwood material. In this way quality planting material for the future should be more available locally as proximity to supply is often a constraint to farmer adoption of some development recommendations.

There is also potential through the VDP and Confidence Building Measure funds to finance some small scale quality cashew gardens if this is identified as a village development preference. In this instance the Project could also assist with quality control of the seedlings and with delivery.

**Cash Crops:** At present many poor farmers are not maximizing the potential returns from the staple crops of rice and maize. Primary problems are directly associated with lack of ready cash to buy recommended seed varieties and the timely application of fertilizers. There is also a secondary problem of minority farmers often not being aware of or at least not following recommendations from AES ie use of inappropriate technologies.

The Project could make a significant impact to poverty reduction and create much good will if it were able to offer replicable and sustainable support to poor families in this context.

A recommended strategy would be:

- Support the development of a village rotating fund that could enable farmers to have access to finance for necessary quality inputs at critical times in the crop cycle. There would need to be a strict understanding that the money (or the materials) were loans and had to be paid back after harvest. This cash pool would continue to “belong” to the village, be managed by it and be available again for the next major cropping cycle. Initial seed capital could come from CBM, a bank loan or a government fund.

- All beneficiaries of the loan should participate in Farmer Field Schools conducted by relevant service organisations (AES, Farmer’s Union or Women’s Union) as a pre-qualification for eligibility to the permanent material inputs assistance fund. These FFS could be along the lines of well known IPM field classes (Integrated Pest Management). In later cropping cycles these FFS could evolve into Common Interest Support Groups or Extension Clubs.
Annex 1. Soil Fertility, the Forest Fallow & the Nutrient Cycle.

Nutrients within the mature forest ecosystem are stored in 2 main sources namely:

a) the biomass
b) the topsoil

When a cultivated plot is abandoned, presumably due to fertility depletion, the seedlings and regrowth from the previous forest quickly forms a canopy which reduces soil temperature and stops erosion. The litter additions are rapidly decomposed, adding nutrients to the soils which are not leached away because of the quickly established forest roots and the soil cover. A nearly closed nutrient cycle is formed and a plateau is reached in about 8 years.

Obviously the nutrient requirements are different for forest regrowth than for cropping but the period required to recharge that ecosystem in terms of soil fertility is still similar.

Often in the project area many farmers do not have access to enough land to allow sufficient time for these upland farming sites to recover their fertility since the fallow period has been reduced by circumstances. Sites that have lost their capacity to give an economical return do not have sufficient time to recover their nutrient levels before the demand returns and the site is cleared again.

Productivity is reduced as a consequence and a vicious cycle commences – the site is farmed for only 2 years not 3 or 4, the next site in the rotation has not had sufficient time to recover its fertility, and so on until the only solution is to find a new site. This usually means illegal incursion on to land classified as forest land not agriculture land and conflict with the authorities.

The Forest Nutrient Cycle

The Concept of Conservation Agriculture is to mimic the equilibrium that exists between elements leaving and entering the mature or fully occupied forest ecosystem as per the diagram below.

Litter left over from harvested crops and from specially grown cover crops remain on the site and become incorporated through soil microbial activities into the topsoil and join the nutrient pool. At the same time they help prevent erosion, improve the soil structure, improve water retention and help minimize leaching.
Nutrient Cycling in the Natural Forest Ecosystem.

- Rain
- Dust
- N fixation
- Symbiotic
- Leaf and timber fall
- Litter
- Nonsymbiotic
- Runoff + erosion
- Denitrification
- Leaching
- Topsoil Storage
- Subsoil Storage
- Thoroughfall, stemflow
- Plant uptake
Annex 2: Provincial Institutions and Organisations associated with the development and extension of sustainable upland farming systems;

**DARD - Department of Agriculture and Rural Development.**

This department has the mandate to improve and maintain agriculture productivity in a sustainable manner and to contribute to the improvement of rural livelihoods throughout the Province. It is responsible for developing the long term and short term Provincial policies on sustainable natural resource management and encouraging, supporting and extending replicable and sustainable upland farming practices is part of its role. It has sections responsible for the administration and management of development plans for Primary Industry, related production companies and management boards associated with forestry, agriculture and water management.

Most significantly in the context of this paper DARD is responsible for the management of the **Provincial Agriculture Extension Centre** whose responsibilities also include the introduction and evaluation of new species and improved varieties of plants and animals and new farming technologies.

DARD has a direct connection through the **Section of Agriculture and Rural Development (SARD)** to the **District People’s Committees** and similarly the AEC has a **Agriculture Extension Station** in each district which is supported in activities at grass-roots level by commune extension officers, and in some instances by Commune Agriculture Extension Clubs and volunteer extension farmers at village level.

The AEC is also supported in its efforts to disseminate improved farming practices to village households by the Women’s Union network and the Farmer’s Association.

**Department of Science and Technology.**

One of this department’s many responsibilities is to help to develop Provincial policy and programmes in relation to technical developments in Agriculture. It is involved in their introduction and appraisal as they relate to sustainable natural resource development and utilisation. It does not do research itself but identifies needs and contracts appropriate research by local institutions.

**WASI**

The Western Highlands Agro-Forestry Science and Technical Institute concentrates its research activities on perennial crops of significance to the Province economy. These include coffee, cocoa and forestry and it runs a significant commercial nursery supplying selected seedlings for farmers and agriculture enterprises. It is a National Institution and receives most of its budget from the Ministry of Agriculture and Rural Development in Hanoi but this is supplemented by contracts from Provincial Organisation like the Department of Science and Technology.

**Western Highlands Soil Research Station.**

This Centre belongs to the National Institute for Soils and Fertilizer (NISF) and receives funding from Hanoi but does local consultancies as well. As the name suggests it concentrates its research on the sustainable management of agricultural systems including the physical and chemical changes in soils under cultivation and the impact of fertilizers on crop productivity and the environment. It looks at the problems and causes of the loss of site productivity faced by farmers and works to find solutions and to maximise returns for the farmers investments in capital and labour. It is not directly linked to any extension organisation and has few commercial affiliations.

**Tay Nguyen University.**

The faculty of Agroforestry has 6 departments which conduct courses in agriculture and forestry related subjects and award associated Science degrees. All departments are in some way involved in and include farming system in their curriculum. As well as teaching undergraduates, the professional Faculty staff is involved in applied research projects.
associated with post-graduate studies and with their own academic interests and are available for consultancies. The Soil management department is a recent addition to the Faculty.

