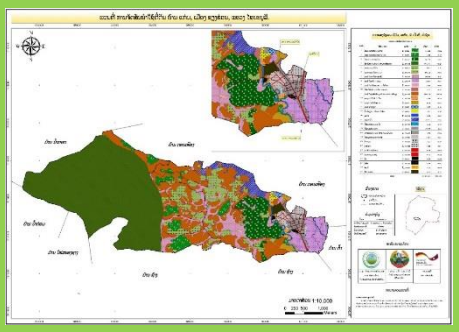
Ministry of Agriculture and Forestry

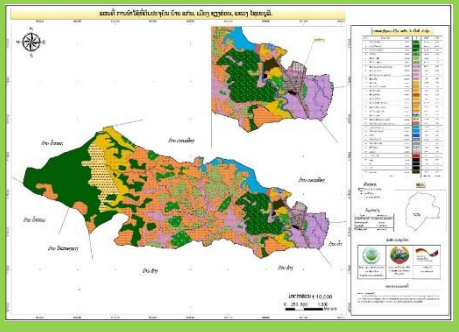
Department of Agricultural Land Management

Manual
Participatory Agricultural Land Management (PALM)
at Village Level





Vientiane, July 2018

Manual

Participatory Agricultural Land Management (PALM)

at Village Level

Compiled by

Department of Agricultural Land Management and the Department of Lands

Supported by:

GIZ – Land Program / CIM

Vientiane, July 2018

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Preface

This manual has the purpose to be used as a tool and reference to implement Participatory Agricultural Land Management (PALM). It is used for agricultural sector planning of land use at village level, based on the roles and responsibilities of the Department of Agricultural Land Management (DALaM), of the Ministry of Agriculture. The process and procedures defined in this manual will be disseminated and used for planning and for the management of 4.5 million ha of agricultural land throughout the country. The purpose of planning is to ensure the use of agricultural land in a sustainable manner and also to maximize benefits for farmers based on site specific conditions, considering the limitations in capital and human resources in the villages.

The procedures in participatory agricultural land management were developed with the goal to create a plan that enables villagers to maximize the income from agricultural land in a sustainable way. Participation is ensured by basing the plan on information from villagers. This method will gain very good results if district staff is able to manage and use the tools for planning by themselves. The overall objectives of the participatory agricultural land management are to promote income generation from agricultural production and to provide a baseline that enables the registration of agricultural land. Therefore, the use of existing agricultural land in the villages urges the elaboration of precise plans. These plans shall be used to enable the use of agricultural land in accordance with the specific situation in the village and to fulfill the needs of the people, especially to enable them to increase income, to use resources in agricultural production efficiently, and to ensure sustainable agricultural production in the future in accordance with the regulations of the Lao PDR.
This manual was developed based on the lessons learned from field experience in implementing participatory land use planning by the technical team from DALaM of the Ministry of Agriculture and Forestry, the integrated expert at DALaM (CIM-GIZ) and the technical team from the Department of Lands (DOL) of the Ministry of Natural Resources and Environment, which were supported by the Land Program of GIZ.

PALM is a specific sector plan for agriculture that is adding detail to the PLUP (Participatory Land Use Planning), as it is mandated to DOL of MONRE. In this way, the PLUP/PALM process was developed to form a collaborative effort to land use planning by both departments, DALaM and DOL, in which the work is shared between the teams of both offices in the district.

In the pilot phase, PLUP and PALM were implemented in Xayaboury, Luang Namtha and Khammouane provinces with teams from the respective District Agriculture and Forestry offices (DAFO) and the District offices of Natural Resources and the Environment (DONRE). These PLUP palm teams attended trainings, implemented by a trainer pool from the national level with technical and financial support from the GIZ-Land Program. The main objective of this pilot

project was to determine appropriate and suitable steps, procedures and methods that enable the district staff to implement the activities on their own, without support or advice from projects and the national trainer teams from DALaM and DOL.

In the future, the PALM methodology should be used to train more trainers at the national level that can act as multipliers and train more staff at the provincial and district levels. However, the improvement of the methods and tools for implementing PALM still continues by sharing experiences and conducting discussions with the field staff implementing PALM in target districts and provinces. This will ensure that the manual will be suitable for future use and that the methods applied are cost efficient and feasible for district teams. After the completion of the initial piloting, the National Steering Committee conducted a review workshop in Vientiane Capital. All relevant stakeholders, from PLUP and PALM teams of district, provincial and national levels participated, discussed and shared the lessons learned.

This Manual will be used as a reference in preparing, implementing and follow up of the Participatory Agricultural Land Management activity for the PLUP/PALM teams at the district level through the training in the theoretical methods and in practical implementation.

Vientiane Capital, date 17. AUG 2018

Director General of the Department of Agricultural Land Management

Khamphone RASACHACK

Purpose of Participatory Agricultural Land Management at village level

1. To explain the Lao Government Policy in relation to the Participatory Agricultural Land Management at the village level.
2. To explain the methods, steps, procedures and regulations in implementing the Participatory Agricultural Land Management at village level in accordance with site specific conditions.
3. To explain the rights, duties, roles and responsibilities of the relevant sectors to be involved in developing and implementing the plan of the Participatory Agricultural Land Management at the village level.
4. To integrate Participatory Agricultural Land Management as a preparatory step for Land Registration, land titling in remote areas.
5. To improve the knowledge and technical skills required for Participatory Agricultural Land Management of district and provincial staff, and of projects staff across the country.

Target Users

This Manual was published to be used for Participatory Agricultural Land Management at the village level by all relevant local organizations of the Lao government. It is also meant to be used by donors, NGOs and other concerned Organizations.

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1 Introduction

The purpose of this handbook is to outline and guide the process, tools and requirements for Participatory Agriculture Land Management (PALM), as an additional agriculture sector plan to the village level land use plan. In order to comply and be coherent with the roles and functions of the Department of Agricultural Land Management and Development (DALaM), the process and procedures outlined in this handbook will be used in the planning and management of agricultural land throughout the country on the total area of 4,500,000 hectares. The focus of planning is on the sustainable use of agricultural land and to create most benefit, considering limitations of monetary and human resources in the village.

The PALM process has been developed with the aim to create meaningful plans by using essential village information. This is to be achieved in a way that the process stays manageable for the staff of district authorities. The overall objective of PALM is the promotion of agricultural activities and the registration of agricultural land. Agricultural land use at village level requires certain planning to meet the requirements of the rural population, to enable income generation, to use agricultural resources wisely, to sustain future generations and to comply with principles and regulations of agricultural land use in Lao PDR.

This handbook is based on the lessons learnt from practical experiences of staff of DALaM MAF and their CIM-GIZ integrated expert, who conducted land use planning in close collaboration with staff from the Department Land Zoning and Development (DLPD) / MONRE and with support of the GIZ land program.

PALM builds on the existence and reliability of a micro land use plan, which shows current land use and provides a land zoning for broad land categories. It is described in more detail in the chapter about PLUP. For this reason, both planning steps should be carried out at the same time, with staff from both DAFO and DONRE.

During piloting activities, implemented in Sayaboury, Luang Namtha and Khammuane provinces, district staff (DAFO and DONRE) were trained in implementing PLUP and PALM. Piloting was funded and technically supported by a Lao-German Cooperation project (GIZ LMDP). The main target for such piloting is to find procedures and formats for a smooth implementation that shall allow staff in the district to implement activities by themselves without or with limited support by donors and the staff from the central level, i.e. DALaM and DLPD. The objective of the piloting activities at the national level was to build up a pool of trainers that can train district staff in the future. Adaptations of the tools and lessons learnt were continuously discussed with the practitioners during the field activities in the provinces and were used to develop the hand book. A lessons learnt workshop with representatives from the national, provincial and district level PLUP/PALM teams was held in Vientiane after the pilot phase.

The handbook should be used as a reference during the preparation, conduction and follow up of PALM activities by the PLUP/PALM teams at the district level. It is meant to accompany practical and theory based trainings.

This handbook consists of two parts:

Part one explains the overall procedures of participatory agricultural land management. It makes clear how tools should be applied, gives hints for a smooth implementation and shows strategies to avoid critical mistakes that can occur.

Part two presents the tools and methodologies of each procedure. The tools are presented in detail in a way that planning can be replicated. For some steps, there may be more than one tool available. Tools were put together in a sequence that is normally functional in the village context. The tools selected and developed for this guide were designed to meet minimum requirements.

1.1 Training Steps and Implementation

The training steps used by the national level trainer pools of DALaM and DLPD are shown in Figure 1. In this way, the capacities at the national level and in the district level were improved during the pilot phase. Once the national level trainer pool is complete, some additional minor adjustments need to be made. District level trainings with follow up activities are essential for a good performance of the teams.

In the beginning, a team of national level trainers needs to be formed. This team consists of at least two technical staff from DLPD (two PLUP/GIS trainers) and 3 technical staff from DALaM (1 PALM trainer, 1 soil scientist, 1 PALM/GIS trainer). Team members should already have experience with the technical skills needed for planning. To improve skills, like the ability to teach, identify and solve problems and to include specific content, a TOT (training of trainers) and on the job training are to be carried out. This is necessary, to improve the training capacities and the technical knowledge of trainers. In a TOT and in on the job training, exercises and presentations are prepared before the field mission. After each field mission, lessons learnt are collected and the material and approach is refined for the next implementation round.

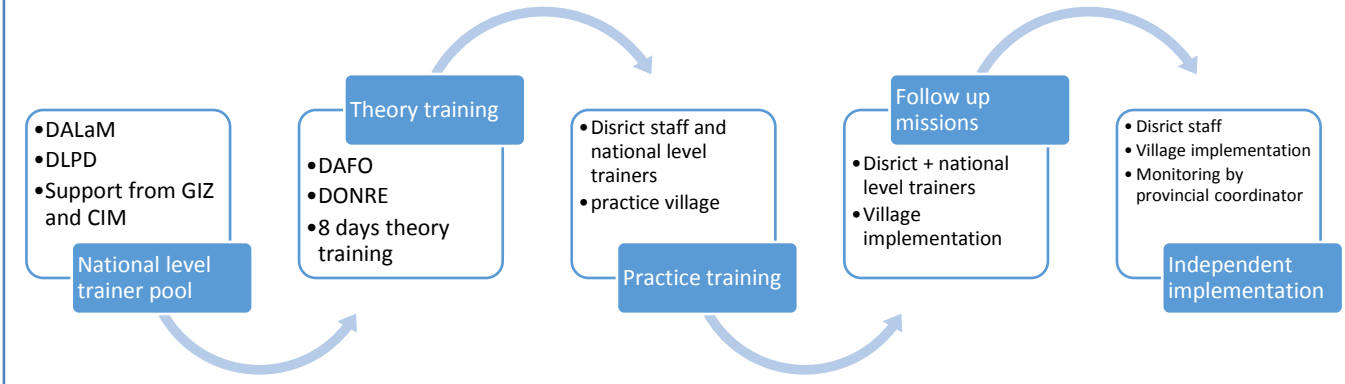


Figure 1: Training set up in LMDP

To conduct the theory training, there are several alternatives possible. It can be carried out in the district or province town or even in the capital. When trainings are conducted in the province town or in the capital, teams from two districts can be invited to a joint training. More time for field implementation and practice trainings will be available with this approach. Depending on the available level of skills and knowledge of the district staff, the theory training takes between 7 and 14 days. It is beneficial to include not only the district staff of DONRE and DAFO but also provincial level coordinators in the theory training. A training needs assessment can help identify which experience and knowledge is available in the team before the start of the activities.

During the practice training in the first village, the national level trainer team demonstrates how PLUP/PALM is carried out in the real working environment. Once this is completed, there are two possible ways to continue supporting the district staff. In the ideal case, one person, either from DLPD or DALaM stays with the district for one month and conducts two more village plans with the district team. After that, the district goes on with the next village independently. This long term trainer should have a good understanding of all tools and steps needed in the planning process. If it is not possible to leave one trainer for a longer period with the district team, backstopping missions need to be conducted regularly.

Once this cycle is completed, the district team continues planning in more villages without support. Backstopping missions are still important at this stage, to develop the capacities of the district staff until they are able to continue working without support from the national level trainers.

1.2 Skills and Knowledge requirements

In total, a district PLUL/PALM implementation team should consist of 6 members, of which 3 are DAFO and 3 are DONRE staff. The list of skills below describes the capabilities of an ideal team after a series of trainings and after having gained experience with the methods. It might also serve as a catalogue of skills that can be used for the selection of PLUP/PALM team members. In this case, those persons who have already some of the qualities listed below should be preferred over those that are not yet familiar with any or little of the topics. It is not recommended to make use of project or government budget for promoting staff that does not have the required skills if other staff with such skills is also available. The reason for this is that even if the staff already has a good background, the PALM method is a new task that requires full attention and commitment. Only if the best available staff is selected, the budget can be used efficiently. The number of staff indicated in each topic of the following list is a recommendation that will allow a smooth performance. Training needs have to be satisfied before district staff is sent to the villages.

- 1-2 staff with GIS software user knowledge (ArcGIS, QGIS or other)
    - Create projects
    - Load all forms of data
    - Ensure correct use of the UTM coordinate system
    - Clip and print georeferenced satellite images and orthophotos
    - Digitizing of polygons, lines and points
    - Correct editing of attribute tables
    - Apply the standard legend
    - Calculate areas
    - Layout and print maps
    - Georeferencing of photos and scans
    - Create point files from GPS points
    - Data storage and file structure

- 4 Staff with GPS handling knowledge
    - Set up GPS to UTM coordinate system
    - Collect reference points and name them
    - Download GPS points to the Computer

- 4 staff with abilities in moderation and facilitation of participatory discussions, conduct semi-structured interviews and facilitate participatory mapping
    - Involve rural population in discussion
    - Enable structured discussion
    - Note taking of important information
    - Results oriented discussion moderation
    - Ensure participation of stakeholders
    - Clarify objectives

- 4 staff with ability to analyze and use the information gathered in planning
    - Perform data analysis
    - Representation of summarized data in tables and charts
    - Draw conclusions from results
    - Make use of results for planning

- 6 staff with ability to collect socio-economic data, perform data entry, data checking and analysis
    - Collect socio-economic data with a structured questionnaire
    - Ensure respondents' understanding of questions
    - Enter data to a databank correctly
    - Check data quality once data entry is completed
    - Analyze data and summarize results in tables and charts
    - Make use of results for planning

- 2 staff that have knowledge on the evaluation of soil quality.
    - Soil sampling
    - Specific knowledge in applying the soil test kit
    - Ability to give recommendations on fertilizer use based on results of soil tests and crops
    - Ability to advise farmers on soil fertility management
    - Ability to advise farmers on soil protection

Apart from this, the district team that will implement this activity shall be trained to clearly divide the tasks as well as to understand all forms before implementing them in the field. Please see the details in the tool box, where a sample work plan is presented.

1.3 PLUP and PALM in Teamwork

Since PALM focuses on agricultural land, it is essential to distinguish the boundaries of the agricultural land from the current land use map and also determine how future land zoning will affect agricultural land. This means that before the PALM team can commence with agricultural planning, land zoning must be completed or updated. Despite PALM being a fully functional stand-alone process mandated to MAF and its sub-national line agencies, it is of advantage in practice to have a mixed team from DAFO and DONRE to carry out PLUP and PALM together, and follow the steps shown in Figure 2. The advantages of the teamwork lie in a better cost efficiency and quality of the output for both teams.

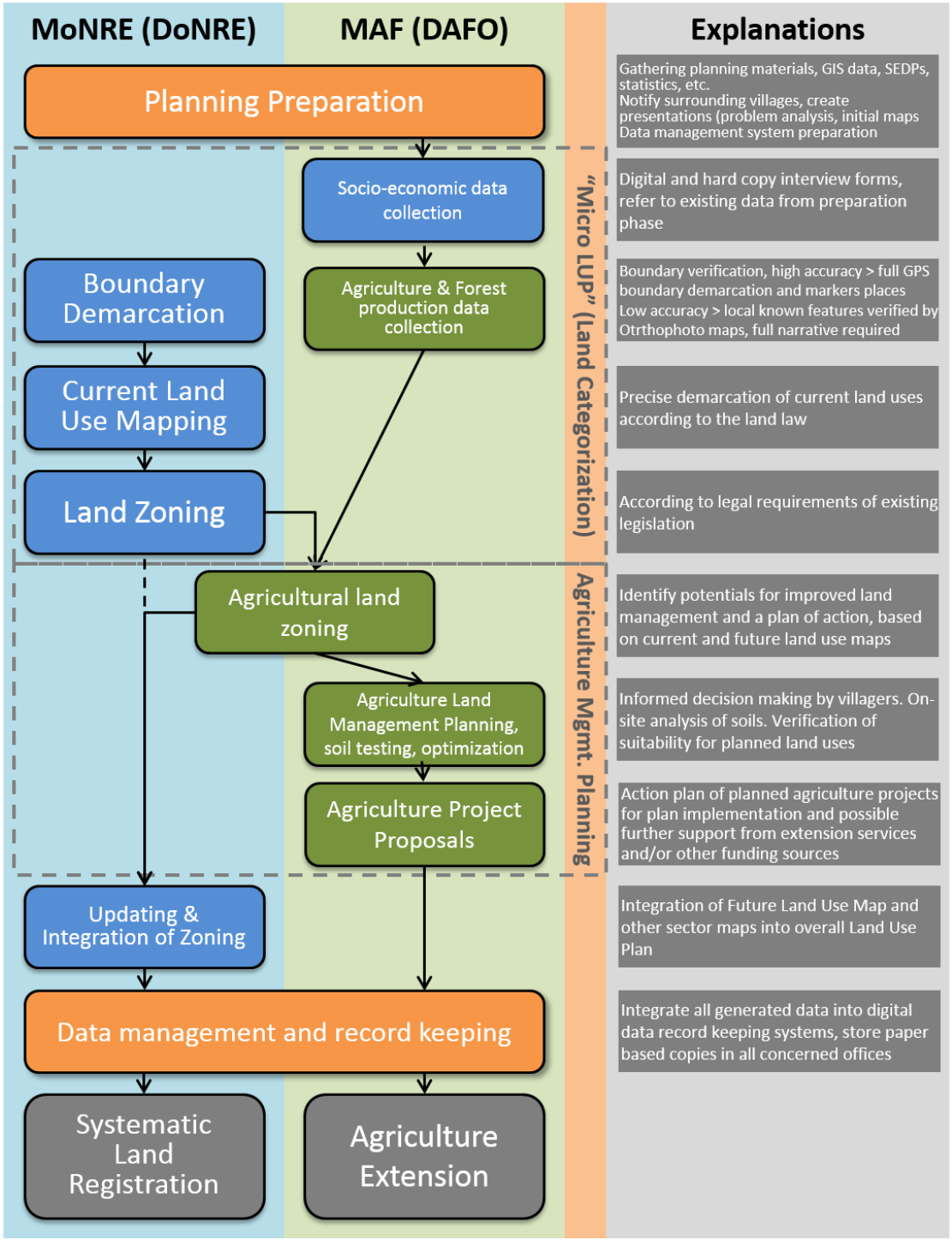


Figure 2 Work flow and responsibilities in PLUP/PALM

Some examples to make clear why joined operations between MAF and MONRE are desirable:

- Socio-economic data collection and the estimation of the population growth are necessary for PLUP and PALM. Data collection and analysis can be done for both approaches at the same time, using a joint format.
- Both procedures require reports and agreements. A joint report that includes the agreements can be written.
- Trainings for district staff can be carried out jointly.
- In districts, where the team of either DAFO or DONRE doesn't have staff capable of using GIS or data analysis tools, persons from the other team can fill the capacity gap.
- Village meetings for opening and closing are carried out jointly.

1.4 A short Summary of PLUP

PLUP has been carried out widely throughout Lao PDR. The standard PLUP manual of 2010 is usually referred to as the green manual. It states in detail which steps are required and provides a toolbox for field work. This chapter shall not describe PLUP in depth but provide a quick overview of the procedures and outputs and recommend some tools that were successfully used during field work. Being aware that conditions in the field have changed since the publication of the guideline, some changes on tools are presented here.

In the PLUP/PALM approach, presented in this guideline, both planning instruments are carried out at the same time. For this reason, teams of DONRE and DAFO carry out the activities together and some steps, especially the data collection on socio-economics and some group discussions need to be merged.

Although one might think that PLUP is already available in Lao PDR and the results could be used for agricultural planning, a reality check shows that existing PLUPs are often outdated. Teams need to check the available data. Where data is outdated or not complete, an update of the village boundary, the zoning within the village and the collection of socio-economic data may be necessary. In many cases, the Village Land Management Committees (VLMC) that were set up during previous PLUP are available.

There are three situations from which the PALM process may start
• No PLUP exists: In this case, the complete planning steps must be followed, as described in the PLUP manual. • PLUP exists but major revisions required: The magnitude of the revisions needs to be checked and the missing steps must be completed. • PLUP exists and small revisions sufficient: In this case, the PLUP is usually less than 2 years old and only minor updates are required.

Socio-economic data collection

Since PLUP and PALM are carried out together, the data collection tools that come from both approaches are harmonized and further developed. A joint set of tools for group interviews and a short village census questionnaire are made available (see Toolbox, chapters 5, 6 and 7). These tools and the analysis of the data are described in more detail in the sections on PALM.

Boundary demarcation

The village boundary is checked and reviewed with the VLMC and representatives from neighboring villages. For this step, it is essential to use the best available satellite images or aerial photos in both digital and printed form for participatory mapping. In addition to that, it is also possible to use the web based google earth software for displaying the landscape using an LCD projector. In villages without mobile internet signal, the required tiles of the images and the terrain data can be downloaded before using them with the VLMC. Especially the terrain representation in google earth proved to be very helpful for the identification of village land. Boundaries follow characteristic topographic features, such as mountain ridges or summits. These can be easily identified, using the terrain representation function of the software.

A sketch map is used to identify areas where the stakeholders can agree on the boundary after discussion and participatory mapping. For areas where an agreement cannot be reached directly, field visits and the necessary clarifying discussions need to be carried out. GPS points are taken during this step. If possible, a boundary walk shall be conducted to collect more GPS points.

In case a boundary agreement cannot be reached between neighboring villages, higher level authorities, such as the district governor's office need to be involved to come to a decision that is recognized by all stakeholders.

Once these steps are complete, the team proposes the boundary map to the stakeholders again and works out a written description for approval.

Current land use mapping:

The eight categories of land mentioned in the green manual seem not sufficient anymore and were changed by the national level DLPD officers as follows:

- Agricultural land
- Residential land
- Cultural land
- Land for national defense and security
- Forest land
- Land for industry and commerce
- Public work land
- Wetland

In addition to that, roads, waterbodies, industrial land, and protected areas, as well as the forest categories (managed use forest, conservation forest, and protection forest) and industrial tree plantations were mapped.