The Uplands can be defined in the microgeographic sense as those areas not associated with growing paddy rice and in the macrogeographic sense as mountainous or elevated geographies. It contains the protective tropical rainforest ecosystem and is the life support system of the lowlands and aquatic areas. As well it is a place where an increasing population of the “poorest of the poor” live and is often expected by planners and Government to absorb more of the expanding population. This is evidenced by the surge in migration by economic refugees from the delta provinces to the Tay Nguyen region through the nineties and indeed continues today though in a more moderate way.

Each individual farm has its own specific characteristics arising from variations in resource endowments and family circumstances. The household, its resources, and the resource flows and interaction at individual farm level are together referred to as the Farm System. Individual farm systems are organised to produce food and to meet other household goals through management of available resources within the existing social, economic and institutional environment. The functioning of any individual farm system is strongly influenced by the external rural environment, including policies and institutions, markets and information linkages.

By contrast a Farming System is defined as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints and for which similar development strategies and interventions would be appropriate.

The analysis of farming systems has now become more participatory, with an increasing stress on indigenous knowledge, and upon group planning, experimentation and monitoring.

The delineation of the major farming systems can provide a useful framework within which appropriate agricultural development strategies and interventions can be determined.

The classification of farming systems can be based on certain criteria including:

- available natural resource base, including water, land, grazing areas and forest; climate of which altitude is one important determinant; landscape including slope; farm size, tenure and organisation
- dominant pattern of farm activities and household livelihoods, including field crops, livestock, trees, aquaculture, hunting and gathering, processing and off-farm activities, and taking into account the main technologies used, which determine the intensity of production and integration of crops, livestock and other activities.

Based on these criteria, the following broad categories of farming system have been distinguished:

- **Irrigated farming systems**, embracing a broad range of food and cash crop production
- **Wetland rice based farming systems**, dependent upon monsoon rains supplemented by irrigation
- **Rainfed farming systems** in humid areas of high resource potential, characterised by a crop activity (notably root crop, cereals, industrial tree crops – both small scale and plantation – and commercial horticulture) or mixed crop-livestock systems
- **Rainfed farming systems** in steep and highland areas, which are often mixed-crop livestock systems
- **Rainfed farming systems** in dry or cold low potential areas, with mixed crop-livestock and pastoral systems merging into sparse and often dispersed systems with very low current productivity or potential because of extreme cold or aridity
- **Coastal artisanal fishing**, often mixed farming systems
- **Urban based farming systems**, typically focused on horticultural and livestock production.
The names also reflect key distinguishing attributes, notably:

1. water resources availability, e.g. irrigated, rainfed, moist, dry,
2. climate, e.g. tropical, temperate, cold,
3. landscape relief/altitude, e.g. highlands, lowlands,
4. farm size, e.g. large scale
5. production intensity, e.g. intensive, extensive, sparse,
6. dominant livelihood source, e.g. root crop, maize, tree crop, artisanal fishing, pastoral,
7. dual crop livelihood, e.g. cereal-root, rice-wheat, crop-livestock
8. location, e.g. forest based, coastal, urban based.

Farming systems are characterised by both bio-physical dimensions (such as soil nutrients and water balances) and socio-economic aspects (such as gender, food security, and profitability. These key determinants can be grouped together into five categories;

- natural resources and climate
- science and technology
- trade liberalization and market development,
- policies, institutions and public goods, and
- information and human capital.

In the opinion of a range of experts, these categories represent the major areas in which farming system performance and evolution are likely to be significantly affected over the next 30 years. Some of these factors are internal or part of the farming system, whereas others are external.

The availability of markets and the prices on offer influence farmer’s decisions on enterprise pattern, on purchase of inputs and on the timing of produce sales. The availability of economic and social infrastructure in rural areas determines the transport costs and the availability of services to households – notably human and animal health. Similarly, information and educational services affect household strategies and decisions.

**Natural Resources and Climate.**

The interaction of natural resources, climate and population determines the physical basis for farming systems. During the early stages of development, increased population generally leads to an expansion in cultivated area and, in many cases, conflict between the different users of land and water resources. Once most good quality land is already exploited, further population increases tend to lead to the intensification of farming systems. As forest and woodlands come under greater pressure, biodiversity is threatened and there may be growing tension between development and conservation goals. Overall, the less reliable the climate is, and thus agricultural productivity, the more risk the farmer faces with a consequent reduction in confident investment and input use.

**Science and Technology**

Nearly 75% of crop production growth worldwide since 1961 have been due to yield increases and the improvement of varieties. Increased yields have contributed to greater food security within developing regions. Overall, research has been focused primarily upon intensifying crop and livestock production, usually by means of purchased inputs. There has been far less research on integrated technologies for diversifying the livelihoods of small farmers in developing countries and increasing the sustainability of land use. Little is understood for instance especially by the farmer about the role of organic matter in soils, the development of reduced tillage practices, the use of on-farm organic resources in combination with inorganic fertilizers and the role of legumes in biological nitrogen fixation.
Trade liberalisation and market development

By the end of the 1970s, the economies of many developing countries had become highly distorted as a result of excessive government intervention and control. Structural Adjustment Packages were introduced and resulted in liberalised trade and radically reduced subsidies. More recently, international agreements, e.g. ASEAN and WTO have further boosted trade liberalisation. Not only is market development accelerating, but patterns of production and natural resource usage are also changing in response to market forces. In the longer run as barriers to trade between countries is diminished, and if subsidies to producers in industrialised countries are removed, developing country products that are competitive in world markets will benefit, replacing those that have previously relied on protection.

Policies, Institutions and Public Goods

Policy makers have increasingly shifted their attention to the potential to increase the efficiency of services delivered through the restructuring of institutions. This has often been in response to the growing tendency at a broader social level to encourage more local participation in decision making and resource allocation. Other policy shifts have had a dramatic effect on production incentives in some farming systems. For example, the introduction of the individual household incentive policies boosted food and agriculture production almost overnight in Vietnam which was transformed from a food deficit country to a food exporter.

Information and Human capital

Lack of education, information and training is frequently a key limiting factor to smallholder development. High returns to primary education have been repeatedly demonstrated and rural education without gender bias is required to be enhanced in order to leave the next generation better equipped to participate in knowledge-based agriculture and to utilize the expanding information base. Whilst in the past many development efforts failed women – because planners had a poor understanding of the role of women in farming and household food security – greater efforts need to be made to take account of their actual situation. There is also a need for a higher proportion of the rural poor to communicate directly in the same language as extension advisors, bankers or agribusiness managers. It is increasingly realized and acknowledged by development workers that the empowerment of women is the key to raising levels of child and family nutrition, improving the production and distribution of food and agricultural products, and enhancing the living conditions of rural populations.