1.5 Minimum Criteria for LUP

At the time of drafting this guideline, there was a discussion going on, that aimed at a consensus on minimum criteria for village level land use planning. Representatives from a number of relevant projects (GIZ-LMDP, CDE, ICBF, SUFOURD-SU, Cirad-EFICAS, GIZ CLIPAD and DALaM) that are involved in LUP have discussed criteria that should be met by village level land use plans. Although the resulting list (see toolbox chapter 1) is already comprehensive, it must not be misunderstood as a checklist for PALM, because many elements more are covered in this approach.

1.6 The PALM Steps

The PALM steps listed here are explained in detail in individual chapters of this guideline. Where tools are required, they can be found in the toolbox, which is supplied as an annex to the guideline.

Table 1 The PALM Steps

PALM Steps	Description of action
1. Preparation	Collect existing data, get material and equipment, train field staff, copy forms from toolbox and cd annex
2. Village opening meeting	Invite all villagers and a District representative, explain the PLUP/PALM process and objective check the operation ability of the VLMC
3. Household level data collection	Collect basic socio-economic data from each household and enter them in the database
4. Group interviews and discussions	Use the predefined forms to discuss various topics with the VLMC. e.g. Problem census, population growth, NTFP and wildlife
5. Updating of PLUP (according to DOL standards)	Check the village boundary and adjust it if required, with participation of representatives from neighboring villages. Update the village boundary agreement and resolve conflicts if there are any.
6. Participatory mapping of current agricultural land use	Use a recent Satellite image or Orthophoto printout and on screen display with an LCD to assess current land use. Farmers participate in creating a base map and in clarifying and updating land use categories. Make sure to assess growing areas of main crops and communal land.
7. Assessment of soil properties of agricultural land	Use the standard soil test kit to analyze about 10 soil samples from representative agricultural land use categories. Determine the pH level, and N, P, K levels.
8. Assessment of economic indicators for main agricultural land use systems	Identify main crops and cropping systems in the village. Interview farmers on the revenue, yield and labor requirements. Assess livestock systems and areas used for livestock to estimate livestock productivity indicators.
9. Summary of results from previous steps to enable planning	Get the results from interviews, mapping, soil testing and productivity estimation together and prepare them for further use.
10. Agricultural land management planning	Conduct a planning and modelling discussion with farmers. Compare different options for agricultural land use with the

PALM Steps	Description of action
	potential and requirements of the village. Find an optimized solution, in which productivity sustains income in the future and the village owned natural resources are conserved.
11. Participatory mapping of future agricultural land use	Having defined the optimized solution for agricultural land use, find out where there is sufficient and suitable space to implement changes.
12. Action plan development	Clearly define what needs to be done in order to implement changes. Define a timeline for actions. Also define who shall be responsible and which kind of support or materials are needed.
13. Reports, agreements and follow-up	A village PLUP PALM report is written, using the DALaM DOL structure and is approved by the District governor's office. The report includes the following annexes: 1. Boundary map with points of interest and geographic features. 2. Current land use map 3. Current agricultural map 4. Future land use map 5. Future agricultural map 6. Map of land tenure (Communal, private, state land) Annex of documents: 1. Village land management committee 2. Boundary agreement 3. Village land use planning agreement 4. Village soil doctor agreement Monitoring missions shall be conducted to help the villagers implement the village action plan.
14. Data Storage and management	Data are stored securely and transmitted to the provincial and national level authorities. The village receives all documents and maps.
15. Village closing meeting	Invite all villagers and a District representative, explain the results of the PLUP/PALM process. Inform villagers on all agreements, results of the survey, the village potential and the agricultural action plan. Also inform villagers in the role of the VLMC as resource persons for the realization of the action plan.

2 Preparation

Before implementing PALM at village level, PLUP/PALM teams need to have received training, as described in the introduction. A detailed work and budget plan needs to be elaborated. It should include the activities to be implemented, the time for the implementation in the field, the arrangement of staff and budget plans. A sample of a work plan for orientation can be found in the toolbox (chapter 3). In reality, a certain degree of flexibility is required, because the completion of some steps might not be possible in the given time, while other steps can be completed smoothly.

For PALM, the District Agriculture and Forestry Office (DAFO) and there, the Agricultural Land Management Division is the body that takes the responsibility and conducts the practical implementation in collaboration with the District Office of Natural Resources and Environment (DONRE).

2.1 Collection of secondary Data and Satellite Maps

The documents collected in this step summarize the activities on land use planning that have already taken place and are materials used in the planning process.

Table 2 Secondary data to be collected

Item description	Where to collect
The law on agriculture and forestry and the land law	Should be available for reference in each DAFO/DONRE office
Socio-economic Development Plan (SEDP) for District level	DPI office or DPI website of the province Can also be collected from PPI and DPI offices
Five-Year Socio-Economic Development Plan of the Province	DPI office or DPI website of the province
Report on the micro land use planning of MONRE	DONRE office
Report on agricultural land use, as created before (if available)	DAFO office
Digital maps created from Micro land use planning, like village boundary, current land use, future land use etc. (if available)	DONRE office
Boundaries and descriptive information for protected areas	DONRE office
Boundaries of large scale investments, land leases and concessions (if available)	DONRE office, PPI office
Recent high resolution satellite image e.g. Quickbird images, SAS planet mosaics or orthophoto (High resolution color images)	MONRE (DOL) and DALaM, NGD
Scanned topographic maps at the largest available scale	To be copied from the trainer team

2.2 Equipment and Tools

In order to collect and summarize the information gained in the village, a number of consumables and equipment is necessary. A complete list of all these things can be found in the toolbox (chapter 4).

When preparing a PALM, special attention should be paid to the materials that are used during the participatory discussions.

The A0 printout of the satellite image is vital to ensure a high quality participatory mapping procedure. The printout needs to be prepared well in advance, because in many district towns, A0 printers are not available and printing needs to be organized in the next provincial capital. The scale of the printed images for participatory mapping should be 1:10.000 or 1:12.000.

Some material, like the one used for the soil test kit can be used for several villages.

2.3 Determination of Validity and Availability of existing Plans

Plans from previously conducted land use planning are collected from persons responsible for land use planning in the DONRE and DAFO offices at the district level. The head of the village cluster administration, the village head and the VLMC should also be in possession of the products of former Micro land use planning or PLUP, which are:

a) For the case of LUP-LA

- Village Boundary and Land Use Zone Maps
- Inter-village Boundary Agreement and Boundary Conflict Resolution Agreements
- Village Forest and Land Management Agreement
- Village Land Use Planning Data
- Village Land Allocation Data
- Village Land Use Planning and Land Allocation Report

b) For the case of PLUP

- Village Boundary and Land Use Zone Maps
- Inter-village Boundary Agreement and Boundary Conflict Resolution Agreements
- Village Forest and Land Management Agreements
- Village Land and Forest Use Planning Data

Once this information is collected, the team leaders shall visit the village and check which maps, agreements and data are outdated or need revision. This is done by consulting the village head and the VLMC if there is already one in the village. (See chapter 3.1).

3 Survey and participatory Discussions

For the collection of information, a set of methods and tools that were designed for their individual purpose is used. Figure 3 shows the sequence of data collection from different stakeholders and gives an overview on the tools to be applied.

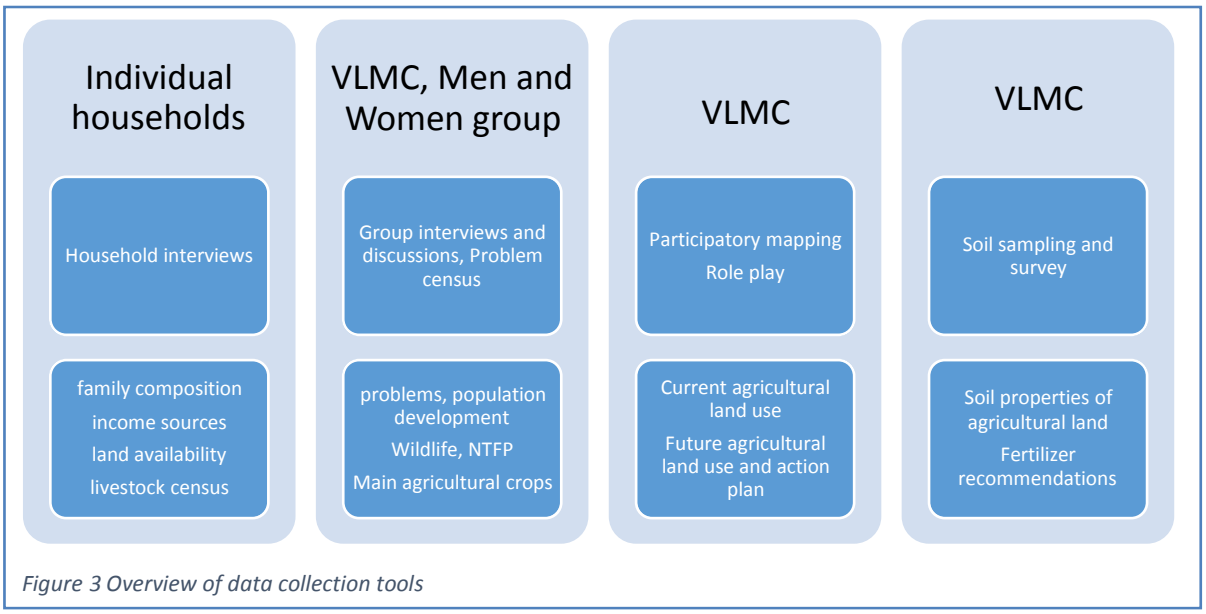


Figure 3 Overview of data collection tools

3.1 Hold a Village Meeting

In holding a village meeting, the village authorities, and village organizations from all levels, representatives from all ethnic groups in the village, representatives of families, in particular women and the relevant parties in the village and village cluster level are invited. This meeting is held to inform on the objective and the goal as well as to introduce the working team. In addition, it also explains the procedures and steps in implementing the participatory management of agricultural land in the village level. It aims at clarifying the PALM steps to the village population and why it is important for the village.

In order to formalize the process, the District Governor or Vice Governor and the directors of DAFO and DONRE are invited to open the village meeting.

Figure 4 Village meeting

In many villages, the VLMC is already in place. During the village meeting, the VLMC is either set up, updated or reconfirmed. During PLUP/PALM, the VLMC is used as a group of source persons, from which all the information needed during group discussions and participatory mapping is retrieved. The VLMC is also be involved in the future land use planning for the village and communicating agreements and plans to the village population.

In the case of PALM, it should be made sure that sufficient knowledge on agricultural practices is available in the VLMC. In case, farmers are underrepresented, some additional members may be appointed to extend the VLMC to a VALMC (Village Agricultural Land Management Committee).

Members of the VLMC
The members of the VLMC can be determined in an election or by appointment, considering their appropriateness for the tasks. 12 to 14 people will be selected to be in the VLMC. If possible, the number of female and male should be equal. Ethnic groups living in the village should be represented. It should cover all social classes within the village and have variety in terms of their occupation. In addition, the VLMC shall represent a good portion of the administrative units in the village and include people from various age groups.

After PLUP/PALM, the VLMC manages the land within the village. This includes the agricultural land and the forest land, as far as they fall into the village jurisdiction. Village land use regulations are agreed upon after the land use planning is completed and the VLMC is the body that makes sure that the agreement is followed and has the possibility of sanctioning violations to the rules according to the sanctions catalogue set up by the village.

The selection of suitable members of the VLMC is based on the agreement of villagers and the village authority.

3.2 Socio –economic Data collection and Analysis

The collection of information is carried out in two ways. With a standardized short questionnaire in every household and by means of group discussions and semi structured interviews with the VLMC.

3.2.1 Group Discussions and semi-structured Group Interviews

The VLMC is used as a group of source persons for important information on various topics, like the Problem census, NTFP (Non-Timber Forest Products), population growth, economic development and future development objectives. For each of these topics, templates are provided in the toolbox (Chapter 7).

For the collection of information in groups, focus group discussions, semi structured interviews, and participatory mapping are used.

A semi-structured interview is a qualitative method of inquiry that combines a pre-determined set of open questions (questions that prompt discussion) with the opportunity for the interviewer to explore particular themes or responses further. A semi-structured interview does not limit respondents to a set of pre-determined answers (unlike a structured questionnaire).

To prepare the semi structured interview or group discussions, the topic of the interview e.g. village history, needs to be prepared in a way that makes clear what to ask and how to structure the discussion.

The focus group discussions can be conducted, using templates from the toolbox (Chapter 7), which should be used to enter the data after the discussion. Some descriptions that come up during the discussion must be summarized in the form of key findings, making sure that important information is not lost.

For topics, like the problem census, NTFP or wildlife the group is divided into a men and women group.

It is usually helpful to conduct group discussions with 2 Facilitators and to divide the tasks between them as follows: One person explains the topic and procedure applied. This person is the discussion leader or moderator, who guides the discussion by means of the leading questions. The discussion leader should also take care that all group members are taking part. The discussion leader makes sure that the work is not be dominated by individuals or biased by groups with special interest.

The second facilitator can help fulfilling the tasks of the discussion leader, but his main task is the documentation of the results. To make the results clear to the participants, notes are taken on an A0 paper on the wall. The resulting tables and narratives are typed to the computer in the office later on.

The tools that were developed for the group discussions are listed in Table 3. Most of them are self-explanatory, while some additional explanation follows for the others. The tools on the main cropping systems and the livestock tool are explained in chapter 4.1 and chapter 4.1.3.

Table 3: List of group discussion tools

List of information needed	Information source (Target group)	Outcome
Demographic information	VLMC	Growth rate of population Future estimation of village population
Problem census	VLMC (separate in male and female groups)	Summary of most important problems related to land and agriculture, the cause of problems, impacts and possible solutions.
Forest use and timber extraction	VLMC (separate in male and female groups)	The use of timber by villagers
Wildlife and its use	VLMC (separate in male and female groups)	What is found and the use of wildlife by villagers

Population development

The collection of demographic information involves some calculations that are presented here. An Excel sheet with the necessary formula is available in the workbook that contains the household census database.

Start filling the template table with the current number of inhabitants, as collected from the village head and calculated from the household census. Then, ask the VLMC how many persons were born, died, moved in and moved out in each of the past 5 to 6 years.

The change of population for each year is then calculated by:

$$\begin{aligned} Change\ of\ population\ (2015) \\ = births\ (2015) - \text{mortality raterate}(2015) \\ + move\ in\ (2015) - move\ out(2015) \end{aligned}$$

Figure 5 Population growth matrix

The population of the year before (e.g. 2015) is calculated by deducting the population change of the previous year (e.g. 2016). Do this calculation for each year. If the population increased in 2016, the population growth is positive and the population for 2015 was smaller than in 2016. If the population decreased in 2016, the population change is negative and population of 2015 was greater than in 2016 consequently.

$$Population\ (2015) = Population\ (2016) - \ Change\ of\ population\ (2016)$$

Once the total population for each year is calculated, calculate the change in percent.

This is done by multiplying the population change of the respective year by 100 and dividing the result by the population of the same year.

$$Population\ change\ (2015)\ (\%) = \frac{population\ change\ (2015) * 100}{population\ (2015)}$$

Once all figures for the observation period have been collected and the percentage increase is calculated, add up the increase in percent and get the total population change in percent over the whole observation period.

To calculate the average population change per year in the observation period, divide the summed up change for the whole period by the number of observed years. This figure is also called rate of increase or rate of decrease, according to the direction of change.

The projection of the future population in a village can now be calculated for each year by:

$$Projected\ population\ in\ 2017 = population\ in\ 2016 + \ average\ rate\ of\ increase\ (\%) * \ population\ in\ 2016$$

$$Projected\ population\ in\ 2018 = population\ in\ 2017 + \ average\ rate\ of\ increase\ (\%) * \ population\ in\ 2017$$

The projected population is calculated for the next five years.

Problem census

The problem census is a powerful tool to assesses, which changes in land use are necessary and within the priorities of the village.

Figure 6 Problem census matrix

Figure 7 Women group discussion

It is crucial for the success of planning that the problem census is conducted with high quality. Only if this is considered, the completeness of all land related problems can be ensured.

Villagers need a good explanation of what is to be collected in the problem census.

Key Elements of a Problem census
Issue: What is the actual problem? A short description of which negative things are happening. Issues are ranked according to their importance. e.g. Crops on vegetable fields are eaten by livestock. **Cause:** What is the reason for the problem to occur? e.g. livestock is grazing freely in the village area and is not controlled. **Impacts:** What happens as a consequence of the issue? Vegetable yields are not as expected, farmers need to replant and fence their fields at their cost, although livestock owners should be responsible to control their animals. A conflict on livestock keeping in the village arises. **Proposed solution:** What could be done to solve the problem? Allocation and fencing of grazing land. Management of livestock grazing land. Restrict moving of livestock. Village regulation for compensation of damages. Grow improved forage grass species for livestock feeding.

The problem census is structured to collect information on topics from agriculture, forestry, public health, infrastructure and other matters. Special topics on land tenure security and general problems on land should also be discussed where appropriate. A detailed discussion is carried out for each of these themes. This discussion needs to be structured and summarized according to the issues, causes and impacts. If possible, a solution for the issue or problem should be defined. Once, the issues are collected, they are ranked according to their priority.

To clarify, what the structure of the problem census means, some explanation on the terms issue, cause, impact and proposed solution is given in the box. The moderator should explain to the group how this structure works but he should not impose answers or problems to the group.

3.2.2 Household Interviews, data entry and analysis

Data collection on the household level has the objective to collect some basic information on the families, their income sources and their land. In villages with up to 150 households, a PLUP/PALM village census should be completed in one day with the complete PLUP/PALM team (6 persons). To enable efficient and correct data collection, the questionnaire was kept very short. It is included in the toolbox (Chapter5).

Figure 8 Household interviews

With the collection of information on the socio-economic situation of the village, the team needs to get some important insights on main income generating activities, composition of the family, the availability of land resources and the stock taking of livestock.

Training of data collection staff

The persons collecting the data have to be trained properly before they are sent out to conduct interviews. This training should involve four steps, in which:

- The content of the questionnaire is explained in detail giving examples for answers, specifying the units in which information is to be collected and what the information is going to be used for later on.
- A role play test interview is conducted, in which trainers act as interviewers and interviewed person. The trainees fill out the form during the test interview.
- The data is entered in the databank under supervision.
- The results of the test interview are compared and interpreted.

Data entry and Data Analysis

The excel database provided with the questionnaire was designed to allow easy and standardized data entry and automatic calculation of results (see Figure 9). This can only be achieved if the data entered is correct and in the right units, as specified in the questionnaire and in the header of the database.

For data entry, the empty database sheet with the filename HH Database_A_Lao_v4 should be used. This file must be kept safe in its original form. Before entering data, the file should be copied and renamed. The file name should include the village name, e.g. HH DatabaseDatabank_A_Lao_v4_Ban Xong. If data are entered by several people on different computers, a copy of the file should be used on each computer.

The header of the database shows all the questions and tables of the standardized questionnaire.

Each row under the header represents one interview.

The other sheets, except the one for population development are results sheets, where no data needs to be entered. These sheets contain formula that calculate indicators from the data entered in the sheet database. Tables and figures on the results sheets update automatically, as data is added to the database sheet. Nothing should be changed here, since the formula are tested for correctness and the tables produced are standardized.

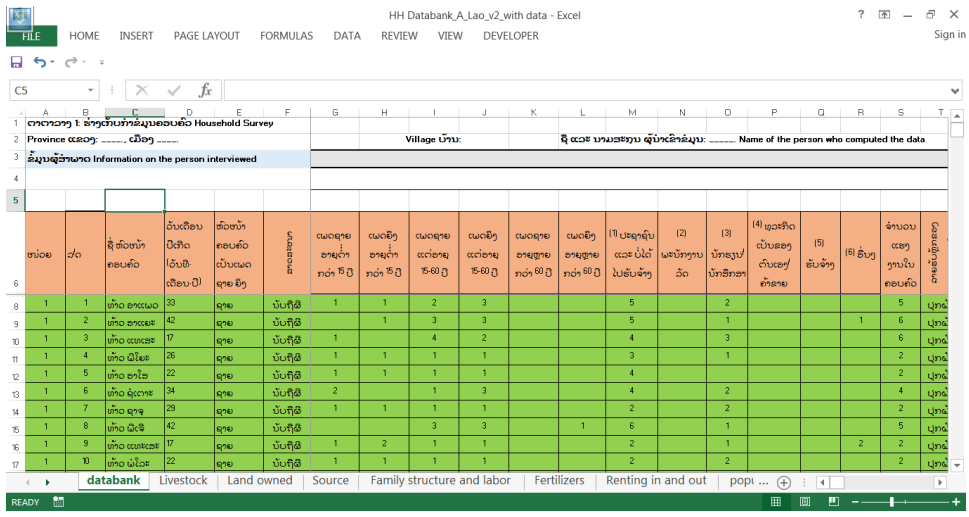


Figure 9 The Excel the database for household interviews

Since the implementation of tools requires learning by doing, it is normal that tools and databases have to be checked and additional clarification has to be provided. After each round of implementation, lessons learned have to be summarized, discussed with the team and solutions have to be provided.

The following **typical problems** usually appear when the questionnaire and database are newly introduced during field work:

- **Metadata**

  The cells above the actual dataset in the sheet database specify the province, district and village of the survey and the name of the person who worked on the data. Unfortunately, these fields are not filled out with the necessary care.

- **Land categories and plots** are not collected clearly enough

  e.g. garden land (=horticultural land) or land for vegetables

  Tree plantations: trees for commercial use. This can be e.g. rubber, teak, and fruit trees.

  Cash crops: crops that are sold and not only consumed, like cassava or sugarcane

- **Area figures**

  The questionnaire asks for the size of plots in hectares but the farmer answered in square meters. Data are entered in the wrong unit and not converted to hectares. One ha is 10.000 square meters.

- **Use of consistent units**

  Make sure, the units for all measurements are used exactly as specified in the questionnaire form. For example, yield and fertilizers figures were often collected and entered in the wrong units. This leads to a confusion between kg and tons. 1.000 kg is 1 ton.

- **Typing mistakes**

  When a zero too much is typed, the result is 10 times too high. This is a mistake easily made with Lao Kip and other currencies that require high absolute numbers.

- **Dot and Comma** mistake: 1.400000 in the databank means 1.4 and not 1400000

  If data are entered in the Lao way of writing numbers, Excel will not recognize the entered information as a number but as text. Consequently, there will be no calculation possible. For example:

  If 1,4 is written, Excel cannot read it as a number. It needs to be 1.4

- **Thousand separators in the English version of Excel are "," 1,400,000 is 1400000.**

  Thousand separators are never entered manually! This is a done by formatting numbers in an Excel sheet.

  BUT: if 1.400.000 is entered wrongly, excel will not be able to read the number. Excel will consider this as text.

Copy paste problems

Once data entry is complete, the datasets need to be copied into one file in order to have the data from all households in the same file.

When joining the data from several computers to one excel sheet, use paste “values” and NOT paste link. If paste a link is used, the cells pasted will always refer to the source table, which might be saved on a USB stick that is removed after copying.

Copy and paste in Excel can be carried out, using a variety of options.

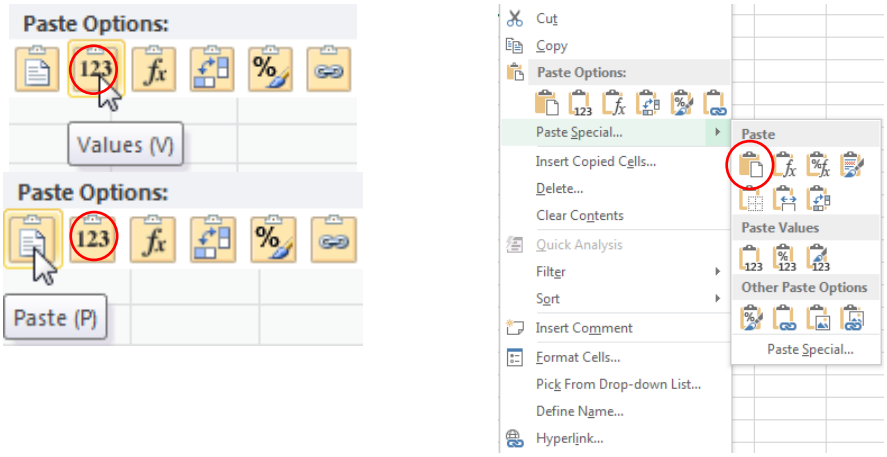


Figure 10 Paste options in Excel

In the case of this database, all the data that were entered on different computers need to be written to one single copy of the database. If the option paste link is selected, Excel will paste the information from the source table as a link into the destination table. This operation will update the values if they are changed in the source table. In the case of this database, **this is not recommendable**, because updating requires the reference files to be saved in the same location even when the database is copied to another computer. So always use paste.

Never use insert copied cells with this database, because it will shift the source information which is used for data validation in drop down menus down and destroy the drop down menus.

For a comprehensive description of these options, please refer to the website http://www.excel-easy.com/examples/paste-options.html, where there is more information on the functionalities of Excel.

Verify the correctness of the data entry

Once all the data of one village is entered and copied to the same workbook, it is necessary to check if the data are correctly entered. The most frequent data entry problems can be detected by using the following steps:

1. Hide the data that are not necessary to be displayed.
   The database and the sheets that contain the formula for the calculation of indicators were designed for a maximum of 992 households. Before entering a formula that will check the data, the rows that are analyzed need to be hidden ore made invisible.
   To hide rows, the rows are marked. A right click shows a pop up menu, which has the command hide. After the execution of the hide command, the marked rows are invisible.
   In the case of the household database, mark the rows 9 to 10000 and hide them.
   Once the rows are hidden, it is easy to check the data quality with some formula.

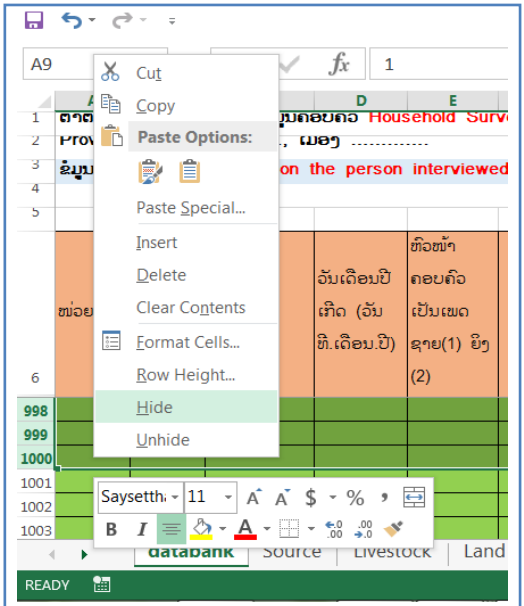


Figure 11 Hiding rows in Excel

2. Write the formula to calculate Sum, Maximum, Minimum and the average value.

   To enter a formula e.g. in cell 1002, click the cell and type "=", followed by the formula. For example, "=max(G8:G1001)" finds the largest number in the range of cells from G8 to G1001.
   Once a formula is typed, it can be transferred to neighboring cells by dragging the formula there.
   Some useful formula:
   =SUM(G8:G1001) Sums up all numbers in the range
   =MAX(G8:G1001) Finds the largest number in the range
   =MIN(G8:G1001) Finds the smallest number in the range
   =AVERAGE(G8:G1001) Calculates the average or mean value in the range
   =AVERAGEIF(G8:G1001,">0") Calculates the average or mean value in the range for those numbers that are greater 0.

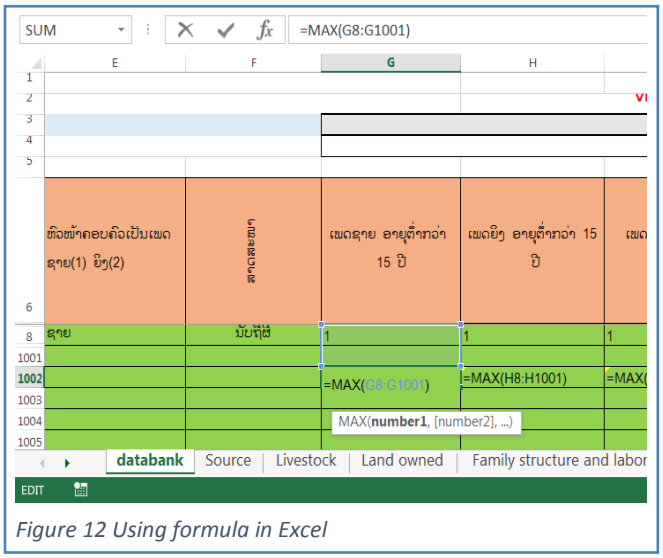


Figure 12 Using formula in Excel

3. Thoroughly look at the result of the formula and decide if the result is trustworthy, always considering the correct use of units, as stated in the questionnaire and in the header rows of the database.

4. Once non-reliable information is detected in the fields calculated with the formula above, the data needs to be unhidden again to find the suspicious cells and correct the data by looking up the information noted in the questionnaire.

The sheets that are following the databank should not be changed by the user, because the cells in these sheets contain formula that calculate indicators.

It is essential to critically look at the tables in the results part. Before tables are copied for further use in planning or in the report, it must be made sure that the results are correct. In case some values do not meet the expectations, the data used for their calculation is usually entered in the wrong way to the database.

3.3 Soil properties of agricultural Land

3.3.1 Survey and Evaluation of Soil Quality

The content of nutrient minerals in the soil and soil pH are decisive factors for soil fertility and thus for plant growth. Different plants and crops use specific levels of nutrients. In the framework of PALM, it is not possible to take soil samples of each plot and analyze them in the laboratory. Representative plots for the main agricultural crops are selected and a field survey with a basic soil analysis that approximates the main soil nutrients (N=Nitrogen, P=Phosphorus, and K=Potassium) and the pH-value (indicates soil acidity) is conducted.

In the ideal case, the current land use map, a result of PLUP, is available at this stage to determine where the agricultural land of the village is located. If the final version of the land use map is not yet available at this point, the agricultural land to be sampled needs to be determined by means of a satellite image, always taking care that sampling points are within the village boundaries.

DAFO officers discuss with the VLMC to determine about 10 sampling sites that should represent the agricultural land as good as possible. These sites should cover the main agricultural crops of the village and also the main soil-relevant units within the agricultural land. Such units can for example be: alluvial

Figure 13 Analyzing soil samples with the toil test kit

land, paddy land, permanent upland fields, shifting cultivation plots, grazing land, areas with high and low yield and areas with different parental material for soil formation. Once the sampling sites are determined on the map or satellite image, the coordinates can be loaded to a GPS device for exact

navigation to the site. In order to find the easiest access to the sampling sites, local farmers should be used as guides. The position of the sample taken should be recorded with GPS.

There are numerous field methods for soil quality assessment. Only the most important ones are mentioned here.

The visual evaluation of soil quality with the village land management committee indicates the soil organic matter content, soil structure and soil texture.

For example, it can be found out if the soil is hard or soft, how deep plant roots can penetrate and how good the soil is in retaining water. Soil texture and organic matter content also indicate how vulnerable a soil is to water and wind erosion.

The evaluation by the soil test kit shows levels of main plant nutrients N (Nitrogen), P (Phosphorus) and K (Potassium) and serves to know about soil pH.

The pH value indicates soil acidity, which plays an important role in the properties of soils to retain nutrients and to make nutrients available for plant growth. If the pH value is low, the soil cannot hold the plant nutrients well. They will be washed out by water from the rain. Acidic soils will also lose important properties of the soil structure and can hold less water.

3.3.2 Fertilizer Requirements

Nitrogen (N) is the most widely recognized nutrient. Nitrogen mainly affects vegetative growth and general health of plants. Chlorophyll, the substance that makes plants green is essential for photosynthesis and it is largely composed of nitrogen. It is also used heavily in new shoots, buds, and leaves. All the proteins, plants produce, also contain Nitrogen as an essential element. Air contains about 78% nitrogen, but atmospheric nitrogen is not readily available to plants. They must absorb it through the soil. Ammonium and nitrate are both readily available forms of nitrogen, but they are common in chemical fertilizers and leach heavily and quickly out of the soil. Nitrogen can be applied organically in many ways. It is for example contained in compost and animal manure. Legumes, such as Beans, Soybeans, Peanut, Cowpea, Lablab, Stylosanthes, Clover and Alfalfa are able to fix atmospheric nitrogen by means of a symbiosis with soil bacteria (rhizobium). Such plants can be used as a cover crop during fallow periods or they can be used for intercropping in many ways.

Nitrogen deficiency is recognized by the yellowing of older leaves (Figure 14), slowing or stopping of growth. Leaves may drop sooner than expected. Excess nitrogen is recognized by extremely fast growth, resulting in long, spindly, weak shoots with dark green leaves. It is crucial for a good fertilizer application to consider stages of plant growth. As the plant grows up and prepares for flowering and producing fruit, the demand for N is increasing (Figure 15).

Phosphorus (P) is important for healthy roots and is used more heavily during blooming and seed set. Phosphorus is easily rendered unavailable to plants when the pH is slightly unbalanced. It is released in soil through decomposing organic matter.

Phosphorus deficiency is recognized by dull green leaves and purplish stems. The plant is generally unhealthy, sometimes yellowing. Lack of blooming with lush green foliage may also indicate a lack of phosphorus.

Potassium (K), sometimes known as potash, is important for general health of plants. It is key in the formation of chlorophyll and other plant compounds. Potassium is also known to help with disease

resistance. Potassium deficiency is hard to symptomize, but plants are generally sickly, with small fruit, yellowing from the older leaves upwards, and sickly blooms.

The amount of N, P and K that should be applied to one hectare of land depends on the availability of these plant nutrients in the soil, the soil texture and the crop. The results of the soil test kit indicate the availability of the nutrients in classes ranging from very low to very high. By means of a set of tables that come with the soil test kit, the availability classes are related to soil texture and the crop to be grown. The result is a combination of N P K requirement that is indicated in kg/ha.

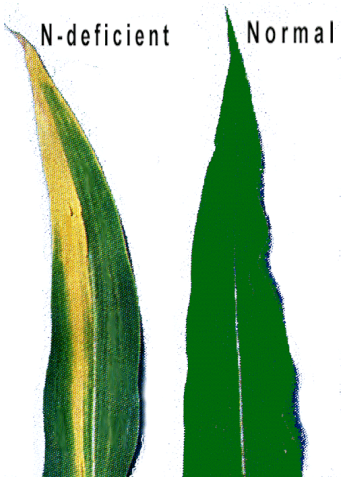


Figure 14 Symptoms of N deficiency on plant leaves

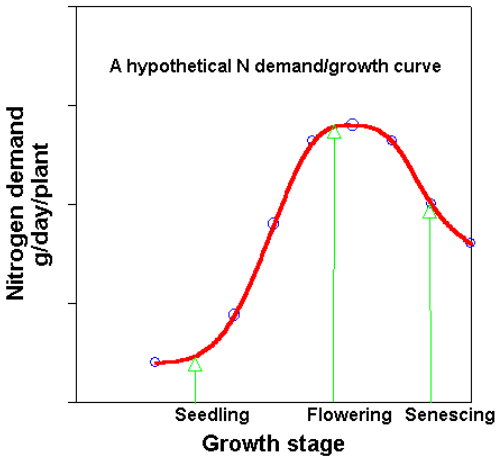


Figure 15 The demand for N during plant growth

Source: https://www.ctahr.hawaii.edu/tpss/research_extension/rxsoil/organic.htm

4 Assessment of agricultural Land Use

Current land use mapping, as carried out in PLUP delivers the agricultural land polygons. It shows the location of the agricultural area and of the grazing land, under the present conditions. On the map produced for land use zoning, the size and location of agricultural land in the future is defined. The future values consider the population growth as it is expected in the next 5 years.

The development of an agricultural land use map is also done in these two steps, the assessment of the current situation is followed by the planning for the future. In order to enable planning, the current situation of the agricultural land and its use need to be assessed. This involves more detailed mapping of agricultural land use systems to sub_cat level (see the legend in the CD Annex). It also has to involve some economic assessment of agricultural production. Agricultural land use planning for the future has to consider the economic interests of the village population and it should also enable to judge upon the sustainability of developments of agricultural land.

4.1 Agricultural Land Use System and Revenue from main Activities

Information on the main cropping systems can be collected in group- or key person interviews. About five farmers should provide the information. Preference is on group interview, in which two staff are working together: one is moderating the discussion and collecting the information on the board, while the other one is entering the information into an Excel sheet and calculates the indicators directly.

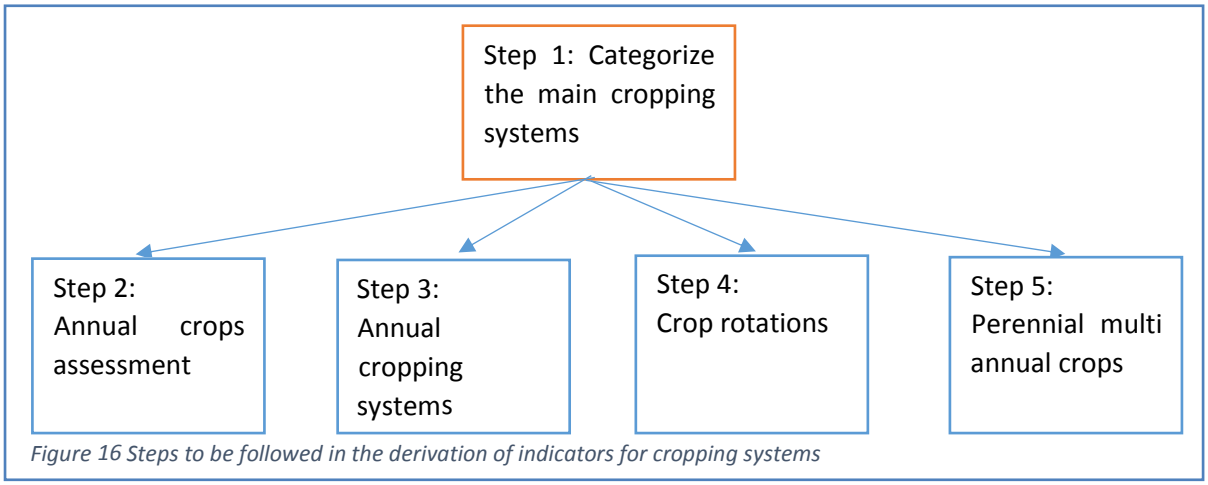


Figure 16 Steps to be followed in the derivation of indicators for cropping systems

By applying these tools, the team assesses areas, yield, labor force requirements and revenue for the most important agricultural land use systems. Although it is limited to collect basic indicators, the tool is challenging because the team that collects the information needs to facilitate and moderate the group discussion and collect the information in a structured way. The calculation of the results is carried out at the time of the group discussion to enable a direct checkup of correctness of the results obtained. This is achieved through a set of ready to use Excel spreadsheets, in which the data are entered and which calculate the predefined indicators for each farmer and the average indicator for the group of farmers. Quality checks can be performed by comparing indicators from each farmer with the average and the other farmers.

Figure 17 Interviewing a farmer group on main crops

The objective of the steps 1 to 5 is to generate some indicators that allow a direct comparison between different cropping systems. How to achieve this, will be explained in chapter 5.1. Once all this is completed, the planning of scenarios (Chapter 5.2) combines the results from the participatory agricultural mapping with the results of the village level indicators for agricultural production and the population development.

4.1.1 Definitions for Indicators

Before presenting the tools, some definitions are needed to clarify the meaning of the indicators to be calculated as the result of the steps 1 to 5.

a) Revenue per hectare per year

Beware of confusion between **revenue** and **net income**
Revenue is defined as the turnover or sales of a business. This means that cost is not deducted when talking about revenue. Confusion comes from the use of the term income, because the term is usually used for net income, in which cost is deducted from the revenue. A synonym to net income is profit. For matters of feasibility, revenue and not net income or profit is calculated. The **correct terms have to be clarified in Lao Language** and in case the differentiation is not clear it has to be explained repeatedly.

The revenue is the gross income. It is calculated by multiplying the amount of the product sold (in kg) by the price obtained (in LAK/kg) from the buyer. Opposed to that, net income is calculated by deducting all cost related to production (inputs, labor cost, machine cost), transport, processing, tax etc. from the revenue. For matters of feasibility in the timeframe available for PALM, only revenue is considered.

Revenue per hectare is obtained by dividing the revenue by the number of hectares used for the cropping system from which the revenue was generated. Revenue per hectare per year is obtained by adding up the revenues obtained in all years of the cropping system and then by dividing it by the number of years, the cropping system is cultivated.

$$revenue\left[\frac{LAK}{\frac{ha}{year}}\right] = \frac{\frac{Amount\ of\ crop\ harvested[kg] * Sale\ price\ of\ crop\left[\frac{LAK}{kg}\right]}{area\ of\ cultivation\ [ha]}}{Number\ of\ years\ [year]}$$

b) Days of labor per hectare per year

One day of labor is a full working day of one adult person.

The days of labor per year are calculated as follows:

$$labor\ \left[\frac{days}{year}\right] = number\ \ [labor\ force] * number\ \ [days]$$

If days of labor from more than one year are used, all the years need to be added up before the sum of days of labor is divided by the number of years.

Example 1:

A farmer works with his wife on the rice field for four days.

$$2\ [persons] * 4\ [days] = 8\ [labor\ days]$$

Example 2:

A farmer, his wife and 5 persons he employs work for collecting rubber. They work four hours per day and collect the rubber every second day. One full day of labor is 8 hours/day. The season for rubber collection is 8.5 months long.

This means:

7 Persons (farmer, wife + 5 employed)

4 hours / day = 0.5 days of labor if one full day of labor is 8 hours

8.5 months

Every second day = 15 days per month

Days of labor = 7 persons * 0.5 days of labor * 8.5 months * 15 days/ month = 446.25 days of labor

$$7\ [person] * 0.5\ [labor\ day] * 8.5\ [month] * 15\left[\frac{day}{month}\right] = 446.25\ [labor\ day]$$

c) Revenue per day of labor

The total revenue divided by the total number of full day of labor

$$\frac{Renevue}{labor\ day}\left[\frac{LAK}{day}\right] = \frac{total\ revenue}{number\ of\ labor\ days}\ \left[\frac{LAK}{day}\right]$$

4.1.2 Categorization of the main Cropping Systems and Assessment of Indicators

In a group discussion, it has to be agreed, which cropping systems are the most important ones grown in the village (usually up to 5).

For each of the crop categories defined, the data is collected, using the lists of questions as provided in the toolbox (Chapter 8) and as listed in the corresponding Excel spreadsheets, which are supplied in the CD annex.

In the spreadsheet, those cells that are marked in green with dots are not to be filled.

Formula for the calculation of the indicators are at the right side of the sheet and at the bottom. These should not be changed.

Special data collection tools for each category of crops are provided in the toolbox (Chapter 8) and as Excel sheets.

4.1.2.1 Annual crops

Examples for annual crops are rice, beans and cassava. This is the easiest and most frequent calculation needed. The assessment of such crops needs only ten questions, as shown in the toolbox. Information on annual crops should be collected first with the farmer group, because it is an exercise for the other crop categories that follow and it makes clear which indicators and data are needed.

Annual crops
An annual crop completes its cultivation cycle from seeding to harvest in less than one year.

4.1.2.2 Annual cropping systems

This tool is needed to assess situations in which farmers cultivate more than one crop per year on the same plot. In order to calculate the indicators that are based on the unit of hectares and days of labor correctly, all revenues and labor requirements are added up before the final indicator is calculated.

For example:

- Irrigated rice with two or even three crops of rice per year
- First rice, then beans
- Rice, then rent out the land for the second crop e.g. watermelon

Annual cropping systems
Cultivation of several annual crops in succession. Once a crop is harvested, the plot is free. In some cases, a second or third crop can be grown on the same plot in the same year.

The data are assessed separately for each crop, as shown in the section before with the same sheet for annual crops.

The values of each indicator that belongs to the cultivation period of one year have to be added up.

For example, the first crop is rice and the second crop is beans:

$$revenue\ (rice + beans)\left[\frac{LAK}{ha}\right] = revenue\ (rice)\left[\frac{LAK}{ha}\right] + revenue\ (beans)\left[\frac{LAK}{ha}\right]$$

The indictors for revenue related to labor input per hectare per year are calculated in the same way.

When plots are rented out for the second crop, calculate the revenue from renting as follows.

$A = Size\ of\ land\ rented\ out\ [ha]$

$B = Rental\ contract\ value\ [LAK]$

$$Revenue\ from\ renting\ out\ \left[\frac{LAK}{ha}\right] = \frac{b}{a}\left[\frac{LAK}{ha}\right]$$

$$Revenue\left[\frac{LAK}{ha}\right] = revenue\ from\ first\ crop\ \left[\frac{LAK}{ha}\right] + revenue\ from\ renting\ out\left[\frac{LAK}{ha}\right]$$

4.1.2.3 Crop rotation and crop sequence

Define a typical rotation cycle and collect the data as shown in the section on annual crop assessment.