Local Farming systems:

A paper entitled “Farming Systems and Poverty – Improving farmers livelihoods in a changing world” put out by FAO and from which a lot of this material comes describes the following 11 farming systems for Southeast Asia.

Major Farming Systems in East Asia.

<table>
<thead>
<tr>
<th>Farming Systems</th>
<th>Principal Livelihoods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowland Rice</td>
<td>Rice, maize, pulses, sugarcane, oil seeds, vegetables, livestock, aquaculture, off-farm work</td>
</tr>
<tr>
<td>Tree Crop Mixed</td>
<td>Rubber, oil palm, coconut, coffee, tea, cocoa, spices, rice, livestock, off-farm work</td>
</tr>
<tr>
<td>Root-Tuber</td>
<td>Root crops (yam, taro, sweet potato) vegetables, fruits, livestock (pigs and cattle), off-farm work</td>
</tr>
<tr>
<td>Upland Intensive Mixed</td>
<td>Rice, pulses, maize, sugarcane, oil seeds, fruits, vegetables, livestock, off-farm work</td>
</tr>
<tr>
<td>Highland Extensive Mixed</td>
<td>Upland rice, pulses, maize, oil seeds, fruits, forest products, livestock, off-farm work</td>
</tr>
<tr>
<td>Temperate Mixed</td>
<td>Wheat, maize, pulses, oil crops, livestock, off-farm work</td>
</tr>
<tr>
<td>Category</td>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Pastoral</td>
<td>Livestock with irrigated crops in local suitable areas</td>
</tr>
<tr>
<td>Sparse (Forest)</td>
<td>Hunting, gathering, off-farm work</td>
</tr>
<tr>
<td>Sparse (Arid)</td>
<td>Local grazing where water available, off-farm work</td>
</tr>
<tr>
<td>Coastal Artisanal Fishing</td>
<td>Fishing, coconut, mixed cropping, off-farm work</td>
</tr>
<tr>
<td>Urban based</td>
<td>Horticulture, dairy, poultry, other work</td>
</tr>
</tbody>
</table>

The Project has two target districts and a goal of concentrating efforts on the most needy and socially and economically underprivileged.

Initial field studies show that as expected and according to this categorisation, several of the farming systems exist in Dak Lak and the target communes. As one would expect when such a broad categorisation is used to cover a large geographic area with many different landscapes and involving people of different ethnic backgrounds with different farming traditions, there has to be an intermingling of activities between systems. This is immaterial in the context of this discussion as the main objective is to highlight the observed shortcomings in the systems and to identify those areas which need the most immediate attention and which will have the biggest impact.
Annex 4 – Sustainable Agriculture and Conservation Agriculture.

Sustainable Agriculture.

Sustainability is a term that has come into widespread use, particularly during the last decade. Its use has been so extensive and it has been applied to so many distinct circumstances that it has come to be interpreted in many different ways. Some people have applied it to an unchanging system of production or to a lifestyle that can be perpetuated indefinitely. Such a static interpretation is inappropriate for farming systems.

The basic challenge for sustainable agriculture is to make better use of available biophysical and human resources by minimizing the use of external inputs, by optimising the use of internal resources, or by combinations of both. Sustainable agriculture seeks the integrated use of a wide range of technologies in soil and water, nutrient and pest management, and agroforestry. A more sustainable agriculture, therefore, pursues:

- a thorough incorporation of natural processes such as nutrient cycling, nitrogen fixation, soil self-regeneration and pest-predator relationships;
- a minimisation of the use of external and non-renewable inputs that damage the environment or harm the health of farmers and consumers.

Sustainable agriculture is an agricultural system which promotes the following goals;

1. increased productivity and income for communities.
2. increased equity
3. enhanced stability and sustainability of the system through soil, water and nutrient conservation. Sustainability has bio-physical and social dimensions.

The biophysical include:

- Nutrient cycling
- Soil quality maintenance
- Biotic diversity and stability
- Hydrological cycle and water conservation
- Biomass production

The social processes are:

- Participation
- Social structure/organisation
- Economic viability
- Incentives
- Information flow
- Needs orientation
- Institutional linkages

Sustainable forms of agriculture can be achieved through:

- the full participation of farmers and rural people in all processes of problem analysis, technology development, adaptation and extension, and monitoring and evaluation;
- a more productive use of local knowledge, practices and resources;
- the incorporation of a diversity of natural resources and enterprises within farms;
• an increase in self-reliance amongst farmers and rural communities.

We concluded earlier in Chapter 2 that the most alarming problem in agriculture today that besets not only the Central Highlands but Vietnam and Southeast Asia is soil erosion and resource degradation.

Obviously a farming technology that could conserve the topsoil and if possible improve its fertility and productivity is needed for these uplands farming situations:

**Conservation Agriculture** may be an appropriate technology.

The practical implications of the principles and objectives of sustainable agriculture requires a technical tool that would change effectively from a conventional agricultural technology that exploits the soil and as a result may destroy its natural ecosystem functions, to a conservationist approach that conserves, and even regenerates the soil properties and the ecological processes and functions of the soil and its biota. This technical tool is called “conservation agriculture”.

**Conservation Agriculture** systems are systems that utilize soils and crops with the aim to reduce the excessive mixing of the soil layers and maintain crop residues on the soil surface in order to minimize damage to the immediate ecosystem and the environment.

In this way it will;

- provide and maintain an optimum condition of the root-zone to maximum possible depth for crop roots to function most effectively and without hindrance by capturing high amounts of desired plant nutrients and water

- ensure that water enters the soil so that:
  - a) plants never, or for the shortest time possible, suffer water stress that will limit the expression of their growth and so that
  - b) residual water passes down to the groundwater and streamflow, not over the surface as runoff.

- favour beneficial biological activity in the soil in order to
  - a) maintain and rebuild soil structure,
  - b) compete with potential in-soil pathogens,
  - c) contribute to capture, retention, chelation and slow release of plant nutrients.

- avoid physical or chemical damage to roots that disrupts their effective functioning.

The three principles of conservation agriculture include:

- minimum tillage or no mechanical soil disturbance especially when sowing the seed.
- permanent soil cover, especially by using crop residues and cover crops
- crop rotation.

**Conservation agriculture** derives from experiences with reduced and zero tillage. It connotes systems of plant production (whether from crops, pastures, trees alone or in combination) which aim to satisfy the above criteria on a continuing basis, achieving both stable production as well as effective conservation and optimum use of water and soil components. It anticipates mutual benefits that arise from combining the dynamics of improved soil productivity processes with the latent skills and enthusiasm of farmers and their rural families, the joint key to sustainability.

Conservation agriculture includes the good management of land and water resource as well as the husbandry of crops, animals and other natural resources, thus allowing the sustainable systems to be commercially productive. The techniques that are involved
minimize or avoid soil-damaging effects often associated with conventional tillage-based crop production methods, particularly in the tropical zones.

Conservation agriculture in this way is able to control the problems of land degradation even under critical climatic conditions. Infiltration of rain water is increased and soil erosion is reduced to a level below the regeneration rate of the soil. As well groundwater resources are maintained or enhanced.

Leaching of soil nutrients or farm chemicals into the soil aquifer is also reduced compared to conventional arable agriculture. The system depends on biological processes to work and thus it enhances the biodiversity in an agricultural production system at a micro as well as macro scale including flora and fauna. It increases soil organic matter content in agricultural soils in the absence of soil tillage, turning agricultural land into a sink for carbon, thus contributing to carbon sequesterisation.

The benefits arising from conservation agriculture have caught the attention of individual farmers, groups within rural communities and local authorities overseas. They have noticed greater stability of agriculture production and security of livelihoods in the face of strong variations in climate and markets. Improved availability – in quantity and duration - of groundwater and streamflow is apparent. At the same time this has reduced amounts of government funds – from local and national authorities – to be allocated for maintenance and repairs of road and bridges, for recuperation of flood damage and flood relief. A consequence has been that greater proportions of their limited funds can be applied to making positive improvements in other social services and infrastructure such as facilities for health, education and public transport.

An experiment, trial or demonstration has 3 main objectives:

- to provide on-field training - observe adaptation of a new technique in the local context, facilitate farmer discussion on technical issues.
- To collect accurate information and data on local farmer practices – accurate measurement of the practices in the farmer plot to determine from a technical point of view what are the constraints to improved yields.
- To test and find sustainable solutions for improving yields and incomes of the farmers. A trial is a research process with the farmer and should help to find the best solution to an identified problem.

Site Selection.

It is critical to the outcome of a trial or demonstration that a suitable site is chosen for the activity. This includes the selection of an appropriate village, a site which is representative of the farming systems being used and a farmer who is interested and is typical of the target group with respect to his farming activities and his available resources.

A village should not be selected merely for its convenience but on its potential to benefit from the skills, knowledge and technologies that the Extension Centre has to offer and for its potential to act as a training site for other farmers, villages and communities.

Some criteria to consider in the selection process are;

A) For the village:

This is one of the roles of the PTD Working Group which has been established in the target communes and includes representatives from each village and the commune organisations associated with natural resource management.

- Which village most qualifies for the Project and the AEC primary social objective of raising the livelihoods of the poorest in the community through sustainable farming technologies.
- Which village is poorest in terms of available resources - lacking money for capital investment, has insufficient arable land and is lacking in knowledge generally.
- Which villages have the highest potential to benefit from the skills and resources that can be applied.
- If the demonstration or trial is successful will the impact be significant.
- Are there other villages nearby that could benefit easily from transfer.
- Are there partners and organisations available that can support the work

B) For the farmer:

The farmer should be selected by the common interest group (CIG) who have indicated at a village meeting that they have common problems for which they are seeking a solution and have been formed to support the implementation of the demonstration. In their selection of an implementing farmer they should consider the following;

- Is the farmer energetic and representative of the group who are seeking a solution to their problem – not necessarily the richest.
- Does the farmer possess a suitable site which is typical of the targeted farming practice.
• Has he/she the capacity with the support of the AES to conduct the activity in terms of resources and knowledge required for implementation, monitoring and evaluation.

• Has the key farmer the ability to become a teacher/trainer in future and assist in the transfer of the technique if it is warranted.

C) For the site:

• Is the site readily accessible and typical of the situation faced by the CIG

• Does it have the necessary characteristics to support the objectives of the trial eg does it have water if irrigation is required.

• Is there sufficient space to include a control representing typical or traditional farming practices that can be used in the evaluation process for comparisons.

**Monitoring and Evaluation.**

Monitoring includes the ongoing supervision, measuring and observation of the trial or demonstration, and is the responsibility of the key-farmer, CIG, a support organisation if involved and ultimately the AES.

Evaluation is the assessment of the activity at the end of trial or at nominated stages during its implementation. It is a process carried out by the farmer and the common interest group with help from the monitoring team. The CIG when presented with all the facts makes an assessment as to the value of the activity and its suitability for inclusion in their personal farm systems.

It is important that the trial remains the property of the Village CIG.

A suggested process for Monitoring and Evaluation would be:

• In the trial design, the AES, the implementing farmer, the CIG and any personnel from supporting organisations agree on an inspection schedule and the data that needs collecting. This spells out the roles and responsibilities of the different participants in the trial implementation.

• At agreed intervals, the responsible supervising/monitoring person or organisation at commune level should present a summary of the situation to the district AES.

• At the end of the trial period or at significant stages during the trial, the CIG and the implementing farmer participate in a field day where they are presented with a summary from the monitoring team and the farmer. They draw conclusions by doing their own cost benefit analysis, weighing the financial and labour saving benefits, summarise lessons learned, and make assessments as to the suitability for inclusion in their own farms.

• The implementing groups and the AES discuss lessons learned and recommend further action.

• The commune PTD working group is informed of the trial result and make recommendations for further dissemination if warranted.

• The district AES reports on the trial outcome to the Province AEC.

Farming Systems Development Concept

1. Background

1.1. Rationale for Project Intervention

1.2. Project Objectives and Results

1.3. Indicators

2. Farming Systems in Project Areas

2.1. Upland farming

- Characteristics of farming systems in Dak Lak targeted by RDDL
  - mostly on sloping sites subject to erosion
  - shifting cultivation includes burning and need for an extended fallow
  - rain fed and therefore little paddy rice growing potential
  - integrated system includes hill rice in rotation with other annual crops
  - mixed farming and therefore livestock important
  - little intercropping practiced
  - farming site usually far from the residence

- Negative outcomes of existing farming practices.
  - loss of top soil causes loss of fertility
  - burning of litter not efficient use of nutrients available in organic matter.
  - labour intensive
  - difficult to intensify production
  - productivity of a particular site is limited

2.2. On-going soil degradation

- Erosion
  - lack of soil cover during establishment and following harvest promotes erosion
  - hoeing on steep slopes encourages loss of top soil
  - shortened fallow therefore not sufficient time for site to regenerate.