Calculate the indicators needed, like revenue/ha/ year, labor force/ha per year, for each crop, using the sheets and questions for the annual crops. In case a multi annual crop is included in the crop rotation, the indicators are calculated, using the sheets and questions as described in the paragraphs before and the toolbox.

Add up the values of each indicator for all crops that belong to one rotation period and divide by the number of years.

Crop rotation and crop sequence
The practice of growing different crops in succession on the same land chiefly to preserve or make use of the productive capacity of the soil

$$\frac{5\ years'\ revenue}{ha}\left[\frac{LAK}{ha}\right]$$
$$= revenue\ (upland\ rice)\left[\frac{LAK}{ha}\right]$$
$$+ revenue\ (maize)\left[\frac{LAK}{ha}\right] + revenue\ (cassava)\left[\frac{LAK}{ha}\right]$$
$$+\ revenue\ (jobs\ tear)\left[\frac{LAK}{ha}\right] + revenue(peanut)\left[\frac{LAK}{ha}\right]$$

Divide 5 years' revenue by 5 and get the revenue per hectare per year of the rotation cycle.

$$average\ crop\ rotation\ cycle\ revenue\ \left[\frac{LAK}{ha}\right] = \frac{5\ year's\ revenue}{5}\ \left[\frac{LAK}{ha}\right]$$

On upland fields, usually a sequence of crops is grown, followed by a fallow period. In such cases, the revenue /ha is calculated including the fallow period. This means that potential revenue from the fallow period should be estimated and the total number of years of the cultivation plus the fallow is used for the calculation.

4.1.2.4 Multi annual and perennial crops

This is the most difficult category to assess, because there are several possibilities of carrying out the interview and the calculation. Figure 18 and show the typical sequence of phases in the life cycle of multi annual crops and perennial plantations. Crops like sugarcane have a life cycle of usually 3 years and the production often starts at the end of the first year. In the case of rubber, there

Multi annual and perennial crops
Perennial crops are crops which are alive year-round and are harvested multiple times before dying. Perennial plants are not new to agriculture; plants such as fruit trees or rubber are perennials that are commercially grown and harvested. Multi annual crops have a shorter life cycle. An example is sugar cane.

are more elements to consider. That's why the life cycle of this category of crops is divided into typical phases of use and management. It is crucial to discuss with farmers, which phases they need to distinguish for the crop that is being discussed and then collect the information for the relevant ones. The excel sheet provided for this calculation allows to leave out phases that are not relevant for specific crops. But when there are major differences in the level of yields or the labor requirements between the three productive phases, these should be recorded. The Excel sheet will calculate wrong indicators if the number of years of the total life cycle and the phases are not entered correctly.

Before beginning with the interview:

Explain and define the phases of production to the farmers (establishment, management, production: including initial, climax and phasing out) before starting.

Collect the duration in years for each phase before going on.

Make sure the farmers are always aware about which phase they are interviewed while the interview is being carried out.

Examples of multi-annual crops are banana or sugarcane. Such crops, typically have a sequence of up to 3 main phases that follow each other as the plantation develops. When collecting the information from the farmers, it has to be discussed with them if the difference in management effort and yield levels are high enough to justify a separate assessment of all phases. If this is the case, the information for all phases has to be collected. If management effort and yield levels do not differ much between the phases, time can be saved by collecting the information once, estimating the average labor requirements and the average production per year. When collecting the information, it must be made sure that the number of years for the whole life cycle of the plantation is collected correctly.

The first year is the **establishment phase.** The soil is prepared, seeding or planting take place. If there is already a product harvested, productive and establishment phase are to be combined.

In the **productive phase**, up to 3 sub phases, according to the yield level of the plantation can be distinguished. These are initial, climax and phasing out.

- In the **initial phase**, the crop is still young and small. It might not yet produce to full capacity.
- In the **climax phase**, the plantation is mature and the production goes up to its maximum capacity.
- **Phasing out** takes place when the best years of the crop are over and the volume of production drops.

In the spreadsheet, leave the cells for phases that are not relevant blank.

Clearing: After the productive period of the plantation, work requirements for clearing the plot have to be collected.

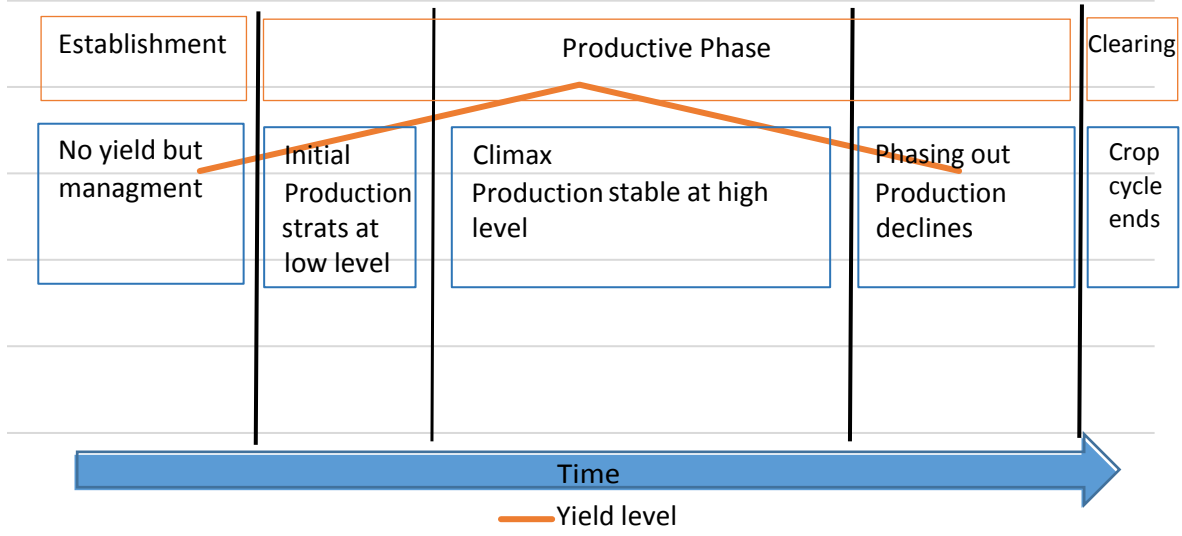


Figure 18 Phases in the production cycle of multi annual crops

Perennial crops

Examples for crops of these categories are rubber, fruit trees, coffee.

With such crops, there is a typical sequence of up to 4 main phases that follow each other as the plantation develops. These are:

Establishment phase: In the first year, soil is prepared, the seeding or planting takes place.

Management phase: covers the years, in which there is no production yet. This is for example the case with rubber or coffee. Usually, work is required to protect the young plantation from weeds and pest. In cases, where intercropping with an annual crop is done in the first years, this needs to be assessed, using the sheet for annual crops and has to be added to the indicators later.

Productive phase: up to 3 phases can be distinguished here. They depend on the yield level of the plantation. These are, as already explained above: initial, climax and phasing out.

Clearing: Once production is no more profitable enough, plantations need to be cleared. Work requirements for clearing the plots and the revenue that is possibly generated from by products, such as wood from rubber trees, have to be collected.

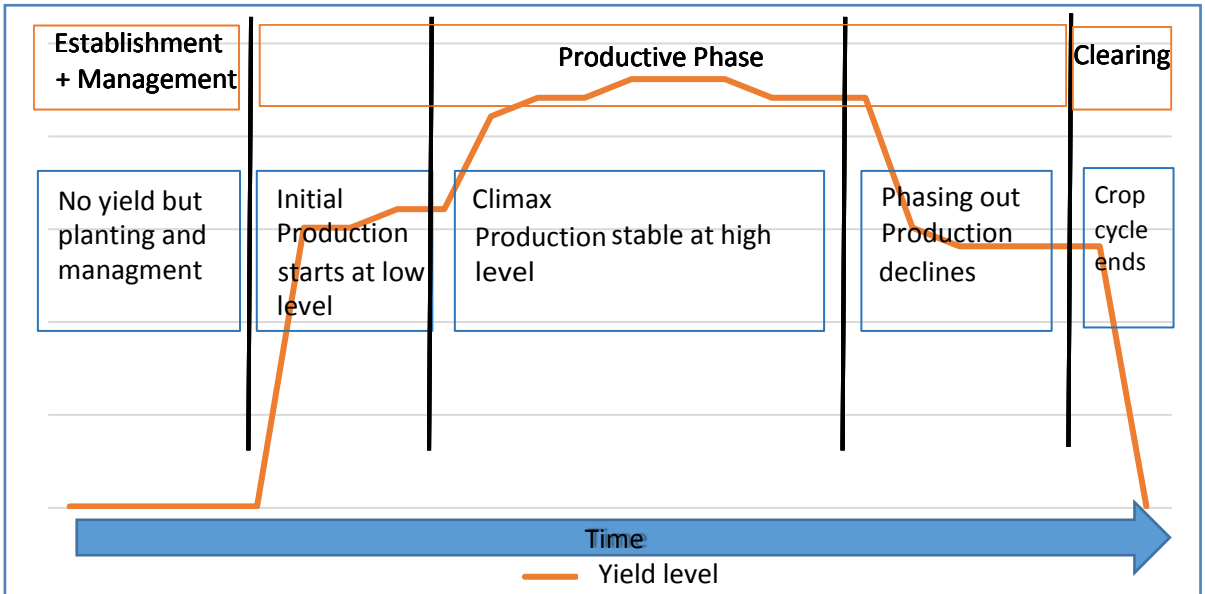


Figure 19 Phases in the production cycle of perennial crops

It also has to be discussed with farmers if the difference in management cost and yield levels are high enough to justify a separate assessment of all phases. If this is the case, the information for all phases should be collected. If management cost and yield levels do not differ much between the phases, time can be saved by collecting the information once, estimating the average costs and productivity per year.

4.1.3 Livestock systems assessment

4.1.3.1 Yearly revenue per head

The revenue from livestock can be estimated in a simple way if production costs are neglected.

The indicator needed is the average revenue per year per livestock head. This information can be obtained as follows. Interview between 4 and 5 livestock owners on the value of a cow at the age of selling and on the average sales age of cows.

This method can be used for buffaloes, cows, goats and sheep in the same way.

Sales value of one cow = 3,000,000 LAK

Sales age 4 years

$$Average\ revenue\ per\ cow\ per\ year = \frac{3{,}000{,}000}{4}\left[\frac{LAK}{year}\right] = 750{,}000\left[\frac{LAK}{year}\right]$$

To upscale the result to village level, use the livestock inventory from the household census, that was collected already (see 3.2.2) and calculate as follows.

$$Village\ level\ revenue\ (cow)\ \left[\frac{LAK}{village}\right] = total\ of\ cows\ in\ the\ village * Average\ revenue\ \left[\frac{LAK}{cow}\right]$$

4.2 Participatory mapping

Participatory mapping combines experts' skills with local knowledge by providing local people with means to share their spatial knowledge and land related future objectives. During land use planning, participatory mapping is used as a tool, which enables informed discussions and stock taking of the village land and agricultural land resources.

This method is applied in several ways in different stages of the PLUP/PALM process, first to update existing PLUP maps and documents and then to assess current agricultural land use and in a separate round to plan future agricultural land use.

4.2.1 Mapping steps and categories to be used

For mapping, a set of standardized categories and a standardized legend (currently version 60) are used. This system was developed by the TABI project. Lao ministries and development agencies have agreed to use this as a common standard for land classification in land use planning. The legend offers the opportunity to do general land use mapping to categories (Cat) and more detailed mapping to subcategories (Sub_Cat). There are two separate legends available, one for the current land use (CLUFC) and one for the land zonation, or future land use (FLUMZ). The legend and the accompanying files are provided on the CD, included in this guideline.

For those maps, that require sub categories it must be considered that some land uses cannot be mapped to the very detail, because sometimes plots of one subcategory are scattered and cannot be mapped in detail from the Orto photomap. In the case of annual crops, changes from year to year occur. In such situations, it is better to keep the categories more general e.g. by choosing the subcategory, which does not further specify instead of mapping small areas of specific crops.

Participatory mapping, a powerful tool
It facilitates the acceptance of an outside project using modern technologies by actively involving the community. It makes use of local knowledge about land, its properties and potentials. It is a good means to empower people in decision-making and to create ownership. It can be used to mediate between various interests as a side effect it will build capacities in collaborative problem analysis.

For agricultural mapping, it is however important to map as much as possible of those crops that were identified as main crops by the villagers and for which the revenue calculations have been done, as described in chapter 4.1.

One more important land use information is related to **communal land**. There are several legal issues to be considered about this land, however these are not treated here in detail. PLUP/PALM teams should access this information from the relevant legal documents, and from a number of studies that analyzed cases and the policies concerning this topic.

Since PLUP and PALM are carried out in teamwork (see chapter 1.3), some combinations of these 5 applications of participatory mapping have proven to increase efficiency. In this way, the current land use map is elaborated to more detail and main agricultural cropping systems are included. Mapping of communal land deserves special attention.

Table 4 Combied mapping stages in PLUP and PALM

Separate PLUP and PALM	PLUP and PALM in Teamwork
Village boundary delineation	Village boundary delineation
Current land use mapping according to the main land categories (CatID Level)	Current land use of main land categories and mapping of main agricultural cropping systems (Sub_CAT_ID level)
Land zoning or future land use mapping (CatZ_ID level)	Land zoning or future land use mapping (CatZ_ID level)
Mapping of current agricultural land use (Sub_CAT_ID level)	Planning and mapping of agricultural land use (SubCatZ_ID level)
Planning and mapping of agricultural land use (SubCatZ_ID level)	Mapping of communal land
Mapping of communal land	

4.2.2 Putting participatory mapping into practice

In order to conduct participatory mapping for land use planning, orthophoto-maps at a scale of 1:8,000 to 1:12,000 (depending on the size of the village) are used as a source of accurate, remotely sensed data. Such data can be obtained for project purposes by setting up a MoU with the NGD (National geographic Department).

On detailed orthophoto-maps, community members can easily identify landmarks or points of interest that facilitate a common orientation, which is necessary for the subsequent mapping steps. It is also helpful to use transparencies, or a transparent plastic foil to let participants delineate land use on the photo map. Information on the transparencies is to be scanned or photographed, geo-referenced and digitized later. Sometimes, the participants preferred to draw directly on the photo map, because when a plastic foil was used, reflections disturbed them from clearly identifying features.

Figure 20 Participatory mapping discussion

Whenever the participants expressed a need for more detail, the area in question was projected on a wall or screen by means of an LCD projector and a laptop computer with GIS.

What if A0 printing is not possible?
Use an A3 color printer. In the GIS software, use page and print set up to set the paper size to A3. Keep the map page size at A0. When printing an A0 map to A3, the GIS will print 15 sheets of A3 size to get the printout complete and at the scale specified. After printing the photomap, carefully glue the paper sheets together.

Live mapping with the GIS and LCD is not to be carried out as a stand-alone method for land use planning in Lao, because of three reasons:

a) When zooming in and out or panning the map, participants tend to lose orientation.

b) Live mapping of areas implies a high level of proficiency in the use of GIS, which is very rarely available amongst the implementing district officers.

c) The GIS/LCD method is an expert system, which does allow only for limited ownership of mapping by community representatives, as compared to mapping on a printed photo map.

Material and equipment:

- A0 orthophoto-map **printout** of the village area.
- Colored markers for drawing on the map
- Transparent plastic foil
- LCD projector and screen
- Pins and paper

Consider these points for participatory mapping of agricultural land use

- Prepare the space for the photomap.
- It works best when the map is put on a table, because the participants can use the 4 sides of the table to come together.
- Turn the map to the right orientation (if necessary by means of a compass) to enable clear referencing with the real world.
- Group size of participants can be up to 10. When the group is bigger, make sure everybody gets a chance to see and comment.
- Clearly explain the objective of the mapping session
- Let the group identify and name typical features on the map, for example village location, roads, streams and mountains. Clearly mark the most important landmarks on the map.
- Start by copying the boundary of the agricultural, which is already available in digital form from the current land use mapping.
- Have the printed legend categories at hand for reference
- Clarify, which categories of agricultural land should be mapped (refer to the group interview on main agricultural crops).
- Don’t forget to assess livestock areas
- Include upland fields and shifting cultivation areas
- Specify where individual or communal use prevails (this needs to be digitized separately)

Georeferencing and polygon creation

Once the agricultural land has been categorized completely, the paper map or the plastic foil has to be georeferenced and digitized. In order to accomplish this, the following steps have to be completed.

Check if the ticks, that show the reference grid on the printed map are clearly visible. If not, mark them more clearly for at least 4 to 6 points on the map or on the plastic sheet

Take the high-resolution photo of the A0 map or of the A0 plastic sheet on which the land categories have been drawn. If mapping has been done on the plastic sheet, take the first photo when the plastic is still lying on the map. Take the second photo from the plastic sheet only, preferably against a white background.

To take a usable photo, the camera should be held over the center and parallel to the map. Avoid reflections from sunlight or from a flash. Georeferencing is done in GIS to achieve two goals. A. coordinates of a geographic reference system are assigned to the image and b) distortions that occur when the photo was taken are eliminated by rectification.

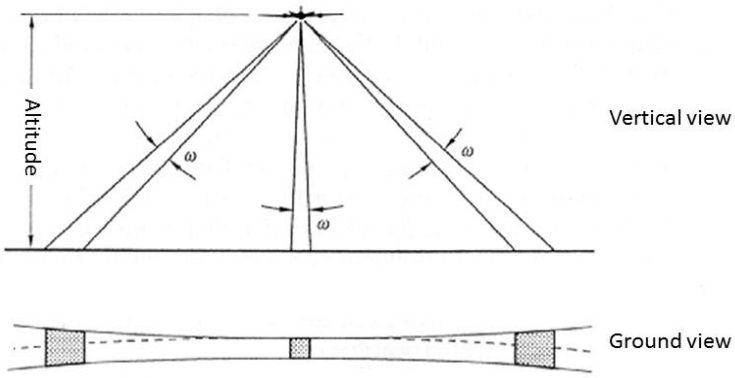


Figure 21 Optical distortions in aerial photography

Just like with aerial photography, our photo of the printed orthophoto map has optical, distortions because the photo is taken from a central point (the camera). The distance from the camera to the central point vertically underneath the camera is smaller than the distance to the points that are not directly vertical under the lens. It is the greatest at the edges. This results in distortions of the geometry of the photo that is taken after participatory mapping. Only the area directly vertical under the lens is correctly displayed. But as further away from the center pixels are located, they cover bigger areas.

5 Summarize the Results and Plan future Use of agricultural Land

In this step, all the relevant information is put together, presented and explained to the VLMC. Having this at hand, the team should be well informed about the village and it should be able to propose possibilities for future agricultural land management that meet the relevant regulations and that improve the villager's land use towards sustainability and resource use efficiency.

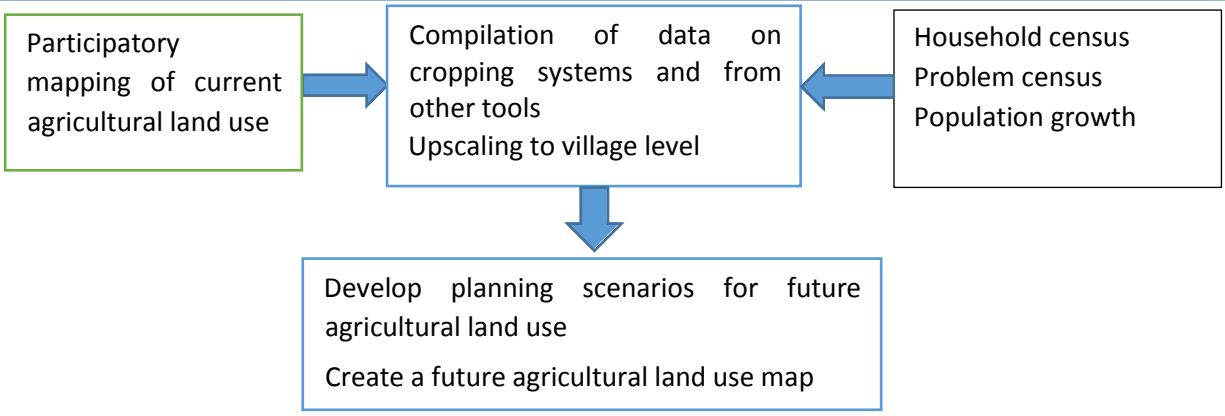


Figure 22 The process of synthesizing results for planning

To standardize and ensure a complete summary of data for planning, refer to the checklist on results needed for this activity in the toolbox (Chapter 10).

5.1 Compile results on Cropping Systems and from other Tools

This step should be conducted in the office, because the tables that are to be produced here need to be correct and carefully made. This should require about one day.

To be able to carry out this step, all the information needed must be ready to use and also correct. This means that final versions of results tables must be available before compilation of results and upscaling to village level is done. When upscaling is done, the results from one table are multiplied by the results of the other table. This step needs to be carried out with utmost attention, because if some figures are not correct, errors will multiply as well and this results in greater errors that can lead to unrealistic planning.

5.1.1 Upscaling to Village Level

For this step, all the data that are going to be used for upscaling to village level need to be prepared. Print out each of these tables for the discussion with the villagers and create a new excel file with the name upscaling to village level villagename.xls. Copy all relevant tables to this file. When copying tables, Excel will offer several paste options.

For the start, data from the following topics are considered:

- Indicator Summary of main agricultural crops
- Village household census
- Revenue from land rented out
- Current agricultural land use
- Livestock assessment

Main crops assessment: For all main crops and cropping systems

For the comparison of cropping systems, use the calculation of indicators for the main crops that has been done according to the cropping systems analysis. Copy the values for the indicators from all cropping systems analyzed to the excel sheet upscaling to village level village name.xlsx

- Revenue (price* yield) / ha (LAK)
- Number of days of labor per ha (Number)
- Revenue (price* yield) / day of labor (LAK)

Table 5: Indicator Summary of main agricultural crops

	Irrigated rice 2 crops	Sugarcane	Rubber	Rice	Cassava
Revenue / ha (LAK/ha)	24,000,000	21,000,000	12,000,000	12,400,000	11,500,000
Days of labor / ha (man day/ha)	127	110	225	60	97
Revenue / day of labor (LAK/man day)	188,976	190,909	53,333	206,667	118,557

Village household census

From the Household census database, select the sheet: “Family structure and labor” and copy the table: Number of labor force in the family by main income source.