- Loss of beneficial soil characteristics
  - intercropping options limited and therefore pathogens build up
  - lack of organic matter prevents soil structure improvement and good water retention
2.3. Socioeconomic and cultural environment

- Low education levels.
  - lack of language skills makes communication and extension difficult.
  - makes access to credit difficult.
  - reduces the capacity to absorb new ideas easily
  - little awareness of alternative crops, varieties and technologies
- Conditions compounded by recent economic developments
  - no longer subsistence farming therefore market access more important
  - poor farmers usually without secure tenure for their farming sites
  - no system for identified farming needs to be addressed by applied research
  - pressure from migration forcing many minority households to marginal farming sites
  - inherent lack of capital for investment in basic farming requirements
  - prohibited access to traditional forests restricts alternative income opportunities.

3. PTD – the proposed Concept

Searches for remedies within the context of these circumstances require an approach which targets and provides for;

- alienated and underprivileged groups especially minorities and women
- solutions that fit particular social, cultural and environmental situations
- a participation in the whole process
- a sense of ownership in the outcome

Participatory Technology Development delivers all this and includes.

- Farmers identifying and prioritizing their problems and causes
- Farmers, researchers and scientists working in a partnership to find solutions.
- The Partnership designing trials
- Farmers implementing and evaluating trials.
3.1. Definition and general outline of process

*Flowchart showing Conceptual Approach for RDDL support to the Agriculture Extension Centre*

**VDP./CDP and PTD Working Group**

- **Existing Agricultural Technologies needing further dissemination**
  - Training for extension service organisations in coordination with Province AEC eg PAEM techniques
  - Demonstrations (PAEM)
  - Training at village level in Agricultural technologies.

- **PTD**
  - Identify sectors within existing farming systems which need addressing by possible new technologies
  - PD - Village meetings
    - Identification of specific problems and possible solutions
    - Formation of Focal group
    - Election of key farmers
  - PAEM - Design of trial
    - Formulating indicators of success
    - Implementing trial
    - Evaluation of trial
  - Dissemination/Extension within the group then to the village, commune and district
    - Facilitated by Project and District Extension
    - Facilitated by key farmers
    - Village groups, Extension center

- Facilitated by Project and District Extension

- M &E of Trials by farmer Group, AES & PTD WG
3.2. Establish PTD Working Groups

- role and composition
- criteria for target groups selection for PTD demonstrations
  - Village/Group should be ethnic, underprivileged or marginalised eg women
  - Village/Group should use typically upland farming practices
- criteria for Implementing farmer (IF) and trial site selection
  - Selected IF should be typical – not rich or not very poor
  - IF should have a typical farming site available for trials
  - IF should have suitable resources eg labour
  - Site should be accessible for implementation
  - IF should have the capacity to be a teacher

3.3. Participatory Diagnosis and potential solutions

- Identification of major problem areas in farming system during VDP-process
- Village meeting to:
  - introduce the PTD concept and framework for implementation
  - form farmer interest groups according to major problem areas
- Farmer interest group meetings
  - problems-cause analysis for identification of specific problems and their causes
  - proposal of potential PAEM-activities including objective and strategy
  - identification of required resources and village contribution
  - prioritisation of proposed PAEM-activities

3.4. PAEM – trials

- Selection of PAEM activities in PTD-Group for implementation
  - discussion of proposed PAEM activities by the villages/communes
  - verification of required resources and available sources
  - selection of PAEM-activities and villages for implementation
  - development of draft schedule for M&E
  - feed-back selection to villages through village representative in PTD-group
- Meeting of relevant farmer group at village level
  - Facilitated by AES
  - identification of site location, trial farmer, and reference system
formulate criteria for M&E of trial
• Development of action plan for trial implementation
  ➢ together with AES and trial farmer
  ➢ time schedule and required resources
  ➢ backstopping schedule for AES
  ➢ M&E schedule (farmer group visits)
  ➢ clarification of availability of required resources
• Establishment of trials
  ➢ facilitation of required supplies and respective logistics together with AES
  ➢ advice to trial farmer in site establishment
  ➢ on-going backstopping by AES

3.5. PAEM - M&E
• M&E of trial
  ➢ Regular visit by farmer group and AES for progress monitoring
  ➢ Evaluation through farmer field day and PTD-group visit
  ➢ Summary of results and lessons learnt in report

3.6. Extension of successful technologies
• Adoption beyond trial sites
  ➢ implementing farmer extends the activity on his own farm
  ➢ common interest groups and other villagers adapt technologies to their own situation
  ➢ neighbouring villages/communes attend farmer field visits and evaluate advantages and disadvantages personally

4. Proposed Pilot Implementation in Project Areas
4.1 Establish PTD-Groups
• 2 in Ea H'leo District (07.2003)
• 1 in Lak District (08.2003)
• Training on role and responsibilities (08.2003)
• Identification of criteria for target group and trial site selection (08.2003)
• Test runs on PTD process in some villages
  ➢ improved fodder production for cattle (start 07.2003)
  ➢ improved maintenance of soil fertility (start 06.2003)
4.2. Training of AES staff and PTD group members in PTD process and facilitation
• Development of a training schedule for extension at village/commune, district and province level
• Province level in 02.2004
• District and Commune level in 02.2004
• Pilot implementation as part of trainings programme
• Continuation of on-going trials

4.3 PTD-Group meetings in each District/Commune (02.2004)
• Selection of 4 villages for pilot implementation according to criteria (1 village per target commune)
• Fine-tuning / agreement of time schedule for pilot implementation of PAEM activities (including M&E)

4.4 Village and farmer group meetings (03.2004)
• Village meeting for introduction of PTD process & formation of farmer groups
• Farmer group meetings for identifying PAEM activities and clarification of required resources
• Village meeting for prioritising proposed PAEM solutions (Village Management Board)

4.5 PTD-Group meeting (03.2004)
• Assessment of PD-process
• Final approval of proposed PAEM-activities for implementation
• Draft schedule for M&E

4.6 Farmer group meetings at village level (04.2004)
• Identification of site location, trial farmer, and reference system
• Formulation of criteria for M&E of trial

4.7 Establishment of trials (04/05.2004)
• Development of action plan for trial implementation with trial farmer
• Establishment of trial site

4.8 M&E (according to drafted M&E schedule)
• Regular visit by farmer group and AES for progress monitoring
• Evaluation through farmer field day and PTD-group visit
• Adjustment of PTD-process and guidelines

4.9 Approach to model replication (02.2005)
• Development of approach for model replication at Commune, District and Province level
• Cost analysis for model replication

4.10 Evaluation workshop at Province level (02.2005)
• Review of PTD-pilots
• Outline of PTD guidelines
• Options of model replication at the various levels
• Agreement on time schedule for the development and approval of a provincial investment plan for model replication
4.11 Development of provincial investment plan for model replication (05.2005)

- Elaboration of process for model replication
- Cost estimate for various stages of model replication
- Draft Provincial investment plan for model replication
- Present to PPC at Provincial Workshop for approval
Annex 7 - Participatory Technology Development:

**Definition of PTD** – PTD, also called farmer-led or farmer-based research, is a complementary research and development process (not substitute) for station-based research and scientist managed on-farm trials. It links the power and capacities of agriculture science to the priorities and capacities of farming communities in an interactive learning process. PTD is closely linked with a process of general community development of self-reliance. It fosters awareness, self-respect, self-confidence as well as the diagnostic and experimentation skills of farmers. Further, it promotes the development of village organisation networks and the sharing of experience between and among the farmers.

**Aim of PTD** – PTD involves identifying, generating, testing and adapting new techniques and practices to help solve local problems. It helps to:

1. gain a joint understanding of the main characteristics and changes of the local agroecological system;
2. define priority problems of farmers and the farming community; and
3. experiment locally with a variety of options derived both from farmers (indigenous knowledge or other farmer experience) and from formal science.

The ultimate goal is to strengthen the experimental and technological management capacities of local people and the communities. Thus the farmers play a key role in the entire process and on farm experimentation becomes an essential element.

The 2 main steps in PTD are:

a) PD or Participatory Diagnosis: A Group of farmers identify their common problem with respect to a particular farming activity and outcome. A problem/cause diagram is a good tool to identify what they have been doing to overcome the problem in the past and what they might like to do in the future

   The farmer with the researcher/extensionist discusses option to help overcome the problems and suggest a course of action.

b) PAEM or Participator Agriculture Experiment Management: On farm research including an evaluation process with the farmer is instigated.

**Introduction to PTD.**

1.1 PTD Concept.

PTD is an approach to making good participatory and farmer lead agricultural extension, and to make sure that action and learning by doing can take place in farmers’ fields.

The approach is based on the principle that farmers learn best by their own experiences and especially when he has a stake in the outcome.

The PTD approach promotes the interaction between farmers and extension workers aiming at improving a joint learning process.

1.2 PTD Objectives.

- To enable farmers to take decisions by themselves as to what in their situation is the best solution to an identified problem
To facilitate farmers in continuously building up new knowledge by setting up, monitoring, and evaluating trials on their own fields and up-scaling.

To enable extension workers to facilitate farmers during implementation of the extension activities in accordance with farmer’s demands.

To build up the capacities of the extension service to manage and to monitor agriculture extension activities.

1.3 Rationale for PTD

Conditions for agriculture in Dak Lak Province are highly diversified, and there is no solution or answer that would fit every location and situation.

Agriculture in Dak Lak is steadily developing, technologies and policies are changing, and new varieties are being introduced to the farmers.

Farmers have continuously to create and adapt new knowledge to help make the right decision in these changing circumstances.

1.4 Activities in PTD

- **Participatory Diagnosis**: A process which helps the village and the extensionist identify and prioritize the problems that need to be solved. It identifies who in the village is most affected and nominates who in the village is best suited to work together to find solutions.

- **Establishing experiments**: One of the most important activities in participatory extension is to support farmers in setting up experiments, and facilitate the monitoring and evaluation of the experiment. Trials consider a new practice, carried out on a small area of a farmer’s field, divided always into 2 plots. One plot is for testing a new technique, the other plot is for applying the common technique as comparison. There are 7 steps for implementing trials which are included in the PAEM manual.

- **Establish demonstrations**: If the trial proves the success of a new technique and its adaptability the Community Extension Worker (CEW) can assist and motivate farmers to replicate the trial results in their own fields on a wider scale.

- **Training**: training for farmers on technical issues should always be according to farmer’s demand, and always contain practical parts or exercises so that farmers can learn from experience and not only from lectures.

- **Cross visits**: can be organised either between villages of the same commune or between villages of two different communes not too far from each other.

- **Study tours**: In some cases it is not easy to convince farmers about new ideas. For example, a new variety of fruit tree or a new technique that they have never seen before. Study tours to villages where farmers apply it already successfully may open up minds and broaden the experiences of farmers.

- **Input supply**: Experiments may be supported by providing inputs like seed or fertilizer.
- **Facilitate interest groups:** For some activities eg poultry raising, beekeeping, it is very suitable for farmers to support each other within one group with similar production interests. The CEW could facilitate these groups or Extension Clubs.

Further descriptions of the planning needs and the steps in implementation of PTD and PAEM can be found in training manuals formulated by the Son La SFDP (Social Forestry Development Project) in collaboration with the Son La DARD and endorsed by the Son La People’s Committee. They include:

2. PAEM Field Guide – SFPD Manual PAEM 2
3. ToT manual for PAEM – reference material for trainers. SFPD Manual PAEM 3
5. ToT Book for advanced trainers. SFPD Manual ToT 2

All the documents listed for use in this process are available on the internet via: http://www.mekonginfo.org/partners/SFPD/index.htm or through the SFPD Project Office.
Table 1: RDDL Target Households with upland farms and ruminants.