Table 6: Main income source of the household

	Number of families	Percentage of families	Average number of labor
Crop production	60.0	100.0	3.9
Livestock	0.0	0.0	0.0
Business	0.0	0.0	0.0
Government staff	0.0	0.0	0.0
Employed	0.0	0.0	0.0
Other	0.0	0.0	0.0

To calculate the labor force for crop production in the village, multiply the number of families which generate their main income from crop production with the average number of labor in this category. Then the number of days of labor per year, considering 20 days of labor per month and 12 months per year can be calculated. The number of days of labor per month may be adjusted according to the information received from farmers in the village, if necessary.

Village crop production labor force = Number of families with main income from crop production * Average number of labor in families with main income from crop production * 20 * 12.

$$\text{Village crop production labor force} = 60\ \text{families} * 3.9\ \frac{\text{labor force}}{family} * 20\ \frac{\text{days}}{month} * 12\ \frac{\text{months}}{year} = 56{,}160\ \frac{labor\ days}{year}$$

Revenue from land leased (only if relevant)

Table 7: Size and revenue from land leased

	Garden	Paddy field	Cash crops
Size in ha (sum)	4	19	13
Renting fee (LAK/ha/year) (average)	9,000,000	4,000,000	6,000,000

Leasing land as an alternative to crop production

For village level planning, leasing can be relevant if there is not sufficient labor force for cultivation available in the village or if leasing land is more profitable than cultivation.

To compare the revenue from leasing land with crop production, the average rental fee per ha per year needs to be assessed and compared to the revenue from crop production. It has to be considered that the rental fee is net income. This means benefit, since usually no cost occurs when land is leased out. Cost related to land lease may occur after the lease period when plots have to be rehabilitated to enable production again. Crop production involves cost (e.g. for seeds, fertilizer, plant protection and wages). In this guideline only revenue from crop production is considered.

As a consequence, leasing land may appear more interesting than crop production where the rental fee is comparable to the revenue from crop production.

To estimate the average rental fee per hectare, teams that are not yet very familiar with calculations and formula in Excel should select the average rental fee per year of the crop that is rented out most. In Table 7, this would be paddy land.

For teams that are very familiar with Excel already, it is possible to calculate the exact average renting fee by means of a weighted average. This is not calculated in the simple way of averaging the renting fee/ha from all crops that were rented out. To calculate the weighted average, it must be considered that both, the areas of the crops and the rental fees of cropland are different. It can be calculated as follows.

$$weighted\ average\ rent\ for\ agricultural\ land\ \left[\frac{LAK}{ha}\right] =$$

$$(Rental\ fee\ (garden)\ [LAK]\ *\ size\ (garden)\ [ha]\ +\ Renting\ (paddy\ field) * size\ (paddy\ field)\ [ha] + Renting\ (cash\ crops)\ *\ size\ (cash\ crops)\ [ha] + Renting\ fee\ (tree\ plantation)\ *\ size\ (tree\ plantation)\ [ha]\ )$$

$$/\ (size\ (garden)\ [ha]\ +\ size\ (paddy\ field)\ [ha]\ +\ size\ (cash\ crops)\ [ha] + size\ (tree\ plantation)\ [ha]$$

This is calculated as follows:

Average renting fee of agricultural land (LAK/ha) =

$$weighted\ average\ rent\ for\ agricultural\ land\ \left[\frac{LAK}{ha}\right]$$
$$= \frac{4 * 9{,}000{,}000 + 19 * 4{,}000{,}000 + 13 * 6{,}000{,}000 + 0 * 0}{4 + 19 + 13 + 0} = 5{,}277{,}777\ \left[\frac{\text{LAK}}{ha}\right]$$

Dangers of leasing land

When land is leased, it has to be made sure that the relevant Lao legislation is followed.

Lease contracts usually do not include land rehabilitation at the end of the lease.

Leaseholders normally use the land in a different way than it used to be. It is common practice that they prepare the land in a way that it fits to their production but they do usually not reverse these changes after the lease period. This requires an investment after the lease period that is in many cases not covered by the lease contract.

For example: Paddy fields are used for commercial plantations of banana. The irrigation canals and the levelling walls are ploughed away. Since banana does not withstand flooding, drainage channels are dug and water cannot be retained anymore for paddy production. High levels of pesticide and herbicide are used in the plantation. Such agrochemicals can remain in the soil for long time. To make paddy production possible again, the landlord has to rebuild terraces, the irrigation channels and fill the drainage lines.

Where contamination with agrochemicals is too high to allow food production after the lease period, farmers may be forced by the Lao authorities to leave the fields bare until the critical levels of harmful substances have dropped under the threshold value.

In many cases, soils are impoverished after the lease, because micro-nutrients are extracted, soil organic matter is decomposed and because the pH value was decreased. Usually, no measures to rehabilitate the soils are taken by the leaseholders.

Wrong waste management can also cause problems and induce post lease contract cost.

From the current agricultural land use

When current agricultural land use was mapped to Sub_Cat level, polygons were created in the GIS and the area of each category was calculated (4.2). Table 8 shows the result of the participatory mapping of agricultural land. It should be copied to the same excel sheet in which the main crops revenue data are already summarized.

Table 8: Area of main agricultural crops in current land use

Main crops	Current land use (ha)
Irrigated rice 2 crops	10
Sugarcane	80
Rubber	105
Rice rain fed	35
Cassava	120
Sum	350

Village level revenue and labor force calculations

Upscaling of the per hectare values on revenue and labor use is done by multiplying the indicators that were already summarized in Table 7 for each main crop with the number of hectares cultivated of each main crop in the village from Table 8. By doing so, the result shows the revenue and the number of days of labor for the whole village. In this way, Table 9 is created.

Revenue village level (crop x) = revenue/ha/year (crop x) * hectares (crop x) in current land use

Labor village level (crop x) = number of days of labor per ha (crop x) * hectares (crop x) in current land use

Once Table 9 is created in Excel, the worksheet should be copied. Having a copy enables us to do some planning based simulations with the farmer group.

Table 9: Village level revenue and labor force figures.

Main crops	Current land use [ha]	Revenue Village level [LAK] under current land use	Labor used Village level [days of labor] under current land use
Irrigated rice 2 crops	10	240,000,000	1,270
Sugarcane	80	1,680,000,000	8,800
Rubber	105	1,260,000,000	23,625
Rice rain fed	35	434,000,000	2,100
Cassava	120	1,380,000,000	11,640
Sum	350	4,994,000,000	47,435

5.1.2 Estimating livestock area productivity

Figure 23 Livestock grazing

To be able to plan livestock areas, it is necessary to compare the revenue per hectare from livestock with the revenue from the main crops.

This is especially relevant in villages that do not have sufficient designated livestock areas and where livestock numbers are high. The clear designation of livestock areas is an important tool for the protection of forests, it helps in solving conflicts and it is necessary for the intensification of livestock production.

The method presented here was piloted. Many of the figures and correction factors have to be estimated with the help of the villagers and the results are used to engage the villagers in a land use planning discussion for livestock areas.

In villages with low livestock numbers, the team has to decide if the application of the tools is needed.

5.1.2.1 Pasture area and quality estimation for land categories

The feeding areas for livestock are usually made up of a combination of different land use classes. These may include pasture areas (dedicated to livestock exclusively), and post-harvest use of cropping areas, like paddy and cash crop land, as well as fallow land and forest areas. To include such areas into an estimation of livestock grazing land and grazing resource efficiency, two basic elements need to be estimated as good as possible. The first element to consider is that each of these land categories is used for a certain amount of time per year depending on the availability of feeding resources and the necessity of using the area for grazing. The second element considers that the land categories offer different amount and quality of forage for the animals.

The current land use map and the current agricultural land use map provide the area figures for all land categories. Having this list at hand villagers are interrogated on the use of each relevant area for grazing.

Once the areas are listed, villagers are asked for how many months each land category is used for livestock. Table 10 shows how the areas are collected and how numbers are processed. For example, there are 66 ha of fallow land, which are used for 2 months out of 12 months in a year. The use factor is calculated by dividing the months of use by the length of the year (2/12= 0.17). To obtain the factor adjusted area, the area in ha is multiplied with the use factor. The factor adjusted area then represents the proportion of use for each land category.

Table 10 Participatory assessment of Land categories and their use for livestock grazing

Land category	Area in ha	Months used per year	Use factor	Factor adjusted area
Grassland/ improved pasture	137	12	1.00	137
Fallow land	66	2	0.17	11
Paddy field post-harvest	81	2	0.17	13.5
Crop residues Maize and Sesame	34	2	0.17	5.7
Forest	500	3	0.25	125
Total	818			292.2

5.1.2.2 Feeding value standardization

If each land category would have the same feeding value, the livestock productivity could be calculated already. Usually, pasture, fallow land, post-harvest paddy fields, crop residues from cash crops and forest have different feeding values. To differentiate the feeding values of the land categories the feeding value of an improved pasture is set to be 1. In the discussion process, villagers are asked how much area of a certain land category is needed to provide the same amount of forage for the animal in the season it is used for grazing.

For example a forest area might provide less forage than a pasture area. Then it is estimated how many hectares of forest land are necessary to replace one hectare of pasture, for example 2 ha of forest would correspond to 1 ha of pasture. The feeding value of forest would be estimated to be ½ the one of pasture, i.e. 50%.

Table 11 Participatory assessment of feeding values

Land category	Area in ha	Months used per year	Use factor	Factor adjusted area	Feeding value estimation	Standardized feeding areas
Grassland/ improved pasture	137	12	1.00	137	100%	137
Fallow land	66	2	0.17	11	70%	7.7
Paddy field post-harvest	84	2	0.17	13.5	60%	8.1
Crop residues Maize	36	2	0.17	5.7	60%	3.4
Forest	500	3	0.25	125	50%	62.5
Total	823			292.2		218.7

The standardized feeding areas can be used to determine how much additional grazing land is required to substitute the use of another land category. In the example in Table 11, the use of forest for grazing could be reduced or even abolished if some new grassland area of about 62.5 ha could be established.

Since all these data are calculated in an Excel sheet, it is now possible to develop and discuss a future land use scenario with the villagers. In this way, it can be found out from which land category how

much land could be taken to be converted to grassland/pasture area. To justify such an estimation, the revenue per hectare from agricultural activity and livestock raising need to be compared.

Table 12 Sample calculation on land categories and their use for livestock grazing

Land category	Area in ha	Months used per year	Use factor	Factor adjusted area	Feeding value estimation	Standardized feeding areas
Pasture, fallow, forest etc.	From GIS adjusted by farmers information	Ask farmers for how many months the land category is used	Calculate Number of months used divided by 12 months of the year	Area in ha from column 2 multiplied with Use factor from column 4	Ask the farmer how much in % is the feeding value compared to the best pasture	Multiply the Factor adjusted area with the feeding value estimation
Example Pastures	137	12	12/12 = 1	137 * 1 = 137	100%	100 % * 137 = 137
Example fallow	66	2	2/12 = 0.17	66 * 0.17 = 11	70%	11 * 70% = 7.7

5.1.2.3 Productivity estimation of livestock areas

Having the results of the participatory assessment of feeding values for land use categories (see Table 11) at hand, the next step consists of calculating the stocking density and the renenue per ha for the livestock.

For this calculation, we need to know the number of grazing animals in the village, that was obtained from the household interviews. To keep the example simple, we estimate that a buffalo and a cow have the same feeding requirement and thus need the same ammount of space.

Where there is a different number of buffaloes and cows in the village, the stoking rates need to be calculated in the respective proportions.

The portion of land use by buffaloes or cows is calculated as follows:

$$Portion\ of\ cows = \frac{Number\ of\ cows}{Number\ of\ cows + Number\ of\ buffaloes}$$

Example: In the village, there are 400 cows and 600 buffaloes

$$Portion\ of\ cows = \frac{400}{400 + 600} = \frac{400}{1000} = 0{,}4$$

The stocking rate in animals/ha is calculated as follows

$$Stocking\ rate\ \left[\frac{cows}{ha}\right] = Portion\ of\ cows * \frac{cows\ in\ the\ village}{area\ used\ for\ livestock}$$

The stocking rate in animals/ha is calculated, using the area figures from the GIS, the factor adjusted area and the standardized feeding areas. In the sample calculation, the GIS figures wewre inserted to the formula.

$$Stocking\ rate\ \left[\frac{cows}{ha}\right] = 0{,}4\ *\ \frac{400}{823} = 0.19$$

The stocking rate for all animals is calculated by adding up the stocking rates of all animal species.

Calculating the stocking rates with the 3 different area estimations elaborated above, yields different results (see Table 13). When the areas obtained from the GIS are inserted in the formula, the stocking density is low. When the factor adjusted areas are used, the stocking density gets higher and even higher when the standardized feeding areas are inserted.

Table 13 Stocking rate estimations based on participatory assessment of land categories use and feeding values

	Stocking rate estimations		
	GIS areas	Factor adjusted areas	Standardized feeding areas
Animals/ha	0.4	1	1.4

In order to calculate the revenue /ha /year, the stocking rate is multiplied with the revenue / cow/year, as calculated in the section on the yearly revenue/head earlier (see chapter 4.1.3). If several species of animals are kept, we need to consider their individual stocking rates.

$$\text{Revenue from cows}\ \left[\frac{\text{LAK}}{\text{year}}\right] = Average\ revenue\ per\ cow\ per\ year\ \left[\frac{LAK}{cow * year}\right] * Stocking\ rate\ \left[\frac{cows}{ha}\right]$$

The results of a calculation for a village with 300 cows, and the areas for grazing as described in the tables before and a yearly revenue /cow of 750,000 LAK are shown in Table 14.

Table 14 Revenue estimations based on participatory assessment of land categories use and feeding values

	Revenue estimations		
	GIS areas	Factor adjusted areas	Standardized feeding areas
LAK/ha/year	273,390	750,000	1,050,000

Only by calculating the per hectare revenue figures for the livestock system, it is possible to compare livestock keeping with other agricultural land uses, as they were already obtained from the main crops analysis. For example if a fallow area is to be converted to livestock grazing land, the revenue from the fallow/production cycle should be lower than the revenue from grazing, or the grazing option has other advantages, like a better use of soil fertility.

5.2 Develop planning scenarios

The goal is to increase the revenue within the limits that are set by the availability and suitability of agricultural land, the availability of labor and the preference of the farmers. It also needs to be considered, which changes are desirable or permitted according to national policies, food security and ecological criteria. In the following subchapters, summarized details are provided to give the PLUP/PALM team a usable background for planning. Many of these details need to be explained to the farmers to clarify roles. Start with the physical land properties of the agricultural land and possibilities for use. The first role play is used to prepare the first round of participatory mapping, in which only main land use zones are planned. After that, a land use optimization scenario is elaborated by the team. All results are presented and explained to the villagers. After that, a role play is done to prepare participatory mapping stage 2 and further discussions.

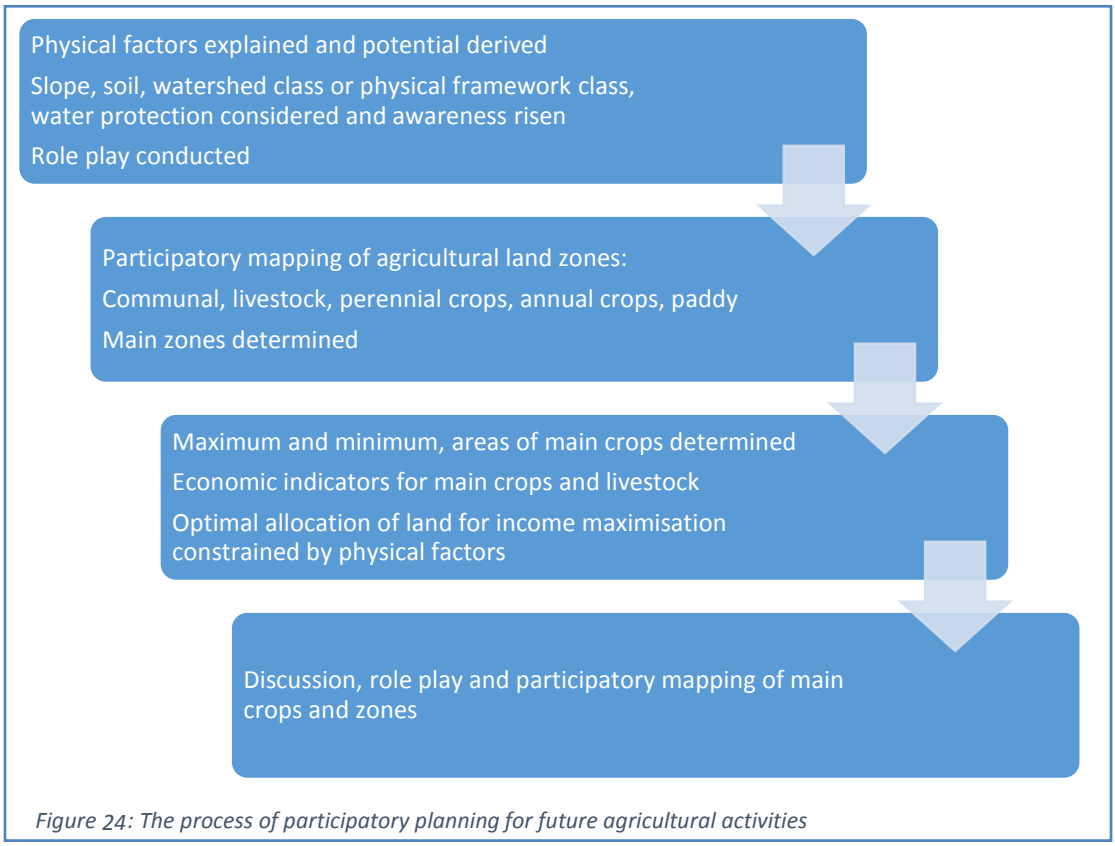


Figure 24: The process of participatory planning for future agricultural activities

5.2.1 Determine Potentials and limitations of the agricultural land

First, it needs to defined, which limitations and potentials exist in the village. To get to know this, a table is created which states how much of each crop category (perennial, annual, paddy, grassland) can be grown maximally and minimally. For each of the following subchapters, a short summary should be written on the A0 paper for the farmer's reference. It will be used later on as role descriptions for the first role play (see toolbox Chapter 11).

The legal basis for the determination of land areas suitable for families is decree 61/PO on the Promulgation of the Amended Land Law. Article 17 of this decree is relevant for our planning scenarios, here a quotation of the endorsed translation:

"The State authorizes individuals and families to use agricultural land in accordance with the allocation plan and objectives, for the long term and in an effective manner, according to areas determined as follows:

- For those using land for cultivating rice and raising animals, the maximum area is one hectare per labor force in the family;
- For those using land for industrial plantation and growing crops, the maximum area is three hectares per labor force in the family;
- For those using land for fruit tree plantation, the maximum area is three hectares per labor force in the family;
- For those who use unstocked land or grassland and thereafter transform such land by planting crops or grass [suitable for grazing] livestock, the maximum area is fifteen hectares per labor force in the family. "

The Rice requirement for a village may be calculated by using the national poverty standard following the Poverty and development standard 2010 to 2015 (see reference for further reading). For the rural area, the poverty line is indicated with 180,000 LAK/ person/ month. At a rice price of 8,000 LAK / kg, this would correspond to a rice requirement of 22 kg/person/month. Multiplied with 12 months, the rice requirement can be estimated to be around 270 kg/person/year. This rice requirement is actually much higher than the per capita consumption estimates in a 2012 rice policy study of FAO, where 112 kg and 179 kg of per capita consumption are mentioned. But since this represents the poverty line, it should not be below the 270 kg, since the people would also require other things than rice for a living.

If a low rice yield from paddy land of about 3.5 t/ha is assumed, it can be concluded that about 0.08 ha of paddy land per person is required. To enable easy calculation, the estimation is set to 0.1 ha/person.

For **upland rice**, yield levels around 1 t/ha for old upland fields and yields levels around 3 t/ha can be assumed. To enable an easy calculation again, the average of 1.5 t/ha can be used. This would mean 0.2 ha/person after rounding.

Be realistic in planning while promoting innovative practices
In many cases, the reality of land use differs much from what needs to be considered to cultivate agricultural land in a sustainable way and to protect natural resources like the soil, wildlife and water resources. Some general rules need to be considered as much as possible, when planning the agricultural land use. Some rules may be adequate for villages with abundance of flat land and water but not applicable to villages with a high share of uplands and scarcity of agricultural land. The PLUP/PALM team should promote good technical solutions. These are available for nearly all agricultural land use systems. Implementation usually requires support. To come up with an action plan, farmers need ideas on what can be done to improve their land management. Actions need to be discussed and planned in interplay between the VLMC and the PLUP/PALM team to define what can be improved under which conditions to make land use more sustainable within the planning horizon.

5.2.1.1 *Conservation of water bodies*

Buffer zones around waterbodies and streams need to be created in both, permanent and annual cropping systems. In these areas, natural vegetation should be preserved or reestablished. In this way, habitats for riverine vegetation and wildlife can be secured. The buffer zone is also an efficient filter zone for chemicals used in the agricultural production. By having this zone, leaching of fertilizers, fungicides and pesticides is reduced and water resources are protected. The size of the buffer zone can vary but should not be smaller than 10 meters. 30 meters are ideal.

5.2.1.2 *Slope steepness and landscape units*

As shown in Figure 25, slope steepness can be used as an easily assessable parameter to guide the choice of agricultural land use. The steeper the slope is the higher is the vulnerability of the soil for water erosion. When it rains on a steep slope, the water that doesn't infiltrate will run down the hill quicker than on gentle slopes. The quicker the runoff is, the more powerful it is and it can transport more soil. This is especially dangerous where ground cover by vegetation is non-sufficient.

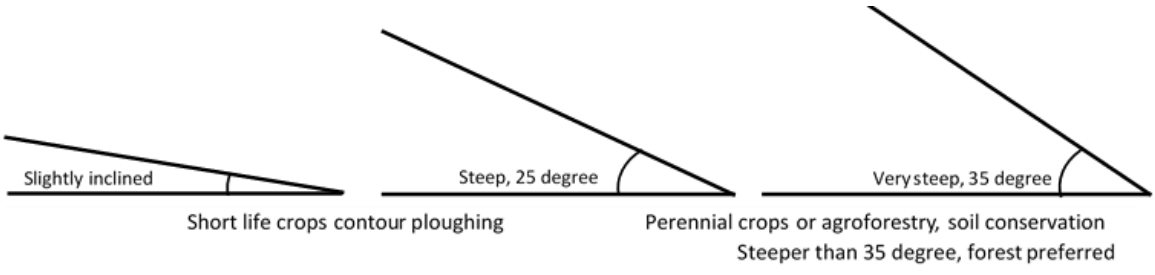


Figure 25 Slope steepness and recommended agricultural activity

Where slopes are too steep and land use cannot be changed, technical soil conservation methods, such as for example cover crops, zero burning, mulching, contour ploughing, terraces or agroforestry should be recommended. It is recommended that the DAFO staff conducting PALM should familiarize with such options for land conservation alongside the normal tasks, since these techniques are of utmost importance for future agriculture.