<table>
<thead>
<tr>
<th>District</th>
<th>Commune</th>
<th>Village</th>
<th>Total hh.</th>
<th>% Hh. with hill rice</th>
<th>% Hh. With hill maize</th>
<th>% Hh. With cattle, buffalow or goat</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lak</td>
<td>Dak Nue</td>
<td>Triek</td>
<td>38</td>
<td>10</td>
<td>26%</td>
<td>5</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D ham 2</td>
<td>132</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>D ham 1</td>
<td>134</td>
<td>4</td>
<td>3%</td>
<td>4</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mih</td>
<td>48</td>
<td>15</td>
<td>31%</td>
<td>6</td>
<td>13%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yen Thanh 1*</td>
<td>88</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yen Thanh 2*</td>
<td>67</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K die 1</td>
<td>102</td>
<td>12</td>
<td>12%</td>
<td>10</td>
<td>10%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>K die 2</td>
<td>123</td>
<td>19</td>
<td>15%</td>
<td>15</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yol</td>
<td>30</td>
<td>4</td>
<td>13%</td>
<td>6</td>
<td>20%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pai Bi</td>
<td>43</td>
<td>29</td>
<td>67%</td>
<td>20</td>
<td>47%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dlay</td>
<td>41</td>
<td>41</td>
<td>100%</td>
<td>41</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>846</td>
<td>134</td>
<td>16%</td>
<td>107</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bong Krang</td>
<td>Shruong</td>
<td></td>
<td>73</td>
<td>0%</td>
<td>0%</td>
<td>58</td>
<td>79%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Da Ju</td>
<td>126</td>
<td>7</td>
<td>6%</td>
<td>40</td>
<td>32%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Krai</td>
<td>38</td>
<td>0%</td>
<td>0%</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hang Gia</td>
<td>78</td>
<td>32</td>
<td>41%</td>
<td>32</td>
<td>41%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diec</td>
<td>102</td>
<td>4</td>
<td>4%</td>
<td>15</td>
<td>15%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Yang Kring</td>
<td>71</td>
<td>69</td>
<td>97%</td>
<td>5</td>
<td>7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thai*</td>
<td>31</td>
<td>0%</td>
<td>0%</td>
<td>8</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ja</td>
<td>197</td>
<td>197</td>
<td>100%</td>
<td>107</td>
<td>54%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>716</td>
<td>309</td>
<td>43%</td>
<td>207</td>
<td>29%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ea H'leo</td>
<td>Ea Sol</td>
<td>Tali</td>
<td>111</td>
<td>58</td>
<td>52%</td>
<td>25</td>
<td>23%</td>
</tr>
<tr>
<td>----------</td>
<td>--------</td>
<td>------</td>
<td>-----</td>
<td>----</td>
<td>-----</td>
<td>----</td>
<td>-----</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Krai</td>
<td>28</td>
<td>0%</td>
<td>0%</td>
<td>6</td>
<td>21%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cham</td>
<td>103</td>
<td>20</td>
<td>19%</td>
<td>99</td>
<td>96%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cham Hoai</td>
<td>58</td>
<td>12</td>
<td>21%</td>
<td>7</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Kari</td>
<td>116</td>
<td>90</td>
<td>78%</td>
<td>90</td>
<td>78%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dran</td>
<td>74</td>
<td>0%</td>
<td>0%</td>
<td>1</td>
<td>1%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diet</td>
<td>50</td>
<td>50</td>
<td>100%</td>
<td>0%</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chu</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tang</td>
<td>61</td>
<td>49</td>
<td>80%</td>
<td>50</td>
<td>82%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bek</td>
<td>62</td>
<td>2</td>
<td>3%</td>
<td>2</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Huing</td>
<td>57</td>
<td>4</td>
<td>7%</td>
<td>2</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bung</td>
<td>27</td>
<td>20</td>
<td>74%</td>
<td>10</td>
<td>37%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>M Nut</td>
<td>80</td>
<td>8</td>
<td>10%</td>
<td>7</td>
<td>9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Houi</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number 2*</td>
<td>85</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number 4*</td>
<td>260</td>
<td>0%</td>
<td>60</td>
<td>23%</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Thai</td>
<td>105</td>
<td>5</td>
<td>5%</td>
<td>5</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>number 5*</td>
<td>80</td>
<td>0%</td>
<td>60</td>
<td>75%</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number 1*</td>
<td>110</td>
<td>5</td>
<td>5%</td>
<td>40</td>
<td>36%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number 3*</td>
<td>113</td>
<td>0</td>
<td>0%</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>1580</td>
<td>323</td>
<td>20%</td>
<td>358</td>
<td>23%</td>
</tr>
</tbody>
</table>

Data from 18/20 villages 5/20 Kinh (*), 1/20 Thai

<table>
<thead>
<tr>
<th>Ea Hiao</th>
<th>Total</th>
<th>797</th>
<th>197</th>
<th>25%</th>
<th>578</th>
<th>73%</th>
<th>22</th>
<th>3%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>146</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5/23 are Ethnic
<table>
<thead>
<tr>
<th>Farming Group</th>
<th>Main components of the farming system</th>
<th>Aims of the farmers</th>
<th>Assets</th>
<th>Constraints</th>
<th>Current adjustments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnic minorities</td>
<td>- Upland food crops on slash and burn sites &lt;br&gt; - Subsistence farming &lt;br&gt; - Extensive cattle breeding on natural pasture lands &lt;br&gt; - Cash crops with low level of intensification (coffee, pepper, cashews cassava, maize) &lt;br&gt; - Some lowland rice, often only one crop</td>
<td>- Insure family’s food supplies &lt;br&gt; - Develop family’s incomes &lt;br&gt; - Achieve better land tenure</td>
<td>- Good knowledge of the environment &lt;br&gt; - own labour &lt;br&gt; - Often mixed farming system with cattle &lt;br&gt; - adaptation of technologies to suit circumstances &lt;br&gt; - assistance from Gov Projects eg 135</td>
<td>- Extensive farming system based on a large Land reserve &lt;br&gt; - Reduction of Land reserve due to migration and reclassification &lt;br&gt; - Extensive system incompatible with V’nam Landuse law &lt;br&gt; - Limited incomes and access to credit &lt;br&gt; - fodder scarce in dry environment</td>
<td>- Forced shorter fallow &lt;br&gt; - Adopting perennial cash crops but less intensively &lt;br&gt; - working as labourers &lt;br&gt; - growing fodder for livestock. &lt;br&gt; - selection crops demanding less intensive management (cashew, cassava)</td>
</tr>
<tr>
<td>Migrants</td>
<td>- Highly intensive (fertilizers, irrigation, pesticides) cash crops (coffee, pepper, maize, cotton) &lt;br&gt; - intercropping during establishment of long term crop &lt;br&gt; - intensive livestock production</td>
<td>- development of cash crops with high profitability &lt;br&gt; - Intensification &lt;br&gt; - maximum return on investment.</td>
<td>- starting capital &lt;br&gt; - credits access &lt;br&gt; - legal Land access easier with perennial crops</td>
<td>- very intensive system irrigation and fertilizer essential &lt;br&gt; - often dependant on international market &lt;br&gt; - sufficient water not always available</td>
<td>- inputs vary depending on prevailing prices &lt;br&gt; - diversification: consideration of other crops and livestock &lt;br&gt; - intercropping</td>
</tr>
<tr>
<td>State or Province Agriculture Enterprises</td>
<td>- Rubber plantations (77,000ha) &lt;br&gt; - Coffee &lt;br&gt; - Pepper</td>
<td>- create critical mass for manufacturing industry &lt;br&gt; - create employment &lt;br&gt; - contribute to State income</td>
<td>- state supported sector eg research &lt;br&gt; - credit access &lt;br&gt; - low labour cost</td>
<td>- fluctuating internat commodity prices &lt;br&gt; - alienates large tracts of land &lt;br&gt; - subsidised system</td>
<td>- diversification &lt;br&gt; - new approaches to give eco certification &lt;br&gt; - search for improved species</td>
</tr>
</tbody>
</table>
Table 3: Conventional versus Participatory approach to Farming Technology Development.