Consider slope steepness when planning agricultural land use
Contour ploughing for short life crops should be introduced even in areas with moderate slope. Areas with slopes steeper than 46 % (= 25 degree) can only be used for perennial crops. Areas with slopes not exceeding 46 % (= 25 degree) can be used for annual crops. (See slope measurement tool in the toolbox Chapter 13). Whenever possible, avoid any agricultural activity on **slopes steeper than 35 degree**. If it cannot be avoided, promote resilient agriculture, like agroforestry systems, erosion control techniques, intercropping, strip agriculture and others.

5.2.1.3 *Landscape characteristics*

Existing data and plans have to be considered for planning agricultural land use. In this context, it is also very important to look at the landscape surrounding the village from a wider perspective, to be able to see which role the village territory plays for example in the conservation of watersheds and forest areas. Having this information enables the PALM team to easily localize areas that need special attention in the planning process. Looking at the landscape at a wider scope should enable the team to identify priority areas in the village territory and gives hints for sustainable use of the land.

In the following, two suitable approaches are presented, that are not to be misunderstood as mandatory or strict zonation approaches but as inputs for the discussion with the VLMC.

One is the physical framework plan (PFP), which has been piloted by MPI (Ministry of Planning and Investment) in 4 provinces of Laos already. It categorizes the landscape in 5 zones, as shown in Figure 26. Unfortunately, the PFP was not yet completed for the whole area of Lao PDR at the time of drafting this guideline. It might become a standard element to consider in PALM in the future. Although the landscape units in the PFP approach are called zones, the names of the zones should not be confused with the zonation of national protected areas.

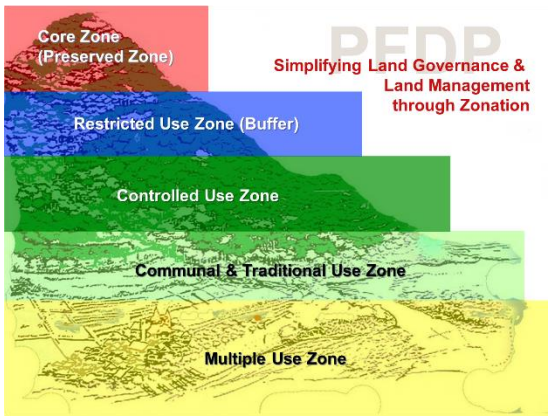


Figure 26 Landscape classification with Physical Framework Planning

The second approach is the classification of watershed areas for Laos, which was developed by Heinimann in 2003 (see further reading) it is used by DALaM for suitability classifications. It is cited here to clarify which areas should be preferred for which use. As mentioned above, these are long term goals that need to be adjusted and negotiated with the villagers.

The **catchment areas** of watersheds need special attention, because this is where the water that is needed in the lowlands comes from. PALM teams should critically analyze in which areas current land use corresponds to the recommendations and requirements of the watershed classification.

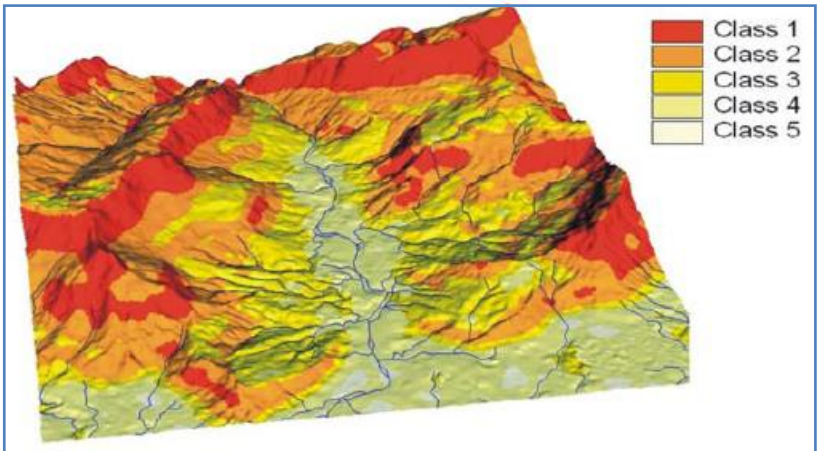


Figure 27 A typical Lao landscape with the watershed classification
Source: Heinimann (2003)

"The watershed classification which is presented here aims at giving an indication of the sensitivity of watersheds with regard to water resources degradation mainly by soil erosion. On the basis of the topography various parameters crucial to degradation processes such as slope, elevation and landform are linked in a watershed class prediction equation. The potential degradation risk is then calculated for each land unit into five classes: Watershed Class one is the most sensitive and Watershed Class five the least sensitive to potential soil erosion. Watershed Class one and two can be considered as critical and classes three to five as uncritical with regard to soil erosion when cleared of natural vegetation. For each watershed class, general recommendations for sustainable land uses are given:

Watershed Class 1: Protection Forest
Areas with very steep slopes and rugged landforms, commonly uplands and headwater areas.
Critical areas for water and soil resources management. Recommended land use: as a rule, these areas should be under permanent forest cover. Other existing land uses based on traditional rights and practices should be considered carefully with regard to their impact on water and soil conservation.

Watershed Class 2: Commercial Forest
Areas with steep slopes, usually at higher elevation. Landforms are in general less susceptible to water and soil degradation than under WSC Class 1. Recommended land use: forest (conservation and production forests), agro-forestry and grazing, if accompanied by strict conservation measures.

Watershed Class 3: Agro-Forestry
Areas with moderate to steep slopes and less erosive landforms. Includes uplands and foot zones of slopes. Wider range of land use tolerable than in WSC Classes 1 and 2 from point of view of water and soil conservation. May be used for commercial forest, grazing and combinations of trees and agricultural crops, if appropriate conservation measures are applied.

Watershed Class 4: Upland Farming
Gently sloping lands. Moderate need for water and soil conservation depending on local conditions. Wide range of land use possible from point of view of water and soil conservation: agriculture and forest.

Watershed Class 5: Lowland Farming

Gently sloping land and flat areas. Suitable for a wide range of land use from point of view of water and soil conservation: paddy rice, other agricultural uses and forest.

It is crucial to note that other land uses are not excluded, provided that adequate care is given to soil conservation. For instance, for areas in Class 1, the recommended land use is forest cover, but there are many examples, which clearly show that forest cover is not the only solution for conserving steep watersheds."

Landscape units, are shown in idealized way in Figure 28. This approach gives more detailed information and can help to suggest to villagers, which land use is recommended where. Technological solutions for each unit are suggested. If they can be put in practice in the landscape the use of natural resources can be improved towards more sustainability. The figure can also be used to illustrate to the VLMC, how an idealized landscape looks like and it can be used to find some fields of action for the village action plan, which is developed in chapter 5.4 .

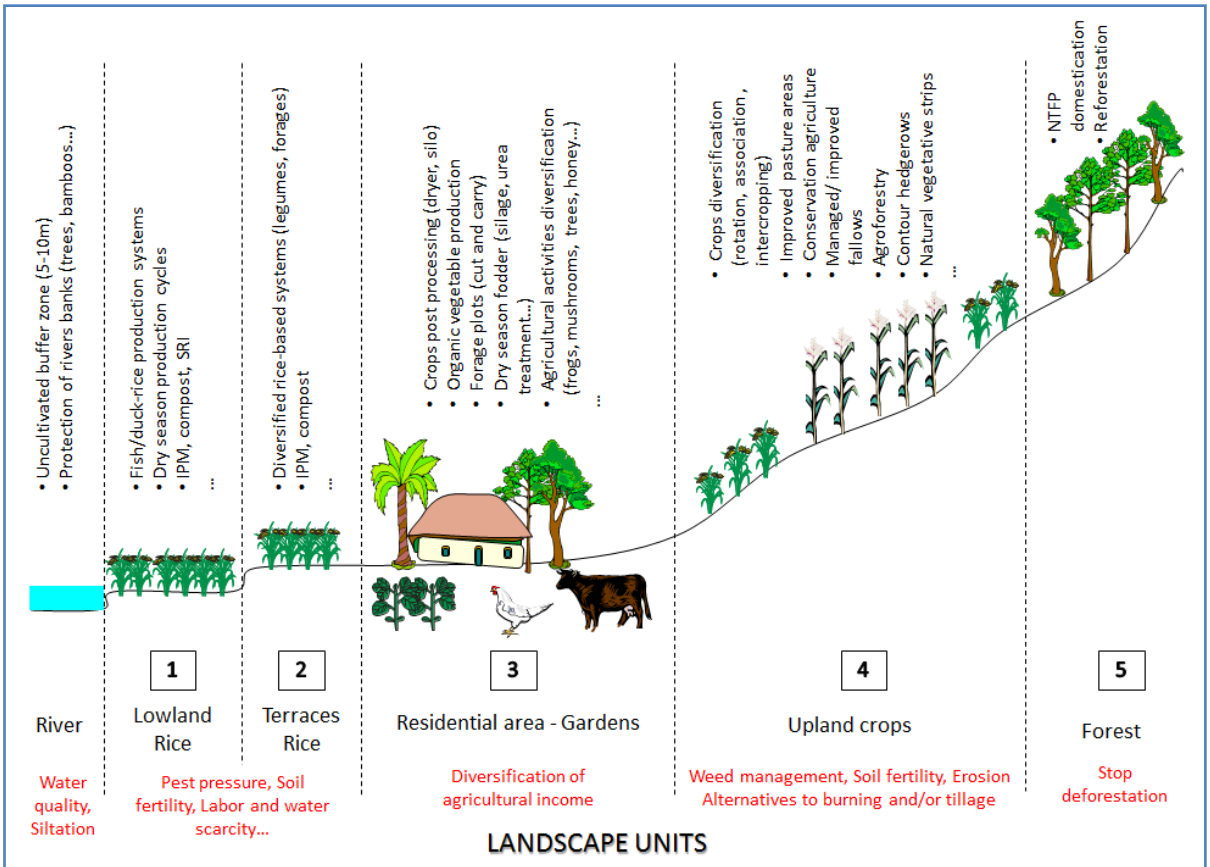


Figure 28 Landscape units in a village

Source: http://www.eficas laos.net/results/development impacts/innovative agricultural systems

When planning future land use, it needs to be discussed with the VLMC, which actions are appropriate in which zone and how land use can be adapted to the requirements that are due to the landscape. The watershed classification and the landscape units shown in Figure 17 do not match exactly but the recommendations for the sustainable use of the areas are valid in both representations. While watershed classes 1 and 2 correspond to landscape unit 5, landscape unit 4 summarizes watershed classes 3 and 4. The landscape units 1, 2 and 3 correspond to the watershed class 5, in which a variety of uses is recommended. The landscape units approach has already many indications on how planning

can be done in detail in the lowland areas, while the watershed classification just shows where lowland areas are located.

Planning livestock areas

The **livestock grazing area** needs to be defined clearly. It should be of sufficient size to produce enough biomass to support the animals and at the same time animals should not be forced to overgraze the area. Where the carrying capacity is overestimated, livestock will not find enough forage and the pasture will degrade, which means that damage occurs to the vegetation and soil erosion accelerates.

If possible, livestock areas should be fenced to avoid that grazing animals use agricultural crops for feeding. It is recommended to plan livestock areas in those zones of the watershed that are no more critical and not the best zones for agriculture, namely watershed class 2 and 3. However, if there is sufficient land available in the village territory, livestock areas may also be considered in lower parts of the watershed.

For the development of livestock areas there are several possibilities available to enhance productivity. Some key words for possible interventions are: fencing, rotation grazing, improved forage grasses, forage legumes, shrubs, hay and silage.

Role play on village agricultural land zoning

After having explained all these principles on the management of land in different zones to the VLMC it is time to let them act as role players, using the summary for each topic discussed before as a role description. In this way, the role play serves as a basis for participatory mapping, which enables to find the right locations for the different land uses. The division of roles can be as follows. NTFP collector, Forest user, Livestock owner, Water conservation person, perennial crop farmer (rubber of fruit tree farmer), annual crop farmer, paddy land farmer investor and district officer.

There have been tools developed, like PLUP fiction (see further reading), which is a more comprehensive role play, involving a game. But it requires more extensive explanations and a high level capacities of moderation and facilitation. The role play used here is easier to carry out. It aims at looking at the land use decisions from different points of view to achieve more realistic and balanced planning.

Participatory mapping of future Agricultural land zones

Having the experience from the role play and the summarized analysis of the physical land endowment for agriculture, mapping of future land use zones can start, using the Orthophoto printout. The methodology is already known from chapter 4.2. In this stage, only the main categories are mapped. This will allow for a first planning step, the zonation into the production forest, the livestock areas, the perennial cropping areas the annual crop land and the paddy land.

5.2.2 Determination of maximum and minimum areas for crops and cropping systems

The maximal production area of a crop can be determined in a sophisticated way by using GIS based suitability models. Such models require input parameters, which need to be defined correctly and in a way, that fits to the village landscape. Unfortunately, such an approach is too time consuming and too demanding on data and technical skills for the activities carried out in the frame of PALM.

To find out what the maximum area for a crop is, the areas from the current agricultural land use map are used and it is discussed with the farmers, how much more of which cropping system can be grown on the village land. At the same time, the limitations of the agricultural land need to be considered as good as possible. In this stage, the information on the economics of the cropping systems are being used. In case some cropping systems already dominate the land use, it can also make sense to restrict further expansion or to reduce the areas of specific crops to create more diversity.

For the economic component of the PALM approach, data were already collected from the VLMC, like the main crops. If land use needs to be changed, it should be considered which kind of investment is necessary.

In this step, the sum of the potential areas for each crop does not necessarily add up to the area of the agricultural land. This will be considered later when planning calculations are done. It is also important to consider marketing possibilities or negative environmental impacts, like for example induced soil erosion or a high level of pesticide use for each crop, because this might also limit the size of the production area.

It is also possible to include new crops that are not yet grown in planning if it is possible to estimate revenue and labor force requirements for these crops. Perhaps, such data are already available from secondary sources or from a planning in another village.

Renting out land should also be included in this table. Data for renting out are available from the household census.

Table 15: Current land use, minimum and maximum areas.

Main crops	Current land use (ha)	Minimum area required (ha)	Estimated maximum area (ha)
Irrigated rice 2 crops	10	10	10
Sugarcane	80	0	200
Rubber	105	80	105
Rice	35	35	60
Cassava	120	20	200
Land rented out	5	0	20
Sum	350		

5.2.2.1 Calculation of optimal land allocation to agricultural land use

The potential future areas and the data about labor force and revenue for the crops are used for calculations to build Table 16, which shows how the agricultural land should be used to maximize revenue. This will only bring useful results if the revenue estimations are well done and correct. Make sure that the minimum required areas are big enough to ensure some diversity of the agricultural landscape. This is important for ecological reasons but it will also help to prevent too high dependencies on single products and markets.

Optimal allocation of land resources is a standard optimization calculation. For very advanced users, optimal allocation of resources can be calculated for example with tools like the solver add in for Excel.

It is just mentioned here for matters of information. Be aware that this method will not bring good results if there is one main crop that brings considerably higher revenue than the others. To avoid a concentration of village activities and a monoculture landscape, the area of such crops should be limited to an extend that is reasonable and agreed by the villagers.

1. Choose the crop with the highest revenue/ha from Table 5, which was generated with tool 6 and multiply revenue/ha/ year with the Maximum area possible (from Table 15) to get the potential revenue on village level for this crop. In our example, this is the cropping system with 2 rice yields. Note the number of hectares used. In this case the maximum and minimum areas are the same because an extension of the irrigation scheme cannot be expected if it is not planned already.
2. Choose the crop with the next highest revenue and multiply revenue/ha/ year (Table 5) with the Maximum area possible (Table 15) to get the maximum village level revenue for this crop. Note the number of hectares used. In our case: Sugarcane.
3. Repeat step 2 until all the agricultural land is used up.

Table 16: Future cropping scenario development

Main crops	Current land use (ha)	Minimal area required (ha)	Maximal area possible (ha)	Revenue Maximizing	Area used for maximizing revenue
Irrigated rice 2 yields	10	10	10	240,000,000	10
Sugarcane	80	0	200	4,200,000,000	200
Rubber	105	80	105	1,260,000,000	105
Rice	35	35	40	434,000,000	35
Cassava	120	0	200	0	0
Sum	350			6,134,000,000	350

4. If the area used now is bigger than the village agricultural land (350 ha), start adapting the areas of the crop as follows:
    a. Take the crop with the lowest revenue/ha and adapt the area grown to the minimum area required for this crop. If the number of hectares used is lower than the village agricultural land, add the difference and all land is covered optimally.
    b. If there are still too many hectares used, continue, as described in the previous step with the crop that brings the second lowest revenue/ha. If the number of hectares used is lower than the village agricultural land, add the difference and all land is covered optimally.
    c. Continue in the same way as described in steps a. and b. with the next higher crop revenue/ha until the hectares used match the village agricultural land.

Once, these calculations are completed, create one more column in the table to calculate the total labor requirement per village for each crop in the future cropping scenario.

Table 17 Comparison of current agricultural land use and future scenario

Main crops	Current land use (ha)	Current revenue Village level	Current labor used Village level	Area used for maximizing revenue (ha)	Revenue Maximized (LAK)	Labor used Maximizing Scenario
Irrigated rice 2 yields	10	240,000,000	1,275	10	240,000,000	1,275
Sugarcane	80	1,680,000,000	8,799	200	4,200,000,000	21,997
Rubber	105	1,260,000,000	23,611	105	1,260,000,000	23,611
Rice	35	434,000,000	2,113	35	434,000,000	2,113
Cassava	120	1,380,000,000	11,680	0	0	0
Sum	350	4,994,000,000	47,477	350	6,134,000,000	48,996

Use data from the household census

In order to check if there is enough **labor force in the village** to make a scenario possible, take the population in working age (15 to 60 years) from the household census dataset that has been collected (see chapter 3.2.2.). To get the available days of labor per year, multiply the population in working age of those households that stated that their main work is agriculture with 20 days per month and with 12 months.

Consider the revenue generation possibilities from contract farming and renting out of land, especially the renting fee per ha per year.

Use the area productivity estimated for livestock

I those areas, where livestock is more productive than a crop or a fallow, a change in land use might be considered and mapped accordingly. The necessary estimations to identify such areas are available from Table 14 and Table 5.

5.3 Presentation of results and informed participatory planning with the VLMC

For the presentation of the results to the VLMC, the preparatory work has already been done in the previous chapters (5.1 and 5.2). The tables created in these steps need to be printed out now and the results have to be explained to the VLMC, starting from / per hectare indicators, followed by the upscaling to village level and finally, the planning scenario can be explained to the villagers.

Prepare planning

- Print all the tables produced in previous steps
- Plan how to explain the results to the VLMC
- Prepare the Current agricultural land use map and the orthophoto map

Explain results to VLMC

- Indicators for main crops and livestock
- Results from the household survey
- Results from current land use mapping, map and table with hectares

Upscaling to village level

- Use the current land use map and the area calculation
- Show how the indicators (Lak/ha and days of labor/ha) are upscaled to village level
- Explain the village level indicators

Explain planning scenario

- How it was made, what is considerd and which adaptations are needed
- Make sure villagers understand that they should criticise the scenario and bring their view in

Get VLMC comments

- Prepare for the role play
- Conduct the role play to get information on the needs and preferences of the village
- Respect villager's view on the future agricultural land use

Adapt the planning scenatio

- Include villager's information in the planning
- Make sure, regulations are met and plan can be sustainable

Recalculate

- Recalculate the village level indicators with the information and prefernces obtained from the villagers
- Compare the result with the planning scenario

Participatory mapping

- Find the areas in which land use should be changed and map them
- Calculate the area and compare it with the planning scenario numbers.

Since the planning scenario, developed earlier is based on optimal allocation of resources to maximize revenue, the view of the farmers might be different, because they consider more factors of real life in the determination of their future land use plans. Our scenario is to be understood as a basis for discussion, that triggers farmers into in depth thinking and to show them how planning works.

Once the content of all tables has been explained to the farmers, they can be asked which changes of agricultural land use they would like to plan for the next years. These changes have to be checked by

the PLUP/PALM team against compliance with rules, regulations, the district development plan and the results of physical planning.

In this step, the number of hectares for each agricultural land use, as proposed by the farmers will be obtained. This information is to be entered to a copy of Table 17. The values for revenue and labor force will update, because the formula for calculating these figures is still available in the table.

Now the revenue figures and the labor used can be compared between current and future land use and the quality of the plan can be assessed.

Role play for main crop production areas to refine the optimization model result

The results and possibilities of revenue maximization need to be discussed with the farmers from different points of view. In the role plays and the discussion, consider for example marketing possibilities/ limitations, soil conservation issues, possibilities for renting land out. Once these topics are discussed, the table is adjusted by the villagers' priorities and their arguments are noted. Once the VLMC agrees on the future scenario table, go on with mapping where the changes should take place, by proposing areas to the farmers and discuss with them where a cultivation change makes most sense. Make sure, livestock areas are included in planning and that other communal land uses are discussed.

It needs to be considered where the suitable areas for each land use are. Livestock, for example will require some water source and sufficient feeding resources. The land use discussion should start with livestock land and other communal land. Then the other land uses are discussed and mapped. Some land uses might be restricted by topographic factors or the proximity to roads. Since the farmers know their village territory, it can be expected that the farmers consider these factors correctly if the team members act as good facilitators. In this step, it is important to let farmers create their future plan and not to impose too much of what the facilitators think is right.

Role plays in planning cropping systems
The results and possibilities of revenue maximization need to be discussed with the farmers from different points of view. A role play, in which the members of the VLMC play different interest groups, or represents an authority is used to get into a discussion with the VLMC to achieve better planning. Examples for such roles are: Farmer, Livestock holder, investor, forestry officer, village head or trader. In the role play, each "actor" represents his interest, fostering a discussion. The roles that are important for the village planning need to be identified and the characters' interest needs to be defined in group work before starting the exercise. At the end, the players should aim at a consensus on the areas to be used for different land use options.

Once the first draft plan is mapped, take a photo of the map and georeferenced it to be able to load it in the GIS, where the polygons of each land use will be digitized and the area will be calculated. The area calculations can then be used for the calculation of the village level indicators.

Usually, the participatory mapping and the recalculation of Table 17 need to be repeated several times until the result is satisfactory and agreed by the VLMC. This is a demanding and also time consuming task but in this way, it can be made sure that farmer's perspective after informed decision making is included and ownership of the plan is reached. It needs patience and a high level of moderation skills to lead the discussion to a successful plan upon which agreement is reached with the villagers.

5.4 Agricultural action planning and village level regulations

In order to implement the plan, it has to be determined when the planned changes take place, what is necessary for implementation and who is responsible for the implementation. See the toolbox (Chapter 14) for a template on this. This involves one more discussion round with the farmers.

It is also possible to define how certain areas should develop, what is allowed and what is prohibited in which areas. For example, the protection forest should not be used for grazing. In case a villager or someone from another village violate this rule, a sanction can be imposed on this person. For this, the VLMC should set up a catalogue of sanctions and disseminate the rules among the villagers.

The rules for managing the agricultural land are partly based on legal and ecological requirements and partly set up in the participatory way.

For all rules, the sanctions for non-compliance are to be set up by the VLMC. A catalogue of sanctions can be elaborated by the persons that enforce the compliance with the rules. In such a catalogue, it should be specified, which sanction is applied if an individual uses the land for a purpose that has not been agreed upon. Sanctions can be imposed if violations to the rules are reported by individual villagers to the VLMC. The VLMC then decides if a sanction is necessary.

5.5 Village closing meeting

After the planning is completed, the team prepares for a village closing meeting to inform the whole village on the outcome of the participatory planning work. Villagers need to know what has been planned and they should understand that the plan is a result of the VLMC, which has been facilitated by the PLUP/PALM team.

All villagers are invited

The local authorities, which include the district governor, the chiefs of both DAFO and DONRE are invited and open the meeting according to Lao customs.

The team prepares presentations on the results of each activity in the following topics. If possible, members of the VLMC and the village head should actively involve in the presentations during the meeting.

- Purpose and process of PLUP/PALM
- Village boundary map, description and agreement
- Current land use
- Population figures, socio-economics, population growth
- Future land zoning
- Status of soil fertility, soil improvement possibilities and recommendations
- Future agricultural land management
- Action plan
- Village regulations and enforcement

In the meeting, the team and the representatives from the district, DAFO and DONRE offices explain all necessary details to the villagers and hand over the plan to the village authorities in two copies, which include all the maps and agreements. In the ideal case, the village closing meeting is held after all products except the final report are finished. In this way, the final version of the report can be created after the comments that draw from the villagers attending this meeting are included and full agreement on the report is reached.

6 Report outline and content

The report, or planning document is intended to be used in the village as a source of information. It should be written in a language that is easy to understand. The report text should be short and provide a summary of the information required for the villagers to understand and respect the plan. The commented outline of the planning document can be studied in the toolbox (Chapter 15).

To make sure the report is of good quality and that all requirements are met, it is put together and reviewed as follows before the official version is sent to the district governor's office.

- All results are checked for correctness
- All results are presented to the village in a village closing meeting and final comments are collected
- PLUP/PALM team puts the information together and distributes the tasks in the same way as the activity was carried out
- Report writing starts
- PLUP/PALM team uses the standard cover page and the standard report structure
- Report draft is reviewed internally by the team members. Now report chapters are switched.
- The draft report is sent to the province coordinator for review.
- After receiving the review of the provincial coordinator, the report is handed in to the district governor's office for comments and approval.
- The report is handed over to the village authorities with all maps printed.
- Copies of the report are to be given to the following recipients:
    - Village head — hardcopy, if possible softcopy
    - DAFO, DONRE — hardcopy and softcopy
    - District office — hardcopy
    - Province PAFO and PONRE — hardcopy and softcopy
    - DALaM and DLPD (national level) — softcopy

7 Data storage and data management

Data needs to be stored securely in several copies and at several administrative levels. The standard folder structure has to be followed.

For secure data storage keep softcopies and hardcopies in the locations listed below.

The softcopies to be delivered to the national level should be short versions, containing the products created and not the material used. All files should end with the village name and all GIS files should be stored in one folder.

Content of the short version:

- All GIS shape files produced
    - BND_village_name (Village Boundary)
    - CLU_village_name (Current land use, mapped to SUB_cat_ID Level)
    - FLUMZ_village_name (Future Land use Zoning, mapped to SUB_Cat_ID Level)
- All maps produced in jpg format
    - Current land use map
    - Future Land use Zoning
    - Map of communal land
- Database of household interviews
- Database of main crops assessment
- Excel and word files for all results of participatory discussions
- Report file in pdf format

In the near future, all produced land use plans should be centrally stored on a server and databank system called LUIS (Land Use Information System). At the time of printing this handbook, a working group consisting of staff from NREIC (Natural Resources and Environment Information Center), DALaM and the DOL had already developed this database for land use plans. LUIS enables storage and analysis of land use plans and related documents. It further includes a system of metadata collection and a web map interface.

Toolbox

Participatory Agricultural Land Management

Vientiane, July 2018

Contents

CD Annex:

Household interview form

Household database (Excel file)

Main annual and perennial Crops_Lao (Excel file)

Main annual and perennial Crops_English (Excel file)

Upscaling and Livestock_Lao (Excel file)

Upscaling and Livestock_English (Excel file)

Fertilizer requirement (Excel file)

Legend for current and future land use

Watershed classification for Laos (GIS file)

Simplified Implementation Guideline - Livestock Lao

Simplified implementation Guideline – Crops Lao

Simplified Implementation Guideline - Areas for Crops Lao

Simplified Implementation Guideline - Population Growth Lao

PALM Guideline and toolbox Lao

PALM Guideline and toolbox English

1 Working Document for the development of a proposal to the GoL on formalizing common criteria in Land Use Planning Version: 2.0 | Date: 29.09.2016

Village Level Land Use Planning (LUP) in Laos shall adhere to the following common criteria:

No.	Criteria Description
1	Consideration of higher level and other sector plans: A Village Land Use Plan must take into consideration higher level (District, Province, National) spatial plans and development plans and sector plans, which have been officially approved by the responsible GoL agency. The consideration and divergence to such plans must be visible in the LUP map or described in the LUP report. The official plans to be considered should include, if available: - DSEDP - ISP - Forest Plans
2	Respect the existing Land Use Plan: The latest approved LUP of a village (by date of appropriate stamp) must be the basis for any proposed changes to the plan. The changes must undergo the appropriate process through the responsible institutions.
3	Content of a LUP: A "complete" LUP must include spatial plans from the NRE sector (Zoning Plan) and agriculture and forest sectors, either combined in one joint plan or as separate attachments. 1. The Zoning Plan must include comprehensive information according to the Standard Land Classes Scheme (see 4), Category I, with regards to all sectors. 2. The Agriculture and Forest plans must include comprehensive information according to the Standard Land Classes Scheme (see 4), Category II, with regards to the respective sector. This also applies to a combined plan.
4	Land Classes and Codes: All village Land Use Maps, regardless of where they are generated, must adhere to a standardized Scheme of Land Classes and respective GIS data coding. This scheme can be found in Annex 1.
5	Data Collection: 1. A LUP planning process must include the collection of appropriate data for informed decision making. A list of the minimum data to be collected can be found in Annex 2. 2. Data can be collected as secondary data from an official source (i.e. official previous plan), not older than 12 months of the date of planning, or as primary data during the planning process 3. An appropriate issue analysis must be carried out in the LUP planning process and documented. It shall address at least the following aspects:
6	Report format: A LUP must include a descriptive report, which adheres to a standardized format. The contents of this report include: 1. Village boundary agreement(s), 2. VLMC composition and responsibilities, 3. Brief description of zoning/sector plans (Standard 3), 4. Description of boundary, current and future land uses, 5. Land use zone descriptions and associated management rules 6. Table of collected data according to Nr 6 In line with the approval process (Standard 13), the different sections must include signatures by responsible stakeholders: i.e. VLMC members, neighboring village authorities, head of relevant GoL agencies, district governor.
7	Minimum set of maps:

	A LUP must include the following maps: 1. Boundary Map a. Topographic data b. Village boundary as approved (see 14.2) c. Land classes of Category I d. Tagged natural features, such as mountain peaks, ridges, rivers, points of interest 2. Current Land Use Map, according to land classes category II 3. Future Land Use Map, according to land classes category II
8	Map contents: All LUP maps must adhere to the following format requirements: 1. Appropriate Title of the map 2. Date of the map creation 3. Display of map scale, bar or numeric 4. North Orientation with display of north arrow on the map 5. Legend explaining all content displayed and adhering to the standard classes scheme 6. Responsible office for the map, including contact details
9	Map precision: 1. For all LUP maps, transparent information must be provided about the precision level (or technology) with which lines and shapes have been created (i.e. GPS field survey, drawing on Topo map, etc.) 2. Village boundaries shall be drawn to the highest possible precision, following natural features clearly visible on the base map, or through supporting GPS points taken in the field. 3. If cadastral mapping data exists in a given village, this data shall be used in the base map for land use planning.
10	Time projection: A LUP must be developed with a minimum time projection of five (5) years, which must be reflected in the planning description (report) and the future land use map.
11	Changes and revisions to an approved LUP: 1. An approved LUP may be modified through an appropriate process by adding approved (partial) changes as Annexes. These changes may derive from different sectors but must be provided to and acknowledged by the Natural Resource & Environment Office. 2. A complete update of a LUP may be done not earlier than 3 years of the last approved plans. All Annexes of changes must be taken into consideration for this complete revision.
12	Participation: All land use planning must be done in a participatory manner. Minimum requirements for participation are: 1. All affected neighboring villages are involved in village boundary demarcation exercises and decisions, through at least 2 official village representatives. 2. If not existing, a Village Land Management Committee, consisting of at least (5) elected members of the village, shall be established. a. The VLMC composition must include: i. No fewer than 2 women ii. Village chief & deputy b. Each member of the elected VLMC shall be given a clear set of responsibilities. 3. The entire village population must be informed and invited to a consultation at the beginning of the planning process. 4. The entire village population must be informed and invited to a consultation at the end of the planning process. All planning decisions must be clearly and transparently explained to the attending villagers.

	a. Villagers must be given the opportunity to inquire, raise concerns or object to planning decisions, which must be taken into consideration before finalization of the plan.
13	Approval Process: 1. The village agreement shall be approved by the VLMC, but only on the basis of a final draft being given to the signatories for review 2. The Village Boundary Agreement shall be approved by representatives (Village Chief or deputy) of all affected villages, but only on the basis of a final draft being given to the signatories for review 3. Each sector LUP, or the joint LUP, is signed by the head of the relevant sector, indicating his/her consent with the contents, as a basis for forwarding to the NRE sector. 4. The head of the NRE sector signs each plan for compliance with the technical standards stipulated above. 5. The district NRE office sends a final draft of the LUP to the Province NRE office for checking and signing compliance with higher level plans. 6. The final approval of a "comprehensive" LUP will be signed by the District Governor's Office, only after all above requirements (standards and signatures) have been met.
14	Data Management: 1. All offices which have produced LUPs or parts of LUPs must keep at least 2 hard copies and 2 soft copies in appropriate storage in their office. 2. All sector plans must be forwarded from the respective sector to the NRE office, including at least one hard copy and one soft copy. 3. The district NRE office must forward all finalized plans to the Province NRE office in a timely manner, which forwards them to national level and distributes the data to relevant sectors, or on demand. 4. Any LUP shall be uploaded to the National LUP Database no longer than 3 months after the date of approval by the District Governor's Office.

2 Checklists for preparation

Category	Item	Not available	Available
Higher Level plans	DSEDP		
Higher Level plans	ISP		
Higher Level plans	Forest plan		
Existing LUP	Maps		
	Digital data (shapefiles)		
	Reports		
	Boundary agreement		
Secondary information	The law on agriculture and forestry and the land law,		
	District strategic plan or district socio-economic development plan,		
	The development plan of village clusters and target villages,		
	Report on the micro land use planning of MONRE (if available),		
	Report on agricultural land use, as created before (if available),		
	Digital maps created from Micro land use planning, like village boundary, current land use, future land use etc. (if available),		
	Boundaries and descriptive information for protected areas,		
	Boundaries of large scale investments, land leases and concessions (if available),		
	Recent high resolution imagery: Orthophoto (High resolution color images available from NGD's Finnmap project (2015)), Quickbird images or SAS planet mosaics usually available from MONRE		
	Scanned and georeferenced topographic maps		

3 Sample work plan

If teams are well trained and have gained routine with the method, timing can be as described here. For teams in the first year of implementation, allow 2 days more.

Day	Activity	Duration	DAFO	DONRE	Result	Material	Participants
1	Village opening	Half day	3	3	VLMC confirmed, Village informed	PLUP/PALM presentation LCD, Computer, Microphone	VLMC All villagers DAFO/DONRE head Provincial coordinator District (vice) governor (to invite on day 0)
1	Socio-economic data collection (HH Census)	Half day	3	3	Filled questionnaire	Printed Questionnaire, pens	Villagers, Village head informs Village unit heads to make sure villagers are at home or come to the interview venue (to prepare on day 0)
2	Socio-economic data collection (HH Census)	Full day	3	1	Filled questionnaire	Printed Questionnaire, pens	
2	Village boundary delineation	Full day		2	Sketch map of village boundary Start GPS walk	Satellite image printout, plastic foil LCD, Computer, Mobile Wifi, GPS	VLMC, representatives of neighboring villages (to invite on day 0), VALMC members
3	Data entry and data checking	Full day	2		Excel sheet with data entered and checked. Result tables printed	Excel sheet for data base, 2 Computers, virus free memory stick Printer	Office
3	Determination of plots for soil samples and soil sample collection	Full day	1		Samples collected and set for drying	Plastic map, satellite image, GPS, Paper boxes for drying, shelter, permanent markers, spade, hoe	Village soil doctor / VALMC member
3	Village boundary checking and finalizing	Full day		3	Verified village boundary. GPS points.	GPS, Computer, GIS	VLMC, representatives of neighboring villages (to invite on day 0)
4	Group interviews (participatory part)	Full day	2		Problem census, NTFP, Village history, Population development	A0 Paper, markers, computer	VLMC, Woman group, Men group
4	Current land use	Full day		2	Current land use sketch map	Satellite image printout, list of land categories,	VLMC, village chief

	(participatory part)					transparent plastic, whiteboard markers, LCD, computer, GPS	
5	Group interviews (office part)	Half day	1		Results and verbal description of group interviews	Results from day 4	Office
5	Current land use (GIS part)	Full day		1	Mapping of current land use		Office
5	Future land use (land zoning) participatory part	Full day		2	Sketch map of land zoning	Sketch map of land zoning	VLMC
5	Main crops interview / livestock interview	Half day	2		A0 paper, markers, computer, excel sheets for main crops interview	Main crops defined, revenue, yield/ha, labor force, livestock revenue	VALMC
6	Private land, Communal land, state land (participatory part and office part)	Half day		2	Satellite image (display on screen, just because VALMC needs the hardcopy)		VLMC
6	Agriculture map current situation (participatory part)	Full day	2		Satellite image hardcopy		
6	Catch up work that has not been done in time	Full day	1	1	Soil test Kit	Samples analyzed	
6	Preparation of results and agreements	Half day		2			
7	Agricultural map office part	Full day	1		Sketch map from day before	Agricultural map in GIS	
7	Data compilation, preparation of results and LU proposal continue soil samples if not yet completed	Full day	2			Tables of all data available and printed	
8	Agricultural land use planning	Full day	3		Proposal on sketch map,	Communal plots identified, suitable crops	VALMC

						proposed, soil preservation and improvement zones identified Village action plan	
8	Data checking and report writing	Full day		3			
9	Agricultural land use planning	Full day	3			Suitable crops proposed, soil preservation and improvement zones identified. Livestock areas planned. Village action plan refined	
10 and 11	Data checking and report writing, presentations	Full day	3	3			
12	Village meeting presentations	Half day	3	3			

4 Checklist of materials needed

A. Material for use during PLUP/PALM data collection and planning at village level		
☐	A4 paper	0.5 rim
☐	Copies of PALM questionnaires A4	1 per household
☐	Transparent tape	1 roll
☐	Paper tape	1 roll
☐	Whiteboard non-permanent marker 4 color	8
☐	Permanent markers	4
☐	Pencils	1 box
☐	Note books for VLMC PALM committee	1 box
☐	Double-side tape	1 roll
☐	Rubber	2 pcs
☐	Ruler	2 pcs
☐	Stapler nails (10)	1 box
☐	Cutter	1
☐	Scissors	1
☐	Map pin	1 box
☐	Stapler nails (big - report book)	1 box
☐	Glue	1
☐	Batteries for GPS	for 2 units
☐	Plastic files	10
☐	Paper clips	10
☐	Envelope A4	20
☐	Tape for PLUP/PALM report	1 roll
☐	Paper A4 color for report	10
☐	Satellite image A0 printout	1
☐	Transparent plastic foil A0	3
☐	Village maps	

B. Material to be used for soil testing		
☐	Mask	10
☐	Gloves	20
☐	Small plastic bag	30
☐		
C. Equipment for soil testing		
☐	Plastic bucket	1
☐	Hoe	1
☐	Spade	1
☐	Soil box	1
☐	Measuring tape	1
☐	Soil test kit (check for completeness)	1
☐	Compass	1
D. Equipment for use in the village		
☐	Digital camera	1
☐	Laptop computer	2
☐	GPS hand held with USB cable	2
☐	LCD projector with HDMI and VGA cables	1
☐	Printer	1
☐	Extension cables	2
☐	Mobile internet connection	1
☐	Power generator (if village is off the grid)	1
E. Office Equipment		
☐	A3 color printer	
☐	Desktop Computer	
☐	External Hard disk	

5 Data collection form for household interviews

Date/Month/Year of interview.....

Province Code..... District..... Village..... Unit …… House number ……

I. Information on the interviewed person

Name and Surname _____

Date of birth DDMMYY Sex : Male /☐ Female ☐

Religion of the family _____

1. Family members, labor froce and off farm activities

Number of **male** family members younger than 15 years: _____

Number of **female** family members younger than 15 years: _____

Number of **male** family members between 15 and 60 years old: _____

Number of **female** family members between 15 and 60 years old: _____

Number of **male** family members older than 60 years: _____

Number of **female** family members older than 60 years: _____

Number of family members by occupation

Village member (farmer)	*Government staff*	*Student*	*Business*	*Employed*	*Other*

How many labor force do you have in your family ? _____

What is your main income source in the family ?

☐ Crop production ☐ Livestock ☐ Business ☐ Government staff ☐ Employed

Other: _____

2. Information of each land plot of the family

Type of land	Plots	Total size (ha)	Number of plots	How did you get the land (1-6)	Relevent document (1-5)	Owned by (1-3)
Settlement	Plot 1					
	Plot 2					
	Plot 3					
	Plot 4					
Garden	Plot 1					
	Plot 2					
	Plot 3					
	Plot 4					
Paddy field	Plot 1					
	Plot 2					
	Plot 3					
	Plot 4					
Fish pond	Plot 1					
	Plot 2					
	Plot 3					
	Plot 4					
Tree plantation	Plot 1					
	Plot 2					
	Plot 3					
	Plot 4					
Other	Plot 1					
	Plot 2					
	Plot 3					
	Plot 4					

How did you get the land ? 1) Reserve (Register for use) 2) Buy 3) Barter 4) Inherit 5) Relative given 6) Given by Government

Relevant document 1) Land title 2) Land declaration form 3) Temporary land use right 4) No document 5) Sketch map

Owned by: 1) Male, 2) Female, 3) Couple

Have you rented out your land during the last year?

Land type	Size (ha)	Renting fee/ year	Period of contract	
			Start	End
Settlement				
Garden				
Paddy field				
Cash crops				
Fish pond				
Tree plantation				
Other				

Have you rented in land during the last year ?

Land type	Size (ha)	Renting fee/ year	Period of contract	
			Start	End
Settlement				
Garden				
Paddy field				
Cash crops				
Fish pond				
Tree plantation				
Other				

3. Fertilization

How much fertilizer did you use last year?

Fertilizer type	**Amount used (kg)**
15 15 15	
46 0 0	
16 20 0	
16 8 8	
Other	
Manure	

4. .Livestock and smallstock inventory :Animal production

	Buffalo	Cattle	Goats	Pig	Poultry	Others		
Number								

5. Family Equipment and household goods: Do have the following goods?

Equipment and household goods	Number owned
Televisions	
Rice mills	
Motorbikes	
Power tillers	
Tractors	
Cars	

Place .....Date.....

Acknowledge by Village chief Name of interviewee Name of interviewer

6 Population development

Province: .....
District: .....
Village: .....
Date of data collection: .....

Year	Total population	Born	Died	Move in	Move out	Change in number of persons	Increase in %
2017							
2016							
2015							
2014							
2013							
						Total increase in 5 years in %	
						Average increase per year in %	

Year	Population	Change
2018		
2019		
2020		
2021		
2022		

7 Group interview tools

7.1 Form for collecting information on NTFPs and the level of abundancy

Province: .....
District: .....
Village: .....
Date of data collection: .....

No.	Species	Places	Abundancy	Timber products and use of timer			NTFPs and use of NTFPs		Handicraft
				Fuel wood	Construction wood	Others	sale	food	
1									
2									
3									
4									
5									
6									
7									
8									

7.2 Form for collecting information on wildlife of village

Province: .....
District: .....
Village: .....
Date of data collection: .....

No.	Species	Where is found	Abundancy	Distance from the village	Other information	Use	
						Sale	food
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

7.3 Form for collecting information on the village problem census

Province: .....
District: .....
Village: .....
Date of data collection: .....

No.	Issue		Cause	Impacts	Proposed solution
1	Agriculture				
2	Forestry				
3	Public health				
4	Infrastructure				
5	Others				

8 Tools for assessment of main crops and main cropping systems

1: Categorize the main cropping systems

2: Annual crops assessment

3: Annual cropping systems assessment

4: Crop rotations

5: Perennial / multi annual crops

6: Summarize data on cropping systems and Compile data on cropping systems and from other tools

8.1 Categorize the main cropping systems

In a group discussion, it has to be agreed which cropping systems are the most important ones in the village (usually 5). For further definitions and clarifications on how to use this set of tools, please refer to the guideline, as this toolbox is only meant tom provide the data collection tools.