<table>
<thead>
<tr>
<th>Sustainable Agriculture through PTD</th>
<th>Conventional Agriculture without PTD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td><strong>General</strong></td>
</tr>
<tr>
<td>Long term sustainability</td>
<td>Short term benefits</td>
</tr>
<tr>
<td>Internal solutions to locally identified problems</td>
<td>Outside solutions to perceived problems</td>
</tr>
<tr>
<td>Participatory and responsive</td>
<td>Lack of local ownership</td>
</tr>
<tr>
<td>Places high value on human fulfilment</td>
<td>Disregards most personal consequences</td>
</tr>
<tr>
<td><strong>Technical</strong></td>
<td><strong>Technical</strong></td>
</tr>
<tr>
<td>Low internal inputs</td>
<td>High external inputs</td>
</tr>
<tr>
<td>Soil productivity maintained by organic inputs from the farm</td>
<td>Use of inorganic chemical fertilizers to maintain fertility</td>
</tr>
<tr>
<td>Biological control to minimize insects and other pests and weeds</td>
<td>Intensive labour or chemical requirements to control pest and diseases (insecticides)</td>
</tr>
<tr>
<td>Considers the whole integrated system</td>
<td>Concentrates on a single crop or outcome</td>
</tr>
<tr>
<td>Promotes biodiversity in species and varieties</td>
<td>Monocropping lacks diversity</td>
</tr>
<tr>
<td>Incorporates local knowledge proven for local conditions</td>
<td>Institutional technologies from outside not always appropriate</td>
</tr>
<tr>
<td><strong>Environment</strong></td>
<td><strong>Environment</strong></td>
</tr>
<tr>
<td>Minimizes soil erosion and siltation</td>
<td>Erosion pollutes the streams</td>
</tr>
<tr>
<td>Maximizes the retention of water, regenerates the water table</td>
<td>Reduces ground water availability</td>
</tr>
<tr>
<td>Top soil and soil structure maintained</td>
<td>Repeated cultivation disrupts soil structure</td>
</tr>
<tr>
<td>Soil biodiversity maintained</td>
<td>Soil micro-organisms reduced</td>
</tr>
<tr>
<td><strong>Economic</strong></td>
<td><strong>Economic</strong></td>
</tr>
<tr>
<td>Priority is food sufficiency/self reliance</td>
<td>Export and cash oriented, market driven</td>
</tr>
<tr>
<td>Few outside inputs required</td>
<td>Capital intensive often requires credit</td>
</tr>
<tr>
<td>Less labour/unit of output</td>
<td></td>
</tr>
</tbody>
</table>
Table 4: Steps in the Introduction of the Upland Farming Concept and PTD to the AEC.

<table>
<thead>
<tr>
<th>Step</th>
<th>Objective</th>
<th>Activity</th>
<th>Output</th>
<th>Responsibility</th>
<th>Project Inputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ensure necessary capacity to implement and replicate the PTD process.</td>
<td>Training</td>
<td>Provincial Staff with the capacity to be ToT Dist/Comm staff able to implement PTD</td>
<td>AEC and RDDL to combine in selection of trainer, trainees, content etc</td>
<td>Design and conduct a suitable training programme</td>
</tr>
<tr>
<td>2</td>
<td>Select 4 villages according to agreed selection criteria (1 from each Commune) for pilot implementation</td>
<td>Commune PTD Work Group Meeting</td>
<td>List of 4 participating villages</td>
<td>AES &amp; RDDL to organise</td>
<td>RDDL facilitate the meeting</td>
</tr>
<tr>
<td>3</td>
<td>PD - Introduce PTD, formulate Common Interest Group (CIG), Conduct Participatory Diagnosis</td>
<td>Village Meeting</td>
<td>Formulation of Common Interest Group Statement of problems, causes, possible solutions</td>
<td>Village Management Board, Commune AES, District AES</td>
<td>RDDL facilitate the meeting</td>
</tr>
<tr>
<td>4</td>
<td>Summarize PD outcome Outline of PAEM activities Consideration of M&amp;E</td>
<td>PTD W Group meeting</td>
<td>An approval of the selected trial topics Guidelines for M&amp;E</td>
<td>District AES RDDL</td>
<td>facilitate the meeting</td>
</tr>
<tr>
<td>5</td>
<td>Identify Implementing Farmers (IF), Design Trial, establish indicators for success (M&amp;E)</td>
<td>CIG Meeting</td>
<td>Implementing farmer (IF) and statement of objectives &amp; indic of success</td>
<td>Commune AES, Common Int Grp RDDL, AEC, AES</td>
<td>facilitate the meeting</td>
</tr>
<tr>
<td>6</td>
<td>Implementation of Trial</td>
<td>Meeting with CIG, farmer and Comm AES</td>
<td>A Work plan for trial implementation Monitoring schedule</td>
<td>Comm AES, CIG, IF</td>
<td>Support with necessary inputs</td>
</tr>
<tr>
<td>7</td>
<td>Monitoring of the trial progress</td>
<td>Field visits</td>
<td>Brief report of trial status according to guidelines</td>
<td>CES, CIG, IF, AES</td>
<td>Coaching</td>
</tr>
<tr>
<td>8</td>
<td>Evaluation at the end or at agreed intervals</td>
<td>Farmer Field Day</td>
<td>A brief report on the outcome of the trial including IF and CIG assessment</td>
<td>CIG, CES, AES, AEC</td>
<td>Facilitate the farmer field day</td>
</tr>
<tr>
<td>9</td>
<td>Consider expansion beyond the Commune/District</td>
<td>Evaluation by AES</td>
<td>Report to AEC for budget consideration</td>
<td>AES, AEC</td>
<td>Consideration of on-going support</td>
</tr>
<tr>
<td>10</td>
<td>PTD Process evaluation</td>
<td>Province WS</td>
<td>Eval Report and recommend future development direction</td>
<td>AEC, AES, RDDL</td>
<td>Facilitate WS</td>
</tr>
</tbody>
</table>