Template: Main cropping systems in the village

Cropping system	Crop	Ranking of importance according to area of agricultural land
Annual crop 1		
Annual crop 2		
Annual crop 3		
Annual cropping system 1		
Annual cropping system 2		
Annual cropping system 3		
Crop rotation, crop sequence 1		
Crop rotation, crop sequence 2		
Crop rotation, crop sequence 3		
Multi annual and perennial crops 1		
Multi annual and perennial crops 2		
Multi annual and perennial crops 3		

Using the selected tools for data collection:

For each of the selected main crop categories defined with Tool 1, the data are collected, using the lists of questions, as presented below and the Excel spreadsheet, as provided to the team and on the CD annex.

In the spreadsheet, those cells that are marked in green with dots are not to be filled.

Formula for the calculation of the indicators are at the right side of the sheet and at the bottom. These should not be changed.

Annual crops assessment

This assessment uses 10 questions:

1.1. General information

Specification of the crop. The name of the crop.
How big is the area you use for this crop (ha)?

1.2. Soil Preparation and planting

With how many people do you work during soil preparation and planting?
For how many days do you need these people during soil preparation and planting?

1.3. Growing period (Includes work for weeding, irrigation, fertilization)

With how many people do you work during the growing period?
For how many days do you need these people during the growing period?

1.4. Harvesting and post-harvest processing

With how many people do you work during harvesting, transport and processing?
For how many days do you need these people during harvesting, transport and processing?
Which amount of crop do you harvest (kg)?
What is the value of this crop /kg?

The result of this interview should be recorded in a table:

Indicator	Annual crop 1	Annual crop 2	Annual crop 3
Revenue per ha (LAK/ha)			
Number of labor days per ha (man day/ha)			
Revenue per labor day (LAK/man day)			

8.2 Annual cropping systems assessment (more than one crop per year on the same plot)

The questions to be asked for annual cropping systems are the same as for annual crops but they have to be asked separately for each crop that belongs to the system. The indicator summarizes the whole cropping system, meaning that the indicators for the individual crops are added. See the Guideline for detailed explanation on how to calculate these values.

Indicator	Annual cropping system 1	Annual cropping system 2	Annual cropping system 3
Revenue per ha (LAK/ha)			
Number of labor days per ha (man day/ha)			
Revenue per labor day (LAK/man day)			

8.3 Rotational crops

Define a typical rotation cycle

Collect the data as shown in the section on annual crop assessment.

Calculate the indicators needed, like revenue/ha/ year, labor force/ha per year, for each crop, using the sheets and questions for the annual crops. In case a multi annual crop is included in the crop rotation, the indicators are calculated, using the sheets and questions as described in the manual.

Add up the values of each indicator for all crops that belong to one rotation period and divide by the number of years including the fallow period. See the Guideline for detailed explanation on how to calculate these values.

Indicator	Rotational crop 1	Rotational crop 2	Rotational crop 3	Rotational crop 4	Rotational crop 5	Fallow period	Cropping systems summary
Number of years for each stage							
Revenue per ha (LAK/ha)							
Number of labor days per ha (man day/ha)							
Revenue per labor day (LAK/man day)							

8.4 Perennial crops and multi annual crops

Sometimes, farmers have just started a perennial crop plantation and they do not yet know how yield levels will develop in the future. In this case, subdivide the total years of use e.g. 30 and distribute the years of use to the production phases. For each production phase you need to insert the best guess for the yield and price. This can also be done by inserting the yield level that is known in each phase. The number of years in each production phase should always sum up to the total length of the cultivation period.

1.1. General information

Specification of the crop. The name of the crop
How big is the area you use for this crop (ha)?
How many years do you keep this crop in total?

Hint: (Crosscheck this number by adding up all years from establishment to clearing)

How many years does it take until this crop brings the first harvest?

Hint: Crosscheck this number by calculating the years of the establishment phase plus the years of the management phase

1.2. Establishment phase (first year):

Hint: Includes the work for clearing, soil preparation, seeding, planting, and weeding (total family and hired labor force).

With how many people do you work during the establishment phase?
For how many days do you use these people during the establishment phase?

1.3. Management phase (not yet producing): Includes the work for Weeding, fertilizing etc.

Hint: This phase might be left out when it is not relevant e.g. for crops, like sugarcane. But it should be collected for crops like rubber.

How many years does the management phase take?
With how many people do you work during the management phase?
For how many days do you use these people during the management phase?

1.4. Productive phase

Hint: In some cases, like sugarcane or rubber the labor days and revenues for this phase can be subdivided into initial, climax and phasing out. In case a phase is not relevant for a specific crop, it does not need to be collected separately.

1.4.1. Initial phase

How long does the initial phase take (years)?

Which amount of product do you harvest per year (kg)?

What is the value of this crop LAK/kg?

With how many people do you work during the initial phase?

For how many days do you use these people during the initial phase?

How many labor days do you need per year in the initial phase?

1.4.2. Climax phase (the questions are the same as for the initial phase)

How long does the climax phase take (years)?

Which amount of product do you harvest (kg)? (See table on crop productivity/year)

What is the value of this crop LAK/kg?

What is your total revenue of this crop LAK?

With how many people do you work during the climax phase?

For how many days do you use these people during the climax phase?

1.4.3. Phasing out (the questions are the same as for the initial phase)

How long does the phasing out take (years)?

Which amount of product do you harvest (kg)?

What is the value of this crop LAK/kg?

What is your total revenue of this crop LAK?

With how many people do you work during the phasing out?

For how many days do you use these people during the phasing out?

1.4.4. Clearing Phase

Once the production cycle is completed, farmers need to clear the area and get rid of remaining crop biomass.

With how many people do you for clearing?

For how many days do you use for clearing?

For how much do you sell byproducts after clearing? (e.g. wood from trees)

Summary of results for perennial and multi annual crops

Indicator	Crop 1	Crop 2
Revenue per ha (LAK/ha)		
Number of labor days per ha (man day/ha)		
Revenue per labor day (LAK/man day)		

9 Compile data on cropping systems

9.1 Main crops assessment for all crops and cropping systems

For the comparison of cropping systems, we need the calculation of indicators for the main crops that has been done, using the tools 1 to 5. For all crops and cropping systems, the values for the indicators have to be copied to the excel sheet upscaling to village level_village name.xlsx

In case some crops that are not yet grown in the village offer new possibilities, data from other villages may be used for projecting future changes and possible implications. However it must be stated clearly to the villagers that numbers are just an indication of what could be the outcome of new activities.

- Revenue (price* yield) / ha (LAK)
- Number of labor days per ha (Number)
- Revenue (price* yield) / labor day (LAK)

Indicator Summary of main agricultural crops

	Crop 1	Crop 2	Crop 3	Crop 4	Crop 5
Revenue (price* yield) / ha (LAK)					
Number of labor days per ha (Number)					
Revenue (price* yield) / labor day (LAK)					

9.2 Village household census

Sheet: “Family structure and labor” Table: Number of labor force in the family by main income source

Main income source of the household

	Number of families	Percentage of families	Average number of labor
Crop production			
Livestock			
Business			
Government staff			
Employed			
Other			

9.3 Revenue from land rented out

Size and revenue from land rented out

	Settlement	Garden	Paddy field	Cash crops	Fish pond	Tree plantation	Other
Size in ha (sum)							
Renting fee (LAK/ha/year) (average)							

9.4 Current agricultural land use

From the participatory mapping of agricultural land use, take the table that shows the areas of the crops and copy it to the same excel sheet in which the main crops revenue data are summarized.

Area of main agricultural crops

Main crops	Current land use (ha) from GIS

9.5 Upscaling of the collected information to village level

This is done by multiplying the revenue/ha/year for each main crop with the number of hectares cultivated in the village. So we get the amounts for the revenue and the number of labor days for the whole village.

Revenue Village level (for crop x) = revenue/ha/year of crop x * hectares of crop x in current land use

Labor used Village level (for crop x) = Number of labor days per ha (for crop x) * hectares of crop x in current land use

Village level revenue and labor force figures.

Main crops	Current land use (ha)	Revenue Village level (LAK) under current land use	Labor used Village level (labor days) under current land use

Once this table is created in Ecxel, the worksheet should be copied. Having a copy enables us to do some planning based simulations with the farmer group.

9.6 Determine Maximum and minimum areas

Guiding questions
Is there enough land where the soil is not degraded by erosion?

Is the slope of the land too steep for annual crops?

Is the soil deep enough to store enough water for annual crops?

Is the soil soft enough for annual crops?

How much more of a land type that has already proven to be suitable for specific crops is available in the village land and where is it?

Is the slope steepness still suitable for permanent crops?

Would livestock find water near the livestock area?

Would the village lose a lot of wildlife of trees when the area is cultivated?

How far away from transportation roads is the area?

Do you consider the area fertile enough?

Current land use, minimum and maximum areas.

Main crops	Current land use (ha) from GIS	Minimum area required (ha)	Maximum area possible (ha)
Sum			

9.7 Calculate potential future areas

In the next step, we start to calculate with the potential future areas and the data about labor force and revenue for the crops to build table 5.

1. Choose the crop with the highest revenue/ha from table 1, generated with tool 6 and multiply revenue/ha/ year with the Maximum area possible to get the potential revenue on village level for this crop. In our case, this is the cropping system with 2 rice yields. Note the amount of hectares used. In this case the maximum and minimum areas are the same because we cannot expect an extension of the irrigation scheme.
2. Choose the crop with the second highest revenue and multiply revenue/ha/ year with the Maximum area possible to get the maximum village level revenue for this crop. Note the amount of hectares used. In our case: Sugarcane.
3. Choose the crop with the third highest revenue. In our case rubber and calculate the revenue based on the maximum area.

4. Choose the crop with the fourth highest revenue. In our case rice and calculate the revenue based on the maximum or required area.
5. Choose the crop with the fifth highest revenue. In our case Cassava and calculate the revenue based on the maximum area.
6. Calculate how many hectares would be used with this land use, by adding up the hectares already used for the crops with in steps 1 to 5.
7. If the area used now is bigger than the village agricultural land (350 ha), start adapting the areas of the crop as follows:
    a. Take the crop with the lowest revenue/ha and adapt the area grown to the minimum area required for this crop. If the number of hectares used is lower than the village agricultural land, add the difference and all land is covered optimally.
    b. If there are still too many hectares used, continue, as described in the previous step with the crop that brings the second lowest revenue/ha. If the number of hectares used is lower than the village agricultural land, add the difference and all land is covered optimally.
    c. Continue in the same way as described in steps a. and b. with the next higher crop revenue/ha until the hectares used match the village agricultural land.

Future cropping scenario development

Main crops	Current land use (ha)	Minimal area required (ha)	Maximal area possible (ha)	Revenue Maximizing	Area used for maximizing revenue
Irrigated rice 2 yields					
Sugarcane					
Rubber					
Rice					
Cassava					
Sum					

Once, these calculations are completed, create one more column in the table to calculate the total labor requirement per village for each crop in the future cropping scenario.

Main crops	Current land use (ha)	Current revenue Village level	Current labor used Village level	Area used for maximizing revenue (ha)	Revenue Maximized (LAK)	Labor used Maximizing Scenario
Irrigated rice 2 yields						
Sugarcane						
Rubber						
Rice						
Cassava						
Sum						

Use data from the household census

In order to check if there is enough labor force in the village to make a scenario possible, you can take the population in working age from the household census dataset that is already available.

To get the available labor days per year, multiply the population in working age of those households that stated that their main work is agriculture with 20 days per month and with 12 months.

Consider the revenue generation possibilities from contract farming and renting out of land, especially the renting fee per ha per year.

9.8 Discuss possibilities of revenue maximization

Once these tables are completed, present the results to the VLMC and discuss possibilities of revenue maximization with them. In this discussion, consider for example marketing possibilities/limitations, soil conservation issues, possibilities for renting land out. Once these topics are discussed, the table is adjusted by the villagers' priorities and their arguments are noted. Once the VLMC agrees on the future scenario table, go on with mapping where the changes should take place, by proposing areas to the farmers and discuss with them where a cultivation change makes most sense.

10 Checklist of results needed for planning agricultural land use and for upscaling to village level

Source of the information	Name of the result	Use for planning and upscaling	Information needed	Check
GIS map of current agricultural land use at Sub_Cat level	Current agricultural land use (printout A3)	Visualize the Agricultural land assessment for VLMC	Map	
Attribute table of current agricultural land use	Area inventory of Agricultural land categories in ha (Sub_Cat level)	Upscaling of main crop and livestock data to village level	Area of agricultural crops in hectare	
Main crops interviews	Indicator summary of main agricultural crops	Enable informed decision making of villagers, upscaling of indicators to village level	For each main crop: Revenue (LAK/ ha) Labor days per ha (Number) Revenue per labor day (LAK / labor day)	
Household census	Number of labor force in the family by main income source	Compliance of current and future agricultural land use with the land law. Upscaling to village level	Available labor force for agriculture	
Household census	Livestock inventory	Plan Livestock grazing land and feeding requirements	Number of livestock per species	
Livestock tool	Revenue and labor force requirements for livestock	Plan livestock population in the village	Revenue from livestock in LAK/head Labor force requirement for livestock in man day/head	
Soil test kit results	Results of soil analyses	Adjustment of recommendations to the agricultural land management plan	pH Values, main nutrient availability and recommendations for soil and nutrient management	
Problem census	Main problems related to agriculture	Refer to problems and possible solutions during planning	Description of problems and anticipated solutions	

11 Role play for agricultural land zoning

Prepare the role play.

Collect some more information from the VLMC on the roles shown in the table and let them include their idea. The table below just shows some examples that might be relevant in the village. It must be completed and updated according to the village conditions.

Rules and regulations: Player 1: Government	**Slope and soil Player 2: DAFO**	**Watershed Player 3:DONRE**	**Main cropping systems Farmer**	**Grazing land Livestock farmer**	**Forest Village forest user**
Rice: 1 ha per labor force	Lowland zone: Rice and annual crops	Water important for agriculture	Marketing possibilities	Animals not profitable	Need timber
Industrial plantation: 3 ha per labor force	Slightly inclined annual crops with contour ploughing and mulching	Need of water conservation Headwater zones need protection agreement.	Need for cash income	No good grass available	Need firewood
Livestock: maximum of 15 ha per labor force in the family	Steep, perennial crops with erosion control	Prevent pollution of water. Keep distance of agricultural plots from waterbodies	Need for food	Animals starving in Dry season	Forest products not sufficient and far away
Communal land	Very steep, forest		Animals eat crops	No fences	Need forest management agreement
Paddy land should stay paddy land	Need to use Biochar for better soil fertility		Soil not deep enough	Need land for grazing	Farmers burn forest for new plots
			Need for upland fields, communal land		

Once all relevant arguments are discussed and the table above is completed, the actors select their role and prepare the play. It can be combined with participatory mapping or just like a play. The focus is on how land shall be used and where there is space for which interest.

12 Slope measurement tool

Slope steepness can be measured in an easy way by making a protractor clinometer. See below or on the web under http://www.wikihow.com/Make-a-Clinometer.

Find a 180º protractor. This type of protractor is shaped like half a circle, with angles marked all around the rim. You can buy them anywhere that sells school supplies. Ideally, choose a protractor with a small hole near the center of the protractor, along its straight base.

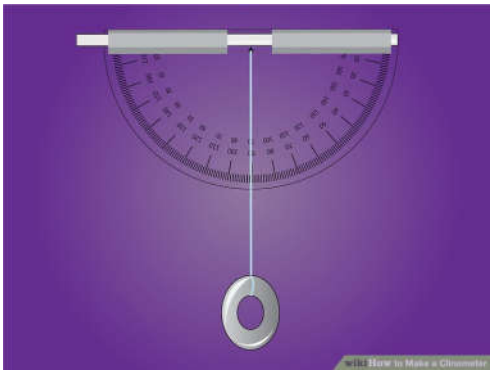
If you don't want to buy one, you can search online for a printable protractor. Print it out, cut it very carefully along its outline, and glue the paper protractor to something a little sturdier, such as construction paper or an index card.

Tape a straw along the straight edge. Tape a straight, plastic drinking straw on or near the straight edge of the protractor. Make sure the straw passes through the two **0º** or **zero** marks on opposite ends of the straight edge.

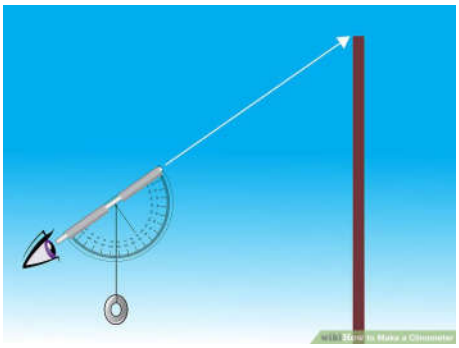
If you don't have a straw, roll a piece of paper into a tight cylinder and use that instead.

Tie a string through the small hole on the straight edge. Many protractors come with a small hole directly between the 0º marks on the protractor, across from the 90º mark on the curved edge of the protractor. If your protractor does not have a small hole here, or if the hole is not situated correctly, tape or glue the string to the protractor where the hole should be. Make sure the string dangles a few inches (several centimeters) below the protractor.

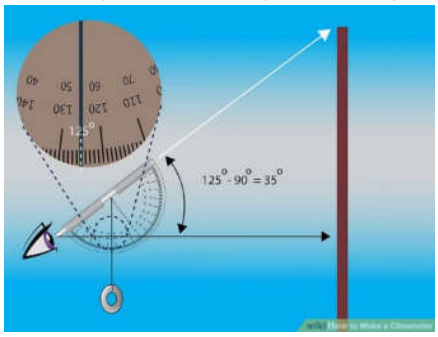
If you are using a paper protractor, you can punch the hole yourself with a sharp pen or hole punch. Do not try to punch a hole in a plastic protractor, as it is probably made from weak plastic and could shatter.



Attach a small weight to the dangling end of the string. Tie a paper clip, metal washer, or other small weight to the end of the string. When you hold the clinometer so the string falls past the circular rim of the protractor, the weight will pull the string straight down past an angle mark on the protractor, such as 60º. This tells you what angle the clinometer is being held at, which can be used to find the heights of distant objects as described in the section below.



Sight the top of a tall object through the straw. Hold the clinometer so the curved rim of the protractor is facing downward. Tilt the clinometer until you can look through the straw or paper tube and see the top of a tall object you want to measure, such as a building. You can use this method to measure the angle between you and the top of that object, or the object's height.



Measure the angle using the protractor. Keep the clinometer steady in that position, until the dangling string becomes still. Calculate the angle between the midpoint of the protractor (90º), and the point where the string crosses the rim by subtracting one from the other. For example, if the string crosses the rim at 60º, the *angle of elevation* between you and the top of the object is 90–60=30º. If the string crosses the rim at 150º, the angle of elevation is 150-90=60º.

The angle of elevation will always be less than 90º, since 90º is straight up in the sky.

The answer will always be positive (greater than 0º). If you subtract the larger number from the smaller and get a negative number, just cross out the minus sign to get the right answer. For example, if you calculate that 60-90=-30º, the actual angle of elevation is +30º.

13 Template for agricultural action plan

Fill the cells for responsibilities, support and village contribution for each action planned.

Description of planned change		Action to achieve in the next 6 months	To achieve in the first year	To achieve in the second year	To achieve in the third year	To achieve in the fourth year	To achieve in the fifth year
Rice production:							
	Responsible:						
	Support needed from:						
	Village contribution:						
Annual crops							
Perennial crops							
Communal land management							
Grazing land management							
Forest and NTFP							

14 PALM Report Outline

1. Introduction
    - Location and geography
    - Landscape information
    - Climate information
    - Main water sources

2. Socio-economic situation and income generation
    - Population, occupation, income sources (create tables) and use the village data to generate charts
    - Population change information for the village (create table on increase or decrease of the population)
    - Land use and possession (create table) and use the village data to generate charts
    - Land market: land rented in and out. Table and explanation

3. Village land assessment

    3.1. Village boundary and agreement

    3.2. Zoning plan for village land management (current land use)

    Current land use classification

Agricultural land	Forest land
Residential land	Land for industry and commerce
Cultural land	Public work land
Land for national defense and security	Wetland

4. Land use planning (future land use)

    4.1. Conservation land (conservation forest, protection forest, cemetery etc.)

    4.2. Reserved land for development

    4.3. Zoning plan for land use classification of the village

    Map of 8 categories of land with table

Zoning Agricultural land	Zoning for forest land
Zoning for residential land	Zoning for land for industry and commerce
Zoning for cultural land	Zoning for public work land
Zoning for land for national defense and security	Zoning for wetland

    4.4. Private land state land concession land, and communal land

    Map and table if not applicable, state that it is not existing in the village

5. The use, management and development of agricultural land

    Zoning for agricultural land (map of current agricultural land use)
    - Soil quality evaluation
    - Survey and soil sample collection

- Advice for soil nutrient management and fertilizer requirements

5.1. Agricultural land use and production
    - Situation of current agricultural land use
    - Creating agricultural land use map
- Economic calculation of cropping systems: average figures revenue for from main crops
- Scaling up to village level, using the GIS figures
    - Village level revenue from main crops
    - Number of working days that villagers spend in the field for of main crops.
- Livestock inventory (create table)
- Non-Timber Forest Products (NTFPs) and wildlife situation
- Aquaculture

6. Prioritizing problems and provide solutions
   6.1. Problem census and solutions by local villagers' knowledge (create table)
   6.2. Potential of agricultural land development (appropriate topics selection for village create table)
        - Agricultural land use planning in the future (map and tables)
        - Scaling up to village level, considering areas, labor force and expected revenues.
        - Comparison of agricultural land use tables and planning for the next 5 years
            - Compare expected agricultural output with current for main crops, using GIS results
            - Standard for zoning the agricultural land (create table for showing agricultural land use planning for the next 5 years)

7. Recommendations
   Development potential of the village
8. References
9. Annexes

About this book

This manual was published to be used for Participatory Agricultural Land Management (PALM) at the village level by all relevant local, organizations of the Lao government. It is also meant to be used by institutions of international collaboration, NGOs and other actors.

The manual was developed by the Department of Agricultural Land Management (DALaM) and its partners. It should be used in various ways; for self-study, as a reference during and after a training and as a guide during the implementation of field activities.

The text provides the necessary background on technical issues in the collection and analysis of data. Data collection tools are available in the second part of the manual, the toolbox.

For each step of PALM, the methodology is presented and the corresponding tools, like questionnaires and formats to structure group interviews are available in the toolbox. To make best use of the publication, while reading through it, the reader is encouraged to regularly flip back to the toolbox to see which data need to be collected and analyzed in which step.

Digital versions of the handbook and toolbox, as well as the necessary spreadsheets to store and analyze the data collected in the household survey, the assessment of main crops and for village level estimations are available for download on the DALaM website and are included on a CD or USB stick that comes with the manual.

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